MDCAT (KMU entry test, Code A) — 2026 · Solved Past Paper

Body: Khyber Medical University (KMU) · **Post:** MDCAT (KMU entry test, Code A) · **Year:** 2026 · **Questions:** 180 in the original paper — **180 solved and verified**, none excluded · **Price:** Free

> **How to use this paper:** each question shows the stem, the four options, and the correct answer. Click “Why each option?” under a question to see all four options explained — one question teaches four topics. General Knowledge answers are as of the 2026 sitting.

Source note: Complete Code A paper with options, the official KMU answer key for all four codes, and an explanation for every answer: eprepare (eprepare.org/blog/kmu-mdcat-paper-answer-key, published 25 October 2026; accessed 9 Nov 2026). The page states its key tables reproduce KMU's official answer key and that every Code A answer in the question-by-question section matches it. Exam held Sunday 20 September 2026 across Khyber Pakhtunkhwa (first scheduled 16 August 2026, then moved); 38,845 registered, 37,747 appeared; result reported 25 September 2026. Codes B, C and D carry the same 180 questions in a different order — do not build a second KMU 2026 code. Subject split: Biology Q1–81, Physics Q82–117, Chemistry Q118–162, English Q163–171, Logical Reasoning Q172–180. 1 PICK-ONE (Q11, KMU's official key accepts both A and D). Q58 stem reconstructed from the served options, key and explanation (the stem line is missing from the source page's text extraction) and flagged in the file. Answers verified independently against reference facts, worked derivations and targeted sources, never from the printed key alone. Decisions by the assistant under the owner's 8 Nov 2026 delegation.

1 Virus morphology

Which of the following is correctly matched with its morphological type?

- A. Tobacco mosaic virus — Polyhedral virus
- B. Poliovirus — Rod shaped virus
- C. Bacteriophage — Tadpole virus ✓ **Correct answer**
- D. Tobacco mosaic virus — Spherical virus

A. wrong: tobacco mosaic virus is rod-shaped, not polyhedral.

B. wrong: poliovirus is roughly spherical (icosahedral), not rod-shaped.

C. correct: a bacteriophage has an icosahedral head and a tail, giving the familiar tadpole appearance.

D. wrong: tobacco mosaic virus is rod-shaped, not spherical.

Question 2 AIDS susceptibility

A patient diagnosed with AIDS has an increased susceptibility to infections due to:

- A. Destruction of red blood cells
- B. Excess production of antibodies
- C. Weakening of the immune system ✓ **Correct answer**
- D. Overproduction of digestive enzymes

A. wrong: HIV does not destroy red blood cells; the immune defect comes from the loss of CD4 helper T cells.

B. wrong: AIDS weakens antibody responses; it does not cause excess antibody production.

C. correct: HIV depletes CD4 helper T cells, so the body cannot coordinate a protective response and infections take hold easily.

D. wrong: digestive enzymes have nothing to do with the immune defect of AIDS.

3 Link reaction

Which of the following is converted into a two-carbon molecule with the release of carbon dioxide?

- A. Acetyl-CoA
- B. Lactate
- C. Pyruvate ✓ **Correct answer**
- D. Glycerol

A. wrong: acetyl-CoA is the two-carbon product of the link reaction, not the molecule converted into it.

B. wrong: lactate is the product of anaerobic glycolysis, not the substrate of the link reaction.

C. correct: in the link reaction, three-carbon pyruvate loses one carbon as carbon dioxide and the remaining two-carbon acetyl group attaches to coenzyme A.

D. wrong: glycerol is a component of fats, not the substrate of the link reaction.

Question 4 Beta oxidation

Metabolism of an 18-carbon fatty acid results in ____ number of Acetyl-CoA?

- A. 3
- B. 6
- C. 9 ✓ **Correct answer**
- D. 18

A. wrong: beta oxidation removes two-carbon units, so 18 carbons give far more than 3 acetyl-CoA.

B. wrong: this would be the result for a 12-carbon fatty acid, not an 18-carbon one.

C. correct: each acetyl-CoA carries 2 carbons, so 18 ÷ 2 = 9 acetyl-CoA molecules (produced

dation cycles).

D. wrong: this would require one acetyl-CoA per carbon, but each carries two carbons.

Question 5 Organic molecules

Which of the following are classified as organic molecules in humans?

- A. Water, mineral, oxygen, carbon dioxide
- B. Carbohydrates, proteins, lipids, nucleic acids ✓ **Correct answer**
- C. Vitamins, minerals, water, oxygen
- D. Glucose, sodium chloride, water, calcium

A. wrong: none of these four is an organic biomolecule (water, minerals, oxygen and carbon dioxide are inorganic).

B. correct: these four groups are the major carbon-based biological molecules of the human body.

C. wrong: minerals, water and oxygen are inorganic, so this list cannot be classified as organic molecules.

D. wrong: sodium chloride, water and calcium are inorganic, so the list is not all organic.

Question 6 DNA and RNA similarity

The structural similarity between DNA and RNA nucleotides is due to the presence of:

- A. Thymine
- B. Ribose
- C. Deoxyribose
- D. Phosphoric acid ✓ **Correct answer**

A. wrong: thymine is found in DNA, not in RNA (RNA uses uracil instead).

B. wrong: ribose is the sugar of RNA, not of DNA (DNA uses deoxyribose).

oxyribose is the sugar of DNA, not of RNA.

D. correct: every nucleotide — DNA or RNA — contains a phosphate group, so phosphoric acid (phosphate) is the component shared by both.

Question 7 Water cooling property

Which property of water is primarily helpful in providing a cooling effect to plants and animals?

- A. Heat capacity
- B. Heat of vaporization ✓ **Correct answer**
- C. Solvent properties
- D. Force of cohesion

A. wrong: water's high heat capacity resists temperature change, but it is not what cools a body when water evaporates.

B. correct: when sweat or water on a leaf evaporates, it absorbs a large amount of heat from the surface, giving evaporative cooling.

C. wrong: being a good solvent does not cool a body.

D. wrong: cohesion holds water molecules together and helps water rise in plants, but it does not provide cooling.

Question 8 Protoplasm dehydration

The reduction of water content in protoplasm to about 10% results in:

- A. Increased metabolic activity
- B. Faster cell division
- C. Loss of survival of protoplasm ✓ **Correct answer**
- D. Increased protein synthesis

A. wrong: severe dehydration stops biochemical reactions; it does not increase them.

dehydrated cell cannot divide faster; its activity shuts down.

C. correct: water is the medium of all cellular reactions, so at about 10% water content the protoplasm cannot survive.

D. wrong: protein synthesis needs water as its medium and stops when water is lost.

Question 9 Maltose

Maltose is classified as:

- A. Monosaccharide
- B. Disaccharide ✓ **Correct answer**
- C. Trisaccharide
- D. Polysaccharide

A. wrong: a monosaccharide is a single sugar unit (e.g. glucose); maltose has two.

B. correct: maltose consists of two glucose units joined by a glycosidic bond.

C. wrong: a trisaccharide has three sugar units; maltose has two.

D. wrong: a polysaccharide is a long chain of many sugar units; maltose has only two.

Question 10 Haemoglobin structure level

Haemoglobin is an example of which level of protein structure?

- A. Primary
- B. Secondary
- C. Tertiary
- D. Quaternary ✓ **Correct answer**

A. wrong: primary structure is the amino acid sequence of a single chain.

B. wrong: secondary structure is the local folding (alpha helix, beta sheet) of a single chain.

tiary structure is the three-dimensional folding of a single polypeptide; each haemoglobin subunit has tertiary structure, but the whole molecule is defined by its four subunits.

D. correct: functional haemoglobin consists of four polypeptide subunits associated in one complex, which is quaternary structure.

Question 11 Glycoproteins in the cell

In cell, glycoproteins are found in the:

- A. Mitochondria ✓ **Correct answer**
- B. DNA
- C. RNA
- D. Plasma membrane

A. one of the two answers KMU accepts: mitochondrial proteins can be glycosylated (glycosylation of mitochondrial proteins is a specialised but real case), and the official Code A key lists A as an accepted answer.

B. wrong: DNA is a nucleic acid, not a glycoprotein; it contains no protein–carbohydrate combination.

C. wrong: RNA is a nucleic acid, not a glycoprotein.

D. the other answer KMU accepts, and the standard textbook example: plasma membrane glycoproteins project carbohydrate groups toward the extracellular surface. PICK-ONE (decided by assistant under owner's 8 Nov 2026 delegation): KMU's official Code A key accepts BOTH A and D for this question, exactly as published; A is served as the keyed answer and D is recorded here as equally accepted.

Question 12 DNA length

A DNA molecule has a length of 340 nm. How many base pairs does it contain?

- B. 340
- C. 500
- D. 1000 ✓ **Correct answer**

A. wrong: this would require 3.4 nm per base pair, ten times the real rise.

B. wrong: this confuses the length in nm with the number of base pairs.

C. wrong: this would require 0.68 nm per base pair, twice the real rise.

D. correct: adjacent base pairs in B-form DNA are separated by about 0.34 nm, so 340 ÷ 0.34 = 1000 base pairs.

Question 13 Fatty acids and amino acids

Fatty acids and glycerol are related to ____, whereas ____ are related to protein.

- A. Nucleic acids; amino acids
- B. Lipids; amino acids ✓ **Correct answer**
- C. Polymers; polypeptides
- D. Amino acids; polypeptides

A. wrong: fatty acids and glycerol are not the building blocks of nucleic acids.

B. correct: fatty acids and glycerol are the building components of many lipids, and proteins are polymers of amino acids.

C. wrong: the first blank asks for the product class (lipids), not for "polymers" generally.

D. wrong: fatty acids and glycerol are not related to amino acids.

Question 14 Chloroplast identification

A student observes a discoid organelle with a double membrane, stroma and thylakoids in a plant cell. Which organelle is this?

- B. Endoplasmic reticulum
- C. Chloroplast ✓ **Correct answer**
- D. Mitochondria

A. wrong: the Golgi has no double membrane, no stroma and no thylakoids.

B. wrong: the endoplasmic reticulum is a network of membranes with no stroma or thylakoids.

C. correct: the stroma is the fluid interior of a chloroplast and thylakoids form its internal membrane system.

D. wrong: a mitochondrion also has two membranes, but it contains cristae rather than thylakoids and has a matrix, not a stroma.

Question 15 Common feature of prokaryotic and eukaryotic cells

Which of the following is a common feature of prokaryotic and eukaryotic cells?

- A. Mitochondria
- B. Ribosomes ✓ **Correct answer**
- C. Endoplasmic reticulum
- D. Golgi complex

A. wrong: mitochondria are membrane-bound organelles absent from prokaryotes.

B. correct: both cell types synthesise proteins, so both contain ribosomes (70S in prokaryotes, 80S in eukaryotes).

C. wrong: the endoplasmic reticulum is a membrane-bound system absent from prokaryotes.

D. wrong: the Golgi complex is absent from prokaryotes.

16 Self-replicating organelle

Which one of the following is a self-replicating organelle?

- A. Golgi apparatus
- B. Lysosome
- C. Peroxisome
- D. Mitochondria ✓ **Correct answer**

A. wrong: the Golgi does not replicate itself independently; it is built from endoplasmic reticulum membranes.

B. wrong: lysosomes bud from the Golgi; they do not self-replicate.

C. wrong: peroxisomes can divide but they lack their own DNA; the standard textbook answer for a self-replicating organelle is the mitochondrion.

D. correct: mitochondria carry their own DNA and divide from pre-existing mitochondria.

Question 17 Smooth endoplasmic reticulum

If a cell's smooth endoplasmic reticulum is destroyed, which processes will be most affected?

- A. Protein synthesis and protein folding
- B. Lipid synthesis and detoxification ✓ **Correct answer**
- C. ATP production and aerobic respiration
- D. DNA replication and cell division

A. wrong: protein synthesis on bound ribosomes belongs mainly to the rough endoplasmic reticulum, not the smooth.

B. correct: the smooth endoplasmic reticulum is a major site for lipid synthesis and enzymatic detoxification.

C. wrong: these belong mainly to the mitochondria.

ese take place in the nucleus and are not the smooth endoplasmic reticulum's work.

Question 18 Centromere

The centromere is important because it:

- A. Synthesizes proteins
- B. Holds identical chromatids together ✓ **Correct answer**
- C. Replicates DNA
- D. Produces ATP

A. wrong: protein synthesis happens on ribosomes, not at the centromere.

B. correct: after DNA replication, the two sister chromatids remain joined at the centromere until separation, and the region supports kinetochore assembly for spindle attachment.

C. wrong: DNA replication is carried out by DNA polymerase along the whole chromosome, not by the centromere.

D. wrong: ATP is produced in mitochondria (and chloroplasts), not at the centromere.

Question 19 Sodium-potassium pump

Which of the following correctly describes the action of the sodium-potassium pump in a resting neuron?

- A. Two Na^+ ions are pumped in and three K^+ ions are pumped out
- B. Three Na^+ ions are pumped in and two K^+ ions are pumped out
- C. Three Na^+ ions are pumped out and two K^+ ions are pumped in ✓ **Correct answer**
- D. Equal numbers of Na^+ and K^+ ions are exchanged

A. wrong: the numbers are wrong and the directions are reversed.

B. wrong: the directions are reversed; sodium is pumped out, not in.

For each ATP used, the pump sends three sodium ions out and brings two potassium ions in, both against their concentration gradients.

D. wrong: the pump moves 3 Na^+ and 2 K^+, not equal numbers.

Question 20 Typical neuron structures

Which of the following structures can be found in a typical neuron?

- A. Dendrites, cell body, cilia
- B. Dendrites, cell body, axon ✓ **Correct answer**
- C. Dendrites, cell body, ganglion
- D. Cauda equina, cell body, myelin sheath

A. wrong: neurons do not have cilia as a standard part.

B. correct: dendrites receive signals, the cell body integrates them, and the axon carries output away — the standard structural plan of a neuron.

C. wrong: a ganglion is a collection of neuronal cell bodies, not one part of a single neuron.

D. wrong: the cauda equina is a bundle of spinal nerve roots, not a part of a single neuron.

Question 21 Depolarization

The reversal of polarity across two sides of the membrane from −70 mV to 50 mV is called:

- A. Polarization
- B. Hyperpolarization
- C. Repolarization
- D. Depolarization ✓ **Correct answer**

A. wrong: polarization is the state of the membrane at rest (−70 mV), not the change to +50 mV.

perpolarization makes the membrane more negative than rest, the opposite of this change.

C. wrong: repolarization is the later return toward the resting negative value.

D. correct: the membrane becomes less negative (from −70 mV toward +50 mV) as sodium enters — the depolarizing phase of the action potential.

Question 22 Spinal reflex

A student quickly pulls his hand away from a hot iron after accidentally touching it. This response is best classified as:

- A. Conditioned reflex
- B. Cranial reflex
- C. Spinal reflex ✓ **Correct answer**
- D. Voluntary action

A. wrong: a conditioned reflex is learned; pulling away from a hot iron is innate.

B. wrong: cranial reflexes are mediated by cranial nerves and the brain; this withdrawal is coordinated through the spinal cord.

C. correct: the rapid withdrawal is coordinated through a spinal reflex arc before conscious processing, protecting the tissue from further heat damage.

D. wrong: the response is involuntary and immediate, not a deliberate voluntary movement.

Question 23 Pons and sleep

A patient suffers a brain injury following a head trauma. During recovery, the patient experiences disturbed sleep patterns and is unable to dream normally. Which part of the brain is most likely affected?

- A. Cerebellum

- C. Pons ✓ **Correct answer**
- D. Thalamus

A. wrong: the cerebellum chiefly coordinates movement, not sleep and dreaming.

B. wrong: the medulla handles vital autonomic functions such as heart rate and breathing, not sleep regulation.

C. correct: the pons participates in sleep regulation and REM sleep circuitry, so injury there can disturb sleep patterns and dreaming.

D. wrong: the thalamus is mainly a relay station for sensory information, not the sleep-regulating centre described here.

Question 24 Dopamine neurons

Damage to the area containing dopamine-releasing neurons would most likely affect the:

- A. Midbrain ✓ **Correct answer**
- B. Cerebellum
- C. Pons
- D. Medulla

A. correct: dopamine-producing neuronal groups such as the substantia nigra and ventral tegmental area are in the midbrain, so damage there affects dopamine-related motor and reward pathways.

B. wrong: the cerebellum coordinates movement but does not house the classic dopamine-producing groups.

C. wrong: the pons is not the site of the substantia nigra or ventral tegmental area.

D. wrong: the medulla does not house the classic dopamine-producing groups.

25 Amygdala

The amygdala is a part of the:

- A. Cerebellum
- B. Limbic system ✓ **Correct answer**
- C. Reticular formation
- D. Medulla oblongata

A. wrong: the cerebellum coordinates movement and balance; the amygdala is not part of it.

B. correct: the amygdala is a limbic structure involved in emotional processing, including fear-related responses.

C. wrong: the reticular formation is a network in the brainstem involved in arousal and consciousness, not the amygdala's system.

D. wrong: the medulla is part of the brainstem controlling vital functions; the amygdala is not part of it.

Question 26 Enzyme characteristic

Which characteristic distinguishes enzymes during a chemical reaction?

- A. They change the final product
- B. They slow down metabolic steps
- C. They remain chemically unchanged ✓ **Correct answer**
- D. They become part of reaction product

A. wrong: an enzyme does not change what the product is; it only speeds up its formation.

B. wrong: enzymes speed reactions up by lowering activation energy.

C. correct: an enzyme binds reactants, lowers the activation energy, releases the products and can be used again without being changed itself.

e enzyme is not incorporated into the product; it is released unchanged.

Question 27 Lock and key active site

According to the lock and key hypothesis, the active site in enzyme action is regarded as a ____ structure.

- A. Rigid ✓ **Correct answer**
- B. Flexible
- C. Dynamic
- D. Elastic

A. correct: the classical lock-and-key model imagines a pre-shaped active site complementary to its substrate, regarded as rigid.

B. wrong: a flexible, changing shape is emphasised by the induced-fit model, not by lock and key.

C. wrong: "dynamic" describes the induced-fit model, not the lock-and-key model named in the question.

D. wrong: the lock-and-key model does not describe the active site as elastic.

Question 28 Pepsin optimum pH

Enzyme pepsin shows maximum activity at pH:

- A. 1.5–1.6 ✓ **Correct answer**
- B. 4.5–4.7
- C. 7.8–8.7
- D. 8.7–9.1

A. correct: pepsin works in the acidic stomach and its activity is greatest at a very low pH of about 1.5–2.

B. wrong: pepsin is much less active at pH 4.5; it needs the strong acidity of gastric juice.

psin is inactive in alkaline conditions; this range suits enzymes such as trypsin.

D. wrong: pepsin is denatured and inactive at alkaline pH.

Question 29 pH effect on enzymes

pH affects the activity of an enzyme by causing the:

- A. Ionization of an active site ✓ **Correct answer**
- B. Increase in the activation energy
- C. Removal of prosthetic group from enzyme
- D. Decreasing the temperature of reaction mixture

A. correct: changing pH changes the protonation and charge of amino acid groups at the active site, disrupting substrate binding or catalysis.

B. wrong: pH does not act by raising the activation energy; enzymes lower activation energy regardless of pH.

C. wrong: pH change does not necessarily remove a prosthetic group.

D. wrong: pH has nothing to do with the temperature of the mixture.

Question 30 Competitive inhibitor

Which molecule has a similar structure to the normal substrate?

- A. Competitive inhibitor ✓ **Correct answer**
- B. Non-competitive inhibitor
- C. Heavy metal ion
- D. Cyanide

A. correct: a competitive inhibitor resembles the substrate closely enough to bind at the same active site, so substrate and inhibitor compete for access.

non-competitive inhibitor binds at a different site and does not resemble the substrate.

C. wrong: heavy metal ions inhibit enzymes by binding to sulfhydryl groups, not by resembling the substrate.

D. wrong: cyanide inhibits cytochrome oxidase by binding its iron, not by resembling the normal substrate.

Question 31 Struggle for existence

Human beings are involved in an intense struggle for existence because resources such as food, water and space:

- A. Double every year
- B. Cannot increase at the same rate ✓ **Correct answer**
- C. Increase at the same rate
- D. Remain constant

A. wrong: resources do not double every year; populations can rise faster than resources.

B. correct: population can rise more rapidly than food, water and space, so resources lag behind demand and individuals compete.

C. wrong: if resources increased at the same rate as population, there would be no struggle.

D. wrong: resources do change; the point is that their increase lags behind population growth.

Question 32 Lamarck's giraffe

Lamarck explained the long neck of giraffe on the basis of:

- A. Mutation
- B. Natural selection

- C. Inheritance of acquired characteristics ✓ **Correct answer**
- D. Genetic drift

A. wrong: mutation is a modern genetic concept, not Lamarck's explanation.

B. wrong: natural selection is Darwin's explanation, not Lamarck's.

C. correct: Lamarck proposed that repeated stretching lengthened the neck and that the acquired change passed to offspring.

D. wrong: genetic drift is random change in allele frequencies, not Lamarck's explanation.

Question 33 Natural selection example

A population of rabbits shows variation in fur colour. During snowy winters, white rabbits are less visible to predators and survive in greater numbers than brown rabbits. According to Darwin, this is an example of:

- A. Overproduction
- B. Natural selection ✓ **Correct answer**
- C. Artificial selection
- D. Genetic drift

A. wrong: overproduction is the production of more offspring than can survive; the example is about differential survival by an inherited trait.

B. correct: white rabbits survive and reproduce more often because the environment favours their inherited trait — natural selection.

C. wrong: artificial selection is deliberate breeding by humans, not survival in the wild.

D. wrong: genetic drift is random change in allele frequency, not selection by the environment.

34 Lamarck's expectation

According to Lamarck, what would be expected if an organism loses or modifies a body part during its lifetime?

- A. It is passed to offspring ✓ **Correct answer**
- B. It has no effect on offspring
- C. It causes genetic mutation
- D. It occurs through natural selection

A. correct: Lamarck's theory held that traits acquired through use or disuse during life could be inherited by offspring.

B. wrong: this is the modern view, not Lamarck's.

C. wrong: Lamarck did not propose genetic mutation.

D. wrong: natural selection is Darwin's mechanism, not Lamarck's.

Question 35 Corpus luteum

Post ovulation, the ruptured follicle is transformed into a glandular structure called:

- A. Cervix
- B. Fimbriae
- C. Endometrium
- D. Corpus luteum ✓ **Correct answer**

A. wrong: the cervix is the neck of the uterus, not the transformed follicle.

B. wrong: fimbriae are the finger-like ends of the fallopian tube.

C. wrong: the endometrium is the uterine lining.

D. correct: after ovulation the remaining follicular tissue reorganises into the corpus luteum, which secretes progesterone.

36 Vasectomy

Both vas deferens of a male are surgically cut (vasectomy done). Which process remains unaffected after the procedure?

- A. Testosterone secretion ✓ **Correct answer**
- B. Sperm transport
- C. Ejaculation of sperms
- D. Fertilization ability

A. correct: vasectomy cuts the vas deferens, blocking sperm from the ejaculate, but the testes remain in place and their hormone-producing cells continue to secrete testosterone.

B. wrong: sperm transport is directly blocked by cutting the vas deferens.

C. wrong: after vasectomy the ejaculate contains no sperm.

D. wrong: without sperm in the ejaculate, fertilisation cannot occur.

Question 37 Estrogen deficiency

A woman has irregular menstruation due to failure of proliferative endometrial thickening. Which hormone is deficient in her body?

- A. Estrogen ✓ **Correct answer**
- B. Oxytocin
- C. Luteinizing hormone
- D. Follicle-stimulating hormone

A. correct: oestrogen from developing ovarian follicles drives the proliferation and thickening of the uterine lining before ovulation.

B. wrong: oxytocin causes uterine contractions and milk ejection, not endometrial thickening.

triggers ovulation and corpus luteum formation; it does not drive proliferative thickening.

D. wrong: FSH stimulates follicle growth, but the hormone that directly thickens the endometrium is oestrogen.

Question 38 Syphilitic chancre

A patient having a painless, non-itching ulcerated sore with hard edges on genitals is most likely suffering from:

- A. Gonorrhea
- B. Syphilis ✓ **Correct answer**
- C. Genital herpes
- D. AIDS

A. wrong: gonorrhoea typically causes a discharge and painful urination, not a painless hard-edged ulcer.

B. correct: a primary syphilitic chancre classically presents as a painless ulcer with a firm (hard) edge.

C. wrong: genital herpes more commonly produces painful grouped vesicles or ulcers.

D. wrong: AIDS is a systemic immune disease, not a localised painless genital ulcer.

Question 39 Floating ribs

The ribs not attached to the sternum are called:

- A. True ribs
- B. False ribs
- C. Floating ribs ✓ **Correct answer**
- D. Vertebro-sternal ribs

A. wrong: true ribs (pairs 1–7) attach directly to the sternum.

se ribs (pairs 8–12) lack a direct sternal attachment, but pairs 8–10 attach indirectly through cartilage to the 7th rib; only pairs 11–12 have no attachment at all.

C. correct: floating ribs (pairs 11 and 12) have no anterior attachment to the sternum at all, which is exactly what the stem describes.

D. wrong: vertebro-sternal ribs are the true ribs, which attach directly to the sternum.

Question 40 Cartilage

A tissue is found to have cells embedded in a firm matrix, lacks blood vessels and receives nutrients by diffusion. It also resists compression forces in joints. This tissue is most likely:

- A. Compact bone
- B. Spongy bone
- C. Adipose
- D. Cartilage ✓ **Correct answer**

A. wrong: compact bone is vascular (it has blood vessels in Haversian canals) and is not nourished by diffusion alone.

B. wrong: spongy bone is also vascular and does not fit the description.

C. wrong: adipose tissue stores fat and has a soft matrix, not a firm compression-resisting one.

D. correct: cartilage cells lie in a firm extracellular matrix, cartilage has no blood vessels of its own, nutrients reach the cells by diffusion, and the matrix resists compression at joints.

Question 41 Skeletal muscle

A tissue sample shows striated, multinucleated cells and has voluntary control. Which fundamental role is most associated with this tissue?

- A. Pumping blood

- C. Maintenance of posture and locomotion ✓ **Correct answer**
- D. Production of digestive enzymes

A. wrong: pumping blood is the work of cardiac muscle (striated but uninucleate and involuntary).

B. wrong: movement of internal organs is mainly the work of smooth muscle.

C. correct: striated, multinucleated fibres under voluntary control identify skeletal muscle, which moves bones and maintains posture.

D. wrong: digestive enzymes are produced by glandular tissue, not by muscle.

Question 42 Muscle triad

The T-tubule and the terminal portion of the adjacent sarcoplasmic reticulum collectively form:

- A. Sarcomere
- B. Triad ✓ **Correct answer**
- C. Sarcoplasm
- D. Sarcolemma

A. wrong: the sarcomere is the contractile unit between two Z-lines, not the T-tubule plus terminal cisternae.

B. correct: a skeletal muscle triad consists of one transverse T-tubule between two terminal cisternae of the sarcoplasmic reticulum, coupling the electrical signal to calcium release.

C. wrong: sarcoplasm is the cytoplasm of a muscle fibre.

D. wrong: the sarcolemma is the muscle cell membrane.

43 A-band during contraction

During skeletal muscle contraction, the A-band of fibre:

- A. Shortens
- B. Elongates
- C. Disappears
- D. Remains constant ✓ **Correct answer**

A. wrong: the A-band corresponds to the length of the thick myosin filaments, which do not shorten during contraction.

B. wrong: the A-band does not lengthen during contraction.

C. wrong: the A-band is still visible during contraction; only the H zone can disappear.

D. correct: sliding-filament contraction changes the degree of overlap without shortening the thick filaments, so the A-band's length stays essentially constant (while the I-band and H zone shrink).

Question 44 Intervertebral joint

The joint formed between adjacent vertebrae allows slight movement and has no synovial cavity. It is classified as:

- A. Synovial joint
- B. Fibrous joint
- C. Hinge joint
- D. Cartilaginous joint ✓ **Correct answer**

A. wrong: synovial joints are freely movable and have a synovial cavity; the intervertebral joint has none.

B. wrong: fibrous joints (such as sutures) allow almost no movement and are joined by fibrous tissue, not by fibrocartilage discs.

hinge joint is a type of synovial joint that bends in one plane.

D. correct: intervertebral discs join vertebral bodies with fibrocartilage, allowing limited movement and absorbing compression, with no synovial cavity.

Question 45 Shoulder joint

A cricketer rotates his shoulder joint to throw the ball in any direction. What type of joint is this?

- A. Pivot joint
- B. Ball and socket joint ✓ **Correct answer**
- C. Hinge joint
- D. Condyloid joint

A. wrong: a pivot joint rotates around one axis only (e.g. atlas–axis); the shoulder moves in many directions.

B. correct: the rounded humeral head fits into the shoulder socket, permitting movement around several axes, including rotation.

C. wrong: a hinge joint chiefly bends in one plane (e.g. the elbow).

D. wrong: a condyloid joint allows movement in two planes but not full rotation; the shoulder is a ball and socket.

Question 46 Arthritis effect

In arthritis, friction and inflammation of joints primarily affects which body function?

- A. Exchange of gases
- B. Production of RBCs
- C. Deposition of calcium in bones
- D. Smooth movement of joints ✓ **Correct answer**

A. wrong: gas exchange happens in the lungs, not in joints.

d blood cells are produced in the bone marrow, not affected by joint inflammation.

C. wrong: calcium deposition is a bone process, not the primary function affected by arthritis.

D. correct: inflammation and damage at a joint increase pain and friction, restricting how smoothly its surfaces move.

Question 47 Homozygous recessive in F_2

If green is a dominant and yellow is a recessive trait, then what percentage of the F_2 generation will be homozygous recessive?

- A. 0%
- B. 25% ✓ **Correct answer**
- C. 50%
- D. 75%

A. wrong: homozygous recessive offspring certainly appear in the F_2.

B. correct: for a cross between heterozygous F_1 parents, the genotypes appear in a 1:2:1 ratio (GG : Gg : gg), so one of four offspring — 25% — is homozygous recessive.

C. wrong: 50% is the share of heterozygotes, not of homozygous recessives.

D. wrong: 75% is the share of the dominant phenotype, not of homozygous recessives.

Question 48 Test cross ratio

In a monohybrid cross of round (RR) and wrinkled seeded (rr) pea plants, all F_1 offspring are round seeded (Rr). If an F_1 plant is crossed with a homozygous recessive (rr) plant, what will be the phenotypic ratio of round to wrinkled offspring?

- A. 1:3
- B. 1:4

- D. 1:1 ✓ **Correct answer**

A. wrong: this is not the ratio from a test cross; Rr × rr gives equal numbers of Rr and rr.

B. wrong: no such ratio arises from this cross.

C. wrong: half the offspring are round (Rr), so the round share is not zero.

D. correct: crossing Rr with rr produces Rr and rr offspring in equal proportions — Rr is round and rr is wrinkled, so the phenotypic ratio is 1:1.

Question 49 Dihybrid test cross ratio

Which condition results in a 1:1:1:1 phenotypic ratio in the offspring of a dihybrid test cross?

- A. Complete linkage
- B. No linkage ✓ **Correct answer**
- C. Sex linkage
- D. Mutation

A. wrong: complete linkage favours parental combinations and disrupts the equal 1:1:1:1 result.

B. correct: an unlinked dihybrid makes four types of gametes in equal frequencies, and a test cross with a double recessive partner reveals them as four equal phenotype classes.

C. wrong: sex linkage does not by itself produce a 1:1:1:1 dihybrid test-cross ratio.

D. wrong: mutation does not produce this ratio.

Question 50 X-linked recessive expression

An X-linked recessive allele inherited from a carrier mother (father is unaffected) is most likely to be expressed in which child?

✓ Correct answer

- B. Daughter
- C. Both equally
- D. None of them

A. correct: a son receives his only X chromosome from his mother and a Y from his father, so if that X bears the recessive allele there is no second normal X to mask it.

B. wrong: a daughter of a carrier mother and unaffected father usually receives a normal paternal X, so she is less likely to express the recessive trait.

C. wrong: sons are far more likely to express an X-linked recessive trait than daughters.

D. wrong: a son who inherits the affected X will express the trait.

Question 51 X-linked recessive disorder

Which of the following is a disorder caused by a recessive X-linked trait?

- A. Vitamin D resistant rickets
- B. Anemia
- C. Colour blindness ✓ **Correct answer**
- D. Cystic fibrosis

A. wrong: vitamin D resistant (hypophosphatemic) rickets is usually taught as X-linked dominant, not recessive.

B. wrong: anaemia is a general condition, not a disorder caused by a recessive X-linked trait.

C. correct: common red-green colour blindness is a classic X-linked recessive trait, more frequent in males because they have only one X chromosome.

D. wrong: cystic fibrosis is autosomal recessive, not X-linked.

52 X-linked dominant disorder

Identify the X-linked dominant disorder from the following:

- A. Haemophilia
- B. Colour blindness
- C. Baldness
- D. Hypophosphatemic rickets ✓ **Correct answer**

A. wrong: haemophilia is X-linked recessive.

B. wrong: common red-green colour blindness is X-linked recessive.

C. wrong: baldness (male pattern) is not an X-linked dominant disorder.

D. correct: X-linked hypophosphatemic rickets can be expressed when one affected X chromosome is present, which is the dominant pattern.

Question 53 Genetic basis of haemophilia

The genetic basis of haemophilia is:

- A. A dominant allele on chromosome 21
- B. A recessive allele on the X chromosome ✓ **Correct answer**
- C. A recessive allele on the Y chromosome
- D. A mitochondrial mutation

A. wrong: haemophilia is not caused by a dominant allele on chromosome 21.

B. correct: the common inherited haemophilias A and B arise from mutations in clotting factor genes on the X chromosome, and the recessive pattern explains why males are more often affected.

C. wrong: haemophilia is not Y-linked.

D. wrong: haemophilia is not a mitochondrial disorder.

54 Pericardial fluid

The fluid present in the pericardial cavity functions to:

- A. Nourish the heart muscles
- B. Prevent blood clotting
- C. Reduce friction during heart movement ✓ **Correct answer**
- D. Generate electrical impulse

A. wrong: the heart muscle is nourished by the coronary arteries, not by pericardial fluid.

B. wrong: pericardial fluid has nothing to do with blood clotting.

C. correct: a thin film of fluid separates the layers of the serous pericardium, lubricating them so the beating heart does not rub against its sac.

D. wrong: the electrical impulse is generated by the sinoatrial node, not by pericardial fluid.

Question 55 Ventricular systole

The phase of the cardiac cycle during which blood is pumped to lungs and the entire body is called:

- A. Atrial systole
- B. Atrial diastole
- C. Ventricular systole ✓ **Correct answer**
- D. Ventricular diastole

A. wrong: atrial systole mainly completes ventricular filling; it does not pump blood to the lungs and body.

B. wrong: atrial diastole is the relaxation and filling of the atria.

C. correct: during ventricular systole the right ventricle ejects blood toward the lungs and the left ventricle ejects it into the aorta.

ntricular diastole is the relaxation and filling phase of the ventricles.

Question 56 Hepatic portal system

Hepatic portal subsystem carries nutrients from the small intestine to the:

- A. Vena cava
- B. Liver ✓ **Correct answer**
- C. Pancreas
- D. Kidney

A. wrong: the vena cava receives blood later, after it has passed through the liver.

B. correct: the hepatic portal vein carries nutrient-rich blood from the gut to the liver first, so the liver can process, store or regulate absorbed materials before they enter general circulation.

C. wrong: the pancreas is not the destination of the hepatic portal blood.

D. wrong: the kidney is not the destination of the hepatic portal blood.

Question 57 Artery wall thickness

Why are arteries thicker than veins?

- A. To store more blood
- B. To prevent backflow
- C. To increase diffusion rate
- D. To withstand high pressure ✓ **Correct answer**

A. wrong: veins, not arteries, are the main blood reservoirs.

B. wrong: backflow is prevented by valves in veins, not by thick arterial walls.

C. wrong: diffusion happens in capillaries, whose walls are thin, not thick.

D. correct: blood leaves the heart under relatively high pressure, so arteries need a thick

d elastic wall to tolerate and smooth pressure changes.

Question 58 Lymph formation

Lymph is formed from:

- A. Blood plasma
- B. Interstitial fluid ✓ **Correct answer**
- C. Sweat
- D. Saliva

A. wrong: lymph ultimately originates from plasma, but its immediate precursor is interstitial fluid, not plasma itself.

B. correct: fluid that leaves capillaries enters tissue spaces as interstitial fluid, and once collected into lymphatic vessels it is called lymph.

C. wrong: sweat is secreted by sweat glands onto the skin; it does not become lymph.

D. wrong: saliva is secreted by salivary glands into the mouth; it does not become lymph. (Note: the stem line for this question was not served in the source page's text extraction — the heading and stem are missing from the page text between Q57 and Q59, while the category, the four options, the official key B and the explanation are all served. The stem "Lymph is formed from:" is reconstructed from those served parts, which unambiguously determine it: the explanation states that fluid leaving capillaries becomes interstitial fluid and, once collected into lymphatic vessels, is called lymph. Recorded openly under the owner's 8 Nov 2026 delegation.)

Question 59 Antibody

B-lymphocytes produce a small, soluble and specific protein called:

- A. Antigen
- B. Antibody ✓ **Correct answer**
- C. Prostaglandin

A. wrong: an antigen is the target that stimulates immunity, not the protein B cells produce.

B. correct: activated B cells become plasma cells that release antigen-specific antibodies, soluble proteins that bind particular targets.

C. wrong: prostaglandins are lipid signalling molecules involved in inflammation, not B-cell products.

D. wrong: perforin is associated mainly with cytotoxic T cells and natural killer cells, not with B-lymphocytes.

Question 60 Vaccine memory

A vaccine containing weakened microbes is administered to a person. Which aspect of adaptive immunity provides long-lasting protection against future infections?

- A. Inflammatory response
- B. Rise in body temperature
- C. Engulfment by phagocytes
- D. Formation of memory cells ✓ **Correct answer**

A. wrong: inflammation is an immediate innate defence; it does not itself explain long-lasting adaptive memory.

B. wrong: fever is an immediate defence, not the basis of long-term protection.

C. wrong: phagocytosis is an immediate innate defence, not the basis of long-term protection.

D. correct: vaccination exposes the adaptive immune system to antigen, and memory B and T cells then persist and respond more rapidly on later exposure.

61 No cartilage

Which has no cartilage in its structure?

- A. Larynx
- B. Trachea
- C. Bronchioles ✓ **Correct answer**
- D. Bronchi

A. wrong: the larynx contains cartilage (e.g. the thyroid and cricoid cartilages).

B. wrong: the trachea is supported by C-shaped cartilage rings.

C. correct: trachea and bronchi have cartilage supporting their walls, while smaller bronchioles lack cartilage; their calibre is controlled largely by smooth muscle.

D. wrong: bronchi have cartilage plates in their walls.

Question 62 Nasal mucus and cilia

The mucus and cilia of the nasal cavity work together to:

- A. Increase the rate of diffusion of oxygen
- B. Produce mucus for vocal cord lubrication
- C. Filter air and prevent the entry of microorganisms ✓ **Correct answer**
- D. Exchange oxygen and carbon dioxide with blood

A. wrong: diffusion of oxygen happens in the alveoli, not in the nasal cavity.

B. wrong: nasal mucus does not lubricate the vocal cords.

C. correct: mucus traps inhaled particles and microbes, and cilia move the trapped material toward the throat so it can be cleared.

D. wrong: gas exchange happens across the alveoli, not in the nasal cavity.

63 CO_2 transport

During gaseous exchange in the human body, the maximum percentage of CO_2 is transported from body tissues to lungs as:

- A. Bicarbonate ion ✓ **Correct answer**
- B. Carbaminohemoglobin
- C. Dissolved CO_2 in plasma
- D. Gaseous form as bubbles

A. correct: most carbon dioxide entering red cells is converted to carbonic acid and then bicarbonate, which carries the largest share (about 70%) toward the lungs.

B. wrong: carbamino compounds carry only about 20–25% of the CO_2.

C. wrong: dissolved CO_2 in plasma carries only about 5–7% of the CO_2.

D. wrong: CO_2 does not travel as gas bubbles in the blood.

Question 64 Emphysema

Smoking causes alveolar destruction in:

- A. Pneumonia
- B. Chronic bronchitis
- C. Emphysema ✓ **Correct answer**
- D. Asthma

A. wrong: pneumonia is an infection that inflames the alveoli; it is not defined by smoking-caused alveolar destruction.

B. wrong: chronic bronchitis mainly involves inflamed, mucus-producing airways, not alveolar destruction.

C. correct: emphysema involves destruction of alveolar walls and loss of elastic recoil, reducing the surface area for gas exchange — the classic smoking-related alveolar

D. wrong: asthma is a reversible narrowing of the airways, not alveolar destruction.

Question 65 Liver function

Which of the following is not a function of liver?

- A. Detoxification
- B. Insulin synthesis ✓ **Correct answer**
- C. Producing bile
- D. Storage of vitamin A

A. wrong: detoxification is a genuine liver function, so it is not the exception.

B. correct: insulin is synthesised and secreted by the pancreatic beta cells, not by the liver.

C. wrong: producing bile is a genuine liver function.

D. wrong: the liver stores vitamin A (and other fat-soluble vitamins), so this is a genuine liver function.

Question 66 Swallowing sequence

Find the correct sequence of phases in the swallowing mechanism. 1. Pharyngeal 2. Oral 3. Esophageal

- A. 2–1–3 ✓ **Correct answer**
- B. 1–2–3
- C. 2–3–1
- D. 3–1–2

A. correct: a swallow begins with the oral phase (2), continues through the pharyngeal phase (1), and then passes through the esophagus (3).

B. wrong: the pharyngeal phase does not come before the oral phase.

e esophageal phase does not come before the pharyngeal phase.

D. wrong: this reverses the order entirely.

Question 67 Secretin

The release of bicarbonate-rich fluid from the pancreas is stimulated by the action of:

- A. Pepsin
- B. Gastrin
- C. Secretin ✓ **Correct answer**
- D. Trypsin

A. wrong: pepsin is a stomach enzyme, not a hormone that stimulates pancreatic bicarbonate.

B. wrong: gastrin mainly stimulates gastric activity, not bicarbonate-rich pancreatic secretion.

C. correct: acidic chyme entering the duodenum stimulates secretin release, and secretin promotes bicarbonate-rich pancreatic secretion that neutralises the acid.

D. wrong: trypsin is a pancreatic enzyme, not the hormone that stimulates bicarbonate release.

Question 68 Villus absorption structures

Which structures in the intestinal villus are directly involved in nutrient absorption?

- A. Blood capillaries and lacteals ✓ **Correct answer**
- B. Arteries and goblet cells
- C. Circular and longitudinal muscles
- D. Crypts of Lieberkühn and microvilli

A. correct: blood capillaries receive many absorbed sugars and amino acids, and a central lacteal transports much of the absorbed lipid in lymph; both are within the villus and

nutrients away.

B. wrong: arteries supply blood and goblet cells secrete mucus; neither directly absorbs nutrients.

C. wrong: these muscle layers move the gut contents; they do not absorb nutrients.

D. wrong: microvilli increase the absorptive surface, but the crypts are glands that secrete intestinal juice; the structures that carry nutrients away are the capillaries and lacteal.

Question 69 Large intestine peristalsis

The primary function of peristalsis in the large intestine is to:

- A. Digest carbohydrates
- B. Move undigested food toward the rectum ✓ **Correct answer**
- C. Absorb fats
- D. Secrete digestive enzymes

A. wrong: carbohydrate digestion happens in the mouth and small intestine, not the large intestine.

B. correct: rhythmic contractions push residual intestinal contents along the colon toward the rectum, while water is absorbed during transit.

C. wrong: fats are absorbed in the small intestine.

D. wrong: the large intestine does not secrete major digestive enzymes.

Question 70 Helicobacter pylori ulcer

A patient experiences chronic gastric discomfort and endoscopy confirms gastric ulcers. Which finding best explains the underlying cause?

- A. Deficiency of pepsinogen secretion
- B. Excess absorption of hydrochloric acid

ead of Helicobacter pylori into stomach wall ✓ **Correct answer**

- D. Lack of intrinsic factor and vitamin B_{12}

A. wrong: a deficiency of pepsinogen would reduce protein digestion, not cause gastric ulcers.

B. wrong: hydrochloric acid is not absorbed in excess; the issue in ulcers is damage to the mucosal barrier, not acid absorption.

C. correct: Helicobacter pylori colonises the gastric mucosa, disrupts its protective barrier and promotes ulcer formation — the common direct explanation for chronic gastric ulcers.

D. wrong: lack of intrinsic factor causes pernicious anaemia (vitamin B_{12} deficiency), not gastric ulcers.

Question 71 Renal cortex

Which region of the kidney contains glomeruli and Bowman's capsules?

- A. Renal medulla
- B. Renal cortex ✓ **Correct answer**
- C. Renal pelvis
- D. Hilum

A. wrong: the medulla contains loops of Henle and collecting ducts, not renal corpuscles.

B. correct: renal corpuscles (a glomerulus within Bowman's capsule) are located in the outer renal cortex.

C. wrong: the renal pelvis is the funnel that collects urine; it contains no glomeruli.

D. wrong: the hilum is the indented region where vessels and the ureter enter the kidney.

72 Glucose in urine

If glucose appears in urine of a patient, it indicates failure of which process?

- A. Pressure filtration
- B. Selective reabsorption ✓ **Correct answer**
- C. Tubular secretion
- D. Osmoregulation

A. wrong: filtration is what brings glucose into the filtrate in the first place; its failure would not put glucose in the urine.

B. correct: glucose is filtered at the renal corpuscle and normally reclaimed in the proximal tubule, so glucose in the urine means reabsorption has failed or its capacity has been exceeded.

C. wrong: tubular secretion adds substances to the filtrate; it does not reclaim glucose.

D. wrong: osmoregulation is the general control of water and salt balance, not the specific process that reclaims glucose.

Question 73 Nephron impermeable to water

Which part of the nephron is impermeable to water?

- A. Glomerulus
- B. Descending limb
- C. Ascending limb ✓ **Correct answer**
- D. Proximal tubule

A. wrong: the glomerulus is a tuft of capillaries where filtration occurs; it is not a tubule segment impermeable to water.

B. wrong: the descending limb of the loop of Henle is water-permeable.

C. correct: the ascending limb of the loop of Henle transports salts but is effectively

e to water, which helps establish the medullary osmotic gradient.

D. wrong: the proximal tubule reabsorbs most of the water from the filtrate; it is water-permeable.

Question 74 High water intake

When water intake is high:

- A. ADH secretion increases, producing concentrated urine
- B. Aldosterone secretion increases, producing concentrated urine
- C. ADH release is inhibited, resulting in a large volume of dilute urine ✓ **Correct answer**
- D. Ultrafiltration stops until water balance is restored

A. wrong: ADH increases when water is scarce, not when intake is high.

B. wrong: aldosterone regulates sodium, not the water response to high intake.

C. correct: with ample water, ADH release falls, the collecting ducts reabsorb less water, and a larger volume of dilute urine is excreted.

D. wrong: ultrafiltration does not stop; the kidney keeps filtering and simply excretes more dilute urine.

Question 75 Peritubular capillaries origin

Peritubular capillaries are formed from:

- A. Glomerulus
- B. Afferent arteriole
- C. Efferent arteriole ✓ **Correct answer**
- D. Interlobular artery

A. wrong: the glomerulus is a capillary tuft itself; peritubular capillaries form downstream of it.

The afferent arteriole carries blood into the glomerulus, so it is upstream of the peritubular capillaries.

C. correct: blood leaves each glomerulus through an efferent arteriole, which branches into peritubular capillaries (and in some nephrons the vasa recta).

D. wrong: the interlobular artery is further upstream in the kidney's blood supply.

Question 76 Dialysis threshold

Dialysis or kidney transplantation is usually required when kidney function falls below ____ of normal.

- A. 70%
- B. 50%
- C. 25%
- D. 10% ✓ **Correct answer**

A. wrong: at 70% of normal function the kidneys still cope without dialysis.

B. wrong: at 50% of normal function dialysis is not usually required.

C. wrong: at 25% of normal function the patient is ill but dialysis or transplantation is not yet the usual requirement.

D. correct: dialysis or transplantation is usually needed when kidney function falls below about 10% of normal (end-stage renal failure).

Question 77 Main nitrogenous waste

Which nitrogenous waste is the main excretory product in humans and has relatively low toxicity compared to ammonia?

- A. Urea ✓ **Correct answer**
- B. Uric acid
- C. Creatinine

A. correct: humans convert much of the highly toxic ammonia from amino acid metabolism into urea in the liver, and the kidneys excrete urea as the main nitrogenous product.

B. wrong: uric acid is the main excretory product of birds and reptiles, not humans.

C. wrong: creatinine is a minor waste product from muscle metabolism, not the main nitrogenous product.

D. wrong: ammonia is the most toxic nitrogenous waste and is converted to urea precisely because of its toxicity.

Question 78 DNA probes

DNA probes enable faster identification of disease-causing bacteria than conventional methods because of advances in:

- A. Non-biological methods
- B. Biotechnology ✓ **Correct answer**
- C. Antibiotics
- D. Surgery

A. wrong: DNA probes are a biological (molecular) method, not a non-biological one.

B. correct: a DNA probe recognises a complementary sequence from a microorganism; this molecular identification is a biotechnology method and is faster than conventional culture.

C. wrong: antibiotics treat infections; they are not the technology behind DNA probes.

D. wrong: surgery is a procedure, not the technology behind DNA probes.

79 Gene therapy vector

The most common vector used to deliver a therapeutic gene into target cells is:

- A. Plasmid
- B. Liposome
- C. Genetically altered virus ✓ **Correct answer**
- D. Restriction enzyme

A. wrong: plasmids can be vectors in some settings, but the most common gene-therapy vector is the engineered virus.

B. wrong: liposomes can deliver genes, but they are not the most common vector.

C. correct: engineered viruses can enter target cells and deliver a therapeutic gene, using their natural cell-entry machinery once modified for safety.

D. wrong: a restriction enzyme cuts DNA; it is not a delivery vector.

Question 80 Monoclonal antibodies

Monoclonal antibodies are:

- A. A mixture of different antibodies
- B. A group of identical antibodies produced by identical immune cells ✓ **Correct answer**
- C. Antibodies produced only by T-lymphocytes
- D. Radioactively labelled antibodies

A. wrong: a mixture of different antibodies is a polyclonal preparation, not monoclonal.

B. correct: a single B-cell lineage produces antibodies with the same binding specificity, so a monoclonal preparation contains essentially identical antibodies derived from one clone.

C. wrong: antibodies are produced by B-lymphocytes (plasma cells), not by T-lymphocytes.

D. wrong: radioactive labelling is a possible later modification, not the definition of

antibodies.

Question 81 Biotechnology product matching

Which of the following correctly matches the biotechnology product with its application?

- A. Biochips: Supply biologically fixed nitrogen to crops
- B. Mycorrhiza: Deliver drugs to target cells using nanoparticles
- C. Nanoparticles: Efficient drug delivery at target cells and diagnosis of disease ✓ **Correct answer**
- D. Biofertilizers: Detect bioterrorism agents using miniaturized laboratories

A. wrong: biochips are miniaturised analytical laboratories (used to detect agents, including bioterrorism agents); supplying fixed nitrogen is the work of biofertilizers.

B. wrong: mycorrhizae are plant–fungus associations that help plants absorb nutrients; they do not deliver drugs.

C. correct: nanoparticles can be designed to carry medicines to target tissues and support diagnostic imaging or detection.

D. wrong: detecting agents with miniaturised laboratories is the work of biochips; biofertilizers supply biologically fixed nitrogen to crops.

Question 82 Vector addition

When two vectors A and B are added, which statement is correct?

- A. A + B and B + A have different magnitudes but the same direction
- B. The resultant depends on which vector is drawn first
- C. A + B = B + A, so changing the order does not change the resultant ✓ **Correct answer**
- D. The commutative law applies only when the vectors are perpendicular

A. wrong: A + B and B + A have the same magnitude and the same direction.

e resultant is the same whichever vector is drawn first.

C. correct: vector addition is commutative; a head-to-tail diagram reaches the same endpoint either way.

D. wrong: the law applies to vectors at any angle; perpendicular vectors are not a special requirement.

Question 83 Direction of linear momentum

The direction of linear momentum is the same as the direction of:

- A. Force
- B. Acceleration
- C. Velocity ✓ **Correct answer**
- D. Displacement

A. wrong: force and momentum can point in different directions (e.g. while an object is slowing down).

B. wrong: acceleration can point elsewhere, particularly while an object is slowing or turning.

C. correct: linear momentum is the product of a positive scalar mass and the velocity vector, so it points along the velocity.

D. wrong: displacement is the change in position; momentum points along the velocity, not necessarily along the displacement.

Question 84 Uniform acceleration

Which situation represents uniform acceleration?

- A. Velocity changes by unequal amounts during equal time intervals
- B. Acceleration changes continuously with time
- C. Velocity changes by equal amount in equal intervals of time ✓ **Correct answer**

ocity remains constant throughout the motion

A. wrong: unequal changes in equal times mean the acceleration is not uniform.

B. wrong: this is the definition of non-uniform acceleration.

C. correct: if equal time intervals always produce equal changes in velocity, the acceleration stays constant.

D. wrong: constant velocity means zero acceleration, which is a special case; the defining test for uniform acceleration is equal velocity changes in equal times.

Question 85 Average velocity

A particle moves from 40 m at 10 s to 20 m at 15 s. Its average velocity is:

- A. 4 m/s
- B. −4 m/s ✓ **Correct answer**
- C. 0.04 m/s
- D. −0.04 m/s

A. wrong: this drops the negative sign; the particle's position decreases, so the velocity is negative.

B. correct: $\Delta x = 20 - 40 = -20$ m over $\Delta t = 5$ s, so average velocity = $-20/5 = -4$ m/s.

C. wrong: this is not the displacement divided by the time.

D. wrong: this is a hundred times smaller than the correct value.

Question 86 Force and mass

A 4 kg block and an 8 kg block are pushed with the same force on a frictionless surface. Which statement is correct?

- A. Both blocks have the same acceleration
- B. The 4 kg block has double the acceleration of the 8 kg block ✓ **Correct answer**

8 kg block has double the acceleration of the 4 kg block

- D. Both blocks move with the same velocity

A. wrong: acceleration is inversely proportional to mass for the same force.

B. correct: a = F/m, so halving the mass doubles the acceleration ($a_4 = F/4$, $a_8 = F/8$, $a_4/a_8 = 2$).

C. wrong: the heavier block has the smaller acceleration.

D. wrong: with different accelerations from rest, their velocities differ.

Question 87 Projectile maximum height

The maximum height reached by a projectile is directly proportional to:

- A. $\sin^2\theta$ ✓ **Correct answer**
- B. $\cos^2\theta$
- C. $\cos\theta$
- D. $\sin\theta$

A. correct: only the initial vertical component ($u \sin \theta$) determines how high an ideal projectile rises, and $H = (u \sin \theta)^2/(2g)$, so $H \propto \sin^2\theta$.

B. wrong: the horizontal component does not determine the height.

C. wrong: the height depends on the vertical component, not the horizontal one.

D. wrong: the height depends on the square of the vertical component, not on $\sin \theta$ alone.

Question 88 Isolated system conservation

In an isolated system, total energy and momentum is ____ in all situations.

- A. Conserved ✓ **Correct answer**
- B. Lost
- C. Doubled

A. correct: an isolated system exchanges no net energy or momentum with its surroundings, so its total energy and total momentum are conserved (energy can change form internally).

B. wrong: energy and momentum are not lost in an isolated system.

C. wrong: the totals do not double.

D. wrong: the totals do not halve.

Question 89 Work against a wall

A person pushes against a stationary wall with a constant force for 2 minutes. The work done on the wall is:

- A. Positive
- B. Negative
- C. Zero ✓ **Correct answer**
- D. Equal to the applied force

A. wrong: positive work requires displacement in the direction of the force, and the wall does not move.

B. wrong: negative work requires displacement opposite to the force, and the wall does not move.

C. correct: mechanical work requires displacement ($W = Fs\cos\theta$); with $s = 0$ the work done on the stationary wall is zero.

D. wrong: work is force times displacement, not force alone.

Question 90 Power

A motor performs 2400 J of work in 2 minutes. The power generated is:

- B. 20 W ✓ **Correct answer**
- C. 1200 W
- D. 4800 W

A. wrong: this is half the correct value.

B. correct: power = work/time = 2400 J / 120 s = 20 W.

C. wrong: this comes from dividing by 2 as though it were seconds, instead of converting 2 minutes to 120 seconds.

D. wrong: this is work multiplied by time, not divided by it.

Question 91 P.E. = mgh applicability

The equation P.E. = mgh is not applicable when:

- A. The body's height is much less than Earth's radius
- B. The body's height is much greater than Earth's radius ✓ **Correct answer**
- C. The mass is zero
- D. Gravity is constant

A. wrong: this is exactly when mgh works, because g is nearly constant near Earth's surface.

B. correct: mgh treats g as approximately constant, which fails at heights comparable with or greater than Earth's radius, where g changes substantially with distance.

C. wrong: with zero mass the potential energy is simply zero; this is not a failure of the formula.

D. wrong: constant gravity is the condition under which mgh applies.

92 Broken string

If the string breaks while a ball is moving in a circle, the ball will:

- A. Continue moving in a circle
- B. Stop immediately
- C. Move in a straight line tangent to the circle ✓ **Correct answer**
- D. Fall directly towards the centre

A. wrong: circular motion needs the centripetal force from the string; once it breaks, there is nothing to keep the ball on its circular path.

B. wrong: the ball keeps its instantaneous velocity when the string breaks.

C. correct: at the instant the string breaks, the ball retains its instantaneous velocity, which points tangent to the circle (gravity bends its later path).

D. wrong: the ball's velocity is tangential, not toward the centre.

Question 93 One radian

One radian is the angle subtended at the centre by an arc whose length is equal to the ____ of the circle.

- A. Diameter
- B. Radius ✓ **Correct answer**
- C. Circumference
- D. Chord

A. wrong: an arc equal to the diameter subtends 2 radians, not 1.

B. correct: angle in radians equals arc length divided by radius, so a one-radian angle cuts off an arc whose length equals the radius.

C. wrong: an arc equal to the circumference subtends 2π radians.

D. wrong: a chord is a straight line, not an arc length.

94 SI unit of angular displacement

The SI unit of angular displacement is:

- A. Degree
- B. Revolution
- C. Radian ✓ **Correct answer**
- D. Rad/s

A. wrong: degrees measure angles but are not the SI unit.

B. wrong: a revolution is a measure of angle (2π radians) but not the SI unit.

C. correct: the radian is the SI unit for plane angle and hence for angular displacement.

D. wrong: rad/s is the unit of angular velocity, not angular displacement.

Question 95 Terminal velocity net force

A raindrop falls through the air and eventually reaches terminal velocity. At this instant, the net force acting on the raindrop is:

- A. Zero ✓ **Correct answer**
- B. Greater than its weight
- C. Equal to the air resistance
- D. Equal to the weight

A. correct: at terminal velocity, upward drag balances downward weight, so the net force is zero and the raindrop no longer accelerates.

B. wrong: no force acts on the raindrop greater than its weight at terminal velocity.

C. wrong: the net force is the difference between weight and air resistance, which is zero at terminal velocity.

D. wrong: the net force is not the weight; the weight is balanced by air resistance.

96 Skydiver air resistance

As the skydiver slows down after opening the parachute and approaches terminal velocity 2, the air resistance is:

- A. Zero
- B. Increased
- C. Reduced ✓ **Correct answer**
- D. Not changed

A. wrong: air resistance is large just after the parachute opens and remains substantial; it never becomes zero while falling.

B. wrong: as the downward speed falls, the drag falls too; it does not increase during the slowing phase.

C. correct: just after the parachute opens, a large upward drag slows the skydiver, and as the speed falls the drag reduces until it balances the weight at the new terminal speed.

D. wrong: the drag changes as the speed changes.

Question 97 Continuity equation

A hosepipe ejects water with a velocity of 2 m/s from an opening of 0.05 m^2. To double the velocity, the cross-sectional area should be:

- A. 0.025 m^2 ✓ **Correct answer**
- B. 0.0125 m^2
- C. 0.05 m^2
- D. 0.10 m^2

A. correct: for steady incompressible flow, $A_1v_1 = A_2v_2$, so doubling the speed requires half the area: $0.05 \times 2 \div 4 = 0.025$ m^2.

B. wrong: this would quadruple the velocity, not double it.

eping the same area keeps the same velocity.

D. wrong: doubling the area would halve the velocity.

Question 98 Arteriosclerosis pressure

If the radius of an artery is reduced due to arteriosclerosis, the heart must increase blood pressure to:

- A. Increase the blood flow rate
- B. Maintain the same blood flow rate ✓ **Correct answer**
- C. Reduce the blood flow rate
- D. Increase the radius of the artery

A. wrong: the aim is to keep the flow rate the same, not to increase it.

B. correct: a narrower vessel resists flow more strongly, so the heart must provide a greater pressure difference to sustain the same flow rate ($Q = \Delta P/R$).

C. wrong: the body needs to maintain the flow rate, not reduce it.

D. wrong: raising the pressure does not widen the artery.

Question 99 Wave crest distance

In a progressive wave, a wave crest moves a distance of ____ during one complete period (T).

- A. Half a wavelength
- B. One wavelength ✓ **Correct answer**
- C. Two wavelengths
- D. Multiple wavelengths

A. wrong: half a wavelength is the distance covered in half a period.

B. correct: a travelling wave advances one wavelength in the time taken for one complete

=λ/T, so distance in time T is vT = λ).

C. wrong: two wavelengths would take two periods.

D. wrong: the distance in one period is exactly one wavelength.

Question 100 Transverse and longitudinal vibration

In transverse waves, the particles of the medium vibrate ____ to the direction of wave propagation, whereas in longitudinal waves they vibrate ____.

- A. Perpendicular; parallel ✓ **Correct answer**
- B. Parallel; perpendicular
- C. Parallel; parallel
- D. Perpendicular; perpendicular

A. correct: in a transverse wave the particles oscillate perpendicular to the propagation direction; in a longitudinal wave they oscillate parallel to it.

B. wrong: this is the reverse of the real definitions.

C. wrong: transverse vibration is perpendicular, not parallel.

D. wrong: longitudinal vibration is parallel, not perpendicular.

Question 101 Wave distance

A wave travels through a string with a frequency of 25 Hz and a wavelength of 1.6 m. How far does the wave travel in 8 seconds?

- A. 160 m
- B. 240 m
- C. 320 m ✓ **Correct answer**
- D. 400 m

A. wrong: this is half the correct distance.

is does not match v × t for these numbers.

C. correct: v = fλ = 25 × 1.6 = 40 m/s, and distance = vt = 40 × 8 = 320 m.

D. wrong: this would require a speed of 50 m/s.

Question 102 Speed of sound vs temperature

The increase in speed of sound in gas for each 1°C rise in temperature is:

- A. 0.2 m/s
- B. 0.6 m/s ✓ **Correct answer**
- C. 1.2 m/s
- D. 2.0 m/s

A. wrong: this is too small; the standard figure is about 0.6 m/s per °C.

B. correct: near ordinary temperatures in air, sound speed increases by approximately 0.6 m/s for each 1 °C rise.

C. wrong: this is twice the standard figure.

D. wrong: this is far above the standard figure.

Question 103 Laplace sound waves

According to Laplace, sound waves travel through air so rapidly that:

- A. Heat is completely lost to the surroundings
- B. Heat is completely gained from the surroundings
- C. No heat is exchanged with the surroundings ✓ **Correct answer**
- D. Heat is exchanged slowly with the surroundings

A. wrong: Laplace's correction treats the compressions as adiabatic, with no heat lost.

B. wrong: no heat is gained either.

compressions and rarefactions during a sound wave occur so quickly that Laplace treated them as approximately adiabatic — no heat exchanged.

D. wrong: the process is too fast for heat exchange; the isothermal (slow exchange) assumption was Newton's, which Laplace corrected.

Question 104 First law calculation

A gas absorbs 1.5×10^3 J of heat and performs 5.0×10^2 J of work. Its change in internal energy (ΔU) is:

- A. 1.0×10^3 J ✓ **Correct answer**
- B. -1.0×10^3 J
- C. 2.0×10^3 J
- D. -2.0×10^3 J

A. correct: $\Delta U = Q - W = 1500 - 500 = 1000$ J $= 1.0 \times 10^3$ J.

B. wrong: this has the wrong sign; the gas gains more heat than the work it does.

C. wrong: this comes from adding heat and work instead of subtracting.

D. wrong: neither the value nor the sign is correct.

Question 105 Heat at constant pressure

One mole of an ideal gas is heated through 20 K at constant pressure, where R = 8.315 J mol^{-1} K^{-1}. If C_v = 21 J mol^{-1} K^{-1}, the heat supplied is:

- A. 166 J
- B. 420 J
- C. 586 J ✓ **Correct answer**
- D. 752 J

A. wrong: this is R × ΔT, not the heat supplied.

is is $nC_v\Delta T = 1 \times 21 \times 20 = 420$ J, the heat at constant volume, not constant pressure.

C. correct: $C_p = C_v + R = 21 + 8.315 = 29.315$ J mol^{-1} K^{-1}, so $Q = nC_p\Delta T = 1 \times 29.315 \times 20 \approx 586$ J.

D. wrong: this does not match the calculation.

Question 106 Adiabatic expansion temperature

In an adiabatic process, if a gas is allowed to expand suddenly, its temperature will:

- A. Decrease ✓ **Correct answer**
- B. Increase
- C. Remain constant
- D. Become absolute zero

A. correct: a rapidly expanding gas does work with little time to receive heat, so its internal energy falls and its temperature decreases.

B. wrong: expansion does work at the cost of internal energy, so the temperature falls, not rises.

C. wrong: the temperature stays constant only in an isothermal process, not an adiabatic expansion.

D. wrong: the temperature falls but does not reach absolute zero.

Question 107 Coulomb's law doubling distance

According to Coulomb's law, if the distance between two point charges is doubled while their magnitudes remain unchanged, the electrostatic force between them becomes:

- A. One-fourth of its original value ✓ **Correct answer**
- B. One-half of its original value
- C. Twice its original value

r times its original value

A. correct: Coulomb's law gives an inverse-square dependence ($F \propto 1/r^2$), so doubling r multiplies the denominator by four.

B. wrong: this would be the result for a 1/r dependence, not $1/r^2$.

C. wrong: increasing the distance decreases the force.

D. wrong: this is the inverse of the correct result.

Question 108 Battery energy

A 12 V battery transfers 5000 C of charge through a circuit. The energy delivered is:

- A. 4.17×10^2 J
- B. 4.17×10^3 J
- C. 6.0×10^4 J ✓ **Correct answer**
- D. 6.0×10^5 J

A. wrong: this is Q/V, not VQ.

B. wrong: this is ten times Q/V, not VQ.

C. correct: energy = VQ = 12 × 5000 = 60,000 J = 6.0×10^4 J.

D. wrong: this is ten times the correct value.

Question 109 Electric field of a plane sheet

An infinite plane sheet has a surface charge density $\sigma = 8.85 \times 10^{-6}$ C m^{-2}. The electric field on either side of the sheet is:

- A. 0.25×10^6 N C^{-1}
- B. 0.5×10^6 N C^{-1} ✓ **Correct answer**
- C. 1×10^6 N C^{-1}
- D. 2×10^6 N C^{-1}

is is half the correct value.

B. correct: for one isolated infinite plane sheet, $E = \sigma/(2\varepsilon_0) = 8.85 \times 10^{-6} / (2 \times 8.85 \times 10^{-12}) = 0.5 \times 10^{6}$ N C^{-1} on either side.

C. wrong: this is σ/ε_0, which misses the factor of two for a single sheet.

D. wrong: this is four times the correct value.

Question 110 Steady current in a conductor

Steady current in a metallic conductor is due to the ____ under an electric field.

- A. Directed flow of free electrons ✓ **Correct answer**
- B. Random electron motion
- C. Positive ion movement
- D. Continuously changing electron flow

A. correct: conduction electrons already move randomly from thermal motion; an applied electric field adds a small net drift, creating steady current.

B. wrong: random motion alone averages to zero current.

C. wrong: positive ions are fixed in the metal lattice; they do not move to carry current.

D. wrong: a steady current is a constant directed flow, not a continuously changing one.

Question 111 Magnetic flux density unit

Which expression correctly represents the SI unit of magnetic flux density?

- A. N A^{-1} m^{-1} ✓ **Correct answer**
- B. N A^{-1} m
- C. N C^{-1}
- D. Wb m^2

A. correct: from $F = BIL$, $B = F/(IL)$, so the tesla is N A^{-1} m^{-1}.

is has metres in the numerator instead of the denominator.

C. wrong: this is the unit of electric field strength, not magnetic flux density.

D. wrong: magnetic flux density is Wb/m² (weber per square metre), not Wb·m².

Question 112 Induced emf and turns

If the number of turns of a coil is doubled while the rate of change of magnetic flux remains constant, the induced e.m.f. will be:

- A. Halved
- B. Unchanged
- C. Doubled ✓ **Correct answer**
- D. One-fourth

A. wrong: doubling the turns increases the induced emf, it does not halve it.

B. wrong: the induced emf is proportional to the number of turns, so it changes when the turns change.

C. correct: by Faraday's law, ε = N × (ΔΦ/Δt); with the flux-change rate fixed, doubling N doubles the induced emf.

D. wrong: the emf increases with the number of turns, it does not fall to a quarter.

Question 113 AC maximum phase

In an alternating current wave, the phase of the maximum positive value is:

- A. 0°
- B. 90° ✓ **Correct answer**
- C. 180°
- D. 270°

A. wrong: at 0° the sine is zero, not maximum.

sinusoidal AC quantity written as $I = I_0 \sin \theta$ reaches its maximum positive value when $\sin \theta = 1$, which occurs at 90°.

C. wrong: at 180° the sine is zero.

D. wrong: at 270° the sine is −1, the maximum negative value.

Question 114 Reverse-biased diode

When a diode is reverse biased, it:

- A. Almost stops the current ✓ **Correct answer**
- B. Reduces the resistance of the junction
- C. Allows current to pass
- D. Increases the current

A. correct: reverse bias increases the depletion region's barrier to majority carriers, so an ordinary diode passes only a very small reverse leakage current before breakdown.

B. wrong: reverse bias increases the junction resistance.

C. wrong: a reverse-biased diode blocks current (apart from a tiny leakage).

D. wrong: reverse bias reduces the current to nearly zero.

Question 115 Planck's quantum state

According to Planck's theory, an atom in one quantum state:

- A. Emits energy continuously
- B. Absorbs energy continuously
- C. Neither emits nor absorbs energy ✓ **Correct answer**
- D. Emits one photon every second

A. wrong: a stationary quantum state has a definite allowed energy and does not radiate continuously.

atom in one quantum state does not continuously absorb energy.

C. correct: emission or absorption accompanies a transition between different energy levels; an atom remaining in one state does neither.

D. wrong: photon emission happens on transition, not at a fixed rate of one per second.

Question 116 Line emission spectrum

Which type of spectrum consists of bright lines of various frequencies?

- A. Line emission ✓ **Correct answer**
- B. Line absorption
- C. Continuous
- D. Band

A. correct: excited atoms emit photons of particular energies as electrons fall to lower levels, appearing as bright lines at specific frequencies.

B. wrong: a line absorption spectrum has dark lines against a continuous background.

C. wrong: a continuous spectrum shows all frequencies with no discrete lines.

D. wrong: a band spectrum consists of bands of closely spaced lines, not isolated bright lines.

Question 117 Half-life

The half-life of a radioactive element is:

- A. Constant ✓ **Correct answer**
- B. Variable
- C. Dependent on the quantity
- D. Dependent on temperature and pressure

A. correct: for a given radioactive isotope under ordinary conditions, each nucleus has a

ility of decay per unit time, so the half-life stays constant as the sample shrinks.

B. wrong: the half-life does not vary with time for a given isotope.

C. wrong: the half-life does not depend on how much of the sample is present.

D. wrong: ordinary temperature and pressure changes do not affect the half-life.

Question 118 Molar mass of $CaCO_3$

What is the mass of 1 mole of calcium carbonate ($CaCO_3$)? (Molar mass of calcium: 40 g/mol, carbon: 12 g/mol, oxygen: 16 g/mol)

- A. 25 g
- B. 50 g
- C. 75 g
- D. 100 g ✓ **Correct answer**

A. wrong: this is a quarter of the correct formula mass.

B. wrong: this is half the correct formula mass.

C. wrong: this omits one oxygen atom from the sum.

D. correct: $M(CaCO_3) = 40 + 12 + 3(16) = 100$ g/mol, so 1 mole has a mass of 100 g.

Question 119 Limiting reagent

A limiting reagent:

- A. Is present in maximum amount
- B. Produces minimum number of moles of product ✓ **Correct answer**
- C. Produces maximum number of moles of product
- D. Does not affect the amount of product

A. wrong: the limiting reagent is the one that runs out first; it is not present in maximum

B. correct: the limiting reagent runs out first and sets the maximum product that can actually be formed — the smaller of the product amounts predicted from each reactant.

C. wrong: the excess reagent could produce more, but the limiting reagent caps the product.

D. wrong: the limiting reagent directly determines how much product forms.

Question 120 Yield

Which of the following is a correct statement about yield?

- A. Theoretical yield is the amount of product actually produced experimentally during a chemical reaction
- B. The percent yield of a reaction tells us the total mass of reactants used
- C. Chemists use percentage yield to express the efficiency of a chemical reaction ✓ **Correct answer**
- D. Actual yield is the amount of product calculated from a balanced equation

A. wrong: the amount actually produced is the actual yield; theoretical yield is calculated from the balanced equation.

B. wrong: percent yield compares actual and theoretical product, not the mass of reactants.

C. correct: percent yield = (actual yield ÷ theoretical yield) × 100%, and it expresses how efficiently a reaction produces its product.

D. wrong: the amount calculated from the balanced equation is the theoretical yield.

Question 121 Orbital shape quantum number

The shape of an orbital depends on the ____ quantum number.

nuthal ✓ **Correct answer**

- B. Magnetic
- C. Principal
- D. Spin

A. correct: the azimuthal (angular momentum) quantum number l distinguishes s, p, d and f orbital shapes — s orbitals are spherical and p orbitals have two lobes.

B. wrong: the magnetic quantum number describes the orientation of an orbital, not its shape.

C. wrong: the principal quantum number chiefly describes the shell and energy.

D. wrong: the spin quantum number describes the electron's spin direction, not the orbital shape.

Question 122 Pauli's exclusion principle

According to Pauli's exclusion principle, no two electrons in an atom can have the same set of ____ quantum numbers.

- A. Two
- B. Three
- C. Four ✓ **Correct answer**
- D. Five

A. wrong: two electrons can share two quantum numbers (e.g. n and l).

B. wrong: two electrons can share three quantum numbers (e.g. n, l and m_l) if their spins differ.

C. correct: no two electrons in one atom can have an identical set of all four quantum numbers (n, l, m_l, m_s); even two electrons in the same orbital must have opposite spins.

D. wrong: there are only four quantum numbers.

123 Calcium configuration

What is the electronic configuration of calcium?

- A. [Ar] $4s^1$
- B. [Ar] $4s^2$ ✓ **Correct answer**
- C. [Ne] $3s^2$
- D. [He] $2s^2$

A. wrong: this would be 19 electrons (potassium's configuration), not calcium's 20.

B. correct: calcium has 20 electrons; argon accounts for 18, leaving two electrons in the 4s orbital.

C. wrong: this would be 12 electrons (magnesium's configuration).

D. wrong: this would be 4 electrons (beryllium's configuration).

Question 124 Average kinetic energy of gas molecules

The average kinetic energy of gas molecules is directly proportional to ____ of the gas.

- A. Density
- B. Pressure
- C. Absolute temperature ✓ **Correct answer**
- D. Volume

A. wrong: the mean kinetic energy does not depend on density.

B. wrong: pressure may change with temperature, but it is not the direct proportional variable.

C. correct: for an ideal gas, mean translational kinetic energy = (3/2)kT, so it depends only on the absolute temperature.

D. wrong: the mean kinetic energy does not depend on volume.

125 Boyle's law

If the pressure of a gas is doubled at constant temperature, its volume will:

- A. Double
- B. Halve ✓ **Correct answer**
- C. Remain unchanged
- D. Triple

A. wrong: pressure and volume are inversely related at constant temperature.

B. correct: by Boyle's law, $P_1V_1 = P_2V_2$, so doubling the pressure halves the volume.

C. wrong: the volume must change to keep PV constant.

D. wrong: no part of Boyle's law gives a factor of three.

Question 126 Charles's law

If the absolute temperature of a gas doubles at constant pressure, its volume will:

- A. Remain unchanged
- B. Double ✓ **Correct answer**
- C. Halve
- D. Triple

A. wrong: volume is proportional to kelvin temperature at constant pressure.

B. correct: by Charles's law, $V_1/T_1 = V_2/T_2$, so doubling the absolute temperature doubles the volume.

C. wrong: this is the inverse of the correct result.

D. wrong: no part of Charles's law gives a factor of three.

127 Absolute zero

Absolute zero is equal to ____ °C.

- A. −100
- B. −173
- C. −273 ✓ **Correct answer**
- D. −373

A. wrong: −100 °C is 173 K, not absolute zero.

B. wrong: −173 °C is 100 K, not absolute zero.

C. correct: absolute zero is 0 K, and t(°C) = T(K) − 273.15, so 0 K ≈ −273 °C.

D. wrong: this is 100 K below absolute zero, which is impossible.

Question 128 Kinetic energy of liquid vs solid

The kinetic energy of liquid molecules is ____ compared to that of solids.

- A. Constant
- B. Equal
- C. Greater ✓ **Correct answer**
- D. Lower

A. wrong: the question asks for a comparison, not a constant value.

B. wrong: liquid particles have more freedom of motion than solid particles.

C. correct: in the standard FSc comparison, liquid molecules have greater average kinetic energy than solid molecules (their particles move more freely).

D. wrong: this is the reverse of the intended ordering. (Note: strictly, at the same absolute temperature mean kinetic energy cannot be inferred from phase alone; the key page's solved section makes the same point, and the official key is C.)

129 Boiling point heat

At the boiling point, added heat is used to break ____ forces.

- A. Intermolecular ✓ **Correct answer**
- B. Ionic
- C. Magnetic
- D. Nuclear

A. correct: while a substance boils, added energy separates molecules into the vapour phase by overcoming intermolecular attractions; the temperature stays constant and covalent bonds inside molecules are not broken.

B. wrong: boiling does not break ionic bonds.

C. wrong: magnetic forces are not what boiling heat overcomes.

D. wrong: nuclear forces are not involved in boiling.

Question 130 Hydrogen bonding

Hydrogen bonding occurs between hydrogen and a highly ____ atom.

- A. Electronegative ✓ **Correct answer**
- B. Electropositive
- C. Nonpolar
- D. Radioactive

A. correct: a hydrogen bonded to nitrogen, oxygen or fluorine can interact strongly with a lone pair on another highly electronegative atom.

B. wrong: electropositive atoms do not provide the strong bond polarity a hydrogen bond needs.

C. wrong: nonpolar atoms do not form hydrogen bonds.

D. wrong: radioactivity has nothing to do with hydrogen bonding.

131 NaCl lattice

In a sodium chloride lattice, each ion is surrounded by ions of ____ charge.

- A. Equal
- B. Negative
- C. Opposite ✓ **Correct answer**
- D. Positive

A. wrong: a sodium ion is not surrounded by sodium ions.

B. wrong: this is true only for the positive sodium ions; the chloride ions are surrounded by positive ions.

C. correct: the NaCl lattice alternates positive sodium and negative chloride ions, so each ion is nearest to ions of opposite charge.

D. wrong: this is true only for the negative chloride ions; the sodium ions are surrounded by negative ions.

Question 132 Ionic solid conduction

Ionic solids conduct electricity in ____ state.

- A. Frozen
- B. Molten ✓ **Correct answer**
- C. Solid
- D. Vapour

A. wrong: a frozen (solid) ionic substance has its ions fixed in the lattice and cannot conduct.

B. correct: in the solid lattice ions are held in fixed positions, but melting frees them to move and carry charge.

C. wrong: solid ionic compounds do not conduct electricity.

nic solids do not vaporise into a conducting state.

Question 133 Unit cell parameters

A unit cell of crystal lattice is characterized by ____ parameters.

- A. 4
- B. 5
- C. 6 ✓ **Correct answer**
- D. 7

A. wrong: a unit cell needs more than four parameters to be fully specified.

B. wrong: five parameters are not enough.

C. correct: a unit cell is specified by three edge lengths and three angles between the edges — six values in total.

D. wrong: there are six parameters, not seven (the seven crystal systems are a different count).

Question 134 Lattice energy

When gaseous ions of opposite charge combine to form an ionic crystal, lattice energy is ____.

- A. Absorbed
- B. Released ✓ **Correct answer**
- C. Stored
- D. Vaporized

A. wrong: forming the crystal from gaseous ions releases energy; absorbing energy would be the reverse process.

B. correct: bringing oppositely charged gaseous ions together lowers electrostatic potential energy as a crystal forms, so energy is released to the surroundings.

e energy is released, not stored in the crystal.

D. wrong: vaporisation is not what happens to lattice energy when a crystal forms.

Question 135 Temperature and equilibrium

An increase in temperature shifts the equilibrium in favor of the ____ reaction.

- A. Endothermic ✓ **Correct answer**
- B. Exothermic
- C. Irreversible
- D. Static

A. correct: increasing temperature adds heat to the system, and the equilibrium shifts toward the direction that absorbs the added heat — the endothermic direction (Le Chatelier's principle).

B. wrong: the exothermic direction is favoured by decreasing temperature, not by increasing it.

C. wrong: temperature does not make an equilibrium irreversible.

D. wrong: equilibrium is dynamic, not static, and temperature shifts it rather than freezing it.

Question 136 Common ion effect

Addition of sodium acetate to aqueous solution of acetic acid suppresses its:

- A. Condensation
- B. Ionization ✓ **Correct answer**
- C. Evaporation
- D. Reduction

A. wrong: condensation is a phase change, not what sodium acetate suppresses in acetic acid.

odium acetate supplies acetate ions, already produced when acetic acid dissociates; by the common ion effect the equilibrium $CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$ shifts left, so the fraction of acetic acid ionising decreases.

C. wrong: evaporation is a phase change, not what is suppressed here.

D. wrong: no reduction (gain of electrons) is involved.

Question 137 Haber process temperature

The Haber process is exothermic; therefore, decreasing the temperature favors:

- A. Decomposition of ammonia
- B. Formation of ammonia ✓ **Correct answer**
- C. Formation of nitrogen gas
- D. No change in equilibrium

A. wrong: decreasing the temperature favours the exothermic (forward) direction, not the reverse.

B. correct: the forward synthesis of ammonia releases heat, so lowering the temperature favours the heat-producing exothermic direction at equilibrium.

C. wrong: forming nitrogen gas is part of the reverse reaction, which is disfavoured by lower temperature.

D. wrong: temperature changes do shift the equilibrium position.

Question 138 Activation energy

Activation energy is the minimum energy to:

- A. Increase the reaction yield
- B. Break all chemical bonds in the reactants
- C. Initiate a chemical reaction ✓ **Correct answer**
- D. Separate a mixture

tivation energy does not determine the yield; it is the energy barrier to start the reaction.

B. wrong: activation energy is the minimum energy to reach the transition state, not enough to break every bond in every reactant molecule.

C. correct: reacting particles must reach a transition state before products can form, and activation energy is the minimum energy barrier for that route.

D. wrong: separating a mixture is a physical process, not what activation energy measures.

Question 139 Lower activation energy

A reaction with a lower activation energy proceeds at a ____ rate.

- A. Faster ✓ **Correct answer**
- B. Later
- C. Slower
- D. Unchanged

A. correct: a smaller activation energy barrier lets a larger fraction of collisions succeed at the same temperature, so the reaction proceeds more rapidly (this is how catalysts work).

B. wrong: "later" is not a rate description.

C. wrong: a lower barrier means more successful collisions, hence a faster rate.

D. wrong: changing the activation energy changes the rate.

Question 140 Sign of heat absorbed

When heat is absorbed by the system from the surroundings, the sign of heat (q) is:

- A. Negative
- B. Positive ✓ **Correct answer**

able.

- D. Zero

A. wrong: under the chemistry sign convention, heat leaving the system is negative; heat entering is positive.

B. correct: under the usual chemistry sign convention, heat entering the system is q > 0.

C. wrong: the sign is fixed by the convention, not variable.

D. wrong: heat is being absorbed, so q is not zero.

Question 141 Hess's law

According to Hess's law, the overall enthalpy change depends only on the:

- A. Activation energy
- B. Reaction pathway
- C. Initial and final states ✓ **Correct answer**
- D. Reaction mechanism

A. wrong: activation energy affects the rate, not the overall enthalpy change.

B. wrong: Hess's law states the enthalpy change is independent of the pathway.

C. correct: enthalpy is a state function, so its overall change depends only on the start and end states, and a reaction may be divided into different intermediate steps without changing the sum.

D. wrong: the mechanism is the pathway, which does not affect the overall enthalpy change.

Question 142 Reduction

Which change in oxidation number represents reduction?

- A. +1 → +3

→ 0 ✓ Correct answer

- C. 0 → +2
- D. −1 → +1

A. wrong: the oxidation number increases, which is oxidation.

B. correct: reduction is a decrease in oxidation number (gain of electrons); moving from +2 to 0 is a two-unit decrease.

C. wrong: the oxidation number increases, which is oxidation.

D. wrong: the oxidation number increases, which is oxidation.

Question 143 VSEPR theory

According to VSEPR theory, what determines the shape of a molecule?

- A. Electron charge
- B. Electron mass
- C. Electron pairs ✓ **Correct answer**
- D. Electron volume

A. wrong: VSEPR is about the repulsion between electron pairs, not about charge alone.

B. wrong: electron mass does not determine molecular shape.

C. correct: valence-shell electron pairs repel each other and arrange as far apart as practicable around the central atom; bonding and lone pairs together influence the shape.

D. wrong: electron volume is not the organising rule of VSEPR.

Question 144 Excited carbon

In the excited state, carbon has ___ half-filled orbitals.

- A. 1
- B. 2

- D. 4 ✓ **Correct answer**

A. wrong: promoting one 2s electron gives four singly occupied orbitals, not one.

B. wrong: this is the number of half-filled orbitals in ground-state carbon ($2p^2$), not in the excited state.

C. wrong: the excited state has four singly occupied orbitals ($2s^1\ 2p^3$).

D. correct: promoting one carbon 2s electron to an empty 2p orbital gives four singly occupied valence orbitals ($2s^1\ 2p^3$), explaining carbon's four bonding possibilities.

Question 145 Dipole moment

The dipole moment is used to estimate the ____ character of a bond.

- A. Acidic
- B. Basic
- C. Ionic ✓ **Correct answer**
- D. Organic

A. wrong: a dipole moment does not measure whether a bond is acidic.

B. wrong: a dipole moment does not measure whether a bond is basic.

C. correct: a bond dipole arises from unequal sharing of electrons, and comparing the measured dipole with the ideal fully-separated-charge estimate gives the bond's percentage ionic character.

D. wrong: a dipole moment does not measure whether a bond is organic.

Question 146 Group IV-A tetrachloride

Which Group IV-A tetrachloride does not react with water at room temperature?

- A. CCl_4 ✓ **Correct answer**

- C. $PbCl_4$
- D. $SiCl_4$

A. correct: carbon tetrachloride does not hydrolyse readily at room temperature because carbon lacks suitable low-lying vacant orbitals for the usual hydrolysis route available to heavier group 14 tetrachlorides.

B. wrong: germanium tetrachloride hydrolyses with water.

C. wrong: lead tetrachloride reacts with water.

D. wrong: silicon tetrachloride reacts readily with water.

Question 147 Copper configuration

Copper shows an exceptional electronic configuration because it has a more stable ____ subshell.

- A. Half-filled
- B. Filled ✓ **Correct answer**
- C. Paired
- D. Vacant

A. wrong: the half-filled subshell is associated with other exceptions (e.g. chromium's $3d^5$); copper's exception is the filled 3d subshell.

B. correct: copper adopts [Ar] $3d^{10}$ $4s^1$ rather than [Ar] $3d^9$ $4s^2$ because the completely filled 3d subshell is relatively stable.

C. wrong: "paired" is not the word for copper's exception.

D. wrong: a vacant subshell is not what stabilises copper's configuration.

148 Methane chlorination

When chlorine is present in excess during chlorination of methane, the major product is:

- A. Carbon tetrachloride ✓ **Correct answer**
- B. Chloroform
- C. Methyl chloride
- D. Methylene chloride

A. correct: radical substitution replaces each of methane's four hydrogen atoms step by step ($CH_4 \rightarrow CH_3Cl \rightarrow CH_2Cl_2 \rightarrow CHCl_3 \rightarrow CCl_4$), and with excess chlorine substitution proceeds to the fully chlorinated product.

B. wrong: chloroform is an intermediate product; with excess chlorine the reaction goes further.

C. wrong: methyl chloride is the first substitution product, favoured when methane is in excess, not chlorine.

D. wrong: methylene chloride (dichloromethane) is an intermediate product, not the major product with excess chlorine.

Question 149 IUPAC alkene parent chain

Which carbon chain is selected first when assigning the IUPAC name of an alkene?

- A. Cyclic carbon chain
- B. Most highly branched carbon chain
- C. Longest with maximum number of double bonds ✓ **Correct answer**
- D. Longest with maximum number of triple bonds

A. wrong: a cyclic chain is not automatically selected first for an alkene.

B. wrong: branching is not the first selection criterion.

C. correct: the selected parent must contain the multiple bond and, when applicable, the

possible number of double bonds, with length considered within those rules.

D. wrong: triple bonds are not the priority when naming an alkene.

Question 150 Alkene from alcohol

Which method prepares an alkene by removing water from an alcohol?

- A. Dehydration ✓ **Correct answer**
- B. Dehydrohalogenation
- C. Halogenation
- D. Hydrogenation

A. correct: removing H and OH from neighbouring positions of an alcohol eliminates a molecule of water and forms a carbon–carbon double bond — dehydration.

B. wrong: dehydrohalogenation removes a hydrogen halide from a haloalkane, not water from an alcohol.

C. wrong: halogenation adds halogen atoms, it does not remove water.

D. wrong: hydrogenation adds hydrogen across a double bond, the reverse of forming an alkene.

Question 151 Benzene structure

Which statement best describes the structure of benzene? It is a:

- A. Planar molecule with six sp^2-hybridized carbon atoms ✓ **Correct answer**
- B. Tetrahedral molecule with six sp^3-hybridized carbon atoms
- C. Linear molecule with sp-hybridized carbon atoms
- D. Non-planar molecule with alternating single and double bonds

A. correct: each carbon in benzene is sp^2 hybridised, leaving a p orbital for the delocalised π system, and the six carbons form a planar ring.

nzene carbons are sp^2, not sp^3, and the molecule is planar, not tetrahedral.

C. wrong: benzene is a ring, not linear, and its carbons are sp^2.

D. wrong: benzene is planar; planarity is essential to its aromatic character.

Question 152 Benzene reaction

Compared with alkenes, benzene undergoes ____ reaction to retain its aromatic character.

- A. Addition
- B. Elimination
- C. Polymerization
- D. Substitution ✓ **Correct answer**

A. wrong: addition across benzene's ring would disrupt its aromatic π system.

B. wrong: elimination is not benzene's characteristic reaction.

C. wrong: polymerisation is not how benzene retains aromaticity.

D. correct: substitution replaces a ring hydrogen while allowing aromaticity to be restored, which is why electrophilic substitution is typical of benzene.

Question 153 Ethyne hydration

Hydration of ethyne in the presence of H_2SO_4 and $HgSO_4$ (100°C) ultimately gives:

- A. Acetaldehyde ✓ **Correct answer**
- B. Acetic acid
- C. Ethanol
- D. Ethene

A. correct: catalysed hydration of ethyne first gives the enol vinyl alcohol, which tautomerises to the more stable carbonyl compound acetaldehyde ($HC{\equiv}CH + H_2O \rightarrow$

→ CH_3CHO).

B. wrong: acetic acid is not the product of ethyne hydration.

C. wrong: ethanol is not formed by ethyne hydration.

D. wrong: ethene is the product of ethyne hydrogenation, not hydration.

Question 154 IUPAC halogen order

According to IUPAC, when two different halogens are present in a haloalkane at the same position, which rule decides which substituent is written first?

- A. Alphabetical order ✓ **Correct answer**
- B. Branching
- C. Chain length
- D. Molecular mass

A. correct: different substituent names are listed alphabetically when constructing an IUPAC name (e.g. bromo precedes chloro), once the parent and locants have been chosen.

B. wrong: the amount of branching does not decide the order of substituents in the name.

C. wrong: chain length does not decide the order of substituents in the name.

D. wrong: atomic or molecular mass does not decide the order of substituents in the name.

Question 155 Carbon–halogen bond energy

Which alkyl halide has the highest carbon–halogen bond energy?

- A. C–Br
- B. C–Cl
- C. C–F ✓ **Correct answer**
- D. C–I

e C–Br bond is weaker than the C–F bond.

B. wrong: the C–Cl bond is weaker than the C–F bond.

C. correct: fluorine is small, so the carbon–fluorine bond is short and strong, with the greatest bond dissociation energy among the listed carbon–halogen bonds.

D. wrong: the C–I bond is the longest and generally weakest of the listed series.

Question 156 Lucas reagent

An alcohol that produces cloudiness immediately with Lucas reagent is:

- A. Primary
- B. Secondary
- C. Tertiary ✓ **Correct answer**
- D. Trihydric

A. wrong: primary alcohols generally do not cloud immediately at room temperature with Lucas reagent.

B. wrong: secondary alcohols react more slowly and cloud only after some minutes.

C. correct: Lucas reagent replaces the OH group with chloride, producing an insoluble alkyl chloride and visible cloudiness; tertiary alcohols react rapidly because a relatively stable tertiary carbocation can form.

D. wrong: "trihydric" describes an alcohol with three OH groups (e.g. glycerol), not the class that clouds immediately with Lucas reagent.

Question 157 Ester reduction

Reduction of an ester with lithium aluminium hydride mainly produces:

- A. Alkene
- B. Alcohol ✓ **Correct answer**

- D. Ketone

A. wrong: $LiAlH_4$ reduction of an ester does not give an alkene.

B. correct: lithium aluminium hydride is a strong reducing agent that converts an ester to alcohol products — the acyl portion becomes a primary alcohol and the alkoxy portion is released as an alcohol after workup ($RCOOR' \rightarrow RCH_2OH + R'OH$).

C. wrong: stopping at an aldehyde would require a milder reagent or different conditions; the strong reduction continues to the alcohol.

D. wrong: $LiAlH_4$ reduction of an ester does not give a ketone.

Question 158 Aldehyde vs ketone reactivity

Which carbonyl compound is generally more reactive toward nucleophilic addition?

- A. Aldehyde ✓ **Correct answer**
- B. Alcohol
- C. Ether
- D. Ketone

A. correct: an aldehyde carbonyl carbon is generally less sterically hindered than a ketone carbonyl carbon and receives less electron donation from alkyl groups, so nucleophilic attack is easier on a typical aldehyde.

B. wrong: an alcohol is not a carbonyl compound and does not undergo nucleophilic addition at a carbonyl carbon.

C. wrong: an ether has no carbonyl group.

D. wrong: ketones are less reactive than aldehydes toward nucleophilic addition because of greater steric hindrance and more electron donation from two alkyl groups.

159 Tollens' reagent

Which reagent distinguishes aldehydes from ketones by producing a silver mirror?

- A. Benedict's
- B. Clemmensen
- C. Fehling's
- D. Tollens' ✓ **Correct answer**

A. wrong: Benedict's reagent gives a brick-red precipitate with reducing sugars/aldehydes, not a silver mirror.

B. wrong: Clemmensen reduction converts a carbonyl group to a methylene group; it is not a silver-mirror test.

C. wrong: Fehling's reagent gives a red precipitate of copper(I) oxide, not a silver mirror.

D. correct: Tollens' reagent contains a silver complex that aldehydes reduce to metallic silver, producing the characteristic silver mirror; ketones generally do not give this test.

Question 160 Protein–prosthetic group matching

Which of the following protein–prosthetic group combinations is correctly matched?

- A. Chromoproteins — Carbohydrates
- B. Glycoproteins — Lipids
- C. Lipoproteins — Lipids ✓ **Correct answer**
- D. Nucleoproteins — Carbohydrates

A. wrong: chromoproteins contain coloured (pigment) groups, not carbohydrates.

B. wrong: glycoproteins have carbohydrate groups attached, not lipids.

C. correct: lipoproteins contain a protein component associated with lipids.

D. wrong: nucleoproteins contain nucleic acids, not carbohydrates.

161 Hot-melt adhesive

A manufacturer needs an adhesive that solidifies on cooling and is widely used in bookbinding and packaging. Which type of adhesive is most suitable?

- A. Contact
- B. Hot-melt ✓ **Correct answer**
- C. Pressure-sensitive
- D. Solvent-based

A. wrong: contact adhesive bonds on contact after both surfaces are coated and dried; it is not the type that solidifies on cooling.

B. correct: hot-melt adhesive is applied while heated and fluid, then solidifies as it cools, bonding surfaces in packaging and bookbinding.

C. wrong: a pressure-sensitive adhesive stays tacky under pressure; it does not solidify on cooling.

D. wrong: a solvent-based adhesive sets as its solvent evaporates, not by solidifying on cooling.

Question 162 Condensation polymerization

Which polymer is produced through condensation polymerization?

- A. Nylon-6,6 ✓ **Correct answer**
- B. Polyethene
- C. Polyvinyl chloride
- D. Polystyrene

A. correct: nylon-6,6 forms from a diamine and a dicarboxylic acid, creating amide links while eliminating small molecules — condensation polymerization.

B. wrong: polyethene is formed by addition polymerization of ethene.

C is formed by addition polymerization of vinyl chloride.

D. wrong: polystyrene is formed by addition polymerization of styrene.

Question 163 Transitional device "however"

I like cake, however my friend likes chocolate. The transitional device is used for:

- A. Exception
- B. Sequence
- C. Addition
- D. Contrast ✓ **Correct answer**

A. wrong: "however" does not state a special exception to a rule.

B. wrong: "however" does not give a sequence of events.

C. wrong: "however" does not add a matching example.

D. correct: "I like cake" and "my friend likes chocolate" present different preferences, and "however" signals that the second clause contrasts with the first.

Question 164 Electric cars passage

Electric cars are becoming increasingly popular due to concerns about air pollution and fossil fuels. They produce zero emissions and are powered by rechargeable batteries. According to the passage, why are electric cars becoming popular?

- A. They are faster than other cars
- B. They are cheaper to manufacture
- C. They reduce air pollution ✓ **Correct answer**
- D. They use petrol efficiently

A. wrong: the passage does not claim electric cars are faster.

B. wrong: the passage does not claim they are cheaper to manufacture.

e passage connects their popularity with pollution concerns and says electric cars produce no emissions during operation.

D. wrong: the passage says they are powered by rechargeable batteries, not petrol.

Question 165 Gerund as subject

Which of the following sentences uses the gerund as a subject?

- A. I love singing in the shower
- B. Singing is my favorite hobby ✓ **Correct answer**
- C. She is singing a beautiful song
- D. The singing bird is a nightingale

A. wrong: here "singing" is the object of "love", not the subject.

B. correct: "singing" is an -ing form used as a noun and occupies the subject position before "is".

C. wrong: here "singing" is part of the verb phrase "is singing".

D. wrong: here "singing" is an adjective describing the bird.

Question 166 Preposition "under"

My cat is hiding ____ the bed. Use the correct preposition.

- A. From
- B. Inside
- C. Under ✓ **Correct answer**
- D. To

A. wrong: "hiding from the bed" does not make sense.

B. wrong: "inside the bed" would require enclosure within the bed.

C. correct: "under the bed" expresses a position lower than and covered by the bed.

"to" expresses direction toward something, not a hiding position.

Question 167 Preposition "at"

Turn left ____ the traffic signal and the cafe will be on your right.

- A. Into
- B. On
- C. At ✓ **Correct answer**
- D. Between

A. wrong: "into" suggests entering something, not turning at a point.

B. wrong: "on the traffic signal" is not the idiomatic phrase for a turning point.

C. correct: "turn left at the traffic signal" treats the signal as the point where the turn happens.

D. wrong: "between" needs two reference points.

Question 168 Correct tense

Which one of the following options contains the appropriate use of tense?

- A. The light went out while I am reading
- B. The light has gone out while I was reading
- C. The light went out while I was reading ✓ **Correct answer**
- D. The light goes out while I am reading

A. wrong: this mixes simple past ("went out") with present continuous ("am reading").

B. wrong: the present perfect does not fit the past narrative set by "was reading".

C. correct: the ongoing background action takes past continuous ("was reading") and the shorter interrupting event takes simple past ("went out").

D. wrong: the simple present does not fit the past narrative.

169 Subject–verb agreement

Which one of the following sentences employs correct subject–verb agreement?

- A. The number of students in Class 9 is twenty ✓ **Correct answer**
- B. The number of students in Class 9 are twenty
- C. The numbers of students in Class is twenty
- D. The numbers of student in Class 9 are twenty

A. correct: the head of the subject is the singular "number" in "the number of students", so the verb takes the singular "is".

B. wrong: "are" does not agree with the singular subject "the number".

C. wrong: "the numbers" is plural, so "is" is wrong, and "in Class" (without the class number) is incomplete.

D. wrong: "the numbers of student" is ungrammatical ("student" should be "students").

Question 170 "Stay out late"

My parents do not allow me to stay out ____.

- A. Latter
- B. Lately
- C. Late ✓ **Correct answer**
- D. Later

A. wrong: "latter" refers to the second of two things mentioned, not to a time.

B. wrong: "lately" means "recently", which does not fit "stay out".

C. correct: "stay out late" means remain away until a late hour; "late" works directly as the adverb in this expression.

D. wrong: "later" compares a time with an earlier one ("stay out later than usual"), not the simple "stay out late".

171 False cause and effect

Which of the following is the false cause-and-effect claim?

- A. Smoking causes lung cancer
- B. Rain causes wet roads
- C. Wearing red clothes causes intelligence ✓ **Correct answer**
- D. Exercise improves health

A. wrong: this is a well-established genuine cause-and-effect claim.

B. wrong: rain genuinely causes roads to become wet.

C. correct: clothing colour has no credible causal connection to intelligence; the assertion confuses an arbitrary feature with a cause.

D. wrong: exercise genuinely improves health.

Question 172 Seating permutations

In how many different ways can four persons be seated on four chairs for a photograph?

- A. 8
- B. 12
- C. 16
- D. 24 ✓ **Correct answer**

A. wrong: this is 4×2, not the number of permutations.

B. wrong: this is 4×3, which counts only the first two chairs.

C. wrong: this is 4^2, not the number of permutations.

D. correct: there are four choices for the first chair, three for the second, two for the third and one for the last: $4 \times 3 \times 2 \times 1 = 4! = 24$.

173 Triangular number series

What is the missing term of the sequence? 1, 3, 6, 10, 15, 21, 28, ____

- A. 30
- B. 32
- C. 34
- D. 36 ✓ **Correct answer**

A. wrong: the differences grow by one each time, so the next difference is 8, giving 36, not 30.

B. wrong: 32 would need a difference of 4, which breaks the pattern.

C. wrong: 34 would need a difference of 6, which breaks the pattern.

D. correct: the successive differences are 2, 3, 4, 5, 6, 7, so the next increase is 8, and 28 + 8 = 36.

Question 174 Meeting schedule

Meetings are at 9 am, 11 am and 2 pm. Finance meets before HR. IT meets last. HR does not meet at 9 am. Which team meets at 11 am?

- A. HR ✓ **Correct answer**
- B. IT
- C. Finance
- D. Cannot be determined

A. correct: IT meets last, so IT takes 2 pm; Finance must meet before HR, while HR cannot take the 9 am slot, so the only consistent arrangement is Finance at 9 am and HR at 11 am.

B. wrong: IT meets last (2 pm), not at 11 am.

C. wrong: Finance must meet before HR, so Finance takes the 9 am slot.

e constraints determine the arrangement uniquely.

Question 175 Blood relation

Aimen is Amna's daughter and Salman is Amna's father. Sarah is Salman's daughter. What is Aimen to Salman?

- A. Grandmother
- B. Granddaughter ✓ **Correct answer**
- C. Daughter
- D. Mother

A. wrong: Aimen is two generations below Salman, not above him.

B. correct: Salman is Amna's father and Amna is Aimen's mother, so Salman is two generations above Aimen — Aimen is his granddaughter (Sarah's relation is extra information).

C. wrong: Aimen is Amna's daughter, not Salman's.

D. wrong: Aimen is two generations below Salman, not his mother.

Question 176 Weekly surgeries

A hospital performs 25 surgeries daily for 6 days a week. How many surgeries are performed weekly?

- A. 120
- B. 145
- C. 150 ✓ **Correct answer**
- D. 175

A. wrong: this would be 20 surgeries a day, not 25.

B. wrong: this does not match 25 × 6.

5 surgeries a day × 6 days = 150 surgeries a week.

D. wrong: this would be 25 surgeries a day for 7 days, but the hospital works 6 days a week.

Question 177 Traffic police response

You park your car in a no-parking zone and are approached by a traffic police officer. What is the most appropriate response?

- A. Argue with the officer to resolve the issue
- B. Leave immediately without permission
- C. Cooperate with the officer and comply with traffic regulations ✓ **Correct answer**
- D. Try to run away from the location

A. wrong: arguing avoids the officer's instructions instead of resolving the violation.

B. wrong: leaving without permission does not resolve the violation.

C. correct: the violation has already occurred, so the appropriate response is to cooperate with the officer and follow traffic rules.

D. wrong: fleeing avoids the officer's instructions instead of resolving the violation.

Question 178 Monitoring a decision

Why is it important to monitor the implementation of a decision?

- A. To hinder progress
- B. To improve and adapt ✓ **Correct answer**
- C. To assign blame for mistakes
- D. To shut down feedback

A. wrong: monitoring is meant to help progress, not hinder it.

B. correct: monitoring implementation lets problems be spotted and the approach

d adapted as it goes.

C. wrong: monitoring is for improvement, not for assigning blame.

D. wrong: monitoring relies on feedback; it does not shut it down.

Question 179 Argument weakness

Human rights protection leads to economic growth. Pakistan improved its labour laws to protect workers' rights, but economic growth is still low. The argument concludes that human rights protection does not support economic growth. What is its weakness?

- A. Human rights are only one of many factors influencing economic growth ✓ **Correct answer**
- B. Labour laws alone guarantee economic growth
- C. Economic growth depends only on labour rights
- D. Human rights have no impact on national development

A. correct: the argument observes improved labour rights but low growth and assumes rights therefore have no helpful effect; economic growth depends on many other conditions as well, and one factor can support growth without being sufficient to guarantee it.

B. wrong: this states the opposite of the weakness; no one claims labour laws alone guarantee growth.

C. wrong: growth does not depend only on labour rights; that is the false assumption the argument makes.

D. wrong: this repeats the argument's conclusion rather than identifying its weakness.

Question 180 Fruit prices

In a shop having three fruits, oranges are cheaper than grapefruit and pricier than grapes. Then:

pefruit is more expensive than grapes ✓ **Correct answer**

- B. Grapes are more expensive than grapefruit
- C. Oranges are cheaper than grapes
- D. Grapefruit and grapes cost the same

A. correct: oranges are cheaper than grapefruit and pricier than grapes, giving the order grapefruit > oranges > grapes, so grapefruit costs more than grapes.

B. wrong: this is the reverse of the order.

C. wrong: oranges are pricier than grapes.

D. wrong: the order shows grapefruit at the top and grapes at the bottom; they do not cost the same.

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