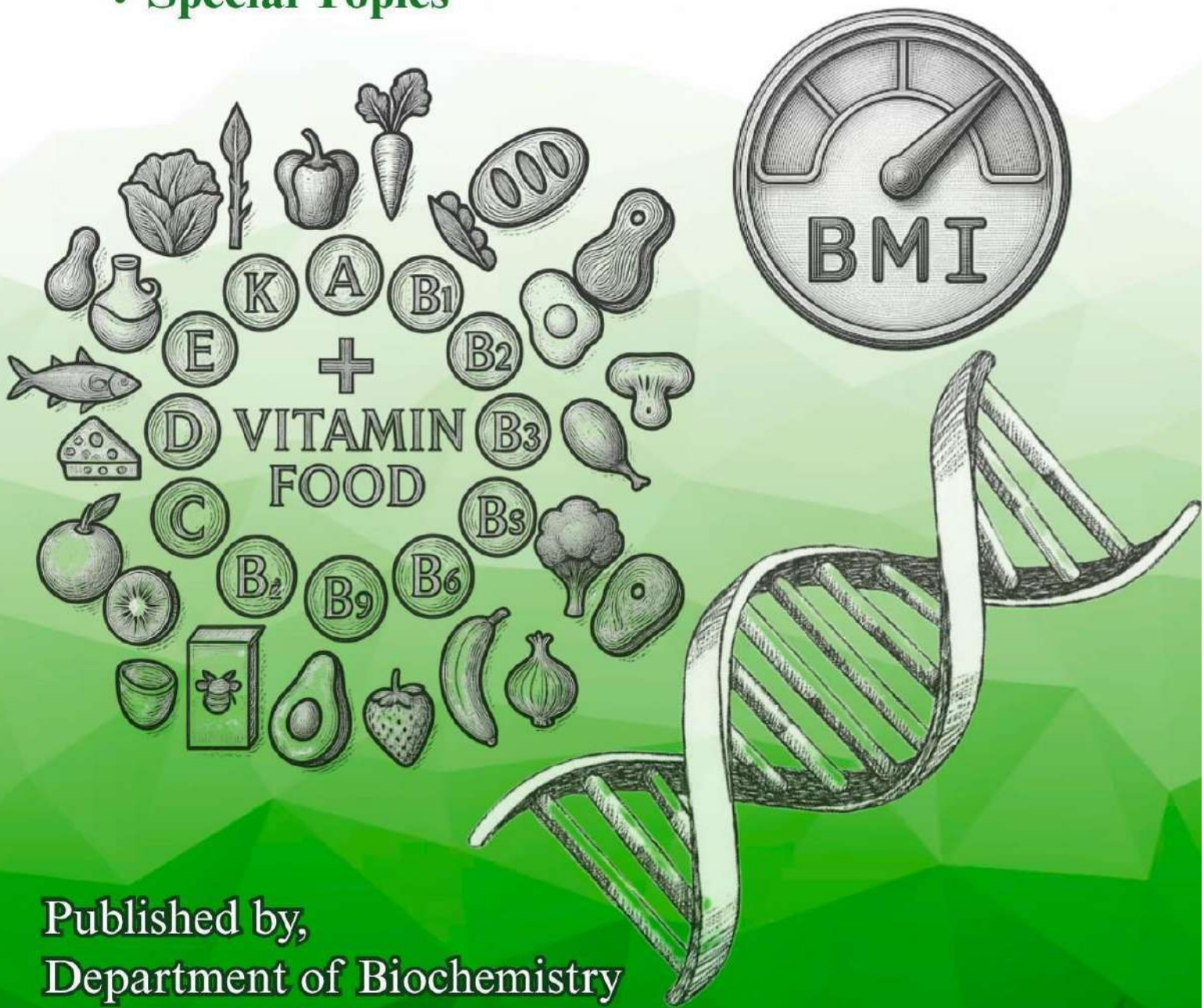
MASTERING BIOCHEMISTRY

A Comprehensive Guide to MCQs, Essays, and OSPEs

Part III

Batch - 1 Semester 3 and 2nd MBBS

- **Food and Diets**
- **Special Topics**



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Authored by:

Department of Biochemistry

Faculty of Medicine

Uva Wellassa University of Sri Lanka

2026

Mastering Biochemistry
A Comprehensive Guide to
MCQs, Essays & OSPEs
Part III

Semester 3

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Contributors to Excellence

A concept of: Snr. Prof. Muditha Vidanapathirana,
MBBS (Col), DLM, MD, MA (SJP), FFFLM (UK),
Dean, Faculty of Medicine

Authors:

Dr. Gayathri Rathnayake
PhD (USJ), BSc in MLS (Special) (USJ)
Senior Lecturer (Grade II),
Head of the Department of Biochemistry

Dr. Kalpani Senevirathna
BSc. (Hons) in Molecular Biology and Biotechnology, PhD.
Lecturer (Probationary), Department of Biochemistry

Ms. S. Induijaa
BSc. Food Science and Nutrition (WUSL), MSc. Food and Nutrition (Reading) (UOP)
Lecturer (Probationary) Department of Biochemistry,
Coordinator, Department of Medical Education

Dr. V.P.A.Thathsarani Vithana Pathirana
MBBS, Dip (Chemical Pathology), MD (Chemical Pathology)
Consultant Chemical Pathologist

Dr. Apsara Bandara
MBBS (Peradeniya),
Temporary Demonstrator, Department of Biochemistry

Snr. Prof. Muditha Vidanapathirana
MBBS (Col), DLM, MD, MA (SJP), FFFLM (UK),
Head of the Department of Forensic Medicine

Cover design by
Dr. Shamod Abeysekera, Temporary Demonstrator, Department of Physiology

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Message from the Vice Chancellor

Dear students,

It gives me great pleasure to extend my heartfelt congratulations and sincere appreciation to the Faculty of Medicine, Uva Wellassa University of Sri Lanka, and particularly to Senior Professor Muditha Vidanapathirana, Dean of the Faculty of Medicine, for their remarkable achievement in successfully publishing "Mastering Biochemistry – Part III: A Comprehensive Guide to MCQs, Essays & OSPEs".
This publication serves as an exceptional academic resource, offering considerable value not only to the MBBS undergraduates of Uva Wellassa University of Sri Lanka but also to medical students throughout the country. I strongly encourage students to make the best use of the high-quality learning materials developed by the Faculty of Medicine. Resources such as this guide can greatly enhance the learning process, making studies more organized, productive, and rewarding.

I wish you every success in your future academic pursuits and professional careers.

Senior Professor Kolitha B. Wijesekara
B.Sc. (Hon.) (Peradeniya), M.Phil. (Peradeniya),
Dr. Sc. Agr. (Gottingen, Germany), M.Biol.
Vice Chancellor
Uva Wellassa University of Sri Lanka



Message from the Head of the Department

Dear Students,

As the Head of the Department of Biochemistry, I am pleased to be associated with the publication of *Mastering Biochemistry: A Comprehensive Guide to MCQs, Essays, and OSPEs*. This guide has been developed in accordance with the Biochemistry curriculum for Year 2, Semester 1 of the Faculty of Medicine, Uva Wellassa University of Sri Lanka.

The publication is intended to support students in their examination preparation by providing practice and guidance in MCQs, essays, and OSPEs. It also serves as a useful tool for reinforcing key concepts and assessing understanding of the subject matter.

I sincerely thank Snr. Prof. Muditha Vidanapathirana, Founder Dean of the Faculty of Medicine, for initiating this valuable project and for his continuous guidance. My appreciation is also extended to all contributors for their dedication and hard work.

I trust that this guide will be a valuable resource in your academic journey and contribute to your success in Biochemistry.

Warm regards

Dr. Gayathri Rathnayake,
PhD (USJ), BSc in MLS (Special) (USJ)
Senior Lecturer (Grade II),
Head, Department of Biochemistry,
Faculty of Medicine,
Uva Wellassa University of Sri Lanka.

BIOCHEMISTRY PRACTICE MCQs(T/F & SBR)

- **Foods and diets**
- **Special topics**

BIOCHEMISTRY PRACTICE MCQs (T/F & SBR)

T/F QUESTIONS

(1) True or False regarding carbohydrate digestion?
- (A) Carbohydrate digestion begins in the mouth with the action of salivary amylase.
- (B) Salivary amylase digests cellulose in plant cell walls.
- (C) Pancreatic amylase continues the digestion of starch in the small intestine.
- (D) Lactase hydrolyzes lactose into glucose and galactose.
- (E) Carbohydrate digestion is completed in the stomach.

(2) True or False regarding the Glycaemic Index (GI)?
- (A) Glycaemic Index (GI) is a measure of how rapidly a carbohydrate-containing food raises blood glucose levels after consumption.
- (B) Foods with a high GI cause a slower rise in blood glucose than foods with a low GI.
- (C) Pure glucose is used as the reference food with a GI value of 100.
- (D) The Glycaemic Index is influenced only by the amount of carbohydrate in a food.
- (E) Foods rich in fiber generally have a lower Glycaemic Index than refined carbohydrate foods.

(3) True or False regarding complete proteins?
- (A) Complete proteins contain all essential amino acids in adequate amounts required by the human body.
- (B) All plant proteins are complete proteins.
- (C) Egg protein is considered a complete protein.
- (D) Complete proteins provide insufficient amounts of one or more essential amino acids.
- (E) Most animal proteins are complete proteins.

(4) True or False regarding essential fatty acids?
- (A) Essential fatty acids cannot be synthesized in sufficient amounts by the human body and must be obtained from the diet.
- (B) Linoleic acid is an essential fatty acid.
- (C) α-Linolenic acid is an essential fatty acid.
- (D) Essential fatty acids are required for normal growth, development, and maintenance of cell membranes.
- (E) Oleic acid is an essential fatty acid.

(5) True or false about respiratory quotient?
- (A) RQ = VO2/VCO2
- (B) It measures heat directly
- (C) RQ = VCO2 produced / VO2 consumed
- (D) It measured by direct calorimetry
- (E) It is constant for all foods

SBR QUESTIONS

(6) A 6-year-old child presents with chronic diarrhea, abdominal bloating, and failure to thrive after consuming milk. Symptoms improve when milk is avoided. Which enzyme deficiency is the most likely cause?
- (A) Sucrase
- (B) Maltase
- (C) Lactase
- (D) Pancreatic amylase
- (E) Trypsin

(7) A 45-year-old man presents with pale, bulky, foul-smelling stools and significant weight loss. Laboratory tests reveal fat-soluble vitamin deficiency. Which process is most likely impaired?
- (A) Protein digestion in the stomach
- (B) Emulsification of fats by bile salts
- (C) Carbohydrate digestion by salivary amylase
- (D) Absorption of amino acids in the colon
- (E) Pancreatic lipase activity in the duodenum

(8) A malnourished elderly patient presents with muscle wasting and frequent infections. Inadequate intake of which nutrient is most directly responsible?
- (A) Carbohydrates
- (B) Fats
- (C) Vitamins
- (D) Proteins
- (E) Minerals

(9) A 52-year-old woman complains of chronic constipation. Her diet mainly consists of refined rice, white bread, and animal protein with minimal fruits and vegetables. Which dietary change would best relieve her symptoms?
- (A) Increase saturated fat intake
- (B) Increase animal protein intake
- (C) Increase insoluble dietary fibre
- (D) Reduce water intake
- (E) Increase soluble dietary fibre

(10) A patient with obstructive jaundice presents with easy bruising and prolonged bleeding time. Which vitamin deficiency is most likely responsible?
- (A) Vitamin A
- (B) Vitamin D
- (C) Vitamin E
- (D) Vitamin K
- (E) Vitamin B12

(11) Vitamin B12 deficiency is more common in strict vegetarians because:
- (A) It is poorly absorbed in the intestine
- (B) It is destroyed by cooking
- (C) It is naturally found only in animal-origin foods
- (D) It requires bile salts for absorption
- (E) It is synthesized only by intestinal bacteria in humans

(12) Absorption of monosaccharides such as glucose and galactose occurs mainly in the:
(A) Stomach
(B) Colon
(C) Small intestine (jejunum)
(D) Ileum
(E) Mouth

(13) Which nutrient provides the highest energy per gram?
(A) Carbohydrates
(B) Proteins
(C) Fats
(D) Vitamins
(E) Minerals

(14) A child with edema, fatty liver, and growth retardation is most likely deficient in:
(A) Carbohydrates
(B) Fats
(C) Proteins
(D) Vitamins
(E) Minerals

(15) Which of the following actions is mediated by insulin?
(A) Glycogenolysis
(B) Gluconeogenesis
(C) Increased glucose uptake by muscle and adipose tissue
(D) Ketogenesis
(E) Lipolysis

(16) Insulin facilitates glucose entry into muscle and adipose tissue by increasing:
(A) GLUT-1
(B) GLUT-2
(C) GLUT-3
(D) GLUT-4
(E) SGLT-1

(17) The insulin receptor has intrinsic:
(A) Adenylate cyclase activity
(B) Tyrosine kinase activity
(C) Serine kinase activity
(D) Phospholipase C activity
(E) Guanylate cyclase activity

(18) Which tissue does NOT require insulin for glucose uptake?
(A) Skeletal muscle
(B) Adipose tissue
(C) Brain
(D) Cardiac muscle
(E) Liver

(19) Glucagon has minimal effect on which tissue?
(A) Liver
(B) Adipose tissue
(C) Skeletal muscle
(D) Kidney
(E) Intestinal mucosa

(20) Which is NOT a direct method of nutritional assessment?
(A) Anthropometry
(B) Biochemical tests
(C) Clinical examination
(D) Dietary assessment
(E) Per capita income

(21) Safe protein intake in adults is approximately:
(A) 0.2 g/kg/day
(B) 0.5 g/kg/day
(C) 0.8 g/kg/day
(D) 1.5 g/kg/day
(E) 2 g/kg/day

(22) The largest component of total energy expenditure is:
(A) Thermic effect of food
(B) Physical activity
(C) Basal metabolic rate
(D) Growth
(E) Digestion

(23) Positive nitrogen balance is seen in:
(A) Starvation
(B) Severe illness
(C) Pregnancy
(D) Trauma
(E) Burns

(24) Basal metabolic rate is influenced by:
(A) Age
(B) Sex
(C) Hormones
(D) Body size
(E) All of the above

(25) Which hormone directly stimulates the thyroid gland to synthesize T3 and T4?
(A) Thyroxine
(B) Triiodothyronine
(C) TRH
(D) TSH
(E) Prolactin

(26) The enzyme responsible for iodide organification and coupling reactions is:
(A) Deiodinase
(B) Peroxidase
(C) Na+/K+ ATPase
(D) Adenylate cyclase
(E) Phosphodiesterase

(27) Which transport protein carries most circulating thyroxine?
(A) Albumin
(B) Transferrin
(C) Thyroxine-binding globulin
(D) Transthyretin
(E) Lipoproteins

(28) Weight loss, tremors, heat intolerance, and pretibial myxedema are most likely due to:
(A) Destruction of thyroid follicles
(B) Iodine deficiency
(C) TSH receptor–stimulating antibodies
(D) Pituitary adenoma
(E) Reduced conversion of T4 to T3

(29) Which feature is characteristic of congenital hypothyroidism?
(A) Exophthalmos
(B) Tachycardia
(C) Poor sucking and hypotonia
(D) Increased appetite
(E) Fine tremors

(30) Which macronutrient has the highest thermic effect of food?
(A) Carbohydrates
(B) Fats
(C) Proteins
(D) Alcohol
(E) Vitamins

(31) A sedentary individual has a BMR of 1500 kcal/day. Approximate TDEE?
(A) 1500 kcal
(B) 1650 kcal
(C) 1800 kcal
(D) 1950 kcal
(E) 2250 kcal

(32) Which condition is required for accurate BMR measurement?
(A) After a large meal
(B) During exercise
(C) Immediately after waking
(D) Post-absorptive state
(E) After coffee

(33) Which contributes the largest percentage to total daily energy expenditure?
(A) TEF
(B) PAEE
(C) NEAT
(D) BMR
(E) Exercise thermogenesis

(34) A BMI of 32 kg/m² is classified as:
(A) Underweight
(B) Normal weight
(C) Overweight
(D) Obese
(E) Morbidly obese

(35) The primary mechanism responsible for obesity is:
(A) Increased protein intake
(B) Increased vitamin intake
(C) Positive energy balance
(D) Increased muscle mass
(E) Water retention

(36) Which cytokine is a pro-inflammatory mediator in obesity?
(A) Insulin
(B) Glucagon
(C) TNF-α
(D) Albumin
(E) Hemoglobin

(37) Android obesity is associated mainly with fat accumulation in the:
(A) Thigh
(B) Arms
(C) Abdomen
(D) Legs
(E) Neck

(38) Metabolic syndrome is diagnosed when how many risk factors are present?
(A) One
(B) Two
(C) Three
(D) Four
(E) Five

(39) A child with pallor, koilonychia, and microcytic hypochromic anemia most likely has:
(A) Increased ferritin
(B) Decreased TIBC
(C) Increased transferrin saturation
(D) Decreased serum ferritin
(E) Increased hepcidin

(40) Iron is primarily absorbed in the:
(A) Stomach
(B) Duodenum
(C) Ileum
(D) Colon
(E) Rectum

(41) Which factor enhances non-heme iron absorption?
(A) Phytates
(B) Tannins
(C) Vitamin C
(D) Calcium
(E) Oxalates

(42) Hepcidin regulates iron metabolism by:
(A) Increasing ferroportin expression
(B) Increasing intestinal absorption
(C) Degrading transferrin
(D) Downregulating ferroportin
(E) Increasing ferritin only

(43) Which is a feature of iron deficiency anemia?
(A) Increased hemoglobin synthesis
(B) Macrocytic RBCs
(C) Increased RDW
(D) Decreased TIBC
(E) Increased hepcidin

(44) A child with rickets and low vitamin D primarily has:
(A) Reduced calcium intake
(B) Impaired vitamin D–dependent calcium absorption
(C) Excess calcitonin
(D) Increased renal calcium loss
(E) Increased PTH suppression

(45) Approximately what percentage of total body calcium is stored in bones and teeth?
(A) 50%
(B) 70%
(C) 80%
(D) 90%
(E) 99%

(46) Which hormone increases calcium reabsorption and bone resorption?
(A) Calcitonin
(B) Insulin
(C) Parathyroid hormone
(D) Aldosterone
(E) Thyroxine

(47) Which dietary component reduces non-heme iron absorption?
(A) Vitamin C
(B) Fructose
(C) Alcohol
(D) Phytates
(E) Meat protein

(48) The transport protein responsible for iron transport in plasma is:
(A) Ferritin
(B) Hemosiderin
(C) Transferrin
(D) Ferroportin
(E) Calbindin

(49) Difficulty seeing in dim light and conjunctival dryness indicate deficiency of:
(A) Retinoic acid
(B) Retinal
(C) Retinol-binding protein
(D) β-carotene
(E) α-tocopherol

(50) Chronic biliary obstruction most commonly impairs absorption of:
(A) Vitamin B12
(B) Vitamin C
(C) Vitamin A
(D) Folic acid
(E) Vitamin B6

(51) A premature infant with hemolytic anemia due to oxidative damage most likely lacks:
(A) Vitamin A
(B) Vitamin D
(C) Vitamin E
(D) Vitamin K
(E) Vitamin C

(52) Which form of vitamin A is commonly used in acne treatment?
(A) Retinol
(B) Retinal
(C) Retinoic acid
(D) β-carotene
(E) Retinyl ester

(53) Dry skin, hepatomegaly, and raised intracranial pressure suggest toxicity of:
(A) Vitamin E
(B) Vitamin K
(C) Vitamin A
(D) Vitamin C
(E) Vitamin B12

(54) Which enzyme was historically most specific for myocardial infarction?
(A) AST
(B) ALT
(C) LDH
(D) CK-MB
(E) ALP

(55) Alcoholic liver disease typically shows:
(A) ALT > AST
(B) AST > ALT
(C) ALP > AST
(D) GGT < ALT
(E) LDH > AST

(56) Which enzyme rises earliest in acute pancreatitis?
(A) Lipase
(B) Amylase
(C) AST
(D) ALP
(E) CK

(57) Which is a physiological cause of elevated ALP?
(A) Bone metastasis
(B) Pregnancy (3rd trimester)
(C) Hepatitis
(D) Biliary obstruction
(E) Rickets

(58) Which LDH isoenzyme predominates in the heart?
(A) LDH-1
(B) LDH-2
(C) LDH-3
(D) LDH-4
(E) LDH-5

(59) Persistent elevation of AST without disease may be due to:
(A) Viral hepatitis
(B) Hemolysis
(C) Macro-AST
(D) Cirrhosis
(E) Alcohol intake

(60) Which enzyme is most useful in detecting alcohol-induced liver injury?
(A) ALT
(B) AST
(C) ALP
(D) GGT
(E) LDH

(61) Elevated serum amylase with low urinary amylase suggests:
(A) Acute pancreatitis
(B) Renal failure
(C) Macroamylasemia
(D) Salivary gland infection
(E) Intestinal obstructio

(62) Which statement regarding troponins is correct?
(A) Troponin T is more specific than Troponin I
(B) Troponin I is cardiac specific
(C) Troponins rise immediately
(D) Troponins are not useful in MI
(E) Troponins are less specific than CK-MB

(63) Which condition causes elevated ALP primarily from bone?
(A) Hepatitis
(B) Cholangitis
(C) Fracture healing
(D) Pancreatitis
(E) Myocardial infarction

(64) A 65-year-old man with a hard prostate most likely requires which tumor marker?
(A) AFP
(B) CA-125
(C) PSA
(D) CEA
(E) CA 19-9

(65) A patient with chronic hepatitis B develops hepatocellular carcinoma. Which tumor marker is elevated?
(A) CEA
(B) CA-125
(C) AFP
(D) PSA
(E) β-hCG

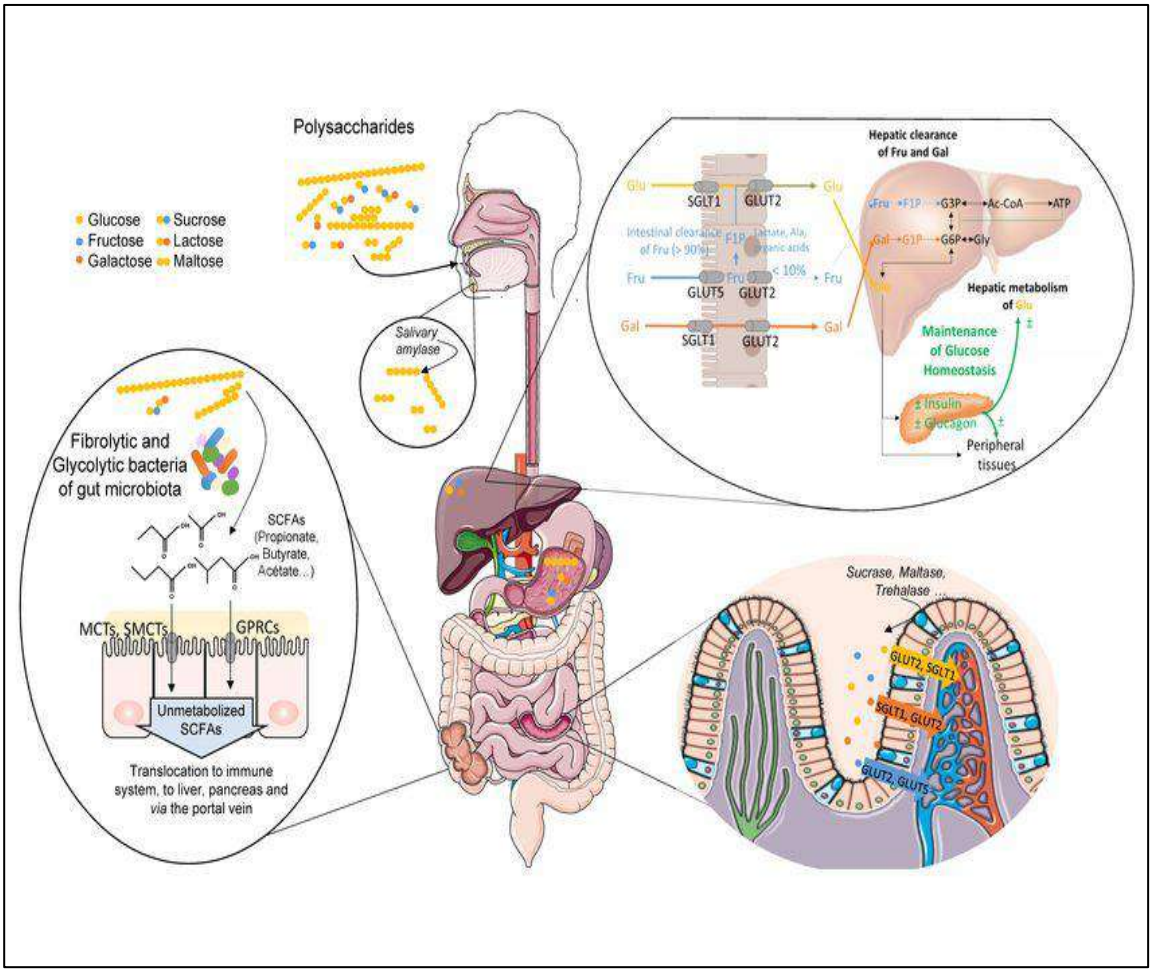
(66) Microcytic hypochromic anemia is associated with decreased:
(A) Serum ferritin
(B) Serum calcium
(C) Serum sodium
(D) Serum potassium
(E) Serum magnesium

(67) Tetany and muscle spasms due to hypocalcemia are most likely caused by deficiency of:
(A) Insulin
(B) Parathyroid hormone
(C) Calcitonin
(D) Aldosterone
(E) Cortisol

BIOCHEMISTRY PRACTICE MCQ (T/F & SBR) ANSWERS

(1) Answer: TFTTF

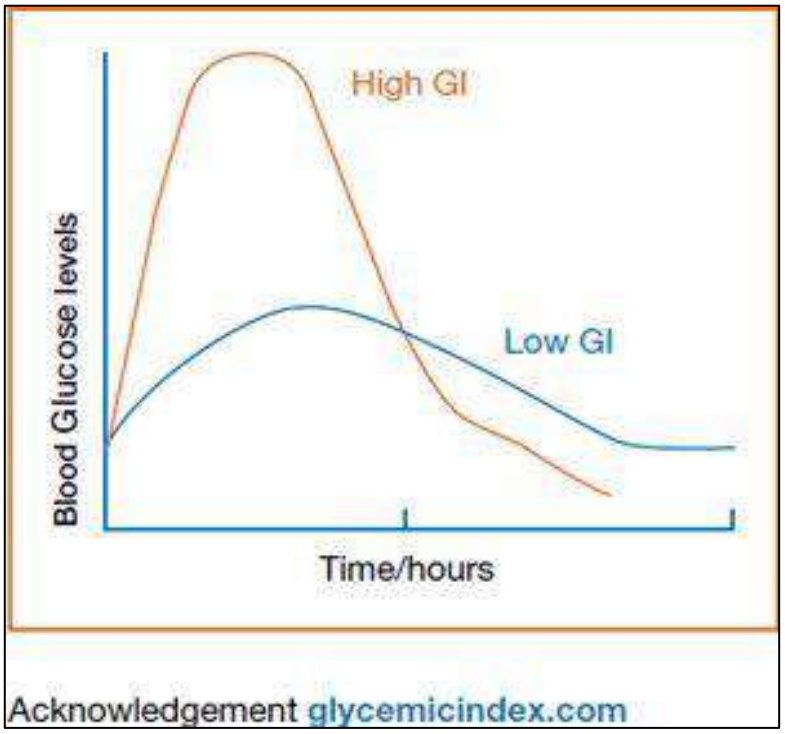
Explanation: Carbohydrate digestion starts in the mouth with **salivary amylase**, which breaks down starch into smaller polysaccharides. In the small intestine, **pancreatic amylase** further digests starch. Brush-border enzymes such as **maltase, sucrase, and lactase** complete carbohydrate digestion by converting disaccharides into absorbable monosaccharides. The stomach plays little role in carbohydrate digestion because the acidic environment inactivates salivary amylase.



(2) Answer: TFTFT

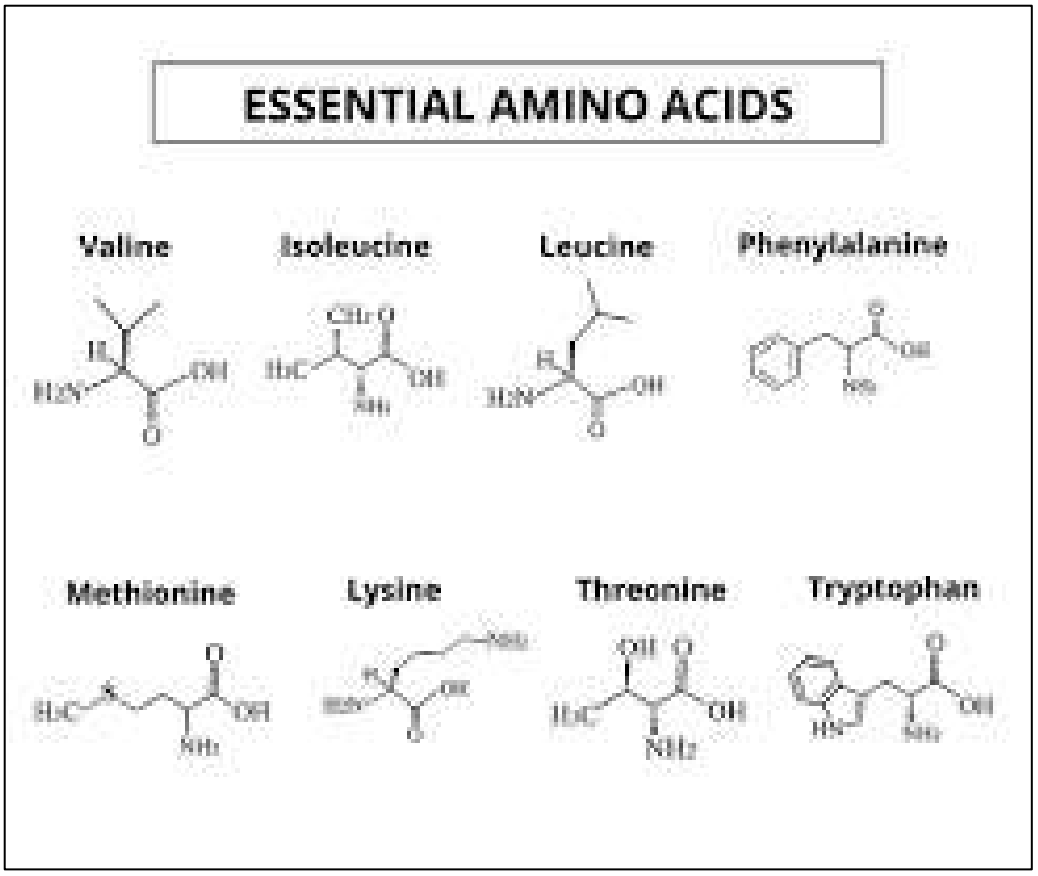
Explanation:

The **Glycaemic Index (GI)** ranks carbohydrate-containing foods according to how quickly they raise blood glucose levels compared with pure glucose (GI = 100). High-GI foods are digested and absorbed rapidly, causing a quick rise in blood sugar, whereas low-GI foods produce a slower, more gradual increase. Factors such as fiber content, food processing, fat, protein, and cooking methods can affect the GI of a food.

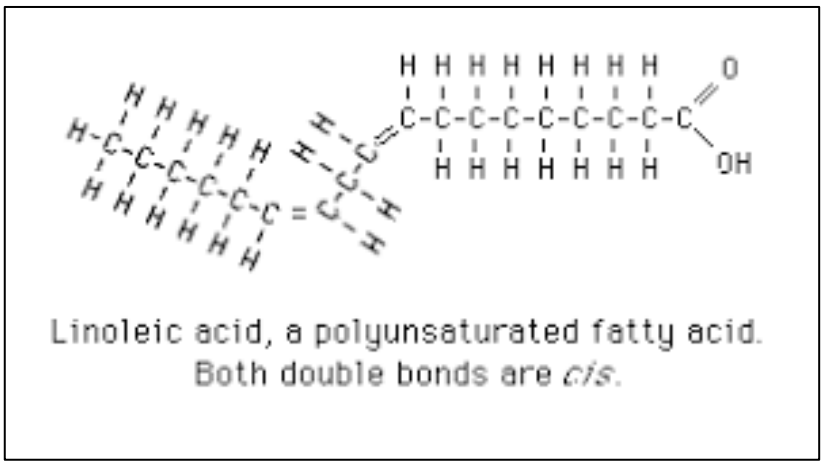


(3) Answer: TFTFT

Explanation: A **complete protein** contains all **essential amino acids** in proportions sufficient to meet the body's requirements for growth, maintenance, and repair. Examples include eggs, milk, fish, meat, and poultry. Most plant proteins are incomplete because they are deficient in one or more essential amino acids, although some plant sources such as quinoa and soy are considered complete proteins.



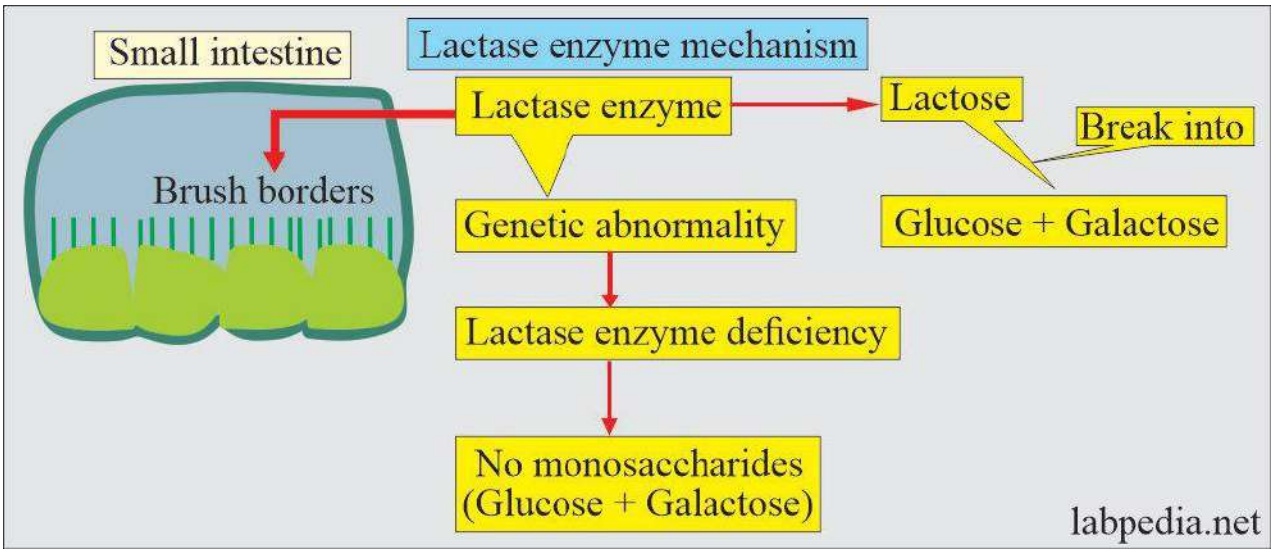
(4) Answer: TTTTF
Explanation:
Essential fatty acids (EFAs) are fatty acids t
hat humans cannot synthesize in adequate amounts and therefore must obtain from food. The two main EFAs are **linoleic acid (omega-6)** and **α-linolenic acid (omega-3)**. They are important for cell membrane structure, growth, brain function, and the synthesis of signaling molecules called eicosanoids. **Oleic acid (omega-9)** is not essential because it can be synthesized by the body.



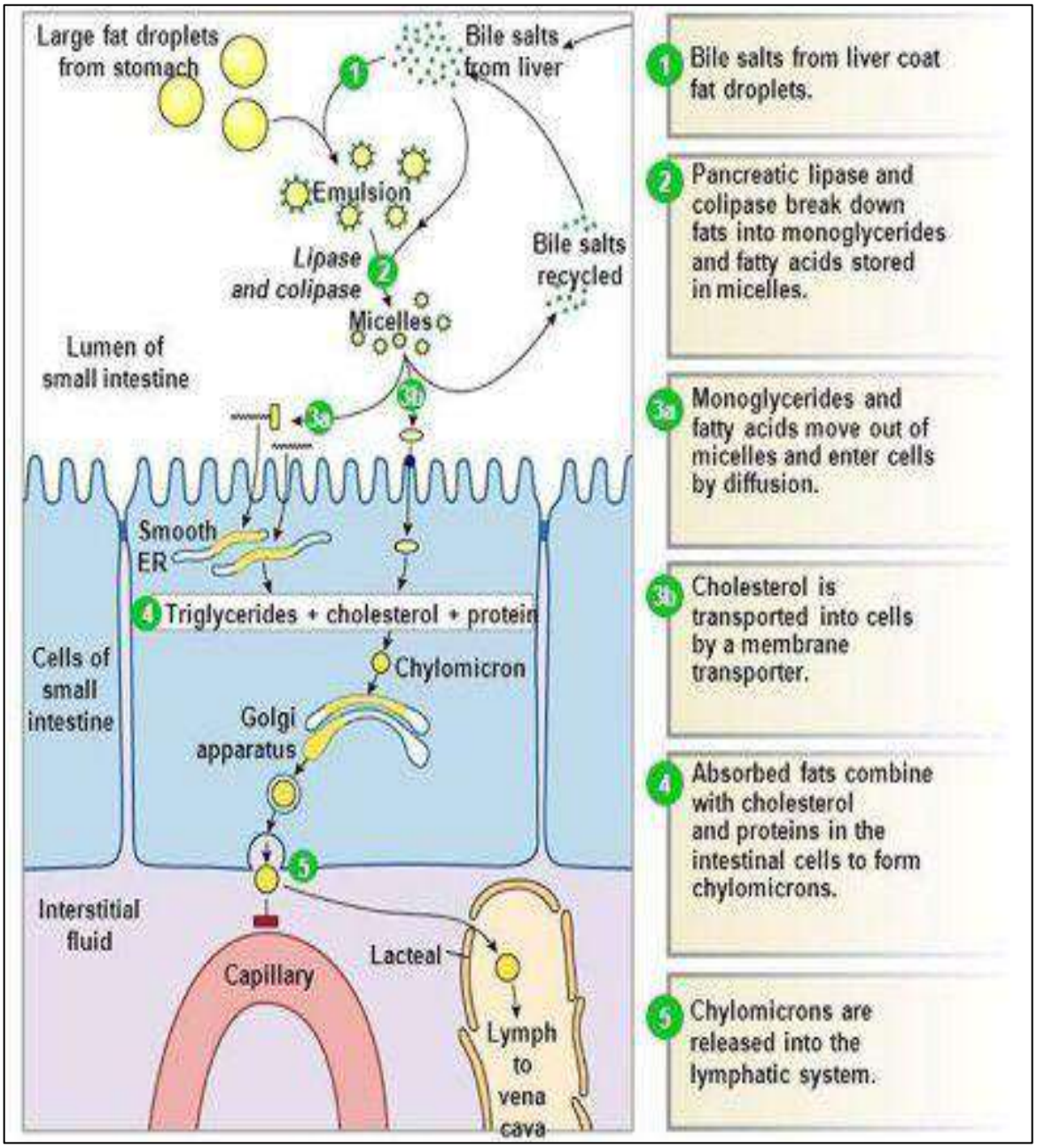
(5) Answer- F F T F F

Explanation-
The respiratory quotient (RQ) is defined as the ratio of carbon dioxide (CO_2) produced to oxygen (O_2) consumed during metabolism. Therefore, the correct formula is RQ = VCO_2 / VO_2, making statement (C) true and statement (A) false. RQ is used to determine the type of nutrient being oxidized for energy. It does not measure heat production directly; heat production is measured by calorimetry. Furthermore, RQ is determined by measuring oxygen consumption and carbon dioxide production (indirect calorimetry), not by direct calorimetry. The RQ value varies with the type of food metabolized: carbohydrates have an RQ of approximately 1.0, fats about 0.7, and proteins about 0.8, so it is not constant for all foods.

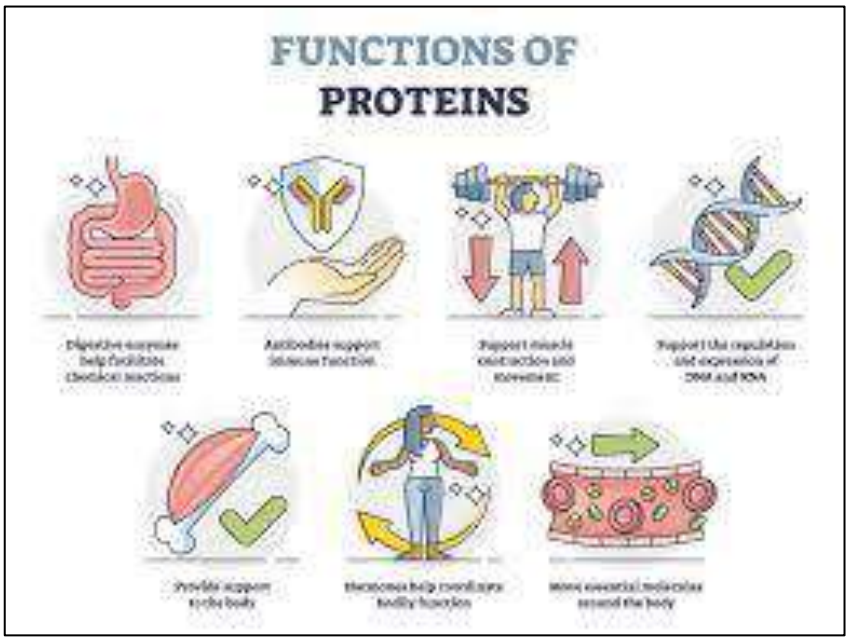
(6) Answer: C. Lactase
Explanation:Lactase deficiency results in impaired digestion of lactose in the small intestine. Undigested lactose causes osmotic diarrhea, bloating, and abdominal discomfort.



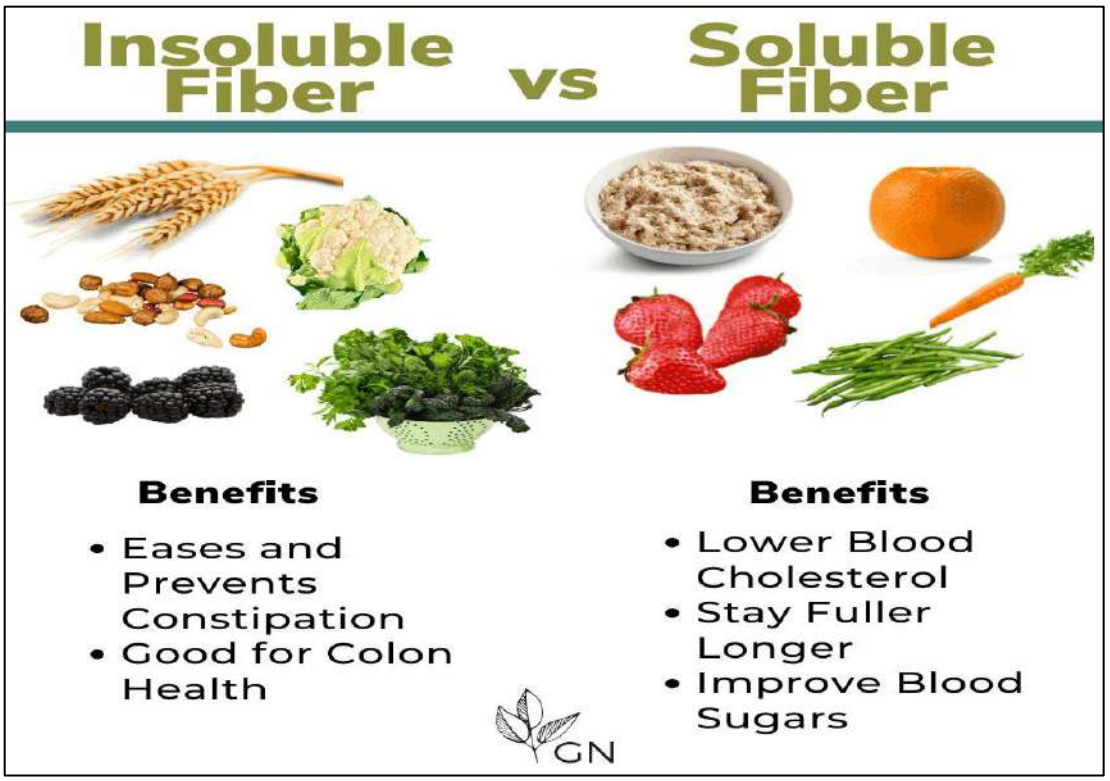
(7) Answer: B. Emulsification of fats by bile salts
Explanation: Bile salts are essential for fat emulsification. Impaired bile secretion leads to steatorrhea and deficiency of fat-soluble vitamins.


Large fat droplets from stomach
Bile salts from liver
1
Emulsion
Lipase and colipase
2
Bile salts recycled
Micelles
Lumen of small intestine
3a
3b
Smooth ER
4 Triglycerides + cholesterol + protein
Chylomicron
Cells of small intestine
Golgi apparatus
5
Interstitial fluid
Capillary
Lacteal
Lymph to vena cava
1 Bile salts from liver coat fat droplets.
2 Pancreatic lipase and colipase break down fats into monoglycerides and fatty acids stored in micelles.
3a Monoglycerides and fatty acids move out of micelles and enter cells by diffusion.
3b Cholesterol is transported into cells by a membrane transporter.
4 Absorbed fats combine with cholesterol and proteins in the intestinal cells to form chylomicrons.
5 Chylomicrons are released into the lymphatic system.

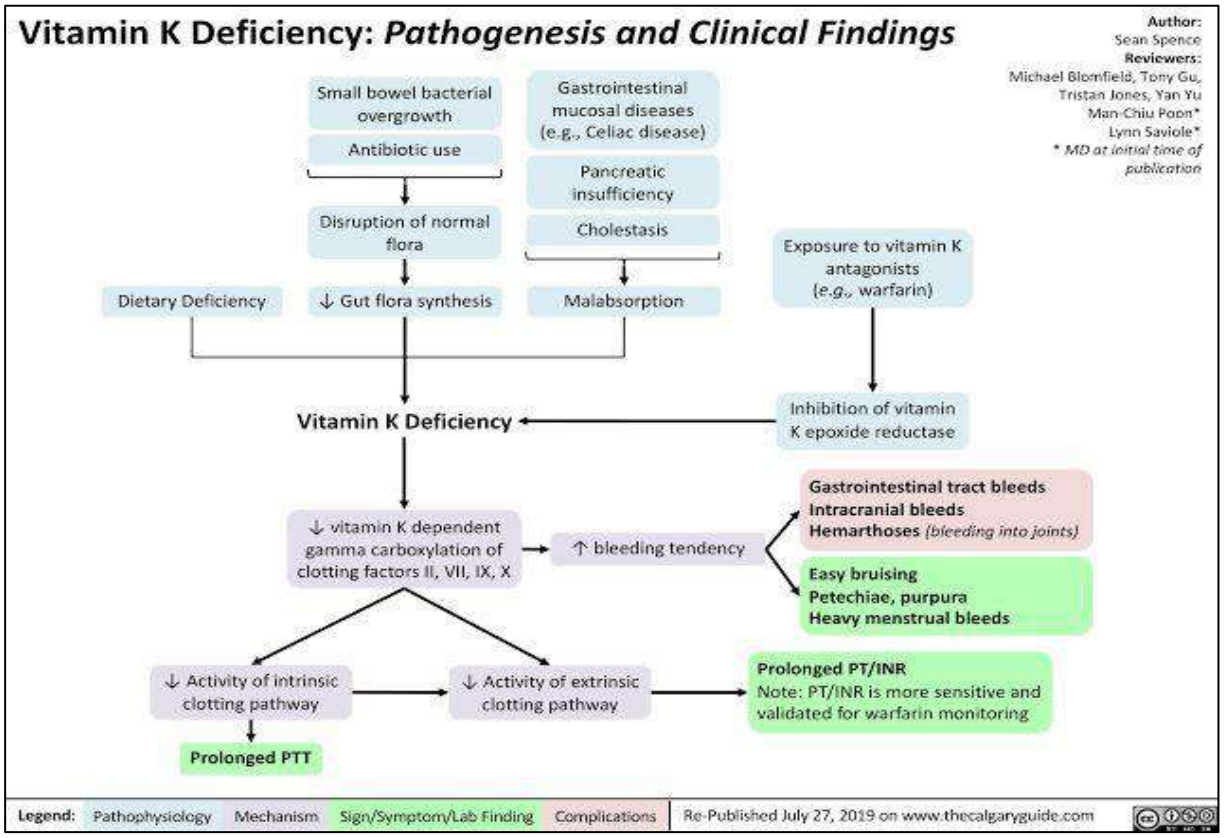
(8) Answer: D. Proteins
Explanation: Proteins are required for tissue repair, immunity, and enzyme synthesis. Deficiency leads to muscle wasting and poor immunity.



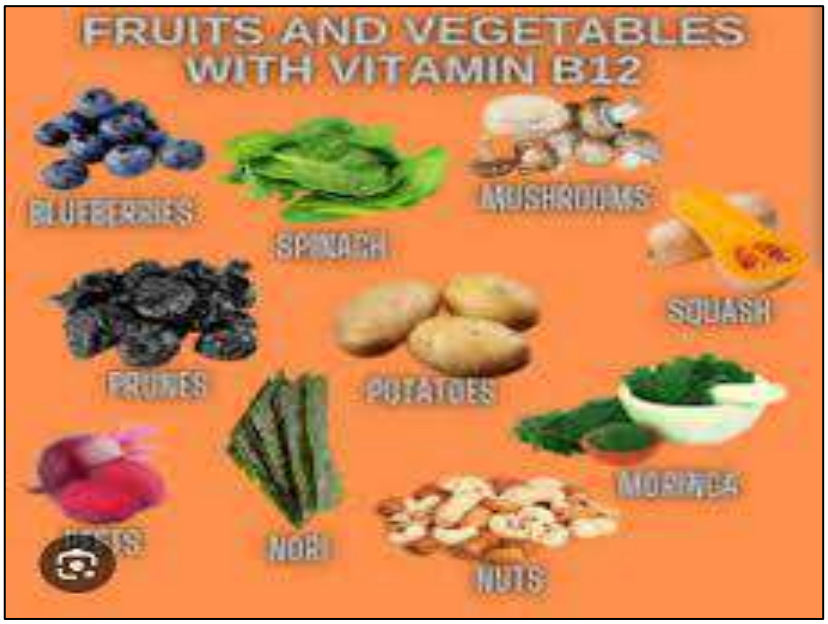
(9) Answer: C. Increase insoluble dietary fibre
Explanation: Insoluble fibre adds bulk to stool and promotes bowel movement.



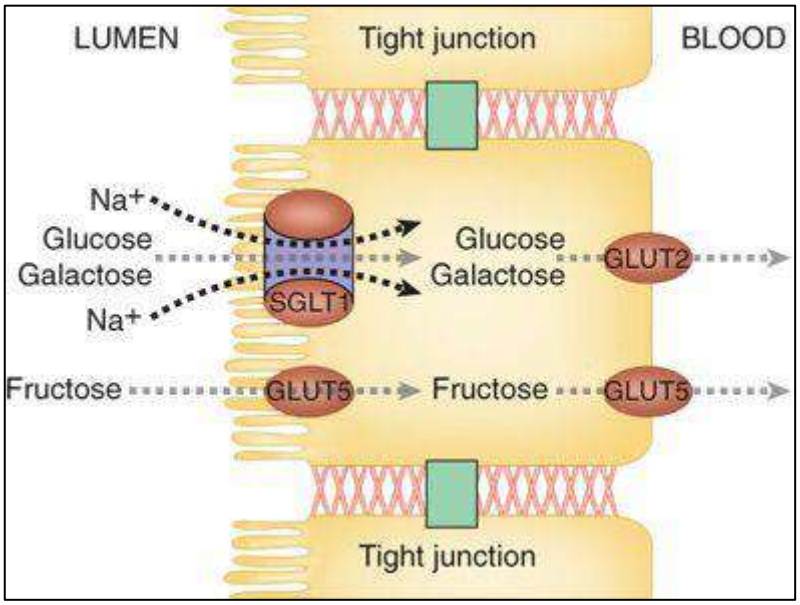
(10) Answer: D. Vitamin K
Explanation: Vitamin K is necessary for clotting factor synthesis. Fat malabsorption reduces its absorption.



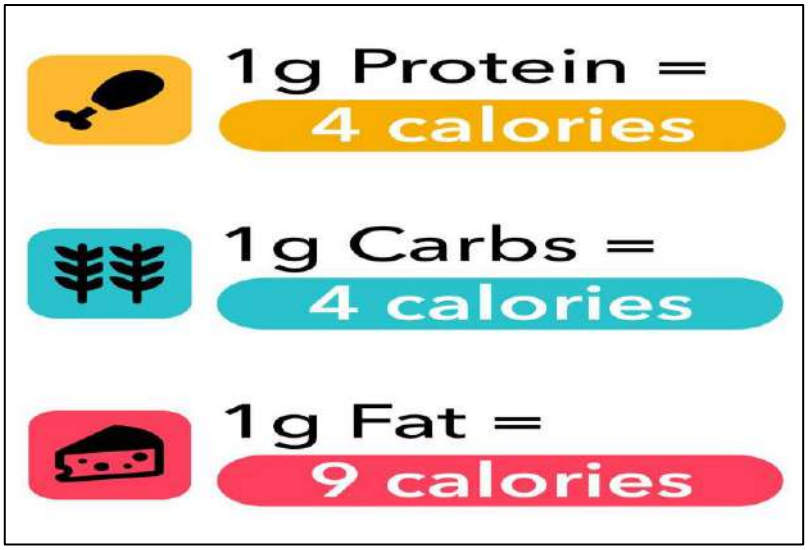
(11) Answer: C. It is naturally found only in animal-origin foods
Explanation: Vitamin B12 is mainly present in meat, fish, eggs, and dairy products.



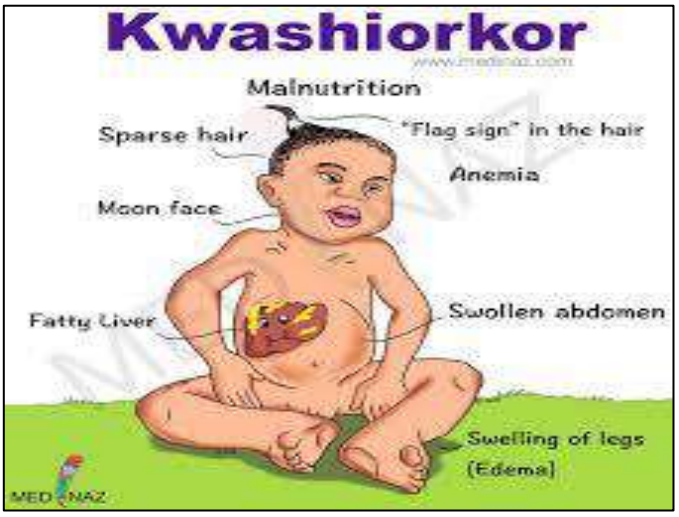
(12) Answer: C. Small intestine (jejunum)
Explanation: Glucose and galactose are absorbed mainly in the jejunum.



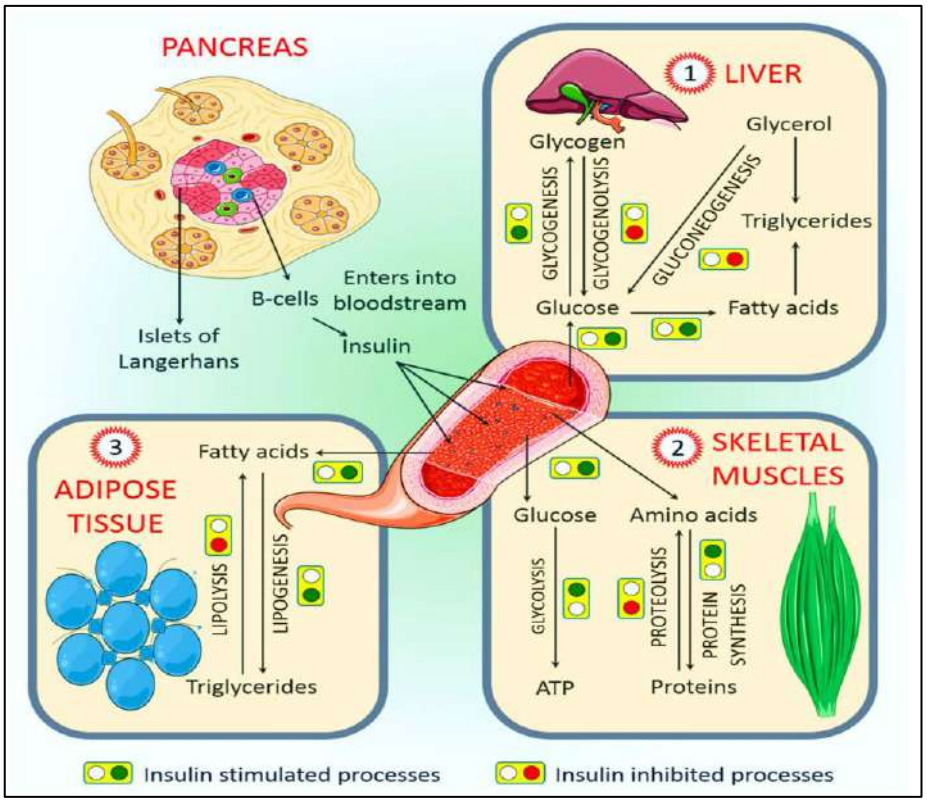
(13) Answer: C. Fats
Explanation: Fats provide 9 kcal/g, while proteins and carbohydrates provide 4 kcal/g.



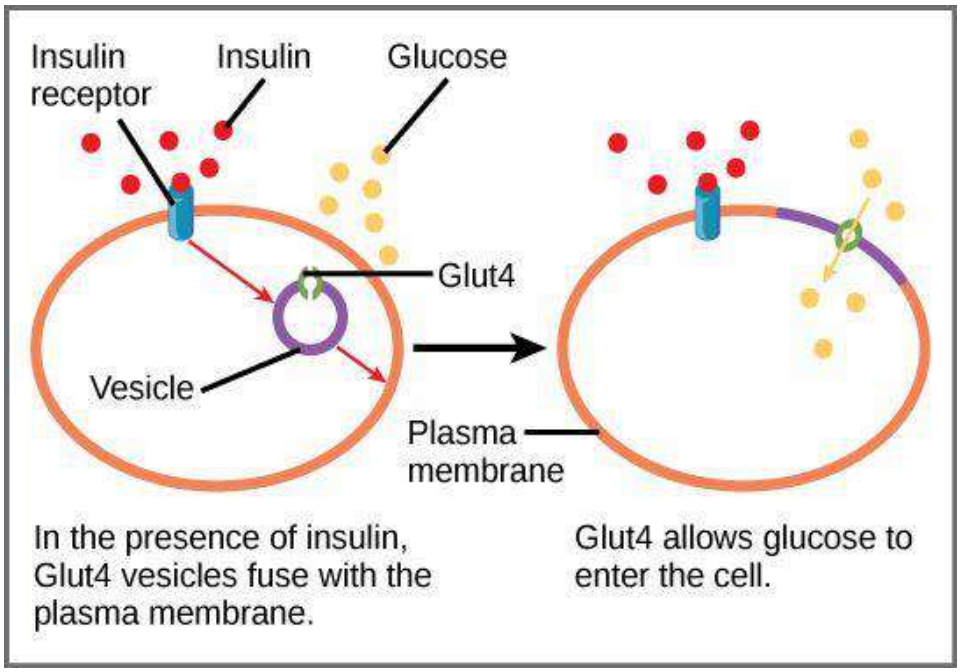
(14) Answer: C. Proteins
Explanation: Protein deficiency causes kwashiorkor.



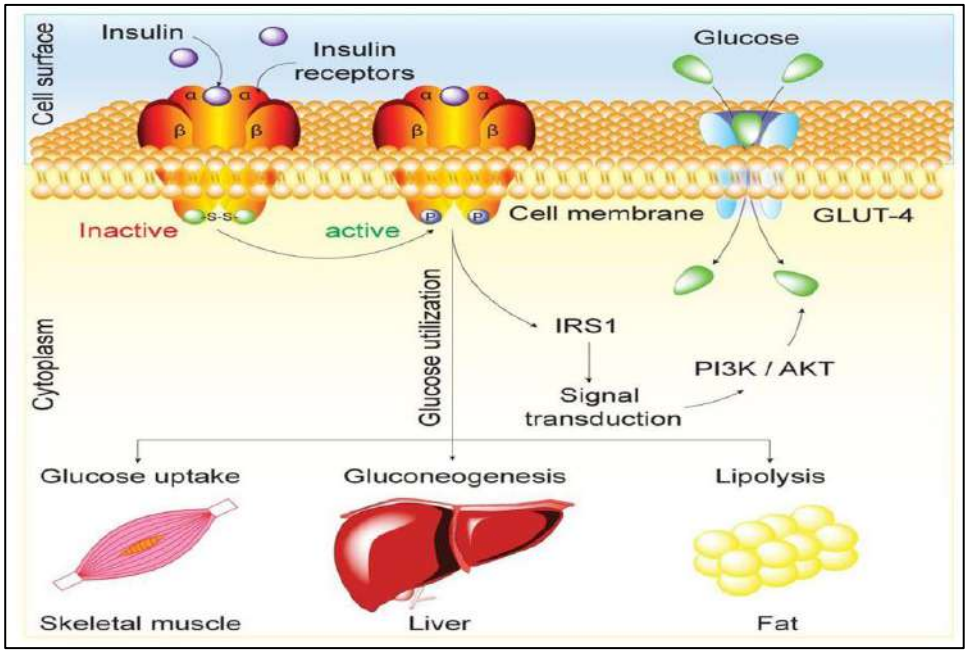
(15) Answer: C. Increased glucose uptake by muscle and adipose tissue
Explanation: Insulin promotes GLUT-4 mediated glucose uptake.



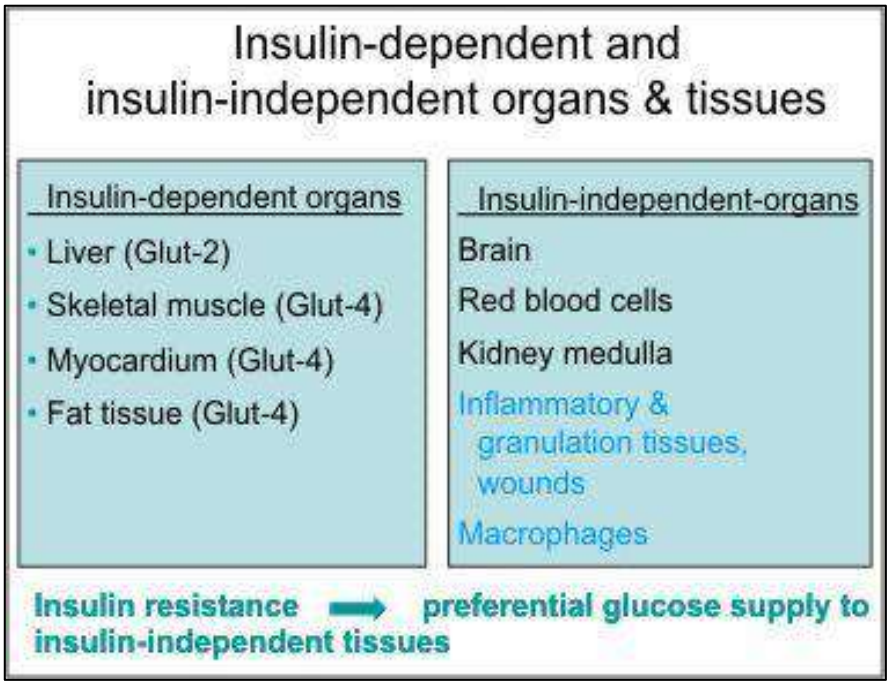
(16) Answer: D. GLUT-4
Explanation: GLUT-4 is the insulin-dependent glucose transporter.



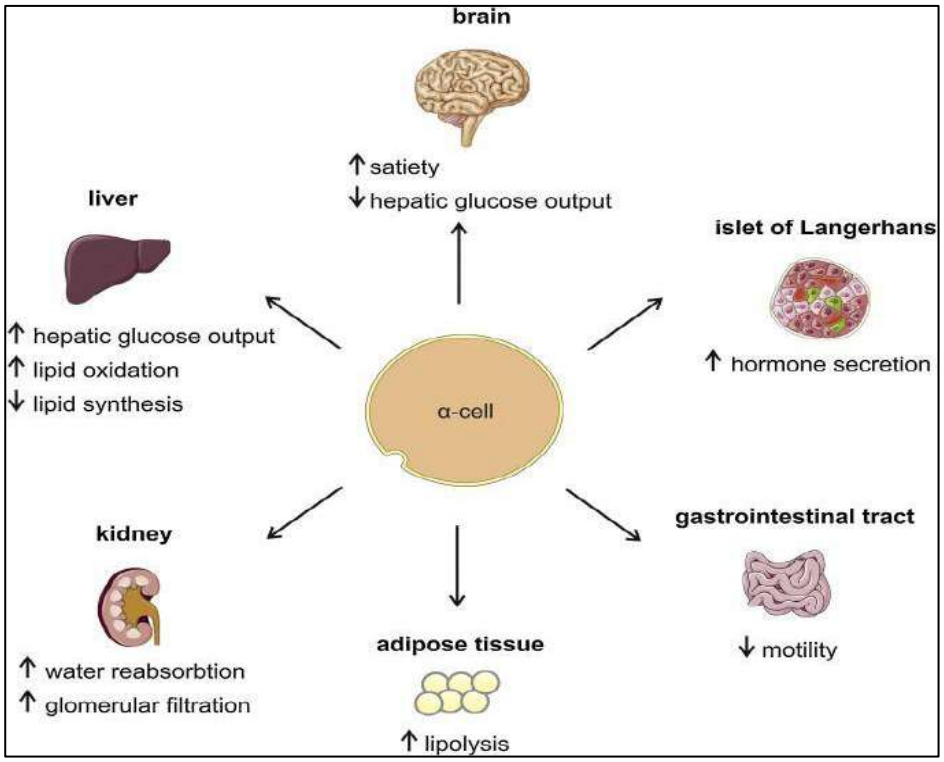
(17) Answer: B. Tyrosine kinase activity
Explanation: The insulin receptor is a receptor tyrosine kinase.



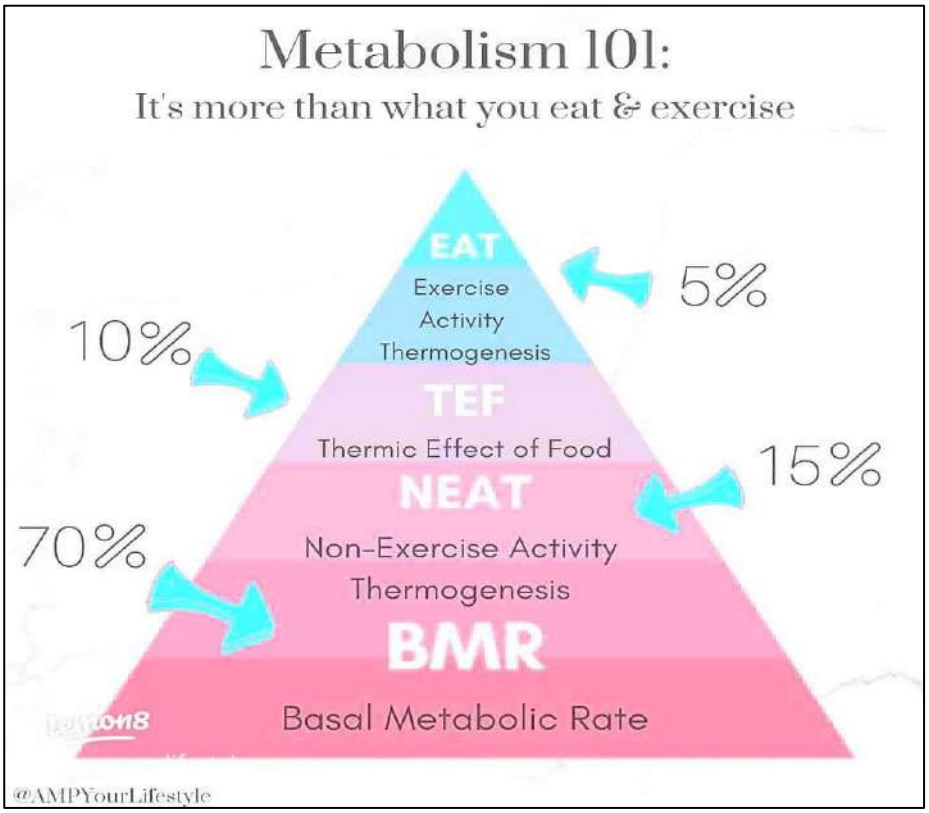
(18) Answer: C. Brain
Explanation: The brain uses insulin-independent GLUT1 and GLUT3 transporters.



(19) Answer: C. Skeletal muscle
Explanation: Skeletal muscle lacks glucagon receptors.



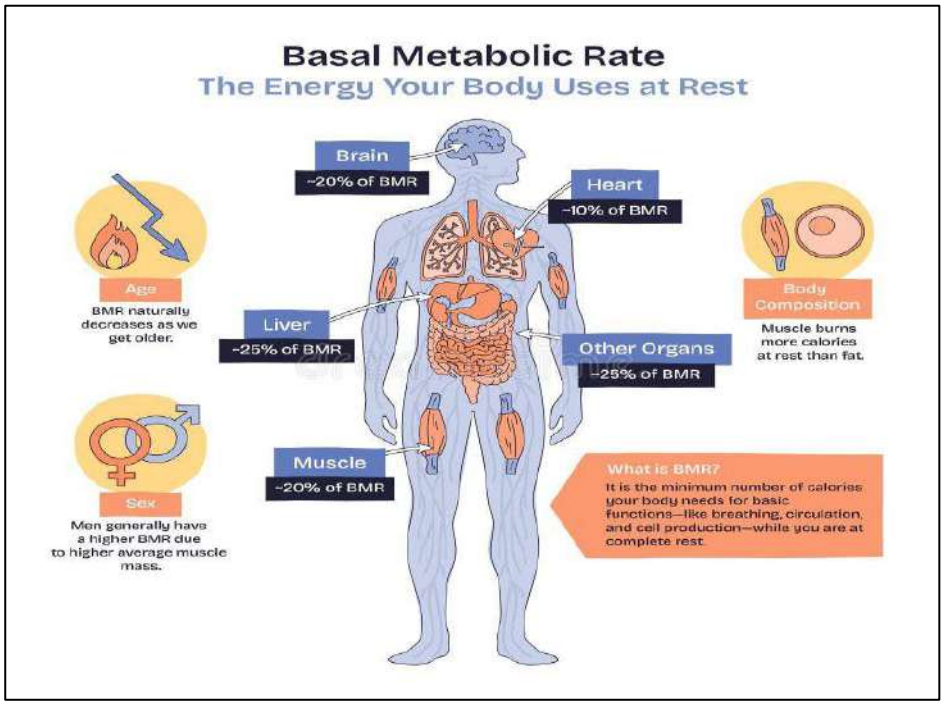
(20) Answer: E. Per capita income
Explanation: Per capita income is an indirect method of nutritional assessment.



(21) Answer: C. 0.8 g/kg/day
Explanation: WHO recommends about 0.8 g/kg/day for healthy adults.



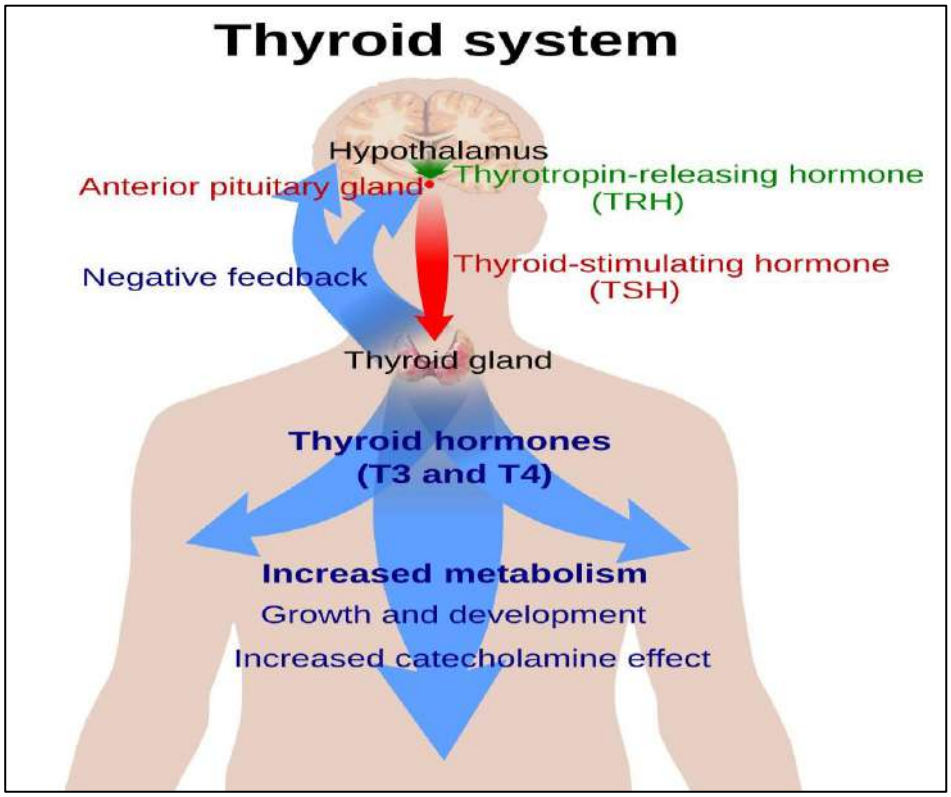
(22) Answer: C. Basal metabolic rate
Explanation: BMR accounts for around 60–70% of total energy expenditure.



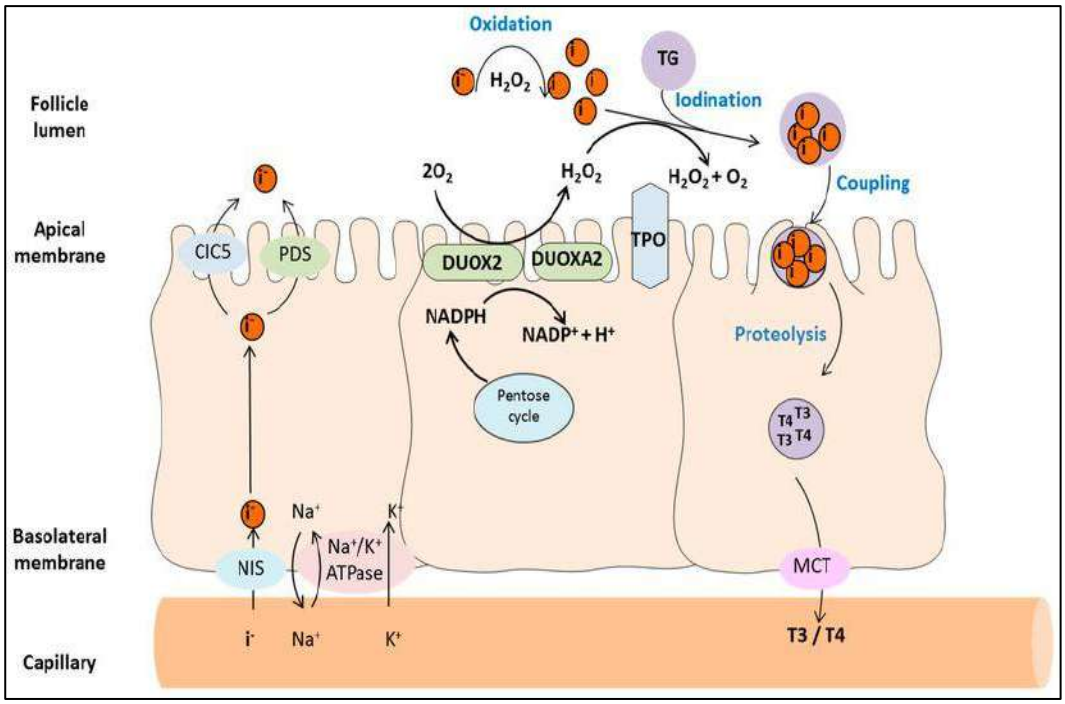
(23) Answer: C. Pregnancy
Explanation: Pregnancy is an anabolic state associated with tissue growth.

(24) Answer: E. All of the above
Explanation: Multiple physiological factors influence BMR.

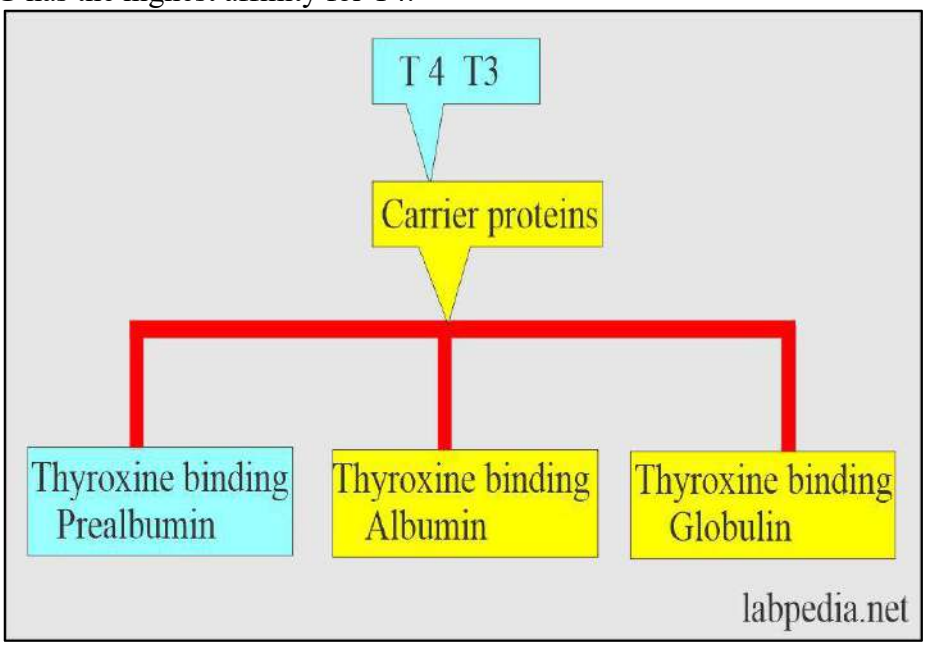
(25) Answer: D. TSH
Explanation: TSH directly stimulates thyroid hormone synthesis.



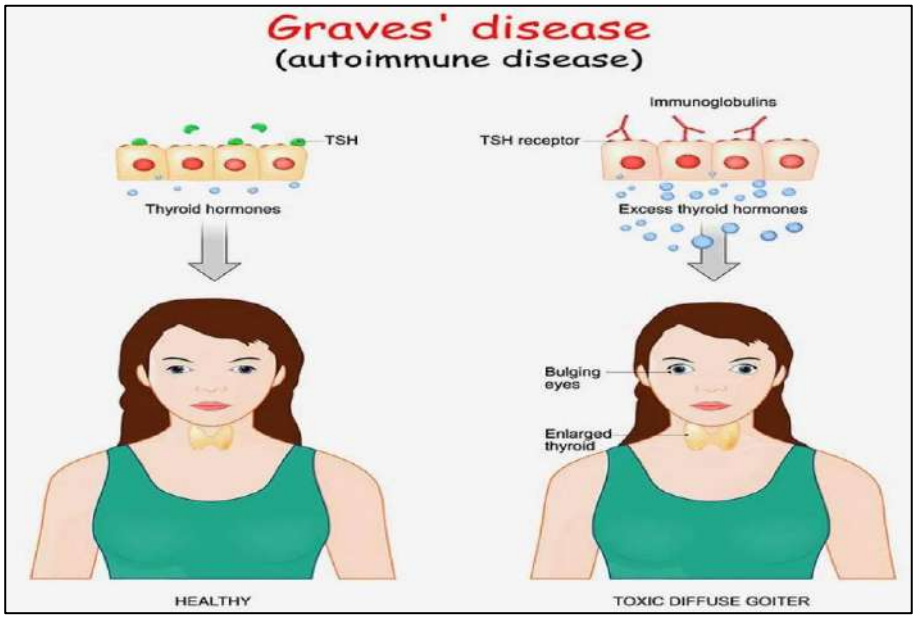
(26) Answer: B. Peroxidase
Explanation: Thyroid peroxidase catalyzes organification and coupling.



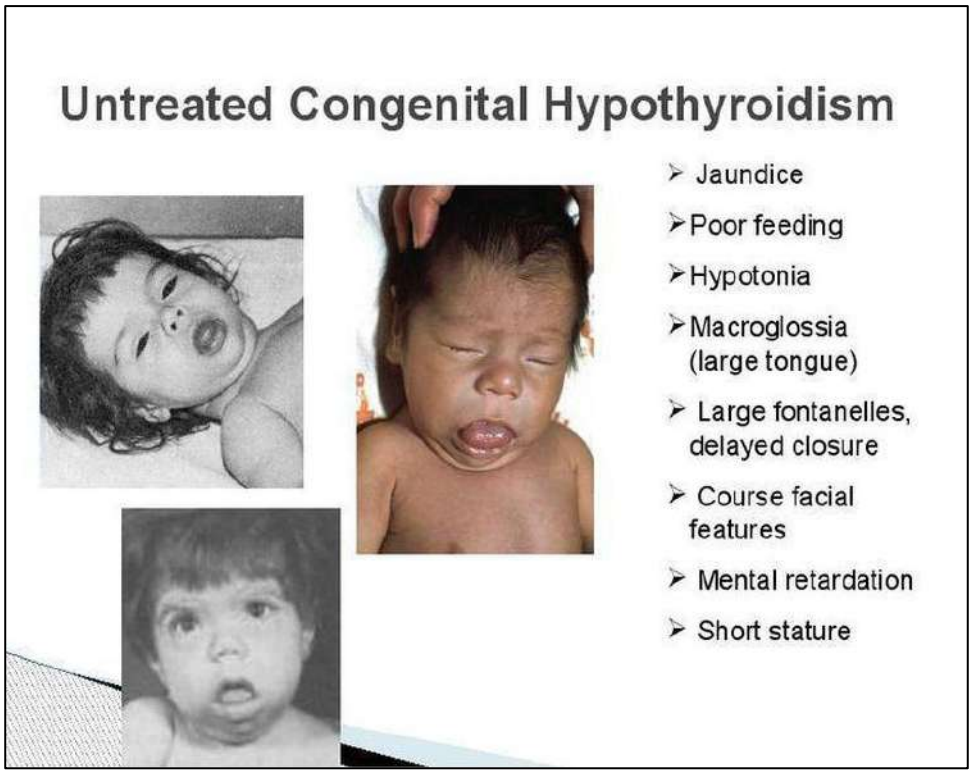
(27) Answer: C. Thyroxine-binding globulin
Explanation: TBG has the highest affinity for T4.



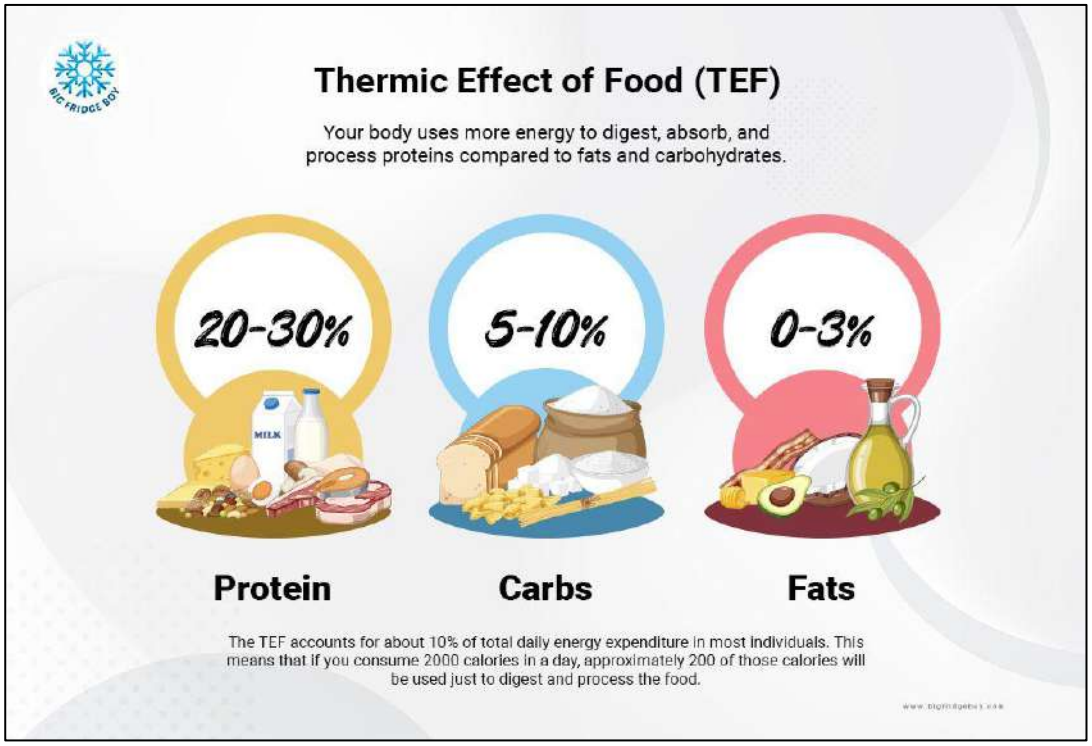
(28) Answer: C. TSH receptor–stimulating antibodies
Explanation: Graves disease is caused by TSH receptor antibodies.



(29) Answer: C. Poor sucking and hypotonia
Explanation: Congenital hypothyroidism presents with hypotonia and poor feeding.



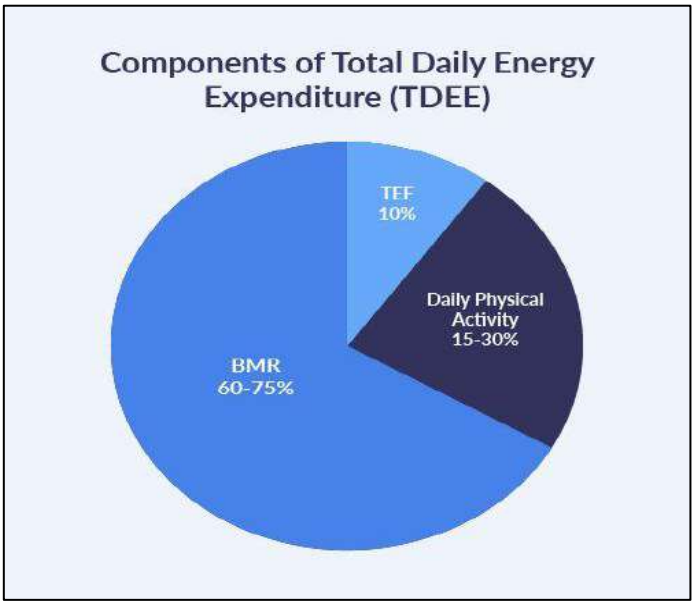
(30) Answer: C. Proteins
Explanation: Protein metabolism requires the greatest energy expenditure.



(31) Answer: C. 1800 kcal
Explanation: Sedentary activity factor is approximately 1.2. Therefore, 1500 × 1.2 = 1800 kcal/day.

(32) Answer: D. Post-absorptive state
Explanation: BMR should be measured after fasting and complete rest.

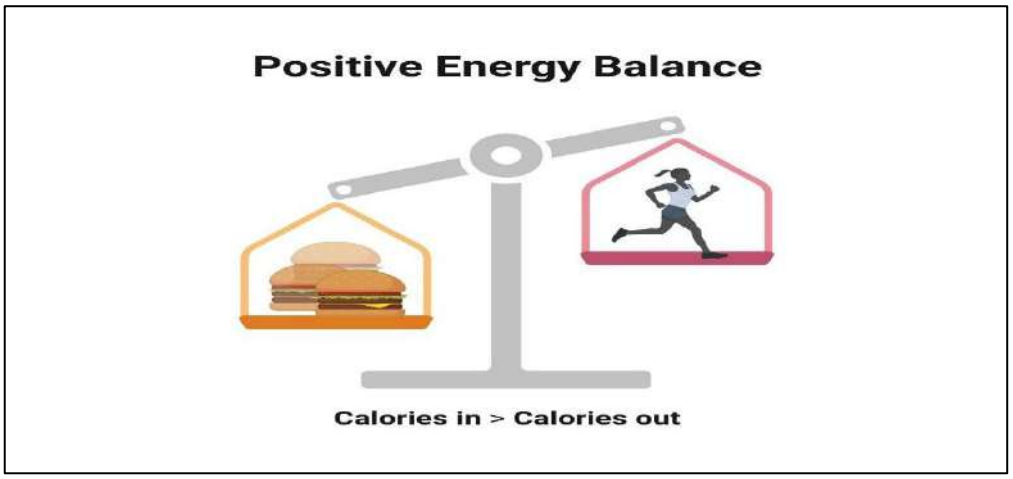
(33) Answer: D. BMR
Explanation: Basal metabolic rate contributes about 60–75% of total daily energy expenditure.



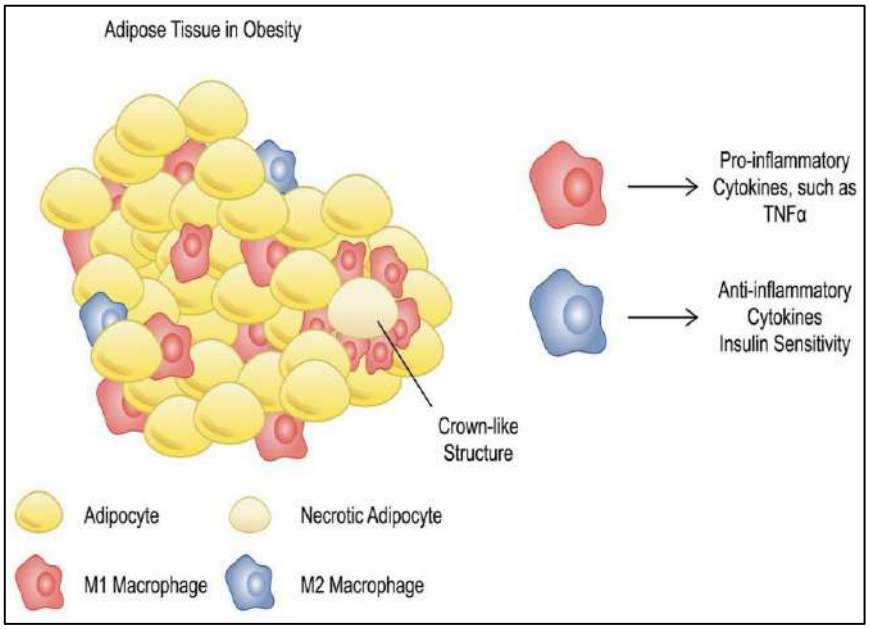
(34) Answer: D. Obese
Explanation: BMI ≥30 kg/m² is classified as obesity.

	WHO	Asia-Pacific
Underweight	<18.5	<18.5
Normal	18.5-24.9	18.5-22.9
Overweight	25-29.9	23-24.9
Obese	≥30	>25

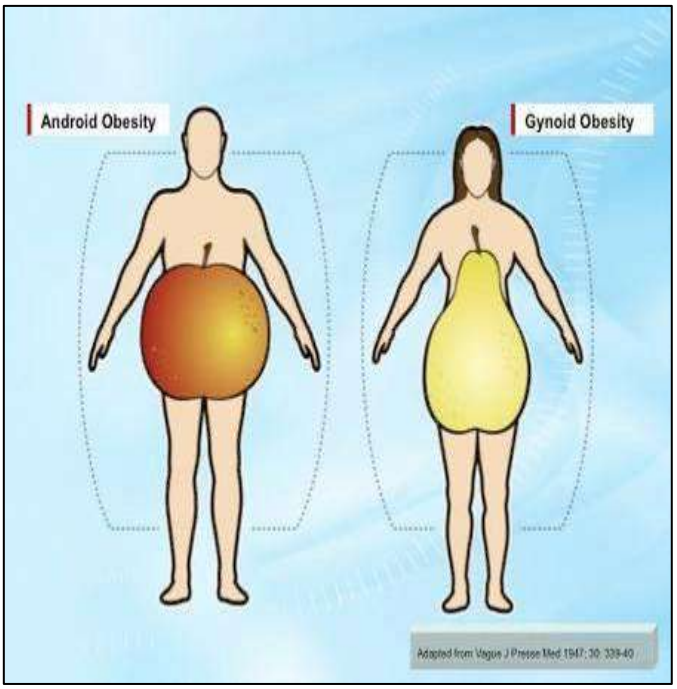
(35) Answer: C. Positive energy balance
Explanation: Obesity occurs when calorie intake exceeds calorie expenditure.



(36) Answer: C. TNF-α
Explanation: TNF-α is a pro-inflammatory cytokine associated with obesity-related inflammation.



(37) Answer: C. Abdomen
Explanation: Android obesity is characterized by central abdominal fat accumulation.



(38) Answer: C. Three
Explanation: Metabolic syndrome is diagnosed when three or more risk factors are present.

Table 1. Diagnostic Criteria for Metabolic Syndrome[a]

Criterion	Definition
Abdominal obesity	Waist circumference: men, >40 in. (>102 cm); women, >35 in. (>88 cm)
Hypertriglyceridemia	≥150 mg/dL
Low HDL-C	Men, <40 mg/dL; women, <50 mg/dL
High blood pressure	≥130/85 mmHg
High fasting glucose	≥110 mg/dL

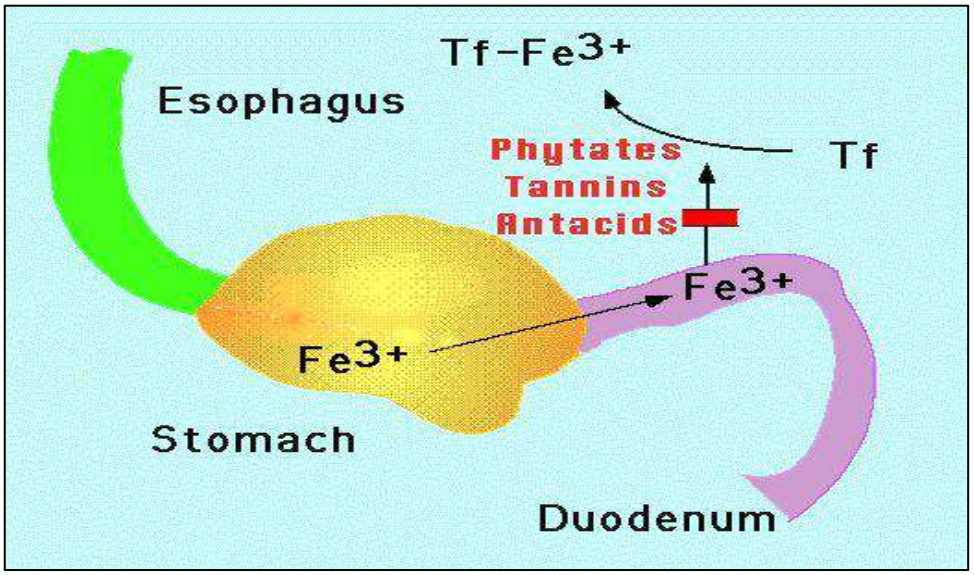
[a] Diagnosis based on presence of three of five factors.
Source: Reference 6.

(39) Answer: D. Decreased serum ferritin
Explanation: Ferritin decreases early in iron deficiency anemia.

	Iron deficiency anemia	Anemia of inflammatory disease
Hematocrit	↓ to ↓ ↓ ↓	↓ to ↓ ↓
MCV	↓ to ↓ ↓ ↓	Normal to ↓
MCHC	↓	Normal
Serum iron	↓ to ↓ ↓ ↓	Normal to ↓ ↓
Serum TIBC	Normal to ↑	Normal to ↓
Serum ferritin	↓ to ↓ ↓	Normal to ↑ ↑
Stainable iron in marrow	Absent	Normal to ↑
Reticulocytes	Normal to ↓	↓

MCV — mean corpuscular volume, MCHC — mean corpuscular hemoglobin

(40) Answer: B. Duodenum
Explanation: Iron absorption mainly occurs in the duodenum.

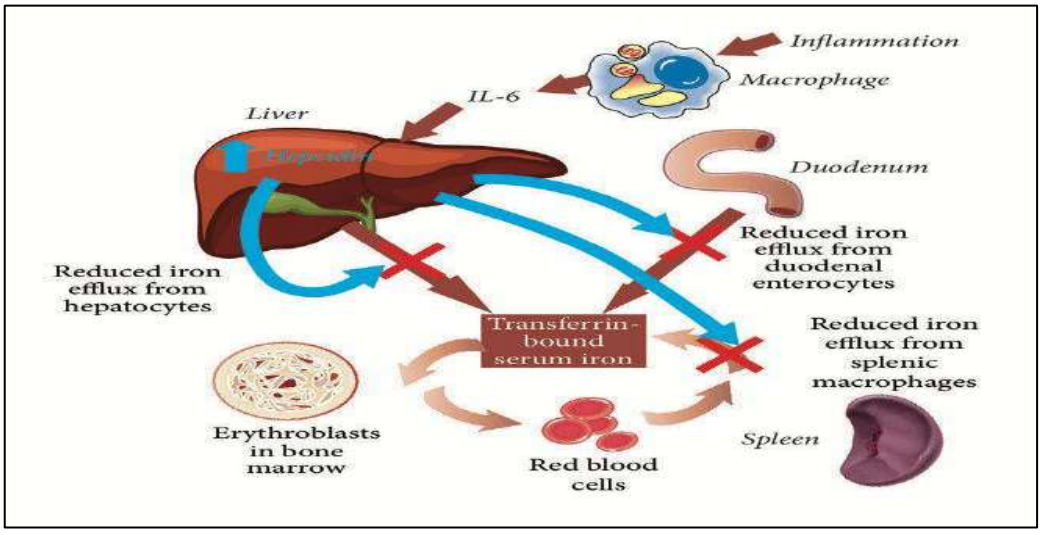


(41) Answer: C. Vitamin C
Explanation: Vitamin C enhances iron absorption by reducing ferric iron to ferrous iron.

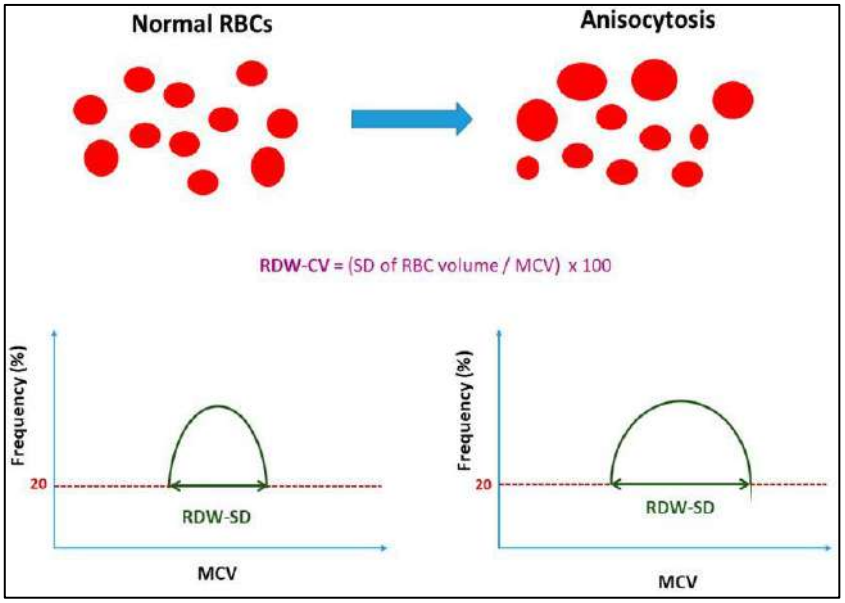
Table 8-7 Factors That Affect Iron Absorption

INCREASE	DECREASE
Acid in the stomach	Phytic acid (in fiber)
Heme iron	Oxalic acid
High body demand for red blood cells (blood loss, pregnancy)	Polyphenols in tea and coffee
Low body stores of iron	Full body stores of iron
Meat protein factor (MPF)	Excess of other minerals (Zn, Mn, Ca) (especially when taken as supplements)
Vitamin C	Some antacids

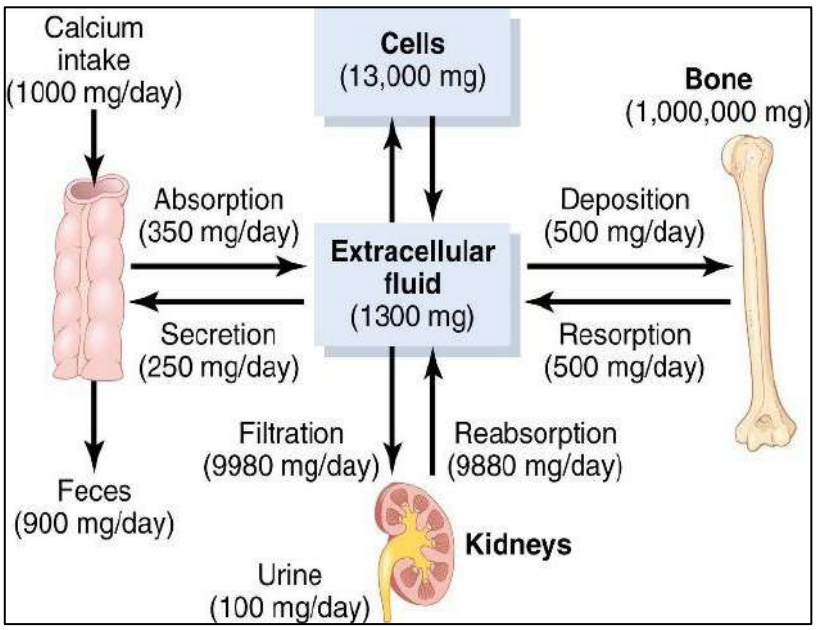
(42) Answer: D. Downregulating ferroportin
Explanation: Hepcidin inhibits iron release by degrading ferroportin.



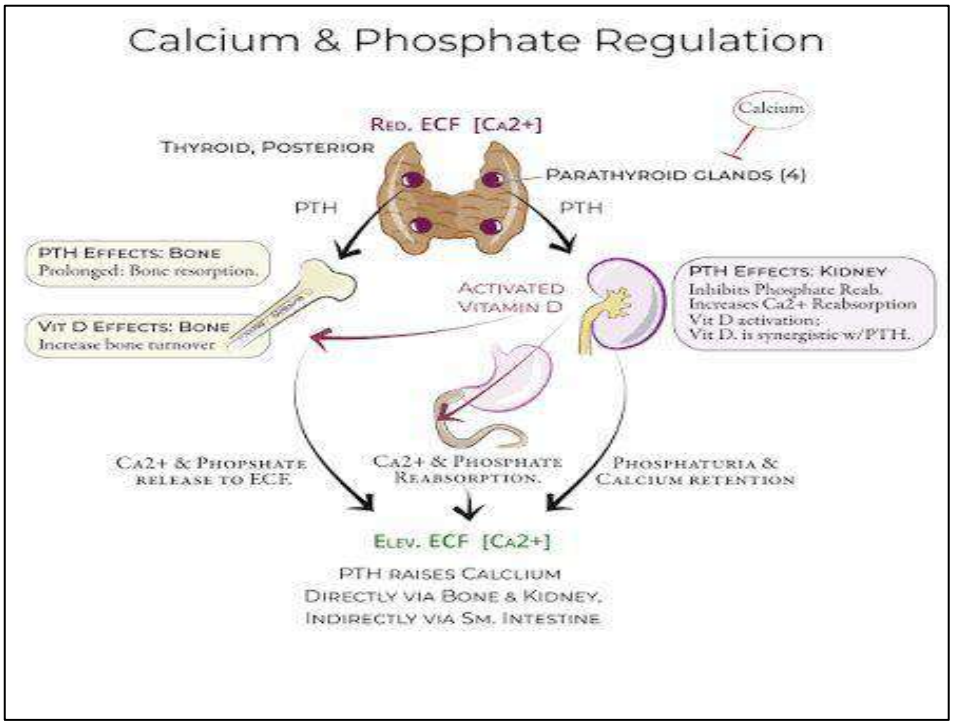
(43) Answer: C. Increased RDW
Explanation: Iron deficiency anemia causes variation in red blood cell size, increasing RDW.



(44) Answer: B. Impaired vitamin D–dependent calcium absorption
Explanation: Vitamin D deficiency reduces intestinal calcium absorption, causing rickets.

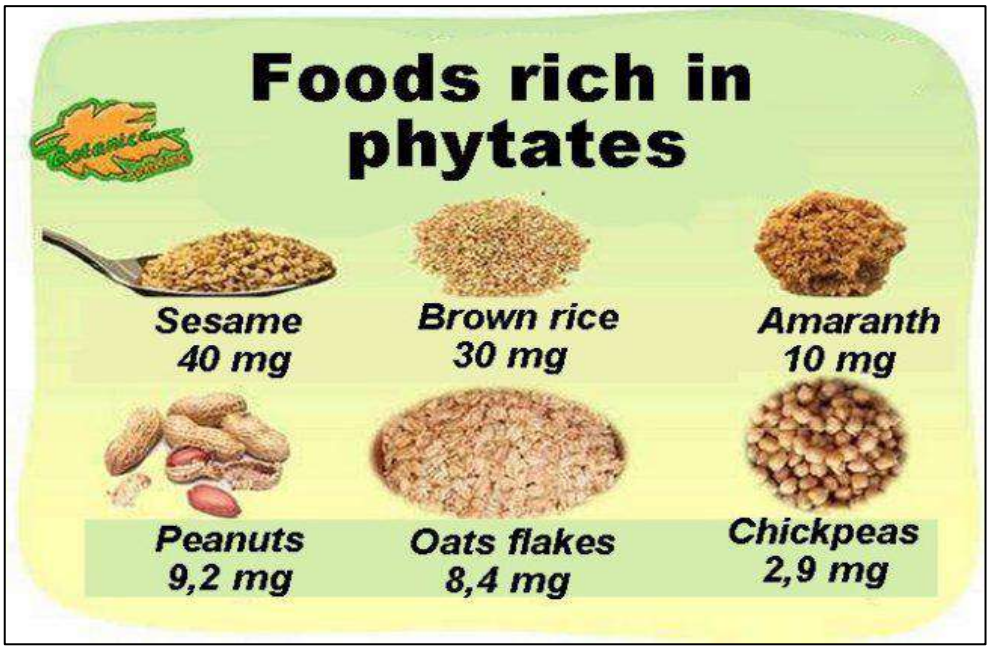


(45) Answer: E. 99%
Explanation: Approximately 99% of body calcium is stored in bones and teeth.

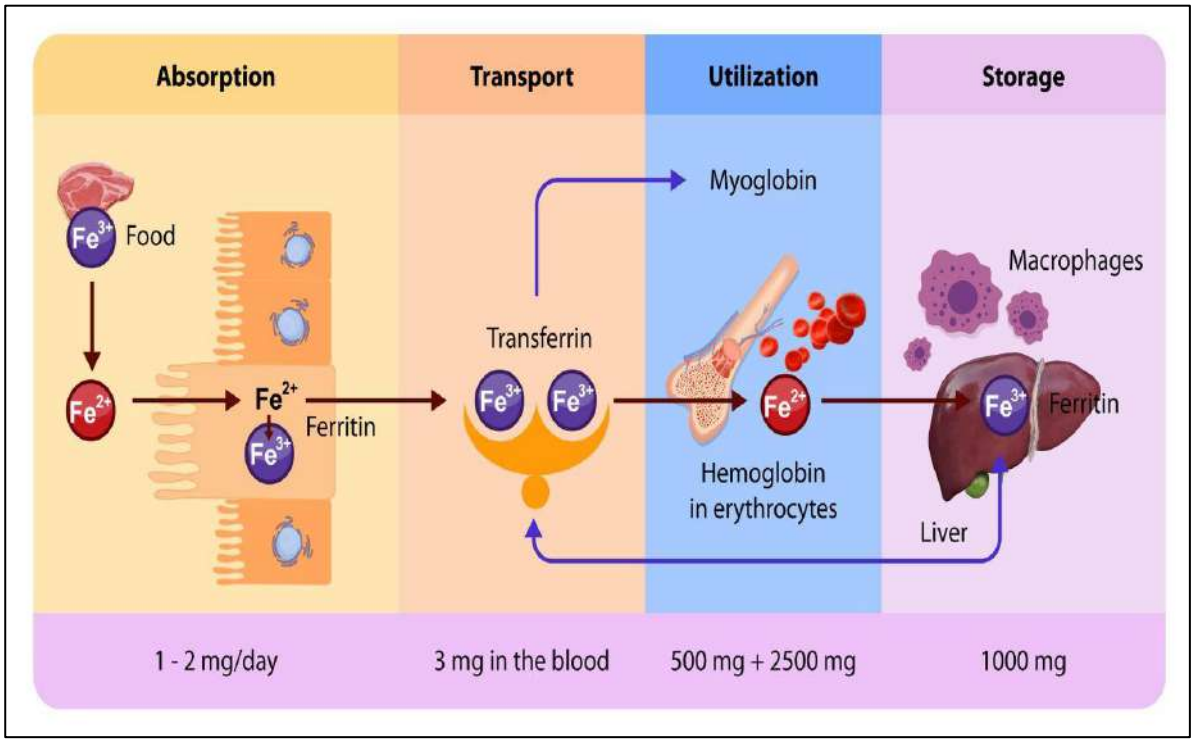


(46) Answer: C. Parathyroid hormone
Explanation: PTH increases calcium reabsorption and bone resorption to raise serum calcium levels.

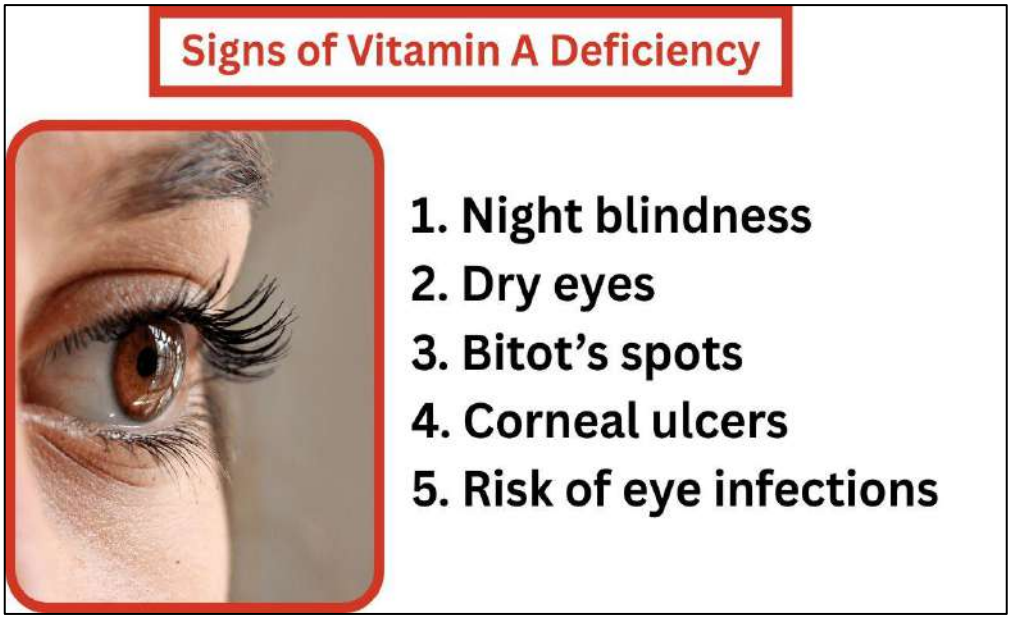
(47) Answer: D. Phytates
Explanation: Phytates bind non-heme iron and reduce its absorption.



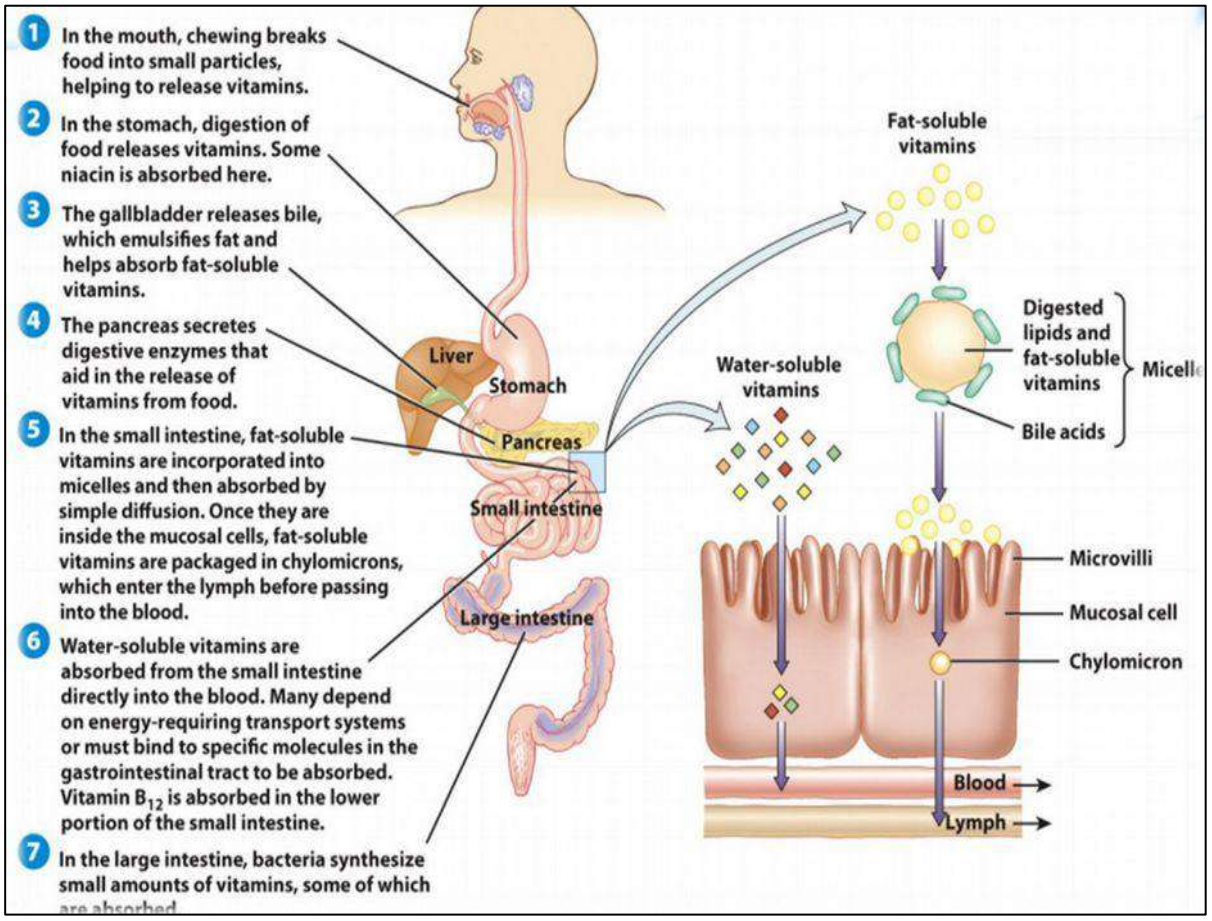
(48) Answer: C. Transferrin
Explanation: Transferrin transports iron in plasma.



(49) Answer: B. Retinal
Explanation: Retinal is required for rhodopsin formation in vision.

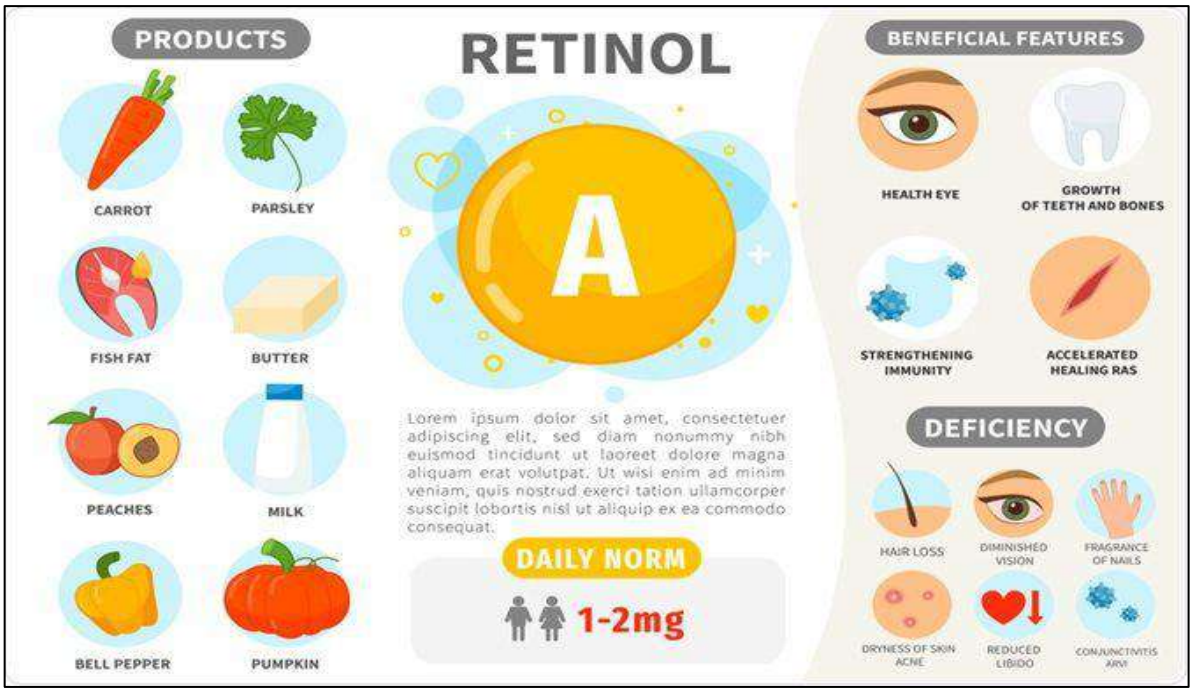


(50) Answer: C. Vitamin A
Explanation: Vitamin A is fat-soluble and requires bile salts for absorption.

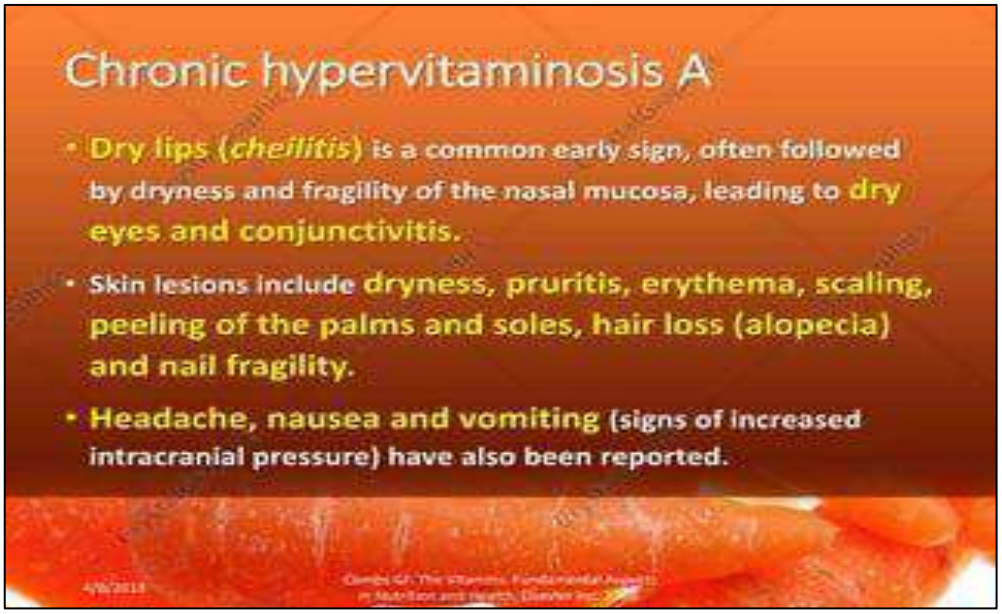


(51) Answer: C. Vitamin E
Explanation: Vitamin E protects red blood cell membranes from oxidative damage.

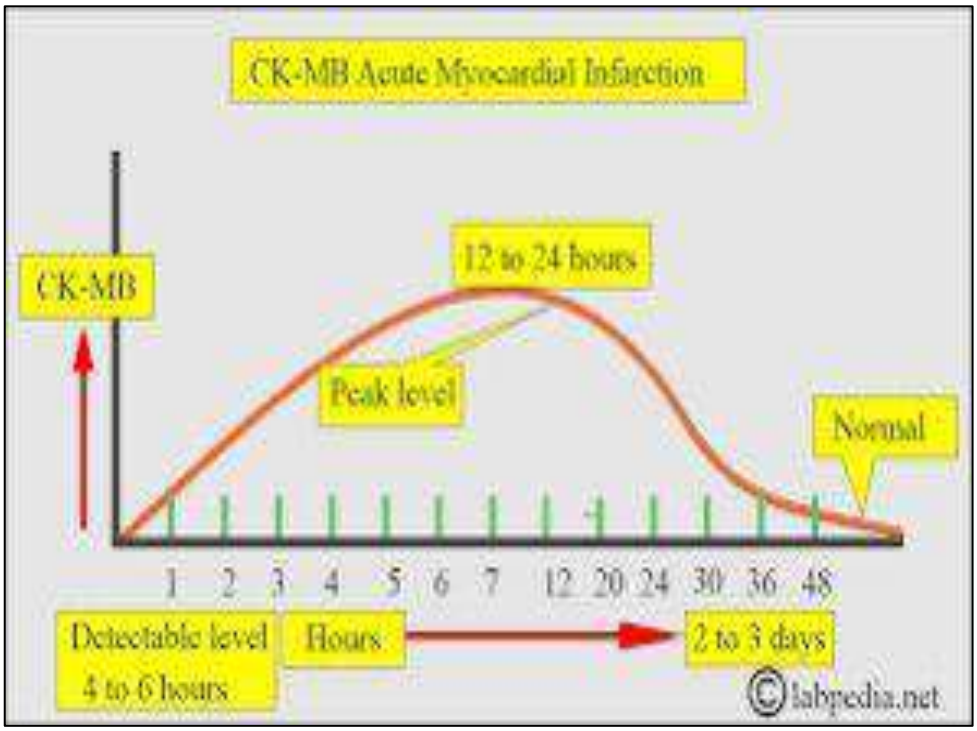
(52) Answer: C. Retinoic acid
Explanation: Retinoic acid is used in acne treatment because it regulates epithelial cell differentiation.



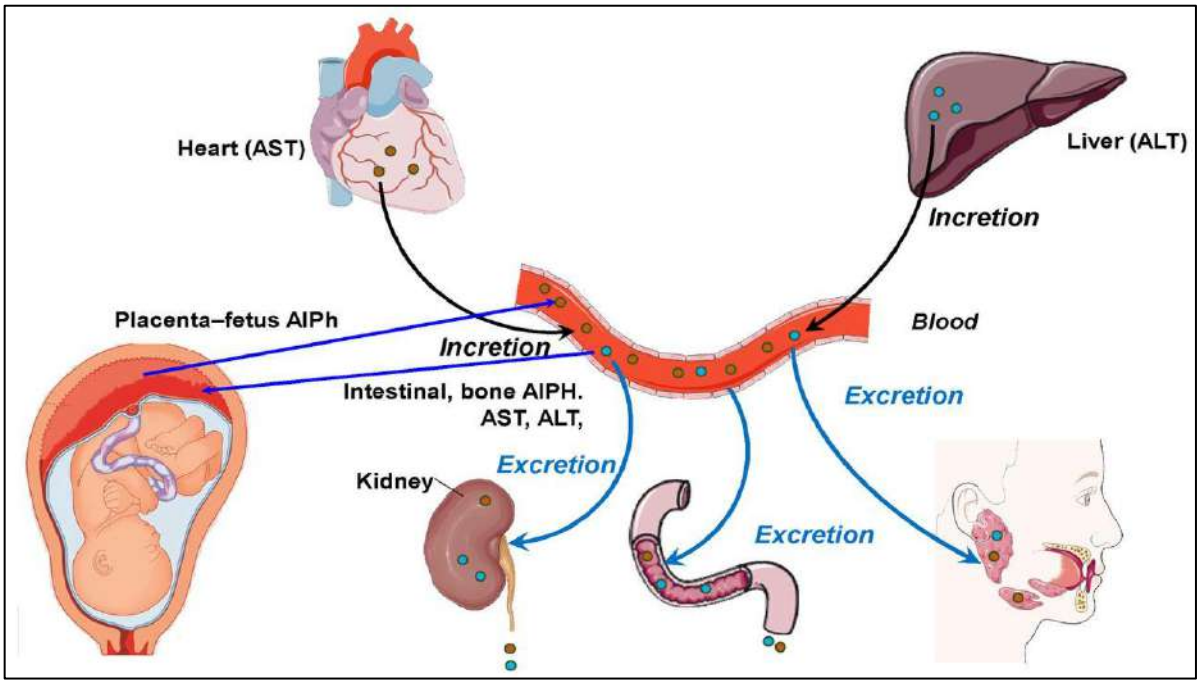
(53) Answer: C. Vitamin A
Explanation: Excess vitamin A causes hepatotoxicity, dry skin, and raised intracranial pressure.



(54) Answer: D. CK-MB
Explanation: CK-MB was historically considered relatively specific for myocardial infarction.



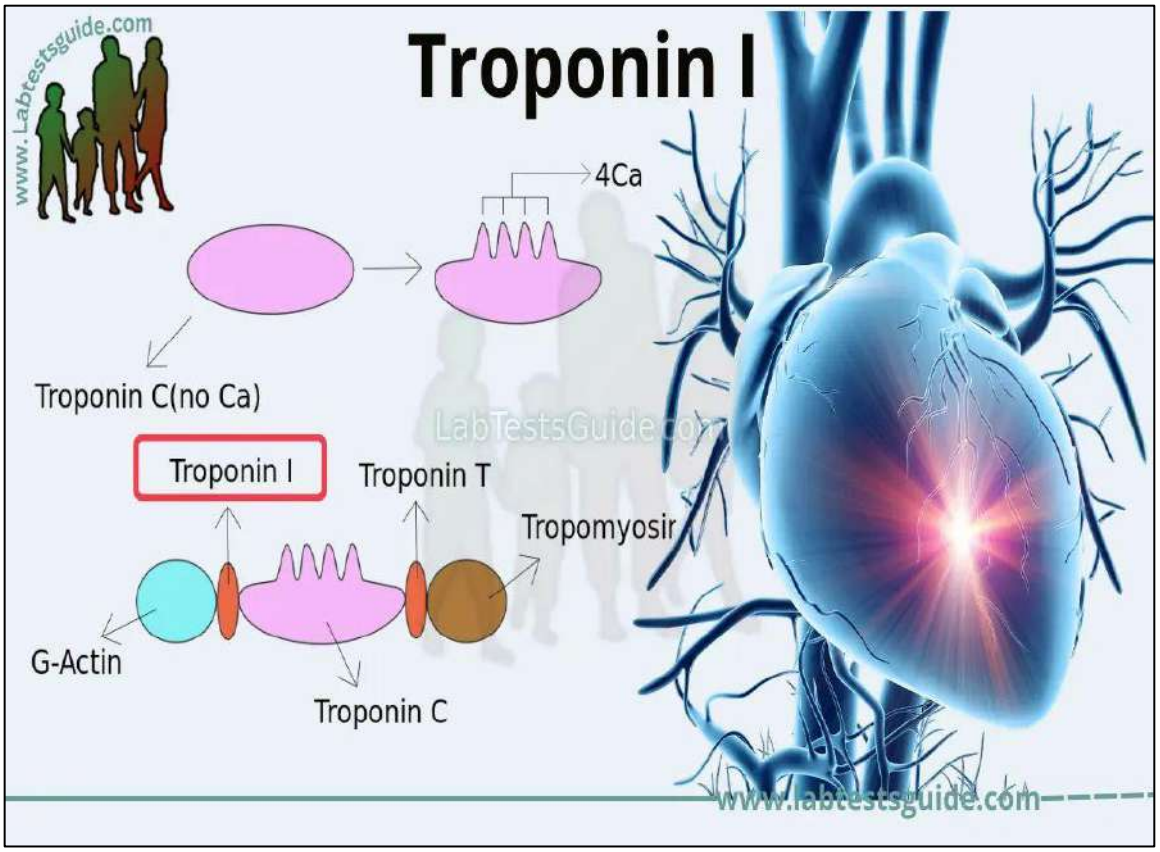
(55) Answer: B. AST > ALT
Explanation: In alcoholic liver disease, AST levels are typically higher than ALT levels.



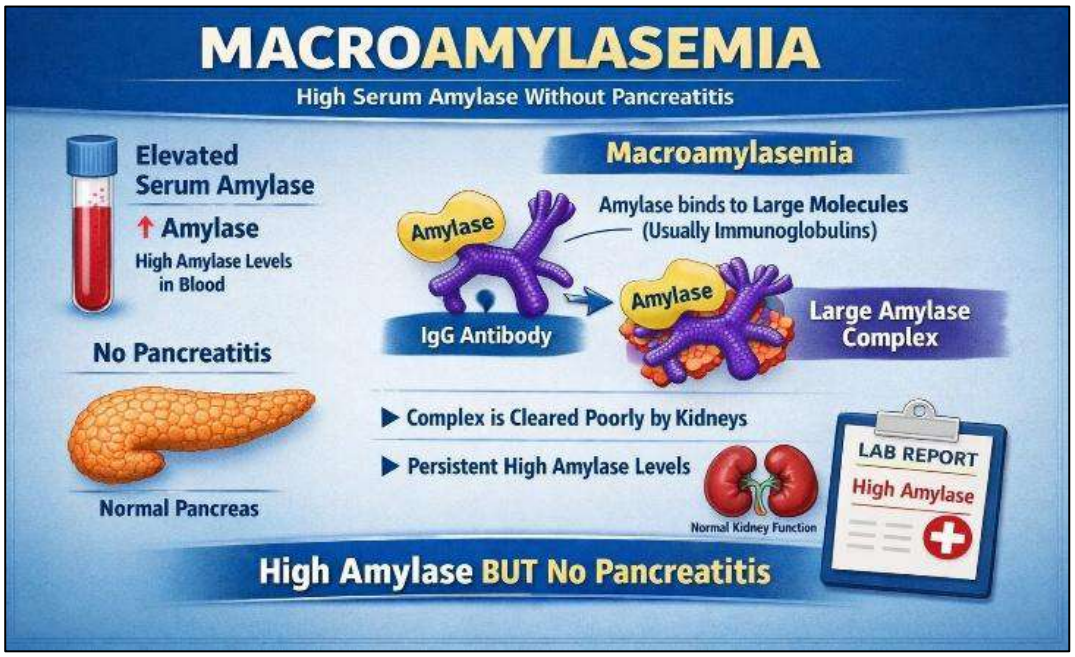
(56) Answer: B. Amylase
Explanation: Serum amylase rises early in acute pancreatitis.

(57) Answer: B. Pregnancy (3rd trimester)
Explanation: Placental alkaline phosphatase increases physiologically during late pregnancy.

(58) Answer: A. LDH-1
Explanation: LDH-1 is the predominant isoenzyme in cardiac muscle.



(59) Answer: C. Macro-AST
Explanation: Macro-AST consists of AST bound to immunoglobulins, causing persistent elevation without disease.

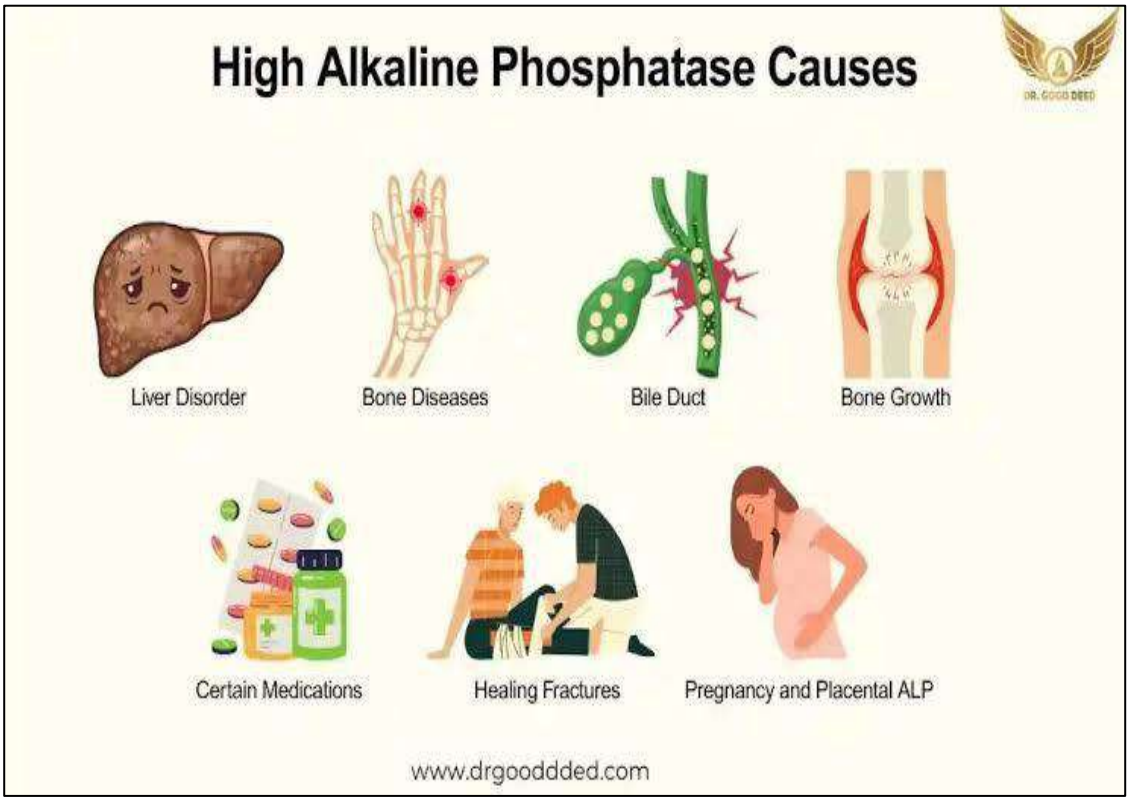


(60) Answer: D. GGT
Explanation: GGT is sensitive for alcohol-induced liver injury.

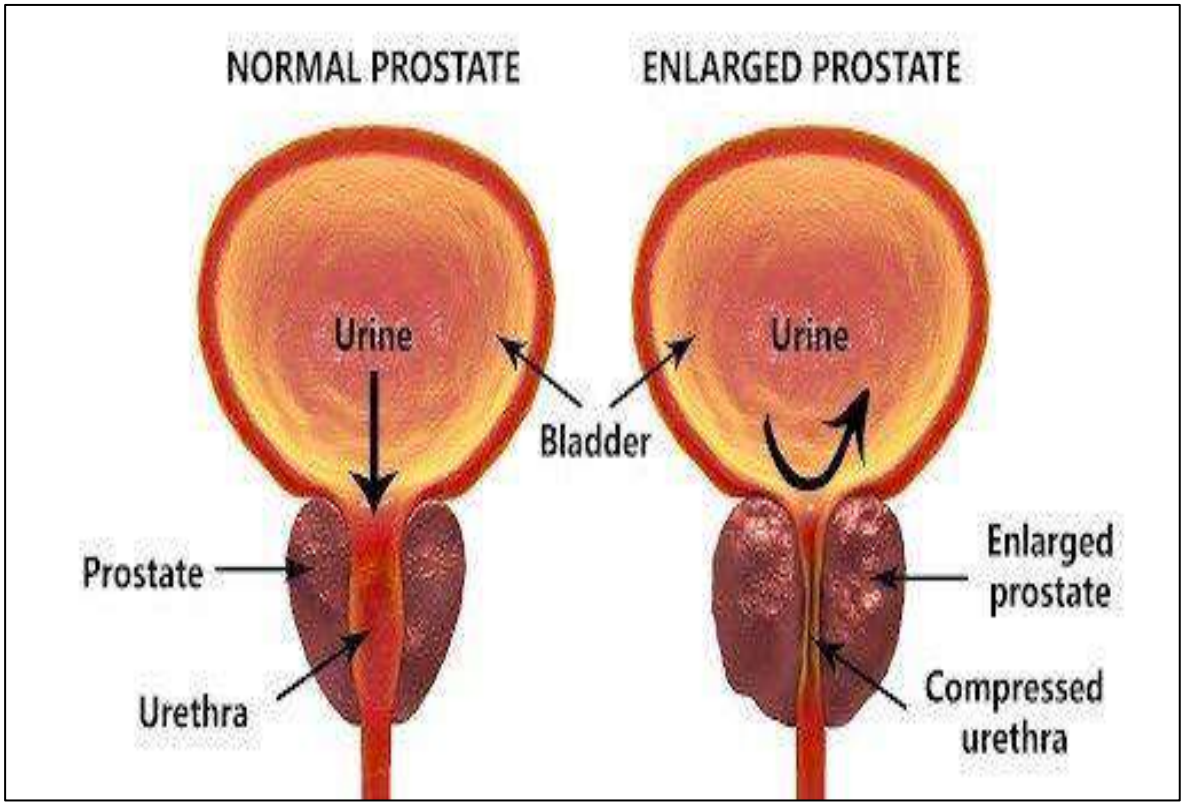
(61) Answer: C. Macroamylasemia
Explanation: In macroamylasemia, amylase forms large complexes that cannot be filtered by the kidneys.

(62) Answer: B. Troponin I is cardiac specific
Explanation: Troponin I is highly specific for cardiac muscle injury and is a key marker for myocardial infarction.

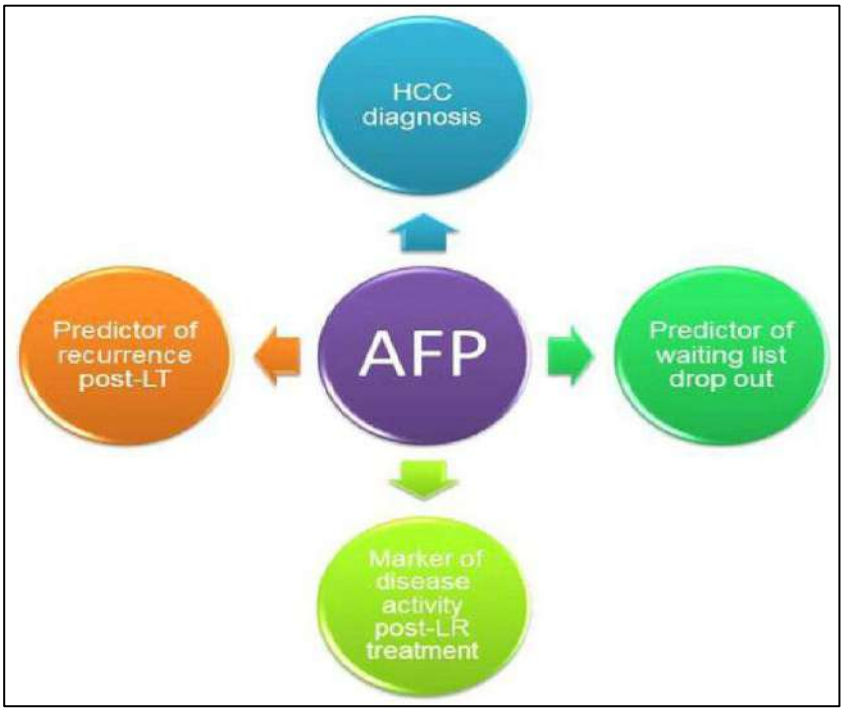
(63) Answer: C. Fracture healing
Explanation: Bone formation during fracture healing increases alkaline phosphatase activity.



(64) Answer: C. PSA
Explanation: Prostate-specific antigen is used in the diagnosis and monitoring of prostate cancer.



(65) Answer: C. AFP
Explanation: Alpha-fetoprotein is commonly elevated in hepatocellular carcinoma.

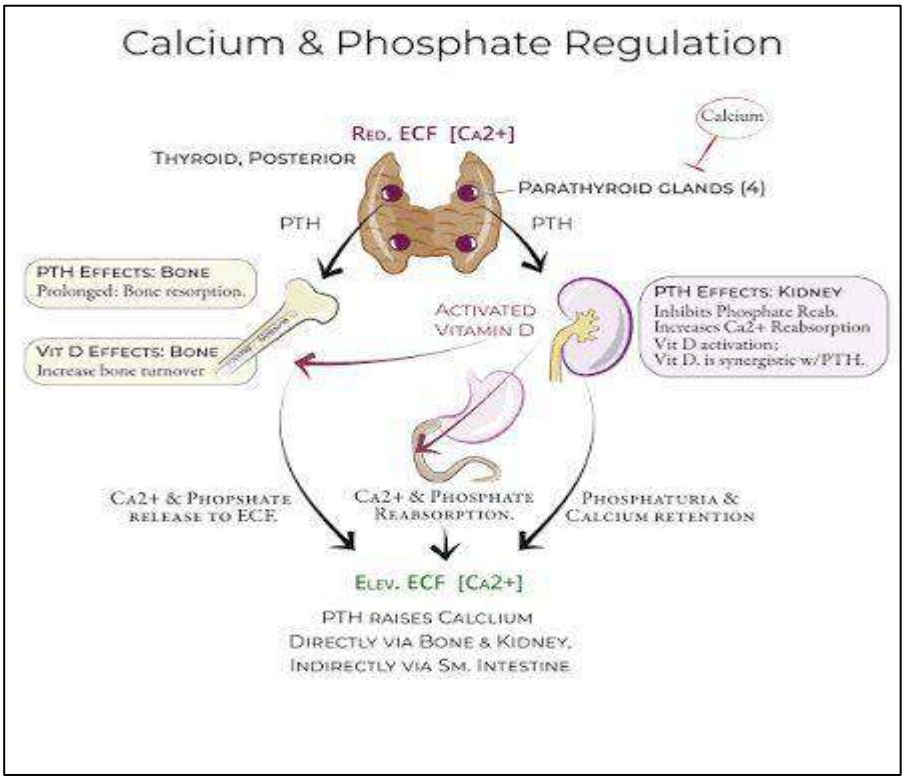


(66) Answer: A. Serum ferritin
Explanation: Iron deficiency anemia is associated with low serum ferritin levels.

	Iron deficiency anemia	Anemia of inflammatory disease
Hematocrit	↓ to ↓ ↓ ↓	↓ to ↓ ↓
MCV	↓ to ↓ ↓ ↓	Normal to ↓
MCHC	↓	Normal
Serum iron	↓ to ↓ ↓ ↓	Normal to ↓ ↓
Serum TIBC	Normal to ↑	Normal to ↓
Serum ferritin	↓ to ↓ ↓	Normal to ↑ ↑
Stainable iron in marrow	Absent	Normal to ↑
Reticulocytes	Normal to ↓	↓

MCV — mean corpuscular volume, MCHC — mean corpuscular hemoglobin

(67) Answer: B. Parathyroid hormone
Explanation: Deficiency of parathyroid hormone leads to hypocalcemia, causing tetany and muscle spasms.


Calcium & Phosphate Regulation
Red. ECF [Ca2+]
Thyroid, Posterior
Calcium
Parathyroid glands (4)
PTH
PTH
PTH Effects: Bone
Prolonged: Bone resorption.
Vit D Effects: Bone
Increase bone turnover
Activated Vitamin D
PTH Effects: Kidney
Inhibits Phosphate Reab.
Increases Ca2+ Reabsorption
Vit D activation;
Vit D. is synergistic w/PTH.
Ca2+ & Phopshate release to ECF.
Ca2+ & Phosphate Reabsorption.
Phosphaturia & Calcium retention
Elev. ECF [Ca2+]
PTH raises Calcium
Directly via Bone & Kidney,
Indirectly via Sm. Intestine

COURSE 1-Foods and Diets

TUTORIALS & ANSWERS

Tutorial 1 – Nitrogen Balance in Adults Questions

Clinical Scenario

A 24-year-old male is recovering from major abdominal surgery. He has poor appetite and is receiving an inadequate calorie intake post-operatively. Urinary nitrogen excretion is found to be increased.

Questions

(Q1) What type of nitrogen balance is this patient likely to be in? Why?

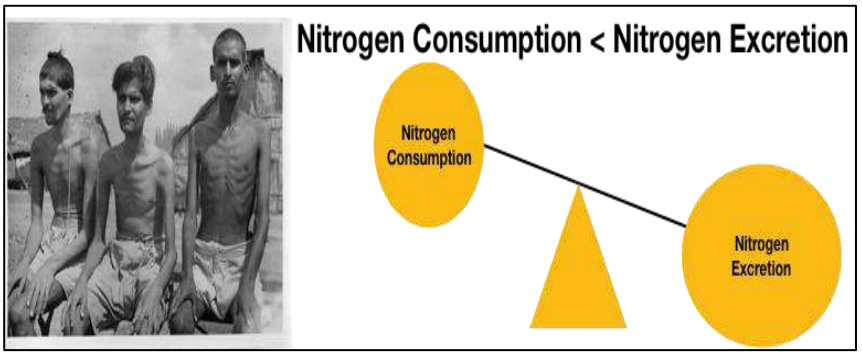
(Q2) Explain how inadequate energy intake influences nitrogen balance, even if protein intake is adequate.

(Q3) Describe the hormonal and metabolic factors contributing to this nitrogen balance state.

(Q4) How can nutritional intervention help restore nitrogen balance in this patient?

Tutorial 1- Nitrogen Balance in Adults Answers

(Q1) What type of nitrogen balance is this patient likely to be in? Why?



Negative nitrogen balance
Excretion > Intake
This indicates catabolism
Reasons

(1) Post-surgical stress increases protein breakdown
(2) Inadequate energy intake forces the body to use protein for energy
(3) Increased urinary nitrogen excretion
(4) Nitrogen loss exceeds intake

(Q2) Explain how inadequate energy intake influences nitrogen balance, even if protein intake is adequate.

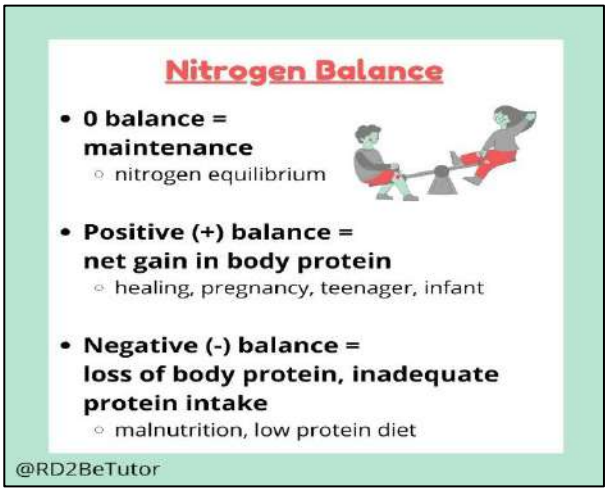
- When energy intake is inadequate, carbohydrates and fats are insufficient to meet the body's energy needs
- As a result, dietary protein and body proteins are broken down and oxidized to provide energy

- This leads to deamination of amino acids, causing increased nitrogen excretion in urine
- Hence, the body enters a negative nitrogen balance, even when protein intake appears adequate
- Conversely, adequate energy intake prevents the use of protein for energy, allowing amino acids to be utilized for tissue repair and growth
- This protective action of energy on body proteins is known as the protein-sparing effect of calories
- Protein synthesis itself is an energy-dependent process; therefore, insufficient energy intake further reduces protein synthesis, worsening nitrogen loss

Adequate calorie intake spares protein
Low energy = ↑ protein breakdown for energy
Protein synthesis depends on the energy-consuming process
15–20 kJ expended per gram of protein synthesized
Balance depends on both

- Nitrogen intake
- Energy availability

(Q3) Describe the hormonal and metabolic factors contributing to this nitrogen balance state.



- Increased stress hormones (cortisol, catecholamines) Promote muscle proteolysis to provide amino acids for energy and gluconeogenesis
- Increased inflammatory cytokines (TNF-α, IL-1) Enhance protein breakdown and reduce nutrient utilization
- Reduced anabolic hormone action (insulin) Decreases amino acid uptake and protein synthesis; fails to inhibit proteolysis
- Enhanced muscle proteolysis Muscle proteins broken down to meet increased metabolic demands
- Reduced protein synthesis Protein synthesis is energy-dependent and is suppressed during energy deficiency and hormonal imbalance

(Q4) How can nutritional intervention help restore nitrogen balance in this patient?

- Adequate energy intake to spare protein Sufficient carbohydrates and fats meet energy needs, preventing the use of body protein for energy (protein-sparing effect)
- Adequate high-quality protein intake Provides essential amino acids required for protein synthesis, tissue repair, and immune function
- Early enteral or parenteral nutrition when oral intake is inadequate Ensures timely delivery of calories and amino acids, reducing muscle protein breakdown and nitrogen loss
- Control of infection and stress Reduces catabolic hormones and inflammatory cytokines that promote protein breakdown
- Restoration of positive nitrogen balance When protein synthesis exceeds breakdown, body protein stores are replenished, leading to tissue repair and recovery

Tutorial 2 -Rice Processing & Glycaemic Response Questions

Clinical Case

A 52-year-old man with type 2 diabetes mellitus presents to the clinic with poor postprandial glycaemic control. He reports that his usual lunch consists of a large portion of raw white rice with a small amount of curry. He notices that his blood glucose level rises sharply within 1–2 hours after the meal, despite adherence to his medications.

Questions

(Q1) What is the reason for the sudden rise in blood sugar in this patient?
(Q2) What is Glycaemic Index (GI)?
(Q3) What is Glycaemic Load (GL)?
(Q4) Explain the rise in blood glucose in this patient in terms of GL.
(Q5) What dietary alterations can be suggested to reduce GL?
(Q6) How does parboiling of rice help in improving glycaemic control?

Tutorial 2 -Rice Processing & Glycaemic Response Questions

(Q1) What is the reason for the sudden rise in blood sugar in this patient?

The sudden rise in blood sugar occurred because the patient consumed a large portion of raw white rice, which has a high glycaemic index (GI) and low fibre content. This results in rapid digestion and absorption of starch, causing a sharp increase in postprandial blood glucose levels.

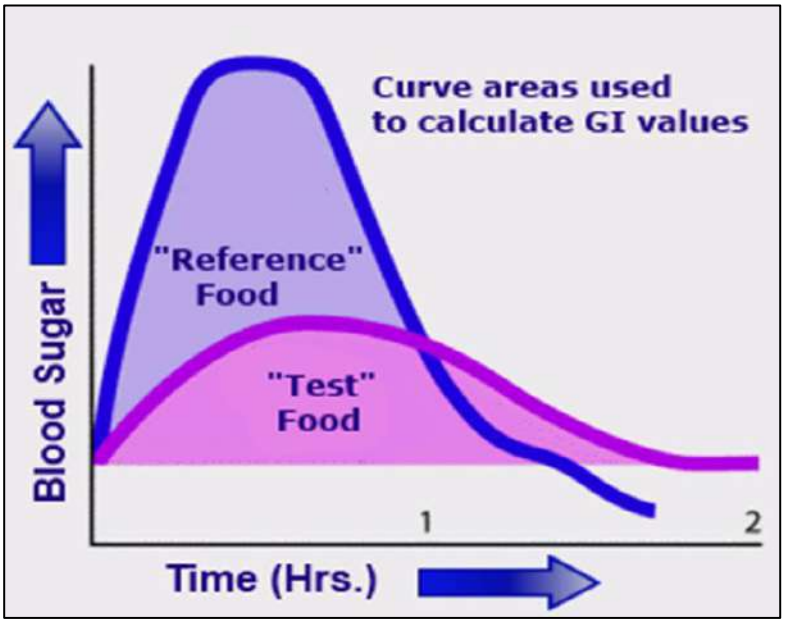


(Q2) What is Glycaemic Index (GI)?

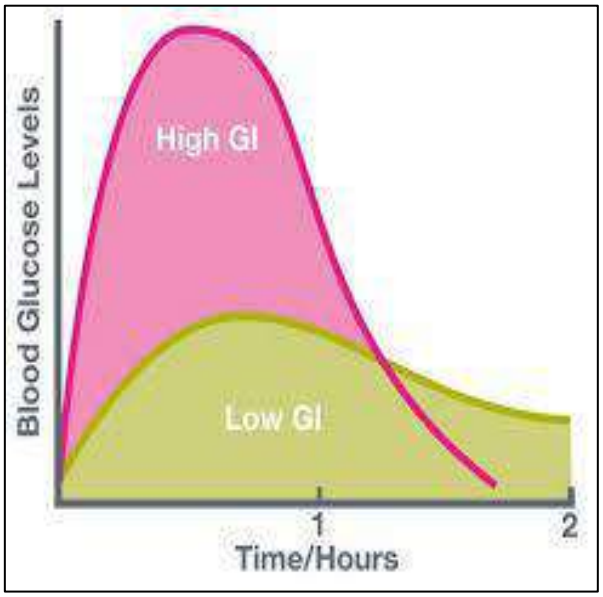
Glycaemic Index (GI) is a measure of how quickly a carbohydrate-containing food raises blood glucose levels compared with a reference food (usually glucose, GI = 100).

Classification of GI:

- Low GI: ≤ 55
- Medium GI: 56–69
- High GI: ≥ 70



Foods with a high GI are digested and absorbed rapidly, producing a quick rise in blood glucose. Foods with a low GI are digested more slowly, leading to a gradual increase in blood glucose levels.



Raw white rice generally has a high GI, whereas parboiled rice has a lower GI.

(Q3) What is Glycaemic Load (GL)?

Glycaemic Load (GL) considers both the quality (GI) and quantity of carbohydrate consumed.

Formula:

$$GL = \left(\frac{GI \times \text{Carbohydrate Content (g)}}{100} \right)$$

GL provides a more realistic assessment of the glycaemic effect of a meal.
Classification of GL:

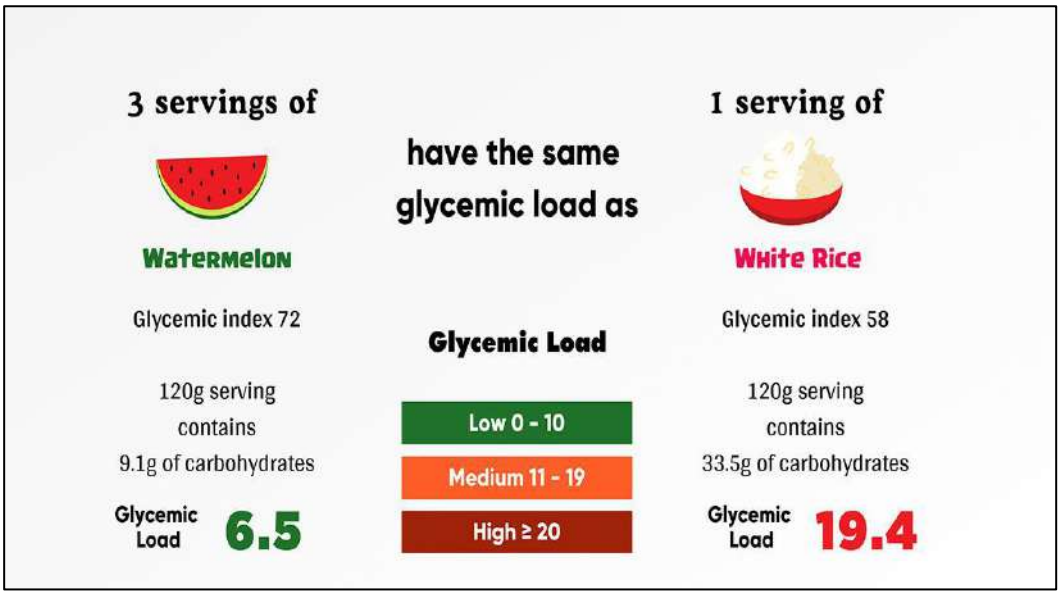
- Low: ≤ 10
- Medium: 11–19
- High: ≥ 20

Example: Watermelon

- GI = 72
- Carbohydrate content per serving (120 g) = 9.1 g

GL=72×9.1100=6.5GL

Although watermelon has a high GI, its GL is low because it contains a relatively small amount of carbohydrate per serving.



(Q4) Explain the rise in blood glucose in this patient in terms of GL.

In this patient:

- Raw white rice has a high GI.
- A large portion was consumed.

Therefore, the meal had a high glycaemic load, resulting in a large amount of glucose entering the bloodstream rapidly and causing marked postprandial hyperglycaemia.

(Q5) What dietary alterations can be suggested to reduce GL?

- Reduce the portion size of rice.
- Replace raw white rice with parboiled rice.
- Increase dietary fibre intake through vegetables and legumes.
- Combine rice with protein and healthy fats to slow gastric emptying and glucose absorption.

These modifications reduce the overall glucose burden and improve blood glucose control.



(Q6) How does parboiling of rice help in improving glycaemic control?

Parboiling is a hydrothermal process involving soaking, steaming, and drying paddy before milling.

Effects of parboiling:

- Causes starch gelatinization followed by retrogradation.
- Increases resistant starch content.
- Slows enzymatic digestion of carbohydrates.
- Improves retention of B-complex vitamins.

Clinical benefits:

- Lower glycaemic index.
- Reduced glycaemic load when consumed in similar amounts.
- Better postprandial blood glucose control, particularly in individuals with diabetes mellitus

Tutorial 3 – Minerals Questions

(1) Which of the following proteins/enzymes are iron-containing?

(A) Hemoglobin
(B) Myoglobin
(C) Cytochrome P450 enzymes
(D) Amylase
(E) Ribonucleotide reductase

(2) True or False regarding iron in the human body?

(A) Iron ions can form complexes with various ligands.
(B) Iron can switch between Fe (II) and Fe (III) oxidation states.
(C) Iron plays no role in carrying biochemically active substances.
(D) Free iron in the body can promote the formation of toxic free radicals.
(E) The body contains a large amount of free iron due to high demand.

(3) True or False regarding the iron distribution in the human body?

(A) The human body contains approximately 3 to 5 grams of iron in total.
(B) Approximate loss of iron in a 70 kg male adult is approximately 1 mg per day.
(C) Approximately 1 g of iron is in transferrin.
(D) About 8 mg of iron in tissues is used in enzymes.
(E) More iron is stored in myoglobin than in hemoglobin.

(4) True or False regarding non-heme iron absorption?

(A) Non-heme iron is primarily found in plant-based foods.
(B) Non-heme iron is absorbed more efficiently than heme iron.
(C) Vitamin C enhances non-heme iron absorption by reducing Fe^{3+} to Fe^{2+}.
(D) Phytates and polyphenols inhibit non-heme iron absorption.
(E) Gastric acid has no effect on non-heme iron absorption.

(5) True or False regarding heme iron absorption?

(A) Heme iron is derived mainly from animal sources such as meat and fish.
(B) Divalent metal transporters are used for the heme iron transport.
(C) Heme iron is absorbed intact into enterocytes without reduction from Fe^{3+} to Fe^{2+}.
(D) Heme oxygenase enzyme catalyzes the release of iron from heme inside enterocytes.
(E) Calcium inhibits heme iron absorption significantly.

(6) True or False regarding the transferrin shuttle?

(A) Transferrin is a plasma protein.
(B) Transferrin receptors are located on the cell surface.
(C) Iron is released from transferrin inside endosomes after acidification to pH ~5.5.
(D) Transferrin transports ferrous (Fe^{2+}) iron in the plasma.
(E) The transferrin receptors are recycled.

(7) True or False regarding ceruloplasmin and iron metabolism?

(A) Ceruloplasmin oxidizes Fe^{2+} (ferrous) iron to Fe^{3+} (ferric) iron in the blood.
(B) Ceruloplasmin is synthesized primarily by the liver.
(C) Ceruloplasmin deficiency leads to impaired iron disposal.
(D) Ceruloplasmin deficiency can be caused by copper deficiency in the diet.
(E) Ceruloplasmin levels increase in Wilson disease.

(8) True or False regarding intracellular iron homeostasis?

(A) The synthesis of transferrin receptor 1 (TfR1) increases when intracellular iron levels are low.
(B) Ferritin synthesis increases in response to low intracellular iron levels.
(C) Iron response element increases ferritin translation when iron is low.
(D) Iron response element increases expression of the transferrin receptor.
(E) Iron response element is a plasma protein.

(9) True or False regarding hepcidin and systemic iron regulation?

(A) Hepcidin is a peptide hormone.
(B) Hepcidin is synthesized in the liver as prohepcidin.
(C) Hepcidin increases iron absorption.
(D) Increased hepcidin levels reduce iron recycling by macrophages.
(E) Hepcidin synthesis decreases when plasma iron levels are high.

(10) Which of the following are key proteins in maintaining iron balance in the body?

(A) Ferritin
(B) Hemoglobin
(C) Hepcidin
(D) Myoglobin
(E) Transferrin

SEQ
Calcium Absorption

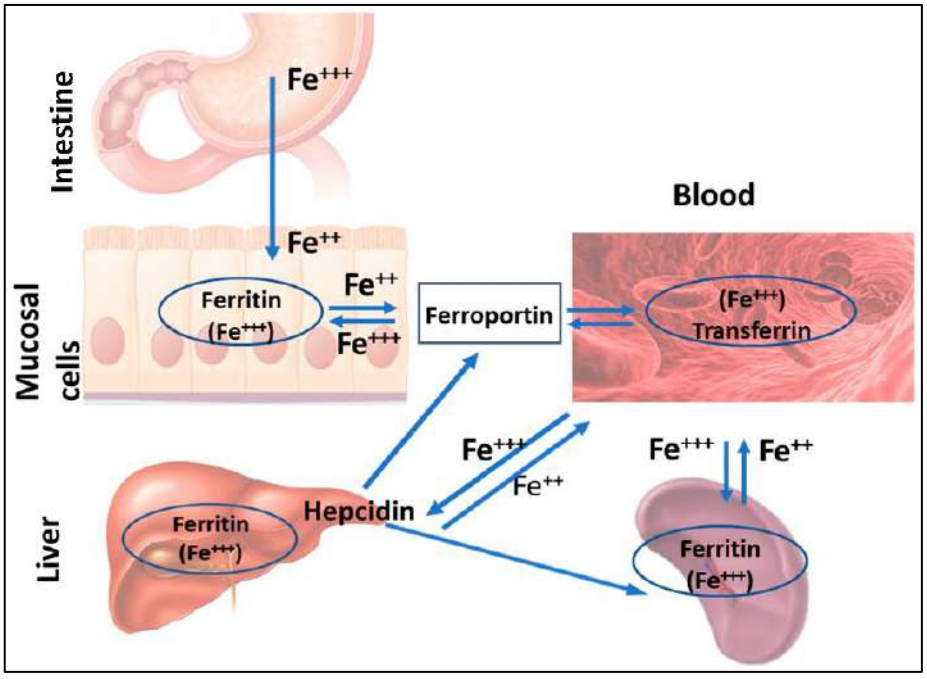
(Q1) Describe the mechanisms of calcium absorption in the small intestine. (25 marks)
(Q2) Explain the role of vitamin D in calcium absorption. (10 marks)
(Q3) List the factors that enhance and inhibit intestinal calcium absorption. (10 marks)
(Q4) State the main sites of calcium absorption in the gastrointestinal tract. (5 marks)
(Q5) List the major physiological functions of calcium. (10 marks)
(Q6) Describe the distribution of calcium in the human body. (10 marks)

Tutorial 3 – Minerals Answers

(1) **Answer:** TTTFT
Explanation:
Iron is an essential component of several proteins and enzymes. Hemoglobin and myoglobin contain heme iron for oxygen transport and storage. Cytochrome P450 enzymes contain heme iron involved in oxidation reactions, while ribonucleotide reductase requires iron for DNA synthesis. Amylase does not contain iron.

(2) **Answer:** TTTTF
Explanation:
Iron can form complexes with many biological molecules and readily switches between Fe^{2+} and Fe^{3+} states, making it important for redox reactions. Iron is involved in oxygen transport and electron transfer. Free iron is potentially toxic because it can generate reactive oxygen species; therefore, most body iron is protein-bound rather than free.

(3) **Answer:** TTFTF
Explanation:
The adult human body contains approximately 3–5 g of iron. Most iron is found in hemoglobin, while smaller amounts occur in storage proteins, myoglobin, transferrin, and enzymes. Daily iron loss in adult males is about 1 mg. Only a small amount of iron circulates bound to transferrin.

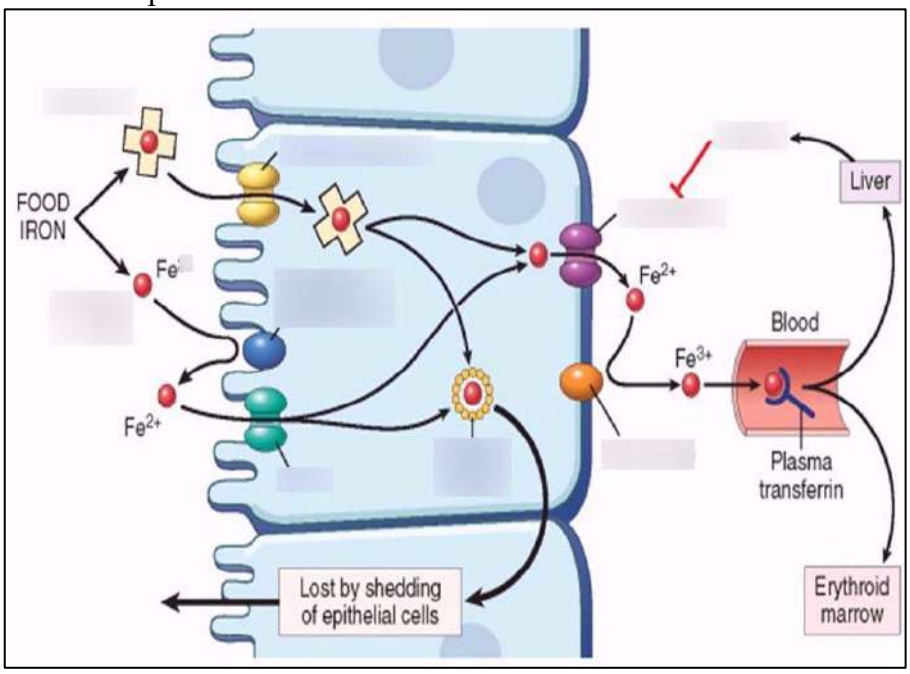


(4) **Answer:** TFTTF
Explanation:
Non-heme iron is mainly found in plant foods and is absorbed less efficiently than heme iron. Vitamin C enhances absorption by reducing ferric iron (Fe^{3+}) to ferrous iron (Fe^{2+}). Phytates and polyphenols inhibit absorption, while gastric acid promotes iron solubility and absorption.

(5) **Answer:** TFTTF

Explanation:

Heme iron originates from animal foods and is absorbed more efficiently than non-heme iron. It is absorbed intact into enterocytes and iron is subsequently released by heme oxygenase. Heme iron absorption is less affected by dietary factors than non-heme iron absorption.



(6) **Answer:** TTTFT

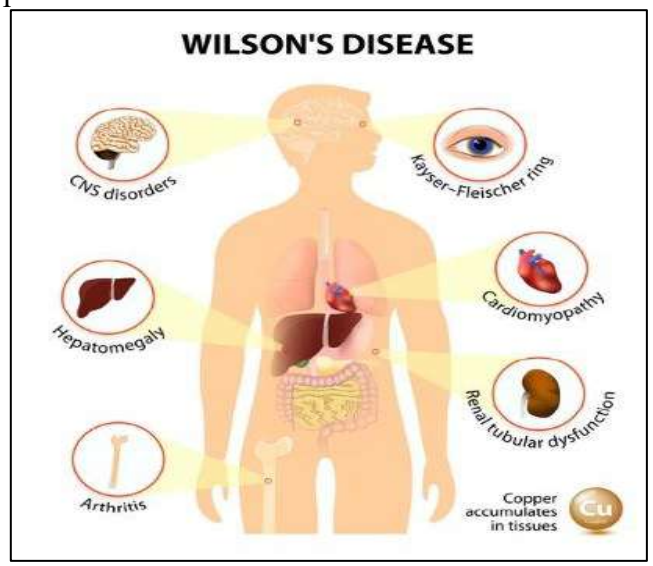
Explanation:

Transferrin is the major iron transport protein in plasma and delivers ferric iron (Fe^{3+}) to cells through transferrin receptors. Iron is released within acidified endosomes, and the receptor-transferrin complex is recycled back to the cell surface.

(7) **Answer:** TTTTF

Explanation:

Ceruloplasmin is a copper-containing protein synthesized in the liver. It oxidizes Fe^{2+} to Fe^{3+}, allowing iron to bind transferrin. Deficiency of ceruloplasmin impairs iron mobilization and may occur in copper deficiency. Wilson disease is associated with reduced ceruloplasmin levels.



(8) **Answer:** TFFTF

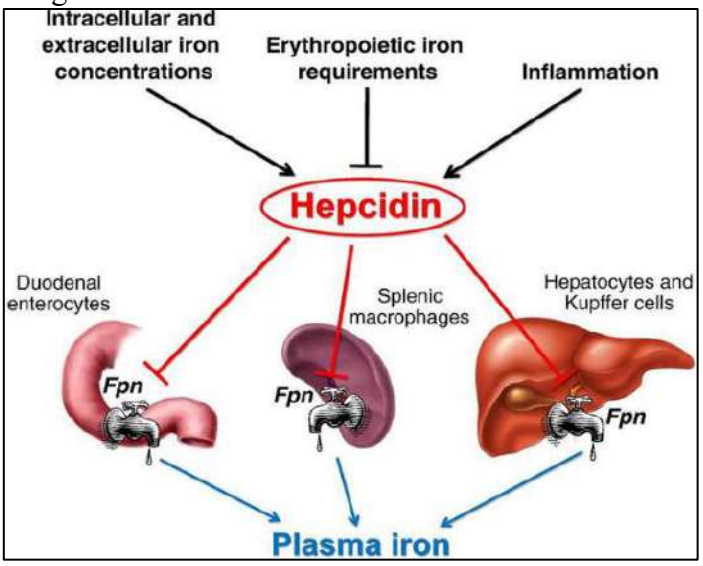
Explanation:

When intracellular iron is low, cells increase transferrin receptor synthesis to enhance iron uptake and decrease ferritin synthesis to reduce iron storage. Iron response elements (IREs) regulate the expression of proteins involved in iron metabolism at the mRNA level.

(9) **Answer:** TTFTF

Explanation:

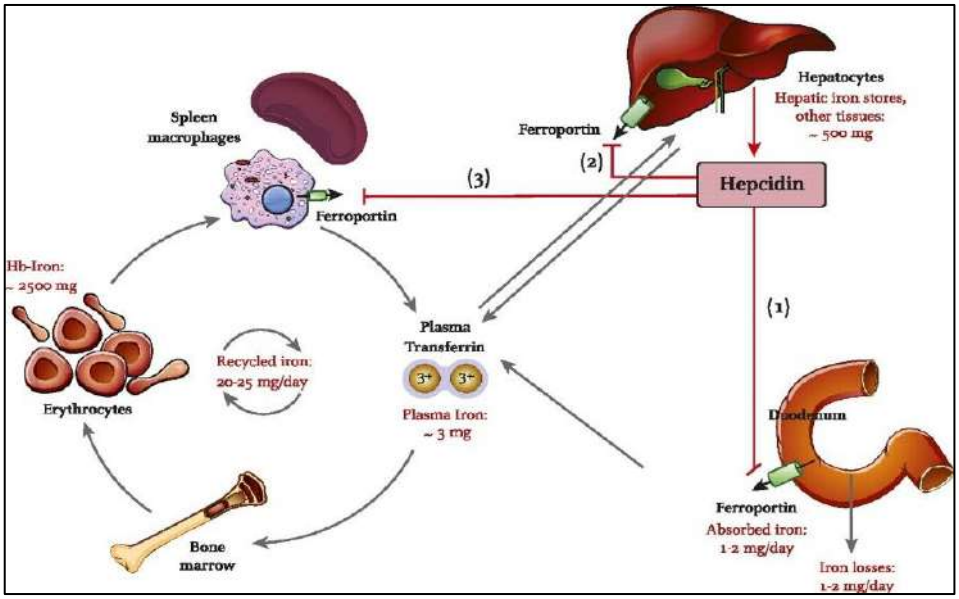
Hepcidin is a peptide hormone produced by the liver that regulates systemic iron balance. It decreases intestinal iron absorption and iron release from macrophages by promoting degradation of ferroportin. Hepcidin production increases when body iron stores are high.



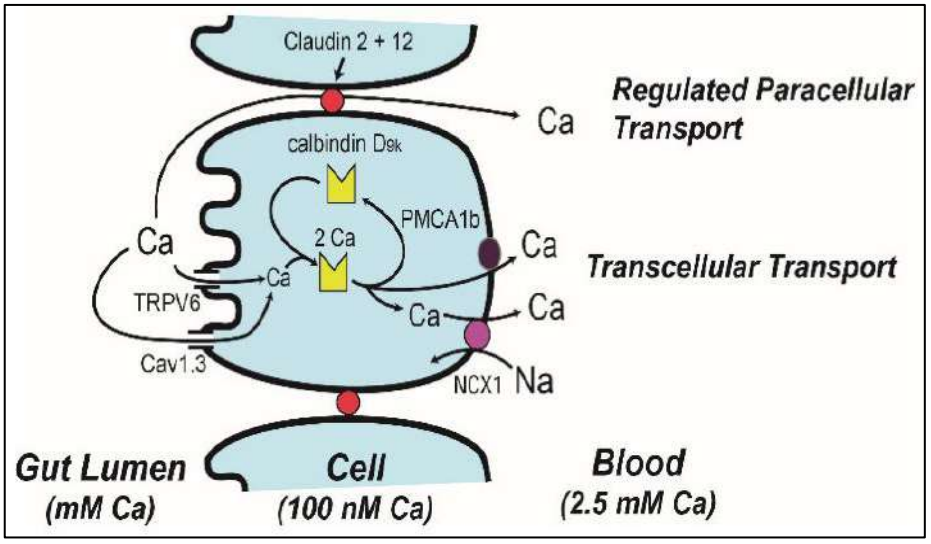
(10) **Answer:** TFTFT

Explanation:

Iron homeostasis is maintained mainly by ferritin (storage), transferrin (transport), and hepcidin (regulation). Hemoglobin and myoglobin contain iron and perform oxygen-related functions but are not primary regulators of iron balance.



(Q1) Calcium absorption in the small intestine occurs by two major mechanisms:



(1) Transcellular (Active) Transport Mechanism

This is a saturable, energy-dependent process and is regulated by vitamin D. It predominates

when:
• Dietary calcium intake is low
• Body calcium requirement is increased (growth, pregnancy, lactation)

Site: Mainly in the duodenum

Steps:
1. Entry across the apical membrane
- Calcium enters enterocytes via TRPV6 (Transient Receptor Potential Vanilloid 6) channels.
- This step is regulated by active vitamin D.

2. Intracellular transport
- Calcium binds to calbindin-D9k, a vitamin D–dependent calcium-binding protein.
- Calbindin prevents rise in intracellular free Ca^{2+} and facilitates diffusion toward the basolateral membrane.

3. Exit across basolateral membrane
- Calcium is extruded into blood by:
  - Ca^{2+}-ATPase (PMCA1b) – primary mechanism
  - Na^{+}/Ca^{2+} exchanger (NCX1)

Characteristics:
• Saturable
• Vitamin D–dependent
• More efficient when dietary calcium is low

(2) Paracellular (Passive) Diffusion

This is a non-saturable, concentration-dependent process.
Site: Mainly in jejunum and ileum

Mechanism:

- Calcium passes between enterocytes via tight junctions.
- Driven by electrochemical gradient.
- Occurs when dietary calcium intake is high.

Characteristics:

- Not vitamin D dependent
- Non-saturable
- Accounts for majority absorption when calcium intake is high

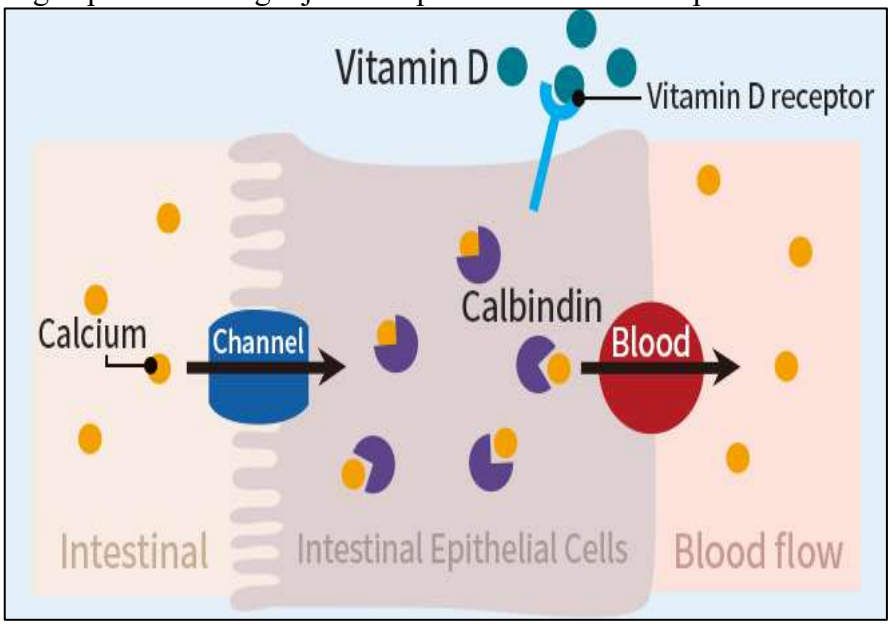
Relative Contribution

- At low intake → active transport predominates
- At high intake → passive diffusion predominates

Approximately 30–40% of dietary calcium is absorbed under normal conditions.

(Q2) The active form of vitamin D is 1,25-dihydroxycholecalciferol (Calcitriol).
Vitamin D enhances intestinal calcium absorption by:

1. Upregulating TRPV6 channels → increases apical calcium entry
2. Increasing calbindin synthesis → enhances intracellular transport
3. Stimulating Ca^{2+}-ATPase synthesis → increases basolateral extrusion
4. Increasing expression of tight junction proteins → enhances paracellular absorption



Mechanism of action:

- Calcitriol binds to intracellular vitamin D receptors (VDR)
- Acts via gene transcription (genomic effect)

Clinical correlation:

- Vitamin D deficiency → ↓ calcium absorption → hypocalcemia → secondary hyperparathyroidism → rickets/osteomalacia

(Q3) Factors Enhancing Calcium Absorption

- Active vitamin D (calcitriol)
- Parathyroid hormone (indirect via vitamin D activation)
- Acidic pH
- Lactose
- Amino acids
- Growth hormone
- Pregnancy and lactation
- Increased physiological demand (growth)

Factors Inhibiting Calcium Absorption

- Vitamin D deficiency
- Phytates (cereals)
- Oxalates (spinach)
- Excess dietary phosphate
- High dietary fiber
- Alkaline intestinal pH
- Aging
- Fat malabsorption (formation of calcium soaps)

(Q4)

Duodenum – major site of active (transcellular) absorption
Jejunum – passive diffusion
Ileum – passive diffusion
Small intestine is the principal site of calcium absorption.

(Q5) Calcium has multiple vital functions:

1. Structural Function
- Bone and teeth mineralization

2. Muscle Contraction
- Required for actin–myosin interaction
- Essential in skeletal, cardiac, and smooth muscle

3. Nerve Transmission
- Required for neurotransmitter release

4. Blood Coagulation
- Factor IV in clotting cascade

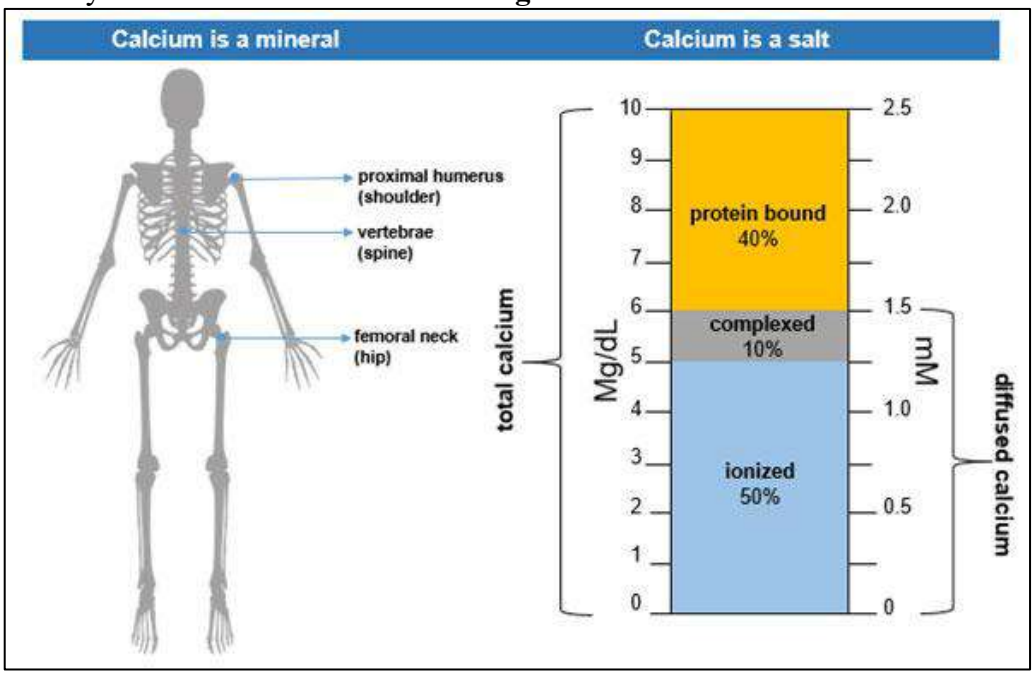
5. Enzyme Activation
- Cofactor for many enzymes

6. Hormone Secretion
- Required for exocytosis

7. Intracellular Signaling
- Acts as a second messenger

8. Membrane Stability
- Maintains cell membrane permeability

(Q6) Total body calcium in adults ≈ **1000–1200 g**



1. Skeletal Calcium (99%)

- Present in bones and teeth
- Stored as **hydroxyapatite crystals**
- Acts as structural support
- Serves as calcium reservoir

2. Extracellular Fluid (0.1%)

Serum calcium level: **8.5–10.5 mg/dL**

Exists in three forms:

1. Ionized (free) calcium (≈50%) – physiologically active
2. Protein-bound (≈40%) – mainly to albumin
3. Complexed (≈10%) – with phosphate, citrate

3. Intracellular Calcium (<1%)

- Very low concentration
- Stored in:
  - Endoplasmic reticulum
  - Sarcoplasmic reticulum
  - Mitochondria
- Acts as second messenger

SGDs & ANSWERS

SGD 1 - Carbohydrate Digestion and Absorption Questions

True / False Type Questions

(1) True or False regarding carbohydrate digestion in the mouth?

(A) Mechanical digestion increases the surface area available for enzyme action.

(B) Salivary α-amylase breaks α-1,6 glycosidic bonds in starch.

(C) Only a small proportion of starch digestion occurs in the mouth.

(D) Salivary amylase converts starch directly into glucose.

(E) Saliva helps to moisten food and facilitates swallowing.

(2) True or False regarding carbohydrate digestion in the stomach?

(A) Carbohydrate digestion continues in the stomach due to pancreatic amylase.

(B) Carbohydrate digestion in the stomach is minimal because specific digestive enzymes are absent.

(C) Salivary amylase is inactivated by the acidic pH of the stomach.

(D) Gastric hydrochloric acid can hydrolyze small amounts of sucrose.

(E) The stomach is the major site of carbohydrate digestion.

(3) True or False regarding pancreatic amylase?

(A) Pancreatic amylase is secreted into the duodenum.

(B) Pancreatic amylase hydrolyzes α-1,4 glycosidic bonds.

(C) Pancreatic amylase hydrolyzes α-1,6 glycosidic bonds.

(D) Pancreatic amylase produces maltose, maltotriose, and dextrins.

(E) Pancreatic amylase functions optimally in an acidic environment.

(4) True or False regarding brush border enzymes?

(A) Brush border enzymes are located on the microvilli of enterocytes.

(B) Brush border enzymes are responsible for the final stage of carbohydrate digestion.

(C) Brush border enzymes include disaccharidases such as lactase and sucrase.

(D) Brush border enzymes directly break down polysaccharides into glucose.

(E) Brush border enzymes convert disaccharides into monosaccharides.

(5) True or False regarding carbohydrate metabolism in the large intestine?

(A) Cellulose is digested by human digestive enzymes.

(B) Intestinal bacteria ferment undigested carbohydrates.

(C) Fermentation produces short-chain fatty acids.

(D) Fermentation can result in gas production.

(E) Significant glucose absorption occurs in the large intestine.

Single Best Answer Questions

(1) Which of the following is the major carbohydrate present in a typical mixed diet?

(A) Sucrose

(B) Lactose

(C) Cellulose

(D) Starch

(E) Fructose

(2) **Which transporter is responsible for sodium-dependent absorption of glucose in the small intestine?**

(A) GLUT2

(B) GLUT5

(C) SGLT1

(D) Na^+/K^+ ATPase

(E) GLUT4

(3) Which transporter is primarily responsible for fructose absorption in the small intestine?

(A) SGLT1

(B) GLUT2

(C) GLUT5

(D) Sodium-dependent active transport

(E) Endocytosis

(4) Which enzyme is required for the digestion of cellulose?

(A) Amylase

(B) Maltase

(C) Lactase

(D) Cellulase

(E) Sucrase

(5) Through which transporter does glucose leave the enterocyte and enter the bloodstream?

(A) SGLT1 on the apical membrane

(B) GLUT2 on the basolateral membrane

(C) GLUT5 on the apical membrane

(D) Passive diffusion through tight junctions

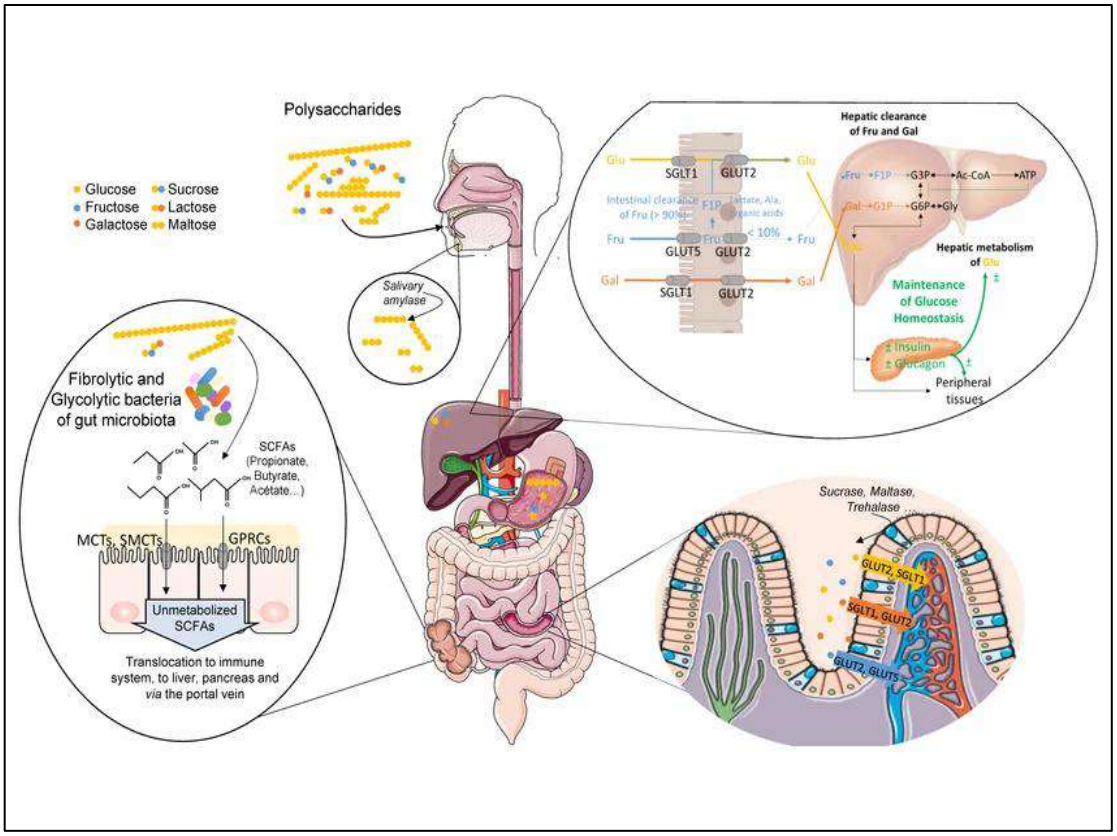
(E) Na^+/K^+ ATPas

SGD 1 - Carbohydrate Digestion and Absorption Answers

(1) Answer: T F T F T

Explanation:

Carbohydrate digestion begins in the mouth. Mechanical chewing increases the surface area of food particles, making them more accessible to digestive enzymes. Salivary α-amylase initiates starch digestion by hydrolyzing α-1,4 glycosidic bonds, producing maltose, maltotriose, and dextrins. It does not break α-1,6 glycosidic bonds and does not produce free glucose. Saliva also lubricates food and facilitates swallowing.



(2) Answer: F T T T F

Explanation:

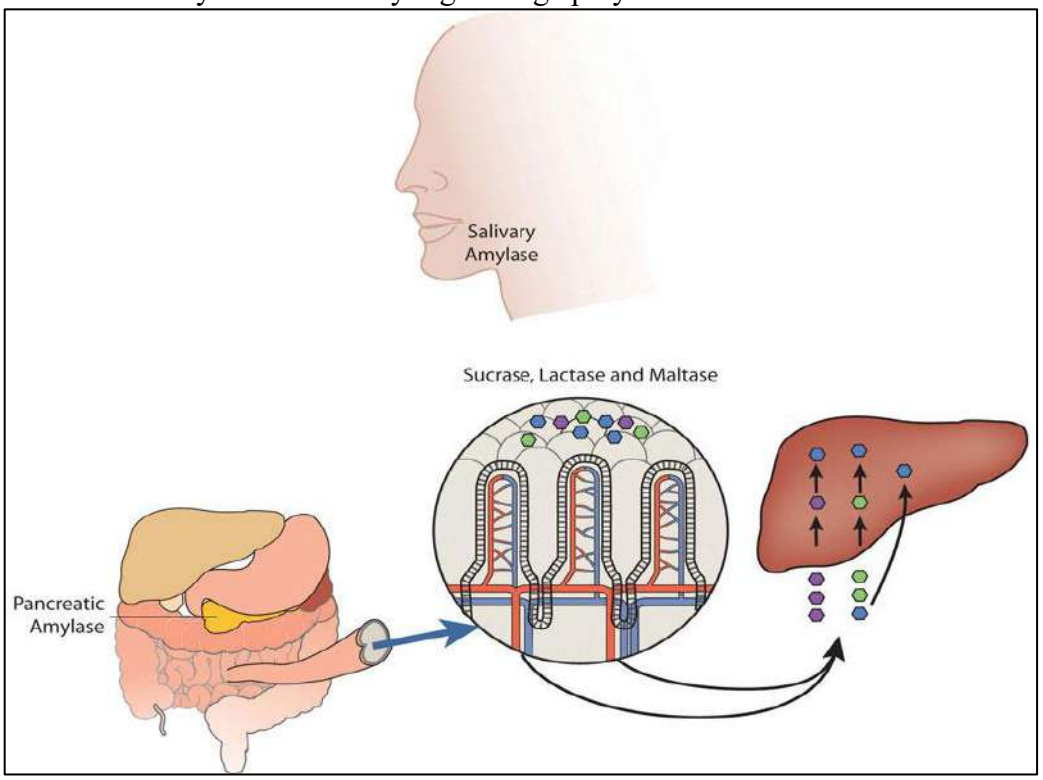
The stomach plays only a minor role in carbohydrate digestion. Pancreatic amylase is secreted into the small intestine, not the stomach. Salivary amylase may continue to act briefly until it is inactivated by gastric acid. Gastric hydrochloric acid can hydrolyze a small amount of sucrose, but most carbohydrate digestion occurs in the small intestine.

(3) Answer: T T F T F

Explanation:

Pancreatic amylase is secreted into the duodenum and is responsible for most starch digestion in the small intestine. It hydrolyzes α-1,4 glycosidic bonds but cannot break α-1,6 glycosidic bonds. Its digestion products include maltose, maltotriose, and α-limit dextrins. It functions optimally in a neutral to slightly alkaline environment.

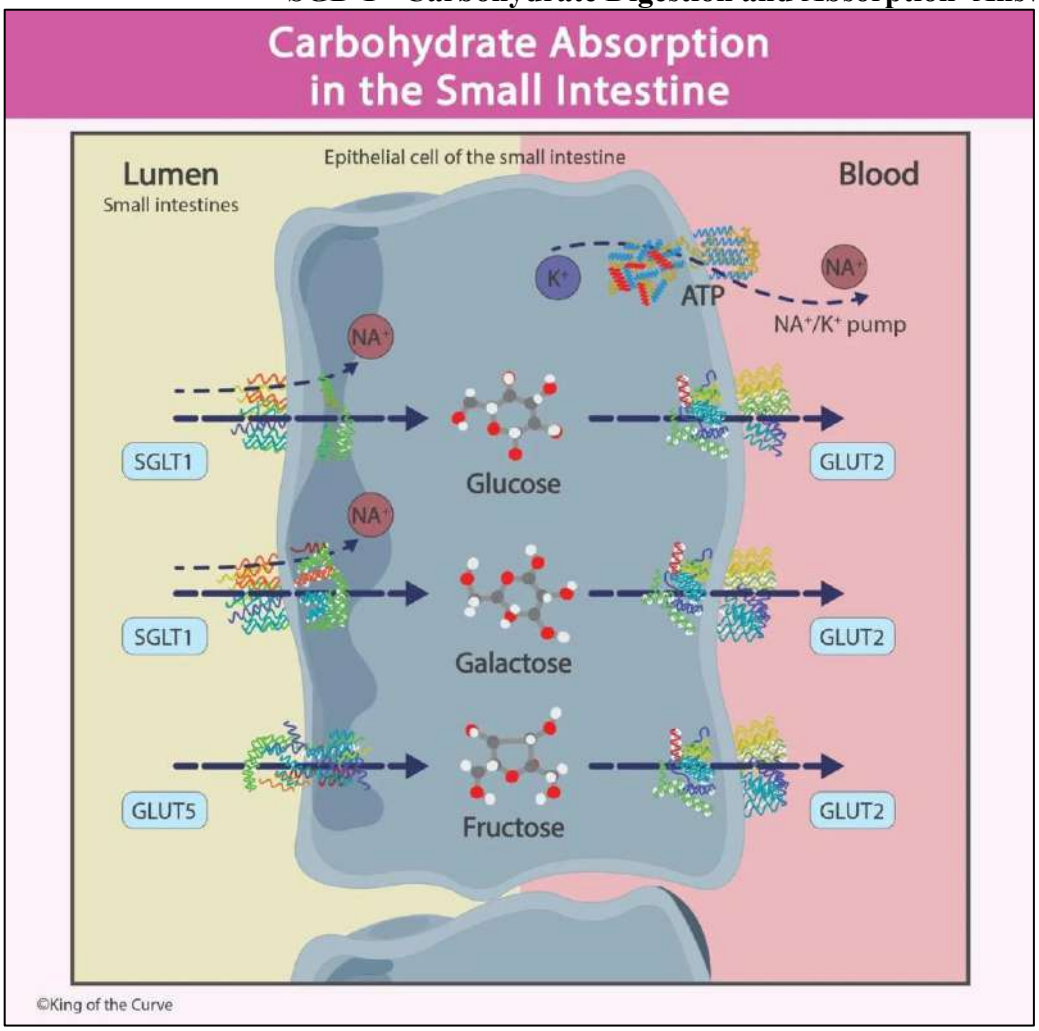
(4) Answer: T T T F T
Explanation:
Brush border enzymes are located on the microvilli of enterocytes lining the small intestine. They complete the final stage of carbohydrate digestion. These enzymes include lactase, sucrase, and maltase, which convert disaccharides and small oligosaccharides into absorbable monosaccharides. They do not directly digest large polysaccharides.



(5) Answer: F T T T F
Explanation:
Humans lack cellulase and therefore cannot digest cellulose. Undigested carbohydrates reaching the large intestine are fermented by gut bacteria, producing short-chain fatty acids (acetate, propionate, and butyrate) and gases such as hydrogen, methane, and carbon dioxide. Significant glucose absorption does not occur in the large intestine.

(6) Answer: D. Starch
Explanation:
Starch is the principal dietary carbohydrate and is found in cereals, rice, potatoes, and other staple foods.

(7) Answer: C. SGLT1
Explanation:
SGLT1 transports glucose and galactose into enterocytes together with sodium ions via secondary active transport.



(8) Answer: C. GLUT5
Explanation:
GLUT5 is a facilitative transporter that specifically transports fructose across the apical membrane of enterocytes.

(9) Answer: D. Cellulase
Explanation:
Cellulose digestion requires cellulase. Humans do not produce this enzyme, which is why cellulose acts as dietary fiber.

(10) Answer: B. GLUT2 on the basolateral membrane
Explanation:
After entering the enterocyte through SGLT1, glucose exits across the basolateral membrane via GLUT2 and enters the bloodstream.

SGD 2 – Vitamin and Mineral Deficiencies Questions

True / False Questions

(1) True or False regarding Protein-Energy Malnutrition (PEM)?

(A) Kwashiorkor results primarily from protein deficiency with relatively adequate energy intake.
(B) Marasmus results from a deficiency of both protein and energy.
(C) Oedema is a characteristic feature of marasmus.
(D) Muscle wasting is commonly seen in marasmus.
(E) Hypoalbuminaemia contributes to the development of oedema in kwashiorkor.

(2) True or False regarding kwashiorkor?

(A) Kwashiorkor is commonly associated with diets rich in carbohydrates but deficient in protein.
(B) Fatty liver may occur in kwashiorkor.
(C) Severe loss of subcutaneous fat is the most prominent feature of kwashiorkor.
(D) Hypoalbuminaemia is a characteristic finding in kwashiorkor.
(E) Oedema is absent in kwashiorkor.

(3) True or False regarding nutrient deficiencies associated with vegan diets?

(A) Vitamin B12 deficiency may occur in individuals following a vegan diet.
(B) Iron deficiency is more common among vegans than among individuals consuming mixed diets.
(C) Vitamin C deficiency is commonly associated with vegan diets.
(D) Zinc deficiency may occur in individuals following a vegan diet.
(E) Omega-3 fatty acid deficiency may occur in individuals following a vegan diet.

(4) True or False regarding vitamin A deficiency?

(A) vitamin A deficiency may cause night blindness.
(B) Bitot spots may develop in vitamin A deficiency.
(C) Keratomalacia is a severe manifestation of vitamin A deficiency.
(D) Rickets is a manifestation of vitamin A deficiency.
(E) Xerophthalmia may occur in vitamin A deficiency.

(5) True or False regarding folate deficiency?

(A) Folate deficiency can cause megaloblastic anaemia.
(B) Folate deficiency is associated with neural tube defects in the fetus.
(C) Inflammatory bowel disease may contribute to folate deficiency.
(D) Chronic alcoholism is a risk factor for folate deficiency.
(E) Methotrexate therapy may precipitate folate deficiency.

Single Best Answer Questions

(6) A 2-year-old child presents with bilateral pitting oedema, fatty liver, sparse hair, irritability, and a history of being fed mainly diluted rice gruel after early weaning. What is the most likely diagnosis?

(A) Marasmus
(B) Kwashiorkor
(C) Iron deficiency anaemia
(D) Vitamin A deficiency
(E) Pellagra

(7) A strict vegan presents with macrocytic anaemia, glossitis, and neurological manifestations. Which nutrient deficiency is the most likely cause?

(A) Folate
(B) Iron
(C) Vitamin B12
(D) Vitamin B6
(E) Vitamin C

(8) A child presents with bowing of the legs, delayed closure of fontanelles, and hypocalcaemia. Which deficiency is the most likely cause?

(A) Vitamin A
(B) Vitamin C
(C) Vitamin D
(D) Vitamin K
(E) Calcium deficiency alone

(9) A chronic alcoholic presents with confusion, ophthalmoplegia, and ataxia. Which vitamin deficiency is most likely responsible?

(A) Vitamin B1 (Thiamine)
(B) Vitamin B3 (Niacin)
(C) Vitamin B6 (Pyridoxine)
(D) Vitamin B12 (Cobalamin)
(E) Folate

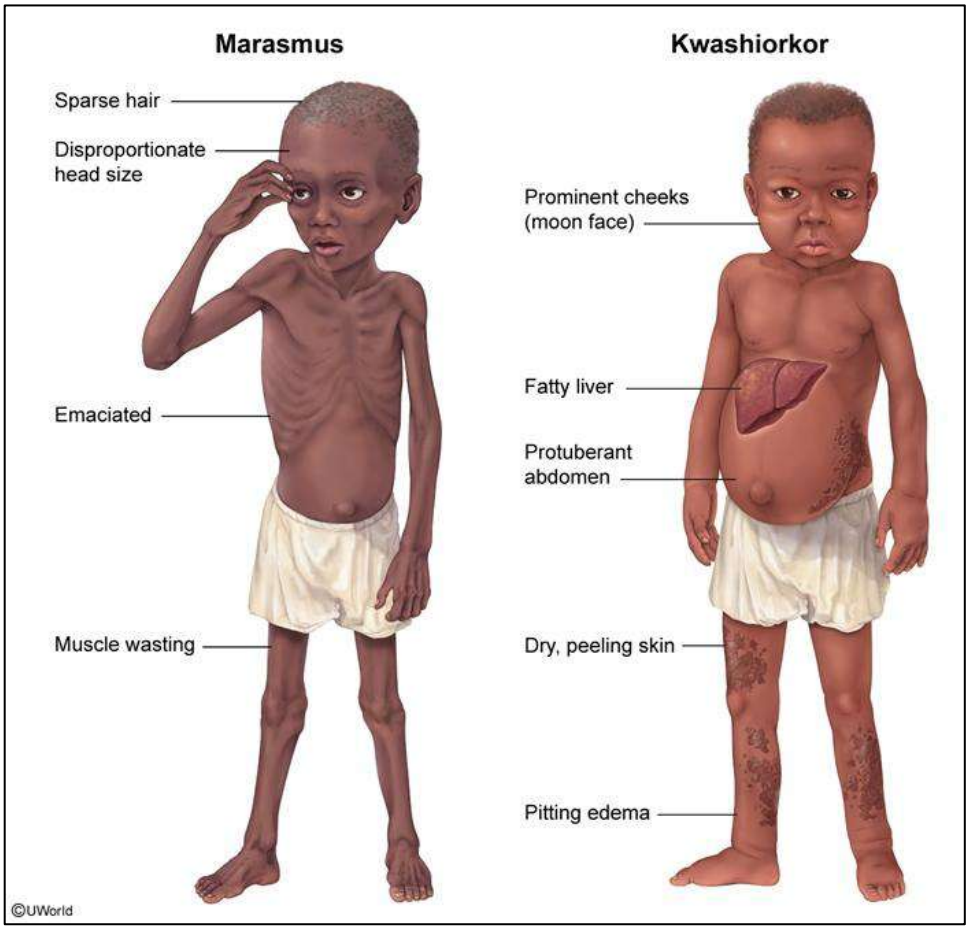
(10) A pregnant woman who did not receive antenatal supplementation delivers a baby with spina bifida. Deficiency of which nutrient is most strongly associated with this condition?

(A) Vitamin B12
(B) Vitamin A
(C) Iron
(D) Folate
(E) Iodine

SGD 2 – Vitamin and Mineral Deficiencies Answers

(1) Answer: T T F T T

Explanation:
Protein-Energy Malnutrition (PEM) includes kwashiorkor and marasmus. Kwashiorkor results primarily from protein deficiency despite relatively adequate calorie intake and is characterized by oedema due to hypoalbuminaemia. Marasmus results from deficiencies of both protein and energy and is characterized by severe muscle wasting and loss of body fat without oedema.

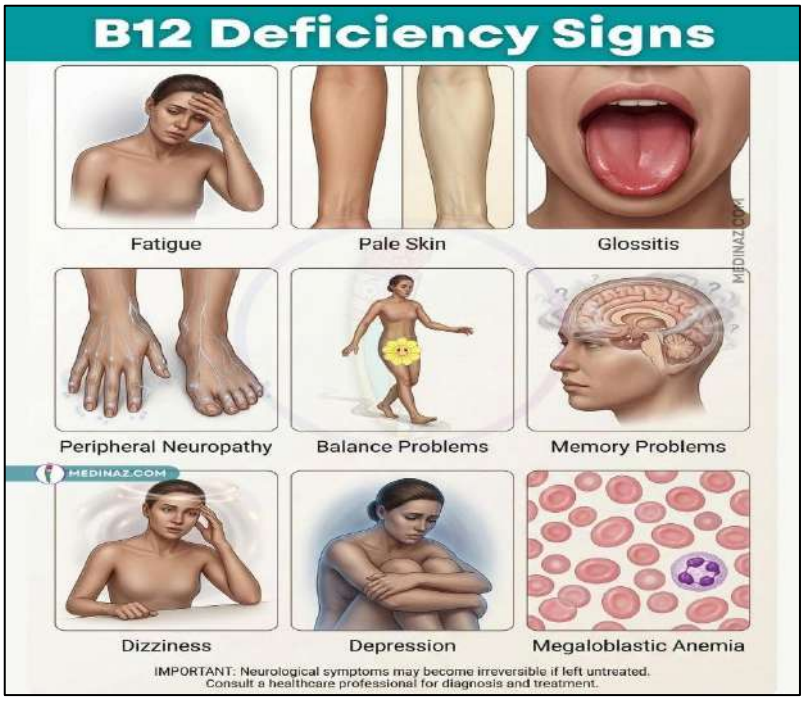


(2) Answer: T T F T F

Explanation:
Kwashiorkor develops when dietary protein intake is inadequate despite sufficient calorie intake. It is characterized by oedema, hypoalbuminaemia, fatty liver, growth retardation, and skin and hair changes. Oedema is a hallmark feature and distinguishes it from marasmus.

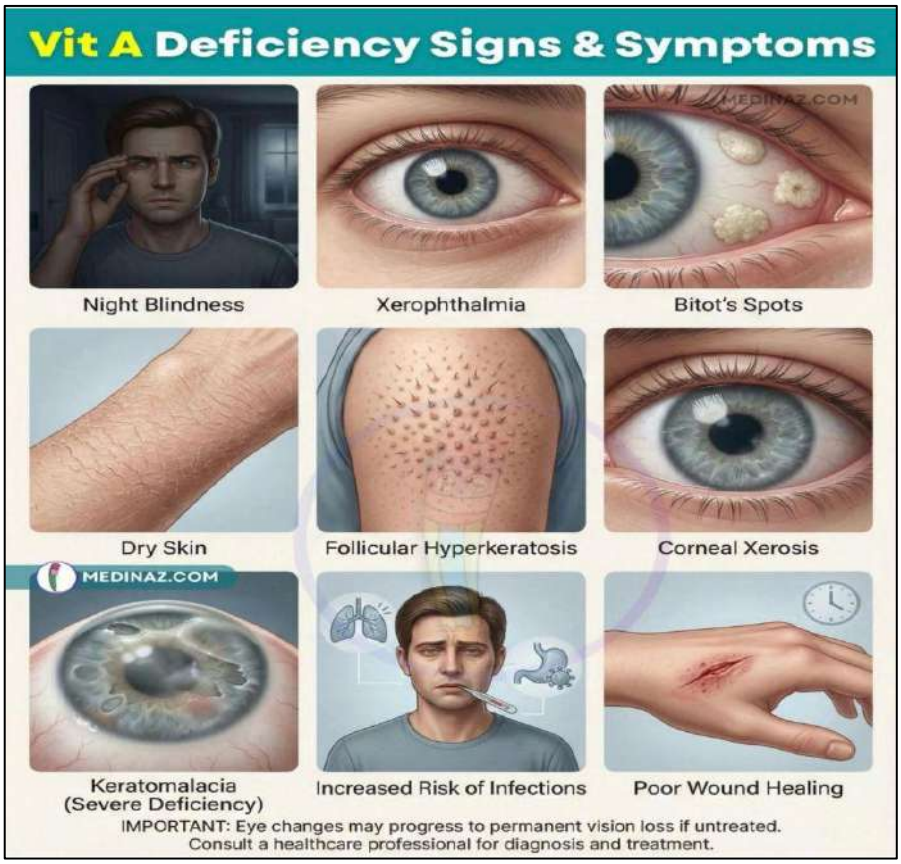
(3) Answer: T T F T T

Explanation:
Strict vegan diets exclude animal products and may lead to deficiencies of vitamin B12, iron, zinc, and omega-3 fatty acids. Vitamin C deficiency is uncommon because fruits and vegetables, which are rich sources of vitamin C, are widely consumed in vegan diets.



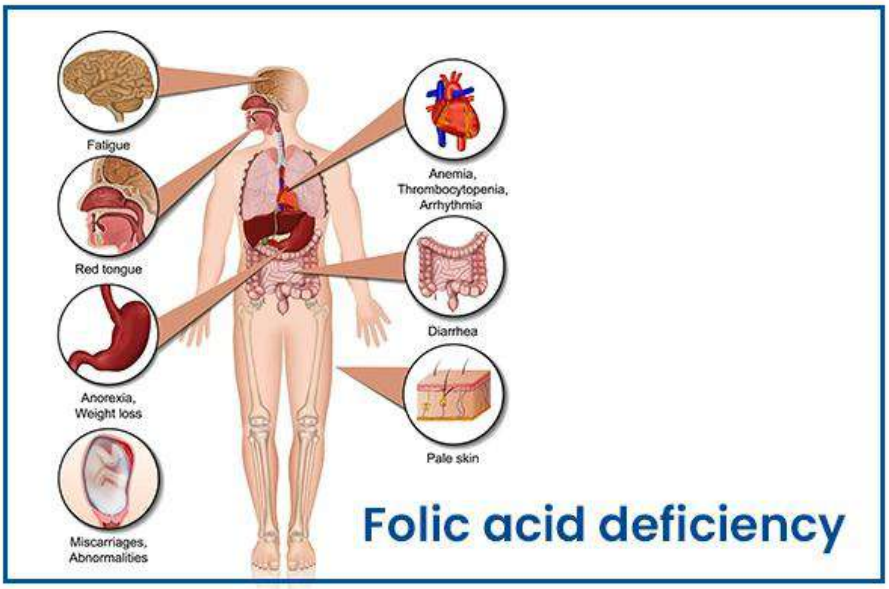
(4) Answer: T T T F T

Explanation:
Vitamin A is essential for vision, epithelial integrity, and immune function. Deficiency may cause night blindness, xerophthalmia, Bitot spots, and keratomalacia. Rickets is caused by vitamin D deficiency rather than vitamin A deficiency.



(5) Answer: T T T T T

Explanation:
Folate is essential for DNA synthesis and cell division. Deficiency causes megaloblastic anaemia and increases the risk of neural tube defects. Folate deficiency can result from poor dietary intake, malabsorption disorders such as inflammatory bowel disease, chronic alcoholism, and drugs such as methotrexate.



(6) Answer: B. Kwashiorkor

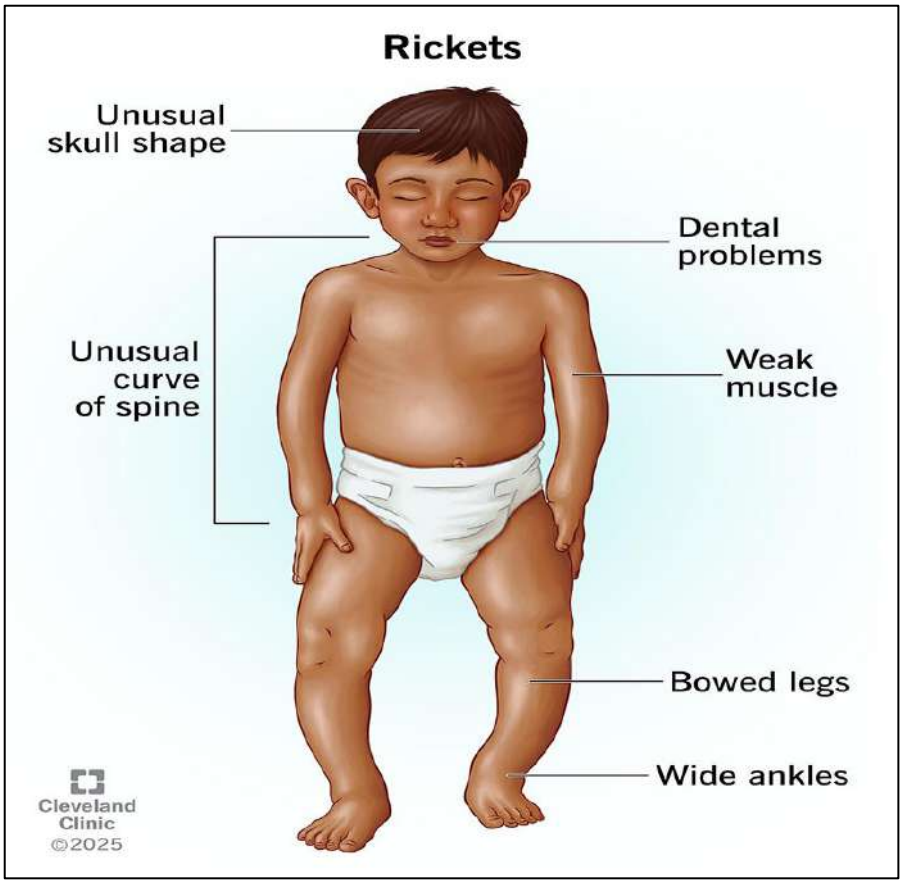
Explanation:
Kwashiorkor is caused by severe protein deficiency and presents with oedema, fatty liver, hair changes, irritability, and hypoalbuminaemia.

(7) Answer: C. Vitamin B12

Explanation:
Vitamin B12 deficiency causes megaloblastic anaemia, glossitis, and neurological abnormalities. It commonly occurs in strict vegans because vitamin B12 is found mainly in foods of animal origin.

(8) Answer: C. Vitamin D

Explanation:
Vitamin D deficiency causes rickets in children, resulting in defective mineralization of growing bones, bowing of the legs, delayed closure of fontanelles, and hypocalcaemia.



(9) Answer: A. Vitamin B1 (Thiamine)

Explanation:
The triad of confusion, ophthalmoplegia, and ataxia is characteristic of Wernicke encephalopathy, a neurological disorder caused by thiamine deficiency, particularly in chronic alcoholics.

(10) Answer: D. Folate

Explanation:
Folate is essential for neural tube development during early pregnancy. Deficiency increases the risk of neural tube defects such as spina bifida. Folic acid supplementation before conception and during the first trimester helps prevent these defects.

SGD 3 - Weight Reduction Plan and Healthy Food Processing for an Obese Adult Female Questions

Case Scenario

Mrs. S is a 42-year-old housewife who weighs 100 kg and has a height of 150 cm (1.5 m). She leads a sedentary lifestyle with minimal physical activity and no regular exercise program. She attends a primary care clinic seeking advice on a safe and sustainable weight reduction plan to achieve her Ideal Body Weight (IBW).

Given Information

- 1 kg of body fat ≈ 7700 kcal
- A daily energy deficit of approximately 1100 kcal results in a weight loss of about 1 kg per week

Question 1 – Anthropometric Assessment

a) Calculate Mrs. S's Body Mass Index (BMI).
b) Classify her BMI according to the Asian BMI classification.
c) Calculate her Ideal Body Weight (IBW).

Question 2 – Energy Requirement Calculations

a) Calculate Mrs. S's Basal Metabolic Rate (BMR) using the Mifflin–St Jeor equation for females.
b) Identify the most appropriate physical activity factor for Mrs. S and justify your choice.
c) Calculate her Total Energy Expenditure Requirement (TEER).

Question 3 – Weight Reduction Planning

a) Determine the total amount of weight Mrs. S needs to lose to achieve her Ideal Body Weight.
b) Calculate the total energy deficit (kcal) required to achieve this weight loss.
c) Assuming a weight loss of 1 kg per week, estimate the time required to reach her target weight.
d) Calculate the recommended daily calorie intake required to achieve safe and sustainable weight reduction.

Question 4 – Meal-wise Calorie Distribution

Mrs. S is prescribed a 1200 kcal/day diet.

a) Distribute the total daily calorie intake among the following meals using appropriate percentages:
   - Breakfast
   - Mid-morning snack
   - Lunch
   - Evening snack
   - Dinner

b) Justify your calorie distribution pattern based on healthy dietary principles and weight management goals.

SGD 3 - Weight Reduction Plan and Healthy FoodProcessing for an Obese Adult Female Answers

Question 1 – Anthropometric Assessment

a) Body Mass Index (BMI)
BMI = Weight(kg) / Height2(m)
BMI=100 / (1.5)2
BMI=100 / 2.25 = 44.4 kg/m2

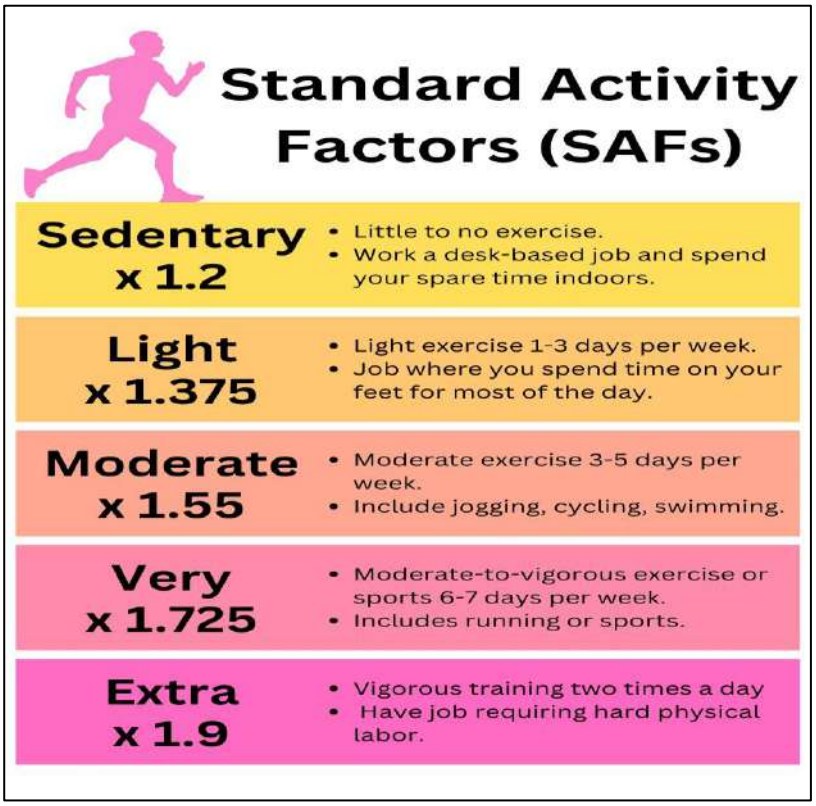
b) BMI Classification (Asian)
BMI ≥ 25 kg/m² → Obesity
She is considered as Obese patient

c) Ideal Body Weight (IBW)
Using Ideal BMI = 23 kg/m²
IBW=BMI×Height2
IBW=23×2.25=51.75≈52kg

Question 2 – Energy Requirement Calculations

a) Basal Metabolic Rate (BMR)
Using Mifflin–St Jeor equation for Female
BMR= (10×W) + (6.25×H) −(5×A)−161
= (10×100) +(6.25×150)−(5×42)−161
= 1000+937.5−210−161
=1566.5kcal/day

b) Physical Activity Factor
Mrs. S has very little physical activity
Her activity level is sedentary
Her activity factor is 1.2



c) Total Energy Expenditure Requirement (TEER)
TEER=BMR×Activity Factor
TEER=1566.5×1.2 =1880 kcal/day

Question 3 – Weight Reduction Planning

a) Total Weight to be Lost
100−52=48 kg

b) Total Energy Deficit Required
48×7700=369,600 kcal

c) Time Required (1 kg/week)
48 kg=48 weeks≈12 months

d) Recommended Daily Calorie Intake
To lose 1 kg/week, daily deficit ≈ 1100 kcal
1880−1100=780 kcal/day

This is very low
Safe practical prescription has to be around 1200 kcal/day, so she can target to reduce ½ kg per week.
[1880 kcal – 1200 kcal = 680 kcal
680 kcal * 7 = 4760 kcal
1kg / 7700 kcal * 4760 kcal = 0.62 kg]

Question 4 – Meal-wise Calorie Distribution

Meal	Percentage	Calories
Breakfast	25%	300 kcal
Mid-morning snack	10%	120 kcal
Lunch	30%	360 kcal
Evening snack	10%	120 kcal
Dinner	25%	300 kcal
Total	**1200 kcal**	

Than a high calorie 3 major meals, having small frequent meals are beneficial for weight reduction and helps to prevent insulin spike and hypoglycemic condition, which can present as dizziness, fatigue, irritability, and reduced concentration.

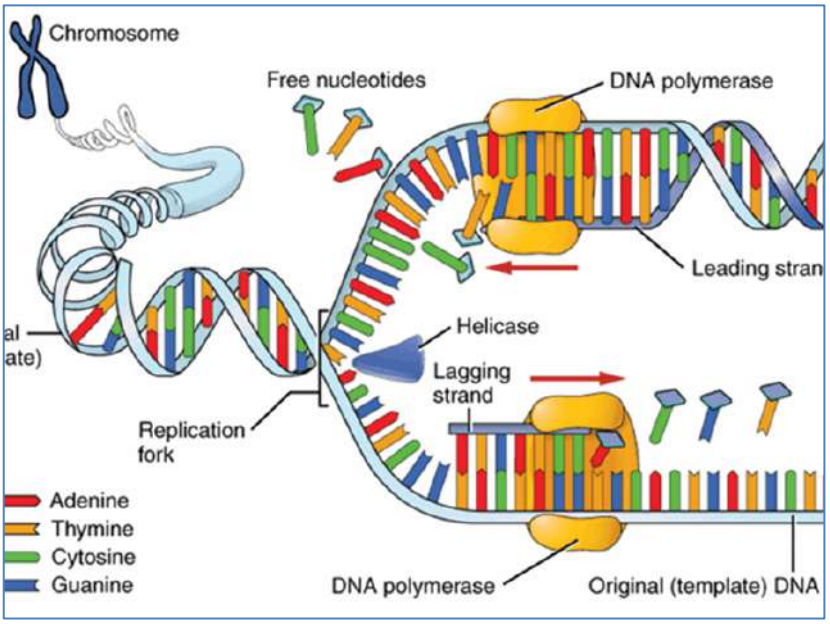
COURSE 2 - Special topics

TUTORIALS & ANSWERS

Tutorial 1-Functions of proteins and protein synthesis Questions

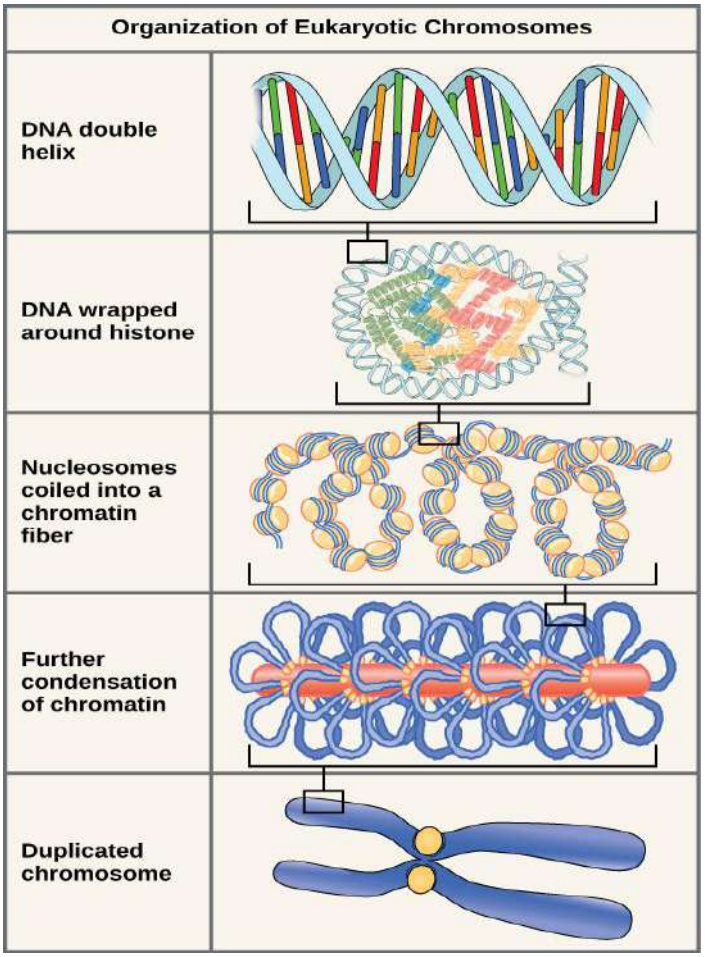
This quiz consists of 40 Fill in the blanks questions. Answer all the questions with in one hour.

Section A: DNA Structure & Function



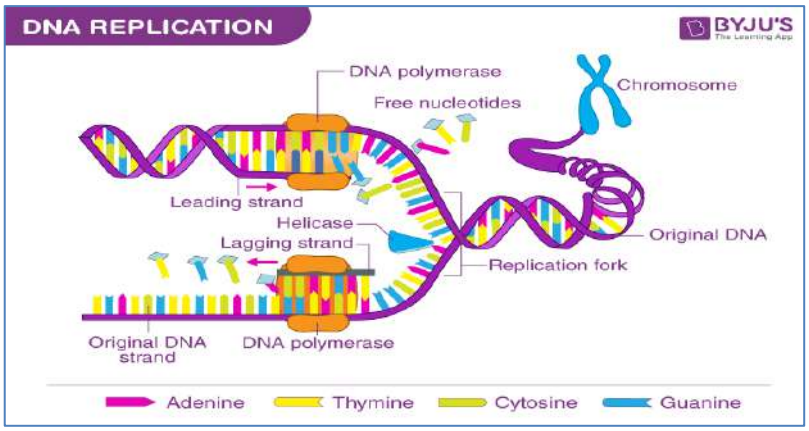
1. DNA is made up of a sugar called _____, are made of a phosphate group, and nitrogenous bases.
2. The nitrogenous base Thymine (T) pairs with _____.
3. DNA strands are held together by _____ bonds between complementary bases.
4. The DNA double helix is arranged in an _____ manner.
5. The process of separating DNA strands is called _____.
6. The temperature at which half of the DNA double helix is lost is called _____.
7. DNA strands can re-form the double helix through a process known as _____.
8. DNA has a directionality from _____ to _____.
9. The loss of helical structure in DNA is referred to as _____.
10. The reformation of the double helix under proper conditions is termed _____.

Section B: Components and Organization



11. DNA in the nucleus is associated with proteins called _____.
12. The basic structural unit of chromatin is the _____.
13. During replication, new histones are synthesized and associate with _____ DNA strands.
14. In prokaryotes, DNA is located in the _____ region.
15. The backbone of DNA is formed by _____ bonds between nucleotides.
16. Each nucleotide consists of a nitrogenous base, a sugar, and a _____ group.
17. The 5'-end of DNA has a free _____ group.
18. The 3'-end of DNA has a free _____ group.
19. The sequence of DNA bases is always read from _____ to _____ direction.
20. The double-stranded nature of DNA allows it to serve as a _____ during replication.

Section C: DNA Replication



21. DNA replication is described as _____ because each new DNA molecule contains one old and one new strand.
22. In prokaryotes, replication begins at a single site called the _____.
23. In eukaryotes, replication begins at multiple sites called _____ sequences.
24. The site where DNA strands unwind to begin replication is called the _____.
25. DNA unwinding is facilitated by an enzyme called _____.
26. _____ prevents reformation (Reannealing) of the double helix .
27. _____ helps relieve supercoiling during DNA replication.
28. Short stretches of RNA required to initiate DNA synthesis are called _____.
29. DNA polymerase adds nucleotides to the _____ end of the new strand.
30. On the leading strand, DNA synthesis is _____.
31. On the lagging strand, DNA synthesis occurs in short fragments called _____ fragments.
32. RNA primers on the lagging strand are removed by the _____ activity of DNA polymerase I.
33. DNA fragments are joined by the enzyme _____.
34. The enzyme that proofreads and corrects replication errors is _____.
35. Errors not corrected by proofreading are repaired by the _____ repair system.
36. In the lagging strand, DNA synthesis proceeds _____ from the replication fork.
37. Each Okazaki fragment requires a separate _____ to initiate synthesis.
38. The enzyme _____ synthesizes short RNA primers needed to start DNA synthesis.
39. DNA Polymerase I in prokaryotes also has _____ activity to remove RNA primers.
40. The enzyme responsible for sealing nicks between fragments during DNA replication is __

Tutorial 1-Functions of proteins and protein synthesis Answers

Answer Key

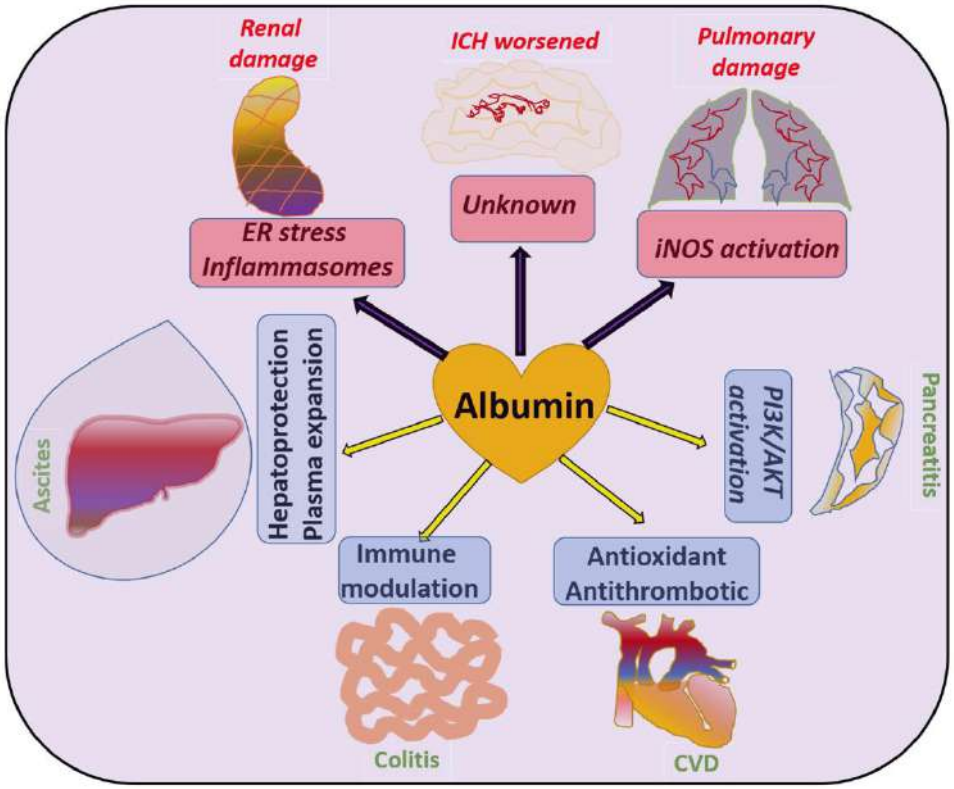
1. Deoxyribose
2. Adenine
3. Hydrogen
4. Antiparallel
5. Denaturation
6. Melting temperature (Tm)
7. Renaturation
8. 5'; 3'
9. Denaturation
10. Renaturation
11. Histones
12. Nucleosome
13. Newly synthesized
14. Nucleoid
15. Phosphodiester
16. Phosphate
17. Phosphate
18. Hydroxyl (OH)
19. 5'; 3'
20. Template
21. Semiconservative
22. Origin of replication
23. Consensus
24. Replication fork
25. Helicase
26. SSB proteins
27. Topoisomerase
28. RNA primers
29. 3'
30. Continuous
31. Okazaki
32. Exonuclease
33. DNA ligase
34. DNA polymerase
35. Mismatch
36. Away
37. RNA primer
38. Primase
39. Exonuclease
40. DNA ligase

Tutorial 2 - Plasma Proteins Questions

(Q1) List four (04) physiological functions of albumin in the body. (10 Marks)
(Q2) List four (04) causes of hypoalbuminemia. (10 Marks)
(Q3) List four (04) clinical features of hypoalbuminemia. (10 Marks)
(Q4) Briefly describe the diagnostic uses of serum albumin levels. (30 Marks)
(Q5) Outline the management strategies for hypoalbuminemia. (40 Marks)
(Q6) Outline the major types of globulins and their functions.
(Q7) Discuss the role of alpha-1 antitrypsin and the consequences of its deficiency.
(Q8) Explain the clinical significance of gamma globulins (immunoglobulins), including their role in immunity and disease states.
(Q9) Describe methods used for the detection of globulin abnormalities and their diagnostic value in conditions like multiple myeloma.

Tutorial 2 - Plasma Proteins Answers

(Q1)



Maintenance of osmotic pressure
Transport,
Buffering,
antioxidant properties

(Q2) Reduced synthesis
Increased excretion or degradation
Increased volume of distribution
inflammation

(Q3)



Oedema, ascites
pleural effusion
Fatigue and Weakness
Delayed Wound Healing
Increased Risk of Infections
Hypotension or Shock (in severe cases)
Drug Toxicity or Altered Drug Response

(Q4) Albumin as a diagnostic marker
Inflammation / Chronic Disease
Albumin is a negative acute-phase reactant
↓ during systemic inflammation, sepsis, trauma, or burns,
Can help assess severity and prognosis in critically ill patients
Prognostic Indicator
Low albumin levels often correlate with:↑ morbidity and mortality, Poor outcomes in ICU, surgery, cancer, or chronic illness
Liver Function

- Low albumin = ↓ liver synthetic function, Seen in chronic liver disease, especially cirrhosis
- Combined with other markers in LFTs (Liver Function Tests)

Nutritional Status

- Hypoalbuminemia may reflect protein-calorie malnutrition.
- Useful in hospitalized patients, elderly, or those with chronic illness

Kidney Function

- Low serum albumin + proteinuria = possible nephrotic syndrome,
- Albumin lost in urine → contributes to oedema

(Q5) Treat the Underlying Cause

- Liver disease (e.g., cirrhosis)

Supportive care, manage complications, possible liver transplant

- Nephrotic syndrome

Control protein loss with medications (e.g., ACE inhibitors), diuretics, treat underlying kidney condition

- Malnutrition

High-protein diet, supplements, treat absorption issues

- Burns or trauma

Replace protein and fluid losses, wound care

- Infections/inflammation

Treat the infection, control inflammation

- Nutritional Support
  - High-protein diet (e.g., eggs, dairy, meat, legumes)
  - Oral or enteral protein supplements (especially if intake is poor)
  - In cases of severe malnutrition, consider parenteral nutrition
- Fluid Management
  - Avoid fluid overload, especially in patients with low oncotic pressure
  - Use diuretics cautiously, often combined with albumin to prevent worsening fluid shifts

(Q6)

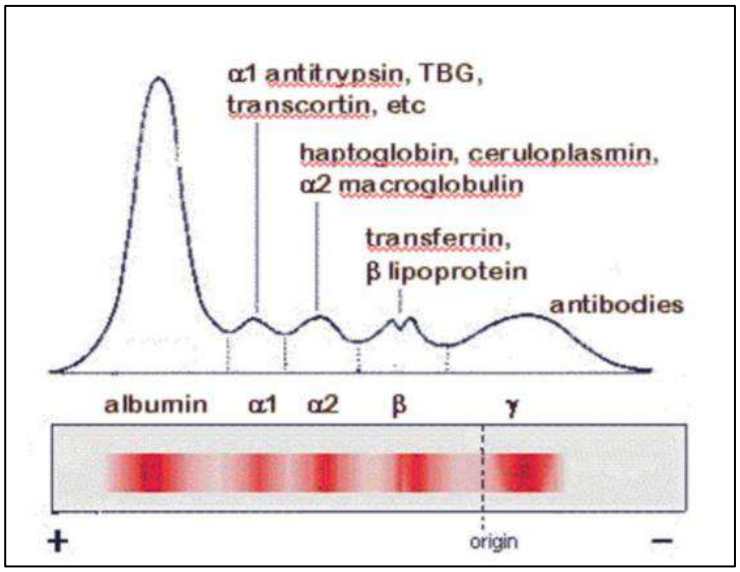


TABLE 52–3 Some Functions of Plasma Proteins

Function	Plasma Proteins
Antiproteases	Antichymotrypsin
	α_1-Antitrypsin (α_1-antiproteinase)
	α_2-Macroglobulin
	Antithrombin
Blood clotting	Various coagulation factors, fibrinogen
Enzymes	Function in blood, for example, coagulation factors, cholinesterase
	Leakage from cells or tissues, eg, aminotransferases
Hormones	Erythropoietin[a]
Immune defense	Immunoglobulins, complement proteins, and β_2-macroglobulin
Involvement in inflammatory responses	Acute phase response proteins (eg, C-reactive protein, α_1-acid glycoprotein [orosomucoid])
Oncofetal	α_1-Fetoprotein (AFP)
Transport or binding proteins	Albumin (various ligands, including bilirubin, free fatty acids, ions [Ca^{2+}], metals [eg, Cu^{2+}, Zn^{2+}], metheme, steroids, other hormones, and a variety of drugs)
	Corticosteroid-binding globulin (transcortin) (binds cortisol)
	Haptoglobin (binds extracorpuscular hemoglobin)
	Lipoproteins (chylomicrons, VLDL, LDL, HDL)
	Hemopexin (binds heme)
	Retinol-binding protein (binds retinol)
	Sex-hormone-binding globulin (binds testosterone, estradiol)
	Thyroid-binding globulin (binds T_4, T_3)
	Transferrin (transport iron)
	Transthyretin (formerly prealbumin; binds T_4 and forms a complex with retinol-binding protein)

(Q7) Role of α1-Antitrypsin (α1-Antiproteinase)

- α1-Antitrypsin is a major plasma serine protease inhibitor (serpin) synthesized mainly by hepatocytes and macrophages.
- It constitutes more than 90% of the α1-globulin fraction of plasma proteins.
- Its main function is to inhibit proteolytic enzymes such as elastase, trypsin, and other serine proteases.
- By inhibiting elastase released from neutrophils, it protects lung connective tissue and alveolar walls from proteolytic destruction.
- It forms inactive covalent complexes with these enzymes, thereby limiting tissue injury during inflammation.

Consequences of α1-Antitrypsin Deficiency
1. Pulmonary Disease – Emphysema

- Genetic deficiency, especially in individuals with the ZZ genotype, results in markedly reduced circulating α1-antitrypsin levels.
- Inadequate inhibition of elastase leads to excessive destruction of elastic tissue in the lungs, causing early-onset emphysema.
- Cigarette smoke oxidizes the critical methionine residue (Met358) in α1-antitrypsin, inactivating it and further reducing its protective effect.
- Therefore, smoking greatly accelerates lung damage in affected individuals.
- Patients are also more susceptible to lung injury during infections such as pneumonia due to increased neutrophil elastase activity.

2. Liver Disease

- In individuals with the ZZ phenotype, abnormal α1-antitrypsin accumulates within hepatocytes because of a mutation in which Glu342 is replaced by lysine.
- The abnormal protein forms polymeric aggregates in the endoplasmic reticulum of liver cells.
- This causes hepatocyte injury leading to hepatitis, progressive liver damage, and eventually cirrhosis.

(Q8)

TABLE 52–9 Major Functions of Immunoglobulins

Immunoglobulin	Major Functions
IgG	Main antibody in the secondary response. Opsonizes bacteria, making them easier to phagocytose. Fixes complement, which enhances bacterial killing. Neutralizes bacterial toxins and viruses. Crosses the placenta.
IgA	Secretory IgA prevents attachment of bacteria and viruses to mucous membranes. Does not fix complement.
IgM	Produced in the primary response to an antigen. Fixes complement. Does not cross the placenta. Antigen receptor on the surface of B cells.
IgD	Found on the surfaces of B cells where it acts as a receptor for antigen.
IgE	Mediates immediate hypersensitivity by causing release of mediators from mast cells and basophils upon exposure to antigen (allergen). Defends against worm infections by causing release of enzymes from eosinophils. Does not fix complement. Main host defense against helminthic infections.

Source: Reproduced, with permission, from Levinson W, Jawetz E: *Medical Microbiology and Immunology*, 7th ed. McGraw-Hill, 2002.

(Q9) Serum Protein Electrophoresis (SPEP) - It is the most important screening test for detecting abnormal globulin patterns.

Diagnostic Value

- In multiple myeloma, SPEP shows a sharp narrow monoclonal spike ("M band" or "M spike") usually in the γ region due to excess monoclonal immunoglobulin produced by malignant plasma cells.

2. Immunofixation Electrophoresis (IFE) - Combines electrophoresis with specific antisera against immunoglobulin heavy and light chains. Identifies the exact type of monoclonal protein (IgG, IgA, κ, λ, etc.).

Diagnostic Value

- Confirms monoclonal gammopathy detected on SPEP.
- Highly sensitive for diagnosing and classifying multiple myeloma, Waldenström macroglobulinemia, and monoclonal gammopathy of undetermined significance (MGUS).

3. Quantitative Immunoglobulin Assay - Measures serum levels of IgG, IgA, and IgM using immunoassays such as nephelometry or turbidimetry.

Diagnostic Value

- Elevated monoclonal immunoglobulin suggests plasma cell disorders.
- Reduced immunoglobulin levels indicate immunodeficiency states.

4. Urine Protein Electrophoresis (UPEP) and Bence Jones Protein Detection - Detects monoclonal free light chains excreted in urine.

Diagnostic Value

- Presence of Bence Jones proteins (κ or λ light chains) strongly supports diagnosis of multiple myeloma.
- Helpful in monitoring disease progression and renal involvement.

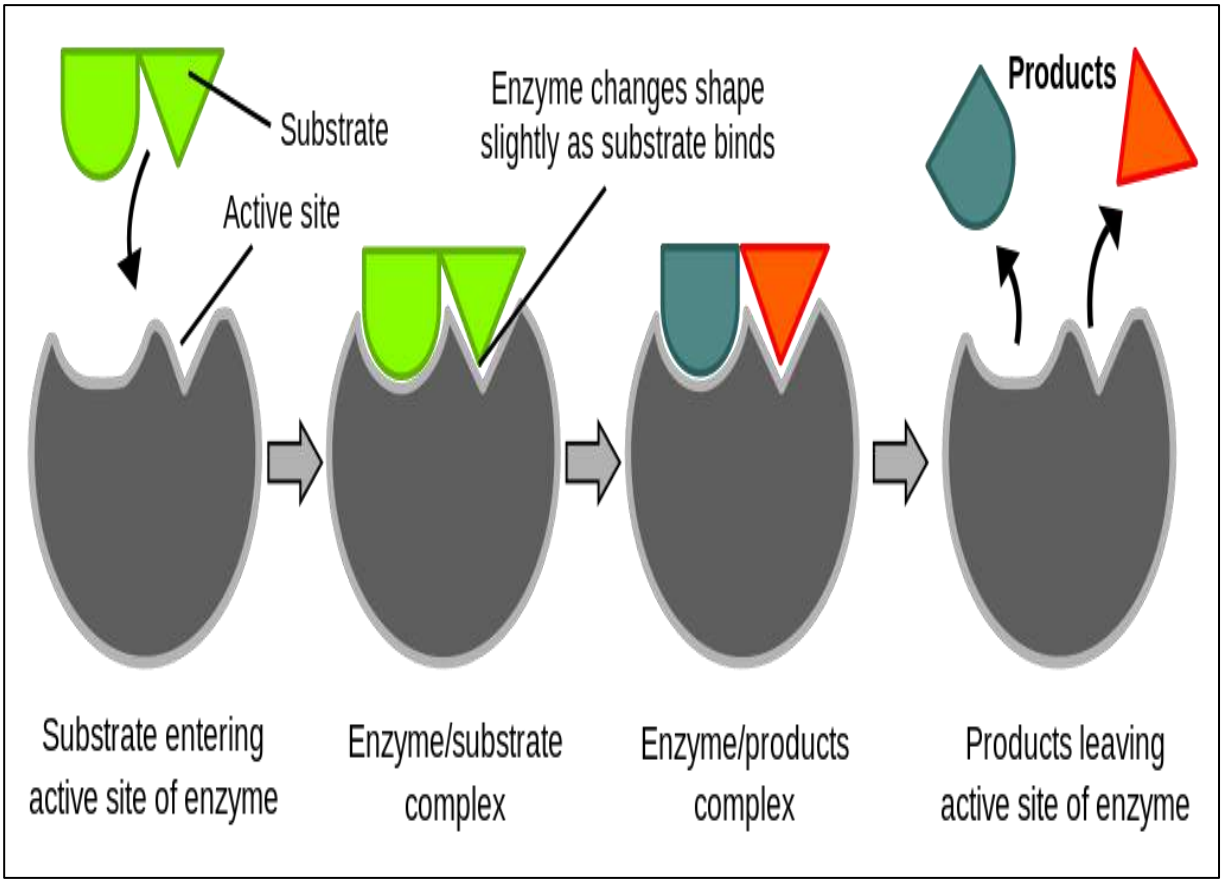
•

Tutorial 03 – Enzymes Questions

(Q1) Define what an enzyme is. (12 Marks)
(Q2) List four (04) factors that affect the enzyme activity. (10 Marks)
(Q3) List six (06) Major classes of enzymes and state the type of chemical reaction catalysed by each of these enzyme classes. (18 Marks)
(Q4) Briefly describe the following related to enzymes
- **(1) Catalytic efficiency (15 Marks)**
- **(2) Specificity (15 Marks)**
- **(3) Holoenzymes (30 Marks)**

Tutorial 03 – Enzymes Answers

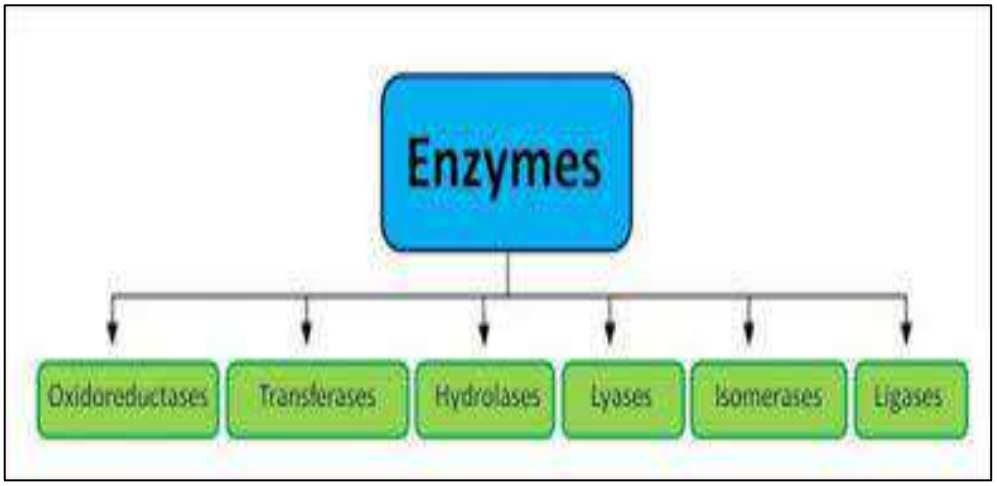
(Q1)



Protein catalysts
that increase
the rate of reactions
without being changed in the overall process.

(Q2) Temperature
pH (Hydrogen Ion Concentration)
Substrate Concentration
Enzyme Concentration

(Q3)



- Oxidoreductases: oxidation-reduction reactions
- Transferases: transfer C, N, or P containing groups
- Hydrolases: catalyse cleavage of bonds by addition of water
- Lyases: catalyse cleavage of C-C, C-S and certain C-N bonds
- Isomerases: catalyse racemization of optical or geometric isomers
- Ligases: catalyse formation of bonds between carbon and O, S, N coupled to hydrolysis of high energy phosphates

(Q4)

(1) Catalytic efficiency (15 Marks)

• Enzyme-catalyzed reactions are highly efficient
• proceeding from 103–108 times faster than uncatalyzed reactions.
• The number of molecules of substrate converted to product per enzyme molecule per second is called the turnover number, or kcat and typically is 102–104s-1.

(2) Specificity (15 Marks)

• Enzymes are highly specific,
• interacting with one or a few substrates
• and catalyzing only one type of chemical reaction.
• The set of enzymes made in a cell determines which metabolic pathways occur in that cell.

(3) Holoenzymes (30 Marks)

• Some enzymes require molecules
• other than proteins for enzymic activity.
• The term holoenzyme refers to the active enzyme with its nonprotein component,
• whereas the enzyme without its nonprotein moiety is termed an apoenzyme and is inactive.
• If the nonprotein moiety is a metal ion such as Zn2+ or Fe2+, it is called a cofactor.
• If it is a small organic molecule, it is termed a coenzyme.
• Coenzymes that only transiently associate with the enzyme are called co-substrates.
• Co-substrates dissociate from the enzyme in an altered state (NAD+ is an example)
• If the coenzyme is permanently associated with the enzyme and returned to its original form, it is called a prosthetic group (FAD is an example).
• Coenzymes frequently are derived from vitamins.
• For example, NAD+
• contains niacin and FAD contains riboflavin

SGDs & ANSWERS

SGD 01 - Mechanisms that lead to cancer and tumour markers and their clinical application Questions

(1) Tumour markers are best described as:

(A) Substances produced only by bacteria.
(B) Substances always absent in healthy people.
(C) Substances associated with cancer presence and progression.
(D) Drugs used to treat cancer.
(E) Imaging agents

(2) The most common tumour markers are:

(A) Lipids
(B) Carbohydrates only
(C) Proteins
(D) Minerals
(E) Vitamins

(3) Which tumour marker is commonly used in prostate cancer?
(A) AFP
(B) CEA
(C) PSA
(D) CA-125
(E) E. hCG

(4) CA-125 is mainly associated with:

(A) Breast cancer
(B) Liver cancer
(C) Ovarian cancer
(D) Lung cancer
(E) Colon cancer

(5) Alpha-fetoprotein (AFP) is increased mainly in:

(A) Pancreatic cancer
(B) Hepatocellular carcinoma
(C) Prostate cancer
(D) Bladder cancer
(E) Thyroid cancer

(6) The main clinical use of tumour markers is:

(A) Confirming cancer by biopsy.
(B) Monitoring treatment response.
(C) Replacing imaging studies.
(D) Preventing cancer.
(E) Curing cancer

(7) Carcinoembryonic antigen (CEA) is commonly elevated in:

(A) Colon cancer
(B) Brain tumours
(C) Skin cancer
(D) Bone cancer
(E) Thyroid cancer

(8) Which of the following is a limitation of tumour markers?

(A) Always specific for cancer.
(B) Rise only in early cancer.
(C) Can be elevated in benign conditions.
(D) Cannot be measured in blood.
(E) Not proteins

(9) SCC antigen is mainly associated with:

(A) Adenocarcinoma.
(B) Squamous cell carcinoma.
(C) Sarcoma.
(D) Lymphoma.
(E) Melanoma

(10) An ideal tumour marker should be:

(A) Present only in urine.
(B) Very expensive.
(C) Highly specific and sensitive.
(D) Detected only in late cancer.
(E) Produced by all tissues.

SEQ

A 62-year-old man presents with weight loss, abdominal discomfort, and altered bowel habits. Investigations reveal a colorectal tumour. His blood tests show elevated carcinoembryonic antigen (CEA) levels. After surgery and chemotherapy, CEA levels are monitored regularly during follow-up.

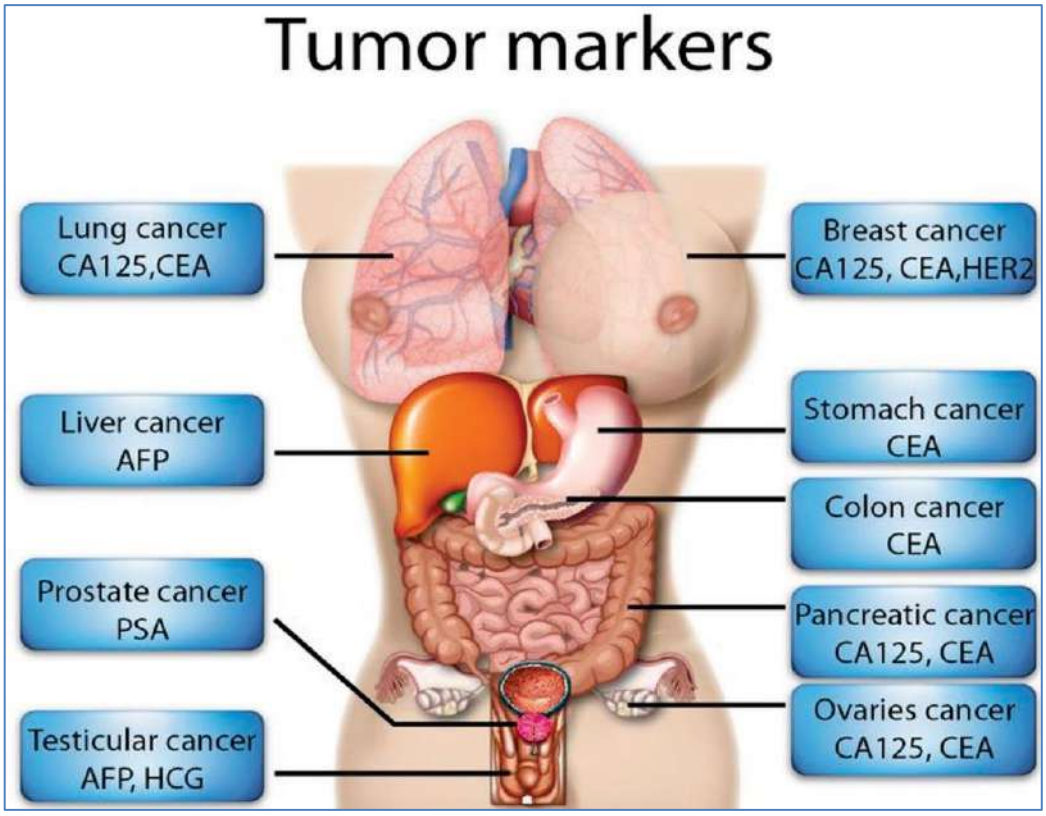
Using this clinical scenario, answer the following:

(Q1) Explain why tumour markers such as CEA become elevated in cancer patients.
(Q2) Describe the biochemical nature of tumour markers and classify them with examples.
(Q3) Explain the concept of sensitivity and specificity in relation to tumour marker interpretation.
(Q4) Give TWO limitations of tumour markers in cancer diagnosis.
(Q5) List the characteristics of an ideal tumour marker.

(Total:100Marks)

SGD 01 - Mechanisms that lead to cancer and tumour markers and their clinical application Answers

(1) C – Substances associated with cancer presence and progression.
Explanation: Tumour markers are substances produced by cancer cells or by the body in response to cancer and are associated with the presence and progression of malignancy.

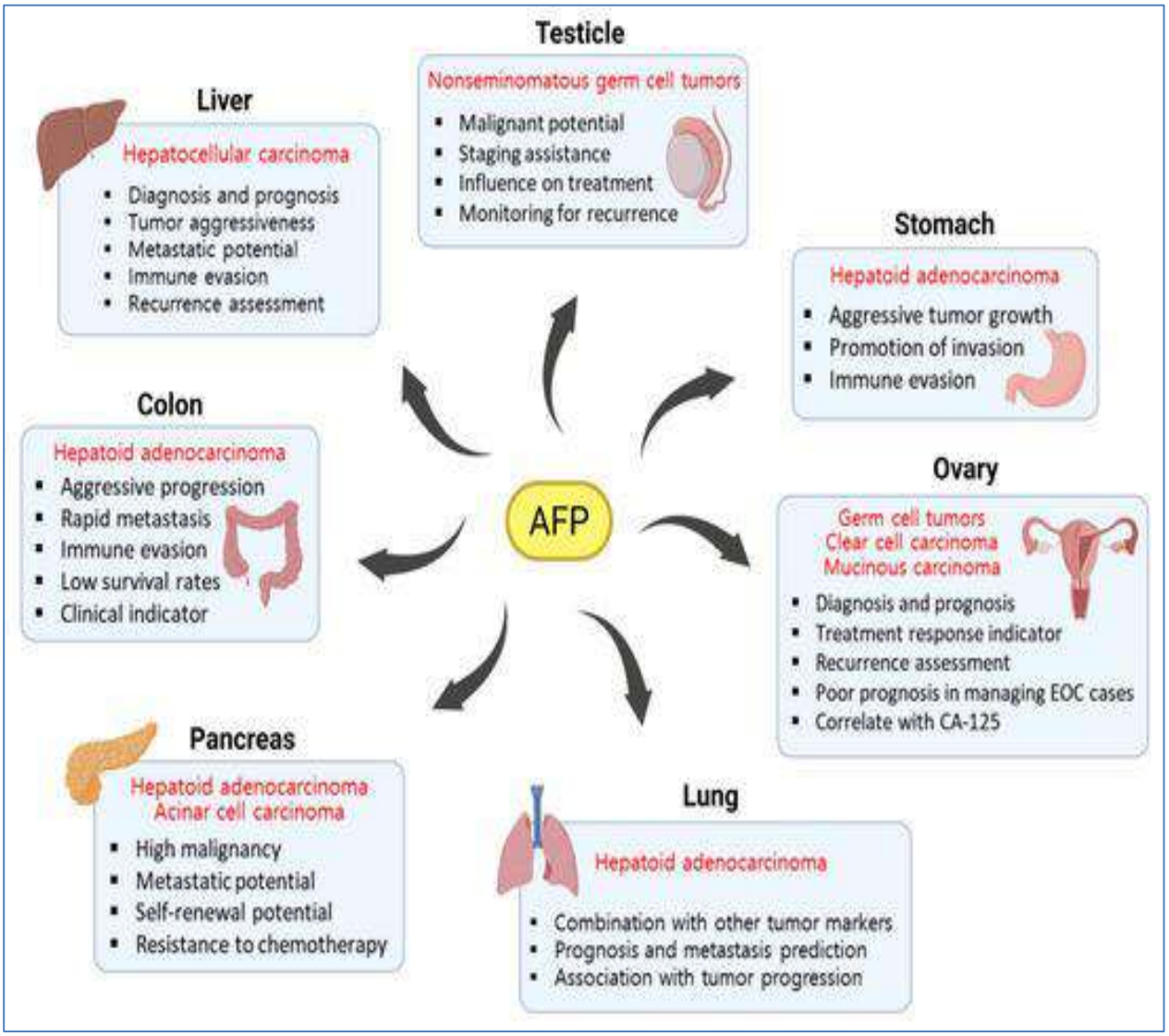


(2) C – Proteins.
Explanation: Most tumour markers are proteins that can be detected in blood, urine, or tissues and used for monitoring cancer.

(3) C – PSA.
Explanation: Prostate-Specific Antigen (PSA) is the most commonly used tumour marker for the diagnosis and monitoring of prostate cancer.

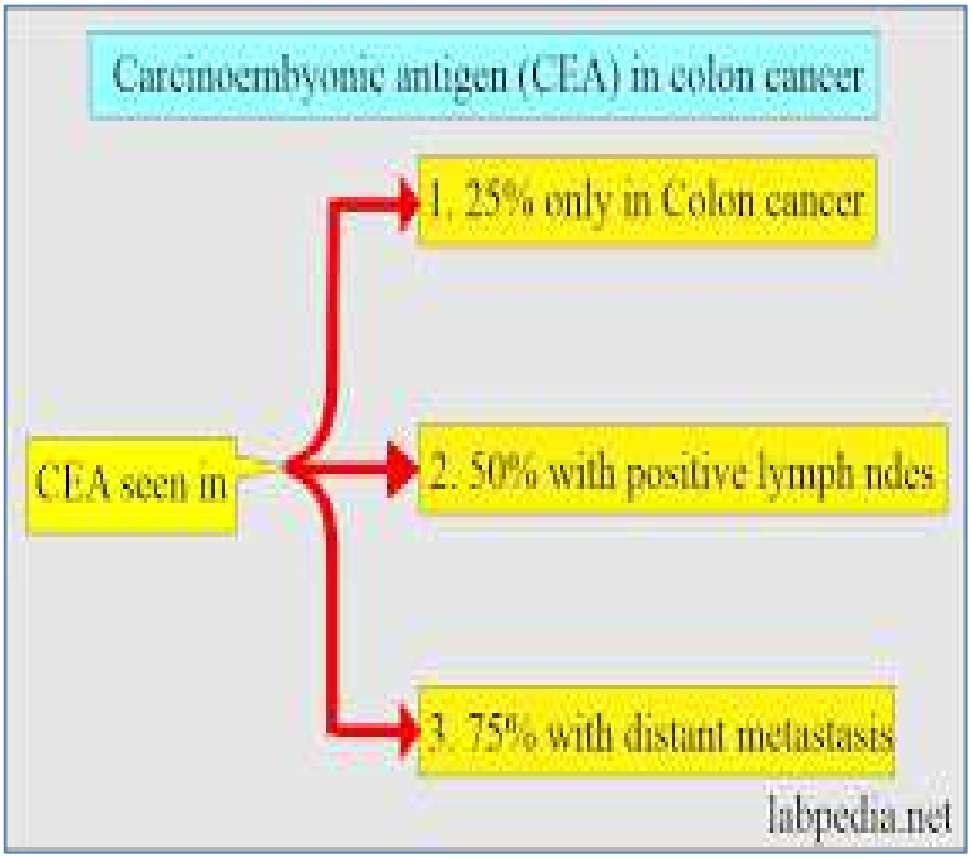
(4) C – Ovarian cancer.
Explanation: CA-125 is a tumour marker mainly used in the diagnosis and monitoring of ovarian cancer.

(5) B – Hepatocellular carcinoma.
Explanation: Alpha-fetoprotein (AFP) levels are commonly elevated in hepatocellular carcinoma and some germ cell tumours.



(6) B – Monitoring treatment response.
Explanation: Tumour markers are mainly used to assess the effectiveness of treatment and detect recurrence of cancer.

(7) A – Colon cancer.
Explanation: Carcinoembryonic Antigen (CEA) is commonly elevated in colorectal (colon) cancer and is useful for monitoring treatment.



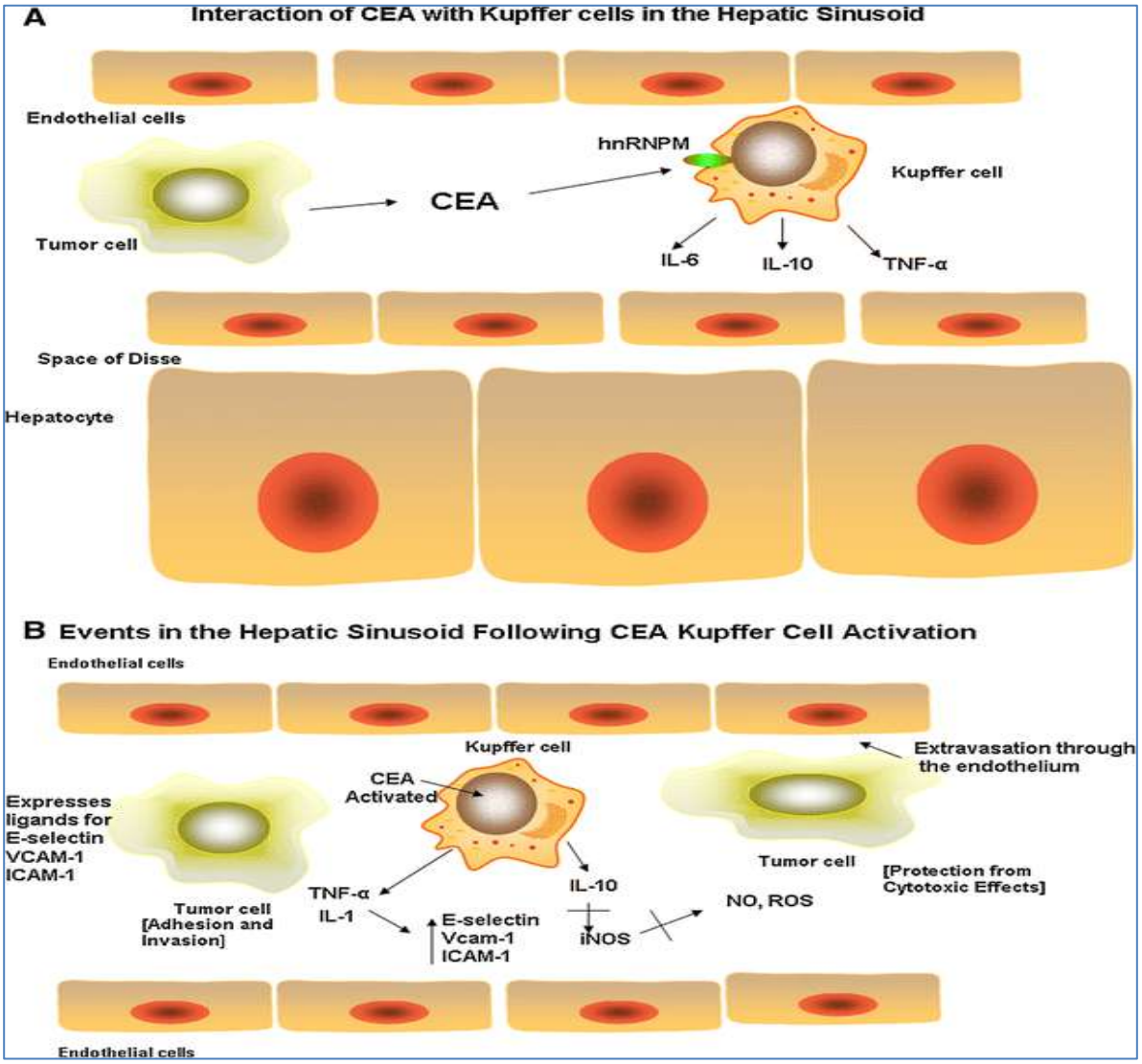
(8) C – Can be elevated in benign conditions.
Explanation: A major limitation of tumour markers is that they may increase in non-cancerous conditions, reducing their specificity.

(9) B – Squamous cell carcinoma.
Explanation: SCC antigen is a tumour marker associated with squamous cell carcinomas, particularly of the cervix, lung, and head and neck.

(10) C – Highly specific and sensitive.
Explanation: An ideal tumour marker should accurately detect cancer (high sensitivity) and be specific to cancer (high specificity).

(Q1) Explain why tumour markers such as CEA become elevated in cancer patients.

Tumour markers become elevated because cancer cells produce and release abnormal amounts of certain substances into the blood. In colorectal cancer, tumour cells produce increased amounts of **Carcinoembryonic Antigen (CEA)**. As the tumour grows and spreads, more CEA is released into the circulation, leading to elevated blood levels. Therefore, CEA levels often reflect tumour burden and may decrease after successful treatment.



(Q2) Describe the biochemical nature of tumour markers and classify them with examples.

Tumour markers are biochemical substances found in blood, urine, or tissues. They are mainly proteins, glycoproteins, enzymes, hormones, or oncofetal antigens produced by tumour cells or by the host in response to cancer.

Classification with examples:

1. **Oncofetal antigens**
   - CEA – Colorectal cancer
   - AFP (Alpha-fetoprotein) – Hepatocellular carcinoma
2. **Hormones**
   - hCG (Human chorionic gonadotropin) – Germ cell tumours
3. **Glycoproteins / Carbohydrate antigens**
   - CA-125 – Ovarian cancer
   - CA 19-9 – Pancreatic cancer
4. **Enzymes and Isoenzymes**
   - Prostatic acid phosphatase (PAP) – Prostate cancer
5. **Specific proteins**
   - PSA (Prostate-specific antigen) – Prostate cancer

(Q3) Explain the concept of sensitivity and specificity in relation to tumour marker interpretation.

Sensitivity is the ability of a tumour marker to correctly identify patients who have cancer (true positives). A highly sensitive marker gives few false-negative results.

Specificity is the ability of a tumour marker to correctly identify individuals who do not have cancer (true negatives). A highly specific marker gives few false-positive results.

An ideal tumour marker should have both high sensitivity and high specificity.

(Q4) Give TWO limitations of tumour markers in cancer diagnosis.

1. **Lack of specificity** – Tumour markers may be elevated in benign conditions such as inflammation, infection, or liver disease, causing false-positive results.
2. **Lack of sensitivity** – Some cancers do not produce detectable levels of tumour markers, especially in early stages, causing false-negative results.

(Q5) List the characteristics of an ideal tumour marker.

- Highly sensitive
- Highly specific
- Detectable in early stages of cancer
- Levels correlate with tumour burden
- Useful for monitoring treatment response
- Useful for detecting recurrence
- Easy and inexpensive to measure
- Reproducible and reliable results
- Not elevated in benign conditions
- Short half-life allowing rapid assessment of treatment effectiveness

BIOCHEMISTRY MOCK PAPERS AND ANSWERS CAT 3 - 2026

CAT- 3 (BATCH 2) MOCK MCQ - 2026

UVA WELLASSA UNIVERSITY FACULTY OF MEDICINE
CAT-3 Examination
April 30, 2026 2023/2024
(02nd)Batch
Biochemistry
Multiple Choice Questions (MCQ)Paper

Please time 8.30- 9.30a.m. (01 hour) Date of the exam: 2026.04.30

do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

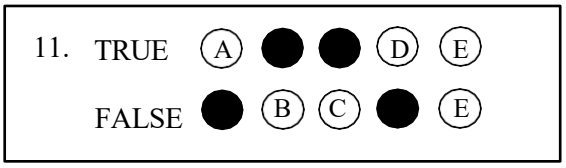
Please read the following instructions before marking responses on your answer sheets

1. Check that your question paper has a total of 5 pages, including the front page.
2. A single answer sheet is provided. Please write your index number in the given space.
3. Read each question carefully before answering.
4. Mark the correct response as a **heavy black mark filling the relevant circle completely**, using a black lead pencil (6B or above grade).
5. Mark no stray marks on the answer sheet. In case of an error, erase cleanly.
6. Your final answer should be a densely coloured circle through which the underlying letter is not visible.
7. Marking using any other method (e.g., mark the circle with a cross) is not valid.

Ten (10) True/False Type Questions (Questions 1-10/Page 2-3)

1. Mark whether each response is true or false.
2. Given below is an example of how to mark a true/false type question.

Q 11. A woman has
A. one ovary.
B. one nose.
C. two ears.
D. one eye.
E. two hairs.

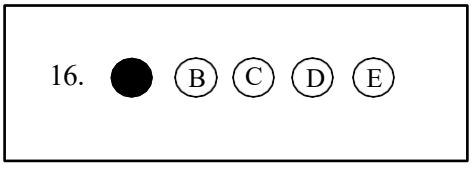


A correct response will get +1 mark
An incorrect response will get -1 mark
No response will get 0 (zero) mark
Negative marks will not be carried over to the next question

Ten (10) Single Best Response Type Questions (Questions 11-20/ Page 4-5)

1. Mark the best response. Only one response per question should be marked.
2. If you mark the correct response, you will get the full marks for the question.
3. If you mark an incorrect response, fail to mark any response, select more than one response, or mark your response unclearly, you will not receive any marks for that question.
4. Given below is an example of how to mark a single best response type question.

Q 16. Speaking is a unique ability observed in humans. Which of the following body parts is primarily used for speech production?
A. Tongue
B. Hands
C. Feet
D. Ears
E. Nose



Question numbers 01 to 10 are True or False type questions. Mark your answer for each of the 5 responses (A to E).

(1) Ture or False regarding zinc in human nutrition and metabolism?
- (A) Zinc is a component of DNA polymerase.
- (B) Zinc deficiency leads to growth retardation.
- (C) Zinc is primarily stored in the liver.
- (D) Zinc enhances iron absorption in the intestine.
- (E) Zinc is required for immune functions.

(2) True or False Transport of iodine across Na-/I- symporter in thyroid follicular cells is
- (A) Influenced by TSH
- (B) Inhibited by perchlorate ions
- (C) Influenced by Ca2+ levels
- (D) Depends on serum iodine levels
- (E) Energy dependent

(3) Cortisol secreted during stress leads to activation of
- (A) Lipolysis in adipocytes
- (B) Protein catabolism
- (C) Gluconeogenesis
- (D) Lipogenesis
- (E) Glycogen synthesis

(4) Derivatives of tyrosine amino acid
- (A) Thyroid hormone
- (B) Growth hormone
- (C) Epinephrine
- (D) Norepinephrine
- (E) Insulin

(5) Pre-pro-insulin
- (A) Is an inactive precursor of insulin
- (B) Contains c peptide
- (C) Is converted to proinsulin by removing signal sequence
- (D) Packed into secretory vesicles
- (E) Contains disulphide bonds

(6) BMI depends on
- (A) Age
- (B) Gender
- (C) Height
- (D) Weight
- (E) Fat mass

(7) Regarding lipoproteins
- (A) Chylomicrons are produced in enterocytes
- (B) Defects in Apo lipoprotein B100 results in increased LDL cholesterol level
- (C) LDL is synthesized in the liver
- (D) HDL contains more triglycerides than VLDL
- (E) VLDL transports dietary triglycerides

(8) In primary hyperthyroidism,
(A) Constipation occurs
(B) Increased blood TSH level
(C) Increased blood T4 level
(D) Increased Basal Metabolic Rate
(E) Increased appetite

(9) During fasting,
(A) Glycogen breakdown increase
(B) Cellular cAMP levels decrease
(C) Tyrosine Kinase is activated
(D) Increased secretion of glucocorticoids
(E) Gluconeogenesis is increased

(10) Somatostatin,
(A) Is an antagonist to GH.
(B) Secreted by the F cells of the pancreas.
(C) Inhibit secretion of insulin.
(D) Decrease GI motility.
(E) Is secreted in response to high fatty acid levels in plasma.

Questions number 11 **to** 20 **are Single Best Response (SBR) type. Select the best response to each question.**

(11) A 45-year-old man with poorly controlled diabetes mellitus presents with polyuria and polydipsia. Insulin deficiency leads to increased hepatic glucose production.
Which of the following metabolic processes is most increased in this patient?
(A) Glycogenesis
(B) Glycolysis
(C) Gluconeogenesis
(D) Lipogenesis
(E) Pentose phosphate pathway

(12) A patient with chronic kidney disease develops hypocalcaemia due to impaired vitamin D metabolism.
Which of the following organs is primarily responsible for converting 25-hydroxycholecalciferol to its active form?
(A) Liver
(B) Skin
(C) Kidney
(D) Intestine
(E) Bone

(13) A 60-year-old man presents with central obesity, hypertension, and insulin resistance. He is diagnosed with metabolic syndrome.
Which of the following adipokines is most associated with increased insulin sensitivity?
(A) Leptin
(B) Resistin
(C) Adiponectin
(D) Tumour necrosis factor-alpha
(E) Interleukin-6

(14) A child presents with bleeding gums and poor wound healing. The deficiency of which vitamin is most likely responsible for this condition?

(A) Vitamin A
(B) Vitamin B1
(C) Vitamin C
(D) Vitamin D
(E) Vitamin K

(15) A 35-year-old man presents with muscle weakness and fatigue. Laboratory tests reveal low potassium levels. Which of the following hormones is most likely responsible for this finding?

(A) Cortisol
(B) Aldosterone
(C) Insulin
(D) Glucagon
(E) Thyroxine

(16) A patient with hypercholesterolaemia is prescribed a statin.
What is the primary mechanism of action of statins?

(A) Inhibition of lipoprotein lipase
(B) Inhibition of HMG-CoA reductase.
(C) Activation of LDL receptors.
(D) Inhibition of bile acid reabsorption.
(E) Increased triglyceride synthesis

(17) A 50-year-old chronic alcoholic presents with confusion, ataxia, and ophthalmoplegia. Deficiency of which vitamin is most likely responsible for this condition?

(A) Vitamin B2
(B) Vitamin B6
(C) Vitamin B12
(D) Vitamin B1
(E) Folate

(18) A patient develops jaundice due to increased breakdown of red blood cells.Which of the following forms of bilirubin is elevated in haemolytic jaundice?

(A) Conjugated bilirubin
(B) Unconjugated bilirubin
(C) Delta bilirubin
(D) Direct bilirubin
(E) Urobilinogen

(19) A 40-year-old woman is advised to increase her dietary fibre intake. Which of the following is a major benefit of dietary fibre?

(A) Increases LDL cholesterol
(B) Decreases intestinal motility
(C) Improves insulin sensitivity.
(D) Increases glucose absorption.
(E) Promotes bile acid retention.

(20) A 22-year-old man undergoes intense exercise. During anaerobic conditions, which of the following is the primary end product of glycolysis in muscle?

(A) Pyruvate
(B) Lactate
(C) Acetyl-CoA
(D) Oxaloacetate
(E) Citrate

CAT- 3 (BATCH 2) MOCK MCQ ANSWERS - 2026

MOCK MCQ Answer Guide
Semester 2

(1) Answer: T, T, F, F, T
Explanation:
Zinc is an essential trace element required for the activity of numerous enzymes, including DNA polymerase. It plays a vital role in growth, cell division, wound healing, and immune function. Zinc deficiency can cause growth retardation and impaired immunity. Although zinc is present in many tissues, it is not primarily stored in the liver. Zinc does not significantly enhance intestinal iron absorption.

(2) Answer: T, T, F, T, T
Explanation:
Iodide uptake into thyroid follicular cells occurs through the sodium-iodide symporter (NIS), an active transport mechanism that requires energy indirectly through the Na^+ gradient. The process is stimulated by TSH and inhibited by perchlorate ions. It is influenced by the availability of iodine in the blood but not directly by calcium levels.

(3) Answer: T, T, T, F, T
Explanation:
Cortisol is a glucocorticoid released during stress. It increases blood glucose by stimulating gluconeogenesis and promoting protein breakdown. It also enhances lipolysis in adipose tissue. Cortisol supports glycogen storage in the liver while reducing glucose utilization by peripheral tissues. It does not stimulate lipogenesis during stress.

(4) Answer: T, F, T, T, F
Explanation:
Tyrosine serves as a precursor for thyroid hormones (T_3 and T_4) and catecholamines such as epinephrine and norepinephrine. Growth hormone and insulin are peptide hormones synthesized from amino acids through protein synthesis and are not derived from tyrosine.

(5) Answer: T, T, T, F, F
Explanation:
Pre-pro-insulin is the initial inactive precursor of insulin synthesized in pancreatic β-cells. It contains a signal peptide and C-peptide. Removal of the signal peptide converts it into proinsulin. Disulphide bonds form mainly during the proinsulin stage, and packaging into secretory granules occurs after conversion to proinsulin.

(1) Answer: F, F, T, T, F
Explanation:
Body Mass Index (BMI) is calculated using body weight and height. It does not directly depend on age, gender, or body fat mass, although these factors may influence the interpretation of BMI values.

(2) Answer: T, F, F, F, F
Explanation:
Chylomicrons are synthesized in intestinal enterocytes and transport dietary triglycerides. ApoB-100 is necessary for LDL formation and receptor binding; defects usually reduce LDL levels rather than increase them. LDL is formed from VLDL metabolism in the circulation, not directly synthesized by the liver. HDL contains relatively little triglyceride, while VLDL is triglyceride-rich.

(3) Answer: F, F, T, T, T
Explanation:
Primary hyperthyroidism causes excessive thyroid hormone production, leading to increased T_4 levels and suppression of TSH through negative feedback. Patients typically have an increased basal metabolic rate, increased appetite, weight loss, and increased bowel movements rather than constipation.

(4) Answer: T, F, F, T, T
Explanation:
Fasting is characterized by increased glucagon and glucocorticoid activity. Glycogen breakdown and gluconeogenesis increase to maintain blood glucose levels. Cellular cAMP levels rise due to glucagon action. Tyrosine kinase activation is associated with insulin signaling and therefore decreases during fasting.

(5) Answer: T, F, T, T, T
Explanation:
Somatostatin is a regulatory hormone that inhibits growth hormone secretion and suppresses the release of several gastrointestinal and pancreatic hormones, including insulin. It decreases gastrointestinal motility and secretion. In the pancreas, it is secreted by δ (D) cells rather than F cells and may be released in response to nutrient intake, including elevated fatty acids.

(6) Answer: C – Gluconeogenesis
Explanation: In insulin deficiency (poorly controlled diabetes mellitus), the liver increases glucose production through gluconeogenesis and glycogen breakdown. This contributes to hyperglycaemia, polyuria, and polydipsia. Insulin normally suppresses gluconeogenesis.

(7) Answer: C – Kidney
Explanation: The kidney converts 25-hydroxycholecalciferol (calcidiol) into the active form, 1,25-dihydroxycholecalciferol (calcitriol), via the enzyme 1α-hydroxylase. In chronic kidney disease, this conversion is impaired, leading to hypocalcaemia.

(8) Answer: C – Adiponectin
Explanation: Adiponectin is an adipokine that increases insulin sensitivity, enhances fatty acid oxidation, and has anti-inflammatory effects. Its levels are usually decreased in obesity and metabolic syndrome.

(9) Answer: C – Vitamin C
Explanation: Vitamin C deficiency causes scurvy, characterized by bleeding gums, poor wound healing, petechiae, and impaired collagen synthesis. Vitamin C is required for hydroxylation of proline and lysine during collagen formation.

(10) Answer: B – Aldosterone
Explanation: Aldosterone promotes sodium reabsorption and potassium excretion in the distal nephron. Excess aldosterone can lead to hypokalaemia, causing muscle weakness and fatigue.

(11) Answer: B – Inhibition of HMG-CoA reductase
Explanation: Statins lower cholesterol by competitively inhibiting HMG-CoA reductase, the rate-limiting enzyme in cholesterol synthesis. This reduces hepatic cholesterol production and increases LDL receptor expression.

(12) Answer: D – Vitamin B1 (Thiamine)
Explanation: The triad of confusion, ataxia, and ophthalmoplegia is characteristic of Wernicke encephalopathy, caused by thiamine deficiency, commonly seen in chronic alcoholics.

(13) Answer: B – Unconjugated bilirubin
Explanation: In haemolytic jaundice, excessive red blood cell destruction produces large amounts of bilirubin. The liver cannot conjugate all of it, resulting in elevated unconjugated (indirect) bilirubin.

(14) Answer: C – Improves insulin sensitivity
Explanation: Dietary fibre slows glucose absorption, improves glycaemic control, enhances insulin sensitivity, promotes satiety, and can reduce serum cholesterol levels.

(15) Answer: B – Lactate
Explanation: During anaerobic exercise, pyruvate produced by glycolysis is reduced to lactate by lactate dehydrogenase. This regenerates NAD^+, allowing glycolysis to continue producing ATP in the absence of sufficient oxygen.

CAT- 3 (BATCH 2) MOCK SEQ - 2026

UVA WELLASSA UNIVERSITY
FACULTY OF MEDICINE
Continuous Assessment Test
Semester III
MOCK Paper
2023/2024 (02nd) Batch

BIOCHEMISTRY

STRUCTURED ESSAY PAPER

Duration -: 01 hour

Instructions to candidates:

- This paper consists of two (02) Structure Essay Questions
- Answer all questions
- Write the answers on answer sheets provided
- Write your index number in the space provided on each answer sheet
- Start each question on a new page

(Q1)

(1.1) A 30-year-old male underwent a routine medical checkup and the following findings were revealed.

- Anthropometry
  - BMI: 29 kg/m²
  - Waist to hip ratio: 0.99
- Blood
  - Fasting blood glucose: 99 mg/dL (65–100 mg/dL)
  - HbA1C: 6.3% (<5.7%)
- Urine
  - Glucose: negative
  - Protein: negative
  - Ketone bodies: negative

(1.1.1) Comment on the following findings of this person.

A. BMI (10 Marks)
B. Waist to hip ratio (10 Marks)
C. Fasting blood glucose (10 Marks)

(1.2.1) Giving reasons, state one biochemical test to arrive at a conclusive decision regarding his fasting blood glucose level. (20 Marks)

(1.3.1) State 02 lifestyle modifications that will improve the health status of this person. (10 Marks)

(1.3) A 45-year-old man presents with epigastric pain radiating to the back, steatorrhea, and weight loss. He has a long history of alcohol use. A diagnosis of chronic pancreatic insufficiency is suspected.

(1.1.1) List 04 major pancreatic enzymes. (10 marks)

(1.2.1) Briefly explain the biochemical basis of steatorrhea in pancreatic insufficiency. (30 marks)

(Q2)

(1.1) A 37-year-old lady presented to the medical clinic with a history of increased appetite and significant weight loss over the past three weeks. On examination she had a goiter. Her investigation reports are given below:

- TSH: 0.2 mU/L (Normal range: 0.5 – 4.5 mU/L)
- Serum free T4: 27.1 pg/mL (Normal range: 7 – 18 pg/mL)

(1.1.1) State the basis for having low TSH levels in this patient. (20 marks)

(1.2.1) Explain the biochemical basis of prescribing an antithyroid drug which inhibits the action of thyroperoxidase for this patient. (40 marks)

(1.2) Based on the physico-chemical properties of hormones, explain the biochemical basis of the following.

(1.1.1) Oral administration of thyroid hormone is effective, but oral administration of insulin is not effective. (20 marks)

(1.2.1) Total thyroid hormone level in blood is affected by binding protein levels in blood, whereas insulin levels are unaffected by plasma protein levels. (20 marks)

CAT-3 (BATCH 2) MOCK SEQ ANSWERS - 2026

MOCK SEQ Answer Guide
Semester 3

Q1

1.1.1 Comment on the following findings

A. BMI (29 kg/m²) (10 Marks)

- BMI = 29 kg/m². (2.5)
- According to the WHO classification, a BMI of 25–29.9 kg/m² indicates overweight (pre-obese). (2.5)
- According to Asian cut-offs, BMI ≥27.5 kg/m² is classified as obesity. (2.5)
- Therefore, this person is overweight/obese and has an increased risk of developing type 2 diabetes mellitus, hypertension, cardiovascular disease, and metabolic syndrome. (2.5)

B. Waist to Hip Ratio (0.99) (10 Marks)

- Normal waist-to-hip ratio for males is <0.90. (2.5)
- A value of 0.99 indicates central (abdominal) obesity. (2.5)
- Central obesity is associated with increased visceral fat deposition. (2.5)
- Visceral fat contributes to insulin resistance and increases the risk of type 2 diabetes, dyslipidaemia, cardiovascular disease, and metabolic syndrome. (2.5)

C. Fasting Blood Glucose (99 mg/dL) (10 Marks)

- Normal fasting blood glucose range: 65–100 mg/dL. (2.5)
- The patient's fasting blood glucose is 99 mg/dL, which falls within the normal range. (2.5)
- However, it is close to the upper limit of normal. (2.5)
- In the presence of obesity and elevated HbA1c (6.3%), there is a possibility of impaired glucose regulation or prediabetes. (2.5)

1.1.2 One biochemical test to arrive at a conclusive decision regarding fasting blood glucose level (20 Marks)

Test: Oral Glucose Tolerance Test (OGTT)

Reason:

- Although fasting blood glucose is normal (99 mg/dL), HbA1c is elevated (6.3%), suggesting impaired glucose metabolism.(5)
- OGTT evaluates the body's ability to handle a glucose load and can detect impaired glucose tolerance or diabetes that may not be identified by fasting glucose alone. (3)
- The patient is given 75 g of glucose orally and plasma glucose is measured after 2 hours. (3)

Interpretation:

- <140 mg/dL = Normal (3)
- 140–199 mg/dL = Impaired glucose tolerance (Prediabetes) (3)
- ≥200 mg/dL = Diabetes mellitus (3)

Therefore, OGTT is useful to confirm the glycaemic status of this patient.

1.1.3 Two lifestyle modifications (10 Marks)

1. Weight reduction through dietary modification (5)

- Reduce calorie intake. (5)
- Limit refined carbohydrates, sugary foods, and saturated fats. (5)
- Increase intake of vegetables, fruits, whole grains, and dietary fibre. (5)

2. Regular physical activity (5)

- Engage in at least 150 minutes of moderate-intensity exercise per week. (5)
- Examples: brisk walking, cycling, swimming, or jogging. (5)
- Exercise improves insulin sensitivity and helps reduce body weight. (5)

1.3.1 Four major pancreatic enzymes (10 Marks)

1. Pancreatic amylase (2.5)
2. Pancreatic lipase (2.5)
3. Trypsin (2.5)
4. Chymotrypsin (2.5)

(Other acceptable answers: elastase, carboxypeptidase, phospholipase A_2) (2.5)

1.3.2 Biochemical basis of steatorrhea in pancreatic insufficiency (30 Marks)

- Pancreatic lipase is the principal enzyme responsible for digestion of dietary triglycerides. (5)
- In chronic pancreatic insufficiency, pancreatic enzyme secretion is markedly reduced.(4)
- Deficiency of pancreatic lipase results in impaired hydrolysis of triglycerides into fatty acids and monoglycerides. (4)
- Without adequate digestion, fat cannot be efficiently incorporated into micelles and absorbed by intestinal mucosal cells. (4)
- Consequently, large amounts of undigested fat remain in the intestinal lumen. (4)
- These fats are excreted in the feces, producing bulky, greasy, foul-smelling stools known as steatorrhea. (4)
- Malabsorption of fat also leads to deficiencies of fat-soluble vitamins (A, D, E, and K) and contributes to weight loss. (4)

Q2

2.1.1 Basis for low TSH levels (20 Marks)

- The patient has elevated free T4 and suppressed TSH, indicating hyperthyroidism. (4)
- Increased thyroid hormone levels exert negative feedback on the hypothalamus and anterior pituitary gland. (4)
- High circulating T4 suppresses hypothalamic TRH secretion and pituitary TSH secretion. (4)
- Therefore, serum TSH levels fall below the normal range. (4)
- This explains the low TSH concentration of 0.2 mU/L. (4)

2.1.2 Biochemical basis of prescribing an antithyroid drug that inhibits thyroperoxidase (40 Marks)

- Thyroperoxidase (TPO) is an essential enzyme in thyroid hormone synthesis. (5)
- It catalyses three important reactions: (3)
    1. Oxidation of iodide (I^-) to iodine (I_2). (3)
    2. Iodination (organification) of tyrosine residues on thyroglobulin to form MIT and DIT. (3)
    3. Coupling of iodotyrosine residues to produce T3 and T4. (3)
- Antithyroid drugs such as methimazole and propylthiouracil inhibit thyroperoxidase. (5)
- As a result:
    - Iodide oxidation is reduced. (3)
    - Organification of iodine is blocked. (3)
    - Coupling reactions are inhibited. (3)
    - Synthesis of T3 and T4 decreases. (3)
- Reduced thyroid hormone production lowers circulating thyroid hormone levels and alleviates symptoms of hyperthyroidism. (3)
- Propylthiouracil additionally inhibits peripheral conversion of T4 to T3. (3)

2.2.1 Why oral thyroid hormone is effective but oral insulin is not effective (20 Marks)

Thyroid hormone

- Thyroid hormones (T3 and T4) are lipid-soluble molecules derived from amino acids. (2.5)
- They are stable in the gastrointestinal tract. (2.5)
- They can be absorbed effectively through the intestinal mucosa. (2.5)
- Therefore, oral administration is effective. (2.5)

Insulin

- Insulin is a protein (peptide) hormone. (2.5)

- It is digested by gastric acid and proteolytic enzymes in the gastrointestinal tract. (2.5)
- As a large peptide molecule, it cannot be absorbed intact through the intestinal epithelium. (2.5)
- Therefore, oral insulin is ineffective and must be administered by injection. (2.5)

2.2.2 Why total thyroid hormone level is affected by plasma proteins but insulin level is not (20 Marks)

Thyroid hormones

- Thyroid hormones are lipid-soluble and circulate largely bound to plasma proteins: (2)
  - Thyroxine-binding globulin (TBG) (2)
  - Transthyretin (2)
  - Albumin (2)
- More than 99% of thyroid hormones are protein-bound. (2)
- Therefore, changes in plasma protein concentrations alter total thyroid hormone levels.

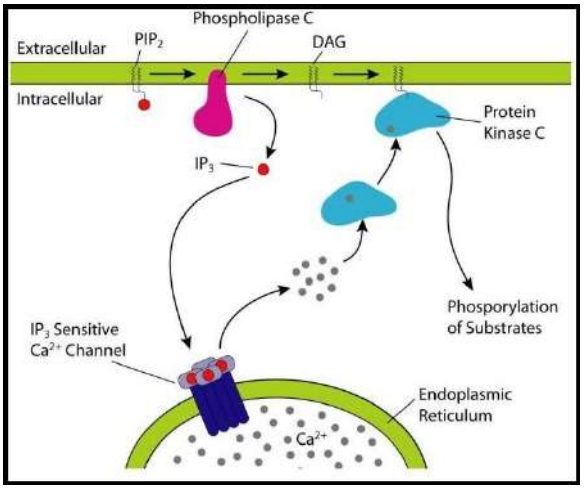
Insulin (2)

- Insulin is a water-soluble peptide hormone. (2)
- It circulates predominantly in the free form. (2)
- It does not require carrier proteins for transport. (2)
- Therefore, changes in plasma protein levels have little or no effect on circulating insulin levels. (2)

CAT- 3 (BATCH 1) MOCK OSPE - 2026

(Q1)

Second Messenger Pathway



The diagram shows a second messenger pathway involved in producing cellular responses.

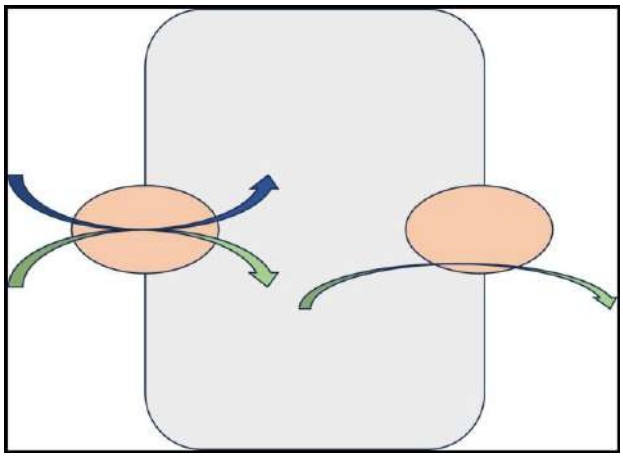
(1.1) Name the second messenger X. (05 Marks)

(1.2) Name a hormone that makes cellular responses through this pathway. (05 Marks)

(Total: 10 Marks)

(Q2)

Iodine Transport in Thyroid Follicular Cell



This diagram illustrates the transport mechanism of iodine across a follicular cell of the thyroid gland.

(2.1) Identify A. (04 Marks)

(2.2) List two plasma proteins that bind thyroid hormones. (03 Marks)

(2.3) Name the precursor for thyroid hormone synthesis. (03 Marks)

(Total: 10 Marks)

(Q3)

Familial Hypercholesterolemia





These pictures show a patient with familial hypercholesterolemia.

(3.1) Identify the abnormality shown here. (03 Marks)

(3.2) Which lipoprotein is mainly elevated in the serum in this condition? (03 Marks)

(3.3) List three ways of improving the condition of this patient. (04 Marks)

(Total: 10 Marks)

(Q4)

Blood Glucose Values

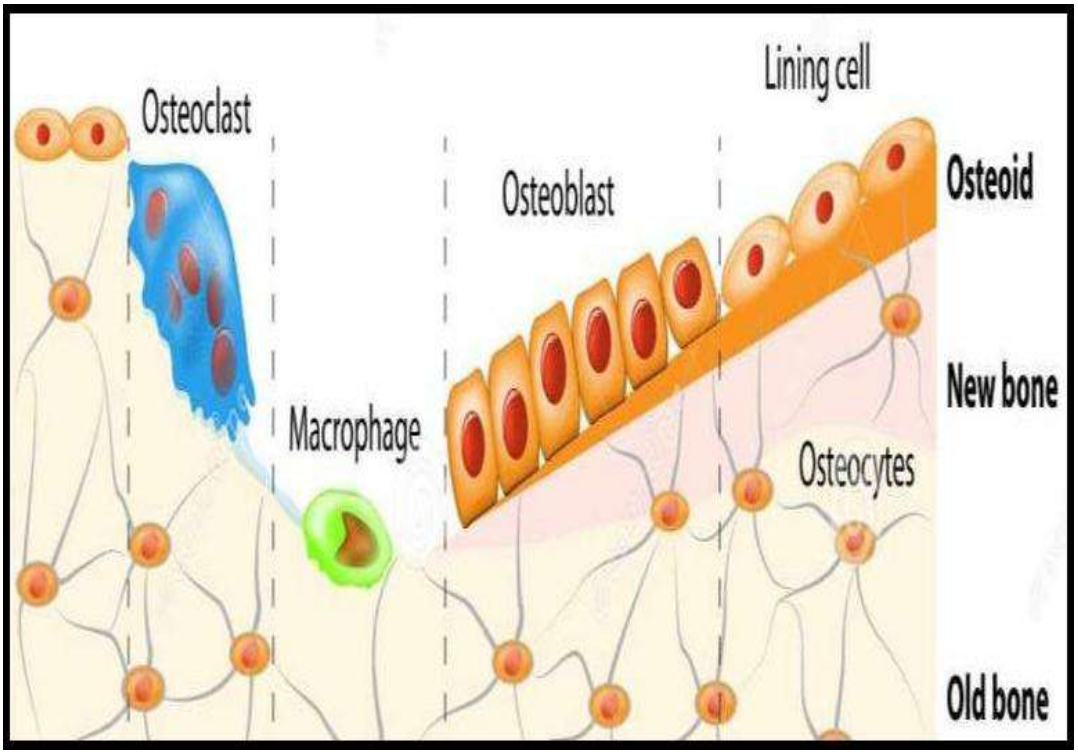
FBS - 97 mg/dL
PPBS in 1 hour - 188 mg/dL
PPBS in 2 hours - 162 mg/dL

(4.1) Comment on the above values of the patient. (05 Marks)
(4.2) State the importance of knowing the above values. (05 Marks)

(Total: 10 Marks)

(Q5)

Bone Remodelling Process



The picture shows a biological process occurring in bone tissue.

(5.1) Name the process interpreted here. (05 Marks)
(5.2) Name the two types of cells shown as A and B. (05 Marks)

(Total: 10 Marks)

(Q6)

Vitamin Deficiency



A 6-year-old child presents with fatigue, bleeding gums and joint pain. On examination, there are petechiae, swollen bleeding gums and poor wound healing. The child has a history of a highly restricted diet lacking fresh fruits and vegetables. A vitamin deficiency is suspected.

(6.1) What is the most likely diagnosis? (04 Marks)
(6.2) State the biochemical role of the deficient vitamin mentioned above. (06 Marks)

(Total: 10 Marks)

(Q7)

Copper Metabolism

A patient has kinky hair, growth retardation and neurological symptoms. A copper deficiency is suspected.

(7.1) Name one copper-containing enzyme. (05 Marks)
(7.2) Name the disease caused by copper accumulation. (05 Marks)

(Total: 10 Marks)

(Q8)

Cardiac Biomarkers

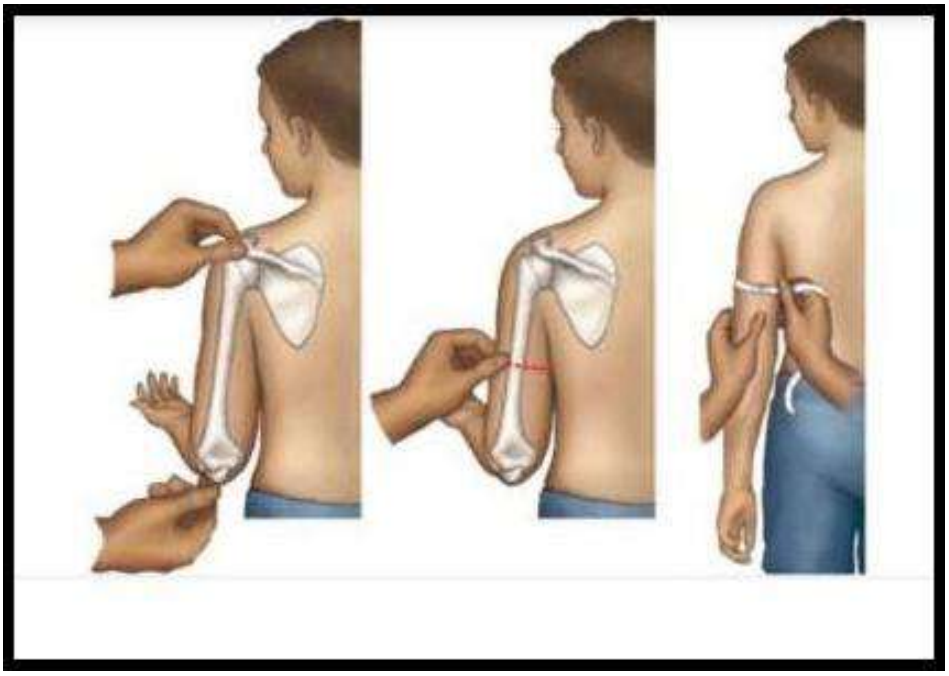
A 55-year-old man presents with chest pain for 4 hours.

(8.1) Which cardiac biomarker is most specific for myocardial infarction? (04 Marks)
(8.2) Which biomarker rises earliest after myocardial infarction? (03 Marks)
(8.3) Name one enzyme previously used in diagnosis of myocardial infarction. (03 Marks)

(Total: 10 Marks)

(Q9)

Anthropometry Measurement



This picture shows one anthropometry measurement taken from the body. The above measurement value is shown as 11 cm.

(9.1) Name the anthropometry shown in the picture. (03 Marks)

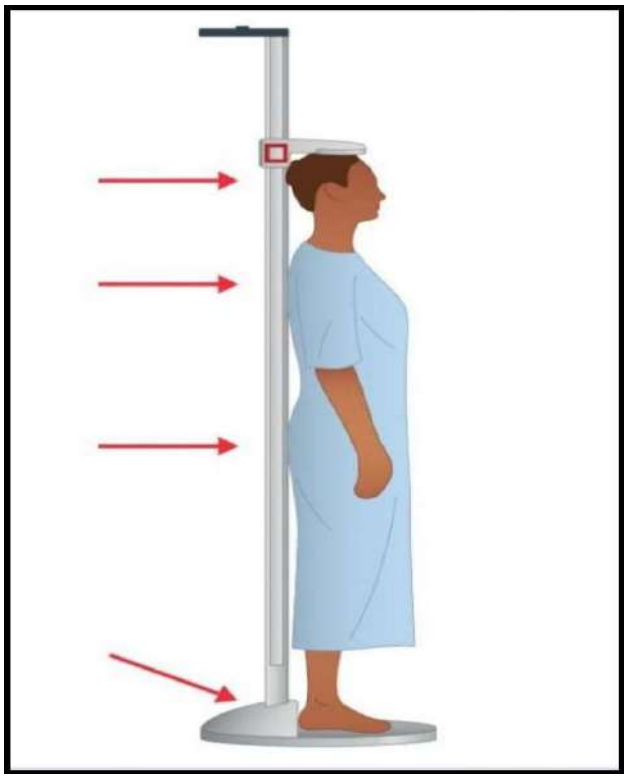
(9.2) What are the advantages of this measurement compared with calculated BMI value in the body? (03 Marks)

(9.3) Conclude your opinion about the person's body status. (04 Marks)

(Total: 10 Marks)

(Q10)

Standing Height Measurement



The picture shows an instrument used to take an anthropometry measurement.

(10.1) What is the instrument shown in the picture? (03 Marks)

(10.2) What is the anthropometry measurement taken from that instrument? (03 Marks)

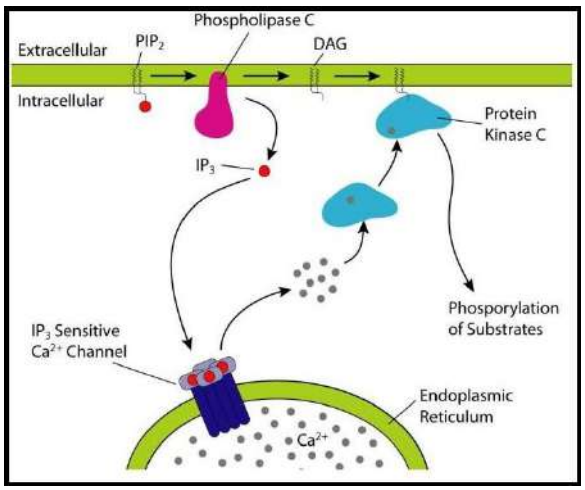
(10.3) What are the body places A, B, C, D and E which should touch the instrument while taking the measurement? (04 Marks)

(Total: 10 Marks)

CAT- 2 (BATCH 1) MOCK OSPE ANSWERS - 2026

MOCK OSPE ANSWER GUIDE

Semester 3



(Q1)
(1.1) Cyclic AMP (cAMP)
(1.2) Glucagon (also acceptable: ACTH, TSH, FSH, LH, PTH)

(Q2)
(2.1) Sodium–Iodide Symporter (NIS)
(2.2) Two plasma proteins that bind thyroid hormones:

- Thyroxine-binding globulin (TBG)
- Transthyretin (Thyroxine-binding prealbumin)

(2.3) Thyroglobulin





(Q3)
(3.1) Tendon xanthoma
(3.2) Low-density lipoprotein (LDL)
(3.3) Three ways to improve the condition:

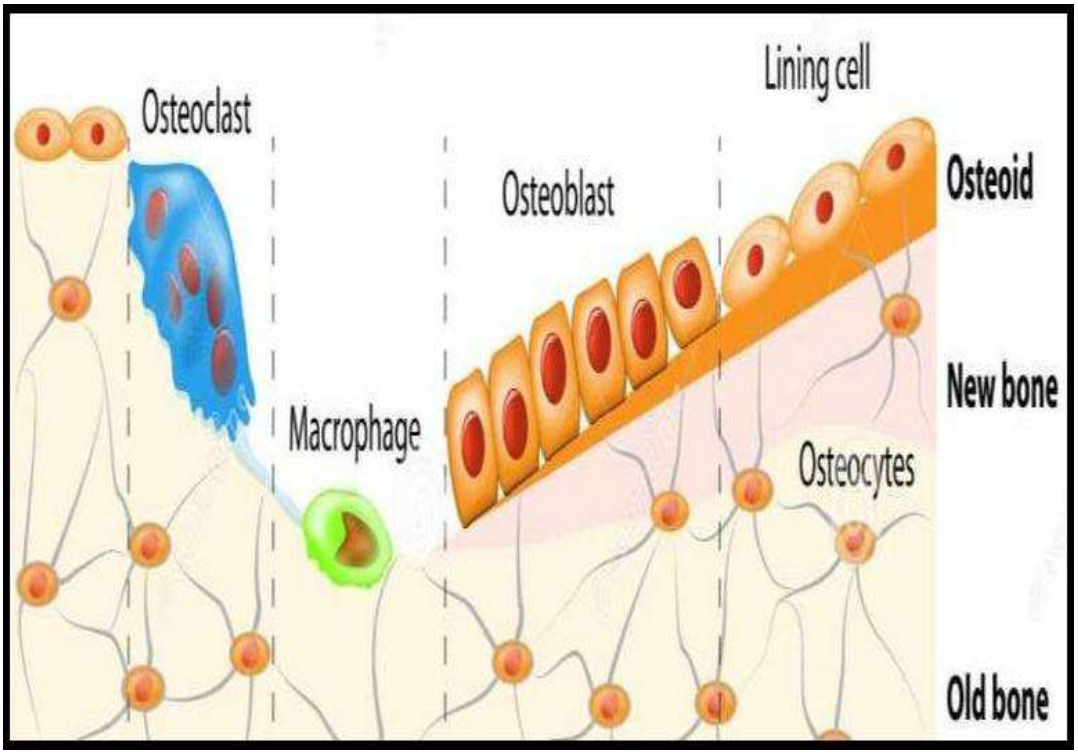
- Low-cholesterol and low-saturated-fat diet
- Regular physical exercise

- Statin therapy

FBS - 97 mg/dL
PPBS in 1 hour - 188 mg/dL
PPBS in 2 hours - 162 mg/dL

(Q4)
(4.1) Impaired glucose tolerance (Prediabetes)
(4.2) Importance:

- Early detection of diabetes mellitus
- Assessment of glucose metabolism
- Identification of individuals at risk of developing diabetes
- Monitoring effectiveness of treatment/lifestyle modification
- Prevention of diabetic complications



(Q5)
(5.1) Bone remodelling
(5.2)
A – Osteoclast
B – Osteoblast

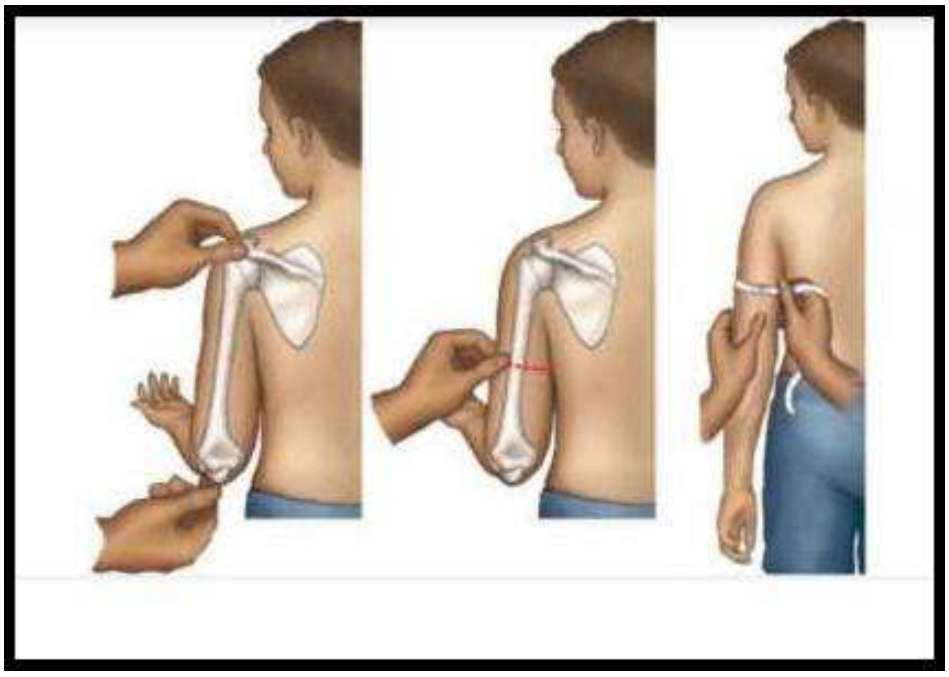


(Q6)
(6.1) Scurvy (Vitamin C deficiency)
(6.2) Biochemical roles of Vitamin C:

- Hydroxylation of proline and lysine during collagen synthesis
- Antioxidant function
- Enhances iron absorption
- Promotes wound healing
- Maintains connective tissue integrity
- Supports immune function

(Q7)
(7.1) Cytochrome c oxidase (also acceptable: Superoxide dismutase, Tyrosinase, Lysyl oxidase)
(7.2) Wilson disease

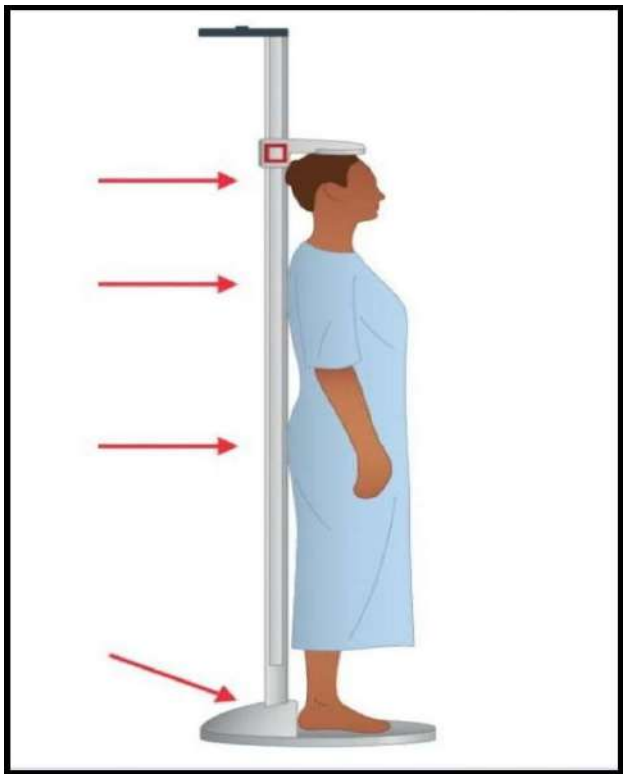
(Q8)
(8.1) Cardiac Troponin I (cTnI) (or Troponin T)
(8.2) Myoglobin
(8.3) Creatine kinase-MB (CK-MB)



(Q9)
(9.1) Waist circumference
(9.2) Advantages compared with BMI:

- Better indicator of central (abdominal) obesity
- Better predictor of cardiovascular and metabolic risk
- Simple and inexpensive measurement

(9.3) The person has abdominal/central obesity (assuming the measurement shown is 110 cm)



(Q10)
(10.1) Stadiometer
(10.2) Standing height
(10.3) Body parts A–E that should touch the instrument:

- Heels
- Calves
- Buttocks
- Shoulders (upper back/scapular region)
- Back of the head (occiput)

BIOCHEMISTRY CONTINUOUS ASSESSMENT-3

2022/2023 (FIRST BATCH)

CAT- 3 (BATCH 1) MCQ PAPER - 2025

UVA WELLASSA UNIVERSITY FACULTY OF MEDICINE
Continuous Assessment 03
August 2025 2022/2023
(01st) Batch
Biochemistry
Multiple Choice Questions (MCQ) Paper

Time 10.00 am - 11.00 am (01 hour) Date of the exam: 2025.08.11

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

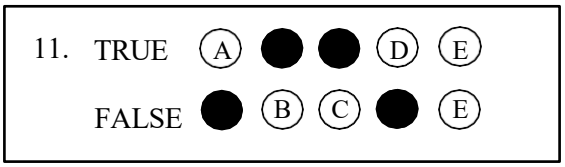
Please read the following instructions before marking responses on your answer sheets

1. Check that your question paper has total of **6 pages,** including the front page.
2. **A single answer sheet is provided**. Please write your index number in the given space.
3. Read each question carefully before answering.
4. Mark the correct response as a **heavy black mark filling the relevant circle completely**, using a black lead pencil (6B or above grade).
5. Mark no stray marks on the answer sheet. In case of an error, erase cleanly.
6. Your final answer should be a densely coloured circle through which the underlying letter is not visible.
7. Marking using any other method (e.g., mark the circle with a cross) is not valid.

Ten (10) True/False Type Questions (Questions 1-10/Page 2-3)

1. Mark whether each response is true or false.
2. Given below is an example of how to mark a true/false type question.

11. A woman has
    A. one ovary.
    B. one nose.
    C. two ears.
    D. one eye.
    E. two hairs.

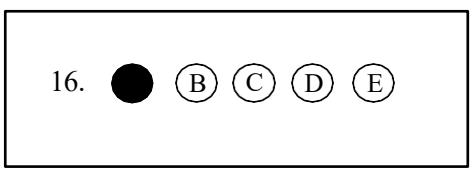


A correct response will get = +1 mark
An incorrect response will get = -1 mark
No response will get = 0 (zero) mark
Negative marks will not be carried over to the next question

Ten (10) Single Best Response Type Questions (Questions 11-20/ Page 4-6)

1. Mark the best response. Only one response per question should be marked.
2. If you mark the correct response, you will get the full marks for the question.
3. If you mark an incorrect response, fail to mark any response, select more than one response, or mark your response unclearly, you will not receive any marks for that question.
4. Given below is an example of how to mark a single best response type question.

16. Speaking is a unique ability observed in humans. Which of the following body parts is primarily used for speech production?
    A. Tongue
    B. Hands
    C. Feet
    D. Ears
    E. Nose



Questions numbers 01 to 10 are True or False type questions. Mark your answer for each of the 5 responses (A to E).

(1) True or False regarding iron absorption?
(A) Dietary heme iron is absorbed more efficiently than non-heme iron.
(B) Ferric iron (Fe^{3+}) is absorbed more readily than ferrous iron (Fe^{2+}).
(C) Iron is absorbed in the duodenum.
(D) Non-heme iron absorption is enhanced by Vitamin C.
(E) The process is independent of the iron stores of the body.

(2) True or False regarding hormones?
(A) Epinephrine is an amino acid-derived hormone.
(B) Peptide hormones are synthesized as preprohormones.
(C) Peptide hormones have long half-lives.
(D) Steroid hormones are stored in secretory granules.
(E) Steroid hormones bind to intracellular receptors.

(3) True or False regarding vitamin K?
(A) It is abundant in meat than in green leafy vegetables.
(B) It is an analogue of dicumarol.
(C) It is synthesized by intestinal microbial flora.
(D) It is the prosthetic group for the prothrombin synthesis.
(E) Its deficiency causes lengthening of clotting time.

(4) True or False regarding beriberi?
(A) Chronic alcoholism is a contributory factor.
(B) It causes increased excretion of branched chain amino acids.
(C) It is a thiamine deficiency disease.
(D) It has malabsorption syndrome features.
(E) It has neurological symptoms.

(5) True or False regarding atherosclerosis?
(A) Chronic vascular inflammation is evident.
(B) High HDL promotes atherosclerosis.
(C) It does not occur in children.
(D) Oxidized LDL particles trigger endothelial dysfunction.
(E) Poor glycaemic control is a risk factor.

(6) Which of the following is/are cellular causes of cancer?
(A) Chemical carcinogens
(B) Immune dysfunctions
(C) Inherited genetic mutations
(D) Ionizing radiation
(E) Oestrogen

(7) True or False regarding the nutritional sources?
(A) Cereal-based foods are poor sources of energy compared to tubers.
(B) Fish provide essential amino acids.
(C) Fruits are rich sources of vitamin K.
(D) Lean meat is a rich source of antioxidants.
(E) Milk products are rich in riboflavin.

(8) True or False regarding methods of nutritional assessment?
(A) Albumin is a sensitive early marker of protein-energy malnutrition.
(B) Height for age is an indicator of acute malnutrition in children.
(C) Hyperkeratosis reflects vitamin A deficiency.
(D) Triceps skin fold thickness is an indicator of muscle wasting.
(E) Waist circumference is an indicator of central obesity.

(9) True or False regarding hormone action?
(A) Antidiuretic hormone (ADH) acts via a second messenger system.
(B) Cortisol binds to intracellular receptors.
(C) Insulin activates tyrosine kinase signalling cascade.
(D) Testosterone exerts its effects by binding to membrane-bound receptors.
(E) Thyroid hormones act by regulating gene expression.

(10) True or False regarding the calculation of Basal Metabolic Rate (BMR)?
(A) BMR increases with age.
(B) BMR of a male is higher compared to a female of similar weight.
(C) Calculation of BMR in females requires an adjustment for the body fat level.
(D) BMR of athletes is calculated by modified equations.
(E) BMR of elderly individuals is not affected by weight.

Questions numbers 11 to 20 are Single Best Response (SBR) type. Select the best response to each question.

(11) Insulin acts through specific receptors and intracellular signalling pathways in the regulation of blood glucose.
Which of the following best describes the mechanism of action of insulin?
(A) It activates cyclic AMP (cAMP) through G-protein coupled receptors.
(B) It acts via phospholipase C.
(C) It binds to a membrane receptor with intrinsic tyrosine kinase activity.
(D) It binds to nuclear receptors.
(E) It modulates transcription via zinc-finger binding domains.

(12) A patient who was on long-standing anti-convulsant therapy developed osteoporosis.
Which of the following processes related to vitamin D metabolism is mainly altered in this patient?
(A) Conversion of 25-hydroxy cholecalciferol to 1, 25-dihydroxy cholecalciferol.
(B) Conversion of 7-dehydrocholesterol to cholecalciferol.
(C) Conversion of cholecalciferol to 25-hydroxy cholecalciferol.
(D) Conversion of 25-hydroxy cholecalciferol to 24,25-dihydroxy cholecalciferol.
(E) Transport system of 25-hydroxy cholecalciferol in the blood.

(13) A 70-year-old female visits a dietitian for dietary counselling. She has experienced decreased appetite over the past few months. The dietitian explains that the loss of appetite is probably due to aging which is associated with a natural reduction in energy requirements due to multiple physiological changes.
Which of the following best explains the decreased energy requirement in the above patient?
(A) Decreased bone mineral density
(B) Increased fat mass
(C) Reduced secretion of digestive enzymes
(D) Reduction of total body water
(E) Sarcopenia

(14) A 2-year-old child presents with complaints of delayed walking, bowing of the legs, and irritability. On examination, there is frontal bossing, widening of the wrists, and a rachitic rosary. X-rays of the wrists show cupping and fraying of the metaphysis.
Which of the following micronutrient deficiencies is the most likely cause for the condition?
(A) Calcium
(B) Vitamin A
(C) Vitamin B12
(D) Vitamin C
(E) Vitamin D

(15) A 32-year-old woman is treated for a recurrent urinary tract infection with a prolonged course of an oral antibiotic, trimethoprim. After a few weeks, she complains of fatigue, pallor, and glossitis. Her lab results show megaloblastic anaemia. The antibiotic prescribed is known to be the cause.
Which of the following best describes the mechanism of action of this antibiotic?
(A) Disruption of gut flora.
(B) Development of vitamin B12 deficiency.
(C) Inhibition of dihydrofolate reductase.
(D) Inhibition of DNA gyrase activity.
(E) Inhibition of protein synthesis via 50S ribosomal subunit binding.

(16) A 30-year-old moderately active woman with a family history of cardiovascular disease is on nutritional counselling for healthy weight maintenance. Her estimated total daily energy requirement is 2,000 kcal/day. A balanced diet was recommended following current dietary guidelines.
Which of the following statements is most appropriate regarding her lipid intake?
(A) Saturated fats should be less than 10% of her total energy intake.
(B) Fish oil supplements are recommended.
(C) Lipid intake should be eliminated from the diet.
(D) Nuts and seeds should be avoided.
(E) Vegetable oils are not recommended.

(17) A 68-year-old man presents with urinary hesitancy, weak stream, and increased frequency. He also reports dull lower back pain over the past few weeks. On digital rectal examination, the prostate is enlarged, firm, and nodular. A pelvic ultrasound reveals a heterogeneous prostate with areas of calcification.
Which of the following tumour markers would be most appropriate to support the diagnosis of this patient?
(A) Alpha-fetoprotein (AFP)
(B) Carcinoembryonic antigen (CEA)
(C) CA-125
(D) CA 19-9
(E) Prostate-specific antigen (PSA)

(18) A 32-year-old woman presents with complaints of fatigue, dizziness, and shortness of breath on exertion. She follows a vegetarian diet and reports heavy menstrual periods. On examination, she appears pale. Her haemoglobin is 9.2 g/dL, and the mean corpuscular volume (MCV) is low. Iron deficiency anaemia is suspected.
Which of the following investigations is most appropriate to determine her iron stores?
(A) Ferritin
(B) Hemosiderin
(C) Serum iron
(D) Total Iron-Binding Capacity (TIBC)
(E) Transferrin saturation

(19) A 28-year-old male competitive weightlifter consults a nutritionist for a dietary evaluation. Despite following a structured training and nutrition plan, his BMI is calculated at 31 kg/m². Which of the following best explains his elevated BMI?

(A) Increased bone mineral density
(B) Increased skeletal muscle mass
(C) Increased subcutaneous fat stores
(D) Increased total body fat percentage
(E) Increased visceral adiposity

(20) A 25-year-old man presents to the emergency department with a 2-day history of profuse watery diarrhoea, vomiting, and muscle cramps. He had a history of drinking unsafe water. His stool is colourless and resembles "rice water." He is suspected to have cholera infection.
Which of the following best explains the molecular mechanism responsible for the development of diarrhoea in this patient?

(A) Activation of guanylate cyclase, increasing intracellular cGMP.
(B) ADP-ribosylation of the Gs alpha subunit, increasing adenylate cyclase activity.
(C) Inactivation of the 60S ribosomal subunit, inhibiting protein synthesis.
(D) Inhibition of phosphodiesterase leading to increased cAMP.
(E) Inhibition of sodium-glucose cotransport in intestinal epithelial cells.

CAT- 3 (BATCH 1) MCQ ANSWERS - 2025

(1) Answer: F T T T F
Explanation:
- Heme iron is absorbed more efficiently than non-heme iron.
- Ferrous iron (Fe^{2+}) is absorbed better than ferric iron (Fe^{3+}).
- Iron absorption mainly occurs in the duodenum and upper jejunum.
- Vitamin C enhances non-heme iron absorption by reducing Fe^{3+} to Fe^{2+}.
- Iron absorption is regulated according to body iron stores; low stores increase absorption.

(2) Answer: T T F F T
Explanation:
- Epinephrine is derived from tyrosine (an amino acid).
- Peptide hormones are synthesized as preprohormones.
- Peptide hormones generally have short half-lives.
- Steroid hormones are synthesized on demand and are not stored in granules.
- Steroid hormones bind intracellular (cytoplasmic or nuclear) receptors.

(3) Answer: F F T F T
Explanation:
- Green leafy vegetables are the richest source of vitamin K.
- Dicumarol is a vitamin K antagonist, not an analogue of vitamin K.
- Intestinal bacteria synthesize vitamin K.
- Vitamin K acts as a cofactor for γ-carboxylation of clotting factors; it is not a prosthetic group.
- Deficiency prolongs clotting time due to impaired clotting factor synthesis.

(4) Answer: T F T F T
Explanation:
- Chronic alcoholism commonly causes thiamine deficiency.
- Beriberi is due to vitamin B1 (thiamine) deficiency.
- It does not characteristically cause increased excretion of branched-chain amino acids.
- Malabsorption syndrome is not a typical feature.
- Neurological manifestations occur in dry beriberi.

(5) Answer: T F F T T
Explanation:
- Atherosclerosis is a chronic inflammatory disease of blood vessels.
- HDL is protective and reduces risk.
- Early lesions (fatty streaks) may occur in childhood.
- Oxidized LDL causes endothelial injury and dysfunction.
- Diabetes and poor glycaemic control increase risk.

(6) Answer: F T T F T

Explanation:

- Immune dysfunction, inherited mutations, and prolonged estrogen exposure contribute to carcinogenesis.
- Chemical carcinogens and ionizing radiation are environmental causes rather than cellular causes.

(7) Answer: F T F F T

Explanation:

- Cereals are major energy sources.
- Fish provide high-quality proteins containing essential amino acids.
- Fruits are not rich sources of vitamin K; green leafy vegetables are.
- Lean meat is rich in protein, iron, and B vitamins but not antioxidants.
- Milk products are rich in riboflavin (vitamin B2).

(8) Answer: F F T F T

Explanation:

- Albumin is not a sensitive early marker because of its long half-life.
- Height-for-age indicates chronic malnutrition (stunting), not acute malnutrition.
- Hyperkeratosis is a clinical sign of vitamin A deficiency.
- Triceps skinfold thickness reflects fat stores, not muscle wasting.
- Waist circumference assesses central obesity.

(9) Answer: T T T F T

Explanation:

- ADH acts through second messenger systems (mainly cAMP).
- Cortisol binds intracellular receptors.
- Insulin receptor possesses intrinsic tyrosine kinase activity.
- Testosterone acts via intracellular androgen receptors, not membrane receptors.
- Thyroid hormones regulate gene transcription.

(10) Answer: F T F T F

Explanation:

- BMR decreases with age.
- Males generally have a higher BMR due to greater lean body mass.
- Standard BMR calculations do not require body fat adjustment in females.
- Athletes may require modified predictive equations because of increased muscle mass.
- Weight remains an important determinant of BMR in the elderly.

(11) Answer: C. It binds to a membrane receptor with intrinsic tyrosine kinase activity.
Explanation: Insulin binds to a receptor tyrosine kinase, causing autophosphorylation and activation of intracellular signaling pathways.

(12) Answer: C. Conversion of cholecalciferol to 25-hydroxy cholecalciferol.
Explanation: Long-term anticonvulsant therapy induces hepatic enzymes, increasing vitamin D metabolism and reducing hepatic 25-hydroxylation, leading to osteomalacia/osteoporosis.

(13) Answer: E. Sarcopenia
Explanation: Aging causes loss of skeletal muscle mass (sarcopenia), reducing basal metabolic rate and total energy requirements.

(14) Answer: E. Vitamin D
Explanation: Delayed walking, bowed legs, rachitic rosary, frontal bossing, and metaphyseal cupping are classic features of rickets due to vitamin D deficiency.

(15) Answer: C. Inhibition of dihydrofolate reductase
Explanation: Trimethoprim inhibits bacterial dihydrofolate reductase, which can contribute to folate deficiency and megaloblastic anemia during prolonged use.

(16) Answer: A. Saturated fats should be less than 10% of her total energy intake.
Explanation: Current dietary guidelines recommend limiting saturated fat intake to less than 10% of total daily energy intake.

(17) Answer: E. Prostate-specific antigen (PSA)
Explanation: PSA is the principal tumor marker used in the diagnosis and monitoring of prostate cancer.

(18) Answer: A. Ferritin
Explanation: Serum ferritin is the best laboratory indicator of body iron stores and is decreased in iron deficiency anemia.

(19) Answer: B. Increased skeletal muscle mass
Explanation: BMI does not distinguish between muscle and fat. Athletes often have high BMI values due to increased muscle mass rather than obesity.

(20) Answer: B. ADP-ribosylation of the Gs alpha subunit, increasing adenylate cyclase activity
Explanation: Cholera toxin ADP-ribosylates the Gs protein, causing persistent activation of adenylate cyclase, increased cAMP, chloride secretion, and profuse watery diarrhea.

CAT- 3 (BATCH 1) SEQ PAPER - 2026

UVA WELLASSA UNIVERSITY FACULTY OF MEDICINE
Continuous Assessment 03
August 2025 2022/2023
(01st) Batch
Biochemistry
Structured Essay Questions (SEQ) Paper

Time **11.15 am – 12.15 pm** (01 hour) Date of the exam: 2025.08.11

Index (MED) Number ……

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

Instructions to Candidates

- This paper contains two (02) Structured Essay Questions.
- Answer all questions.
- Write your answers in the spaces provided.
- If additional space is required, you may use extra sheets. Ensure that the relevant question number is clearly indicated on each additional sheet.
- Write your index number in the designated space on each answer sheet, including any extra sheets used.

(Q1) A 17-year-old girl presented to the medical clinic with excessive sweating, eye changes, and palpitations.Her thyroid profile is mentioned below.

Test	Results	Reference range
TSH	0.1 µIU/mL	0.4–5.5 µIU/mL
Free T4	56 pmol/L	15–23 pmol/L
Free T3	15 pmol/L	5–7 pmol/L

After starting on propylthiouracil, her clinical features improved.

1.1 Regarding thyroid profile

1.1.1. State the biochemical diagnosis that can be made from this thyroid profile. (10 Marks)

1.1.2. Explain the biochemical basis for the above laboratory findings. (20 Marks)

1.1.3. Write three (03) other clinical features you may see in this condition. (15 Marks)

1.2 Regarding thyroid hormone synthesis

1.2.1. Describe the thyroid hormone synthesis. (40 Marks)

1.2.2. State the action of propylthiouracil in this patient. (15 Marks)

(Q2) A 56-year-old male patient presented to the emergency treatment unit with acute, severe constricting central chest pain, which was not relieved with routine analgesics. His electrocardiogram revealed the presence of an acute myocardial infarction.

2.1.1. Write three (03) biomarkers that are elevated in acute myocardial infarction. (15 Marks)

2.1.2. State the best cardiac biomarker that can be used in the diagnosis of this patient. (05 Marks)

2.1.3. Explain the biochemical basis for using the biomarker stated in 2.1.2 in this patient. (30 Marks)

2.2 Regarding enzyme markers of hepatocellular injury

2.2.1. Name the two (02) enzyme markers that can be used to identify the presence of acute hepatocellular injury. (10 Marks)

2.2.2. Explain the biochemical basis for the use of one enzyme marker mentioned in 2.2.1 for the identification of hepatocellular injury. (15 Marks)

2.3 Regarding enzyme markers of cholestasis

2.3.1. Name the two (02) enzyme markers that can be used to identify the presence of cholestasis in a patient. (10 Marks)

2.3.2. Explain the biochemical basis for the use of one enzyme marker mentioned in 2.3.1 for the identification of cholestasis. (15 Marks)

CAT -3 (BATCH 1) SEQ ANSWERS - 2025

(Q1)

1.1.1

Primary hyperthyroidism (thyrotoxicosis) (10)

1.1.2

- In primary thyrotoxicosis, the thyroid gland is overactive and produces excess T4 and T3 independent of pituitary regulation. (4)
- High free T4 and T3 exert negative feedback on the hypothalamus and pituitary. (2)
- This suppresses thyrotropin-releasing hormone (TRH) and thyroid-stimulating hormone (TSH) secretion. (2)
- Graves' disease is caused by thyroid-stimulating immunoglobulins (TSI) that bind to and activate TSH receptors on thyroid follicular cells. (2)
- This leads to uncontrolled stimulation of the thyroid gland. (2)
- Increased iodide uptake occurs. (2)
- Increased synthesis and release of thyroid hormones occur. (2)
- Excess thyroid hormones cause palpitations and excessive sweating through increased sympathetic activity. (2)
- Increased glycosaminoglycan deposition behind the eyes causes eye changes (exophthalmos). (2)

1.1.3

- Goitre (5)
- Weight loss (5)
- Hyperreflexia (5)

1.2.1

- Dietary iodide is absorbed from the gastrointestinal tract into the bloodstream. (4)
- Iodide is actively transported into thyroid follicular cells by the Na^+/I^- symporter. (4)
- Iodide is oxidized to iodine by thyroid peroxidase (TPO). (4)
- Iodine binds to tyrosine residues of thyroglobulin. (4)
- Monoiodotyrosine (MIT) and diiodotyrosine (DIT) are formed. (4)
- MIT + DIT → T3.
- DIT + DIT → T4.
- T3 and T4 remain stored in the colloid bound to thyroglobulin. (4)
- Colloid is endocytosed into follicular cells. (4)
- Lysosomal enzymes release T3 and T4. (4)
- T4 is converted to T3 by deiodinases. (4)
- T4 can also be converted to reverse T3. (4)
- Synthesis is regulated by TRH and TSH. (4)
- T3 and T4 exert negative feedback on the hypothalamus and pituitary. (4)

1.2.2

- Propylthiouracil inhibits thyroid peroxidase. (5)
- It inhibits oxidation of iodide to iodine. (5)
- It inhibits organification of iodine. (5)
- It inhibits coupling reactions required for T3 and T4 synthesis. (5)
- It decreases production of new thyroid hormones. (5)
- It also inhibits peripheral conversion of T4 to T3. (5)

(Q2)

2.1.1

- Cardiac Troponin I/T (5)
- CK-MB (5)
- Myoglobin (5)

2.1.2

Cardiac Troponin I (cTnI) (5)

2.1.3

- Cardiac troponins are intracellular proteins of myocardial cells. (4)
- They are present in the cytoplasm and contractile apparatus.(2)
- Acute myocardial infarction causes cessation of blood supply. (2)
- Myocardial ischemia and anoxia occur. (2)
- Cell death and infarction result. (2)
- Cell membrane integrity is lost. (2)
- Troponins are released into the bloodstream. (2)
- Troponin I is highly specific for cardiac muscle. (2)
- It rises 4–9 hours after infarction. (2)
- Peaks at 12–24 hours. (2)
- Remains elevated for 10–14 days. (2)
- Useful in detecting late presentations. (2)
- Levels correlate with the severity of myocardial damage. (2)
- It is also a prognostic marker. (2)

2.2.1

- Alanine aminotransferase (ALT) (5)
- Aspartate aminotransferase (AST) (5)

2.2.2 (ALT)

- ALT is predominantly present in hepatocytes. (2)
- It is mainly a cytosolic enzyme. (2)
- Hepatocellular injury damages liver cells. (2)
- ALT leaks into the bloodstream. (2)
- Blood ALT levels rise rapidly. (2)
- It is an early marker of hepatocellular injury. (3)
- Elevation may occur before jaundice becomes apparent. (2)

2.3.1

- Alkaline phosphatase (ALP) (5)
- Gamma-glutamyl transferase (GGT) (5)

2.3.2 (ALP)

- ALP has several isoenzymes. (3)
- In the liver, ALP is located in biliary epithelial cells. (3)
- Cholestasis induces increased synthesis of ALP. (3)
- ALP is released into the bloodstream. (3)
- Serum ALP levels increase proportionally to the degree of biliary obstruction. (3)
- Elevation is usually greater in extrahepatic cholestasis than intrahepatic cholestasis. (3)

CAT -3 (BATCH 1) OSPE PAPER - 2025

(Q1)

Question 01



Figure A



Figure B

A mother brought her 3-year-old son to the paediatric clinic complaining of poor growth. On examination following two clinical signs were noticed by the paediatrician (Figure A & Figure B).

(1.1) Identify the two (02) clinical signs, A and B. (03 Marks)

(1.1.1) A

(1.1.2) B

(1.2) What is the condition developed by the child? (02 Marks)

(1.3) What nutritional deficiency is developed by the child? (02 Marks)

(1.4) State two (02) basic blood investigations you need to perform initially in the diagnostic workup of this child. (03 Marks)

(1.4.1)

(1.4.2)

(Total: 10 Marks)

(Q2)

Mifflin-St Jeor Equations

Men

BMR = (10 × weight in kg) + (6.25 × height in cm) – (5 × age in years) + 5

Women

BMR = (10 × weight in kg) + (6.25 × height in cm) – (5 × age in years) – 161

A 24-year-old male university student wants to calculate his daily energy requirements. His height is 165 cm and his weight is 50 kg. The Mifflin-St Jeor Equation is given.

(2.1) Calculate his Basal Metabolic Rate (BMR) using the Mifflin-St Jeor Equation. (05 Marks)

(2.2) He is a lightly active student. Calculate his total daily energy requirement, assuming an activity factor of 1.375. (03 Marks)

(2.3) If his daily calorie intake is 1550 kcal, comment on his energy balance. (02 Marks)

(Total: 10 Marks)

(Q3)

Two Rice Samples

Two rice samples are shown (Sample A and B).



Sample A



Sample B

(3.1) Identify the (04 Marks)

(3.1.1) Sample A

(3.1.2) Sample B

(3.2) State two (02) nutrients lost during milling. (04 Marks)

(3.2.1)

(3.2.2)

(3.3) State the rice variety having the low glycaemic index. (02 Marks)

(Total: 10 Marks)

(Q4)

A 35-year-old female presents with complaints of chronic fatigue, pallor, and occasional dizziness. Her haemoglobin and serum ferritin levels are given.

Test	Results	Reference range
Haemoglobin (Hb)	9.2 g/dL	12-16 g/dL
Serum ferritin	8 ng/mL	12-150 ng/mL

(4.1) Interpret the laboratory findings. (06 Marks)

(4.1.1) Haemoglobin :

(4.1.2) Ferritin :

(4.2) State the most likely condition. (02 Marks)

(4.3) State one (01) cause for the development of the condition mentioned in 4.2. (02 Marks)

(Total: 10 Marks)

(Q5)

A 50-year-old male with a history of chronic liver disease is evaluated for suspected impaired iron metabolism. The laboratory results are provided.

Test	Results	Reference range
Serum iron	180 µg/dL	60-170 µg/dL
Unsaturated Iron Binding Capacity (UIBC)	120 µg/dL	250-450 µg/dL

(5.1) Calculate the Total Iron Binding Capacity (TIBC). (05 Marks)

(5.2) Interpret the results in the context of iron metabolism. (05 Marks)

(Total: 10 Marks)

(Q6)

A 55-year-old male patient who is a smoker presented with tightening-type central chest pain. His ECG showed mild ST depressions in inferior leads and T inversions in lateral leads. Furthermore, a blood sample was sent for hs-troponin I. The report is given.

Test	Result	Unit
High Sensitive Troponin I	1125.6	ng/L

Condition	Male	Female
Adult	< 34	< 16

Method: Chemiluminescence Micro-particle Immunoassay in Abbott Architect i1000 SR System

(6.1) Interpret the report. (03 Marks)

(6.2) What is the most likely diagnosis of this patient? (03 Marks)

(6.3) State why Troponin I is given a cut-off value instead of a reference range. (04 Marks)

(Total: 10 Marks)

(Q7)

A 50-year-old male patient was admitted to the emergency treatment unit with severe epigastric pain radiating to the back, suspected of having acute pancreatitis. He was a chronic alcohol user. Serum enzyme levels are ordered to support the diagnosis.

(7.1) Name two (02) serum enzyme markers useful for the diagnosis of suspected acute pancreatitis. (04 Marks)

(7.1.1)

(7.1.2)

(7.2) Mention the digestive functions of the enzymes mentioned in 7.1. (06 Marks)

(7.2.1)

(7.2.2)

(Total: 10 Marks)

(Q8)

A 65-year-old male with fatigue and leg swelling was suspected of having chronic kidney disease.

(8.1) Name two (02) most appropriate biochemical investigations to diagnose the condition. (04 Marks)

(8.1.1)

(8.1.2)

(8.2) State the biochemical derangements related to the following. (06 Marks)

(8.2.1) Bone density

(8.2.2) Serum triglycerides

(8.2.3) Haemoglobin

(Total: 10 Marks)

(Q9)

A 7-year-old boy from a rural community is brought to the clinic by his parents with complaints of poor night vision, dry eyes, and repeated respiratory infections. On examination, Bitot's spots are seen on the conjunctiva. A biochemical assessment is requested, and the test result are given.

Test	Result	Reference Range
Serum Retinol	0.18 µmol/L	0.70-2.8 µmol/L

(9.1) What is the clinical condition? (04 Marks)

(9.2) State the biochemical basis of the following features seen in the condition identified in 9.1.

(9.2.1) Night blindness (03 Marks)

(9.2.2) Recurrent respiratory infections (03 Marks)

(Total: 10 Marks)

(Q10)

A 50-year-old male patient with central obesity, fatigue, and slow-healing wounds is presented to a medical clinic. He has a family history of diabetes. His fasting plasma glucose values on two occasions are given.

Test	Result	Reference Range
Fasting plasma glucose Reading 01	138 mg/dL	70-99 mg/dL
Fasting plasma glucose Reading 02	145 mg/dL	70-99 mg/dL

(10.1) What is the most likely diagnosis? (04 Marks)

(10.2) Name the primary hormonal dysfunction in this condition. (03 Marks)

(10.3) Name one (01) diagnostic test to determine the long-term glycaemic control of this patient. (03 Marks)

(Total: 10 Marks)

CAT -3 (BATCH 1) OSPE ANSWERS - 2025

Question 01



Figure A



Figure B

(Q1)

(1.1)

(1.1.1) A – Pallor

(1.1.2) B – Koilonychia (spoon-shaped nails)

(1.2) Iron deficiency anaemia

(1.3) Iron deficiency

(1.4)

(1.4.1) Full Blood Count (FBC/CBC)

(1.4.2) Serum Ferritin

(Q2)

(2.1)

BMR = (10 × 50) + (6.25 × 165) – (5 × 24) + 5

= 500 + 1031.25 – 120 + 5

= 1416.25 kcal/day

(2.2)

Total Daily Energy Requirement

= 1416.25 × 1.375

= 1947.3 kcal/day

(2.3)

Negative energy balance (calorie intake is lower than energy requirement)





(Q3)

(3.1)

(3.1.1) Sample A – White rice (polished rice)

(3.1.2) Sample B – Brown rice (unpolished rice)

(3.2)

(3.2.1) Dietary fibre

(3.2.2) Vitamin B1 (Thiamine)

(3.3)

Brown rice (Sample B)

Test	Results	Reference range
Haemoglobin (Hb)	9.2 g/dL	12-16 g/dL
Serum ferritin	8 ng/mL	12-150 ng/mL

(Q4)

(4.1)

(4.1.1) Haemoglobin: Low (Anaemia)

(4.1.2) Ferritin: Low (Depleted iron stores)

(4.2)

Iron deficiency anaemia

(4.3)

Chronic blood loss (e.g., menorrhagia)

Test	Results	Reference range
Serum iron	180 µg/dL	60-170 µg/dL
Unsaturated Iron Binding Capacity (UIBC)	120 µg/dL	250-450 µg/dL

(Q5)

(5.1)

TIBC = Serum Iron + UIBC

= 180 + 120

= 300 µg/Dl

(5.2)

High serum iron with low UIBC indicates increased iron saturation and possible iron overload

Test	Result	Unit
High Sensitive Troponin I	1125.6	ng/L

Condition	Male	Female
Adult	< 34	< 16

(Q6)

(6.1)

Troponin I is markedly elevated above the cut-off value, indicating myocardial injury

(6.2)

Non-ST Elevation Myocardial Infarction (NSTEMI)

(6.3)

Troponin I is a cardiac injury marker and healthy individuals have very low or undetectable levels; therefore, a diagnostic cut-off is used to identify myocardial damage

(Q7)

(7.1)

(7.1.1) Serum Amylase

(7.1.2) Serum Lipase

(7.2)

(7.2.1) Amylase – Digestion of carbohydrates/starch into smaller sugars

(7.2.2) Lipase – Digestion of triglycerides into fatty acids and glycerol

(Q8)

(8.1)

(8.1.1) Serum Creatinine

(8.1.2) Estimated Glomerular Filtration Rate (eGFR)

(8.2)

(8.2.1) Bone density – Decreased

(8.2.2) Serum triglycerides – Increased

(8.2.3) Haemoglobin – Decreased

Test	Result	Reference Range
Serum Retinol	0.18 µmol/L	0.70-2.8 µmol/L

(Q9)

(9.1)

Vitamin A deficiency (Xerophthalmia)

(9.2)

(9.2.1) Night blindness

Deficiency of retinal leads to impaired rhodopsin formation in rod cells

(9.2.2) Recurrent respiratory infections

Loss of epithelial integrity and impaired immune function due to vitamin A deficiency

Test	Result	Reference Range
Fasting plasma glucose Reading 01	138 mg/dL	70-99 mg/dL
Fasting plasma glucose Reading 02	145 mg/dL	70-99 mg/dL

(Q10)

(10.1)

Type 2 Diabetes Mellitus

(10.2)

Insulin resistance with relative insulin deficiency

(10.3)

HbA1c (Glycated haemoglobin) test

2023/2024 (SECOND BATCH)

CAT- 3 (BATCH 2) MCQ PAPER - 2026

UVA WELLASSA UNIVERSITY OF SRI LANKA
FACULTY OF MEDICINE
Continuous Assessment 03
May 2026
2023/2024 (02nd) Batch
Biochemistry
Multiple Choice Questions (MCQ) Paper

Time 10.00 am – 11.00 am (01 hour) Date of the exam: 2026.05.11

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

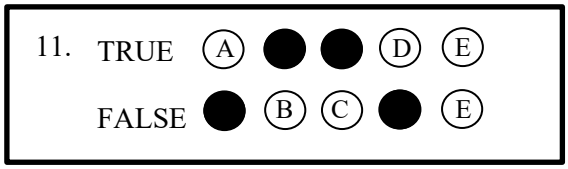
Please read the following instructions before marking responses on your answer sheets

1. Check that your question paper has a total of **06 pages,** including the front page.
2. **A single answer sheet is provided**. Please write your index number in the given space.
3. Read each question carefully before answering.
4. Mark the correct response as a **heavy black mark, filling the relevant circle completely**, using a black lead pencil (6B or above grade).
5. Do not make stray marks on the answer sheet. In case of an error, erase cleanly.
6. Your final answer should be a densely coloured circle through which the underlying letter is not visible.
7. Marking using any other method (e.g., mark the circle with a cross) is not valid.

Ten (10) True/False Type Questions (Questions 1-10/Page 2-3)

1. Mark whether each response is true or false.
2. Given below is an example of how to mark a true/false type question.

Q 11. A woman has
A. one ovary.
B. one nose.
C. two ears.
D. one eye.
E. two hairs.

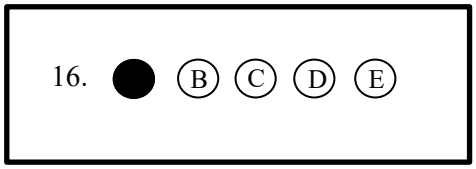


A correct response will get = +1 mark
An incorrect response will get = -1 mark
No response will get = 0 (zero) mark
Negative marks will not be carried over to the next question

Ten (10) Single Best Response (SBR) Type Questions (Questions 11-20/ Page 4-6)

1. If you mark the correct response, you will get the full marks for the question.
2. If you mark an incorrect response, fail to mark any response, select more than one response, or mark your response unclearly, you will not receive any marks for that question.
3. Given below is an example of how to mark a single best response type question.

Q 16. Speaking is a unique ability observed in humans. Which of the following body parts is primarily used for speech production?
A. Tongue
B. Hands
C. Feet
D. Ears
E. Nose



Question numbers 01 to 10 are True or False type questions. Mark your answer for each of the five responses (A to E).

(1) Which of the following factors increase the basal metabolic rate (BMR)?

(A) Aging
(B) ⁄pothyroidism
(C) Increased fat mass
(D) Increased lean body mass
(E) Male gender

(2) True or False regarding obesity?

(A) Chronic low-grade inflammation is associated with it.
(B) Genetics contribute to development of obesity.
(C) Gynoid obesity is associated with a higher metabolic risk than android obesity.
(D) It is an underlying cause for insulin resistance.
(E) It is defined based on the waist-to-hip ratio.

(3) True or False regarding cancers?

(A) Cancers arise from accumulation of genetic mutations in a single cell.
(B) Oncogenes are derived from proto-oncogenes.
(C) Tumour markers are absent in normal individuals.
(D) Tumour markers are useful in monitoring treatment response.
(E) Tumour suppressor genes promote uncontrolled cell proliferation.

(4) True or False regarding renal function tests?

(A) Blood urea is used to detect pre-renal failure.
(B) In calculating the eGFR, body surface area is used.
(C) Microalbuminuria is useful in detecting early stage of CKD.
(D) Serum creatinine is an early marker of renal dysfunction.
(E) Urinary electrolyte measurement is used to diagnose renal tubulopathies.

(5) True or False regarding enzymes used in diagnostic purposes in clinical settings?

(A) Alkaline phosphatase (ALP) is elevated in pregnancy.
(B) AST is liver-specific than ALT.
(C) Bone ALP is present in osteoclasts.
(D) Creatine phosphokinase is cytosolic.
(E) Lactate dehydrogenase is elevated in intravascular haemolysis.

(6) True or False regarding digestion and absorption of nutrients?

(A) Absorption of amino acids is an active process.
(B) Digestion of carbohydrates begins in the mouth.
(C) Digestion of lipids is completed in the duodenum.
(D) Fat-soluble vitamins are absorbed in the stomach.
(E) Triglycerides are absorbed directly into the bloodstream.

(7) True or False regarding hormonal signal transduction?

(A) Adenylyl cyclase is activated upon binding of steroid hormones to its active site.
(B) Ca^{2+}-calmodulin complex activates protein kinases.
(C) cAMP is synthesized from ATP by the action of phospholipase C.
(D) G-proteins act as molecular switches in signal transduction.

(E) Phosphoinositides produce diacylglycerol as a second messenger.

(8) Which of the following sites absorb dietary iron?
(A) Colon
(B) Duodenum
(C) Ileum
(D) Jejunum
(E) Stomach

(9) True or False regarding thyroglobulin?
(A) It produces MIT and DIT in a non-enzymatic process.
(B) It provides precursors for T_3 and T_4.
(C) It contains four active tyrosine residues.
(D) It is a protein present in the Golgi apparatus.
(E) Upon stimulation, it is degraded to release thyroid hormones.

10) True or False regarding vitamin D?
(A) 25-hydroxycholecalciferol is the major storage form.
(B) Deficiency is seen in end-stage renal failure.
(C) Hydroxylation requires NADPH.
(D) The enzyme responsible for the second hydroxylation is located in the liver.
(E) Vitamin D_2 is a biologically active form.

Question numbers 11 to 20 are Single Best Response (SBR) type. Select the best response for each question.

11) A 28-year-old office worker presents for a routine health check-up. He has a sedentary lifestyle with minimal physical activity. His total daily energy expenditure (TDEE) is being evaluated.

Which of the following component contributes most to the total daily energy expenditure (TDEE)?

(A) Basal metabolic rate (BMR)
(B) Non-exercise activity thermogenesis (NEAT)
(C) Physical activity energy expenditure (PAEE)
(D) Thermic effect of food (TEF)
(E) Thermoregulation

12) A 6-year-old male child presents with delayed growth and bone deformities. Child's mother reports that the child has poor dietary intake and limited exposure to sunlight. On examination, bowing of legs and widening of wrists are observed. Laboratory investigations reveal low serum calcium and phosphate levels.

What is the most likely cause of his clinical presentation?

(A) Chronic kidney disease
(B) Hypermagnesemia
(C) Hypoparathyroidism
(D) Tumour lysis syndrome
(E) Vitamin D deficiency

13) 45-year-old man presents to the ETU 1 hour after onset of acute chest pain.

what is the best investigation that can be used to rule out myocardial infarction?

(A) Aspartate aminotransferase (AST)
(B) Creatine kinase-MB (CK-MB)
(C) High-sensitivity cardiac troponin I
(D) Lactate dehydrogenase (LDH)
(E) Myoglobin

14) 54-year-old patient presents with severe dysphagia, generalized oedema, muscle wasting, and delayed wound healing. Laboratory tests reveal hypoalbuminemia.

which of the following condition is most likely to cause hypoalbuminemia in this patient?

(A) Chronic kidney disease
(B) Chronic liver disease
(C) Nephrotic syndrome
(D) Protein deficiency
(E) Protein-losing enteropathy

15) A 40-year-old man presents with pale, bulky, foul-smelling stools and significant weight loss with evidence of chronic liver cell disease. Laboratory tests reveal fat-soluble vitamin deficiency.

Which of the following process is most likely impaired in this patient?
(A) Absorption of amino acids
(B) Carbohydrate digestion
(C) Emulsification of fats
(D) Pancreatic lipase activity
(E) Protein digestion

16) A 48-year-old man presents for a routine health check-up. He has a sedentary lifestyle and reports gradual weight gain over the past few years. On examination, it was found that the waist circumference was 105 cm and relatively thin limbs. His BMI is 30 kg/m².

Which of the following is most strongly associated with central obesity?
(A) Decreased waist-to-hip ratio
(B) Increased bone density
(C) Increased hip circumference
(D) Increased risk of insulin resistance
(E) Reduced subcutaneous fat

17) A patient with obstructive jaundice presents with easy bruising and prolonged bleeding time.

Which of the following vitamin deficiency is most likely responsible for the haemostatic abnormality in this patient?
(A) Vitamin A
(B) Vitamin B_{12}
(C) Vitamin C
(D) Vitamin E
(E) Vitamin K

18) A 22-year-old university student presents with fatigue and poor muscle recovery after exercise. His diet mainly consists of cereals and pulses, with minimal animal protein intake. The dietitian advises including an additional food source with high-quality protein.

Which of the following food source is most likely to fulfil this requirement?
(A) Dairy products
(B) Egg
(C) Fruits
(D) Nuts
(E) Vegetables

19) A 35-year-old man is recovering in hospital following a moderate burn injury. Following the acute inflammatory phase, his condition stabilizes. Nutritional support is initiated with high-protein enteral feeding.

Which of the following phase, a positive nitrogen balance is most likely to be observed?

(A) Acute catabolic phase
(B) Anabolic phase during tissue repair
(C) Burn injury complicated with secondary infection
(D) Early post-burn inflammatory phase
(E) Recovery phase

20) A 70-year-old postmenopausal woman presents with progressive loss of height and a recent vertebral compression fracture following a minor fall. She has no history of chronic illness but is a converted vegetarian. A DEXA scan confirms osteoporosis.

Which of the following is the most likely biochemical basis of her condition?

(A) Decreased collagen synthesis
(B) Defective renal activation of vitamin D
(C) Excess calcium deposition in osteoid
(D) Increased bone resorption
(E) Vitamin C deficiency

CAT- 3 (BATCH 2) MCQ ANSWERS- 2026

(1) FFFTT
(2) TTFTF
(3) TTFTF
(4) TTTFT
(5) TFFTT
(6) TTFFF
(7) FTFTT
(8) FTFFF
(9) FTFFT
(10) TTFFF
(11) A
(12) E
(13) C
(14) D
(15) C
(16) D
(17) E
(18) B
(19) B
(20) D

CAT- 3 (BATCH 2) SEQ PAPER - 2026

UVA WELLASSA UNIVERSITY OF SRI LANKA
FACULTY OF MEDICINE
Continuous Assessment 03
May 2026
2023/2024 (02nd) Batch
Biochemistry
Structured Essay Questions (SEQ) Paper

Time: 11.15 a.m. – 12.15 p.m. (01 hour) Date of the exam: 2026.05.11

Index (MED) Number ……

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

Instructions to Candidates

1. This paper contains two (02) Structured Essay Questions.
2. Answer all questions.
3. Write your answers in the spaces provided.
4. If additional space is required, you may use extra sheets. Ensure that the relevant question number is clearly indicated on each additional sheet.
5. Write your index number in the designated space on each answer sheet, including any extra sheets used.

(Q 1) Regarding nutrition

(1.1) Four (04) major food groups are listed below. Write one predominant and one deficient nutrient in each group. (20 Marks)

Major food group	Predominant macro or micro nutrient	Deficient micronutrient
Cereals		
Pulses		
Dairy products		
Fruits		

(1.2) Briefly describe the digestion (25 Marks) and absorption (10 Marks) of proteins in the gastrointestinal tract. (35 Marks)

(1.3) A 3-year-old child from a low socioeconomic background presents with generalized oedema, irritability, growth retardation, and a distended abdomen. Dietary history reveals a carbohydrate-rich, protein-deficient diet. The child is suspected of having Kwashiorkor.

(1.3.1) Briefly explain the biochemical basis for the development of oedema in Kwashiorkor. (30 Marks)

(1.3.2) State two dietary management strategies for this child. (15 Marks)

(Total: 100 Marks)

(Q 2) A 52-year-old man with a history of smoking, hypertension, and dyslipidaemia presents with central chest pain radiating to the left arm for 2 hours. On examination, he is distressed and anxious. An acute myocardial infarction (MI) is suspected.

(2.1) Define dyslipidaemia. (15 Marks)

(2.2) State three risk factors that contribute to the development of atherosclerosis in this patient. (15 Marks)

(2.3) Describe the biochemical mechanisms leading to the formation of foam cells. (30 Marks)

(2.4) List four components of an atherosclerotic plaque. (20 Marks)

(2.5) List two biomarkers which can be used to diagnose MI in this patient. (10 Marks)

(2.6) List two lifestyle modifications need to be recommended on discharge. (10 Marks)

(Total: 100 Marks)

CAT-3 (BATCH 2) SEQ ANSWERS - 2026

(Q1)
(1.1)

Major food group	Predominant nutrient	Deficient micronutrient
Cereals	Carbohydrates	Vitamin A
Pulses	Protein	Vitamin C
Dairy products	Protein / Calcium	Iron
Fruits	Vitamin C	Vitamin B12

(4 per each)

(1.2) Briefly describe the digestion and absorption of proteins

Digestion of proteins

- Protein digestion begins in the stomach. (3)
- Hydrochloric acid denatures proteins. (3)
- Pepsinogen is converted to pepsin by HCl. (3)
- Pepsin hydrolyses proteins into polypeptides. (3)
- In the duodenum, pancreatic enzymes are released. (3)
- Trypsinogen is activated to trypsin by enteropeptidase. (3)
- Trypsin activates chymotrypsinogen, proelastase and procarboxypeptidases. (3)
- Trypsin, chymotrypsin and elastase break polypeptides into smaller peptides. (3)
- Carboxypeptidases remove amino acids from the carboxyl end. (3)
- Brush border peptidases further digest peptides into amino acids, dipeptides and tripeptides. (3)

Absorption of proteins

- Amino acids are absorbed mainly in the jejunum. (2)
- Amino acids enter enterocytes by sodium-dependent active transport. (2)
- Dipeptides and tripeptides are absorbed by H^+-dependent transporters. (2)
- Inside enterocytes, dipeptides and tripeptides are hydrolysed to amino acids. (2)
- Amino acids leave enterocytes by facilitated diffusion. (2)
- Amino acids enter the portal circulation and are transported to the liver. (2)

(1.3.1) Biochemical basis for oedema in Kwashiorkor

- Dietary protein deficiency leads to decreased amino acid availability. (5)
- Hepatic synthesis of albumin decreases. (5)
- Plasma albumin concentration falls (hypoalbuminaemia). (5)
- Plasma colloid osmotic pressure decreases. (5)
- Fluid moves from the intravascular compartment to the interstitial space. (5)
- Water accumulates in tissues causing generalized oedema and Reduced synthesis of plasma proteins further aggravates fluid imbalance. (5)

(1.3.2) Two dietary management strategies

- Gradual introduction of a high-protein diet. (7.5)
- Adequate energy intake with vitamin and mineral supplementation. (7.5)

(Q2)
(2.1) Define dyslipidaemia

Dyslipidaemia is an abnormal concentration of lipids and/or lipoproteins in blood, including elevated total cholesterol, LDL cholesterol, triglycerides, or reduced HDL cholesterol. (15)

(2.2) Three risk factors contributing to atherosclerosis
- Smoking (5)
- Hypertension (5)
- Dyslipidaemia (5)

(2.3) Biochemical mechanisms leading to foam cell formation
- Endothelial injury increases permeability of the arterial wall. (3)
- LDL particles enter the subendothelial space. (3)
- LDL undergoes oxidative modification. (3)
- Oxidized LDL attracts monocytes. (3)
- Monocytes migrate into the intima and differentiate into macrophages. (3)
- Macrophages express scavenger receptors. (3)
- Scavenger receptors take up oxidized LDL in an uncontrolled manner. (3)
- Cholesterol esters accumulate within macrophages. (3)
- Lipid-laden macrophages become foam cells. (3)
- Aggregation of foam cells forms fatty streaks, the earliest lesion of atherosclerosis. (3)

(2.4) Four components of an atherosclerotic plaque
- Foam cells (5)
- Cholesterol and cholesterol crystals (5)
- Smooth muscle cells (5)
- Fibrous cap (collagen-rich connective tissue) (5)

(2.5) Two biomarkers used to diagnose myocardial infarction
- Cardiac Troponin I (or Troponin T) (5)
- CK-MB (5)

(2.6) Two lifestyle modifications recommended on discharge
- Smoking cessation (5)
- Regular physical exercise and a heart-healthy diet(5)

CAT- 3 (BATCH 2) OSPE PAPER - 2026

(Q1)

Nitrogen Balance

Investigation	Result	Reference Range
Blood Urea Nitrogen (BUN) (mg/dL)	32	7-20
Serum Creatinine (mg/dL)	1.0	0.7-1.3
Serum Total Protein (g/dL)	6.2	6.4-8.3
Serum Albumin (g/dL)	3.1	3.5-5.0

A 30-year-old male patient is admitted following severe trauma. During recovery, he is noted to have significant muscle wasting. Laboratory investigations show increased urinary urea nitrogen levels despite moderate protein intake.

(1.1) What is the type of nitrogen balance present in this patient? (04 Marks)
(1.2) Suggest two nutritional interventions to improve this patient's condition. (06 Marks)

(Total: 10 Marks)

(Q2)

Weight Gain



A 35-year-old male presents with gradual weight gain over 5 years. He consumes portions of rice higher than the recommended size, fried foods, sugary drinks, and snacks frequently, and has a sedentary lifestyle.

(2.1) List two features of obesity seen in this patient. (04 Marks)
(2.2) List three dietary modifications and food-based strategies that can be suggested to manage obesity in this patient. (06 Marks)

(Total: 10 Marks)

(Q3)

Urine Tests

Test	Result
Urinary creatinine (mg/dL)	21.5
Urinary albumin (g/dL)	1500

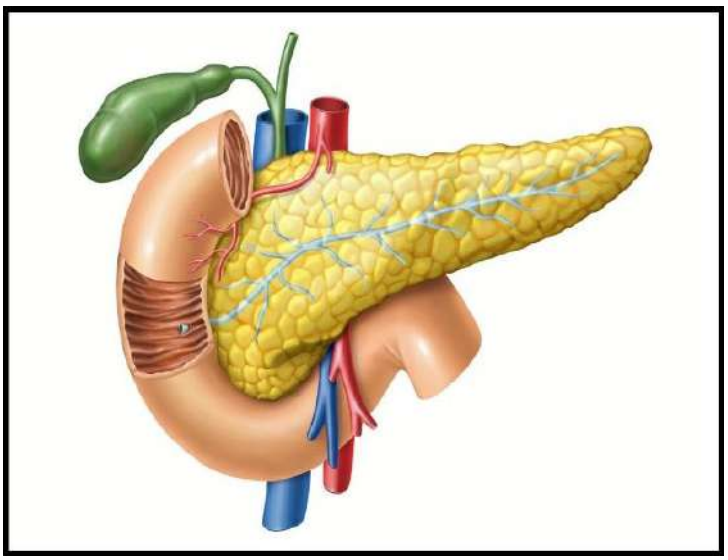
The above urinary test results belong to a 65-year-old female with diabetes.

(3.1) Calculate albumin to creatinine ratio (ACR) in g/mg. (06 Marks)
(3.2) Comment on her albumin to creatinine ratio (ACR). Normal ACR < 30 g/mg. (04 Marks)

(Total: 10 Marks)

(Q4)

Pancreatic Insufficiency



A patient presents with chronic diarrhea and weight loss. Pancreatic insufficiency is suspected.

(4.1) Name one pancreatic enzyme involved in protein digestion. (04 Marks)
(4.2) State two causes for chronic pancreatitis. (06 Marks)

(Total: 10 Marks)

(Q5)

Vitamin Deficiency



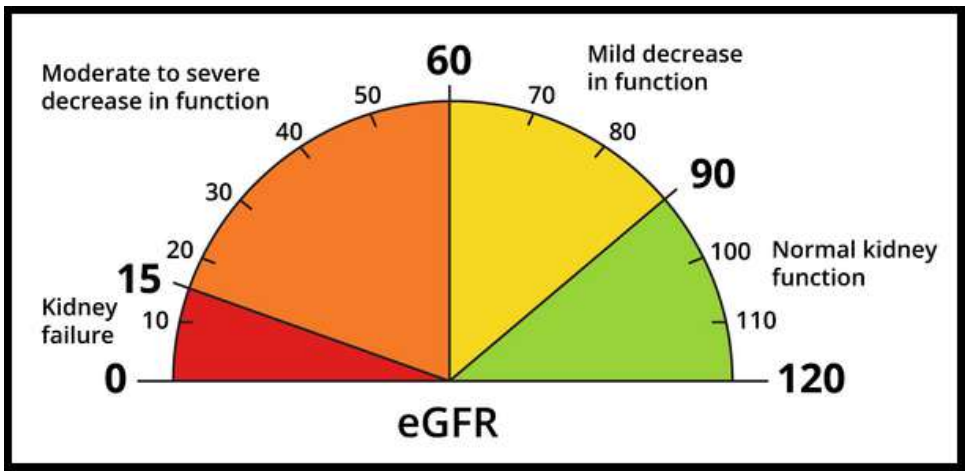
A 5-year-old child presents with bowed legs and delayed growth. A vitamin deficiency is suspected.

(5.1) State the deficient vitamin. (04 Marks)
(5.2) Name one biochemical function of this vitamin. (03 Marks)
(5.3) State one biochemical investigation to confirm the diagnosis. (03 Marks)

(Total: 10 Marks)

(Q6)

Glomerular Filtration Rate (GFR)



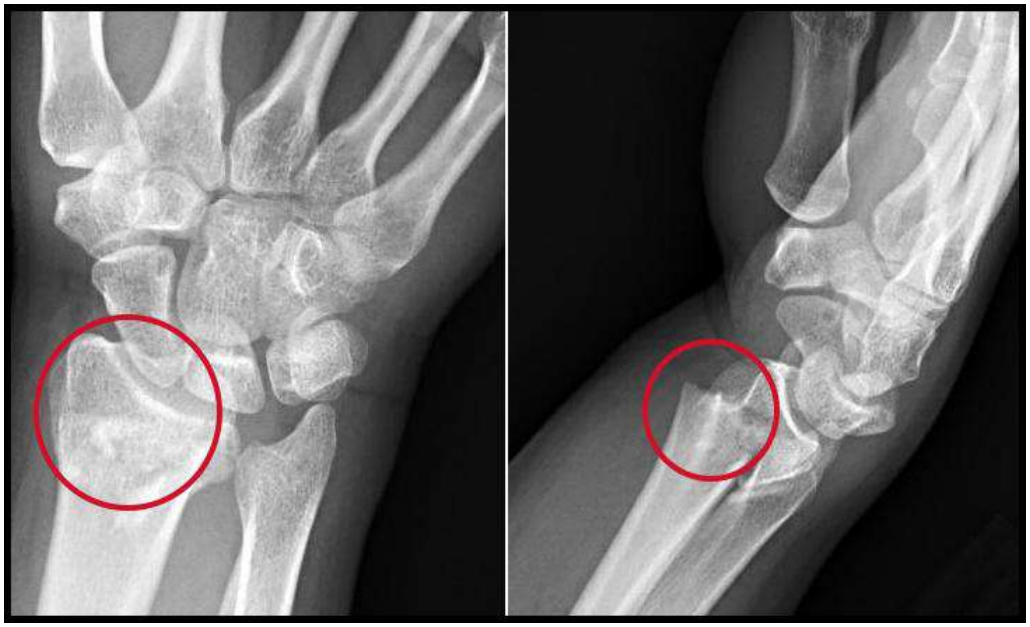
A patient undergoes evaluation of a kidney disease.

(6.1) Name one biochemical marker used to estimate GFR. (04 Marks)
(6.2) State two properties of the biochemical marker mentioned in 6.1, which makes it suitable to estimate GFR. (06 Marks)

(Total: 10 Marks)

(Q7)

Bone Fractures



A 60-year-old woman presents with bone pain and fractures. This patient is suspected of having osteoporosis.

(7.1) What is the biochemical basis of osteoporosis. (04 Marks)
(7.2) Name one biochemical marker of bone resorption. (03 Marks)
(7.3) State one cause of osteoporosis in this patient. (03 Marks)

(Total: 10 Marks)

(Q8)

Thyroid Profile

Test	Result	Reference Range
TSH (mIU/L)	0.001	0.4-4.0
Free T4 (ng/dL)	3.2	0.8-1.8
Free T3 (pg/mL)	5.1	2.3-4.2

A patient presents with weight loss, heat intolerance, and palpitations. The above shown laboratory results are obtained. Primary hyperthyroidism is suspected.

(8.1) State the cellular process which causes heat intolerance in this patient. (04 Marks)
(8.2) State one biochemical function of thyroid hormones. (03 Marks)
(8.3) State the biochemical basis for the suppressed TSH level. (03 Marks)

(Total: 10 Marks)

(Q9)

Zinc Deficiency



A 19-year-old male presents with poor wound healing, recurrent skin infections, loss of appetite, and delayed growth since childhood. On examination, there is perioral dermatitis, thinning hair, and hypogonadism features. A provisional diagnosis of zinc deficiency is considered.

(9.1) State one biochemical role of zinc in human body. (05 Marks)
(9.2) State one biochemical process responsible for poor wound healing in zinc deficiency. (05 Marks)

(Total: 10 Marks)

(Q10)

Iron Studies

Test	Result	Reference Range
Hemoglobin (g/dL)	9.0	12-16
Serum ferritin (ng/mL)	8	15-150
Serum iron (microg/dL)	30	60-170
Total iron binding capacity (TIBC) (microg/dL)	420	250-370

A 25-year-old woman presents with fatigue and pallor. The above laboratory results were obtained. Iron deficiency anaemia is suspected.

(10.1) State one biochemical function of iron. (05 Marks)
(10.2) State the reason for increased TIBC in this patient. (05 Marks)

(Total: 10 Marks)

CAT-3 (BATCH 2) OSPE ANSWERS - 2026

Investigation	Result	Reference Range
Blood Urea Nitrogen (BUN) (mg/dL)	32	7-20
Serum Creatinine (mg/dL)	1.0	0.7-1.3
Serum Total Protein (g/dL)	6.2	6.4-8.3
Serum Albumin (g/dL)	3.1	3.5-5.0

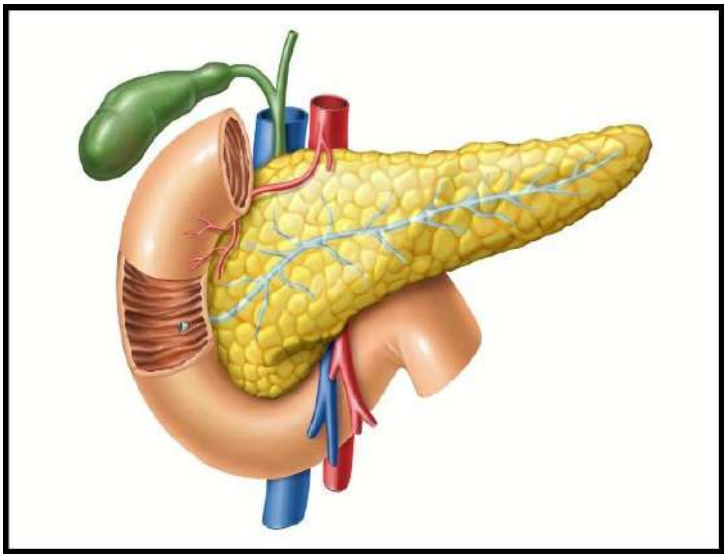
(Q1)
(1.1) Negative nitrogen balance
(1.2)
(1.2.1) High-protein diet or protein supplementation
(1.2.2) Adequate energy (calorie) intake to reduce protein catabolism



(Q2)
(2.1)
(2.1.1) Excess body fat accumulation
(2.1.2) Increased waist circumference (central obesity)
(2.2)
(2.2.1) Reduce portion sizes of rice and other calorie-dense foods
(2.2.2) Increase intake of fruits, vegetables, and dietary fibre
(2.2.3) Avoid sugary drinks, fried foods, and frequent snacking

Test	Result
Urinary creatinine (mg/dL)	21.5
Urinary albumin (g/dL)	1500

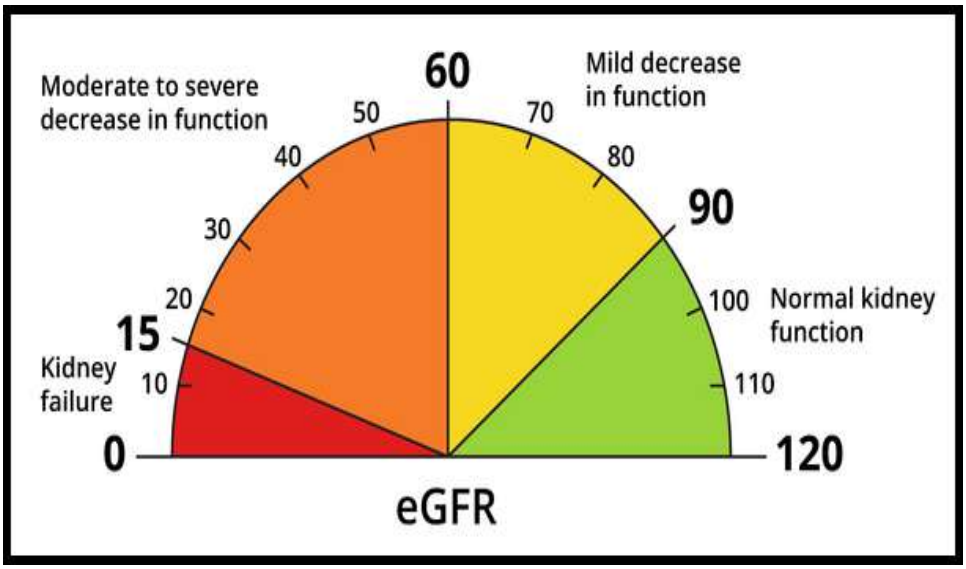
(Q3)
(3.1)
ACR = Albumin / Creatinine
= 1500 / 21.5
= 69.8 g/mg
(3.2)
ACR is markedly elevated (>30 g/mg), indicating significant albuminuria consistent with diabetic kidney disease.



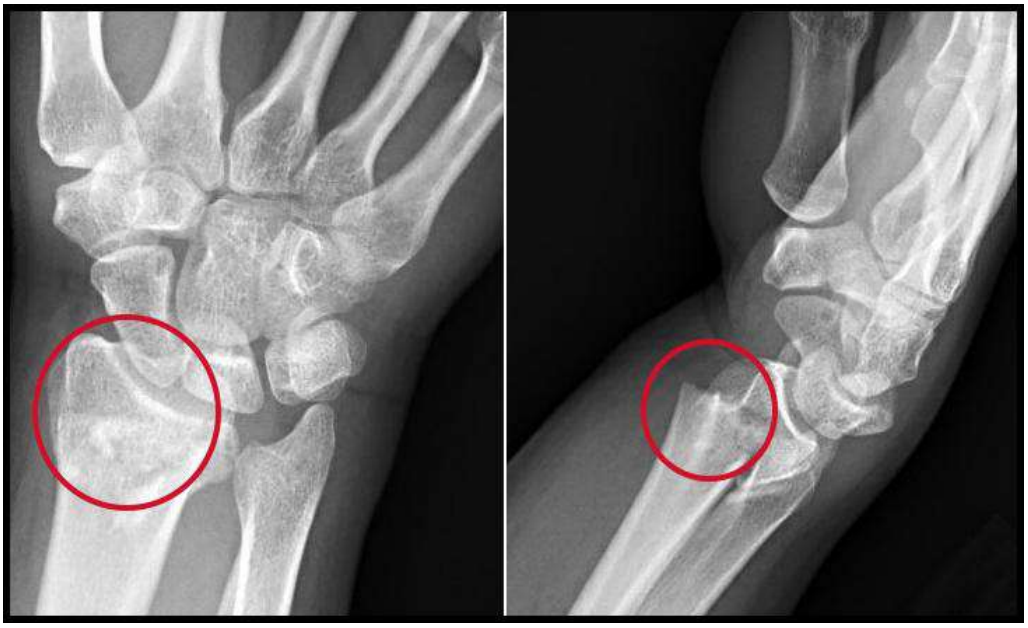
(Q4)
(4.1) Trypsin
(4.2)
(4.2.1) Chronic alcohol consumption
(4.2.2) Pancreatic duct obstruction (e.g., gallstones)



(Q5)
(5.1) Vitamin D deficiency
(5.2) Promotes intestinal absorption of calcium and phosphate
(5.3) Serum 25-hydroxyvitamin D level



(Q6)
(6.1) Serum creatinine
(6.2)
(6.2.1) Freely filtered by the glomerulus
(6.2.2) Produced at a relatively constant rate in the body



(Q7)
(7.1) Increased bone resorption relative to bone formation, resulting in reduced bone mass and density
(7.2) Urinary N-telopeptide (NTX) *(or C-terminal telopeptide, CTX)*
(7.3) Postmenopausal estrogen deficiency

Test	Result	Reference Range
TSH (mIU/L)	0.001	0.4-4.0
Free T4 (ng/dL)	3.2	0.8-1.8
Free T3 (pg/mL)	5.1	2.3-4.2

(Q8)
(8.1) Increased cellular metabolic rate (increased thermogenesis)
(8.2) Increases basal metabolic rate
(8.3) Negative feedback inhibition of pituitary TSH secretion by elevated T3 and T4 levels



(Q9)
(9.1) Zinc acts as a cofactor for many enzymes involved in DNA and protein synthesis
(9.2) Impaired collagen synthesis and cell proliferation during tissue repair

Test	Result	Reference Range
Hemoglobin (g/dL)	9.0	12-16
Serum ferritin (ng/mL)	8	15-150
Serum iron (microg/dL)	30	60-170
Total iron binding capacity (TIBC) (microg/dL)	420	250-370

(Q10)
(10.1) Iron is required for oxygen transport as a component of haemoglobin
(10.2) Increased synthesis of transferrin by the liver in response to iron deficiency, resulting in increased TIBC

SECOND MBBS (BATCH 1)

SECOND MBBS (BATCH 1) – MCQ PAPER - 2025

UVA WELLASSA UNIVERSITY FACULTY OF MEDICINE
2nd MBBS Examination
September 2025
2022/2023 (01st) Batch
Biochemistry
Multiple Choice Questions (MCQ) Paper

[illegible] 12.00 pm (03 hours) Date of the exam: 2025.09.15

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

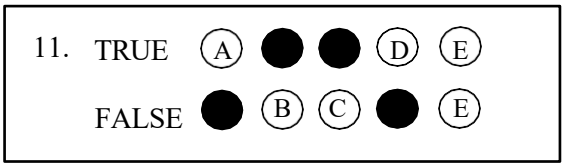
Please read the following instructions before marking responses on your answer sheets

1. Check that your question paper has a total of **14 pages,** including the front page.
2. **A single answer sheet is provided**. Please write your index number in the given space.
3. Read each question carefully before answering.
4. Mark the correct response as a **heavy black mark filling the relevant circle completely**, using a black lead pencil (6B or above grade).
5. Mark no stray marks on the answer sheet. In case of an error, erase cleanly.
6. Your final answer should be a densely coloured circle through which the underlying letter is not visible.
7. Marking using any other method (e.g., mark the circle with a cross) is not valid.

Thirty (30) True/False Type Questions (Questions 1-30/Page 2-6)

1. Mark whether each response is true or false.
2. Given below is an example of how to mark a true/false type question.

Q 11. A woman has
- A. one ovary.
- B. one nose.
- C. two ears.
- D. one eye.
- E. two hairs.

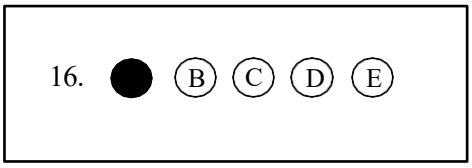


A correct response will get = +1 mark
An incorrect response will get = -1 mark
No response will get = 0 (zero) mark
Negative marks will not be carried over to the next question

Thirty (30) Single Best Response Type Questions (Questions 31-60/ Page 7-14)

1. Mark the best response. Only one response per question should be marked.
2. If you mark the correct response, you will get the full marks for the question.
3. If you mark an incorrect response, fail to mark any response, select more than one response, or mark your response unclearly, you will not receive any marks for that question.
4. Given below is an example of how to mark a single best response type question.

Q 16. Speaking is a unique ability observed in humans. Which of the following body parts is primarily used for speech production?
- A. Tongue
- B. Hands
- C. Feet
- D. Ears
- E. Nose



Questions numbers 01 to 30 are True or False type questions. Mark your answer for each of the 5 responses (A to E).

(1) True or false regarding enzyme inhibition?
(A) Competitive inhibitors cause an increase in K_m.
(B) Cyanide competitively inhibits cytochrome oxidase.
(C) Heavy metals inhibit enzymes by binding sulfhydryl (-SH) residues.
(D) Maximal velocity is affected by competitive inhibitors.
(E) Mercury irreversibly inhibits enzymes.

(2) True or false regarding allosteric enzymes?
(A) Affinity to the substrate is low in the relaxed (R) state.
(B) Constituent subunits cooperate when binding substrate molecules.
(C) The allosteric modifications in enzymes are slower compared to covalent modifications.
(D) Their inhibitors require hormonal signalling.
(E) They possess a quaternary structure.

(3) True or false regarding bilirubin?
(A) Bilirubin diglucuronide is soluble in water.
(B) Bilirubin uptake by hepatocytes is a carrier-mediated process.
(C) Conjugated bilirubin is transported in the blood bound to albumin.
(D) Secretion of conjugated bilirubin is an active process.
(E) Unconjugated bilirubin crosses the blood-brain barrier of the newborn.

(4) True or false regarding the processes that bile pigments undergo in the intestine?
(A) Conjugated bilirubin is deconjugated by beta-glucuronidase.
(B) Conjugated bilirubin is reabsorbed into the portal circulation.
(C) Conjugated bilirubin is converted to urobilinogen.
(D) Urobilinogen does not appear in faeces.
(E) Urobilinogen is reabsorbed into the portal circulation.

(5) True or false regarding the causes for the right-shifted oxygen dissociation curve?
(A) Acidosis
(B) Presence of HbF
(C) Fever
(D) High 2,3-DPG (2,3-Diphosphoglycerate) levels
(E) Methaemoglobinaemia

(6) Which of the following hormones exerts its action via intracellular receptors?
(A) Adrenaline
(B) Cortisol
(C) Glucagon
(D) Insulin
(E) Thyroxine

(7) True or false regarding insulin?
(A) It activates glycogen synthase.
(B) It acts through cAMP as its second messenger.
(C) It promotes glucose uptake in muscle cells by translocation of GLUT-4 transporters.
(D) Insulin resistance leads to type 1 diabetes.
(E) It suppresses hormone-sensitive lipase activity.

(8) True or false regarding haemoglobin?
(A) HbA is composed of two alpha and two beta chains.
(B) Each subunit contains a heme molecule.
(C) Foetal haemoglobin (HbF) has a higher affinity for oxygen than HbA.
(D) The iron in heme is in the ferric (Fe^{3+}) state when binding oxygen.
(E) Transport CO_2 as carbamino-haemoglobin.

(9) Which of the following carbohydrate sources possess a high glycaemic index (GI)?
(A) Brown rice
(B) Cornflakes
(C) Sugar-sweetened beverages
(D) Sweet potatoes
(E) White bread

(10) True or false regarding plasma proteins?
(A) Albumin maintains the plasma colloid osmotic pressure.
(B) Ceruloplasmin transports copper.
(C) Fibrinogen plays a major role in defence against bacterial infection.
(D) Haptoglobin scavenges free haemoglobin in blood.
(E) Transferrin transports iron to the tissues.

(11) True or false regarding immunoglobulins?
(A) IgA is mainly found in mucosal secretions.
(B) IgG is the first to appear in the first encounter with an antigen.
(C) IgM is a monomer.
(D) Cross-linking of IgE occurs on the mast cell in type I hypersensitivity.
(E) Monoclonal gammopathy occurs in multiple myeloma.

(12) True or false regarding nutrient deficiencies?
(A) Iodine deficiency during pregnancy results in cretinism in the newborn.
(B) Vitamin A deficiency causes xerophthalmia.
(C) Vitamin B12 deficiency leads to megaloblastic anaemia.
(D) Vitamin D deficiency in children causes osteomalacia.
(E) Zinc deficiency causes hypogonadism.

(13) True or false regarding amino acids?
(A) All aromatic amino acids are essential.
(B) Essential amino acids must be supplied through the diet.
(C) Glutathione is an example of an essential amino acid.
(D) Histidine contributes to buffering action in proteins.
(E) Tyrosine is required for thyroid hormone synthesis.

(14) True or false regarding dietary fibres?
(A) Cellulose increases faecal bulk.
(B) Dietary fibres are digested in the human small intestine.
(C) Insoluble fibres help lower blood cholesterol.
(D) Intake of dietary fibres improves satiety.
(E) Pectin reduces glucose absorption in the intestine.

(15) True or false regarding secondary (acquired) lactose intolerance?
(A) Gut microbes contribute in pathogenesis.
(B) Lactose intolerance leads to bloating after consuming condensed milk.
(C) Patients with lactose intolerance can tolerate yoghurt.
(D) Occurs after infective diarrhoea.
(E) Secondary lactose intolerance is irreversible.

(16) True or false regarding metabolic changes in galactosemia?
(A) Accumulation of galactose-1-phosphate in the liver leads to hepatomegaly.
(B) Galactosemia is caused by a deficiency of the enzyme galactase.
(C) Galactosemia causes neurological defects.
(D) Galactosemia causes cataracts.
(E) Soy-based formulas are recommended for infants with galactosemia.

(17) True or false regarding germination of pulses?
(A) It decreases tannins.
(B) It increases vitamin C content.
(C) It leads to the formation of new enzymes that aid in metabolism.
(D) It reduces the digestibility of carbohydrates.
(E) It reduces the protein content.

(18) True or false regarding diet planning for patients with chronic kidney disease (CKD)?
(A) Bananas in the diet are encouraged.
(B) Fluid restriction is required in patients on dialysis.
(C) Intake of nuts is restricted in advanced CKD.
(D) Patients with CKD should avoid meat.
(E) Sodium restriction is recommended.

(19) True or false regarding diet planning for patients with obesity?
(A) Legumes help maintain muscle mass during weight loss.
(B) Oats help to reduce overall food intake.
(C) Recommended portion is not influenced by physical activity.
(D) Diet soda is encouraged in rapid weight loss diets.
(E) Calorie-dense food restriction is a key strategy.

(20) True or false regarding vitamins?
(A) Thiamine deficiency causes beriberi
(B) Vitamin B12 deficiency causes pernicious anaemia.
(C) Vitamin C deficiency leads to night blindness.
(D) Vitamin D toxicity causes hypercalcemia.
(E) Vitamin K deficiency causes scurvy.

(21) True or false regarding carbohydrate metabolism?
(A) Fructose-1,6-bisphosphate inhibits glycolysis.
(B) Gluconeogenesis occurs in the kidneys.
(C) Glycogen storage disease type I is caused by a deficiency of glucose-6-phosphatase.
(D) Lactose intolerance is caused by an immune reaction to milk proteins.
(E) Pyruvate dehydrogenase links glycolysis to the TCA cycle.

(22) True or false regarding disorders of protein metabolism?
(A) Homocysteineuria leads to decreased levels of methionine.
(B) Hyperammonemia results from carbamoyl phosphate synthetase I (CPS I) deficiency.
(C) Phenylketonuria is due to tyrosine deficiency.
(D) Alkaptonuria is an acquired condition.
(E) Maple syrup urine disease (MSUD) is an autosomal recessive disorder.

(23) True or false regarding lipid metabolism?
(A) Carnitine is required for the transport of long-chain fatty acids into mitochondria.
(B) Dietary cholesterol is not an energy source.
(C) Deficiency of lipoprotein lipase leads to hypertriglyceridemia.
(D) Medium-chain triglycerides require bile salts for absorption.
(E) Statins inhibit HMG-CoA reductase enzyme.

(24) True or false regarding purine metabolism?
(A) Allopurinol inhibits xanthine oxidase.
(B) Hypoxanthine-guanine phosphoribosyltransferase (HGPRT) deficiency leads to the accumulation of guanine.
(C) Hyperuricemia is the main cause of self-mutilation in Lesch–Nyhan syndrome.
(D) Purine nucleotides are degraded into glucose.
(E) Xanthine oxidase converts xanthine to uric acid.

(25) True or false regarding pyrimidine metabolism?
(A) Defects in pyrimidine synthesis leads to orotic aciduria.
(B) Pyrimidine catabolism produces uric acid as the final product.
(C) Pyrimidine de novo synthesis starts with ribose-5-phosphate.
(D) Pyrimidine nucleotides are degraded to intermediates of energy production.
(E) Pyrimidine breakdown produces β-Alanine.

(26) True or false regarding effects of hormones?
(A) Epinephrine decreases lipolysis.
(B) Estrogen promotes the accumulation of subcutaneous fat.
(C) Follicle-stimulating hormone (FSH) stimulates estradiol production.
(D) Thyroid hormones increase the basal metabolic rate.
(E) The effects of vitamin D are enhanced by magnesium.

(27) True or false regarding haemoglobin metabolism?
(A) Heme is degraded to bilirubin.
(B) The reduction of ferric (Fe^{3+}) into ferrous (Fe^{2+}) leads to methemoglobinemia.
(C) Excessive degradation of haemoglobin causes porphyria.
(D) Unconjugated bilirubin levels are elevated in sickle cell anaemia.
(E) Production of globin chains is reduced in thalassemia.

(28) True or false regarding the functions of phospholipids?
(A) It is a precursor for steroid hormones.
(B) They act as surfactants in the lungs.
(C) They form the basic structural framework of cell membranes.
(D) They increase membrane fluidity at high temperatures.
(E) They serve as intracellular signalling molecules.

(29) True or false regarding maple syrup urine disease (MSUD)?
(A) Early dietary restriction of branched-chain amino acids minimises neurological damage.
(B) It leads to the accumulation of leucine.
(C) It commonly results in hypoglycaemia as the main metabolic abnormality.
(D) It is caused by a deficiency of branched-chain α-ketoacid dehydrogenase.
(E) Urine has a characteristic sweet odour.

(30) True or false regarding transcription?
(A) A poly (A) tail is added to the 5’ end of most eukaryotic mRNAs.
(B) In eukaryotes, transcription occurs in the nucleus.
(C) mRNA is synthesized in the 3’ to 5’ direction.
(D) pre-mRNA undergoes splicing to remove introns before translation.
(E) RNA polymerase binds to promoter regions to initiate transcription.

Questions numbers 31 to 60 are Single Best Response (SBR) type. Select the best response to each question.

(31) A 45-year-old man with a history of chronic alcoholism presents with confusion, ataxia, and ophthalmoplegia. On examination, peripheral neuropathy and oedema were detected. Thiamine deficiency is suspected.

Which of the following biochemical processes is directly impaired in thiamine deficiency?
(A) Conversion of pyruvate to acetyl-CoA by pyruvate dehydrogenase.
(B) Formation of carbamoyl phosphate in the urea cycle.
(C) Formation of NADPH via the HMP shunt.
(D) Glycogen breakdown by glycogen phosphorylase.
(E) Oxidation of fatty acids by β-oxidation.

(32) A 22-year-old athlete performs a 400-meter sprint. During the sprint, his skeletal muscles become hypoxic, and he experiences rapid fatigue.

Which of the following best explains the metabolic adaptation in his muscles during this period?
(A) Activation of gluconeogenesis in muscle.
(B) Anaerobic glycolysis regenerating NAD^+.
(C) Increasing oxidative phosphorylation in mitochondria.
(D) Inhibition of phosphofructokinase.
(E) β-oxidation of fatty acids for rapid ATP production.

(33) A 20-year-old man skips breakfast and goes for a morning jog. During exercise, his blood tests reveal low plasma glucose and elevated glucagon.

Which of the following biochemical processes is primarily responsible for maintaining his blood glucose during this period?
(A) Fatty acid β-oxidation in muscle
(B) Gluconeogenesis from amino acids
(C) Glycogenolysis in the liver
(D) Glycogenolysis in the muscle
(E) Ketone body production in the liver

(34) A 40-year-old man has been trapped without food for 10 days. Over this period, he has lost significant body weight and developed noticeable muscle wasting. Despite the presence of elevated ketone bodies in his blood, his blood glucose remains low.

Which of the following metabolic processes is primarily ensures a continuous supply of substrates for energy production at this stage?
(A) Glycogenolysis
(B) Ketone body utilization by the brain
(C) Lactate fermentation
(D) Lipolysis
(E) Proteolysis of skeletal muscle

(35) A 35-year-old man presents with bleeding gums, easy bruising, and fatigue. On examination, his gums are swollen, spongy, and bleed easily. Dietary history reveals a very low intake of fruits and vegetables over the past several months.

Which of the following nutrient deficiencies best explains the biochemical basis of his gum findings?
(A) Fluoride
(B) Iron
(C) Vitamin C
(D) Vitamin D
(E) Zinc

(36) A 30-year-old man notices cola-coloured urine after strenuous exercise. Dipstick urinalysis is positive for blood, but no RBCs on microscopy.

Which of the following is the most likely cause?
(A) Acute glomerulonephritis
(B) Haemoglobinuria
(C) Proteinuria
(D) Urolithiasis
(E) UTI causing haematuria

(37) A 58-year-old man presents with fatigue, pallor, and glossitis. Laboratory tests reveal macrocytic anaemia and low serum vitamin B12 levels. His gastric biopsy shows autoimmune destruction of parietal cells.

Which of the following best explains his vitamin B12 deficiency?
(A) Absence of intrinsic factor secretion
(B) Defective absorption due to Crohn's disease
(C) Folate deficiency due to poor diet
(D) Increased vitamin B12 utilization during haemolysis
(E) Lack of dietary vitamin B12 intake

(38) A 7-year-old boy is thin, with low weight and height for his age. His mid-upper arm circumference is reduced. Blood tests show low serum albumin and mild anaemia.

Which of the following best describes his nutritional status?
(A) Acute infection
(B) Acute starvation
(C) Chronic malnutrition
(D) Iron deficiency
(E) Vitamin B12 deficiency

(39) A 55-year-old man with chronic obstructive pulmonary disease (COPD) is brought to the emergency department with shortness of breath. His arterial blood gas shows:

- pH: 7.32 (7.35-7.45)
- $PaCO_2$: 60 mmHg (↑)
- HCO_3^-: 35 mEq/L (↑)

Which of the following is the most important immediate buffer system in the blood that resists this acid–base disturbance?
(A) Ammonia buffer system
(B) Bicarbonate buffer system
(C) Haemoglobin buffer system
(D) Phosphate buffer system
(E) Plasma proteins buffer system

(40) Coconut oil contains substances that are considered to be harmful to human health.

Which of the following compounds found in coconut oil is most likely to promote atherosclerosis?
(A) Lauric acid
(B) Linoleic acid
(C) Medium-chain triglycerides
(D) Oleic acid
(E) Trans-fatty acids

(41) Atherosclerotic plaque is made of several molecular and cellular components.

Which of the following is the major biochemical component of atherosclerotic plaques?
(A) Cholesterol esters
(B) Chylomicrons
(C) HDL
(D) Phospholipids
(E) Triglycerides

(42) Red blood cells lack mitochondria and therefore depend on specific cytosolic pathways for energy production and protection against oxidative damage.

Which of the following is a key metabolic reaction occurring in RBCs that helps protect haemoglobin and the cell membrane from oxidative stress?
(A) ATP generation by oxidative phosphorylation
(B) Krebs cycle for aerobic ATP production
(C) NADPH production via the pentose phosphate pathway
(D) Urea cycle for ammonia detoxification
(E) β-oxidation of fatty acids for energy

(43) The glucose–alanine cycle is a key metabolic pathway that manages nitrogen disposal and energy metabolism, especially during fasting or prolonged exercise.

Which of the following best describes the role of the glucose–alanine cycle in nitrogen disposal?

(A) Conversion of ammonia to glutamate in the brain
(B) Detoxification of ammonia in the intestine
(C) Storage of ammonia in adipose tissue
(D) Transport of ammonia from muscle to liver
(E) Transport of ammonia from the liver to the kidneys

(44) Transamination is a significant biochemical reaction in amino acid metabolism.

Which of the following processes best describes the primary role of transamination reactions?

(A) Conversion of ammonia to urea
(B) Direct oxidation of amino acids for ATP
(C) Production of nonessential amino acids
(D) Removal of nitrogen from the body
(E) Storage of amino acids in the liver

(45) Cholesterol is a lipid molecule consisting of a rigid four-ring steroid nucleus with a hydroxyl group (-OH) at C3, a hydrocarbon tail at C17.

Which of the following processes best describes one of primary functions of cholesterol in the human body?

(A) Energy production via oxidation
(B) Generation of cyclic AMP (cAMP)
(C) Production of inositol triphosphate (IP_3)
(D) Production of prostaglandins
(E) Synthesis of bile acids

(46) A 9-month-old infant presents with vomiting, hypoglycaemia, jaundice, and hepatomegaly after introduction of fruit juices. Laboratory shows elevated fructose-1-phosphate levels and diagnosed with hereditary fructose intolerance.

Which of the following enzyme deficiencies is present in this patient?

(A) Aldolase B
(B) Galactose-1-phosphate uridyltransferase
(C) Glucose-6-phosphatase
(D) Glycogen phosphorylase
(E) Lactase

(47) A 55-year-old man was diagnosed with type 2 diabetes and screened for chronic complications. His serum creatinine is mildly elevated, and his HbA1c level is 9% (Normal range < 6.5%).

Which of the following investigations best estimates the early diabetic nephropathy in this patient?

(A) Blood urea
(B) Creatinine clearance
(C) Serum uric acid
(D) Serum creatinine
(E) Urine albumin/ urine creatinine ratio

(48) An adult patient presents with yellowish discoloration of the skin and sclera. Bile duct obstruction was suspected.

Which of the following biochemical findings is expected to be present in this patient?
(A) Elevated indirect bilirubin
(B) Elevated urinary urobilinogen
(C) Elevated AST
(D) Elevated ALT
(E) Elevated ALP

(49) A 3-day-old newborn presents with yellowish discoloration of the skin and sclera. Laboratory tests show elevated unconjugated bilirubin levels. The baby is otherwise healthy, feeding well, and active. There is no history of blood group incompatibility or family history of haemolytic disease. Upon examination, mild icterus is observed, with no hepatosplenomegaly.

Which of the following is the primary cause of unconjugated hyperbilirubinemia in this infant?
(A) Haemolysis due to ABO incompatibility
(B) Hepatocellular damage caused by infection
(C) Impaired conjugation due to immature UDP-glucuronyltransferase
(D) Increased production of conjugated bilirubin
(E) Obstruction of the common bile duct

(50) A 10-year-old child presents with recurrent painful crises. His Hb electrophoresis shows predominantly HbS.

Which of the genetic abnormalities is present in sickle cell anaemia?
(A) Mutation of α-globin gene
(B) Deficiency of γ-globin chains
(C) Deletion of δ-globin gene
(D) Deletion of β-globin gene
(E) Mutation in β-globin gene

(51) A 2-year-old child presents with bowed legs, delayed walking, and softening of the skull. The child was suspected of having rickets.

Which of the following biochemical abnormalities is most likely to be present in rickets?
(A) Decreased alkaline phosphatase
(B) Decreased serum calcium
(C) Elevated parathyroid hormone
(D) Increased serum phosphate
(E) Normal vitamin D levels

(52) A patient with type 1 diabetes presents with vomiting, abdominal pain, and rapid breathing. Laboratory tests show high blood glucose and ketone bodies.

Which of the following is the most likely cause for the development of ketoacidosis in this patient?
(A) Decreased fatty acid oxidation
(B) Decreased gluconeogenesis
(C) Excess insulin stimulated lipogenesis
(D) Increased hepatic ketogenesis
(E) Reduced activity of hormone-sensitive lipase

(53) A 45-year-old man presents with fatigue, joint pain, and skin hyperpigmentation. Laboratory tests reveal high serum ferritin and transferrin saturation. Genetic testing confirms a mutation in the HFE gene.

Which of the following is the most likely diagnosis?
(A) Anaemia of chronic disease
(B) Beta thalassaemia trait
(C) Hereditary hemochromatosis
(D) Polycythaemia
(E) Sideroblastic anaemia

(54) A 35-year-old woman presents with fatigue, pallor, and shortness of breath on exertion. Examination revealed pale conjunctiva and spoon-shaped nails. Her investigations identified the presence of microcytic, hypochromic anaemia.

Which of the following laboratory findings is most likely to be present?
(A) Decreased serum folate levels
(B) Decreased serum transferrin saturation
(C) Decreased total iron-binding capacity (TIBC)
(D) Increased serum ferritin
(E) Reduced serum haptoglobin

(55) A 5-year-old boy presents with recurrent respiratory tract infections, steatorrhea, and poor weight gain. His parents report salty-tasting skin. Genetic testing confirms a mutation in a gene encoding a membrane transport protein.

Which of the following is the most likely defective protein in this patient?
(A) Aquaporin-2
(B) Cystic fibrosis transmembrane conductance regulator (CFTR)
(C) Glucose transporter 4 (GLUT4)
(D) Hydrogen-potassium ATPase
(E) Sodium-potassium ATPase

(56) A 28-year-old woman presents to the clinic with recurrent severe abdominal pain, episodes of anxiety and hallucinations, and dark-colored urine. Her symptoms are intermittent and often triggered by certain medications. Genetic testing suggests a porphyria.

Which of the following enzymes is the most likely to be defective in this patient?
(A) Dihydropyrimidine dehydrogenase
(B) Hypoxanthine-guanine phosphoribosyltransferase (HGPRT)
(C) Orotate phosphoribosyltransferase
(D) Porphobilinogen deaminase
(E) Xanthine oxidase

(57) A baby born to a mother with rubella infection during late pregnancy is found to have serum IgM antibodies against the rubella virus. He is diagnosed with congenital rubella infection.

What is the best explanation for the high IgM levels of this baby?
(A) IgM is stored in the liver before birth.
(B) IgM is transferred through breast milk.
(C) IgM production starts after birth.
(D) Maternal IgM antibodies crossed the placenta.
(E) Production of IgM in utero by the baby.

(58) A 55-year-old man with a history of hyperlipidaemia presents with exertional chest pain suggestive of angina. His ECG shows ischemic changes.

Which of the following biochemical processes primarily contributes to the formation of atherosclerotic plaques?
(A) Decreased uptake of very-low-density lipoprotein (VLDL) by the liver.
(B) Enhanced fibrinolysis in blood vessels.
(C) Excessive production of ketone bodies.
(D) Increased synthesis of high-density lipoprotein (HDL).
(E) Oxidation of low-density lipoproteins (LDL) results in foam cells.

(59) A 30-year-old woman experiences abdominal cramps, bloating, and diarrhoea shortly after consuming milk. Her symptoms improve with a lactose-free diet.

Which of the following best explains her condition?
(A) Autoimmune destruction of intestinal villi
(B) Deficiency of sucrase enzyme in the brush border
(C) Deficiency of lactase enzyme
(D) Impaired absorption of glucose in the small intestine
(E) Increased pancreatic amylase secretion

(60) A 38-year-old lady underwent radiotherapy for an intracranial tumour. A few months later, she presents with cold intolerance, lethargy, and weight gain. Her thyroid profile is given below.

Analytes	Test results	Reference range
TSH (mIU/L)	0.2	0.4 - 4.0
Free T4 (ng/dL)	0.01	0.8 -1.8
Free T3 (ng/dL)	30.0	70 -200

Which of the following is the most likely diagnosis?
(A) Primary hyperthyroidism
(B) Primary hypothyroidism
(C) Secondary hyperthyroidism
(D) Secondary hypothyroidism
(E) Graves' disease

SECOND MBBS (BATCH 1) – MCQ ANSWERS - 2025

(1) TFTFT
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(21) FTTFT
(22) FTFFT
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(25) TFFTT
(26) FTTTT
(27) TFFTT
(28) FTTTT
(29) TTFTT
(30) FTFTT
(31) A
(32) B
(33) C
(34) D
(35) C
(36) B
(37) A
(38) C
(39) B
(40) E
(41) A
(42) C
(43) D
(44) C
(45) E
(46) A
(47) E
(48) E
(49) C
(50) E
(51) C
(52) D
(53) C
(54) B
(55) B
(56) D
(57) E
(58) E
(59) C
(60) D

SECOND MBBS (BATCH 1) – SEQ PAPER - 2025

UVA WELLASSA UNIVERSITY FACULTY OF MEDICINE

2nd MBBS Examination

September 2025 2022/2023

(01st) Batch Biochemistry

Structured Essay Questions (SEQ) Paper

Time 1.00 pm – 4.00 pm (03 hours) Date of the exam: 2025.09.15

Index (MED) Number ……

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

Instructions to Candidates

- This paper contains two (06) Structured Essay Questions.
- Answer all questions.
- Write your answers in the spaces provided.
- If additional space is required, you may use extra sheets. Ensure that the relevant question number is clearly indicated on each additional sheet.
- Write your index number in the designated space on each answer sheet, including any extra sheets used.

(Q1) A 15-year-old boy presents with polyuria, polydipsia, weight loss, and fasting plasma glucose levels of 380.0 mg/dL (Normal range 70-110 mg/dL). Ketone bodies are detected in urine.

(1.1) What is the most probable diagnosis? (10 Marks)

(1.2) What is the underlying cause? (05 Marks)

(1.3) Name one (01) qualitative test to detect ketone bodies in urine. (05 Marks)

(1.4) Explain the biochemical basis for the following findings in this patient.

(1.4.1) Hyperglycaemia (25 Marks)

(1.4.2) Ketone bodies in urine (20 Marks)

(1.4.3) Weight loss (25 Marks)

(1.5) Mention two (02) principles of treatment for this patient. (10 Marks)

(Total: 100 Marks)

(Q2) A 45-year-old obese woman diagnosed with gallstones developed colicky abdominal pain. Ultrasound scan of the abdomen showed common bile duct obstruction. She complained of passing fatty stools.

(2.1) State the probable reason for the development of fatty stools. (10 Marks)

(2.2) Briefly explain the role of bile salts in the process of lipid digestion and absorption. (20 Marks)

(2.3) Explain the biochemical basis of the formation of cholesterol gallstones. (30 Marks)

(2.4) in this patient. (10 Marks)

(2.5) Briefly explain the role of the chylomicrons in the process of exogenous lipid transport. (30 Marks)

(Total: 100 Marks)

(Q3) A 10-year-old boy diagnosed with beta thalassemia major was on chronic blood transfusions due to severe anaemia. After three months of treatment, he was found to have very high serum ferritin levels.

(3.1) What is the type of inheritance of beta thalassemia major? (05 Marks)
(3.2) What is the type of genetic mutation? (05 Marks)
(3.3) Explain the biochemical basis for the development of anaemia in this child. (35 Marks)
(3.4) Explain the biochemical basis for the high serum ferritin levels. (35 Marks)
(3.5) What is the treatment for the iron overload? (10 Marks)
(3.6) State two (02) complications that he can develop due to iron overload. (10 Marks)

(Total: 100 Marks)

(Q4) A 65-year-old man was a chronic alcohol user admitted to a medical ward with abdominal distension, bilateral leg swelling, altered consciousness, and mild jaundice. His abdominal ultrasound scan showed a nodular liver. Biochemical investigations revealed elevated levels of serum ammonia.

(4.1) What is the most probable cause for the altered consciousness of this patient? (10 Marks)
(4.2) Explain the biochemical basis for hyperammonaemia in this patient. (30 Marks)
(4.3) What is the reason for the development of abdominal distension and lateral leg swelling? (10 Marks)
(4.4) Explain the biochemical basis for the development of the lateral leg swelling. (40 Marks)
(4.5) Mention two (02) other complications that he could develop. (10 Marks)

(Total: 100 Marks)

(Q5)

(5.1) Regarding vitamins

(5.1.1) State two (02) vitamins with antioxidant properties. (10 Marks)
(5.2.2) State two (02) vitamins that form coenzymes. (10 Marks)
(5.2) Briefly explain the biochemical basis of the development of night blindness. (35 Marks)
(5.3) A 3-year-old child presents with bowing of the legs and delayed tooth eruption. A vitamin deficiency is suspected.
(5.3.1) What is the most likely vitamin deficiency? (05Marks)
(5.3.2) List two (02) sources of the vitamin mentioned in 5.3.1. (10Marks)
(5.3.3) What is the active form of the vitamin mentioned in 5.3.1? (05Marks)
(5.3.4) What is the probable condition developed in this child? (05Marks)
(5.3.5) Outline the biochemical basis for the development of the condition mentioned in 5.3.4. (20Marks)

(Total: 100 Marks)

(Q6) A 52-year-old chain smoker presents with central obesity and chest pain on exertion. His mother had diabetes mellitus and died of premature coronary heart disease. He does little exercise and frequently consumes high-energy food.

(6.1) State three (03) cardiovascular risk factors present in this patient. (15 Marks)

(6.2) What is the most appropriate biochemical investigation to assess the lipid abnormalities of this patient? (05 Marks)

(6.3) State two (02) expected lipid abnormalities present in this patient. (10 Marks)

(6.4) State the biochemical basis for the development of obesity of this patient. (25 Marks)

(6.5) This patient has high risk of developing atherosclerosis. What is the biochemical basis for the development of atherosclerosis? (30 Marks)

(6.6) State three (03) lifestyle modifications recommended for this patient. (15 Marks)

(Total: 100 Marks)

SECOND MBBS (BATCH 1) – SEQ ANSWERS - 2025

(Q1)
(1.1) Type 1 Diabetes Mellitus with diabetic ketoacidosis (10)
(1.2) Absolute insulin deficiency due to autoimmune destruction of pancreatic β-cells(05)
(1.3) Rothera's test (05)
(1.4.1) Hyperglycaemia

• Absolute insulin deficiency reduces glucose uptake by muscle and adipose tissue (5)
• Increased hepatic glycogenolysis releases glucose into blood (5)
• Increased gluconeogenesis in the liver increases glucose production (5)
• Increased protein catabolism provides amino acids for gluconeogenesis (5)
• Increased secretion/action of counter-regulatory hormones (glucagon, adrenaline, cortisol, growth hormone) further elevates blood glucose (5)

(Total: 25 Marks)

(1.4.2) Ketone bodies in urine

• Insulin deficiency activates hormone-sensitive lipase causing increased lipolysis (5)
• Increased release of free fatty acids from adipose tissue to the liver (5)
• Hepatic β-oxidation of fatty acids generates excess acetyl-CoA (5)
• Excess acetyl-CoA is converted into ketone bodies, which are excreted in urine (5)

(Total: 20 Marks)

(1.4.3) Weight loss
• Glucose is lost in urine due to glycosuria, causing caloric loss (5)
• Increased lipolysis depletes adipose tissue fat stores (5)
• Increased proteolysis leads to muscle wasting (5)
• Dehydration due to osmotic diuresis contributes to weight loss (5)
• Negative energy balance due to inability to utilize glucose effectively (5)

(Total: 25 Marks)

(1.5)
• Insulin therapy (5)
• Rehydration and correction of electrolyte imbalance (5)

(Total: 10 Marks)
(Total: 100 Marks)

(Q2)
(2.1) Impaired fat digestion due to cholestasis/bile duct obstruction (10)
(2.2)
- Bile salts emulsify dietary fats (5)
- Increase surface area for pancreatic lipase (5)
- Form micelles (5)
- Facilitate absorption of fatty acids and monoglycerides (5)

(2.3)
- Reduced bile salts in bile (5)
- Cholesterol exceeds solubilizing capacity of bile (5)
- Cholesterol precipitates in gallbladder (5)
- Formation of cholesterol gallstones (5)

(2.4)
- Vitamin A deficiency (5)
- Vitamin D deficiency (5)
  (Also acceptable: Vitamin E or Vitamin K deficiency)

(2.5)

Synthesized in intestinal mucosal cells (6)

- Transport dietary triglycerides and cholesterol (6)
- Enter circulation via lymphatics (6)
- Deliver triglycerides to muscle and adipose tissue (6)
- Remnants are taken up by the liver (6)

(Q3)

(3.1) Autosomal recessive (5)
(3.2) Point mutation (5)
(3.3)

- Decreased or absent β-globin chain synthesis (5)
- Excess α-globin chains precipitate (5)
- Oxidative damage to erythroid precursors (5)
- Ineffective erythropoiesis (5)
- Extravascular hemolysis (5)
- Reduced hemoglobin synthesis causing severe anemia (5)

(3.4)

- Suppressed hepcidin increases intestinal iron absorption(5)
- Repeated blood transfusions cause iron accumulation (5)
- No physiological mechanism for iron excretion (5)
- Excess iron stored as ferritin and hemosiderin (5)
- Markedly elevated serum ferritin levels (5)

(3.5) Iron chelation therapy(10)
(3.6)

- Cirrhosis (5)
- Diabetes mellitus(5)

(Q4)

(4.1) Hepatic encephalopathy due to hyperammonaemia (10)
(4.2)

- Impaired urea cycle activity (5)
- Reduced ammonia detoxification (5)
- Portosystemic shunting (5)
- Increased intestinal ammonia production (5)
- Reduced hepatic uptake of ammonia (5)

(4.3) Portal hypertension and hypoalbuminaemia (10)
(4.4)

- Reduced albumin synthesis (8)
- Decreased plasma oncotic pressure (8)
- Fluid movement into interstitial spaces (8)
- Sodium and water retention (8)
- Increased hydrostatic pressure due to portal hypertension (8)

(4.5.1) Hepatorenal syndrome (5)
(4.5.2) Coagulopathy/bleeding tendency (5)

(Q5)

(5.1.1)

- Vitamin C (5)
- Vitamin E (5)
-

(5.1.2)

- Vitamin B_1 (Thiamine) (5)
- Vitamin B_2 (Riboflavin) (5)

(5.2)
- Vitamin A deficiency (7)

- Reduced formation of 11-cis-retinal (7)
- Impaired rhodopsin regeneration (7)
- Poor adaptation to dim light (7)
- Night blindness (7)

- **(5.3.1)** Vitamin D deficiency (5)

(5.3.2)
- Sunlight exposure (5)
- Dietary sources (fish liver oil, egg yolk, fortified milk) (5)

(5.3.3) 1,25-Dihydroxycholecalciferol (Calcitriol) (5)
(5.3.4) Rickets (5)
(5.3.5)
- Decreased intestinal calcium absorption (4)
- Decreased phosphate absorption (4)
- Hypocalcaemia (4)
- Secondary hyperparathyroidism (4)
- Defective bone mineralization (4)

(Q6)

(6.1)
- Smoking (5)
- Central obesity (5)
- Family history of diabetes mellitus/premature coronary heart disease (5)

(6.2) Lipid profile (5)
(6.3.1) Elevated triglycerides/VLDL (5)
(6.3.2) Reduced HDL cholesterol (5)
(6.4)
- Chronic positive energy balance (5)
- Excess caloric intake (5)
- Reduced physical activity (5)
- Increased lipogenesis (5)
- Increased triglyceride storage in adipose tissue (5)
- Hyperinsulinaemia promotes fat accumulation (5)

(6.5)
- Dyslipidaemia with elevated LDL/VLDL (5)
- Oxidation of LDL (5)
- Endothelial dysfunction (5)
- Macrophage uptake of oxidized LDL (5)
- Foam cell formation (5)
- Fatty streak formation (5)
- Fibrous plaque development (5)
- Plaque rupture and thrombosis (5)

(6.6.1) Smoking cessation (5)
(6.6.2) Regular physical exercise (5)
(6.6.3) Weight reduction through healthy diet and lifestyle changes (5)

SECOND MBBS (BATCH 1)- OSPE PAPER - 2025

(Q1)

Primary Hypothyroidism



A 28-year-old woman from a rural area in Sri Lanka presents with fatigue, weight gain, cold intolerance, and constipation. On examination, she has dry skin, a slow heart rate, and a diffusely enlarged, non-tender thyroid gland. Primary hypothyroidism is suspected.

(1.1) State the most likely micronutrient deficiency in this patient? (03 Marks)
(1.2) State the most appropriate biochemical investigation to confirm the diagnosis? (03 Marks)
(1.3) State the function of the micronutrient mentioned in 1.1. in this condition. (04 Marks)

(Total: 10 Marks)

(Q2)

Hyperbilirubinemia

A 2-day-old neonate's bilirubin report is given.

Test	Results	Reference range
Total bilirubin (mg/dL)	15	Up to 5
Direct (conjugated) bilirubin (mg/dL)	1	< 1

(2.1) What type of hyperbilirubinemia is present in this baby? (03 Marks)
(2.2) State two (02) possible causes for this condition in neonates. (04 Marks)
(2.3) State the biochemical basis for the phototherapy in this patient? (03 Marks)

(Total: 10 Marks)

(Q3)

Acid-Base Balance

A 45-year-old man is brought to the emergency department with rapid shallow breathing, confusion, and generalized weakness. His arterial blood gas (ABG) analysis results are given.

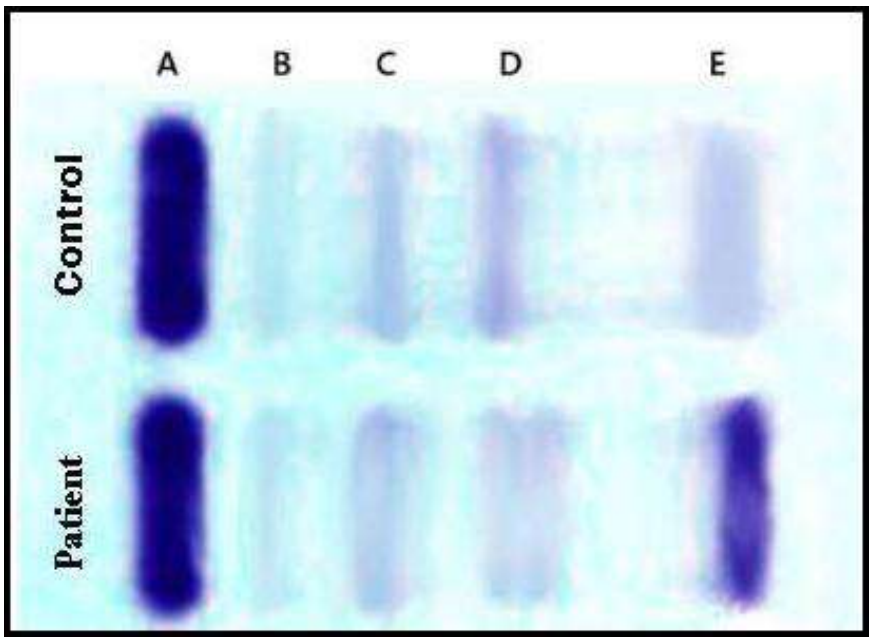
Test	Results	Reference range
pH	7.25	7.35-7.45
HCO3- (mmol/L)	15	22-26
pCO2 (mmHg)	30	35-45

(3.1) State the type of acid-base disturbance developed by this patient. (04 Marks)
(3.2) List two (02) possible causes for the condition mentioned in 3.1. (06 Marks)

(Total: 10 Marks)

(Q4)

Serum Protein Electrophoresis



A 60-year-old man presents with persistent bone pain, anaemia, and recurrent infections. His serum protein electrophoresis pattern is given.

(4.1) Name the main protein fractions separated by serum protein electrophoresis labelled as A, B, C, D, and E. (05 Marks)

(4.2) State the abnormality observed in the serum protein electrophoretogram of the patient. (05 Marks)

(Total: 10 Marks)

(Q5)

Fasting Blood Glucose

A 42-year-old woman with obesity is screened for diabetes. Her test results are shown.

Test	Results	Reference range
Fasting blood glucose (mg/dL)	115	<100

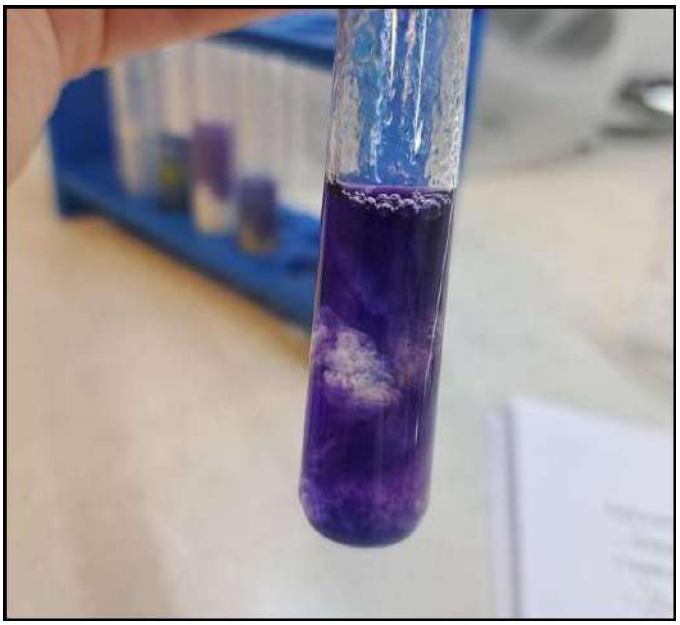
(5.1) What is the most likely condition developed by this patient? (05 Marks)

(5.2) State the most appropriate biochemical investigation to find out her long-term glycaemic control? (05 Marks)

(Total: 10 Marks)

(Q6)

Biuret Test



A 19-year-old male athlete presents for a nutritional assessment. His diet is supplemented with protein shakes. To confirm the presence of proteins in a sample of his supplement, the Biuret test is performed, and the result is given.

(6.1) Interpret the result of the Biuret test. (05 Marks)
(6.2) Explain the biochemical reason behind the result of the Biuret test of the above sample. (05 Marks)

(Total: 10 Marks)

(Q7)

Hereditary Fructose Intolerance

A 7-year-old child presents with recurrent episodes of vomiting and fatigue after consuming fruits. The clinician suspects hereditary fructose intolerance. A qualitative test on the patient's urine sample was performed.

(7.1) State the test performed on the sample of urine. (03 Marks)
(7.2) Interpret the results. (03 Marks)
(7.3) State the underlying metabolic defect in hereditary fructose intolerance. (04 Marks)

(Total: 10 Marks)

(Q8)

Nephrotic Syndrome

A 10-year-old boy with a history of nephrotic syndrome was discharged after being treated for recurrent episodes of generalized oedema and proteinuria.

(8.1) State the qualitative test that can be performed to detect protein in urine at home. (04 Marks)
(8.2) What is the underlying principle for the test mentioned in 8.1? (03 Marks)
(8.3) What is the main protein present in the urine of this child? (03 Marks)

(Total: 10 Marks)

(Q9)

Total Cholesterol

A 45-year-old male patient comes for a routine health check-up. He consumes a high-energy diet with fast foods. He has a family history of coronary artery disease. The result of the total cholesterol report is given.

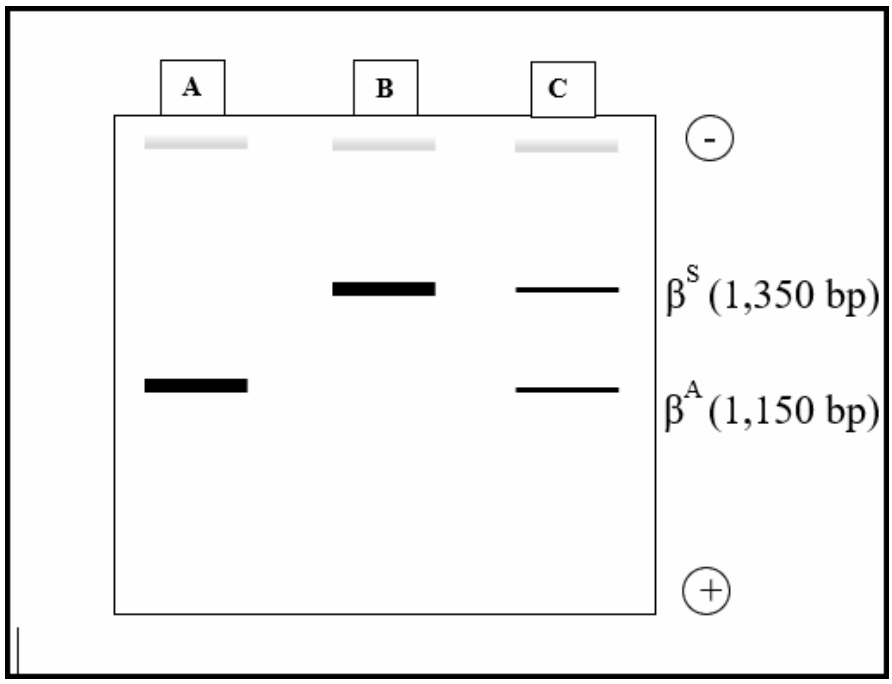
Test	Results	Reference range
Total cholesterol (mg/dL)	260	<200

(9.1) Interpret the test results. (02 Marks)
(9.2) State the most appropriate biochemical investigation to assess the blood lipid levels of this patient. (04 Marks)
(9.3) Mention two (02) lifestyle modifications to minimize coronary artery disease. (04 Marks)

(Total: 10 Marks)

(Q10)

Gel Electrophoresis



You are provided with a gel electrophoresis image showing the results of an RFLP analysis performed on fetal DNA samples obtained via chorionic villus sampling. The DNA was amplified and digested with the restriction enzyme MstII, targeting the beta-globin gene region. Analyse the provided gel image. Based on the banding patterns and known fragment sizes (1.15 kb for normal allele and 1.35 kb for beta S allele): Identify the genotype of each sample shown in the gel.

(10.1) Normal homozygous
(10.2) Heterozygous carrier
(10.3) Sickle cell disease homozygous

(Total: 10 Marks)

(Q11)

Gout



A 45-year-old man presents to the clinic with sudden onset of severe pain, swelling, and redness in his right big toe. He reports that the pain started at night and worsened by morning, making it difficult to walk. He is suspected of having gout. An image of his foot is given.

(11.1) Mention the underlying metabolic abnormality. (04 Marks)
(11.2) State two (02) possible reasons that could lead to the metabolic abnormality mentioned in 11.1. (03 Marks)
(11.3) State one microscopic feature seen under polarized light microscopy of synovial fluid. (03 Marks)

(Total: 10 Marks)

(Q12)

Haemoglobin Electrophoresis

A 35-year-old lady presented with an acute onset of chest pain. Her Full blood count showed anaemia. Haemoglobin electrophoresis was performed on her blood sample, and the report is given.

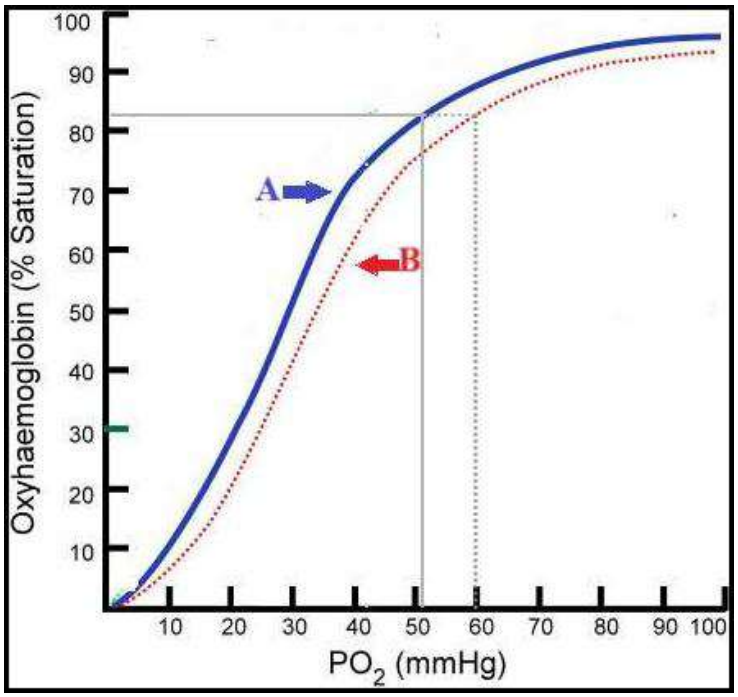
Parameter	Results	Reference range
HbA	69%	96-97%
HbF	0.5%	<1%
HbS	27%	0%
HbA2	3%	2.5-3.5%

(12.1) Interpret the laboratory findings and state the abnormality observed. (06 Marks)
(12.2) What is the type of mutation causing the condition mentioned in 12.1? (04 Marks)

(Total: 10 Marks)

(Q13)

Haemoglobin-Oxygen Dissociation Curve



A haemoglobin-oxygen dissociation curve is given. The normal curve is depicted as A.

(13.1) Identify the change in the oxygen dissociation curve labelled B. (05 Marks)
(13.2) State the biochemical reason for the typical sigmoid shape of the curve. (05 Marks)

(Total: 10 Marks)

(Q14)

HbA1c

A 52-year-old man with type 2 diabetes attends the clinic for follow-up. His latest HbA1c level is 9.2% (elevated).

(14.1) What is the biochemical process for the formation of HbA1c? (04 Marks)
(14.2) List three (03) complications of diabetes that occur due to the above biochemical process mentioned in 14.1. (06 Marks)

(Total: 10 Marks)

(Q15)

Fouchet's Test

A 32-year-old woman presents with yellowish discoloration of her eyes and skin for the past 5 days. She complains of dark urine and loss of appetite. A urine sample is tested with Fouchet's test. After addition of Fouchet's reagent to the barium sulphate precipitate obtained from urine, a green colour is observed.

(15.1) Interpret the result of Fouchet's test. (05 Marks)
(15.2) Describe the reason for the results of Fouchet's test of this patient? (05 Marks)

(Total: 10 Marks)

(Q16)

Liver Profile

A 45-year-old obese female is admitted to the Emergency Treatment Unit of Teaching Hospital Badulla with upper abdominal pain. Imaging studies revealed the presence of a gallstone blocking the common bile duct. A liver profile was done on this patient.

(16.1) Interpret the expected findings for the markers in this patient. (08 Marks)
- (16.1.1) Alkaline phosphatase
- (16.1.2) Gamma glutamyltransferase

(16.2) Which type of hyperbilirubinemia is expected in this patient? (02 Marks)

(Total: 10 Marks)

(Q17)

Acute Pancreatitis

A 61-year-old male chronic alcohol user is admitted to the Emergency Treatment Unit of Teaching Hospital Badulla with severe epigastric pain radiating to the back. He is suspected of having developed an episode of acute pancreatitis.

(17.1) Write two (02) enzyme markers that are useful in the diagnosis of pancreatitis in this patient. (04 Marks)

(17.2) Select the most specific marker out of the two mentioned in 17.1 to diagnose pancreatitis. (02 Marks)

(17.3) State the function of each enzyme mentioned in 17.1. (04 Marks)

(Total: 10 Marks)

(Q18)

Type 1 Diabetes

A 21-year-old man with type I diabetes who was off treatment for two-week duration is admitted to an emergency treatment unit with dehydration and altered consciousness. His breath smells fruity odour. And his urine was positive for reducing sugars. A qualitative test performed on the urine sample of this patient is given.

(18.1) Identify the test. (03 Marks)

(18.2) Mention two (02) metabolites that give positive test results for the test mentioned in 18.1. (04 Marks)

(18.3) State is the condition developed by this patient. (03 Marks)

(Total: 10 Marks)

(Q19)

Benedict's Test

A 3-month-old infant is brought to the paediatric clinic due to poor weight gain, vomiting after feeds, and persistent jaundice. The child also has hepatomegaly and cataracts. Mother reports intolerance to milk-based feeds. A urine test using Benedict's reagent is performed and the result is shown.

(19.1) Interpret the likely biochemical abnormality. (03 Marks)

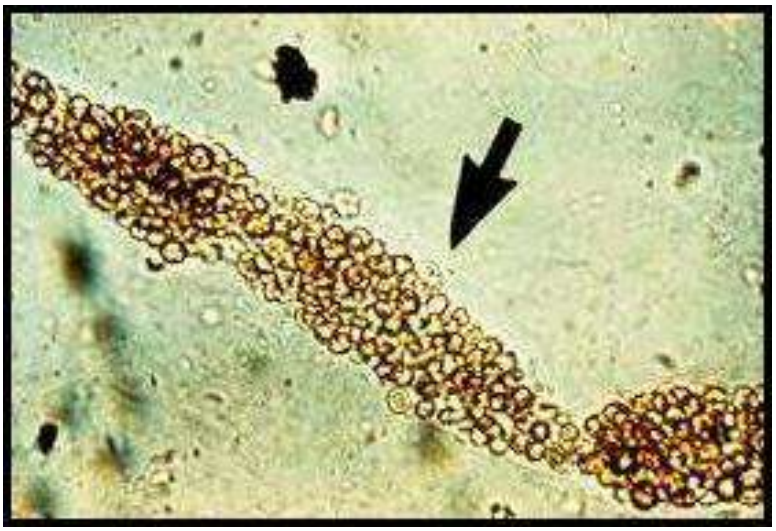
(19.2) Explain the biochemical basis for the positive sugar test. (03 Marks)

(19.3) Which laboratory test would you recommend to confirm the diagnosis? (04 Marks)

(Total: 10 Marks)

(Q20)

Urine Casts



A 32-year-old man presents with tea-colored urine, facial puffiness, and mild hypertension. He reports a recent episode of sore throat 2 weeks ago. A urine sample was sent for analysis, and a cast was observed in urine microscopy.

(20.1) Identify the cast. (04 Marks)
(20.2) What is the composition of the cast mentioned in 20.1? (06 Marks)

(Total: 10 Marks)

SECOND MBBS (BATCH 1) – OSPE ANSWERS - 2025



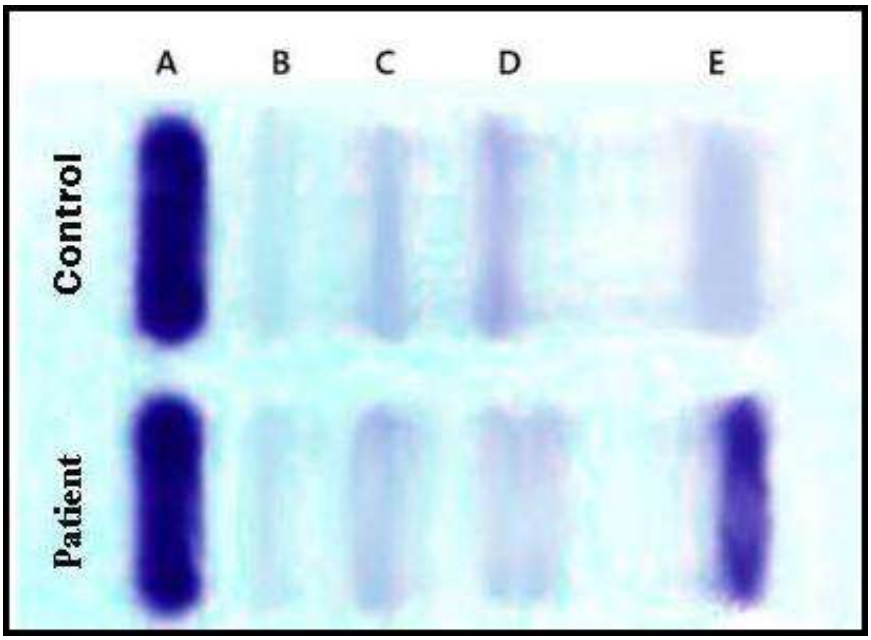
(Q1)
(1.1) Iodine deficiency
(1.2) Thyroid function tests (TSH and Free T4)
(1.3) Iodine is required for the synthesis of thyroid hormones (T_3 and T_4)

Test	Results	Reference range
Total bilirubin (mg/dL)	15	Up to 5
Direct (conjugated) bilirubin (mg/dL)	1	< 1

(Q2)
(2.1) Unconjugated (indirect) hyperbilirubinemia
(2.2)
(2.2.1) Physiological jaundice of the newborn
(2.2.2) Hemolytic disease of the newborn
(2.3) Phototherapy converts unconjugated bilirubin into water-soluble photoisomers that can be excreted without conjugation

Test	Results	Reference range
pH	7.25	7.35-7.45
HCO3- (mmol/L)	15	22-26
pCO2 (mmHg)	30	35-45

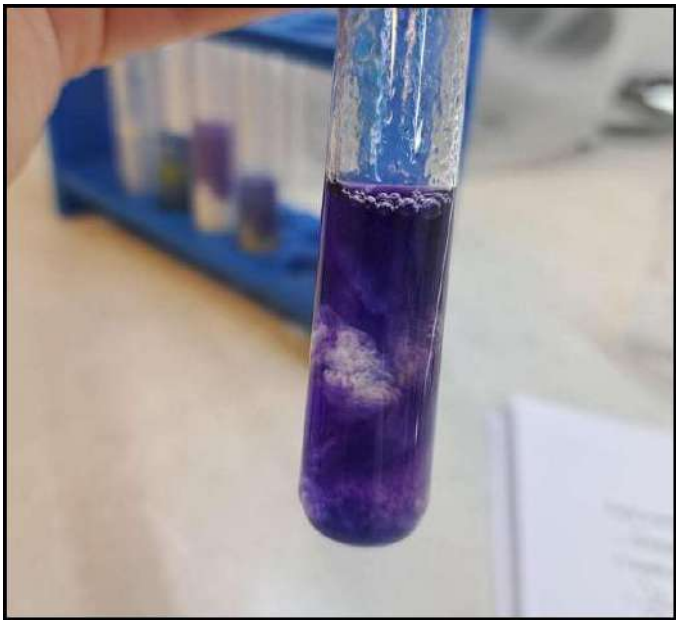
(Q3)
(3.1) Metabolic acidosis with respiratory compensation
(3.2)
(3.2.1) Diabetic ketoacidosis
(3.2.2) Chronic renal failure



(Q4)
(4.1)
(4.1.1) A – Albumin
(4.1.2) B – Alpha-1 globulin
(4.1.3) C – Alpha-2 globulin
(4.1.4) D – Beta globulin
(4.1.5) E – Gamma globulin
(4.2) Monoclonal gammopathy (M band/M spike) suggestive of multiple myeloma

Test	Results	Reference range
Fasting blood glucose (mg/dL)	115	<100

(Q5)
(5.1) Impaired fasting glucose (Prediabetes)
(5.2) HbA1c (Glycated haemoglobin)

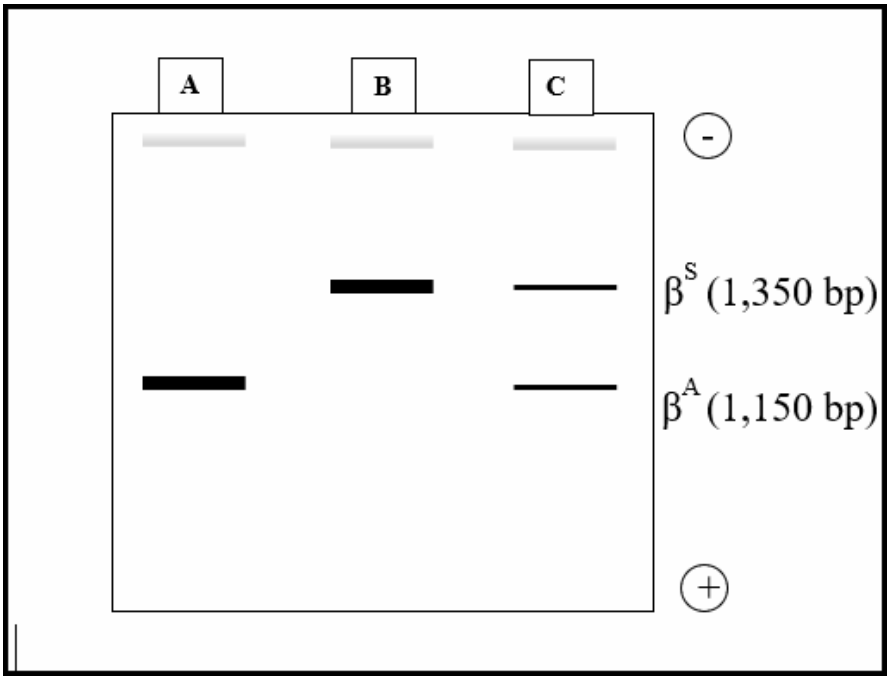


(Q6)
(6.1) Positive Biuret test indicating the presence of proteins
(6.2) Peptide bonds in proteins form a violet-coloured complex with copper ions in alkaline medium

(Q7)
(7.1) Benedict's test
(7.2) Positive test for reducing sugar (fructose) in urine
(7.3) Aldolase B deficiency

(Q8)
(8.1) Heat coagulation test
(8.2) Proteins coagulate and precipitate when heated
(8.3) Albumin

(Q9)
(9.1) Hypercholesterolemia (elevated total cholesterol)
(9.2) Lipid profile (Lipid panel)
(9.3)
(9.3.1) Regular physical exercise
(9.3.2) Low-fat, low-cholesterol diet



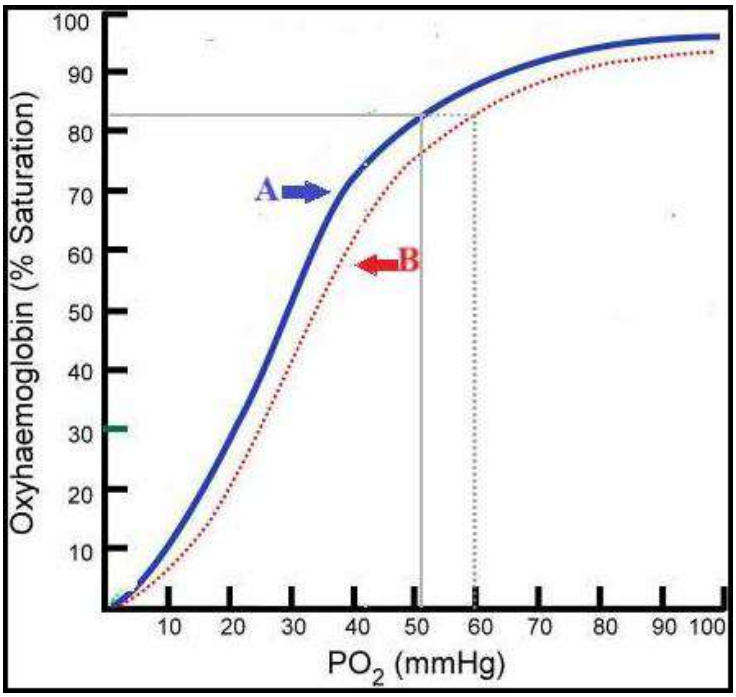
(Q10)
(10.1) Normal homozygous – HbA/HbA (1.15 kb band only)
(10.2) Heterozygous carrier – HbA/HbS (1.15 kb and 1.35 kb bands)
(10.3) Sickle cell disease homozygous – HbS/HbS (1.35 kb band only)



(Q11)
(11.1) Hyperuricemia due to increased uric acid accumulation
(11.2)
(11.2.1) Increased purine intake or metabolism
(11.2.2) Reduced renal excretion of uric acid
(11.3) Needle-shaped, negatively birefringent monosodium urate crystals

Parameter	Results	Reference range
HbA	69%	96-97%
HbF	0.5%	<1%
HbS	27%	0%
HbA2	3%	2.5-3.5%

(Q12)
(12.1) Sickle cell trait (heterozygous HbAS)
(12.2) Missense point mutation in the β-globin gene (Glu → Val substitution)



(Q13)
(13.1) Right shift of the oxygen dissociation curve
(13.2) Cooperative binding of oxygen to haemoglobin

(Q14)
(14.1) Non-enzymatic glycation of haemoglobin
(14.2)
(14.2.1) Diabetic nephropathy
(14.2.2) Diabetic retinopathy
(14.2.3) Diabetic neuropathy

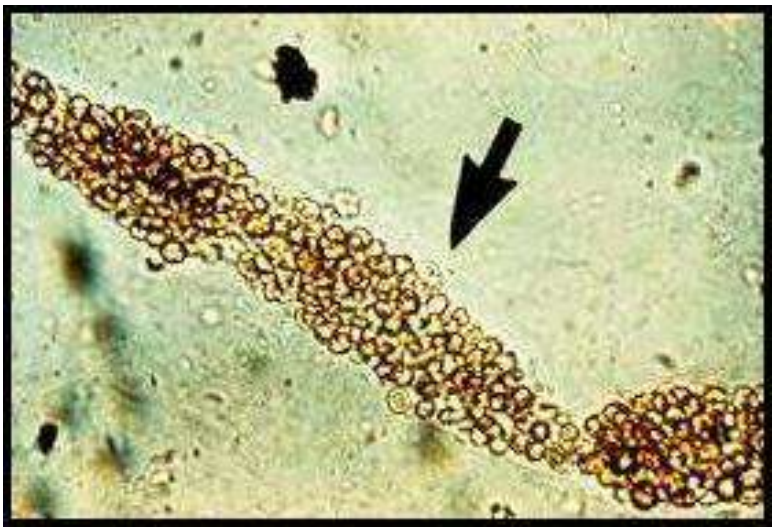
(Q15)
(15.1) Positive Fouchet's test indicating bilirubin in urine
(15.2) Conjugated bilirubin is present in urine and is oxidized by Fouchet's reagent to biliverdin, producing a green colour

(Q16)
(16.1)
(16.1.1) Alkaline phosphatase – Increased
(16.1.2) Gamma glutamyltransferase – Increased
(16.2) Conjugated (direct) hyperbilirubinemia

(Q17)
(17.1)
(17.1.1) Serum amylase
(17.1.2) Serum lipase
(17.2) Serum lipase
(17.3)
(17.3.1) Amylase – Digestion of starch/carbohydrates
(17.3.2) Lipase – Digestion of triglycerides into fatty acids and glycerol

(Q18)
(18.1) Rothera's test
(18.2)
(18.2.1) Acetoacetate
(18.2.2) Acetone
(18.3) Diabetic ketoacidosis (DKA)

(Q19)
(19.1) Galactosemia
(19.2) Accumulation and urinary excretion of galactose, a reducing sugar, gives a positive Benedict's test
(19.3) Assay for Galactose-1-phosphate uridyl transferase (GALT) enzyme activity



(Q20)
(20.1) Red blood cell (RBC) cast
(20.2) Red blood cells embedded in a matrix of Tamm–Horsfall protein (uromodulin)

SECOND MBBS REPEAT (BATCH 1)

SECOND MBBS REPEAT (BATCH 1)- MCQ PAPER - 2026

UVA WELLASSA UNIVERSITY FACULTY OF MEDICINE
2nd MBBS Repeat Examination
December 2025
2022/2023 (01st) Batch
Biochemistry
Multiple Choice Questions (MCQ) Paper

[illegible] 12.00 pm (03 hours) Date of the exam: 2025.12.29

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

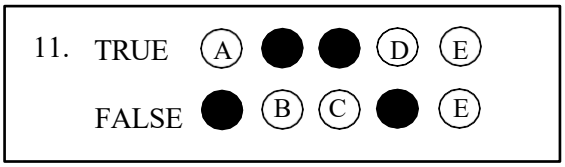
Please read the following instructions before marking responses on your answer sheets

1. Check that your question paper has a total of **14 pages,** including the front page.
2. **A single answer sheet is provided**. Please write your index number in the given space.
3. Read each question carefully before answering.
4. Mark the correct response as a **heavy black mark, filling the relevant circle completely**, using a black lead pencil (6B or above grade).
5. Do not make stray marks on the answer sheet. In case of an error, erase cleanly.
6. Your final answer should be a densely coloured circle through which the underlying letter is not visible.
7. Marking using any other method (e.g., mark the circle with a cross) is not valid.

Thirty (30) True/False Type Questions (Questions 1-30/Page 2-6)

1. Mark whether each response is true or false.
2. Given below is an example of how to mark a true/false type question.

Q 11. A woman has
- A. one ovary.
- B. one nose.
- C. two ears.
- D. one eye.
- E. two hairs.

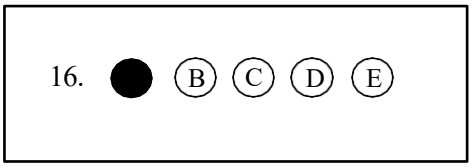


A correct response will get = +1 mark
An incorrect response will get = -1 mark
No response will get = 0 (zero) mark
Negative marks will not be carried over to the next question

Thirty (30) Single Best Response (SBR) Type Questions (Questions 31-60/ Page 7-14)

1. Mark the best response. Only one response per question should be marked.
2. If you mark the correct response, you will get the full marks for the question.
3. If you mark an incorrect response, fail to mark any response, select more than one response, or mark your response unclearly, you will not receive any marks for that question.
4. Given below is an example of how to mark a single best response type question.

Q 16. Speaking is a unique ability observed in humans. Which of the following body parts is primarily used for speech production?
- A. Tongue
- B. Hands
- C. Feet
- D. Ears
- E. Nose



Question numbers 01 to 30 are True or False type questions. Mark your answer for each of the five responses (A to E).

(1) True or false regarding glycosaminoglycans**?**

(A) Branches are made of disaccharides.
(B) Hyaluronic acid is covalently attached to a core protein.
(C) Hyaluronic acid is hydrophilic.
(D) They are long polysaccharides.
(E) They are positively charged.

(2) True or false regarding triglycerides?

(A) Melting point of triglycerides is increased by hydrogenation.
(B) Plant-based triglycerides stay in liquid form at room temperature.
(C) Simple triglycerides are composed of short-chain fatty acids.
(D) They are formed by esterification of three fatty acids with glycerol.
(E) They provide a major contribution to form the cell membrane.

(3) True or false regarding phospholipids?

(A) Phosphatidylserine mediates apoptosis.
(B) The most abundant phospholipid is phosphatidylcholine.
(C) They are the primary energy storage molecules in the body.
(D) They contain two phosphate groups.
(E) They have a glycerol backbone.

(4) True or false regarding cholesterol?

(A) Conversion of cholesterol to bile acids requires ascorbic acid.
(B) It has four hydrocarbon rings.
(C) It has multiple hydroxyl groups.
(D) It regulates membrane fluidity and stability.
(E) It serves as a precursor for Vitamin D.

(5) Which of the following cause a left shift in the oxygen-haemoglobin dissociation curve?

(A) Alkalosis
(B) High altitude
(C) High temperature
(D) Increased 2,3-DPG levels
(E) Low $PaCO_2$ level

(6) True or false regarding carbaminohaemoglobin?

(A) CO_2 binds to its heme iron directly.
(B) CO_2 binds to the amino groups of its globin chains.
(C) Formation is enhanced at low pH.
(D) Formation is independent of oxygen saturation of Hb.
(E) It releases CO_2 in the lungs.

(7) True or false regarding the buffering action of haemoglobin?
- (A) Deoxyhaemoglobin has higher affinity for H^+ ions than oxyhaemoglobin.
- (B) Haemoglobin is an extravascular buffer.
- (C) Hb acts as a buffer in blood by binding free H^+ ions released from carbonic acid.
- (D) Hb contributes to the Bohr effect by releasing H^+ ions during oxygen binding.
- (E) It is the main buffer in blood.

(8) True or false regarding enzymes?
- (A) Enzyme activity is controlled by hormones.
- (B) Inorganic compounds act as cofactors for their activity.
- (C) They catalyse reversible reactions.
- (D) They lower the equilibrium constant of a reaction.
- (E) They reduce the activation energy of a reaction.

(9) True or false regarding simple diffusion?
- (A) It does not require energy.
- (B) It exhibits saturation kinetics at high solute concentrations.
- (C) It requires a carrier protein.
- (D) Na^+ crosses the lipid bilayer by this process.
- (E) Oxygen crosses the membrane by this process.

(10) True or false regarding dendrotoxin?
- (A) It blocks K^+ channels in neurons.
- (B) It blocks Na/K ATPase in neurons.
- (C) It enhances Ca^{2+} influx in dendrites.
- (D) It is a neurotransmitter agonist.
- (E) It is produced by pufferfish.

(11) True or false regarding oxidative phosphorylation?
- (A) It generates ATP using the proton gradient.
- (B) It involves complexes I–IV.
- (C) It occurs in the cytoplasm.
- (D) It produces ATP directly from substrate-level phosphorylation.
- (E) Oxygen acts as the final electron acceptor.

(12) True or false regarding creatine phosphate shuttle?
- (A) It directly makes ATP by catabolising glucose.
- (B) It is an important energy source in heart and skeletal muscles.
- (C) It transfers high-energy phosphate from mitochondria to cytosol.
- (D) It uses creatine kinase in mitochondria and cytosol.
- (E) Phosphocreatine provides quick energy for high-intensity activities.

(13) True or false regarding nucleotides?
- (A) They act as allosteric regulators of enzymes.
- (B) They are components of ribozymes.
- (C) They are precursors for NAD^+.
- (D) They provide phosphate groups for phosphorylation reactions.
- (E) They trap energy for long-term storage.

(14) True or false regarding synthetic nucleotide analogues in chemotherapy?
(A) Chain termination occurs due to lack of 3'-OH group.
(B) They are used to selectively kill rapidly dividing cancer cells.
(C) They inhibit DNA gyrase.
(D) They mimic natural nucleotides.
(E) They stimulate DNA repair in cancer cells.

(15) True or false regarding transamination?
(A) Ammonia is an end product.
(B) It helps to make non-essential amino acids.
(C) It is a non-enzymatic reaction.
(D) It requires pyridoxal phosphate as a cofactor.
(E) It transfers amino groups from amino acids to keto acids.

(16) True or false regarding decarboxylation?
(A) Amino acid decarboxylase enzymes are active in the cytosol.
(B) H2CO3 is an end product
(C) It directly produces ATP.
(D) It removes a -COOH group as CO_2.
(E) Vitamin B_1 (thiamine) acts as a cofactor.

(17) True or false regarding essential fatty acids?
(A) Alpha-linolenic acid is present in chia seeds.
(B) Oleic acid is an essential fatty acid.
(C) Prostaglandins are synthesised from them.
(D) They are synthesized in human body.
(E) They have one or more double bonds.

(18) True or false regarding synthesis of cholesterol?
(A) Cholesterol is synthesized directly from dietary fats.
(B) Cholesterol is synthesized in the liver.
(C) HMG-CoA reductase is the main regulatory enzyme.
(D) It starts from acetyl-CoA.
(E) Mevalonate is an intermediate in this pathway.

(19) True or false regarding heme metabolism?
(A) Heme degradation produces bilirubin.
(B) Heme oxygenase is the rate-limiting enzyme in heme biosynthesis.
(C) It occurs in the cytosol.
(D) Porphyrins are precursors for heme synthesis.
(E) Synthesis of heme begins with glycine and succinyl-CoA.

(20) True or false regarding regulators of nucleotide synthesis?
(A) CTP is a feedback inhibitor.
(B) GTP regulates purine synthesis.
(C) IMP can be converted to AMP or GMP.
(D) It is a passive process.
(E) It is activated by phosphoribosyl pyrophosphate (PRPP) synthetase.

(21) True or false regarding folic acid analogues?
(A) High doses of vitamin B3 reverse the effects of folic acid analogues.
(B) Methotrexate inhibits dihydrofolate reductase.
(C) They are useful in treating cancers.
(D) They inhibit DNA replication
(E) They prevent the conversion of tetrahydrofolate to dihydrofolate.

(22) True or false regarding transcription of RNA?
(A) A poly (A) tail is added to the 3′ end of mRNAs.
(B) It occurs in the nucleus. –
(C) mRNA is synthesized in 3′ to 5′ direction.
(D) pre-mRNA undergoes splicing to remove introns before translation.
(E) RNA polymerase binds to promoter regions to initiate transcription.

(23) True or false regarding cirrhosis?
(A) Ammonia level is elevated in blood.
(B) Beta-gamma band fusion is seen in serum protein electrophoresis.
(C) Prothrombin time is shortened.
(D) Serum albumin concentration is decreased.
(E) Serum gamma-glutamyl transferase (GGT) level is low.

(24) True or false regarding cholestasis?
(A) Alkaline phosphatase level is markedly elevated.
(B) Conjugated bilirubin is high.
(C) Pruritus is due to bile salt accumulation.
(D) Unconjugated bilirubin is the primary bilirubin elevated in extrahepatic obstruction.
(E) Urobilinogen is high in urine.

(25) True or False regarding acute pancreatitis?
(A) Amylase remains elevated longer period than lipase.
(B) Elevation of amylase is more specific than lipase.
(C) Exocrine pancreatic functions are affected earlier than endocrine pancreatic functions.
(D) Hypertriglyceridemia is a cause.
(E) Serum amylase levels rise earlier than serum lipase.

(26) True or false regarding renal functions?
(A) Blood urea level decreases in dehydration.
(B) Dysmorphic red blood cells are present in urine in glomerular damage.
(C) Estimated GFR is more accurate than creatinine clearance.
(D) Hematurea is present in acute glomerulonephritis.
(E) Urine albumin to creatinine ratio is used to assess nephrotic syndrome.

(27) Which of the following are considered as tumour markers?
(A) Albumin
(B) Alpha-fetoprotein (AFP)
(C) Beta HCG
(D) C-reactive protein
(E) Prostate-specific antigen (PSA)

(28) True or false regarding vitamin C?
(A) It enhances non-heme iron absorption.
(B) It is a fat-soluble vitamin.
(C) It is required for collagen synthesis.
(D) It primarily functions as an antioxidant.
(E) Its deficiency causes scurvy.

(29) True or false regarding hormone receptors?
(A) Catecholamines act through cell surface receptors.
(B) Growth hormone receptor works via tyrosine kinase mechanism.
(C) Insulin receptor is an example of a G-protein coupled receptor.
(D) Steroid hormone receptors act as transcription factors.
(E) Thyroid hormone receptor is located in the nucleus.

(30) True or false regarding dietary protein-energy malnutrition?
(A) Kwashiorkor is characterized by oedema.
(B) Kwashiorkor presents with fatty liver.
(C) Marasmus is primarily due to deficiency of protein.
(D) Marasmus presents with severe loss of subcutaneous fat.
(E) Serum albumin is normal in Kwashiorkor.

Question numbers 31 to 60 are Single Best Response (SBR) type. Select the best response for each question.

(31) A 6-year-old child presents with recurrent infections and gum bleeding. On examination, there are petechiae noted. X-ray shows a pencil-shaped epiphysis.Which of the following vitamin deficiency is most likely?
(A) Vitamin A
(B) Vitamin C
(C) Vitamin D
(D) Vitamin E
(E) Vitamin K

(32) A patient with uncontrolled type 1 diabetes presents with deep, rapid breathing and a fruity odour on breath.Which of the following biochemical abnormality is most likely to be responsible for the above features ?
(A) Decreased gluconeogenesis
(B) Increased blood pH
(C) Increased glucagon secretion
(D) Increased glycogenolysis
(E) Increased ketogenesis

(33) A child with recurrent hypoglycaemia is found to have hepatomegaly. Investigations shows absence of glucose-6-phosphatase enzyme in the liver.Which of the following is the most likely diagnosis?
(A) Andersen disease (Glycogen storage disease type IV)
(B) Cori disease (Glycogen storage disease type III)
(C) McArdle disease (Glycogen storage disease type V)
(D) Pompe disease (Glycogen storage disease type II)
(E) von Gierke disease (Glycogen storage disease type I)

(34) The urea cycle is a metabolic pathway in the liver that converts toxic ammonia produced from amino acid catabolism into urea for safe excretion in urine.Which of the following is the most likely immediate substrate for urea formation in the urea cycle?

(A) Arginine
(B) Aspartate
(C) Carbamoyl phosphate
(D) Glutamate
(E) Ornithine

(35) An infant presents with seizures and hepatomegaly. Blood acylcarnitine levels are elevated, suggesting a defect in fatty acid transport into mitochondria.Which enzyme is most likely deficient?

(A) Acetyl-CoA carboxylase
(A) Carnitine acyltransferase I
(B) HMG-CoA synthase
(C) Hormone-sensitive lipase
(D) Lipoprotein lipase

(36) Bilirubin conjugation is a process that occurs in the liver to form water-soluble conjugated bilirubin for excretion in bile.Which of the following enzymes is most likely conjugates bilirubin in the liver?

(A) Biliverdin reductase
(B) Ferrochelatase
(C) Glucokinase
(D) Heme oxygenase
(E) UDP-glucuronyltransferase

(37) A patient presents with acute, severe pain and swelling in the joints of the big toe. Synovial fluid reveals monosodium urate crystals.Which of the following enzyme deficiency is most commonly associated with this condition?

(A) Adenylate cyclase
(B) Arginase
(C) Galactokinase
(D) Hypoxanthine-guanine phosphoribosyltransferase (HGPRT)
(E) Xanthine oxidase

(38) A child presents with muscle weakness, fatigue, muscle cramps, and circumoral numbness. Laboratory tests reveal low serum levels of a mineral (after adjusting for serum albumin level).Which of the following mineral deficiency is most likely responsible?

(A) Calcium
(B) Iodine
(C) Iron
(D) Selenium
(E) Zinc

(39) A 45-year-old male presents with sudden chest pain. Acute myocardial infarction is suspected. Blood tests reveal elevated serum LDH.Which of the following is the best explanation for the rise in serum LDH in this patient?

(A) It binds strongly to plasma proteins.
(B) It is excreted slowly by the kidneys.
(C) It is synthesized in the liver in response to injury.
(D) It leaks from damaged cells into the bloodstream.
(E) Its half-life in plasma is very long.

(40) A 60-year-old patient on long-term broad-spectrum antibiotics presents with easy bruising. Laboratory tests reveal prolonged prothrombin time, normal platelet count, and normal liver function tests.Which of the following is the best explanation for this coagulation defect?

(A) Decreased hepatic synthesis of clotting factors.
(B) Decreased vitamin K_2 production
(C) Impaired absorption of fat-soluble vitamins.
(D) Increased urinary excretion of vitamin K.
(E) Inhibition of vitamin K epoxide reductase.

(41) Plasma proteins are a group of proteins in blood plasma that help maintain osmotic pressure, transport substances, and perform immune, clotting, and regulatory functions.Which of the following plasma protein mainly contributes to the oncotic pressure of blood?

(A) Albumin
(B) Ceruloplasmin
(C) Fibrinogen
(D) Immunoglobulin G
(E) Lipoproteins

(42) A patient presented with increased heat intolerance, tachycardia, weight loss, and eye signs. Laboratory investigations reveal an increase in a hormone level.Which of the following hormone is most likely to be elevated?

(A) Cortisol
(B) Epinephrine
(C) Growth hormone
(D) Thyroxine (T_4)
(E) TSH

(43) Carbon dioxide is produced as a metabolic waste product in tissues and diffuses into blood. Red cells in blood help in transport of this CO2 from tissue to lungs.Which of the following compound in red cells is most likely responsible for this transport?

(A) Carbaminohemoglobin
(B) Carboxyhemoglobin
(C) Dissolved CO2
(D) H2CO3
(E) Methemoglobin

(44) Systemic iron transport is carried out by a plasma protein that binds iron and delivers it to tissues such as bone marrow, liver, and spleen.Which of the following protein is the most likely protein responsible for systemic iron transport?

(A) Ceruloplasmin
(B) Ferritin
(C) Haptoglobin
(D) Hemosiderin
(E) Transferrin

(45) Polymerase Chain Reaction (PCR) is a laboratory technique used to amplify specific DNA sequences, producing millions of copies for analysis or diagnosis.Which of the following enzyme is used in PCR to amplify DNA?

(A) DNA polymerase I
(B) Ligase
(C) Reverse transcriptase
(D) RNA polymerase
(E) Taq polymerase

(46) A newborn boy presents with vomiting, hyperammonemia, and lethargy. Urine has high orotic acid.Which of the following enzyme deficiency is most likely to be present in this newborn?

(A) Arginase
(B) Arginosuccinate synthetase
(C) Ornithine transcarbamylase
(D) Phenylalanine hydroxylase
(E) Tyrosinase

(47) A coenzyme is a non-protein molecule that binds to an enzyme and is essential for its catalytic activity, often serving as a carrier of chemical groups or electrons.What is the vitamin that functions as a coenzyme for transaminases?

(A) Vitamin B1
(B) Vitamin B2
(C) Vitamin B3
(D) Vitamin B6
(E) Vitamin B12

(48) Diabetic nephropathy is a progressive kidney disease caused by long-term hyperglycemia, leading to glomerular damage.Which of the following is the earliest detectable biochemical marker of diabetic nephropathy?

(A) Elevated blood urea
(B) Elevated serum creatinine
(C) Glucosuria
(D) Microalbuminuria
(E) Proteinuria

(49) Lipoproteins are complexes of lipids and proteins that transport hydrophobic fats, such as cholesterol and triglycerides, through the bloodstream.Which of the following lipoprotein is most likely to be responsible for reverse cholesterol transport?

(A) Chylomicrons
(B) HDL
(C) IDL
(D) LDL
(E) VLDL

(50) Amino acids are organic molecules that serve as the building blocks of proteins and play key roles in metabolism, signalling, and enzyme function.Which of the following amino acid is exclusively ketogenic?

(A) Alanine
(B) Histidine
(C) Lysine
(D) Methionine
(E) Serine

(51) Insulin stimulates, an insulin-dependent glucose transporter found mainly in muscle and adipose tissue, promoting glucose uptake from the blood into these cells.Which of the following glucose transporter function is most likely to be increased by insulin in muscle and adipose tissues?

(A) GLUT1
(B) GLUT2
(C) GLUT3
(D) GLUT4
(E) GLUT5

(52) Goitre in iodine deficiency primarily occurs due to elevated levels of a certain hormone. Which of the following hormones is most likely to be elevated in iodine deficiency goitre?

(A) Calcitonin
(B) Epinephrine
(C) T3
(D) T4
(E) TSH

(53) In obstructive jaundice, bile flow from the liver to the intestine is blocked.Which of the following compound is most likely to be elevated in urine in obstructive jaundice?

(A) Albumin
(B) Bile salts
(C) Ketone bodies
(D) Unconjugated bilirubin
(E) Urobilinogen

(54) A 3-year-old child presented with significant developmental delay, ulcers in the tongue and fingers suggestive of self-mutilating behaviour. This child was diagnosed with Lesch-Nyhan syndrome.Which of the following enzymes is deficient in Lesch–Nyhan syndrome?

(A) Adenosine deaminase
(B) Adenylate cyclase
(C) hypoxanthine-guanine phosphoribosyltransferase
(D) Uricase
(E) Xanthine oxidase

(55) Thyroid hormones are transported in blood bound to a plasma proteins.Which of the following plasma protein is mainly responsible for the transport of thyroid hormones in the blood?

(A) Albumin
(B) Ceruloplasmin
(C) Haptoglobin
(D) Thyroxine-binding globulin
(E) Transthyretin

(56) A 2-year-old child coming from Mahiyanganaya presented with oedema, enlarged liver, and growth retardation. He has been diagnosed with Kwashiorkor.Which of the following deficiencies is the cause of Kwashiorkor?

(A) Calcium
(B) Calories
(C) Fat
(D) Protein
(E) Vitamin C

(57) Cardiac biomarkers are molecules released into blood during myocardial infarction, and are used to diagnose and monitor cardiac events.Which of the following enzyme is elevated in myocardial infarction and remains elevated the longest?

(A) AST
(B) CK-MB
(C) LDH
(D) Troponin I
(E) Troponin T

(58) Foetal haemoglobin has a higher affinity for oxygen compared to HbA.Which of the following is the best explanation for this higher affinity in feotal haemoglobin?

(A) It has gamma chains.
(B) It has less affinity for CO2.
(C) It has lesser affinity for 2-3-DPG.
(D) It has more Fe^{2+} atoms.
(E) It shows resistance to formation of methaemoglobin.

(59) There are laboratory techniques used to transfer and detect specific biomolecules, such as DNA, RNA, or proteins.Which of the following techniques is most commonly used to separate DNA fragments based on size?

(A) Electrophoresis
(B) ELISA
(C) Northern blotting
(D) Southern blotting
(E) Western blotting

(60) A five-year-old child was presented with intellectual disability, growth retardation, seizures, and a musty body odour (mouse urine odour). He was diagnosed with phenylketonuria.Which of the following enzyme deficiency is most likely to be present in this child?

(A) Dihydropteridine reductase
(B) Homogentisate oxidase
(C) Phenylalanine Decarboxylase
(D) Phenylalanine hydroxylase
(E) Tyrosinase

SECOND MBBS REPEAT (BATCH 1)- MCQ ANSWERS - 2026

(1) FFTTF
(2) TTFTF
(3) TTFFT
(4) FTFTT
(5) TTFFT
(6) FTTFT
(7) TFTFF
(8) TTTFT
(9) TFFFT
(10) TFFFF
(11) TTFFT
(12) FTTTT
(13) TTTTF
(14) TFTTF
(15) FTFTT
(16) TFFTT
(17) TFTFT
(18) FTTTT
(19) TFTTT
(20) TTTFT
(21) FTTTF
(22) TTFTT
(23) TTFTF
(24) TTTFF
(25) FFTTT
(26) FTTTT
(27) FTTFT
(28) TFTTT
(29) TFFTT
(30) TTFTF

(31) B
(32) E
(33) E
(34) A
(35) B
(36) E
(37) D
(38) A
(39) D
(40) B
(41) A
(42) D
(43) A
(44) E
(45) E
(46) C
(47) D
(48) D
(49) B
(50) C
(51) D
(52) E
(53) B
(54) C
(55) D
(56) D
(57) E
(58) C
(59) A
(60) D

SECOND MBBS REPEAT (BATCH 1)- SEQ PAPER - 2026

UVA WELLASSA UNIVERSITY OF SRI LANKA
FACULTY OF MEDICINE
2nd MBBS (Repeat) Examination
December 2025
2022/2023 (01st) Batch
Biochemistry
Structured Essay Questions (SEQ) Paper

Time 1.00 pm – 4.00 pm (03 hours) Date of the exam: 2025.12.29

Please do not attempt or promote copying. No textbooks, notes, mobile phones, smart watches, or any other electronic communication devices are allowed.

Instructions to Candidates

1. This paper contains six (06) Structured Essay Questions.
2. Answer all questions.
3. If additional space is required, you may use extra sheets. Ensure that the relevant question number is clearly indicated on each additional sheet.

Q (1)

A 4-year-old child presents with recurrent vomiting, sweating, tremors, and irritability within 30 minutes after consuming fruits, honey, or sweetened foods. Laboratory testing reveals hypoglycaemia, fructosuria, and mild hepatomegaly. The patient is suspected of having hereditary fructose intolerance.

(1.1) Name the enzyme that is deficient in this condition. (10 Marks)
(1.2) Name one (01) urine test that could detect fructose. (10 Marks)
(1.3) Name two (02) organs that actively metabolize fructose. (10 Marks)
(1.4) State two biochemical differences between essential fructosuria and hereditary fructose intolerance on following.

(20 Marks)

Feature	Essential Fructosuria	Hereditary Fructose Intolerance
(1.4.1) Metabolite accumulated		
(1.4.2) Severity		

(1.5) Explain the biochemical basis for the development of hypoglycaemia in this patient. (20 Marks)
(1.6) Explain the biochemical basis for the presence of fructoseuria in this patient. (15 Marks)
(1.7) State one dietary management advice that could be given for this patient. (15 Marks)

(Total: 100 Marks)

Q (2) Regarding lipid metabolism

(2.1) Name two essential fatty acids. (20 Marks)
(2.2) Name two key enzymes involved in hepatic fatty acid oxidation and mention their cellular locations.

(20 Marks)

	Enzyme	Cellular location
a)		
b)		

A 48-year-old man with a history of chronic alcohol intake presents with right upper quadrant discomfort and fatigue. Laboratory investigations reveal elevated AST and ALT levels, and ultrasound confirms fatty infiltration of liver tissue. The patient is suspected of having alcoholic fatty liver disease.

(2.3.1) Name two enzymes involved in the pathogenesis of alcoholic fatty liver disease. (20 Marks)
(2.3.2) Explain the biochemical mechanisms of triglyceride accumulation in alcoholic fatty liver disease.

(40 Marks)

(Total: 100 Marks)

Q (3) Regarding haemoglobin and drug-induced haemolysis

(3.1) Name two essential components required for heme synthesis. (10 Marks)
(3.2) State two functions of haemoglobin. (10 Marks)
(3.3) Name two functions of NADPH in red blood cells. (20 Marks)

A 30-year-old male develops jaundice and dark urine two days after taking antimalarial medication. Lab results show anaemia, elevated unconjugated bilirubin, and the presence of Heinz bodies on blood smear. Drug-induced haemolysis is suspected.

(3.4.1) Name the enzyme deficiency present in this patient. (10 Marks)
(3.4.2) Explain the biochemical basis of oxidative haemolysis in this patient. (20 Marks)
(3.4.3) State the biochemical basis for the development of jaundice in this patient. (30 Marks)

(Total: 100 Marks)

Q (4) Regarding bilirubin metabolism and kernicterus

(4.1) Name one plasma protein involved in bilirubin transport. (10 Marks)
(4.2) Name the enzyme responsible for bilirubin conjugation in the liver. (10 Marks)
(4.3) State two biochemical differences between conjugated and unconjugated bilirubin. (10 Marks)

A 10-day-old newborn is brought to the postnatal clinic by his mother because she has noticed a yellowish discoloration of his skin and eyes. The mother reports that the baby is feeding well. There is no history of lethargy, poor feeding, a high-pitched cry, and seizures. Laboratory results show markedly elevated unconjugated bilirubin, with no evidence of haemolysis. It is reassured that the baby is having physiological jaundice.

(4.4.1) What do you expect regarding the conjugated bilirubin level of this baby? (10 Marks)
(4.4.2) Explain the biochemical basis for the accumulation of unconjugated bilirubin in physiological jaundice. (30 Marks)
(4.4.3) Explain how unconjugated bilirubin causes brain damage. (30 Marks)

(Total: 100 Marks)

Q (5) Regarding micronutrients

(5.1) Name the coenzyme forms of the following vitamins.
(5.1.1) Vitamin B3 (10 Marks)
(5.1.2) Vitamin B6 (10 Marks)
(5.2) Name two microminerals with structural functions in the body. (20 Marks)
(5.3) Name two trace minerals that act as enzyme cofactors. (10 Marks)

A 28-year-old pregnant woman presents with glossitis, fatigue, pallor, and macrocytic anaemia. Blood reports show elevated MCV and low serum folate levels.

(5.4.1) Explain the biochemical basis for macrocytic anaemia in this patient. (20 Marks)
(5.4.2) State two biochemical consequences of folate deficiency except macrocytic anaemia. (20 Marks)
(5.4.3) Name one vitamin that works together with folate in homocysteine metabolism. (10 Marks)

(Total: 100 Marks)

Q (6) Regarding renal function

(6.1) List four metabolic waste products excreted by the kidneys. (20 Marks)

(6.2) List two hormones secreted by the kidneys. (10 Marks)

A 60-year-old man with long-standing hypertension presents with ankle swelling, frothy urine, and elevated blood urea and creatinine levels. Urine dipstick shows albuminuria. The patient is suspected of having chronic kidney disease.

(6.3.1) Explain the biochemical basis for elevated serum creatinine in this patient. (20 Marks)

(6.3.2) Explain the buffer systems functions in the renal system in acid-base balance. (30 Marks)

(6.3.3) Name two biochemical tests used to assess glomerular filtration. (20 Marks)

(Total: 100 Marks)

SECOND MBBS REPEAT (BATCH 1)- SEQ ANSWERS - 2026

(Q1)
(1.1) Aldolase B deficiency (10)
(1.2) Seliwanoff's test (10)
(1.3)
- Liver (5)
- Kidney (5)

(1.4)

Feature	Essential Fructosuria	Hereditary Fructose Intolerance
Metabolite accumulated	Fructose (10)	Fructose-1-phosphate (10)
Severity	Benign/asymptomatic disorder (10)	Severe disorder with hypoglycaemia and liver dysfunction (10)

(1.5)

- Aldolase B deficiency causes accumulation of fructose-1-phosphate (5)
- Fructose-1-phosphate traps inorganic phosphate (Pi) (5)
- Decreased Pi reduces ATP synthesis (5)
- Glycogenolysis and gluconeogenesis are inhibited, causing hypoglycaemia (5)

(1.6)

- Fructose cannot be metabolized normally because of aldolase B deficiency (5)
- Excess fructose accumulates in blood (5)
- Excess fructose is filtered by kidneys and excreted in urine (5)

(1.7)

- Avoid foods containing fructose, sucrose and sorbitol (15)

(Total: 100 Marks)

(Q2)
(2.1)

- Linoleic acid (10)
- Alpha-linolenic acid (10)

(2.2)

Enzyme	Cellular location
a) Carnitine palmitoyltransferase-I (10)	Outer mitochondrial membrane (10)
b) Acyl-CoA dehydrogenase (10)	Mitochondrial matrix (10)

(2.3.1)

- Alcohol dehydrogenase (10)
- Aldehyde dehydrogenase (10)

(2.3.2)

- Ethanol metabolism increases NADH production (10)
- High NADH inhibits fatty acid β-oxidation (10)
- Excess NADH promotes triglyceride synthesis (10)
- Triglycerides accumulate in hepatocytes causing fatty liver (10)

(Total: 100 Marks)

(Q3)
(3.1)

- Glycine (5)
- Succinyl-CoA (5)

(3.2)

- Transport of oxygen (5)
- Transport of carbon dioxide/buffering of blood pH (5)

(3.3)

- Maintains reduced glutathione (10)
- Protects red cells from oxidative damage (10)

(3.4.1)

- Glucose-6-phosphate dehydrogenase (G6PD) deficiency (10)

(3.4.2)

- G6PD deficiency reduces NADPH production (5)
- Reduced NADPH decreases regeneration of reduced glutathione (5)
- Oxidative damage denatures haemoglobin forming Heinz bodies (5)
- Damaged red cells undergo haemolysis (5)

(3.4.3)

- Haemolysis increases breakdown of haemoglobin (10)
- Increased heme degradation produces excess bilirubin (10)
- Unconjugated bilirubin accumulates in blood causing jaundice (10)

(Total: 100 Marks)

(Q4)
(4.1)

- Albumin (10)

(4.2)

- UDP-glucuronyl transferase (UGT1A1) (10)

(4.3)

- Conjugated bilirubin is water soluble (5)
- Unconjugated bilirubin is water insoluble (5)

(4.4.1)

- Conjugated bilirubin level is normal or low (10)

(4.4.2)

- Neonatal liver has low UDP-glucuronyl transferase activity (10)
- Bilirubin conjugation is reduced (10)
- Unconjugated bilirubin accumulates in blood (10)

(4.4.3)

- Unconjugated bilirubin is lipid soluble (10)
- It crosses the immature blood-brain barrier (10)
- Deposition in basal ganglia and brain tissue causes neuronal damage (10)

(Total: 100 Marks)

(Q5)
(5.1.1)

- NAD^+ / $NADP^+$ (10)

(5.1.2)

- Pyridoxal phosphate (PLP) (10)

(5.2)

- Calcium (10)
- Phosphorus (10)

(5.3)

- Zinc (5)
- Copper (5)

(5.4.1)

- Folate is required for thymidylate and purine synthesis (5)
- DNA synthesis is impaired (5)
- Nuclear maturation is delayed (5)
- Large immature red cell precursors develop causing macrocytic anaemia (5)

(5.4.2)

- Elevated homocysteine levels (10)
- Increased risk of neural tube defects in fetus (10)

(5.4.3)

- Vitamin B12 (10)

(Total: 100 Marks)

(Q6)
(6.1)

- Urea (5)
- Creatinine (5)
- Uric acid (5)
- Ammonium ions (5)

(6.2)

- Erythropoietin (5)
- Renin (5)

(6.3.1)

- Creatinine is normally filtered by glomeruli (5)
- Chronic kidney disease reduces GFR (5)
- Reduced filtration decreases creatinine excretion (5)
- Creatinine accumulates in blood causing elevated serum creatinine (5)

(6.3.2)

- Bicarbonate buffer neutralizes excess hydrogen ions (10)
- Kidneys secrete H^+ into urine (10)
- Kidneys generate and reabsorb bicarbonate to maintain blood pH (10)

(6.3.3)

- Serum creatinine/eGFR (10)
- Creatinine clearance test (10)

(Total: 100 Marks)

SECOND MBBS REPEAT (BATCH 1)- OSPE PAPER - 2026

(Q1)

Urine pH Measurement



A 22-year-old university student presents with burning micturition and lower abdominal discomfort. A routine Urine Full Report (UFR) shows a urine pH of 8.0. A urinary tract infection is suspected.

(1.1) Define pH. (03 Marks)
(1.2) List two biochemical methods used for the measurement of urine pH. (03 Marks)
(1.3) State the biochemical basis for the alkaline urine pH in this patient. (04 Marks)

(Total: 10 Marks)

(Q2)

Characteristics of Carbohydrates



A nutritionist is explaining to medical students why glucose is a reducing sugar. A test was performed on four samples to determine the presence of reducing sugars.

(2.1) Identify the test shown performed for the identification of reducing sugars. (03 Marks)
(2.2) Interpret the result for Samples A, B, C, and D. (04 Marks)
(2.3) State why glucose is considered a reducing sugar. (03 Marks)

(Total: 10 Marks)

(Q3)

Acute Myocardial Infarction

A patient presents 1 hour after chest pain. Troponin I is normal, and myoglobin is elevated in this patient. Acute myocardial infarction is suspected.

(3.1) State why myoglobin is elevated earlier than troponins. (05 Marks)
(3.2) Name one advantage of troponin I over myoglobin. (05 Marks)

(Total: 10 Marks)

(Q4)

Uncontrolled Diabetes



A 25-year-old patient with uncontrolled diabetes presents with polyuria, polydipsia, weight loss, and fruity-smelling breath. The urine test strip was positive for glucose.

(4.1) State the biochemical basis for the test result. (05 Marks)
(4.2) State what is the substance that gives rise to the fruity-smelling breath of this patient. (05 Marks)

(Total: 10 Marks)

(Q5)

Serum AST (SGOT)

A patient with chronic alcohol consumption presents with jaundice. His AST levels are given.

Test	Results	Reference range
AST (U/L)	300	10-45

(5.1) Give one (01) function of AST in metabolism. (05 Marks)
(5.2) Explain why AST is elevated in this patient. (05 Marks)

(Total: 10 Marks)

(Q6)

Pancreatic Disease

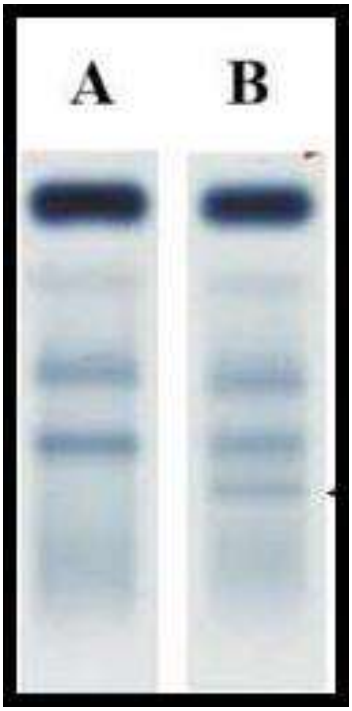
A chronic alcoholic user presents with mildly elevated serum amylase levels with steatorrhea.

(6.1) State the function of serum amylase. (03 Marks)
(6.2) Name one (01) condition where serum amylase is elevated. (03 Marks)
(6.3) Explain the reason for the presence of undigested fat in faeces (steatorrhea) in this patient. (04 Marks)

(Total: 10 Marks)

(Q7)

Electrophoresis



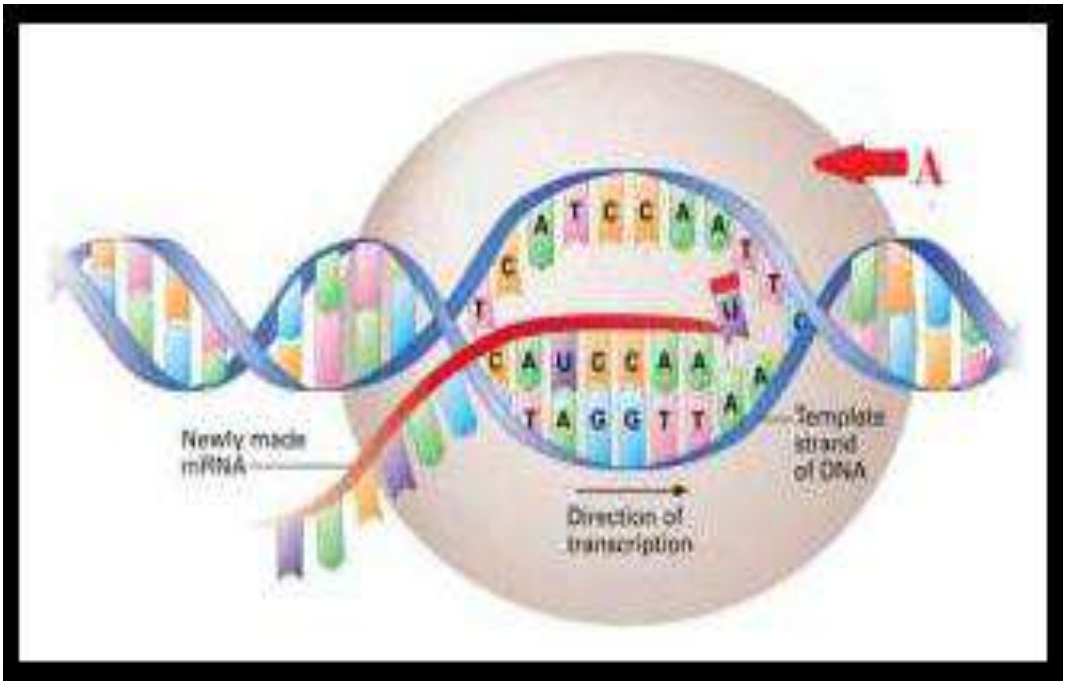
Protein electrophoresis was performed on a serum sample and a plasma sample. The result is given.

(7.1) Identify the serum sample. (04 Marks)
(7.2) Name two applications of serum electrophoresis in clinical biochemistry. (06 Marks)

(Total: 10 Marks)

(Q8)

Transcription



An illustration of the transcription process is given.

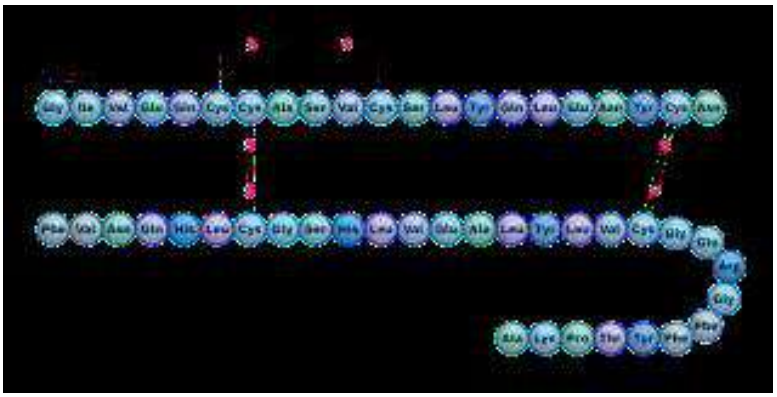
(8.1) Name the enzyme labelled as A. (04 Marks)

(8.2) List two biomedical applications of the enzyme mentioned in 8.1. (06 Marks)

(Total: 10 Marks)

(Q9)

Post-Translational Modifications



A medical student is examining how insulin is produced from proinsulin.

(9.1) Name the type of modification involved in converting proinsulin to insulin. (05 Marks)
(9.2) State the importance of post-translational modifications. (05 Marks)

(Total: 10 Marks)

(Q10)

Methemoglobinemia



A 2-year-old child presents with cyanosis. Methemoglobinemia is suspected.

(10.1) Name the abnormal form of hemoglobin expected in this child. (05 Marks)
(10.2) State the biochemical reason for cyanosis in this condition. (05 Marks)

(Total: 10 Marks)

(Q11)

Creatinine

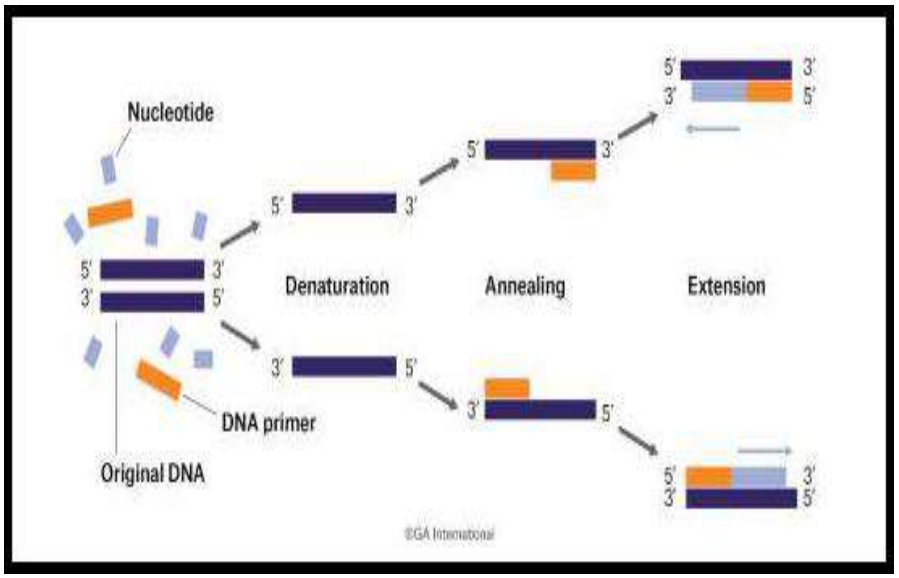
A 65-year-old hypertensive patient has elevated serum creatinine.

(11.1) State the source of creatinine in the body. (03 Marks)
(11.2) Mention one biochemical test to assess kidney function using creatinine. (03 Marks)
(11.3) Explain the biochemical basis of measurement of serum creatinine to test the renal function. (04 Marks)

(Total: 10 Marks)

(Q12)

Molecular Biology Techniques



An illustration of a molecular biology technique is given.

(12.1) Name the technique shown in the above illustration. (04 Marks)
(12.2) Name two medical applications of the technique mentioned in 12.1. (06 Marks)

(Total: 10 Marks)

(Q13)

Endocrine Assays

A patient's thyroid profile reveals TSH 12 microIU/mL (elevated), low T3 and T4.

(13.1) Name the type of immunoassay commonly used in endocrine testing. (05 Marks)
(13.2) Identify the thyroid disorder present in this patient. (05 Marks)

(Total: 10 Marks)

(Q14)

Osteoporosis



A 60-year-old postmenopausal woman with multiple fractures is suspected of osteoporosis.

(14.1) Name one hormone in bone metabolism. (04 Marks)
(14.2) State the biochemical basis of postmenopausal osteoporosis. (06 Marks)

(Total: 10 Marks)

(Q15)

Biomarkers of Skeletal Muscle Damage

An athlete presents with severe muscle pain after intense exercise. Lab tests show elevated CK-MM (creatine kinase muscle type).

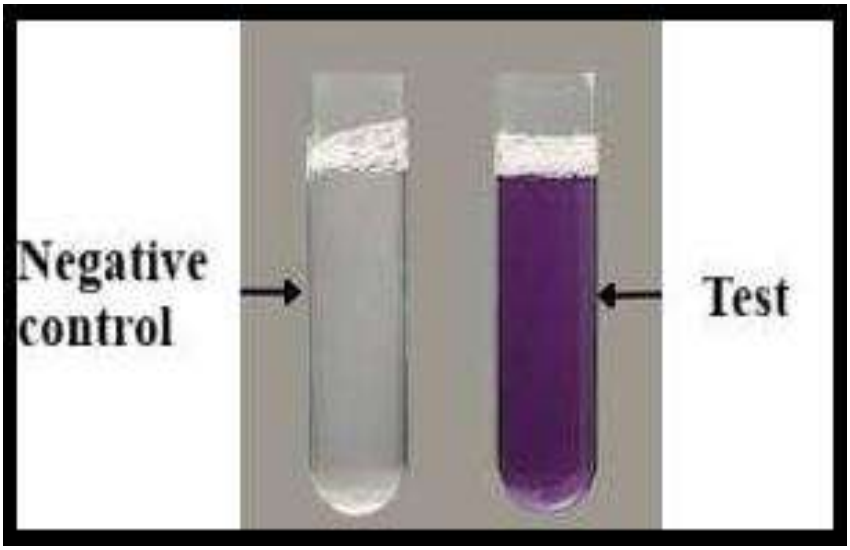
(15.1) State the function of this enzyme. (05 Marks)

(15.2) Mention one (01) clinical condition where CK-MM is elevated other than exercise. (05 Marks)

(Total: 10 Marks)

(Q16)

Biuret Test



A nutritional powder is tested using the Biuret reagent, and the result is given.

(16.1) Interpret this result. (04 Marks)

(16.2) State the principle behind the Biuret test. (06 Marks)

(Total: 10 Marks)

(Q17)

Sulphosalicylic Acid Test



A 40-year-old man presents with frothy urine. A urine sample is tested with sulphosalicylic acid, and the result is shown.

(17.1) Identify the substance detected in urine. (04 Marks)
(17.2) State the biochemical principle of this test. (06 Marks)

(Total: 10 Marks)

(Q18)

Urine Appearance



A urine sample from a 30-year-old man is received in the laboratory. An image of the urine sample is given.

(18.1) Report the appearance of the sample. (04 Marks)
(18.2) Mention two possible reasons for the appearance reported in 18.1. (06 Marks)

(Total: 10 Marks)

(Q19)

Urine Casts



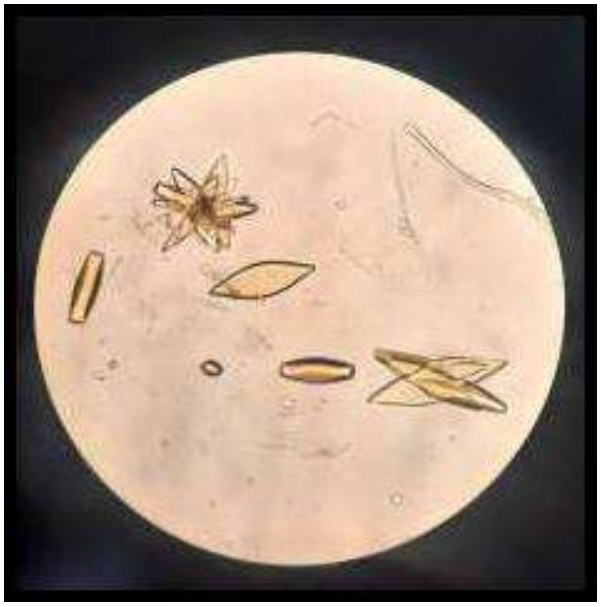
A 28-year-old woman presents with dysuria, fever, and discomfort in the side of the back. Urine analysis shows pyuria, and microscopy reveals casts.

(19.1) Identify the type of cast observed. (04 Marks)
(19.2) List two components of the illustrated cast. (06 Marks)

(Total: 10 Marks)

(Q20)

Urine Crystals



A 35-year-old man presents with severe pain in the big toe (podagra). Urine microscopy shows crystals.

(20.1) Identify the type of crystal observed. (05 Marks)
(20.2) Name the affected metabolic pathway of this patient. (05 Marks)

(Total: 10 Marks)

SECOND MBBS REPEAT (BATCH 1)- OSPE ANSWERS - 2026



(Q1)
(1.1) pH is the negative logarithm of hydrogen ion concentration.
(1.2)
(1.2.1) pH meter method
(1.2.2) Indicator paper (dipstick) method
(1.3) Urease-producing bacteria split urea into ammonia, making urine alkaline.



(Q2)
(2.1) Benedict's test
(2.2)
(2.2.1) Sample A – Negative
(2.2.2) Sample B – Trace positive
(2.2.3) Sample C – Moderate positive
(2.2.4) Sample D – Strong positive
(2.3) Glucose possesses a free aldehyde (reducing) group capable of reducing metal ions.

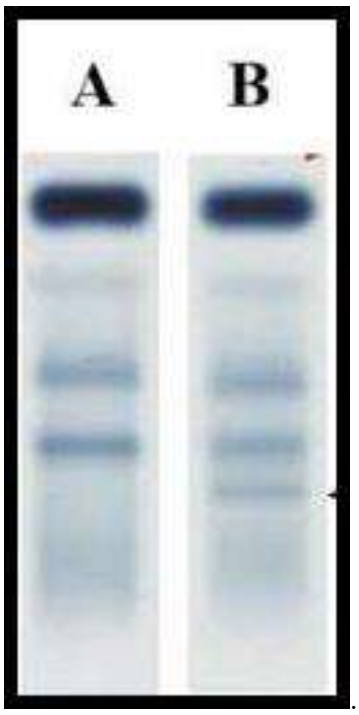
(Q3)
(3.1) Myoglobin is a small cytoplasmic protein released rapidly from damaged cardiac muscle.
(3.2) Troponin I is more specific for myocardial injury.



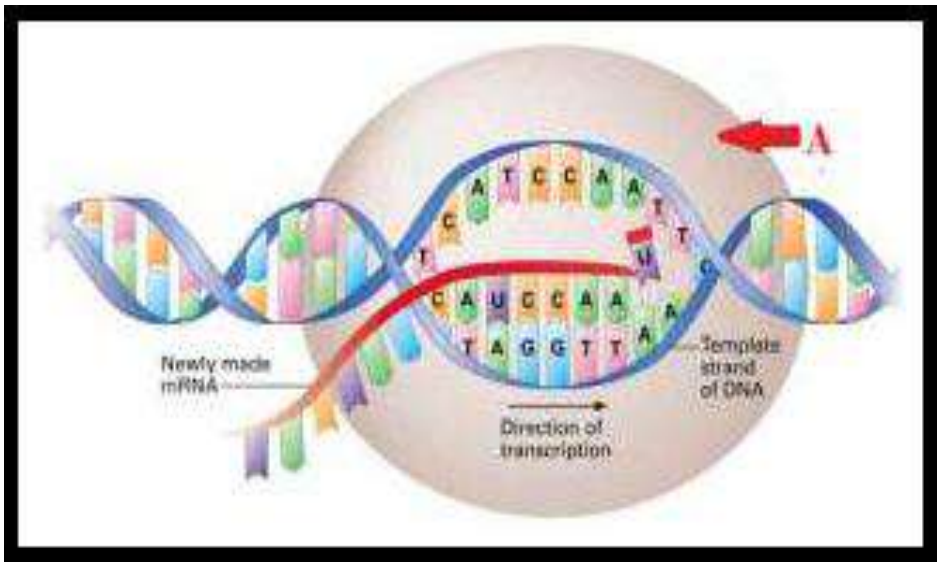
(Q4)
(4.1) Blood glucose exceeds the renal threshold, causing glucose to appear in urine (glycosuria).
(4.2) Acetone

(Q5)
(5.1) Catalyzes transamination between aspartate and α-ketoglutarate to form oxaloacetate and glutamate.
(5.2) Hepatocellular damage due to chronic alcohol use releases AST into the bloodstream.

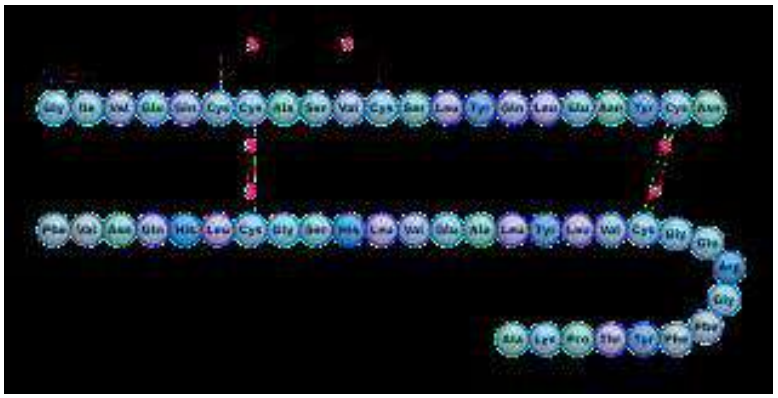
(Q6)
(6.1) Digestion of starch into maltose and smaller carbohydrates.
(6.2) Acute pancreatitis
(6.3) Pancreatic insufficiency reduces lipase secretion, causing fat malabsorption and steatorrhea



(Q7)
(7.1) The sample without the fibrinogen band is the serum sample.
(7.2)
(7.2.1) Diagnosis of multiple myeloma
(7.2.2) Evaluation of liver disease and immunoglobulin disorders



(Q8)
(8.1) RNA polymerase
(8.2)
(8.2.1) Reverse transcription PCR (RT-PCR)
(8.2.2) Gene expression studies

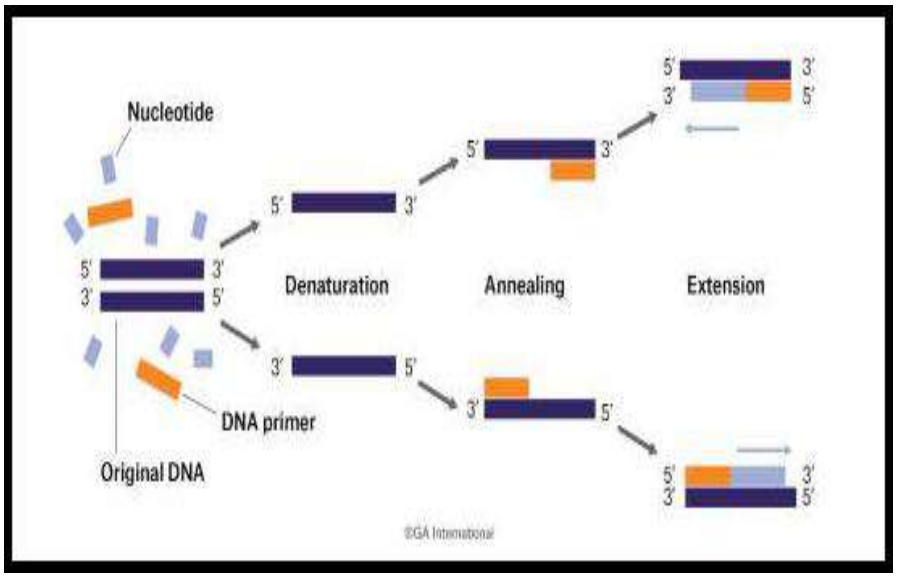


(Q9)
(9.1) Proteolytic cleavage (post-translational processing)
(9.2) Converts inactive proteins into biologically active functional proteins.



(Q10)
(10.1) Methemoglobin
(10.2) Iron is present in the ferric (Fe^{3+}) state and cannot bind oxygen effectively, causing tissue hypoxia and cyanosis.

(Q11)
(11.1) Breakdown of creatine phosphate in skeletal muscle
(11.2) Creatinine clearance test
(11.3) Reduced glomerular filtration leads to accumulation of creatinine in blood



(Q12)
(12.1) Polymerase Chain Reaction (PCR)
(12.2)
(12.2.1) Detection of genetic disorders
(12.2.2) Diagnosis of infectious diseases

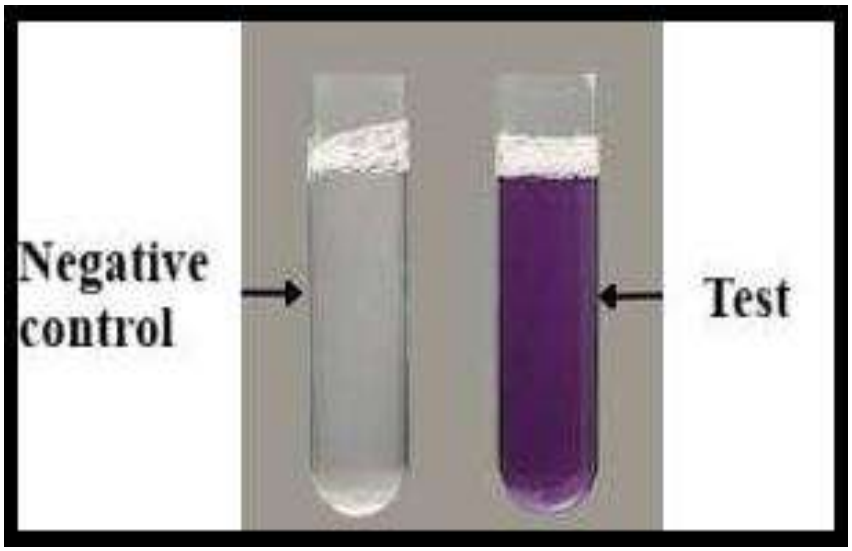
(Q13)
(13.1) Enzyme-linked immunosorbent assay (ELISA)
(13.2) Primary hypothyroidism



(Q14)
(14.1) Parathyroid hormone (PTH)
(14.2) Estrogen deficiency increases osteoclast activity, increased bone resorption and reduced bone mass.

(Q15)

(15.1) Catalyzes reversible transfer of phosphate between ATP and creatine.
(15.2) Muscular dystrophy



(Q16)
(16.1) Positive Biuret test indicating the presence of protein.
(16.2) Peptide bonds form a violet-colored complex with copper ions in alkaline medium.



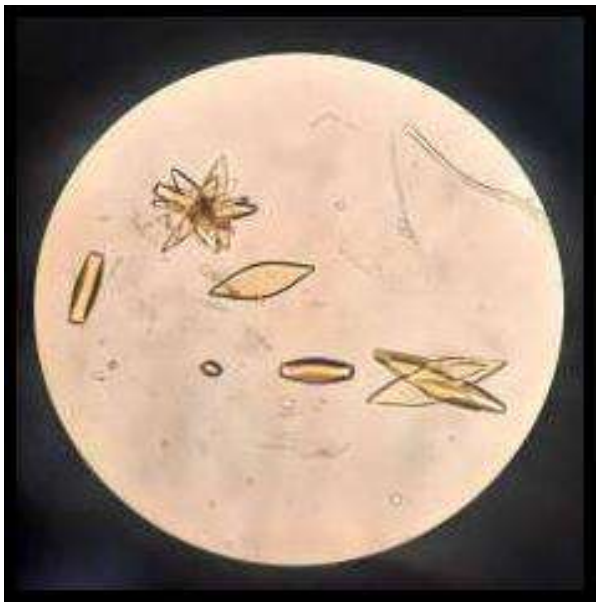
(Q17)
(17.1) Protein
(17.2) Sulphosalicylic acid denatures and precipitates proteins, producing turbidity.



(Q18)
(18.1) Turbid (cloudy) urine
(18.2)
(18.2.1) Urinary tract infection
(18.2.2) Presence of crystals or phosphates



(Q19)
(19.1) White blood cell (WBC) cast
(19.2)
(19.2.1) Leukocytes (pus cells)
(19.2.2) Tamm–Horsfall protein (uromodulin)



(Q20)
(20.1) Uric acid crystal
(20.2) Purine metabolism pathway (purine degradation pathway)



MESSAGE OF THE DEAN

As the Dean of the Uva Wellassa Medical Faculty, I am delighted to present "Mastering Biochemistry – Part III: A Comprehensive Guide to MCQs, Essays, and OSPEs." This publication represents a significant achievement in our ongoing commitment to enhancing the quality of medical education and supporting student learning.

In the ever-evolving discipline of medicine, a thorough knowledge of Biochemistry continues to be a cornerstone of academic and professional success. This guide has been thoughtfully designed to serve as a comprehensive learning resource, covering a wide range of assessment formats, including MCQs, essays, and OSPEs, while providing detailed explanations and model answers to reinforce understanding.

The primary aim of this book is to equip students with the knowledge and skills necessary to excel in examinations and deepen their comprehension of principles in biochemistry. We believe that this guide will become a trusted companion throughout your academic journey, helping to build confidence, improve clarity, and establish a strong foundation for learning.

I extend my heartfelt gratitude to the faculty members and contributors whose dedication, expertise, and hard work made this publication possible. It is our sincere hope that you will find this guide both informative and inspiring as you advance through your medical studies.

I wish you every success in your academic endeavors and in your future career as a medical professional.

Sincerely,

Senior Professor Muditha Vidanapathirana,
MBBS (Col), DLM, MD, MA (SJP), FFFLM (UK)
Dean,
Faculty of Medicine,
Uva Wellassa University of Sri Lanka

Rs. 1500/-