SOPHIA MEDPREP SYSTEM / KLIMENT EDITION

MEDICINE ENTRANCE EXAM ACADEMIC SOLUTION COMPANION

SCENARIO 01 • BIOLOGY + CHEMISTRY

50 university-sourced, Sophia-adapted examination items • 50 English academic explanations • distractor-by-distractor analysis • 50 Turkish YKS approaches • 150 new four-option reinforcement questions

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EDITORIAL NOTE / HOW TO USE THIS BOOK

This companion accompanies Sophia MedPrep Medicine Entrance Exam Scenario 01. The student examination comprises 25 Biology and 25 Chemistry questions, adapted from the two Biology and two Chemistry university-published sample papers supplied for this project. The text was revised to repair ambiguous or defective answer choices. The adapted mock tests must not be represented as examinations actually administered by Sofia University or as an official university answer key.

For every question

1 Answer the adapted examination item before looking at the key.
2 Study the scientific reason for the correct answer in English.
3 Review the separate explanations for all three incorrect options.
4 Read the Turkish YKS Perspective to connect the concept with familiar examination reasoning.
5 Complete the three new reinforcement questions and check the concise rationale printed below each.

Symbols and editorial choices

GREEN = correct response and scientific reasoning. RED = why incorrect options fail. GOLD = Turkish YKS Perspective. BLUE = check your understanding. All four answer alternatives are given for each practice question, and the keyed response is explained.

Scientific quality and provenance

The source sample papers contain drafting weaknesses. These are addressed in the separate Sophia-adapted scenario booklets used as the basis for this publication. Corrections are editorial and do not imply official university approval. Scientific statements in this book are subject to final independent subject-specialist review before commercial publication.

Source materials

Biology example 1; Biology example 2; Chemistry example 1; Chemistry example 2. Supplied by the user as university-authored example examination materials. No official examination-year attribution is asserted for these sample test questions.

Design authorship

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SECTION I / BIOLOGY

Questions 01–25 • Cellular biology, human physiology, genetics and biology reasoning.

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QUESTION 01 | BIOLOGY

CELL BIOLOGY

Which organelle functions as the "powerhouse" of the cell by producing most of the ATP needed for cellular activities?

A. Cytoplasm
B. Ribosomes
C. Nucleus
D. Mitochondria

CORRECT ANSWER • D — Mitochondria

Mitochondria generate most cellular ATP through the respiratory electron-transport chain and oxidative phosphorylation across the inner mitochondrial membrane.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. The cytoplasm is the setting for glycolysis, not the principal organelle for oxidative phosphorylation.

B. Ribosomes translate mRNA into proteins and do not synthesize ATP by respiration.

C. The nucleus stores and transcribes genetic information rather than supplying most ATP.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Mitokondri iç zarındaki elektron taşıma sistemi ve ATP sentaz oksidatif fosforilasyon yapar; ribozom protein sentezler, çekirdek genetik bilgiyi taşır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Where is the electron-transport chain located in a mitochondrion?

A. Outer membrane
B. Matrix only
C. Cytosol
D. Inner mitochondrial membrane

Answer: D. Respiratory complexes are embedded in the inner membrane.

R2. Which enzyme complex directly synthesizes ATP from ADP and phosphate?

A. ATP synthase
B. DNA polymerase
C. Pepsin
D. RNA polymerase

Answer: A. ATP synthase uses the proton motive force.

R3. Which pathway takes place in the cytosol rather than the mitochondrion?

A. Citric acid cycle
B. Glycolysis
C. Mitochondrial oxidative phosphorylation
D. Pyruvate oxidation

Answer: B. Glycolysis occurs in the cytosol.

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QUESTION 02 | BIOLOGY

CELL STRUCTURE

Which of the following organelles is surrounded by a double membrane?

A. Lysosome
B. Nucleus
C. Peroxisome
D. Endoplasmic reticulum

CORRECT ANSWER • B — Nucleus

The nucleus is bounded by a double-membrane nuclear envelope with pores. Mitochondria and chloroplasts also have double membranes, but they are not offered as options.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Lysosomes have a single limiting membrane.

C. Peroxisomes have a single surrounding membrane.

D. The endoplasmic reticulum is bounded by one membrane enclosing its lumen.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Çekirdek zarı çift katlı zar sistemi ve porlardan oluşur; lizozom, peroksizom ve ER tek sınırlayıcı zar taşır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which organelle, besides the nucleus, possesses two surrounding membranes?

A. Mitochondrion
B. Lysosome
C. Golgi cisterna
D. Peroxisome

Answer: A. Mitochondria have outer and inner membranes.

R2. What is the principal function of nuclear pores?

A. ATP oxidation
B. Selective nuclear-cytoplasmic transport
C. Chromosome replication exclusively
D. Lysosomal hydrolysis

Answer: B. Nuclear pore complexes mediate macromolecular traffic.

R3. Which single-membrane organelle contains acid hydrolases?

A. Nucleus
B. Mitochondrion
C. Lysosome
D. Chloroplast

Answer: C. Lysosomes digest materials using hydrolytic enzymes.

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QUESTION 03 | BIOLOGY

HUMAN TISSUES

Which set correctly lists the four basic types of animal tissue?

A. Epithelial, squamous, muscular, connective

B. Epithelial, connective, muscular, cardiac

C. Connective, muscular, epithelial, nervous

D. Cuboidal, ciliated, glandular, columnar

CORRECT ANSWER • C — Connective, muscular, epithelial, nervous

The four foundational animal tissue categories are epithelial, connective, muscle and nervous tissue. Terms such as squamous, cardiac and cuboidal designate subtypes.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Squamous is an epithelial subtype; nervous tissue is missing.

B. Cardiac is a muscle subtype and nervous tissue is missing.

D. Cuboidal, ciliated, glandular and columnar are epithelial characteristics or subtypes.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Hayvansal dokular epitel, bağ, kas ve sinirdir; yassı/kübik epitel ya da kalp kası ana grup değil alt türdür.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. **Which of these is one of the four principal animal tissue types?**

A. Cuboidal epithelium

B. Connective tissue

C. Cardiac muscle only

D. Columnar epithelium

Answer: B. Connective tissue is a principal category.

R2. **Neurons and supporting glial cells belong primarily to which tissue?**

A. Epithelial tissue

B. Skeletal muscle

C. Nervous tissue

D. Adipose tissue

Answer: C. Neurons and glia form nervous tissue.

R3. **Blood is classified as a specialized form of which tissue?**

A. Nervous tissue

B. Epithelial tissue

C. Muscle tissue

D. Connective tissue

Answer: D. Blood is a fluid connective tissue.

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QUESTION 04 | BIOLOGY

DIGESTIVE ENZYMES

Which group of nutrients is primarily broken down by lipases?

A. Complex carbohydrates
B. Simple carbohydrates
C. Fats
D. Proteins

CORRECT ANSWER • C — Fats

Lipases catalyze hydrolysis of ester bonds in dietary triacylglycerols, yielding fatty acids and monoacylglycerols or glycerol depending on the enzyme and reaction.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Complex starches are hydrolyzed by amylases, not lipases.

B. Simple carbohydrates are processed by disaccharidases and other carbohydrate enzymes.

D. Proteins are hydrolyzed by proteases and peptidases.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Lipaz yağları, amilaz nişastayı, proteaz proteinleri parçalar; enzim-substrat eşleştirmesi yap.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which pancreatic enzyme hydrolyzes dietary triacylglycerols?

A. Pepsin
B. Lactase
C. Pancreatic lipase
D. Salivary amylase

Answer: C. Pancreatic lipase participates in lipid digestion.

R2. Which product can result from the action of pancreatic lipase on triglycerides?

A. Free amino acids
B. Glucose only
C. Nucleotides
D. Free fatty acids

Answer: D. Lipase releases fatty acids from ester bonds.

R3. Which enzyme family primarily digests protein peptide bonds?

A. Proteases
B. Lipases
C. Nucleases only
D. Amylases

Answer: A. Proteases hydrolyze peptide bonds.

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QUESTION 05 | BIOLOGY

DNA STRUCTURE

Assuming similar ionic conditions, which double-stranded DNA fragment would generally require the highest temperature to denature?

A. Short fragment with a high proportion of A–T pairs

B. Long fragment with a high proportion of A–T pairs

C. Short fragment with a high proportion of G–C pairs

D. Long fragment with a high proportion of G–C pairs

CORRECT ANSWER • D — Long fragment with a high proportion of G–C pairs

Longer duplexes generally show higher thermal stability than comparable shorter duplexes, and GC-rich DNA tends to melt at higher temperatures because of base pairing and stacking thermodynamics. Under the stated similar conditions, the long GC-rich duplex is most resistant to denaturation.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. A short AT-rich fragment has the lowest expected duplex stability.

B. A long AT-rich fragment gains length-related stability but lacks the GC-rich advantage.

C. A short GC-rich fragment benefits from GC content but is shorter than option D.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: GC oranı ve uzunluk arttıkça, benzer koşullarda DNA çift sarmalının erime sıcaklığı genellikle yükselir; iki değişkeni birlikte karşılaştır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which base pair forms three canonical hydrogen bonds in DNA?

A. A-T
B. A-U
C. T-U
D. G-C

Answer: D. A G-C base pair typically forms three hydrogen bonds.

R2. What does DNA melting temperature (Tm) describe?

A. Temperature at which half the duplex population is denatured
B. Temperature of chromosome replication
C. Temperature at which proteins denature exclusively
D. Temperature at which all cells die

Answer: A. Tm measures the duplex-to-single-strand transition.

R3. Which factor generally lowers DNA duplex stability?

A. Higher GC fraction
B. Greater proportion of A-T pairs at fixed length
C. Greater complementary length
D. Increasing ionic shielding within physiological limits

Answer: B. At fixed length, more AT usually lowers Tm.

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QUESTION 06 | BIOLOGY

BLOOD BIOCHEMISTRY

Which element is not normally a structural component of a hemoglobin molecule?

A. Iron
B. Oxygen
C. Nitrogen
D. Phosphorus

CORRECT ANSWER • D — Phosphorus

Hemoglobin contains globin polypeptides with carbon, hydrogen, oxygen and nitrogen, and iron in each heme group. Phosphorus is not a normal structural element of the hemoglobin molecule itself.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Iron is a central component of heme and reversibly binds oxygen.

B. Oxygen atoms are present in the organic polypeptide/heme structures and molecular O2 can bind iron.

C. Nitrogen occurs in peptide backbones and the porphyrin ring.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Hemoglobinde hem grubu Fe ve globin protein bulunur; N ve O moleküler yapıya girer; fosfor temel yapısal bileşen değildir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which metal ion lies at the center of each functional heme group of hemoglobin?

A. Iron(II)
B. Magnesium(II)
C. Calcium(II)
D. Zinc(II)

Answer: A. Heme normally contains ferrous iron.

R2. Which component binds oxygen reversibly in hemoglobin?

A. Phosphate
B. Heme iron
C. Sodium
D. Amino-terminal phosphate

Answer: B. Molecular oxygen coordinates to heme iron.

R3. How many heme groups does a normal adult hemoglobin tetramer contain?

A. One
B. Two
C. Four
D. Eight

Answer: C. Each of the four globin subunits binds one heme group.

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QUESTION 07 | BIOLOGY

HUMAN PHYSIOLOGY

Kwashiorkor involves severe dietary protein deficiency and low plasma albumin. Which consequence is most characteristic?

A. Increased plasma oncotic pressure

B. Movement of water from capillaries into tissues, causing edema

C. Persistent elevation in plasma albumin

D. Excessively increased blood urea production

CORRECT ANSWER • B — Movement of water from capillaries into tissues, causing edema

Severe protein deficiency lowers plasma albumin and colloid oncotic pressure. Fluid then shifts from capillaries into interstitial tissues, contributing to edema.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. A low albumin concentration lowers rather than raises plasma oncotic pressure.

C. Albumin remains reduced, not elevated, in the stated protein-deficient condition.

D. Urea production is not characteristically increased by severe shortage of dietary protein.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Albümin azalırsa plazmanın onkotik basıncı düşer; su dokulara geçer ve ödem oluşur. Ozmoz/onkotik basınç ilişkisini kullan.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which plasma protein is a major contributor to colloid oncotic pressure?

A. Hemoglobin inside erythrocytes
B. Albumin
C. Fibrin within clots
D. Myosin
Answer: B. Albumin is the most abundant plasma protein.

R2. Decreased capillary oncotic pressure tends to cause which change?

A. Enhanced fluid retention inside capillaries
B. Complete cessation of filtration
C. Increased interstitial fluid accumulation
D. More red-cell synthesis
Answer: C. Lower oncotic pressure promotes edema.

R3. Kwashiorkor is classically associated with severe deficiency of which macronutrient?

A. Sodium chloride
B. Fiber
C. Water only
D. Protein
Answer: D. Marked insufficient protein intake is characteristic.

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QUESTION 08 | BIOLOGY

KIDNEY PHYSIOLOGY

Which abnormality can produce large volumes of dilute urine?

A. Deficiency of antidiuretic hormone (vasopressin)

B. Severe hemorrhage

C. Low blood glucose in a healthy person

D. Damage restricted to the large intestine

CORRECT ANSWER • A — Deficiency of antidiuretic hormone (vasopressin)

ADH (vasopressin) promotes water reabsorption in the renal collecting ducts through aquaporin-2 insertion. ADH deficiency causes excretion of excessive dilute urine, as in central diabetes insipidus.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

B. Severe blood loss typically stimulates ADH and water conservation.

C. Low glucose does not itself produce the osmotic diuresis seen with severe hyperglycemia.

D. The large intestine is not the primary regulator of collecting-duct water permeability.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: ADH eksikliğinde toplayıcı kanallardan su geri emilimi azalır, çok ve seyreltik idrar çıkar; diabetes insipidus ve mellitus farkına dikkat.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. ADH acts prominently on which renal structure?

A. Glomerular basement membrane only
B. Afferent arteriole only
C. Collecting duct
D. Renal pelvis
Answer: C. Collecting ducts alter water permeability in response to ADH.

R2. Which membrane protein is inserted into collecting-duct cells under ADH action?

A. Hemoglobin
B. Pepsin
C. Collagen II
D. Aquaporin-2
Answer: D. Aquaporin-2 increases water permeability.

R3. Central diabetes insipidus usually involves deficiency of:

A. Vasopressin
B. Insulin
C. Parathyroid hormone
D. Calcitonin
Answer: A. Central diabetes insipidus reflects impaired ADH release.

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QUESTION 09 | BIOLOGY

ENDOCRINE SIGNALING

Why do steroid hormones usually bind intracellular receptors, whereas many peptide hormones bind cell-surface receptors?

A. Steroid hormones generally cannot cross lipid bilayers

B. Steroid hormones are lipid-soluble and can cross the plasma membrane

C. Peptide hormones always enter cells by diffusion

D. All hormones bind identical receptors in the nucleus

CORRECT ANSWER • B — Steroid hormones are lipid-soluble and can cross the plasma membrane

Most steroid hormones are lipophilic and diffuse across lipid bilayers to bind intracellular nuclear-receptor-family proteins. Many peptide hormones are hydrophilic and instead signal via receptors on the cell surface.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. The premise is reversed: steroid hormones commonly cross membranes.

C. Peptide hormones generally do not freely diffuse across the hydrophobic membrane core.

D. Different hormones use distinct receptor families and cellular locations.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Steroid hormon lipitte çözünür, hücre içi reseptöre; peptit hormon çoğunlukla zar reseptörüne bağlanır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which hormone is most likely to bind an intracellular nuclear receptor?

A. Insulin
B. Glucagon
C. ADH
D. Cortisol

Answer: D. Cortisol is a steroid hormone.

R2. Which physical property helps many steroid hormones cross membranes?

A. Lipid solubility
B. Permanent high ionic charge
C. Large peptide size
D. Exclusive water solubility

Answer: A. Lipophilicity enables passage through lipid bilayers.

R3. Insulin normally binds receptors located mainly where?

A. Mitochondrial matrix
B. Plasma membrane
C. Chromosome centromere
D. Ribosomal catalytic site

Answer: B. Insulin activates a surface receptor tyrosine kinase.

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QUESTION 10 | BIOLOGY

MEMBRANE BIOLOGY

Which class of biomolecules contains long hydrophobic chains and is a major structural component of cell membranes?

A. Polypeptides
B. Carbohydrates
C. Phospholipids
D. Nucleotides

CORRECT ANSWER • C — Phospholipids

Phospholipids contain hydrophobic hydrocarbon tails and hydrophilic head groups; their amphipathic structure causes them to assemble into membrane bilayers in water.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Polypeptides are amino-acid polymers rather than the dominant bilayer-forming amphipathic lipid class.

B. Carbohydrates usually lack the phospholipid architecture forming a stable bilayer.

D. Nucleotides are components of nucleic acids and metabolic cofactors, not bilayer structural lipids.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Fosfolipitte hidrofilik baş ve hidrofobik iki kuyruk vardır; zarın çift tabakasını oluşturur.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. **Which part of a phospholipid bilayer faces the aqueous cytosol?**

A. Polar heads
B. Nonpolar fatty-acid tails
C. Aromatic DNA bases
D. Peptide bonds

Answer: A. Hydrophilic heads contact water.

R2. **The tendency of phospholipids to form bilayers is mainly related to their:**

A. Chromosomal location
B. Amphipathic structure
C. Peptide sequence
D. Glycosidic bonds

Answer: B. Their polar and nonpolar regions drive self-assembly.

R3. **What lies in the central hydrophobic region of a cell membrane?**

A. Phosphate heads only
B. Nuclear RNA
C. Fatty-acid tails
D. Free calcium ions only

Answer: C. Lipid tails point inward.

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QUESTION 11 | BIOLOGY

MALE REPRODUCTION

Where do human spermatozoa primarily mature after they are produced in the testes?

A. Prostate gland
B. Epididymis
C. Bulbourethral glands
D. Seminal vesicles

CORRECT ANSWER • B — Epididymis

Sperm cells acquire motility and functional maturity while transiting the epididymis following formation in the seminiferous tubules of the testes.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. The prostate contributes secretions to semen but is not the maturation site.

C. Bulbourethral glands produce mucus-like secretions rather than maturing sperm.

D. Seminal vesicles secrete fructose-rich seminal fluid, not the principal site of sperm maturation.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Sperm testiste üretilir, epididimiste olgunlaşır, vas deferens ile taşınır; yardımcı bezlerle karıştırma.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. In which testicular compartment are sperm generated?

A. Prostatic ducts
B. Seminiferous tubules
C. Seminal vesicles
D. Bladder lumen

Answer: B. Spermatogenesis occurs in seminiferous tubules.

R2. Which structure stores and matures sperm following spermatogenesis?

A. Prostate
B. Urethral meatus
C. Epididymis
D. Bulbourethral gland

Answer: C. Sperm mature within the epididymal duct.

R3. Which duct conveys sperm from epididymis toward the ejaculatory duct?

A. Ureter
B. Fallopian tube
C. Bile duct
D. Vas deferens

Answer: D. The vas deferens transports sperm.

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QUESTION 12 | BIOLOGY

RESPIRATORY PHYSIOLOGY

During exercise, what immediate physiological adjustment helps supply more oxygen to working muscles?

A. Increasing food intake within seconds

B. Increasing carbon dioxide intake

C. Retaining metabolic waste products

D. Increasing breathing rate and ventilation

CORRECT ANSWER • D — Increasing breathing rate and ventilation

Exercise rapidly increases ventilatory drive through neural and chemical control, improving oxygen delivery and carbon dioxide removal as metabolic demand rises.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Food intake cannot supply an immediate ventilation adjustment within seconds.

B. CO_2 is a metabolic waste gas, not something exercise requires people to inhale.

C. Retaining waste products would impair rather than support homeostasis.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Egzersizde solunum hızı ve derinliği artar; oksijen alımı ve CO_2 uzaklaştırılması yükselir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which respiratory variable usually rises rapidly during vigorous exercise?

A. Alveolar oxygen consumption stops

B. Respiratory rate becomes zero

C. Minute ventilation

D. Airway resistance must be infinite

Answer: C. Breathing frequency and tidal volume can increase.

R2. Which gas diffuses from alveoli toward pulmonary capillary blood under normal conditions?

A. Nitrogen as the principal metabolic substrate

B. Helium

C. Methane

D. Oxygen

Answer: D. Oxygen follows its partial-pressure gradient.

R3. What typically triggers greater ventilatory drive during exercise?

A. Increased metabolic demand

B. Complete disappearance of CO_2 production

C. Lack of cellular ATP utilization

D. Loss of all neural input

Answer: A. Ventilation is matched to metabolic needs.

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QUESTION 13 | BIOLOGY

NEUROPHYSIOLOGY

In Pavlov's classical conditioning experiment, why did dogs salivate when a bell sounded?

A. The bell caused an innate hunger response

B. They learned to associate the bell with the appearance of food

C. The bell acoustically resembled food bowls

D. Any loud sound always produces salivation

CORRECT ANSWER • B — They learned to associate the bell with the appearance of food

A previously neutral bell became a conditioned stimulus after repeated pairing with food, so it elicited the learned salivary conditioned response even without food present.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. The bell alone was not an innate unconditioned trigger for hunger.

C. Similarity to bowls is not required; temporal association with food establishes conditioning.

D. Salivation is not an unavoidable response to every loud sound.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Pavlov deneyinde zil koşullu uyaran, salya koşullu tepkidir; besin koşulsuz uyarandır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. **Before training, food naturally elicits salivation. Food is termed the:**

A. Conditioned stimulus
B. Neutral stimulus only
C. Conditioned inhibitor
D. Unconditioned stimulus

Answer: D. Food elicits a reflex without learning.

R2. **After repeated bell-food pairings, the bell becomes a:**

A. Conditioned stimulus
B. Unconditioned response
C. Genetic mutation
D. Habituation reflex

Answer: A. The learned bell signal predicts food.

R3. **Which form of learning is illustrated by Pavlovian salivation?**

A. Operant extinction only
B. Classical conditioning
C. Chromosomal imprinting
D. Motor recruitment

Answer: B. Classical conditioning links two stimuli.

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QUESTION 14 | BIOLOGY

RENAL CIRCULATION

Which sequence correctly traces blood flow through the renal corpuscle and surrounding nephron capillaries?

A. Peritubular capillaries → efferent arteriole → glomerulus → afferent arteriole

B. Efferent arteriole → glomerulus → afferent arteriole → peritubular capillaries

C. Afferent arteriole → glomerulus → efferent arteriole → peritubular capillaries

D. Afferent arteriole → glomerulus → peritubular capillaries → efferent arteriole

CORRECT ANSWER • C — Afferent arteriole → glomerulus → efferent arteriole → peritubular capillaries

Blood arrives through the afferent arteriole, filters in the glomerular capillaries, exits through the efferent arteriole and then enters peritubular capillaries (or vasa recta).

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. This reverses the actual order of vessels.

B. Blood cannot enter the glomerulus through an efferent arteriole before the afferent one.

D. Peritubular capillaries originate downstream of the efferent arteriole.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Getiren arteriyol → glomerulus → götüren arteriyol → peritübüler kılcal sırası. İsimleri yönüne göre kodla.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. **Which vessel delivers blood into the glomerulus?**

A. Afferent arteriole
B. Efferent arteriole
C. Renal vein
D. Collecting duct

Answer: A. Afferent means carrying toward the glomerulus.

R2. **Which vessel carries blood out of the glomerulus?**

A. Afferent arteriole
B. Efferent arteriole
C. Ureter
D. Bowman capsule

Answer: B. Efferent carries blood away.

R3. **What vascular network receives blood after the efferent arteriole in most cortical nephrons?**

A. Pulmonary capillaries
B. Hepatic sinusoids
C. Peritubular capillaries
D. Coronary arteries

Answer: C. Peritubular capillaries surround the nephron tubules.

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QUESTION 15 | BIOLOGY

SKELETAL SYSTEM

Which joint is a ball-and-socket joint that permits movement in multiple directions?

A. Shoulder

B. Knee

C. Interphalangeal joint

D. Elbow

CORRECT ANSWER • A — Shoulder

The glenohumeral shoulder joint is a multiaxial ball-and-socket synovial joint allowing flexion, rotation, abduction and circumduction.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

B. The knee is mainly a modified hinge joint.

C. Finger interphalangeal joints are hinge joints.

D. The elbow functions primarily as a hinge joint.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Omuz ve kalça küresel eklemdir; diz, dirsek ve parmak menteşe örnekleridir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which second major joint is also ball-and-socket?

A. Knee
B. Hip
C. Elbow
D. Proximal interphalangeal joint
Answer: B. The hip is a multiaxial ball-and-socket joint.

R2. A joint chiefly allowing flexion and extension is usually classified as a:

A. Ball-and-socket joint
B. Suture
C. Hinge joint
D. Pivot joint only
Answer: C. Hinge joints mainly move in one plane.

R3. Circumduction is readily possible at which joint?

A. Interphalangeal joint
B. Distal tibiofibular syndesmosis
C. Cranial suture
D. Shoulder
Answer: D. Shoulder architecture permits circumduction.

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QUESTION 16 | BIOLOGY

CELL SECRETION

Proteins destined for secretion by a cell are typically:

A. Synthesized entirely on free ribosomes with no signal sequence

B. Produced with an N-terminal signal peptide directing them toward rough ER

C. Unrelated to the Golgi and secretory vesicle pathways

D. Always larger when secreted than when in the ER

CORRECT ANSWER • B — Produced with an N-terminal signal peptide directing them toward rough ER

Secretory proteins usually contain a nascent N-terminal signal sequence that targets a ribosome to the rough endoplasmic reticulum via the signal-recognition-particle pathway; they then pass through the Golgi and secretory vesicles.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. A signal-less, entirely free-ribosome route is not typical for conventional secretion.

C. The Golgi apparatus and secretory vesicles are central elements of the secretory pathway.

D. Proteolytic processing can make secreted products smaller than ER precursors.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Salgı proteini sinyal peptidiyle granüllü ER → Golgi → salgı vezikülüne gider; çekirdekle karıştırma.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which organelle first receives most proteins destined for conventional secretion?

A. Lysosome lumen
B. Mitochondrial matrix
C. Rough endoplasmic reticulum
D. Peroxisomal matrix
Answer: C. Rough ER hosts co-translational entry of secretory proteins.

R2. Which organelle sorts and modifies proteins after the rough ER?

A. Centrosome
B. Nucleolus
C. Ribosomal small subunit
D. Golgi apparatus
Answer: D. Golgi processes and sorts secretory cargo.

R3. A typical secretory protein begins with which targeting feature?

A. An N-terminal signal peptide
B. A second chromosome
C. An additional phosphate backbone
D. A mitochondrial genome
Answer: A. The signal peptide directs ER entry.

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QUESTION 17 | BIOLOGY

LIVER METABOLISM

Which carbohydrate is synthesized and stored in human liver cells?

A. Galactose

B. Lactose

C. Glycogen

D. Vitamin B12

CORRECT ANSWER • C — Glycogen

The liver polymerizes glucose into glycogen as a rapidly mobilizable carbohydrate reserve, releasing glucose during fasting under hormonal regulation.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Galactose is a monosaccharide, not the principal stored glucose polymer.

B. Lactose is milk sugar and is not stored as a liver carbohydrate reserve.

D. Vitamin B12 is a vitamin and not a carbohydrate.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Karaciğer glikozu glikojene çevirir; glikojen hayvanlardaki depo polisakkarittir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which polymer is the major carbohydrate energy store in animals?

A. Cellulose
B. Chitin
C. Lactose
D. Glycogen

Answer: D. Glycogen is a branched glucose polymer.

R2. Which hormone stimulates hepatic glycogen breakdown during fasting?

A. Glucagon
B. Insulin alone
C. Calcitonin
D. Melatonin

Answer: A. Glucagon promotes glycogenolysis.

R3. Which process builds glycogen from glucose?

A. Glycolysis
B. Glycogenesis
C. Gluconeogenesis
D. Lipolysis

Answer: B. Glycogenesis stores glucose as glycogen.

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QUESTION 18 | BIOLOGY

HUMAN TISSUES

In human newborns, brown adipose tissue is commonly found at several sites. Which is NOT a typical major depot?

A. Around the heart
B. Axillary region
C. Within the brain substance
D. Around the kidneys

CORRECT ANSWER • C — Within the brain substance

Brown adipose tissue is found in characteristic neonatal depots such as interscapular, cervical, perirenal, axillary and mediastinal regions. It is not a normal major depot inside brain tissue.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Pericardial and mediastinal regions can contain neonatal brown fat.

B. Axillary depots are recognized sites in infants.

D. Perirenal brown adipose tissue is common in newborns.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Kahverengi yağ UCP1 ile ısı üretir; yenidoğanda boyun, kürek arası ve böbrek çevresinde bulunur, beynin içinde depo değildir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Brown adipose tissue is specialized for:

A. Non-shivering thermogenesis
B. Synthesis of hemoglobin
C. Bone mineralization
D. Light perception

Answer: A. Brown fat generates heat through uncoupled respiration.

R2. Which mitochondrial protein is associated with brown-fat thermogenesis?

A. Hemoglobin beta
B. UCP1
C. Aquaporin-2
D. Insulin receptor

Answer: B. UCP1 uncouples respiration to generate heat.

R3. Which age group has particularly important brown adipose tissue thermogenesis?

A. Only people older than 90
B. Only adult reptiles
C. Newborn infants
D. Only embryos with no cells

Answer: C. Brown fat helps newborns regulate temperature.

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QUESTION 19 | BIOLOGY

MEIOSIS

During which process does homologous chromosome crossing-over normally occur?

A. S phase
B. Mitosis
C. Prophase I of meiosis
D. Meiosis II

CORRECT ANSWER • C — Prophase I of meiosis

Crossing-over normally occurs between nonsister chromatids of homologous chromosomes during prophase I of meiosis, especially at the pachytene stage; it contributes to genetic recombination.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. S phase is DNA replication rather than the normal crossover stage.

B. Mitotic recombination is uncommon and not the standard meiotic crossing-over event.

D. Meiosis II separates sister chromatids after homologues have already separated.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Crossing-over profaz I pakiten evresindedir; homologların kardeş olmayan kromatitleri parça değiştirir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Between which chromatids does normal meiotic crossing-over take place?

A. Only sister chromatids of one chromosome
B. Nonsister chromatids of homologues
C. Chromatids from unrelated species
D. RNA strands

Answer: B. Meiotic recombination exchanges homologous DNA.

R2. Which meiotic substage is most directly associated with crossing-over?

A. Anaphase II
B. Telophase II
C. Pachytene
D. G1

Answer: C. Crossing-over is associated with pachytene of prophase I.

R3. What is a major genetic consequence of crossing-over?

A. Destruction of all genetic diversity
B. Permanent chromosome doubling
C. Suppression of recombination
D. New allele combinations

Answer: D. Crossing-over contributes to variation.

QUESTION 20 | BIOLOGY

GAMETOGENESIS

What is the chromosome complement of a normal human secondary oocyte?

A. 23, Y
B. 23, X
C. 46, XY
D. 46, XX

CORRECT ANSWER • B — 23, X

A human secondary oocyte is haploid after completion of meiosis I, with 22 autosomes and one X chromosome (23,X). Its chromosomes still comprise sister chromatids until meiosis II is completed.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. An oocyte has an X, not a Y, sex chromosome.

C. 46,XY is a male diploid complement, not that of a secondary oocyte.

D. 46,XX describes a diploid female somatic cell or a primary oocyte before reduction.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: İkincil oosit n=23, X taşır; metafaz II'de 23 kromozomun her biri iki kromatitli olabilir. DNA molekülü sayısını kromozom sayısıyla karıştırma.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. How many chromosomes are in a normal human secondary oocyte?

A. 46
B. 92
C. 23
D. 44

Answer: C. Meiosis I produces a haploid secondary oocyte.

R2. Which sex chromosome is present in a normal human ovum?

A. Y
B. XY together
C. Neither X nor Y
D. X

Answer: D. Human ova carry an X chromosome.

R3. At metaphase II, a secondary oocyte contains how many chromatids in total?

A. 46
B. 23
C. 92
D. 44

Answer: A. Each of the 23 chromosomes still has two sister chromatids.

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QUESTION 21 | BIOLOGY

ENDOCRINE SYSTEM

All the following are secreted by the anterior pituitary gland EXCEPT:

A. Growth hormone
B. Follicle-stimulating hormone
C. Parathyroid hormone
D. Thyroid-stimulating hormone

CORRECT ANSWER • C — Parathyroid hormone

Parathyroid hormone (PTH) is secreted by parathyroid gland chief cells, not the anterior pituitary. The anterior pituitary releases GH, FSH and TSH.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Growth hormone is a classic anterior-pituitary hormone.

B. FSH is secreted by anterior-pituitary gonadotrophs.

D. TSH is secreted by anterior-pituitary thyrotrophs.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Ön hipofiz GH, FSH, TSH, LH, ACTH, prolaktin; PTH paratiroit bezinden salgılanır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which gland secretes parathyroid hormone?

A. Anterior pituitary
B. Adrenal medulla
C. Pineal gland
D. Parathyroid gland

Answer: D. Parathyroid chief cells produce PTH.

R2. TSH is normally released by the:

A. Anterior pituitary
B. Parathyroid gland
C. Adrenal cortex
D. Pancreatic islets

Answer: A. Thyrotrophs secrete TSH.

R3. Which anterior-pituitary hormone stimulates ovarian follicle development?

A. PTH
B. FSH
C. Insulin
D. ADH

Answer: B. FSH promotes follicular maturation.

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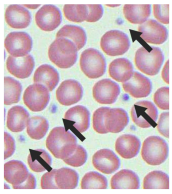
QUESTION 22 | BIOLOGY

BLOOD CELLS

The arrows in the blood smear indicate mature red blood cells. Which statements are correct?

1. They arise directly as fragments of megakaryocytes.
2. Their average life span is approximately 120 days.
3. About 20% are normally stored in the spleen at any time.
4. Only mammals possess cells that carry oxygen in blood.
5. Their major function is oxygen transport.

A. 1 and 2
B. 2 and 5
C. 3 and 4
D. 1, 3 and 5



CORRECT ANSWER • B — 2 and 5

Mature human red blood cells circulate for approximately 120 days and transport oxygen via hemoglobin. Megakaryocytes produce platelets, not red blood cells.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Statement 1 describes platelets, not red cells; statement 2 alone is not the offered pair.

C. Statements 3 and 4 are incorrect: red cells are not normally 20% sequestered in spleen, and nonmammalian vertebrates also possess oxygen-carrying erythrocytes.

D. The set includes false claims about megakaryocytes, splenic storage and mammal-only oxygen transport.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Eritrosit kemik iliğinde eritropoezle oluşur; 120 gün yaşar ve O2 taşır. Trombosit megakaryosit parçalanmasıyla oluşur.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which formed blood elements are fragments of megakaryocytes?

A. Platelets
B. Erythrocytes
C. Neutrophils
D. Lymphocytes

Answer: A. Platelets originate from megakaryocytes.

R2. What is the approximate normal life span of a human erythrocyte?

A. 7 days
B. 120 days
C. 1 year
D. 4 hours

Answer: B. Circulating red cells last about 120 days.

R3. Which protein is chiefly responsible for oxygen transport by red blood cells?

A. Albumin
B. Fibrinogen
C. Hemoglobin
D. Insulin

Answer: C. Hemoglobin reversibly binds oxygen.

QUESTION 23 | BIOLOGY

AUTONOMIC NERVOUS SYSTEM

Which effects are associated with activation of the sympathetic nervous system?

1. Contraction of the bladder detrusor muscle.
2. Pupillary dilation.
3. Reduced gastrointestinal motility.
4. Bronchiolar constriction.

A. 1 and 2
B. 1 and 3
C. 2 and 3
D. 2, 3 and 4

CORRECT ANSWER • C — 2 and 3

Sympathetic activation dilates pupils and tends to suppress gastrointestinal motility. It instead relaxes the detrusor during bladder filling and generally produces bronchodilation.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. The detrusor normally relaxes rather than contracts during sympathetic storage responses.

B. Option B includes the incorrect detrusor-contraction statement.

D. Option D includes bronchiolar constriction, contrary to beta-2-mediated sympathetic bronchodilation.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Sempatik sistem savaş-kaç: pupilla genişler, sindirim yavaşlar, bronşlar genişler; idrar kesesi detrusoru gevşer.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which pupil response is characteristic of sympathetic activation?

A. Permanent constriction
B. Dilation
C. No neural response
D. Disappearance of pupil

Answer: B. Sympathetic activity causes mydriasis.

R2. Which gastrointestinal effect is typical of sympathetic activation?

A. Markedly increased peristalsis
B. Immediate bile synthesis stop
C. Reduced motility
D. Pepsin synthesis in brain

Answer: C. Sympathetic tone inhibits motility.

R3. What happens to the bladder detrusor in the urine storage phase under sympathetic influence?

A. Contracts forcefully
B. Turns into skeletal muscle
C. Disappears
D. Relaxes

Answer: D. Detrusor relaxation promotes urine storage.

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QUESTION 24 | BIOLOGY

RNA TYPES

Which option correctly assigns the following RNA characteristics?
a. Contains an anticodon.
b. Carries the coding information used for protein synthesis.
c. Carries amino acids covalently attached to its 3′ end.
d. Is a major structural and catalytic component of ribosomes.
e. Is the most abundant class of cellular RNA.

A. tRNA: a,c; mRNA: b; rRNA: d,e
B. tRNA: a,b; mRNA: c; rRNA: d,e
C. tRNA: d,e; mRNA: a; rRNA: b,c
D. tRNA: a,d; mRNA: b,e; rRNA: c

CORRECT ANSWER • A — tRNA: a,c; mRNA: b; rRNA: d,e

Transfer RNA carries anticodons and amino acids, messenger RNA carries coding sequences, and ribosomal RNA forms the major structural and catalytic core of ribosomes and is the most abundant RNA class.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

B. mRNA does not carry amino acids covalently and tRNA is not the main coding RNA.

C. rRNA does not contain the anticodon and tRNA is not the major structural ribosomal RNA.

D. This option confuses the RNA carrying amino acids with the ribosomal component and misassigns the most abundant class.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: tRNA=antikodon+amino asit; mRNA=kodon/bilgi; rRNA=ribozomun yapısal-katalitik bileşeni.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which RNA carries an anticodon?

A. mRNA
B. rRNA
C. tRNA
D. Genomic DNA

Answer: C. tRNA anticodons recognize mRNA codons.

R2. Which RNA conveys codons specifying the amino acid sequence?

A. tRNA
B. rRNA
C. snDNA
D. mRNA

Answer: D. mRNA carries coding information.

R3. Which RNA class is a principal catalytic component of the ribosome?

A. rRNA
B. tRNA
C. mRNA
D. miDNA

Answer: A. Ribosomal RNA participates in peptide-bond formation.

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QUESTION 25 | BIOLOGY

ENDOCRINE SYSTEM

Which statement about insulin is correct?

A. It is a steroid hormone secreted by the adrenal cortex

B. It promotes cellular glucose uptake in insulin-sensitive tissues and supports protein synthesis

C. It is indispensable for glucose uptake by all tissues including red blood cells

D. Its deficiency characteristically produces persistent hypoglycemia

CORRECT ANSWER • B — It promotes cellular glucose uptake in insulin-sensitive tissues and supports protein synthesis

Insulin is a pancreatic beta-cell peptide hormone that stimulates GLUT4-mediated glucose uptake in skeletal muscle and adipose tissue and promotes anabolic processes including protein synthesis.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Insulin is a peptide from pancreas, not an adrenal steroid.

C. Erythrocytes and several other tissues use insulin-independent glucose transporters.

D. Insulin deficiency typically causes hyperglycemia, not sustained hypoglycemia.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: İnsülin pankreas beta hücresinden salgılanır; kas/yağ GLUT4 ile glikoz alır. Eritrosit GLUT1 ile insülinden bağımsız glikoz alır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which pancreatic cell type secretes insulin?

A. Alpha cell
B. Parietal cell
C. Chief cell
D. Beta cell
Answer: D. Beta cells of pancreatic islets produce insulin.

R2. Which transporter is recruited by insulin in skeletal muscle?

A. GLUT4
B. GLUT1 only
C. Aquaporin-2
D. SGLT1 only
Answer: A. Insulin promotes GLUT4 trafficking.

R3. Untreated severe insulin deficiency most directly tends to cause:

A. Persistent hypoglycemia
B. Hyperglycemia
C. Zero glucagon
D. Inability to digest starch
Answer: B. Reduced cellular insulin action raises blood glucose.

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SECTION II / CHEMISTRY

Questions 26–50 • General, inorganic and organic chemistry.

QUESTION 26 | CHEMISTRY

ATOMIC STRUCTURE

Which statement about an atomic nucleus is correct?

A. It is electrically neutral

B. It contains electrons

C. It has a positive electric charge

D. It normally contains no neutrons

CORRECT ANSWER • C — It has a positive electric charge

Atomic nuclei are positively charged because they contain protons (+1) and neutrons (0); electrons occupy the region outside the nucleus.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Protons make the nuclear charge positive, not neutral.

B. Electrons occupy orbitals around the nucleus in the usual atomic model.

D. Most stable nuclei contain neutrons, with protium as a notable exception.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Atom çekirdeğinde proton (+) ve nötron (0), elektronlar çekirdek dışında bulunur; çekirdek pozitiftir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which nuclear particle determines an element's atomic number?

A. Proton
B. Neutron
C. Electron
D. Photon

Answer: A. Z equals the number of protons.

R2. What is the charge of a neutron?

A. Positive one
B. Zero
C. Negative one
D. Positive two

Answer: B. Neutrons are electrically neutral.

R3. An atom has 8 protons. What is the nuclear charge?

A. −8e
B. 0
C. +8e
D. +16e

Answer: C. Nuclear charge is +Ze.

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QUESTION 27 | CHEMISTRY

ATOMIC STRUCTURE

The total number of protons and neutrons in the nucleus determines the:

A. Number of outer-shell electrons

B. Number of occupied electron shells

C. Mass number of the nuclide

D. Number of valence orbitals

CORRECT ANSWER • C — Mass number of the nuclide

The mass number A is the sum of nucleons: A = number of protons (Z) + number of neutrons (N). The isotope is identified by its Z and A together.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Valence electrons depend on electron configuration rather than nucleon total.

B. Shell occupation is determined by electronic structure.

D. The number of valence orbitals cannot be deduced simply from proton-plus-neutron count.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Kütle numarası A=p+n, atom numarası Z=p; nötron N=A−Z. İzotoplarda p aynı, n farklıdır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. An atom has 11 protons and 12 neutrons. Its mass number is:

A. 11

B. 23

C. 12

D. 1

Answer: B. Mass number is 11+12.

R2. Isotopes of one element have equal numbers of:

A. Neutrons

B. Nucleons

C. Protons

D. Electron shells in every ion

Answer: C. Element identity is fixed by proton number.

R3. For a nuclide with A=35 and Z=17, the neutron count is:

A. 17

B. 35

C. 52

D. 18

Answer: D. N=A−Z=18.

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QUESTION 28 | CHEMISTRY

CHEMICAL BONDING

Which compound contains polar covalent bonds?

A. NaCl
B. $MgBr_2$
C. N_2O_3
D. K_2S

CORRECT ANSWER • C — N_2O_3

N2O3 is composed of nitrogen and oxygen nonmetals with polar covalent N–O bonds due to their different electronegativities.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. NaCl is predominantly an ionic sodium–chloride compound.

B. MgBr2 is predominantly ionic in elementary bond classification.

D. K2S is an ionic salt containing potassium and sulfide ions.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Ametal-ametal arasında çoğunlukla kovalent; farklı elektronegatiflikte polar kovalent bağ oluşur. N–O bağı buna örnektir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which bond is polar covalent?

A. Cl–Cl
B. Na–Cl
C. H–Cl
D. K–F

Answer: C. H and Cl share electrons unequally.

R2. Which pair usually forms a predominantly ionic compound?

A. C and O
B. N and O
C. H and Cl
D. Na and Cl

Answer: D. Metal-nonmetal electron transfer favors ionic bonding.

R3. Which molecule contains a nonpolar bond between identical atoms?

A. N2
B. HCl
C. CO
D. NH3

Answer: A. N–N has no electronegativity difference.

QUESTION 29 | CHEMISTRY

OXIDATION STATES

What is the most common oxidation state of aluminium in its ordinary compounds?

A. −1
B. +1
C. +2
D. +3

CORRECT ANSWER • D — +3

Aluminium is a group-13 metal with three valence electrons and most commonly forms Al^{3+} or compounds in formal oxidation state +3.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. −1 is not the normal oxidation state in ordinary aluminium compounds.

B. +1 is uncommon and not the standard state in salts and oxides.

C. +2 is not the normal stable oxidation state of typical aluminium compounds.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Al 3A/13. grup metalidir; Al_2O_3 ve $AlCl_3$ yapılarında genelde +3 yükseltgenme basamağı kullanılır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. What is the oxidation state of Al in Al_2O_3?

A. −3
B. +2
C. 0
D. +3

Answer: D. Three O at −2 require two Al at +3.

R2. What is the charge of the common aluminium cation?

A. 3+
B. 1−
C. 2+
D. 1+

Answer: A. Al typically forms Al^{3+}.

R3. Which formula represents aluminium chloride?

A. AlCl
B. $AlCl_3$
C. $AlCl_2$
D. Al_3Cl

Answer: B. One Al^{3+} pairs with three Cl^- ions.

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QUESTION 30 | CHEMISTRY

THERMOCHEMISTRY

According to Hess's law, the enthalpy change of a reaction depends on:

A. The initial state of the reactants only

B. The final state of the products only

C. The number of intermediate steps

D. The initial and final thermodynamic states, not the path

CORRECT ANSWER • D — The initial and final thermodynamic states, not the path

Enthalpy is a state function. Hess's law therefore makes the reaction enthalpy depend on the initial and final states, independent of the chemical pathway.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. The final thermodynamic state also matters, so the initial state alone is insufficient.

B. The initial state also matters, so the product state alone is insufficient.

C. Intermediate stages do not change net enthalpy if the endpoints are the same.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Entalpi hâl fonksiyonudur; Hess yasasına göre başlangıç-son durum belirleyicidir, izlenen basamak sayısı değil.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which physical quantity is a state function?

A. Enthalpy

B. Path length

C. Number of collisions in one pathway

D. Number of reaction vessels

Answer: A. Enthalpy depends on state.

R2. Two routes have identical initial and final states. Their ΔH values are:

A. Always opposite

B. Equal

C. Always zero

D. Unrelated

Answer: B. Hess's law gives path-independent ΔH.

R3. If A→B has ΔH=+20 kJ and B→C has ΔH=−5 kJ, A→C has:

A. +25 kJ

B. −15 kJ

C. +15 kJ

D. −25 kJ

Answer: C. Add the step enthalpies.

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QUESTION 31 | CHEMISTRY

HESS'S LAW

For A → B, ΔH = +30 kJ mol^{-1}; for B → C, ΔH = +60 kJ mol^{-1}. What is ΔH for A → C?

A. +30 kJ mol^{-1}
B. +60 kJ mol^{-1}
C. +90 kJ mol^{-1}
D. +180 kJ mol^{-1}

CORRECT ANSWER • C — +90 kJ mol^{-1}

For the overall A→C reaction, Hess's law requires addition of the two step enthalpies: +30 + +60 = +90 kJ per mole of A converted as written.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. +30 neglects the second step.

B. +60 neglects the first step.

D. +180 incorrectly doubles the sum without a doubled overall stoichiometry.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Tepkimeleri topla; ΔHtoplam=30+60=90 kJ/mol. Tepkime katsayısı değişirse ΔH de aynı oranla değişir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. If X→Y releases 20 kJ and Y→Z absorbs 50 kJ, net ΔH is:

A. −70 kJ
B. +30 kJ
C. +70 kJ
D. −30 kJ

Answer: B. Sum −20+50=+30 kJ.

R2. Reversing an equation with ΔH=+40 kJ gives:

A. +40 kJ
B. 0
C. −40 kJ
D. +80 kJ

Answer: C. Reverse reaction changes the sign.

R3. Doubling a balanced reaction with ΔH=−12 kJ changes its ΔH to:

A. −6 kJ
B. +24 kJ
C. 0
D. −24 kJ

Answer: D. Enthalpy scales with reaction extent.

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QUESTION 32 | CHEMISTRY

CATALYSIS

Which statement applies to all true catalysts?

A. They are completely consumed in the overall reaction

B. They must be transition metals

C. They never interact with reactants

D. They are regenerated by the end of the overall reaction

CORRECT ANSWER • D — They are regenerated by the end of the overall reaction

Catalysts can participate in intermediate steps but are regenerated overall, allowing alternative pathways with lower activation energies. They do not change the equilibrium constant at fixed temperature.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. A catalyst is regenerated rather than completely consumed in the net reaction.

B. Enzymes and acid/base catalysts show catalysts need not be transition metals.

C. A catalyst can interact directly with reactants during the mechanism.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Katalizör aktivasyon enerjisini düşürür, tepkime sonunda yeniden oluşur; K ve ΔH değişmez.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. What does a catalyst typically lower?

A. Reaction enthalpy
B. Equilibrium constant at fixed T
C. Activation energy
D. Mass number
Answer: C. It offers a lower-barrier pathway.

R2. Which biological molecules catalyze many reactions?

A. Triglycerides only
B. DNA bases only
C. Oxygen atoms only
D. Enzymes
Answer: D. Enzymes are biological catalysts.

R3. At fixed temperature, adding catalyst changes equilibrium by:

A. Speeding approach without shifting K
B. Increasing K tenfold
C. Reversing all oxidation states
D. Making ΔH zero
Answer: A. Catalysts affect kinetics, not thermodynamic K.

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QUESTION 33 | CHEMISTRY

CHEMICAL EQUILIBRIUM

For a given chemical reaction, the value of the equilibrium constant K is determined principally by:

A. The amount of catalyst added
B. The initial concentration of reactants
C. The initial concentration of products
D. Temperature

CORRECT ANSWER • D — Temperature

For a specified reaction, the thermodynamic equilibrium constant is related to the standard Gibbs energy by $\Delta G^\circ = -RT \ln K$, making K temperature dependent. Catalysts and initial amounts do not set K.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. A catalyst speeds equilibration but does not change K.

B. Changing initial reactant concentration affects reaction quotient Q, not K at fixed temperature.

C. Changing initial product concentration also affects Q but not K at fixed temperature.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Denge sabiti K yalnız sıcaklıkla değişir; derişim, basınç veya katalizör dengeye ulaşma koşulunu etkiler ama K'yı değil.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. At fixed temperature, doubling a reactant concentration changes which quantity immediately?

A. Equilibrium constant K
B. Atomic number
C. Standard molar mass
D. Reaction quotient Q

Answer: D. Concentrations change Q.

R2. For a given chemical reaction, K can change when:

A. Temperature changes
B. A catalyst is added
C. More solid is added to an equilibrium with unchanged temperature
D. A beaker is stirred

Answer: A. K depends on temperature.

R3. Which relation connects K and standard free energy?

A. $K = nRT$
B. $\Delta G^\circ = -RT \ln K$
C. $\Delta G^\circ = Q/t$
D. $K = p+n$

Answer: B. Thermodynamic equilibrium is linked to Gibbs energy.

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QUESTION 34 | CHEMISTRY

CHEMICAL EQUILIBRIUM

At dynamic equilibrium in a closed system, which statement is correct?

A. All reactants have been completely consumed

B. Forward and reverse reactions occur at equal rates

C. The reaction has stopped at the molecular level

D. Reactant and product concentrations must be equal

CORRECT ANSWER • B — Forward and reverse reactions occur at equal rates

Dynamic equilibrium means the forward and reverse reactions continue at equal rates so macroscopic concentrations stay constant, not necessarily equal.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. At equilibrium significant reactants may remain.

C. Molecular transformations continue at equilibrium.

D. Concentrations are constant but need not be numerically equal.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Dinamik dengede ileri ve geri hız eşittir; derişimler sabittir ama birbirine eşit olmak zorunda değildir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. **At chemical equilibrium, forward and reverse reaction rates are:**

A. Equal
B. Both necessarily zero
C. Always ten times apart
D. Unrelated
Answer: A. Equal opposing rates define dynamic equilibrium.

R2. **What happens to concentrations at equilibrium in a closed stable system?**

A. They must all become zero
B. They remain constant
C. They must become identical
D. They double each minute
Answer: B. No net change persists.

R3. **An equilibrium system is disturbed by adding reagent. It initially changes its:**

A. Nuclear charge
B. Avogadro constant
C. Reaction quotient
D. Atomic mass
Answer: C. Changing composition changes Q.

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QUESTION 35 | CHEMISTRY

COLLIGATIVE PROPERTIES

Which statement about aqueous solutions is FALSE? Assume solutions are sufficiently dilute for colligative comparisons.

A. Adding dissolved NaCl normally raises the boiling point of water

B. A 1 M NaCl solution has a lower osmotic pressure than a 1 M methanol solution

C. Dissolved KCl normally lowers the vapor pressure of water

D. An aqueous KCl solution normally freezes below pure water

CORRECT ANSWER • B — A 1 M NaCl solution has a lower osmotic pressure than a 1 M methanol solution

NaCl generally dissociates into approximately two particles per formula unit, whereas methanol remains molecular; at equal molarity and comparable ideal dilute conditions, NaCl generates higher, not lower, osmotic pressure.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Dissolved nonvolatile NaCl ordinarily causes boiling-point elevation, so A is true.

C. Dissolved nonvolatile KCl lowers solvent vapor pressure, so C is true.

D. Dissolved KCl decreases the freezing point of water, so D is true.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Koligatif özellikler tanecik sayısına bağlıdır; NaCl yaklaşık 2 iyon, metanol 1 tanecik verir. Aynı M'de NaCl osmotik basıncı daha büyüktür; yanlış B.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. For equal dilute molarity, which yields greater ideal osmotic pressure?

A. Glucose(aq)
B. NaCl(aq)
C. Methanol(aq)
D. Sucrose(aq)
Answer: B. NaCl yields roughly two dissolved ions per unit.

R2. Adding nonvolatile solute to water usually causes:

A. Freezing-point increase
B. Vapor-pressure increase
C. Freezing-point depression
D. No osmotic effect
Answer: C. Solute lowers solvent chemical potential.

R3. What property mainly governs ideal colligative changes?

A. Solution color
B. Solute name alone
C. Container label
D. Dissolved-particle concentration
Answer: D. Particle number controls colligative effects.

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QUESTION 36 | CHEMISTRY

SOLUTIONS

Which statement about colligative properties is correct?

A. They depend only on the solute's chemical identity

B. They depend on the effective concentration of dissolved particles

C. Every 1 M electrolyte and 1 M nonelectrolyte solution has an identical boiling point elevation

D. Osmotic pressure is independent of absolute temperature

CORRECT ANSWER • B — They depend on the effective concentration of dissolved particles

Colligative effects depend primarily on the number of independently moving solute particles per amount of solvent or solution; dissociation increases effective particle concentration.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Chemical identity alone is not sufficient without concentration and dissociation.

C. Electrolytes can create more particles than nonelectrolytes at the same analytical molarity.

D. The ideal osmotic-pressure equation $\pi = iMRT$ includes absolute temperature.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Koligatif özellikte i (van't Hoff) faktörü dikkate alınır; $\pi = iMRT$, sıcaklık önemlidir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Ideal osmotic pressure is proportional to:

A. Solution color

B. Molecular shape only

C. Absolute temperature

D. Catalyst loading

Answer: C. $\pi = iMRT$ at ideal dilution.

R2. Which solution has more dissolved ideal particles at equal molarity?

A. Glucose

B. Urea

C. Methanol

D. $CaCl_2$

Answer: D. $CaCl_2$ dissociates into three ions ideally.

R3. Which property is colligative?

A. Boiling-point elevation

B. Atomic number

C. Covalent bond polarity

D. Nuclear charge

Answer: A. Boiling-point elevation depends on dissolved particles.

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QUESTION 37 | CHEMISTRY

ACIDS AND BASES

Which salt is formed from a strong base and a WEAK acid?

A. NaCl
B. NaF
C. NaBr
D. NaI

CORRECT ANSWER • B — NaF

NaF contains Na+ from strong base NaOH and F− from weak acid HF; fluoride hydrolyzes water and the solution is mildly basic.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. NaCl derives from strong NaOH and strong HCl.

C. NaBr derives from strong NaOH and strong HBr.

D. NaI derives from strong NaOH and strong HI.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: NaF'de F− zayıf asit HF'nin eşlenik bazıdır; F− + H2O HF + OH−. NaCl/Br/I güçlü asit tuzlarıdır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. **Which weak acid corresponds to the fluoride ion?**

A. HCl
B. HBr
C. HI
D. HF

Answer: D. Hydrofluoric acid is weak in water.

R2. **An aqueous NaF solution tends to be:**

A. Basic
B. Strongly acidic
C. Exactly pH zero
D. Anhydrous gas

Answer: A. Fluoride hydrolyzes to generate OH−.

R3. **Which salt is most likely near neutral at moderate dilution?**

A. NaF
B. NaCl
C. CH3COONa
D. Na2CO3

Answer: B. NaCl is formed from strong acid and strong base.

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QUESTION 38 | CHEMISTRY

REDOX CHEMISTRY

What is the oxidation number of sulfur in S_2Cl_2?

A. +1

B. −1

C. +2

D. −2

CORRECT ANSWER • A — +1

Chlorine usually has oxidation number −1 in S2Cl2. Charge balance gives 2x + 2(−1)=0, so each sulfur has average formal oxidation number +1.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

B. −1 would fail charge balance for neutral S2Cl2.

C. +2 would produce a net +2 charge under the usual −1 chlorine assignment.

D. −2 would give an incorrect negative total.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: S2Cl2 için 2x+2(−1)=0 → x=+1. Her zaman toplam yükseltgenme basamağını formülün yüküne eşitle.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. What is chlorine's usual oxidation number in binary chlorides?

A. −1

B. +1

C. +2

D. 0

Answer: A. Chlorine is typically −1 outside elemental chlorine and special exceptions.

R2. What is sulfur's oxidation number in SO2?

A. +2

B. +4

C. −2

D. +6

Answer: B. x+2(−2)=0 gives +4.

R3. For a neutral compound, the sum of formal oxidation numbers is:

A. Always +1

B. Always −1

C. Zero

D. Equal to proton number

Answer: C. Neutral compounds have zero net formal sum.

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QUESTION 39 | CHEMISTRY

ORGANIC ISOMERISM

How many constitutional chain isomers does C_5H_{12} have?

A. Five

B. Three

C. Four

D. Two

CORRECT ANSWER • B — Three

C5H12 has three distinct carbon skeletons: n-pentane, 2-methylbutane and 2,2-dimethylpropane. These are its three constitutional chain isomers.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Five overcounts by including duplicate drawings or structures of other formulas.

C. Four similarly overcounts distinct C5H12 connectivities.

D. Two misses the highly branched neopentane skeleton.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: C5H12 için düz zincir, tek dallanma ve çift dallanma düzeni: 3 yapı izomeri bulunur.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which molecule is a chain isomer of n-pentane?

A. Pent-1-ene
B. 2-Methylbutane
C. Cyclopentane
D. Butane

Answer: B. 2-Methylbutane shares C5H12 but differs in carbon skeleton.

R2. How many carbon atoms are in neopentane?

A. Four
B. Six
C. Five
D. Three

Answer: C. Neopentane is 2,2-dimethylpropane (C5H12).

R3. Constitutional isomers have the same:

A. Atom connectivity
B. Boiling point always
C. Structural formula always
D. Molecular formula

Answer: D. Isomers share formula but differ connectivity.

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QUESTION 40 | CHEMISTRY

AROMATIC SUBSTITUTION

Which substituent is an ortho/para director in electrophilic aromatic substitution?

A. $-NH_2$
B. $-NO_2$
C. $-N(CH_3)_3^+$
D. −CN

CORRECT ANSWER • A — $-NH_2$

An amino group (−NH2) donates electron density by resonance and generally activates a benzene ring toward electrophilic substitution at ortho and para positions.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

B. Nitro (−NO2) is electron-withdrawing and meta-directing.

C. Quaternary ammonium (−N(CH3)3+) strongly withdraws electron density and is meta-directing.

D. Cyano (−CN) withdraws electron density and is meta-directing.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: NH2, OH, alkil gibi elektron verici gruplar çoğunlukla orto/para; NO2, CN gibi çekiciler meta yönlendirir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which group is a common meta director?

A. −NH2
B. −OH
C. −NO2
D. −OCH3

Answer: C. Nitro withdraws electrons and favors meta substitution.

R2. An electron-donating −OH group on benzene generally directs electrophiles to:

A. Meta only
B. Carbonyl carbon
C. Side-chain carbon exclusively
D. Ortho and para

Answer: D. −OH donates by resonance.

R3. Which ring position is para to carbon 1 on benzene?

A. Carbon 4
B. Carbon 2
C. Carbon 3
D. Carbon 6

Answer: A. Para substitution is 1,4.

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QUESTION 41 | CHEMISTRY

ALKYNES

Which compound can undergo electrophilic addition followed by keto–enol tautomerism upon hydration?

A. Butane

B. 1-Butene

C. 1-Butyne

D. Benzene

CORRECT ANSWER • C — 1-Butyne

Hydration of a terminal alkyne (1-butyne) under typical acid/mercury-catalyzed conditions forms an enol by electrophilic addition, followed by keto–enol tautomerization to a ketone.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Butane is saturated and lacks the unsaturation for this addition mechanism.

B. 1-Butene hydrates to an alcohol and does not normally form a ketone via enol tautomerization.

D. Benzene preserves aromaticity in typical substitution reactions and does not hydrate like a simple alkyne.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Alkin hidrasyonunda önce enol oluşur, keto-enol tautomerisiyle karbonil bileşiği elde edilir; 1-bütin → 2-bütanon.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Typical Markovnikov hydration of 1-butyne gives which main carbonyl product?

A. Butan-1-ol

B. Butane

C. Butanal only

D. Butan-2-one

Answer: D. An enol tautomerizes to butan-2-one.

R2. What is keto-enol tautomerism?

A. Equilibrium between carbonyl and enol forms

B. Change of isotope only

C. Ionization of a noble gas

D. Stereoisomerization without proton transfer

Answer: A. Tautomers differ in proton and double-bond position.

R3. Which functional group appears in an enol?

A. C≡N

B. C=C–OH

C. COOH only

D. COO– only

Answer: B. Enols combine an alkene and hydroxyl group.

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QUESTION 42 | CHEMISTRY

OXIDATION STATES

In which compound does nitrogen have the LOWEST oxidation number?

A. NH_3
B. N_2H_4
C. NO
D. NH_2OH

CORRECT ANSWER • A — NH_3

Nitrogen is −3 in NH3 because each H is +1. In N2H4 the average N is −2, in NO nitrogen is +2, and in NH2OH nitrogen is −1. Thus NH3 has the lowest nitrogen oxidation state.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

B. N2H4 gives N = −2 rather than −3.

C. NO has N = +2 because oxygen is −2.

D. NH2OH gives N = −1 from charge balance.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: NH3: N=−3; N2H4: −2; NO: +2; NH2OH: −1. En düşük en negatif olan −3'tür.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. What is nitrogen's oxidation number in NH3?

A. −3
B. −2
C. +3
D. 0

Answer: A. x+3(+1)=0.

R2. What is nitrogen's oxidation number in NO?

A. −2
B. +2
C. +1
D. +4

Answer: B. x+(−2)=0 gives +2.

R3. What is the average N oxidation number in N2H4?

A. −3
B. 0
C. −2
D. +2

Answer: C. 2x+4=0 gives −2.

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QUESTION 43 | CHEMISTRY

ELECTROLYTES

Which compound behaves as an electrolyte in aqueous solution?

A. CH_3OH
B. CH_3COOH
C. $C_3H_5(OH)_3$
D. $C_{12}H_{22}O_{11}$

CORRECT ANSWER • B — CH_3COOH

Acetic acid is a weak electrolyte: in water a fraction of its molecules ionizes to CH3COO− and H3O+, so its aqueous solution conducts electricity.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Methanol is a molecular nonelectrolyte under ordinary aqueous conditions.

C. Glycerol is an alcohol and does not appreciably form ions in water.

D. Sucrose dissolves as neutral molecules rather than ions.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Elektrolit suda iyon oluşturarak akım iletir; CH3COOH zayıf asit, zayıf elektrolittir; alkol/şeker değildir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which is a strong electrolyte in dilute water?

A. Ethanol
B. NaCl
C. Glucose
D. Glycerol

Answer: B. NaCl dissociates into ions.

R2. Which is a weak electrolyte?

A. Sucrose
B. Methanol
C. Acetic acid
D. Hexane

Answer: C. Acetic acid only partially ionizes.

R3. What transports charge through an electrolyte solution?

A. Neutral sugar molecules
B. Only photons
C. Molecular orbitals without ions
D. Mobile ions

Answer: D. Ionic motion conducts electrical current.

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QUESTION 44 | CHEMISTRY

CARBOXYLIC ACIDS

Which formula represents a carboxylic acid?

A. CH_3CH_2COOH
B. $HOCH_2CH_3$
C. $C_{12}H_{22}O_{11}$
D. $C_6H_{12}O_6$

CORRECT ANSWER • A — CH_3CH_2COOH

CH3CH2COOH is propanoic acid and contains the carboxyl group (−COOH), which can donate a proton in acid–base reactions.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

B. HOCH2CH3 is ethanol, an alcohol without a carboxyl group.

C. C12H22O11 is a disaccharide formula and not a carboxylic acid.

D. C6H12O6 is a hexose formula and not a carboxylic acid.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Karboksilik asit fonksiyonel grubu −COOH'dur; etanol −OH taşıyan alkoldür.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which functional group characterizes a carboxylic acid?

A. −O− between two alkyls
B. −CHO only
C. −COOH
D. −NH2 only

Answer: C. The carboxyl group combines C=O and OH.

R2. What is the name of CH3COOH?

A. Methanol
B. Ethanal
C. Ethene
D. Ethanoic acid

Answer: D. CH3COOH is acetic/ethanoic acid.

R3. Which ion is formed when propanoic acid loses H+?

A. Propanoate
B. Propanol
C. Propane
D. Propene

Answer: A. Deprotonation yields CH3CH2COO−.

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QUESTION 45 | CHEMISTRY

BIOCHEMICAL REACTIONS

During alcoholic fermentation of glucose, ethanol is produced together with:

A. Water only
B. Molecular oxygen
C. Carbon dioxide
D. Sulfur dioxide

CORRECT ANSWER • C — Carbon dioxide

Alcoholic fermentation of glucose by yeast yields ethanol and carbon dioxide overall: $C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. Water is not the characteristic paired gaseous product in the net standard equation.

B. Oxygen is not produced; alcoholic fermentation is anaerobic.

D. Sulfur dioxide is not formed in normal glucose-to-ethanol fermentation stoichiometry.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Alkollü fermantasyon: $C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$; oksijen ürünü değildir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. What gas is released during yeast alcoholic fermentation?

A. Oxygen
B. Chlorine
C. Hydrogen sulfide
D. Carbon dioxide

Answer: D. Yeast converts pyruvate into ethanol with CO_2 evolution.

R2. What is the principal organic product of alcoholic fermentation?

A. Ethanol
B. Lactic acid only
C. Acetic anhydride
D. Methane

Answer: A. Alcoholic fermentation makes ethanol.

R3. How many CO_2 molecules form per glucose in the ideal overall fermentation equation?

A. One
B. Two
C. Three
D. Six

Answer: B. Glucose yields 2 ethanol + 2 CO_2.

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QUESTION 46 | CHEMISTRY

ALKENES

The reaction $CH_2=CH_2 + H_2 \rightarrow CH_3CH_3$ is an example of:

A. Substitution

B. Addition

C. Esterification

D. Fermentation

CORRECT ANSWER • B — Addition

Hydrogen adds across the carbon–carbon double bond of ethene, converting it into ethane. This is catalytic hydrogenation, an addition reaction.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. No atom or functional group is replaced in a substitution mechanism.

C. No ester functional group is created.

D. Fermentation is a metabolic conversion, not simple hydrogen addition to an alkene.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Alken çift bağına H2 eklenir, tek bağ oluşur; katılma tepkimesidir. Eten → etan.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. **What product forms when propene is completely hydrogenated?**

A. Propane
B. Propyne
C. Propanoic acid
D. Propanal

Answer: A. H2 saturates the C=C bond.

R2. **Which reagent adds across alkene double bonds in hydrogenation?**

A. HCl only as polymerization
B. H2
C. NaOH only
D. O2 only

Answer: B. Molecular hydrogen is added with a catalyst.

R3. **Addition of Br2 to ethene removes which bond feature?**

A. All carbon-carbon sigma bonds
B. Every C-H bond
C. The pi component of C=C
D. The carbon nuclei

Answer: C. The pi bond opens during addition.

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QUESTION 47 | CHEMISTRY

HYDROCARBONS

Which pair consists of hydrocarbons that can each contain exactly one carbon–carbon double bond?

A. C_2H_2 and C_2H_6
B. C_2H_2 and C_3H_6
C. C_4H_8 and C_2H_4
D. C_6H_6 and C_7H_8

CORRECT ANSWER • C — C_4H_8 and C_2H_4

C4H8 and C2H4 can each be acyclic monoalkenes obeying CnH2n (e.g., but-1-ene and ethene).

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. C2H2 is an alkyne, and C2H6 is saturated ethane.

B. C2H2 is an alkyne and has a triple bond, so the pair fails.

D. Benzene C6H6 is aromatic; toluene C7H8 is also aromatic and is not an isolated monoalkene pair.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Açık zincirli tek çift bağlı alken genel formülü CnH2n; C4H8 ve C2H4 uygun. Aromatik ve alkinleri ayır.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. What is the general formula of an acyclic alkene with one double bond?

A. CnH2n+2
B. CnH2n
C. CnH2n−2
D. CnHn

Answer: B. A monoalkene has one unsaturation relative to an alkane.

R2. Which of the following is an alkyne?

A. C2H6
B. C3H8
C. C2H2
D. CH4

Answer: C. Ethyne contains a C≡C bond.

R3. Which molecular formula fits propene?

A. C3H8
B. C3H4
C. C3H10
D. C3H6

Answer: D. Propene is C3H6.

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QUESTION 48 | CHEMISTRY

AMINES

Trimethylamine, $N(CH_3)_3$, is classified as a:

A. Primary amine

B. Amide

C. Tertiary amine

D. Aniline derivative

CORRECT ANSWER • C — Tertiary amine

Trimethylamine has three methyl groups bonded to nitrogen and no N–H bond; it is a tertiary amine.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. A primary amine has only one carbon substituent on nitrogen.

B. An amide contains nitrogen adjacent to a carbonyl, which trimethylamine lacks.

D. Aniline refers to aryl amines with a phenyl group, absent here.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: Amin derecesi N atomuna bağlı karbon grubu sayısıdır: 1 primer, 2 sekonder, 3 tersiyer.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which formula represents a primary amine?

A. (CH3)3N
B. (CH3)2NH
C. CH3NH2
D. CH3CONH2
Answer: C. Methylamine has one alkyl attached to nitrogen.

R2. How many carbon substituents are attached to N in a tertiary amine?

A. One
B. Two
C. Four plus hydrogen
D. Three
Answer: D. Tertiary amines are R3N.

R3. Which group distinguishes an amide from a simple amine?

A. Carbonyl adjacent to nitrogen
B. Carbon-carbon double bond only
C. Phosphate group
D. Sulfonic acid group
Answer: A. Amides contain C(=O)–N.

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QUESTION 49 | CHEMISTRY

ORGANIC FORMULAS

How many hydrogen atoms are present in one molecule of glycerol, $C_3H_5(OH)_3$?

A. 1
B. 5
C. 3
D. 8

CORRECT ANSWER • D — 8

Glycerol is C3H8O3: the three hydroxyl groups contribute three hydrogens in addition to the five hydrogens in the C3H5 portion. Hence 5 + 3 = 8.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. One counts neither the carbon-attached nor hydroxyl hydrogen atoms completely.

B. Five omits all three OH hydrogen atoms.

C. Three counts only the hydroxyl hydrogens.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: C3H5(OH)3 açılımında H sayısı 5+3=8. Parantezi ve grubu açmadan sayma.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. What is the molecular formula of glycerol?

A. C3H5O3
B. C3H3O3
C. C3H6O2
D. C3H8O3

Answer: D. Glycerol has three C atoms and three OH groups.

R2. How many hydroxyl groups does glycerol have?

A. Three
B. One
C. Two
D. Four

Answer: A. Glycerol is propane-1,2,3-triol.

R3. What is the total number of H atoms in C2H4(OH)2?

A. Four
B. Six
C. Two
D. Eight

Answer: B. The two OH groups add two to the written H4.

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QUESTION 50 | CHEMISTRY

SULFUR COMPOUNDS

CH_3SO_3H is classified as a:

A. Sulfonate salt

B. Thiol (mercaptan)

C. Sulfonic acid

D. Sulfuric acid

CORRECT ANSWER • C — Sulfonic acid

CH3SO3H is methanesulfonic acid and contains a sulfonic acid functional group, R–SO3H.

WHY INCORRECT? / OPTION-BY-OPTION ANALYSIS

A. A sulfonate is the conjugate-base salt or anion R–SO3– rather than the protonated acid.

B. Thiols have R–SH and lack the three oxygens of sulfonic acid.

D. Sulfuric acid is H2SO4, an inorganic oxoacid distinct from CH3SO3H.

YKS PERSPECTIVE / TÜRKÇE AÇIKLAMA

YKS: R–SO3H sülfonik asittir; R–SH tiyol, R–SO3– sülfonat, H2SO4 sülfürik asittir.

CHECK YOUR UNDERSTANDING / THREE NEW QUESTIONS

R1. Which functional group identifies a sulfonic acid?

A. R–SO3H
B. R–SH
C. R–OH
D. R–COOR′

Answer: A. Sulfonic acids have the –SO3H group.

R2. What is the conjugate base of methanesulfonic acid?

A. Methanethiol
B. Methanesulfonate
C. Methanol
D. Methanoate

Answer: B. Deprotonation of –SO3H gives –SO3–.

R3. Which molecule is sulfuric acid?

A. CH3SO3H
B. CH3SH
C. H2SO4
D. SO2

Answer: C. Sulfuric acid has formula H2SO4.

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