NUMS MDCAT — 2024 · Solved Past Paper

Body: National University of Medical Sciences (NUMS), national (separate test) · **Post:** MDCAT (Medical & Dental College Admission Test) · **Year:** 2024 · **Questions:** 150 in the original paper — **137 solved and verified**, 11 excluded as defective, 2 excluded as unrecoverable (diagram/graph) · **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.

Source note: Fold-in 8 Nov 2026: TRUE TOTAL 150 from the second reproduction (mdcatguide.com 'NUMS 2024 — Original Complete Question Paper' PDF, fetched via noteslelo.pk 8 Nov 2026 — 150 MCQs, Biology 55, Chemistry 40, Physics 40, English 15, 150 minutes, no negative marking). The mdcatpapers.com transcription holds 137; the 13 omitted questions are recovered here as Q138–Q150 in PDF order (7 VERIFIED, 4 DEFECTIVE-excluded, 2 unrecoverable-excluded: PDF Q9 chloroplast diagram and PDF Q120 non-ohmic graph, which cannot be reproduced as text). The 14 former SINGLE-SOURCE items were promoted to VERIFIED (9 on the sprint addendum 5 Nov 2026, 5 on the nearest-papers addendum 8 Nov 2026, 3 by direct read of the PDF key 8 Nov 2026). The 10 former DISPUTED items were decided: Q28 pick-one to D, Q32 pick-one to A, Q95 pick-one to B (signed change -16 Ns; the marked key C is the magnitude, corrected); Q61, Q70, Q78, Q83, Q107, Q113, Q122 DEFECTIVE-excluded. Q124 GAP resolved to VERIFIED A (50 N) — mdcatpapers marked answer and PDF Q135 key agree. KEY CORRECTION: Q148 (PDF Q129) A -> D — 18F undergoes beta-plus decay to 18O + e+ + neutrino; the PDF key A claims beta-minus decay, which would give 18Ne. CORRECTION to the sprint addendum: its 'PDF Q50 gap-fill' is wrong — PDF Q50 is filed Q45; the true thirteenth missing question is PDF Q44 (lizard tail), recovered as Q142. All decisions by the assistant under the owner's 8 Nov 2026 delegation; one source is FINAL under the owner's 8 Nov 2026 verification standard.

s excluded (11 defective, 2 unrecoverable): the 11 defective questions have no correct option (or two correct options), and the 2 unrecoverable questions depend on a diagram/graph that cannot be reproduced as text — so no answer is taught for any of them. They are listed here openly — never learn them as having a single answer.

- **Question 61:** DEFECTIVE-excluded: no option states the correct reason (iodine is a molecular solid of discrete I2 molecules held by weak van der Waals forces, with no free electrons or mobile ions), and the marked option C is factually wrong as well — solid iodine is usually described as orthorhombic, not tetragonal. The second reproduction's key (PDF Q66) repeats the same error and does not cure it. No answer is asserted.
- **Question 70:** DEFECTIVE-excluded: A and D both satisfy the definition — each forms one mole of compound from its elements in their standard states (H2O from H2 + 1/2 O2; SO3 from S + 3/2 O2) — so the stem has two correct options. The second reproduction's key (PDF Q75) keys A without addressing D, which does not resolve it. No answer is asserted.
- **Question 78:** DEFECTIVE-excluded: in the iodoform reaction a methyl ketone + I2/base gives a carboxylate + CHI3 (iodoform) as product B; CHI3 is not among the options, and the marked option A names the reactant (acetone), not the product. The second reproduction's key (PDF Q84) keys A while its own explanation concedes the true product is CHI3. No answer is asserted.
- **Question 83:** DEFECTIVE-excluded: A is the SN2 order (tertiary < secondary < primary) and C is the SN1/carbocation order (tertiary > secondary > primary), and the stem states no mechanism — alcohols most commonly undergo nucleophilic substitution via carbocations after protonation of –OH. The second reproduction's key (PDF Q90) keys A with an explanation that flip-flops between SN1 and SN2. No answer is asserted.
- **Question 107:** DEFECTIVE-excluded: the correct field is $E = kq/r^2 = (9 \times 10^9)(2 \times 10^{-6})/(0.10)^2 = 1.8 \times 10^6$ N/C, which appears in NO option, and every option carries the unit "C" (coulomb, a charge) instead of N/C. The marked D is wrong by a factor of 1000 and in the wrong unit. The second reproduction's key (PDF Q115) keys D

ts own working computes 1,800,000 and then states "1800 N/C". No answer is asserted; the question is written in full so the defect is visible; nothing has been reconstructed.

- **Question 113:** DEFECTIVE-excluded: A and C are both physically correct — the resistance of insulators also falls as temperature rises (thermal excitation creates more carriers), as does a semiconductor's — and the stem does not exclude insulators or ask for the "best example". The second reproduction's key (PDF Q123) keys C without addressing A. No answer is asserted.
- **Question 122:** DEFECTIVE-excluded: C and D are both somatic effects on the exposed individual, and the stem does not ask for an "except" or a single example with any qualifier distinguishing them. The second reproduction's key (PDF Q133) keys C while its own explanation lists cataracts (eye damage) as a somatic effect. No answer is asserted.
- **Question 141:** UNRECOVERABLE-excluded: this is PDF Q9 of the second reproduction, a diagram-labelling question. The PDF key is C, but the options are only the diagram's labels (A/B/C/D) and the chloroplast diagram itself cannot be reproduced as text — without it the question cannot be answered or taught. Its stem, options and key letter are recorded here in full; nothing is reconstructed.
- **Question 144:** DEFECTIVE-excluded: reactivity toward nucleophilic addition falls with more alkyl groups (electron-donating +I effect and steric hindrance), and ketones are less reactive than aldehydes, so the correct increasing order is CH3COCH3 (acetone, least) < CH3CH2CHO (propanal) < CH3CHO (ethanal) < HCHO (methanal, most) — confirmed by AskFilo's worked solution and standard textbook order (HCHO > CH3CHO > CH3CH2CHO > CH3COCH3). That order is NOT among the options: the keyed D (CH3CH2CHO < CH3COCH3 < CH3CHO < HCHO) swaps propanal and acetone, and no other option gives the correct order either. No answer is asserted.
- **Question 145:** DEFECTIVE-excluded: the options are period-3 elements, not group I, and their first ionisation energies are Na 496 < Al 577 < Mg 737 < Si 786 kJ/mol, so the correct increasing order is Na < Al < Mg < Si — which is NOT among the options. The keyed C (Si < Al < Mg < Na) is the DECREASING order, and the second

duction's own solution admits the correct order "matches none perfectly" while still calling C the "standard textbook answer". No answer is asserted.

- **Question 146:** UNRECOVERABLE-excluded: this is PDF Q120 of the second reproduction, a graph question. The PDF key is A (the I–V graph curving upward, concave up), but the options are only the graphs' labels (A/B/C/D) and the graphs themselves cannot be reproduced as text — without them the question cannot be answered or taught. Its stem, options and key letter are recorded here in full; nothing is reconstructed.
- **Question 147:** DEFECTIVE-excluded: total power = 4 × 10 + 2 × 100 = 240 W; daily = 240 × 2 = 480 Wh; 30 days = 14,400 Wh = 14.4 kWh — which is NOT among the options (A 4, B 1, C 2, D 10 kWh). The second reproduction's own solution computes 14.4 kWh and then hand-waves "≈ 4 kWh with rounding" to reach its keyed A. No answer is asserted.
- **Question 150:** DEFECTIVE-excluded: the keyed A is a standard CORRECT sentence, not an incorrect one — Wren & Martin's rule 111 ("words joined to a singular subject by with, as well as, etc., are parenthetical; the verb should be put in the singular") gives "Justice, as well as mercy, allows it" as its example of correct agreement, and error-spotting keys mark it "No error". The other options are likewise acceptable (B is correct inversion with plural agreement; C is the correct biblical idiom; D is acceptable). The second reproduction's own explanation concedes "some argue this is correct" while still marking A. No option is unambiguously incorrect, so no answer is asserted.

Question 1 Biology

Which function cannot be attributed to plasma membrane lipids?

- A. Recognition of cells having non-self surface markers
- B. Maintaining cell membrane flexibility
- C. Control of metabolic reaction across cell membrane ✓ **Correct answer**
- D. Binding ligands for intracellular response

s in the membrane act as recognition markers, so lipids do take part in cell recognition; not the exception.

B. The lipid bilayer's fluidity is a core lipid property; cholesterol and unsaturated lipids keep it flexible.

C. Transport and membrane enzyme activity are controlled by membrane PROTEINS (transporters, channels, enzymes), not by the lipids themselves; the keyed exception. Flagged: the answer rests on the textbook attribution convention — "control" here means protein-mediated control.

D. Lipid-derived and membrane-lipid-associated binding (e.g. lipid rafts and phospholipid signalling) is attributed to the lipid environment in this convention, so D is not the intended exception.

Question 2 Biology

Loss of reactivity of sucrose is due to its:

- A. High solubility in water
- B. Polar nature
- C. Unavailability of functional group
- D. Alpha 1-2 Glycosidic linkage ✓ **Correct answer**

A. Solubility does not remove reactivity; many very soluble sugars (glucose, fructose) are reactive reducing sugars.

B. Polarity is shared by all sugars and does not explain why sucrose alone is non-reducing.

C. Read literally this is false: sucrose is full of hydroxyl functional groups. What is unavailable is only the FREE anomeric (reducing) group, and that is a consequence of the linkage in D, not an independent cause.

D. The α-1,2 bond joins the two anomeric carbons of glucose and fructose, so neither anomeric carbon is free; with no free aldehyde/keto group sucrose is non-reducing and

ss reactive, correct.

Question 3 Biology

Proteins with tertiary structure are helpful in:

- A. Carrying messages from glands to target organs ✓ **Correct answer**
- B. Maintaining epithelial lining of skin
- C. Making the matrix of connective tissue
- D. Helping muscle contraction

A. Peptide/protein hormones (e.g. insulin) need their folded tertiary shape to fit receptors and travel in blood; correct.

B. That is keratin, a FIBROUS protein whose role depends on its extended secondary/Quaternary packing, not on a globular tertiary fold.

C. That is collagen, a fibrous triple-helix protein, not a globular tertiary-structure messenger.

D. That is actin and myosin, contractile proteins whose sliding-filament action is not a tertiary-structure signalling role.

Question 4 Biology

Rebounding is process of straightening the curly hairs. Which bond is targeted by oxidizing agents used during this process?

- A. Peptide bond
- B. Ionic bond
- C. Disulphide bridge ✓ **Correct answer**
- D. Hydrogen bond

A. Peptide bonds hold the keratin chain together; breaking them would destroy the protein, not reshape the hair.

…es in keratin are weak and are not the bonds rearranged in rebonding.

C. Curl is held by covalent S–S (cystine) cross-links between keratin chains; reducing/oxidising treatments break and reform these bridges to set a new shape; correct.

D. Hydrogen bonds are broken by water/heat (temporary setting), not by the oxidising step that fixes the new shape.

Question 5 Biology

Ions of heavy metal are harmful for living organisms because of their ability to:

- A. Cleave nucleic acid
- B. Interfere with fat metabolism
- C. Break glycosidic bonds
- D. Destabilize proteins ✓ **Correct answer**

A. Some metals can damage DNA indirectly, but cleavage of nucleic acids is not the principal acute mechanism of heavy-metal toxicity.

B. Not the main mechanism; lipid effects are secondary to protein damage.

C. Heavy metals do not characteristically hydrolyse glycosidic bonds in polysaccharides.

D. Heavy-metal ions (Hg^{2+}, Pb^{2+}, Cd^{2+}) bind strongly to thiol (–SH) and other side chains, unfolding proteins and destroying enzyme activity; correct.

Question 6 Biology

Which mechanism would be compromised in the absence of cytochrome complex during light reaction of photosynthesis?

- A. Reduction of reaction center chlorophyll
- B. Photolysis of water
- C. Oxidation of primary electron receptor

ablishment of proton gradient across thylakoid membrane ✓ **Correct answer**

A. The reaction centre is reduced by electrons arriving from water/PSII; the cytochrome complex sits downstream of that step.

B. Water splitting is done by the oxygen-evolving complex of PSII, upstream of cytochrome b6f.

C. The primary acceptor (pheophytin/QA) is oxidised by passing electrons onward; its oxidation is not the step the cytochrome complex performs.

D. Cytochrome b6f transfers electrons from plastoquinol to plastocyanin and pumps protons into the thylakoid lumen, building the proton gradient that drives ATP synthase; without it the gradient cannot be properly established; correct.

Question 7 Biology

During glycolysis, isomerization takes place in the formation of:

- A. Dihydroxyacetone phosphate and 2-phosphoglycerate
- B. G3P and fructose 6-phosphate ✓ **Correct answer**
- C. PEP and pyruvate
- D. Fructose 6-phosphate and 3-phosphoglycerate

A. DHAP is produced by aldolase cleavage of fructose-1,6-bisphosphate, not by an isomerisation; 2-phosphoglycerate is produced by a mutase step, which this syllabus does not count among the named isomerisations.

B. Phosphoglucose isomerase converts glucose-6-phosphate to fructose-6-phosphate, and triose-phosphate isomerase interconverts DHAP and glyceraldehyde-3-phosphate (G3P); the two textbook isomerase steps; correct on that convention. Flagged: the answer rests on the syllabus listing of isomerase steps; a mutase is in enzyme nomenclature an isomerase, so the classification is conventional, not absolute.

C. Pyruvate is formed from PEP by pyruvate kinase (phosphate transfer to ADP), not by

D. 3-phosphoglycerate is formed by phosphoglycerate kinase (phosphate transfer), not by isomerisation, although fructose-6-phosphate itself is an isomerisation product.

Question 8 Biology

Presence of PEP carboxylase in C4 plants enables them to avoid photorespiration due to:

- A. Presence of enzyme in high concentration
- B. Absence of Rubisco
- C. PEP carboxylase being strictly carboxylase ✓ **Correct answer**
- D. High yield of enzyme

A. Concentration alone would not prevent oxygenation; a concentrated oxygenase would still waste carbon.

B. False: Rubisco IS present in C4 bundle-sheath cells, where it fixes the concentrated CO2.

C. PEP carboxylase has no oxygenase activity and a high affinity for CO2 (as bicarbonate); it fixes CO2 in mesophyll cells and delivers it concentrated to Rubisco, so Rubisco's oxygenase (photorespiration) reaction is suppressed; correct.

D. Yield is not a mechanism; the decisive property is the enzyme's specificity, not its amount.

Question 9 Biology

Fats and proteins are metabolized via — which of the following serves as common duct for both metabolisms?

- A. Acetyl-CoA ✓ **Correct answer**
- B. Pyruvate
- C. G3P
- D. Lactate

β-oxidation and the catabolism of many amino acids both yield acetyl-CoA, the shared two-carbon entry point to the citric-acid cycle; correct.

B. Central to carbohydrate metabolism and convertible to acetyl-CoA, but fats do not pass through pyruvate.

C. A glycolysis intermediate (and a glycerol product of fat breakdown), not the common entry for amino-acid catabolism.

D. An anaerobic end-product of glycolysis, not a shared hub for fat and protein breakdown.

Question 10 Biology

Which of the following virus has a double stranded DNA genome?

- A. Rubella
- B. Influenza
- C. HIV
- D. Small pox ✓ **Correct answer**

A. A single-stranded RNA virus (togavirus), not DNA at all.

B. A segmented single-stranded RNA virus.

C. A single-stranded RNA retrovirus (two copies of +ssRNA, reverse-transcribed to DNA in the host, but the virion genome is RNA).

D. Variola, a poxvirus with a large linear double-stranded DNA genome; correct.

Question 11 Biology

An enzyme is capable of acting on a wide range of related substrates. Which of the following is a property of this enzyme?

- A. Inflexible active site

ulatory enzyme

- C. Non-regulatory enzyme ✓ **Correct answer**
- D. Highly specific enzyme

A. A rigid, inflexible active site fits one substrate precisely (lock-and-key specificity), the opposite of broad-substrate action.

B. Regulatory (allosteric, control-point) enzymes are typically highly specific and tightly controlled; broad action does not mark them.

C. In this paper's convention, a broad-specificity enzyme that is not a control-point enzyme is described as non-regulatory; the keyed answer. Flagged: the inference is conventional, not a law — some regulatory enzymes accept several substrates and some non-regulatory enzymes are specific; the answer rests on the textbook pairing used here.

D. Directly contradicts the stem: acting on a wide range of substrates is low, not high, specificity.

Question 12 Biology

All are the characteristics responsible for better survival of encapsulated bacteria except:

- A. High pathogenicity
- B. Withstand dehydration
- C. Strict adhesion to internal surfaces
- D. Easy recognition by host ✓ **Correct answer**

A. The capsule is a virulence factor: it increases the bacterium's ability to cause disease and survive in the host.

B. The hydrated polysaccharide capsule resists drying, aiding survival outside the host.

C. Capsular material aids adherence/colonisation of host surfaces.

D. The capsule MASKS surface antigens and resists phagocytosis, making recognition by

nune system harder, not easier, the exception; correct.

Question 13 Biology

Probiotics in infants formula milk keep babies healthy by doing all of the following actions except:

- A. Produce important vitamins
- B. Kill pathogenic bacteria ✓ **Correct answer**
- C. Prevent colonization of pathogens
- D. Enhance immunity

A. Gut probiotic bacteria synthesise B-group vitamins and vitamin K, a recognised benefit.

B. The keyed exception: probiotics act mainly by competition, exclusion and immune stimulation, not by directly killing pathogens as a primary mechanism. Flagged: the line is not absolute — some strains secrete bacteriocins with antimicrobial activity — so the answer rests on the textbook "primary mechanism" convention.

C. Competitive exclusion: probiotics occupy adhesion sites and consume nutrients, blocking pathogen colonisation.

D. Probiotics stimulate gut-associated immune responses, a recognised benefit.

Question 14 Biology

Activation of all of the following enzymes need a regulatory molecule except:

- A. Pepsinogen
- B. Trypsinogen
- C. Erepsin ✓ **Correct answer**
- D. Chymotrypsinogen

A. A zymogen, activated by HCl (and by pepsin itself) to pepsin in the stomach; needs activation.

n, activated by enteropeptidase (enterokinase) in the duodenum; needs activation.

C. Not a single zymogen: the name denotes a mixture of already-active intestinal peptidases (aminopeptidases/dipeptidases) that need no activation step; the exception; correct.

D. A zymogen, activated by trypsin to chymotrypsin; needs activation.

Question 15 Biology

Weakened papillary muscles of right ventricle would result in constant back flow of blood into:

- A. Right atrium ✓ **Correct answer**
- B. Left ventricle
- C. Right ventricle
- D. Left atrium

A. Papillary muscles anchor the chordae tendineae of the tricuspid (right atrioventricular) valve; weakened muscles let the valve prolapse in systole, so blood regurgitates into the right atrium; correct.

B. On the opposite side of the heart, fed by the mitral valve; right-ventricular regurgitation cannot flow there directly.

C. The chamber the blood is leaving; backflow goes UPSTREAM, into the atrium, not back into the ventricle itself.

D. Receives pulmonary venous blood and is guarded by the mitral valve; unrelated to the right-sided valve.

Question 16 Biology

A person with a removed gall bladder experiences difficulty in fat digestion due to:

ence of Bile

- B. Uncontrolled release of Bile ✓ **Correct answer**
- C. Reduced alkalinity of bile
- D. Absence of bile pigments

A. False: the liver still makes bile after cholecystectomy; only storage and timed release are lost.

B. Without the gallbladder, dilute bile drips continuously into the duodenum instead of being stored, concentrated and released in a meal-timed surge, so fat emulsification at meals is inefficient; correct.

C. Bile remains alkaline; alkalinity is not the lost function.

D. Pigments (bilirubin) are still made and excreted in bile; their absence is not the cause.

Question 17 Biology

Waxy cuticle protects the plant cell from:

- A. Desiccation ✓ **Correct answer**
- B. Photorespiration
- C. Toxin metabolism
- D. Protein loss

A. The hydrophobic waxy cuticle over aerial epidermis cuts evaporative water loss; correct.

B. A biochemical pathway in chloroplasts (Rubisco oxygenation); a surface wax layer does not prevent it.

C. Detoxification is a metabolic (largely vacuolar/enzymatic) function, not a cuticle function.

D. Proteins are intracellular; the cuticle does not guard against protein loss.

18 Biology

Which of the following set of characteristics are related to veins?

- A. Valves: Present, Wall thickness: Thick, Diameter: 7-9mm
- B. Valves: Absent, Wall thickness: Thick, Diameter: 40-50mm
- C. Valves: Present, Wall thickness: Thinner, Diameter: 40-50mm ✓ **Correct answer**
- D. Valves: Absent, Wall thickness: Thinner, Diameter: 40-50mm

A. Wrong wall: veins have THINNER walls than arteries; thick walls describe arteries.

B. Wrong on both counts: veins DO have valves and thin walls.

C. The only set with the two defining qualitative traits (valves present, walls thinner than arteries) plus a large lumen; correct by elimination. Defect: "40–50 mm" is not a general venous diameter (most veins are far narrower; only the great veins approach such sizes) — the diameter figure is not relied on; the valves/wall traits decide it.

D. Thin walls are right, but absence of valves is wrong for veins (valves prevent backflow in low-pressure venous return).

Question 19 Biology

Which of the following would not be compromised in the absence of lymphatic system?

- A. Blood pressure
- B. Oxygen carrying capacity of blood ✓ **Correct answer**
- C. Blood composition
- D. Defense mechanism

A. Would be compromised: lymphatics return interstitial fluid to the blood; without them plasma volume and pressure fall and oedema develops.

B. Depends on red-cell number and haemoglobin, neither of which the lymphatic system supplies; unaffected; correct.

compromised: lymph returns plasma proteins and fluid, maintaining blood volume and composition.

D. Would be compromised: lymph nodes and lymphocytes are core immune structures.

Question 20 Biology

The presence of which molecules distinguishes blood from interstitial fluid?

- A. Large proteins and electrolytes
- B. Glucose and RBCs
- C. Antibodies and electrolytes
- D. RBCs and large proteins ✓ **Correct answer**

A. Electrolytes are present in both fluids at similar levels, so the pair as a whole does not distinguish blood.

B. Glucose is present in interstitial fluid too (it diffuses out of capillaries); only the RBC part distinguishes.

C. Electrolytes are common to both fluids, and antibodies (as plasma proteins) leak in small amounts; the pair does not cleanly distinguish.

D. Red cells never leave intact vessels, and large plasma proteins (e.g. albumin, fibrinogen) are largely retained in blood, so interstitial fluid has essentially no RBCs and far less large protein; correct.

Question 21 Biology

Plants growing in saline soil face the problem of dehydration due to:

- A. Yw of soil > Yw of root
- B. Ys of soil < Ys of root
- C. Yw of root > Yw of soil ✓ **Correct answer**
- D. Yw of root = Yw of soil

d drive water INTO the root (from higher to lower water potential), the opposite of dehydration.

B. A lower (more negative) soil solute potential is the CAUSE of low soil water potential, but the option as a bare inequality does not state the water-potential condition that moves water out of the root; the keyed statement is C. (Yw = water potential, Ys = solute potential, as printed.)

C. Salts make soil water potential very negative (below the root's), so water moves from the higher-potential root into the lower-potential soil and the plant dehydrates despite wet soil; correct.

D. Equal potentials mean no net water movement, not dehydration.

Question 22 Biology

During Covid-19 epidemic, plasma of recovered patients was injected in covid patients. Which component of plasma was responsible for this?

- A. Plasminogen
- B. Interferons
- C. Antibodies ✓ **Correct answer**
- D. Interleukin-I

A. The inactive precursor of plasmin (clot breakdown); not the neutralising agent in convalescent plasma.

B. Antiviral signalling proteins, but they are not the transferred protective component of convalescent plasma therapy.

C. Convalescent plasma transfers the donor's anti-SARS-CoV-2 immunoglobulins, giving the recipient passive immunity by neutralising the virus; correct.

D. An inflammatory cytokine; not the protective transferred component.

23 Biology

Choose the one which is an example of artificial active immunity:

- A. Fetus receiving antibodies of mother through placenta
- B. Mother receiving antibodies
- C. Baby receiving MMR shots ✓ **Correct answer**
- D. Prevention of disease due to previous infection

A. Natural PASSIVE immunity: ready-made antibodies, no immune response by the fetus.

B. Passive immunity (antibodies received, not made); also not artificial in the stated sense.

C. Artificial (deliberate vaccination) and ACTIVE (the baby's own immune system makes antibodies and memory cells); correct.

D. NATURAL active immunity (immunity from the disease itself), not artificial.

Question 24 Biology

Which of the following type of T cells are required for the activation of B cells?

- A. Helper T cells ✓ **Correct answer**
- B. Cytotoxic T cells
- C. Suppressor T cells
- D. Memory T cells

A. CD4+ helper (Th) cells give B cells the co-stimulatory signals and cytokines (e.g. IL-4, IL-5) needed for proliferation and differentiation into plasma/memory cells; correct.

B. CD8+ killers of infected cells; they do not activate B cells.

C. Regulatory T cells that DAMPEN immune responses, the opposite role.

D. Long-lived cells for faster recall on re-exposure; they do not provide the primary activation signal to naive B cells.

25 Biology

What is the fate of a neurotransmitter after the transmission of nerve impulse across synapse?

- A. It is taken into post synaptic neuron
- B. Released to post synaptic membrane
- C. Released into the synaptic cleft
- D. Broken down by enzymes ✓ **Correct answer**

A. Wrong direction: reuptake, where it occurs, is into the PRESYNAPTIC terminal, not the postsynaptic neuron.

B. Release is INTO the cleft and binding to postsynaptic receptors happens during transmission, not as the post-transmission fate.

C. That is the START of transmission (release from the presynaptic terminal), not what happens afterwards.

D. The listed terminating fate: e.g. acetylcholinesterase breaks down acetylcholine in the cleft, ending the signal; correct by elimination among the options. Caveat: reuptake into the presynaptic terminal and diffusion away are also real fates for many transmitters, but neither is offered as an option; enzymatic breakdown is the fate the options describe.

Question 26 Biology

Which immediate change is brought about in the post synaptic membrane on binding with excitatory neurotransmitter?

- A. Calcium gates open
- B. Sodium gates open ✓ **Correct answer**
- C. Sodium gates close
- D. Sodium potassium pump ceases to work

A. Ca^{2+} entry matters presynaptically (triggering transmitter release) and in some

signalling, but the immediate EPSP event is Na^+ entry.

B. Excitatory transmitter opens ligand-gated Na^+ channels; Na^+ influx depolarises the membrane (EPSP) toward threshold; correct.

C. Closing Na^+ channels would hyperpolarise or prevent depolarisation, the effect of an inhibitory, not excitatory, input.

D. The Na^+/K^+ pump works continuously to restore gradients; it does not stop on transmitter binding, and stopping it is not the immediate EPSP change.

Question 27 Biology

During the conduction of nerve impulse, hyperpolarization would not occur if:

- A. Sodium gates didn't close in time
- B. Potassium gates were not so lousy ✓ **Correct answer**
- C. Sodium potassium pump stopped working
- D. Calcium gates open instantly

A. Late Na^+-channel closure prolongs depolarisation; it does not abolish the K^+-driven undershoot itself.

B. Hyperpolarisation (the undershoot below resting potential) is caused by K^+ channels staying open ("lousy"/slow-closing, as printed) so extra K^+ leaves; if they closed promptly, the extra K^+ efflux and the undershoot would not occur; correct. Defect: "lousy" is the page's word for slow-closing/leaky; read in that sense.

C. The pump restores gradients over time; stopping it alters long-term gradients, it is not the cause of the brief hyperpolarising undershoot.

D. Ca^{2+} opening does not determine the K^+ undershoot phase of the action potential.

28 Biology

Which of the following is a characteristic of electrical synapse?

- A. Presence of neurotransmitters
- B. Transmission of nerve impulse
- C. Sodium potassium gradient
- D. Absence of neurotransmitter ✓ **Correct answer**

A. False for electrical synapses: they have no chemical transmitter step.

B. True: electrical synapses do transmit impulses, directly as current through gap junctions.

C. The Na^+/K^+ gradient exists in all neurons and is not a characteristic of electrical synapses in particular.

D. True and distinguishing: current passes directly through gap junctions with no transmitter released into a cleft.

Note: DECISION — VERIFIED as D (decided by assistant under owner's 8 Nov delegation): B is true of every synapse, chemical and electrical alike, so it does not characterise electrical synapses as such; D (absence of neurotransmitter — current passing directly through gap junctions) is the distinguishing characteristic, and the second reproduction's key (PDF Q32) + explanation agree: D is "the key distinguishing characteristic". B's generic truth is recorded here, not hidden.

Question 29 Biology

Which option given below characterizes refractory period?

- A. Reversal of charges across neural membrane ✓ **Correct answer**
- B. Change in the type of ions across the membrane
- C. Next impulse can be conducted
- D. Membrane potential +50mV

answer: the refractory period follows the depolarising reversal of membrane polarity, during which Na^+ channels are inactivated and the membrane cannot immediately fire again. Flagged: the wording is loose — the reversal itself is depolarisation, and the refractory period is strictly the inactivated recovery phase AFTER it; the answer rests on that textbook association.

B. Meaningless as stated: the same Na^+/K^+ ions are involved throughout; it is their movement and channel states that change, not their type.

C. False during the absolute refractory period (no new impulse can be fired); it describes the state AFTER the period ends.

D. +40 to +50 mV is roughly the PEAK of the spike, not the defining feature of the refractory period that follows it.

Question 30 Biology

During complex activity of flight, birds require coordination of many skeletal muscles. Which part of their brain has to be well developed?

- A. Amygdala
- B. Cerebrum
- C. Cerebellum ✓ **Correct answer**
- D. Thalamus

A. A limbic structure for emotion/fear processing, not motor coordination.

B. The seat of cognition and voluntary initiation, but fine coordination/timing of movement is cerebellar.

C. Integrates sensory feedback and coordinates the timing, precision and balance of complex skeletal-muscle activity such as flight; famously enlarged in birds; correct.

D. A sensory relay station to the cortex, not the coordinator of movement.

31 Biology

Which part of the brain is actively used by mathematician trying to formulate a new equation?

- A. Hippocampus
- B. Cerebrum ✓ **Correct answer**
- C. Amygdala
- D. Pons

A. Concerned with forming/consolidating memories, not with abstract mathematical reasoning itself.

B. The cerebral cortex mediates higher functions — abstract reasoning, problem-solving, formulating new ideas; correct.

C. Emotional processing; not the seat of mathematical formulation.

D. A brainstem relay for motor/sensory pathways and sleep; not a reasoning centre.

Question 32 Biology

A desert mammal faces severe dehydration in a hot sunny day. Which internal condition would lead to secretion of ADH?

- A. High osmotic pressure of blood ✓ **Correct answer**
- B. High blood pressure
- C. Low osmotic pressure of blood
- D. Low solute potential of blood

A. Dehydration raises plasma osmolarity/osmotic pressure, stimulating osmoreceptors and ADH release to conserve water; the marked answer.

B. High blood pressure (volume expansion) SUPPRESSES ADH via volume receptors; dehydration typically lowers, not raises, blood pressure.

od suppresses ADH, the opposite condition.

D. In water-potential terms, solute potential Ψs = −osmotic pressure: a LOW (more negative) solute potential means a HIGH solute concentration, i.e. the same condition as A.

Note: DECISION — VERIFIED as A (decided by assistant under owner's 8 Nov delegation): D (low solute potential, Ψs = −osmotic pressure) does describe the same dehydrated state as A, and that equivalence is recorded here, not hidden. A is the answer the paper's key gives in both reproductions (PDF Q36 keys A), and the osmoreceptor phrasing (high osmotic pressure triggers ADH) is the convention the paper tests; the key arbitrates A.

Question 33 Biology

Which would be diagnosed by a doctor on seeing a patient with thick skin and low metabolic rate?

- A. Cretinism
- B. Cushing disease
- C. Myxedema ✓ **Correct answer**
- D. Addison's disease

A. Congenital hypothyroidism in CHILDREN (stunted growth, intellectual disability); the adult form with thick skin and low metabolism is myxoedema.

B. Cortisol excess: central obesity, moon face, hypertension, hyperglycaemia — not thick skin with low metabolic rate.

C. Adult hypothyroidism: low metabolic rate, weight gain, puffy/thickened (myxoedematous) skin, cold intolerance; correct.

D. Adrenal-cortex failure: weakness, weight loss, hypotension, skin hyperpigmentation — not this picture.

34 Biology

Choose the one related to hypoparathyroidism:

- A. Kidney stones
- B. Hypercalcemia
- C. Weakness of muscles
- D. Tetany ✓ **Correct answer**

A. A feature of HYPERparathyroidism/hypercalcaemia (excess calcium excreted), not of hypo-.

B. The opposite: hypoparathyroidism causes HYPOcalcaemia (low PTH → low blood Ca^{2+}).

C. Low calcium increases neuromuscular excitability (spasm), it does not characteristically cause flaccid weakness; weakness is not the hallmark.

D. Hypocalcaemia raises nerve/muscle excitability, producing sustained muscle spasms (tetany), the classic sign of hypoparathyroidism; correct.

Question 35 Biology

Choose the mismatched pair:

- A. Graffian follicle - progesterone ✓ **Correct answer**
- B. ICSH - interstitial cell
- C. Estrogen - inhibits FSH
- D. LH - ovulation

A. Mismatched: the mature Graafian follicle mainly secretes OESTROGEN; progesterone is secreted after ovulation by the corpus luteum; correct as the mismatch.

B. Matched: ICSH (interstitial-cell-stimulating hormone = LH in the male) acts on the interstitial (Leydig) cells to secrete testosterone.

C. Matched: oestrogen exerts negative feedback on FSH secretion (at most cycle stages).

the mid-cycle LH surge triggers ovulation.

Question 36 Biology

Which of the following is an example of negative feedback mechanism?

- A. Aggregation of platelets during wound healing
- B. Labour contraction
- C. Milk secretion during suckling
- D. Control of body temperature ✓ **Correct answer**

A. Positive-feedback amplification: each platelet releases factors recruiting more platelets, accelerating clotting.

B. Positive feedback: oxytocin-driven contractions push the baby down, stimulating more oxytocin.

C. Positive feedback: suckling stimulates prolactin/oxytocin, increasing milk let-down, which encourages more suckling.

D. Negative feedback: a rise above the set point triggers sweating/vasodilation and a fall triggers shivering/vasoconstriction, opposing the change and restoring the set point; correct.

Question 37 Biology

Most CO2 in blood is transported as bicarbonate ions. Choose the event NOT taking place during gaseous exchange at tissue level:

- A. Formation of HHb
- B. Formation of sodium bicarbonate
- C. Formation of oxyhemoglobin ✓ **Correct answer**
- D. Chloride shift

A. At tissues, oxyhaemoglobin unloads O2 and becomes reduced haemoglobin (HHb, after

); a genuine tissue-level event.

B. At tissues, $HCO3^-$ leaves the red cell into plasma where it associates with Na^+ as sodium bicarbonate; a genuine tissue-level event.

C. Oxyhaemoglobin is FORMED in the lungs, where O2 loads; at tissues it BREAKS DOWN as O2 is released; the event that does NOT take place at tissue level; correct.

D. At tissues, Cl^- enters red cells in exchange for outgoing $HCO3^-$ (Hamburger shift); a genuine tissue-level event.

Question 38 Biology

All are related to 'X' except: (X is interneuron shown in diagram)

- A. It passes information to brain
- B. It passes information to sensory neurons ✓ **Correct answer**
- C. It synapses with axon of sensory neurons
- D. It is present in gray matter

A. Interneurons relay processed signals onward within the CNS, including toward the brain; related.

B. Interneurons receive FROM sensory neurons and pass onward to motor neurons or higher centres; they do not send information BACK to sensory neurons; the exception; correct.

C. The sensory axon terminates on the interneuron; that synapse is the input to the relay.

D. Interneurons lie in the CNS grey matter (e.g. spinal cord grey horn, cortex). Flagged: the diagram referred to in the stem does not appear in the fetched text; the answer follows from the definition of an interneuron, not from the missing diagram.

39 Biology

Which one is the function of plasma membrane proteins?

- A. Restrict entry of polar molecules
- B. Prevention of freezing during cold weather
- C. Movement of ions in and out of the cell ✓ **Correct answer**
- D. Maintenance of membrane flexibility

A. That barrier is the lipid bilayer's hydrophobic core, not a protein function.

B. Antifreeze proteins exist in some organisms, but they are not the general function of plasma-membrane proteins.

C. Ion channels, pumps and carriers — integral membrane proteins — mediate regulated ion movement; correct.

D. Fluidity/flexibility is maintained by the lipids (and cholesterol), not by the proteins.

Question 40 Biology

Choose the option showing the correct set of characteristics for Intermediate filaments:

- A. Diameter 8-10nm, Vimentin, Mechanical support ✓ **Correct answer**
- B. Diameter 0.2-25um, Vimentin, Cilia flagella
- C. Diameter 8-10nm, Tubulin, Muscle contraction
- D. Diameter 7nm, Tubulin, Cyclosis

A. Intermediate filaments are ~8–10 nm, include vimentin (in mesenchymal cells), and give cells mechanical strength; all three correct.

B. Wrong size and wrong function: cilia/flagella are built of MICROTUBULES (9+2), not intermediate filaments.

C. Tubulin is the microtubule protein; muscle contraction uses actin/myosin, not intermediate filaments.

e actin microfilament diameter, tubulin is the wrong protein, and cyclosis (cytoplasmic streaming) is an actin-based process. (Option B prints "0.2-25um" as fetched.)

Question 41 Biology

Nucleo proteins are involved in:

- A. Cell to cell recognition
- B. Passing hereditary information to next generation ✓ **Correct answer**
- C. Ensuring fast speed of nerve impulse
- D. Acting as a cell surface marker

A. Recognition is done by cell-surface glycoproteins/glycolipids, not by nucleoproteins.

B. Nucleoproteins are DNA complexed with protein (chromosomes/chromatin); they carry and transmit the genetic information; correct.

C. Impulse speed depends on myelination and axon diameter, not on nucleoproteins.

D. Nucleoproteins are nuclear, not cell-surface markers.

Question 42 Biology

If reproductive cycle of a female starts on 10th of July, ovulation is most likely to occur on:

- A. 1st August
- B. 28th of July
- C. 24th of July ✓ **Correct answer**
- D. 5th August

A. Day 23 of the cycle; far past the mid-cycle ovulatory window.

B. Day 19; after ovulation, in the luteal phase, not the ovulation day.

C. The closest listed date to the mid-cycle ovulation window (around day 14–15 of a 28-day

:t as the best listed option. Flagged: counting strictly, day 1 = 10 July makes day 14 = 23 July, so 24 July is day 15; ovulation timing varies (about days 12–16), and 24 July is the only listed date inside that window.

D. Day 27; just before the next period, not ovulation.

Question 43 Biology

Which of the following would be produced as a result of reduction division during gametogenesis?

- A. Oogonium
- B. Primary oocyte
- C. Primary spermatocyte
- D. Secondary oocyte ✓ **Correct answer**

A. A diploid germ cell produced by mitosis before meiosis begins; not a product of reduction division.

B. A diploid cell arrested in prophase I; it ENTERS reduction division, it is not produced by it.

C. A diploid cell that ENTERS meiosis I; it is the starting cell of reduction division in the male, not its product.

D. The haploid product of meiosis I (reduction division) of the primary oocyte, formed with the first polar body; correct.

Question 44 Biology

What will be the probability of purple and terminal flower in Pea plant in F2 generation, if we cross true breeding purple axial with white terminal?

- A. 1/16
- B. 3/16 ✓ **Correct answer**

- D. 1/2

A. The probability of the double-recessive class (white terminal, ppaa), not purple terminal.

B. Purple is dominant (P_ = 3/4 in F2) and terminal is recessive (aa = 1/4); independent assortment gives 3/4 × 1/4 = 3/16; correct.

C. The double-dominant class (purple axial, P_A_), not purple terminal.

D. No F2 dihybrid class has probability 1/2 for this combination; it confuses a test-cross ratio with the F2 ratio.

Question 45 Biology

A carrier female for hemophilia is married to an affected male. What would be the probable percentage for their sons to be affected?

- A. 100%
- B. 50% ✓ **Correct answer**
- C. 25%
- D. 0%

A. Would require every son to receive the affected X; the mother is only a carrier, so half her X chromosomes are normal.

B. Sons receive Y from the father and one X from the carrier mother (X^H X^h): half receive X^h and are affected, half receive X^H and are normal; correct.

C. The figure for affected children OVERALL in some carrier × normal crosses, or for a specific quarter of all offspring here; for sons alone it is 50%.

D. Impossible: the mother carries the allele and passes it to half her sons.

46 Biology

Which of the following is not related to ABO blood group system?

- A. It is an example of multiple alleles
- B. I^A and I^B are codominant
- C. I doesn't code for any antigen
- D. I^O obeys Mendel's laws of inheritance ✓ **Correct answer**

A. Related and true: three alleles I^A, I^B, i at one locus.

B. Related and true: both antigens appear in AB individuals.

C. Related and true in substance: the i (I^O) allele produces no functional transferase, so no A/B antigen.

D. The keyed exception: the ABO system is presented as departing from SIMPLE Mendelian dominant–recessive inheritance (multiple alleles + codominance). Flagged: the statement is only an exception under that simple-dominance reading — the i allele itself segregates in Mendelian fashion; the answer rests on the paper's convention.

Question 47 Biology

Which is correct for pattern baldness?

- A. It is sex linked trait
- B. Occurs due to hormonal differences between sexes ✓ **Correct answer**
- C. Heterozygous male is normal
- D. Heterozygous female is affected

A. False: pattern (androgenic) baldness is autosomal and SEX-INFLUENCED, not sex-linked; the gene is not on a sex chromosome.

B. Androgen (DHT) sensitivity drives follicle miniaturisation, and the trait is expressed far more in males because of their androgen levels; correct.

males the allele behaves dominantly, so heterozygous males show baldness.

D. False: in females it behaves recessively, so heterozygous females are normally unaffected carriers of the phenotype.

Question 48 Biology

Which of the following is correct about hamstring muscles?

- A. It is an extensor muscle
- B. Its insertion is on tibia ✓ **Correct answer**
- C. Originate from pelvic girdle and top of femur
- D. Originate from ilium and femur

A. False: hamstrings FLEX the knee (and extend the hip); the knee extensors are the quadriceps.

B. Semimembranosus and semitendinosus insert on the medial tibia (biceps femoris inserts on the fibular head); the tibial insertion is the keyed correct statement.

C. Wrong as a general statement: the main origin is the ischial tuberosity of the pelvis; only the short head of biceps femoris arises from the femur.

D. False: the origin is the ischium (ischial tuberosity), not the ilium.

Question 49 Biology

Choose the correct for muscle in relaxed position:

- A. Exposed binding sites on actin
- B. Broad H-zone in sarcomere ✓ **Correct answer**
- C. Formation of cross bridges
- D. Ca2+ released in cytosol

A. At rest, tropomyosin covers the myosin-binding sites on actin; they are exposed only when Ca^{2+} binds troponin during activation.

ere is little actin–myosin overlap, so the H-zone (myosin-only region) and I-bands are wide; correct.

C. Cross-bridges form during contraction, not in the relaxed state.

D. At rest Ca^{2+} is sequestered in the sarcoplasmic reticulum; cytosolic Ca^{2+} is low, and release triggers contraction.

Question 50 Biology

Children of a mason do not inherit strong muscles developed by father due to hard labour. This is an example of:

- A. Survival of the fittest
- B. Over production of offspring
- C. Not inheriting acquired characters ✓ **Correct answer**
- D. Use and disuse of organs

A. Natural selection favouring better-adapted individuals; it says nothing about whether a father's developed muscles are inherited.

B. Darwin's observation that more offspring are produced than survive; unrelated to inheritance of acquired muscle.

C. The mason's muscles are acquired during his lifetime (somatic change, not a germ-line change) and are not passed on; the classic refutation of Lamarckian inheritance; correct.

D. Lamarck's proposed MECHANISM (use strengthens, disuse weakens); the example shows that mechanism does NOT lead to inheritance, so D names the theory refuted, not the principle illustrated.

Question 51 Chemistry

Ca + S → CaS. If 2.0g of Calcium and 4.0g of Sulphur are available, amount of product formed:

- B. 1.6g
- C. 2.6g
- D. 3.6g ✓ **Correct answer**

A. More than the limiting reactant can yield; it ignores the 1:1 mole ratio.

B. No mole combination of the given masses gives this; it undercounts the limiting amount.

C. An arithmetic distractor; the mole calculation gives 3.6 g.

D. Moles Ca = 2.0/40 = 0.05 mol; moles S = 4.0/32 = 0.125 mol; Ca is limiting, so 0.05 mol CaS forms: 0.05 × (40 + 32) = 0.05 × 72 = 3.6 g; correct.

Question 52 Chemistry

Select the greatest number of particles in the following:

- A. 2g of Sodium (atomic mass = 23)
- B. 2g of Hydrogen gas (atomic mass of H = 1) ✓ **Correct answer**
- C. 2g of Nitrogen gas (atomic mass of N = 14)
- D. 2g of Carbon dioxide gas (C=12, O=16)

A. 2/23 ≈ 0.087 mol, the fewest particles after CO2.

B. H2 has molar mass 2 g/mol, so 2 g = 1.0 mol, far more particles than any other option; correct.

C. N2 molar mass 28, so 2/28 ≈ 0.071 mol.

D. CO2 molar mass 44, so 2/44 ≈ 0.045 mol, the fewest particles.

Question 53 Chemistry

The value of 'l' for 4p orbital is:

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

A. l = 0 denotes an s orbital, not p.

B. The azimuthal quantum number depends only on subshell type: p always has l = 1, whatever n is; correct.

C. l = 2 denotes a d orbital.

D. l = 3 denotes an f orbital.

Question 54 Chemistry

The element having the electronic configuration (Kr) 5s24d8 is:

- A. Sr
- B. Ru
- C. Pd ✓ **Correct answer**
- D. Zr

A. Strontium is Z = 38, [Kr]$5s^2$; it has no 4d electrons.

B. Ruthenium is Z = 44, [Kr]$4d^7 5s^1$ in its ground state; its electron count (44) does not match the stated configuration.

C. [Kr] (Z = 36) + $5s^2$ (2) + $4d^8$ (8) = 46 electrons = palladium, Z = 46; correct by electron count. Note: palladium's actual ground state is the exception [Kr]$4d^{10}$, with no 5s electrons; the question identifies the element from the configuration AS WRITTEN, and 46 is unambiguously Pd.

D. Zirconium is Z = 40, [Kr]$4d^2 5s^2$; too few electrons.

55 Chemistry

Choose the correct quantum numbers:

- A. n=3, l=2, m=0, s=+1/2 ✓ **Correct answer**
- B. n=-3, l=3, m=0, s=-1/2
- C. n=4, l=3, m=4, s=+1/2
- D. n=4, l=2, m=4, s=-1/2

A. Satisfies every rule: n > 0, 0 ≤ l ≤ n−1 (2 ≤ 2), −l ≤ m ≤ +l (0 within ±2), s = ±1/2; correct.

B. Invalid twice over: n can never be negative, and l must be less than n.

C. Invalid: m must lie between −l and +l, so m = 4 exceeds l = 3.

D. Invalid: m = 4 exceeds l = 2.

Question 56 Chemistry

A gas has volume 10dm3 at 10°C. At what temperature is volume reduced to half?

- A. 283K
- B. 566K
- C. 142K ✓ **Correct answer**
- D. 373K

A. That is the STARTING temperature (10 °C = 283 K), at which the volume is still 10 dm^3.

B. Doubling the absolute temperature would DOUBLE the volume (Charles's law), not halve it.

C. At constant pressure V ∝ T (kelvin): T2 = (1/2) × 283 K = 141.5 K ≈ 142 K; correct.

D. 100 °C; heating the gas increases its volume, the opposite of the asked change.

57 Chemistry

The relationship between absolute temperature and velocities of gas molecules is given by:

- A. Crms = sqrt(3RT/M) ✓ **Correct answer**
- B. PV = nRT
- C. V = sqrt(2Ek/m)
- D. PV = 1/3mNc2

A. The root-mean-square speed expressed directly in terms of absolute temperature T, gas constant R and molar mass M; correct.

B. The ideal-gas equation; it relates pressure, volume and temperature of the bulk gas, not molecular speeds.

C. Gives a speed from a kinetic energy, not the temperature dependence of the molecular speed distribution; it is not the rms–temperature relation.

D. The kinetic-theory pressure equation ($PV = \frac{1}{3}mN\bar{c}^2$); it connects pressure to mean-square speed, but the asked temperature–velocity relation is A.

Question 58 Chemistry

The maximum polarizability is exhibited in:

- A. C6H14 ✓ **Correct answer**
- B. C3H6
- C. C5H12
- D. C2H6

A. The largest molecule offered, with the most electrons and the largest, most easily distorted electron cloud; polarizability rises with size/electron count; correct.

B. Propene's π electrons are polarizable, but the molecule is much smaller than hexane, so its total polarizability is lower.

s larger than ethane and propene but smaller than hexane; second-highest, not maximum.

D. The smallest molecule offered, with the fewest electrons; lowest polarizability.

Question 59 Chemistry

Which of the following compound have any characteristic heat of fusion except?

- A. NaCl
- B. Aluminium oxide
- C. Iron oxide
- D. Silicates ✓ **Correct answer**

A. A crystalline ionic solid with a sharp melting point and a defined enthalpy of fusion; not the exception.

B. A crystalline solid with a sharp melting point and defined heat of fusion; not the exception.

C. A crystalline solid with a defined heat of fusion; not the exception.

D. Many silicates form glasses/amorphous network structures that soften over a temperature RANGE with no sharp melting point and no single characteristic heat of fusion; the exception; correct. (Stem as printed is garbled — "have any characteristic heat of fusion except" — read as "which does NOT have a characteristic heat of fusion".)

Question 60 Chemistry

If external pressure is reduced to half, boiling point of ethanol will be:

- A. Greater than 78°C
- B. Less than 78°C ✓ **Correct answer**
- C. Equal to 78°C
- D. Reduced to half

e effect of INCREASING external pressure, not reducing it.

B. A liquid boils when its vapour pressure equals the external pressure; at half the external pressure that equality is reached at a lower temperature, so the boiling point falls below the normal 78 °C; correct.

C. 78 °C is the NORMAL boiling point at 1 atm only; it changes with pressure.

D. Boiling point does not scale proportionally with pressure, and halving a Celsius temperature is meaningless without the kelvin scale; the drop is modest, not to ~39 °C by proportion.

Question 62 Chemistry

Predict the shape of CsCl having radius ratio of 0.93:

- A. Tetrahedral
- B. Octahedral
- C. Body centered cubic ✓ **Correct answer**
- D. Hexagonal

A. Coordination number 4, expected for radius ratios 0.225–0.414 (e.g. ZnS); far below 0.93.

B. Coordination number 6, expected for radius ratios 0.414–0.732 (e.g. NaCl); below 0.93.

C. A radius ratio of 0.93 exceeds 0.732, giving coordination number 8: the CsCl arrangement, a cube with one ion at the centre and the other at the corners, conventionally described as body-centred-cubic-like; correct. Note: strictly it is two interpenetrating simple-cubic lattices (the ions differ), not a true bcc lattice of identical particles; the option uses the textbook shorthand.

D. Not the arrangement predicted by a 0.93 radius ratio for CsCl.

63 Chemistry

The solubility of PbS at 25°C is 4.0 × 10−28. Then ionic concentration will be:

- A. 4x10−14
- B. 2x10−14 ✓ **Correct answer**
- C. 1x10−14
- D. 3.0x10−10

A. Double the correct value; it takes the square root incorrectly (or doubles s).

B. $PbS \rightleftharpoons Pb^{2+} + S^{2-}$, so with $[Pb^{2+}] = [S^{2-}] = s$, $K_{sp} = s^2 = 4.0 \times 10^{-28}$ and $s = \sqrt{(4.0 \times 10^{-28})} = 2.0 \times 10^{-14}$ mol/L; correct. Defect: the stem calls 4.0×10^{-28} the "solubility"; it is the solubility PRODUCT (Ksp) — the calculation is correct only on that reading, which the options confirm.

C. Half the correct value; no valid derivation gives it.

D. Orders of magnitude too large; it does not follow from the given number.

Question 64 Chemistry

What conditions should be applied to minimize the leftover reactants in Ammonia synthesis?

- A. 200atm, 500°C
- B. 400atm, 200°C
- C. 100atm, 400°C
- D. 200atm, 400°C ✓ **Correct answer**

A. Higher temperature shifts the exothermic equilibrium back toward N2 + H2, leaving more reactants unreacted.

B. Equilibrium alone would favour this (highest pressure, lowest temperature), but at 200 °C the iron catalyst is effectively inactive, so the rate is negligible and reactants remain in practice; it is not the usable industrial answer.

ssure than the industrial optimum gives a poorer equilibrium yield than D.

D. The standard industrial compromise: high enough pressure to favour NH3, moderate temperature for an acceptable rate with the catalyst; the keyed answer. Flagged: the answer rests on the industrial-compromise convention; on pure equilibrium grounds B would convert most, so D is "best usable", not "best equilibrium".

Question 65 Chemistry

Select the buffer solution having highest pH:

- A. 0.1M CH3COOH, 0.01M CH3COO-
- B. 0.1M CH3COOH, 0.05M CH3COO-
- C. 0.1M CH3COOH, 0.10M CH3COO-
- D. 0.1M CH3COOH, 0.15M CH3COO- ✓ **Correct answer**

A. Ratio [salt]/[acid] = 0.1, the smallest ratio, hence the lowest pH of the four.

B. Ratio 0.5; higher than A but below C and D.

C. Ratio 1.0, so pH = pKa; below D.

D. Ratio 1.5, the largest; by Henderson–Hasselbalch pH = pKa + log([A^-]/[HA]) it gives the highest pH; correct.

Question 66 Chemistry

Formation of hydrogen gas can be increased by reacting which Zn sample with 1M HCl?

- A. 1g Zn Rod
- B. 1g Zn Pellets
- C. 1g Zn Ribbon
- D. 1g Zn Powder ✓ **Correct answer**

A. The smallest surface area per gram; the slowest reaction.

ace than a rod but far less than powder.

C. Thin and fairly high-area, but still less surface per gram than powder.

D. The greatest surface area per gram, so the heterogeneous reaction with acid is fastest and hydrogen is formed most quickly; correct. (Same mass and acid in all cases, so only surface area differs.)

Question 67 Chemistry

$6CO_2 + 6H_2O \rightarrow \text{sunlight} \rightarrow C_6H_{12}O_6 + 6O_2$. Predict the order of reaction:

- A. 2nd
- B. 1st
- C. Zero ✓ **Correct answer**
- D. 3rd

A. Would require the rate to depend on the square of a reactant concentration; not the photochemical convention for this equation.

B. Would require rate ∝ $[CO_2]$ or $[H_2O]$; the light-driven process is treated as concentration-independent under constant illumination.

C. In the textbook photochemical convention, the rate is governed by photon flux (light intensity) rather than reactant concentrations, so the reaction is treated as zero-order in the reactants; the keyed answer. Flagged: this is a simplification — real photosynthesis is a complex multi-step biochemical process, not an elementary zero-order reaction; the answer rests on the photochemical convention.

D. No basis: the stoichiometric coefficients do not determine order, and no third-power dependence applies.

Question 68 Chemistry

Which mechanism is consistent with rate law Rate = $K[NO]_2[H_2]$?

-) + H2 → N2 + H2O2 (slow), H2O2 + H2 → 2H2O (fast) ✓ **Correct answer**
- B. NO + H2O → N2 + H2O2 (slow), H2O2 + H2 → 2H2O (fast)
- C. 2NO + 2H2 → N2O + H2 (slow), H2O + H2 → H2O2 (fast)
- D. NO + NO → N2 + O2 (slow), O2 + H2 → H2O (fast)

A. The slow (rate-determining) step involves 2 NO and 1 H2, giving rate ∝ $[NO]^2[H2]$, and the two steps sum to the overall 2NO + 2H2 → N2 + 2H2O; correct.

B. The slow step would give rate ∝ [NO][H2O], and the step is not even balanced; inconsistent with the given law.

C. The slow step would give rate ∝ $[NO]^2[H2]^2$, and the steps do not sum to the correct overall reaction.

D. The slow step involves no H2, so the rate would be ∝ $[NO]^2$ only, independent of [H2]; inconsistent. (Note: a termolecular elementary step, as in A, is a textbook idealisation.)

Question 69 Chemistry

DeltaH° for sublimation of one mole of iodine: H2(g) + I2(g) → 2HI(g) DH = 51.8kJ/mol H2(g) + I2(s) → 2HI(g) DH = -10.5kJ/mol

- A. 41.3 kJ/mol
- B. 62.3 kJ/mol ✓ **Correct answer**
- C. 53.5 kJ/mol
- D. 36.5 kJ/mol

A. 51.8 − 10.5 with the wrong sign on the second enthalpy; it subtracts where Hess's law requires adding.

B. By Hess's law, ΔHsub = ΔH(gas reaction) − ΔH(solid reaction) = 51.8 − (−10.5) = 62.3 kJ/mol for I2(s) → I2(g); correct.

C. No valid combination of 51.8 and 10.5 gives this.

ombination of the two given enthalpies gives this.

Question 71 Chemistry

Expansion takes place when gas evolves during reaction between carbohydrates and dilute HCl. Predict energy change and work done:

- A. w is positive, q is negative
- B. w is negative, q is positive ✓ **Correct answer**
- C. q is positive, no work done
- D. w is positive, q is positive

A. Wrong sign for work: expansion means work is done BY the system, so w is negative in the chemistry convention ($w = -P\Delta V$).

B. The keyed answer: expansion gives negative w, and the paper treats the process as heat-absorbing (q positive). Flagged: the stem as printed gives no temperature/thermochemical data from which the sign of q could be derived; B is asserted on the keyed convention, with w-negative as the decisive, derivable part.

C. False: expansion against external pressure IS work done by the system; "no work" contradicts the stated expansion.

D. Wrong work sign for an expansion, for the same reason as A.

Question 72 Chemistry

Zn rod acts as cathode when coupled with magnesium electrode because reduction potential of:

- A. Zn > Mg ✓ **Correct answer**
- B. Zn < Mg
- C. Zn = Mg
- D. Zn = 0

) = −0.76 V is greater (less negative) than E°(Mg^{2+}/Mg) = −2.37 V, so Zn^{2+} is reduced (cathode) and Mg is oxidised (anode); correct.

B. Reversed: if Zn's potential were lower, Zn would be the anode.

C. The potentials are not equal; equal potentials would give no cell EMF.

D. No standard potential here is zero except the standard hydrogen electrode by definition; Zn's is −0.76 V.

Question 73 Chemistry

Placing a rod of iron metal in a solution of CuSO4:

- A. Cu will be deposited ✓ **Correct answer**
- B. Fe is precipitated out
- C. Cu and Fe both dissolve
- D. No reaction taken place

A. Iron is the stronger reducing agent (lower reduction potential), so Fe → Fe^{2+} + $2e^{-}$ while Cu^{2+} + $2e^{-}$ → Cu(s); copper metal plates onto the rod; correct.

B. Iron DISSOLVES as Fe^{2+}; it is not precipitated.

C. Copper ions are reduced to solid copper; copper does not dissolve here.

D. A spontaneous displacement reaction does occur, as the potentials predict.

Question 74 Chemistry

In CH3Cl, bond length of C-Cl is 176.7pm and covalent radius of Cl is 99.4pm. Covalent radius of carbon is:

- A. 66.3 pm
- B. 276.1 pm
- C. 175.4 pm

3 pm ✓ **Correct answer**

A. No valid operation on 176.7 and 99.4 gives this.

B. The SUM of the two numbers (176.7 + 99.4); bond length is the sum of the radii, so adding again is wrong.

C. Approximately the bond length itself, not a radius.

D. Bond length ≈ r(C) + r(Cl), so r(C) = 176.7 − 99.4 = 77.3 pm; correct.

Question 75 Chemistry

Correct order of decreasing electron affinities of group VII is:

- A. F > Cl > Br > I
- B. Cl > F > Br > I ✓ **Correct answer**
- C. F < Cl < Br < I
- D. Cl < F < Br < I

A. The naive electronegativity order; it ignores the fluorine anomaly.

B. Chlorine's electron affinity exceeds fluorine's because the small 2p subshell of F suffers strong electron–electron repulsion on adding an electron; thereafter EA falls down the group as size increases; correct.

C. Reversed down the group: EA decreases, not increases, from Cl to I.

D. Wrong at every step: it puts Cl lowest and I highest.

Question 76 Chemistry

Predict the highest bond energy of the following single bond:

- A. C-H ✓ **Correct answer**
- B. C-N
- C. C-O

A. About 413 kJ/mol, the strongest of the four single bonds listed; correct.

B. About 305 kJ/mol, the weakest of the four.

C. About 358 kJ/mol, stronger than C–C and C–N but below C–H.

D. About 347 kJ/mol, below C–H.

Question 77 Chemistry

Compound X + Na2CO3 → Compound Y + CO2 + H2O. The compound X is:

- A. CH2=CH-CH2-CH3
- B. CH3CH2CHO
- C. CH3C(O)OCH3
- D. CH3CH2COOH ✓ **Correct answer**

A. An alkene (but-1-ene); it does not react with carbonate to liberate CO2.

B. An aldehyde (propanal); aldehydes do not liberate CO2 from carbonates.

C. An ester (methyl ethanoate); esters do not liberate CO2 from carbonates (they hydrolyse under other conditions).

D. Propanoic acid, a carboxylic acid; acids neutralise carbonate, liberating CO2 and water: 2RCOOH + Na2CO3 → 2RCOONa + CO2 + H2O; correct.

Question 79 Chemistry

Select the carboxylic acid with highest melting point:

- A. Ethanoic acid ✓ **Correct answer**
- B. Propanoic acid
- C. Butanoic acid
- D. Pentanoic acid

oint ≈ 16.6 °C, the highest of the four; correct.

B. Melting point ≈ −21 °C, far below ethanoic acid.

C. Melting point ≈ −6 to −8 °C, below ethanoic acid.

D. Melting point ≈ −34 °C, the lowest of the four. (Note: the reasoning is not "longer chains always lower the melting point" — melting points of these short acids show even–odd alternation in packing; the VALUES decide it, and ethanoic acid is highest here.)

Question 80 Chemistry

Identify the following compound having shortest bond length:

- A. Methyl amine
- B. Formamide
- C. Formic acid ✓ **Correct answer**
- D. Ethanol

A. Contains only single bonds (C–N ≈ 1.47 Å, C–H, N–H); no short double bond.

B. Contains a C=O bond, but amide resonance (lone pair on N delocalised into the carbonyl) lengthens its C=O and gives the C–N partial double-bond character, so its shortest bond is longer than formic acid's C=O.

C. Contains a C=O double bond (≈ 1.20–1.23 Å), significantly shorter than any single bond in the other molecules, and with less resonance lengthening than the amide; correct.

D. Contains only single bonds (C–C, C–O ≈ 1.43 Å, O–H); no double bond. (The stem does not say WHICH bond is compared; read as "the compound whose shortest bond is shortest", decided by the carbonyl bond.)

Question 81 Chemistry

Identify the alkene which gives only one type of aldehyde upon ozonolysis:

- B. 2-methyl propene
- C. 2-butene ✓ **Correct answer**
- D. 2,3-dimethyl-2-butene

A. Ozonolysis gives formaldehyde (methanal) + butanal: two different aldehydes.

B. Ozonolysis gives formaldehyde + acetone: an aldehyde and a ketone, not one type of aldehyde.

C. The symmetric internal alkene CH3–CH=CH–CH3 cleaves to two identical acetaldehyde (ethanal) molecules: only one type of aldehyde; correct.

D. Ozonolysis gives two identical acetone molecules: only one type of carbonyl compound, but a KETONE, not an aldehyde.

Question 82 Chemistry

Bakelite is formed upon polymerization of:

- A. Phenol + HCHO dilute base ✓ **Correct answer**
- B. Phenol + NaOH H2O
- C. Phenol + H2SO4 H2O
- D. Phenol + CH3-C(=O)-Cl H2SO4

A. Phenol + formaldehyde (methanal) under basic conditions gives a resole that cross-links to the thermoset Bakelite; correct.

B. Gives sodium phenoxide in solution; no polymer forms without formaldehyde.

C. Sulphonation conditions; no formaldehyde, no Bakelite.

D. Friedel–Crafts acylation conditions (acetyl chloride); gives an acyl phenol, not Bakelite.

84 Chemistry

The most reactive alcohol towards Lucas reagent is:

- A. 2-butanol
- B. 2-methyl-1-butanol
- C. 2-methyl-2-butanol ✓ **Correct answer**
- D. 2,2-dimethyl-1-butanol

A. A secondary alcohol; reacts with Lucas reagent, but slowly (turbidity after minutes), via a less stable carbocation.

B. A primary alcohol; reacts very slowly (turbidity only on heating) via an unstable primary carbocation/SN2 path.

C. A tertiary alcohol; forms the most stable tertiary carbocation and gives immediate turbidity with Lucas reagent (conc. HCl/ZnCl2); correct.

D. A primary (neopentyl-type) alcohol; very slow with Lucas reagent due to the unstable primary carbocation and steric hindrance.

Question 85 Chemistry

The most readily sulphonated compound is:

- A. Benzene
- B. Chlorobenzene
- C. Nitrobenzene
- D. Toluene ✓ **Correct answer**

A. The unsubstituted reference; sulphonation occurs, but more slowly than on an activated ring.

B. Chlorine deactivates the ring toward electrophilic substitution (despite being ortho/para-directing), so sulphonation is slower than benzene.

group strongly deactivates the ring; sulphonation is very slow and needs forcing conditions.

D. The methyl group donates electron density (inductive + hyperconjugation), activating the ring toward electrophilic attack; sulphonation is fastest here; correct.

Question 86 Chemistry

Select the alkene showing geometrical isomerism:

- A. 3-methyl-1-butene
- B. Methyl cyclopentane
- C. 2,3-dimethyl-2-butene
- D. 3-methyl-2-pentene ✓ **Correct answer**

A. A terminal alkene, CH2=CH–; one double-bond carbon carries two identical H atoms, so no cis/trans isomerism.

B. An alkane (saturated ring), not an alkene; no C=C geometrical isomerism.

C. (CH3)2C=C(CH3)2: each double-bond carbon carries two identical methyl groups, so no geometrical isomers.

D. CH3–CH=C(CH3)–CH2CH3: each double-bond carbon carries two different groups (H/CH3 on one, CH3/CH2CH3 on the other), so E/Z (cis/trans) isomers exist; correct.

Question 87 Chemistry

When a metal carbonate is heated at 100°C, which will readily decompose?

- A. $BaCO_3$
- B. $MgCO_3$
- C. $BeCO_3$ ✓ **Correct answer**
- D. $SrCO_3$

A. The most thermally stable of the four (largest cation, most ionic); decomposes only at

nperatures.

B. Decomposes on heating (around 350 °C), but far less readily than beryllium carbonate.

C. The smallest cation polarises the carbonate ion most strongly, making the carbonate the most covalent and least thermally stable; it decomposes readily at low temperatures; correct by the group trend.

D. More stable than MgCO3 and BeCO3, decomposing only at high temperature.

Question 88 Physics

At what angle of applied force, work done will be 50%?

- A. 30°
- B. 60° ✓ **Correct answer**
- C. 90°
- D. 45°

A. cos 30° ≈ 0.866, so work would be about 87% of maximum, not 50%.

B. W = Fd cosθ; 50% of the maximum (θ = 0°) requires cosθ = 0.5, i.e. θ = 60°; correct.

C. cos 90° = 0, so no work is done at all.

D. cos 45° ≈ 0.707, so work would be about 71% of maximum, not 50%. (Read as 50% of the maximum work, at θ = 0°.)

Question 89 Physics

What is the power of electric motor when it performs work of 64 × 106 J in 8 seconds?

- A. 6 Kilowatts
- B. 7 Kilowatts
- C. 8 Megawatts ✓ **Correct answer**
- D. 7 Megawatts

of magnitude too small, it mistakes megawatts for kilowatts.

B. Likewise far too small, and the wrong number.

C. P = W/t = (64 × 10^6 J)/8 s = 8 × 10^6 W = 8 MW; correct. (The stem prints "106" for 10^6.)

D. The right unit but the wrong quotient: 64/8 = 8, not 7.

Question 90 Physics

The relation between K.E and momentum P is given by:

- A. K.E = 1/2 P/M
- B. K.E = 1/2 P/M2
- C. K.E = 1/2 P2/M2
- D. K.E = 1/2 P2/M ✓ **Correct answer**

A. Dimensionally wrong: p/m has the dimensions of velocity, not energy.

B. Dimensionally wrong and missing the square on p.

C. Gives p^2/m^2, i.e. velocity squared, not energy; it divides by mass twice.

D. From p = mv, KE = ½mv^2 = p^2/(2m) = ½·P^2/M; correct. (Options print "P2"/"M2" for P^2/M^2.)

Question 91 Physics

When dolphin leaves the water it has lots of kinetic energy. At its highest point its energy is:

- A. Kinetic energy
- B. Potential energy ✓ **Correct answer**
- C. Elastic potential energy
- D. Neither kinetic nor potential energy

A. At the apex the vertical velocity is zero, so the launch kinetic energy has been converted; kinetic energy is at its minimum, not the stored form.

highest point the energy is stored as gravitational potential energy (maximum height, PE = mgh); correct as the intended answer. Caveat: a projectile launched at an angle retains its horizontal velocity at the apex, so a small horizontal KE remains; the option describes the dominant, stored form of the energy.

C. No spring or elastic deformation is involved in a dolphin's leap.

D. False: total mechanical energy is conserved (ignoring air resistance) and is present as potential energy at the top.

Question 92 Physics

The absolute potential energy is given as Ug = -GmMe/R. The negative sign indicates Earth's gravitational field for mass 'm' is:

- A. Repulsive
- B. Less attractive
- C. Attractive ✓ **Correct answer**
- D. More repulsive less attractive

A. A repulsive field would give positive potential energy increasing toward the source; gravity is the opposite.

B. The sign does not grade the attraction as "less"; it records that the force is attractive with zero potential at infinity.

C. Potential energy is negative (relative to zero at infinite separation) precisely because work must be done AGAINST gravity to separate the masses: gravity pulls them together; correct.

D. Self-contradictory and wrong: the field is attractive, not repulsive in any degree.

Question 93 Physics

The velocity of an object moving in a circle is:

stant

- B. Variable ✓ **Correct answer**
- C. Zero
- D. Negative

A. The SPEED may be constant in uniform circular motion, but velocity is a vector and its direction changes continuously, so velocity is not constant.

B. The direction of the velocity vector changes at every point of the circle (tangent direction rotates), so velocity varies even at constant speed; correct.

C. The object is moving; its velocity is non-zero (only its average velocity over a full circle is zero).

D. "Negative" is not a property of a changing vector direction; speed and velocity magnitude are positive quantities here.

Question 94 Physics

If you stop your car quickly by wearing seat belts, chance of injury is greatly reduced because seat belt applied:

- A. Extra force
- B. Perpendicular force
- C. Opposite force ✓ **Correct answer**
- D. Zero force

A. The belt does not add force; it spreads the stopping force and increases stopping time, REDUCING the peak force on the body.

B. The restraining force acts along (opposite to) the direction of motion, not perpendicular to it.

C. The belt exerts a restraining force opposite to the passenger's forward motion, decelerating them with the car instead of letting them continue into the

windscreen, the keyed answer. (The fuller physics: by stretching slightly and holding the occupant, the belt lengthens the stopping time Δt, so for the same impulse FΔt the peak force F is smaller.)

D. A zero force would not stop the passenger at all.

Question 95 Physics

A ball with momentum 8 kg m/s hits a wall and bounces back without losing K.E. Change in momentum is:

- A. 4 Ns
- B. -16 Ns ✓ **Correct answer**
- C. 16 Ns
- D. 8 Ns

A. No valid momentum calculation gives 4: it is half the initial momentum, for no reason.

B. The SIGNED change: final momentum −8 kg·m/s minus initial +8 kg·m/s = −16 kg·m/s (−16 Ns); the correct value with sign, taking the initial direction as positive.

C. The MAGNITUDE of the change (16 Ns), without the sign; the marked answer.

D. The initial momentum itself, not its change.

Note: DECISION — VERIFIED as B (decided by assistant under owner's 8 Nov delegation; the marked key C is corrected): the change in momentum is final minus initial = (−8) − (+8) = −16 Ns. The stem does not ask for the magnitude, and the source page's own explanation derives −16 and then keys C (16 Ns, the magnitude) — the derivation is followed, not the key. C is the magnitude of the change, recorded here, not hidden.

Question 96 Physics

In projectile motion for which angle maximum height is half of its range?

- A. 73°

- C. 63° ✓ **Correct answer**
- D. 68°

A. Gives H well above R/2 (tan 73° ≈ 3.27, against the required 2).

B. tan 65° ≈ 2.14, slightly above the required value; the angle is slightly too large.

C. $H = u^2\sin^2\theta/(2g)$ and $R = u^2\sin2\theta/g$; $H = R/2$ gives $\sin^2\theta = \sin2\theta = 2\sin\theta\cos\theta$, so $\tan\theta = 2$ and $\theta = \arctan 2 \approx 63.4°$; correct.

D. tan 68° ≈ 2.48, too large; H would exceed R/2.

Question 97 Physics

Sara goes around a circular track of diameter 20m for distance 180m. Angular displacement is:

- A. 16 radians
- B. 18 radians ✓ **Correct answer**
- C. 50 radians
- D. 8 radians

A. No valid radius/distance combination gives 16; it is a near-miss distractor.

B. Radius r = 20/2 = 10 m; $\theta = s/r = 180/10 = 18$ rad; correct.

C. Uses the diameter (20) as if it were the radius in the wrong place, or misdivides; 180/20 = 9, and 50 follows from no correct step.

D. Roughly half the correct value; it uses a radius of about 22 m, not 10 m.

Question 98 Physics

Angle swept by minute hand in one minute is:

- A. 6° ✓ **Correct answer**

- C. 8°
- D. 20°

A. The minute hand sweeps 360° in 60 minutes, so 360/60 = 6° per minute; correct.

B. The angle swept in 6 minutes, not one.

C. No division of the clock face gives 8° per minute.

D. The angle swept in about 3⅓ minutes, or a misreading of the dial (60 minutes ≠ 18 divisions).

Question 99 Physics

To find the direction of angular displacement, use:

- A. Grasp axis of rotation in right hand ✓ **Correct answer**
- B. Grasp axis of rotation in left hand
- C. Put thumb of right hand in direction of circular motion
- D. Put thumb of left hand in direction of circular motion

A. The right-hand rule: curl the fingers of the RIGHT hand in the direction of rotation and the thumb points along the rotation axis, giving the direction/sign of the angular-displacement vector; the keyed answer.

B. The left hand gives the opposite (wrong) sign; the convention is right-handed.

C. Reversed: the fingers follow the circular motion and the THUMB points along the axis, not along the motion.

D. Wrong hand and wrong thumb placement.

Question 100 Physics

A particle moves in a circle of radius 10m with speed 20 m/s. Find angular velocity:

d/s ✓ **Correct answer**

- B. 200 rad/s
- C. 20 rad/s
- D. 10 rad/s

A. ω = v/r = 20/10 = 2 rad/s; correct.

B. The product v × r (20 × 10), the inverse of the correct operation.

C. The linear speed itself, with the radius ignored.

D. The radius itself, with the speed ignored (or 20/2, dividing by the wrong quantity).

Question 101 Physics

For anti-clockwise rotation the angular displacement is:

- A. Negative
- B. Positive ✓ **Correct answer**
- C. Null
- D. Zero

A. Clockwise rotation is taken as negative in the standard convention, not anti-clockwise.

B. By convention, anti-clockwise (counter-clockwise) rotation is the positive direction for angular displacement; correct.

C. "Null" is not a sign; a real rotation has a non-zero signed displacement.

D. Zero displacement means no rotation at all, not anti-clockwise rotation.

Question 102 Physics

Speed of sound in solid is greater than in air because ratio:

- A. (√E/ρ) solid < (√E/ρ) air
- B. (√E/ρ) solid > (√E/ρ) air ✓ **Correct answer**

- D. (√E/ρ) solid ≤ (√E/ρ) air

A. Would make sound slower in solids, the opposite of the observed fact.

B. Sound speed v = √(E/ρ); solids have a vastly larger elastic modulus E than air, which outweighs their larger density, so √(E/ρ) and hence v are greater in solids; correct.

C. Would make the speeds equal, which they are not (≈ 5000 m/s in steel vs ≈ 340 m/s in air).

D. Combines the two wrong claims (less or equal); both contradict the observed greater speed in solids.

Question 103 Physics

Body mass 10kg, spring k=20 N/m, max displacement 20cm. Acceleration is:

- A. 2.2 ms−2
- B. 4 ms−2
- C. 2 ms−2
- D. 0.4 ms−2 ✓ **Correct answer**

A. No valid combination of 10, 20 and 0.2 gives 2.2.

B. k × x = 4 N, the maximum FORCE, mistaken for the acceleration (force not divided by mass).

C. k/m = 2, the factor ω^2, without multiplying by the displacement.

D. Maximum acceleration a_max = kx/m = (20 × 0.20)/10 = 4/10 = 0.4 m/s²; correct.

Question 104 Physics

Normal person hears 20Hz to 20KHz. Maximum wavelength is:

- A. 17m ✓ **Correct answer**

- C. 17cm
- D. 17km

A. Longest wavelength pairs with the LOWEST frequency: λ = v/f ≈ 340/20 = 17 m; correct (using v ≈ 340 m/s; 343 m/s gives 17.15 m, still option A).

B. A thousand times too small; it confuses metres with millimetres.

C. A hundred times too small; 17 cm corresponds to about 2000 Hz, not 20 Hz.

D. A thousand times too large; it confuses metres with kilometres.

Question 105 Physics

NaCl dissolves quickly in water due to:

- A. Low εr
- B. High εr ✓ **Correct answer**
- C. εr = 0
- D. εr = ∞

A. A low relative permittivity would leave the Na^{+}–Cl^{-} attraction strong and dissolution poor.

B. Water's high relative permittivity (εr ≈ 80) weakens the Coulomb attraction between ions (F ∝ 1/εr) and, with hydration, separates them readily; correct.

C. Physically impossible for a solvent (it would imply infinite force) and not water's value.

D. Would imply zero attraction between any charges; not water's value and not needed to explain dissolution.

Question 106 Physics

A capacitor can be fully charged because time required is:

ne constant

- B. 2 time constant
- C. 4 time constant
- D. Infinity ✓ **Correct answer**

A. After 1τ (RC) the capacitor reaches only about 63% of full charge.

B. After 2τ it reaches about 86%, not full charge.

C. After 4τ about 98%; for practical purposes nearly charged, but not mathematically fully charged.

D. Charging is exponential, V(t) = Vmax(1 − e^(−t/RC)), which approaches Vmax asymptotically and reaches it exactly only as t → ∞; the strictly correct answer; correct. (In practice ~5τ is treated as fully charged.)

Question 108 Physics

At midpoint P between two +4μc charges. V and E at midpoint P:

- A. V=0, E≠0
- B. V=0, E=0
- C. V≠0, E≠0
- D. V≠0, E=0 ✓ **Correct answer**

A. Both parts wrong: the fields cancel and the potentials add.

B. The field part is right but the potential part is wrong: potential is a scalar and the two positive contributions add.

C. The potential part is right but the field part is wrong: the two equal, opposite fields cancel at the midpoint.

D. The fields from the two equal + charges are equal in magnitude and opposite in direction at the midpoint (E = 0), while potentials add as scalars (V = 2kq/r ≠0); correct.

109 Physics

A process in which all heat energy is used for increasing internal energy is:

- A. Isobaric
- B. Isochoric ✓ **Correct answer**
- C. Isothermal
- D. Adiabatic

A. Constant pressure: the gas expands and does work, so part of the heat goes into work, not all into internal energy.

B. Constant volume: no boundary work (W = 0), so by the first law ΔQ = ΔU + W all the heat goes into internal energy; correct.

C. Constant temperature: for an ideal gas ΔU = 0, so all heat goes into WORK, the opposite of the stem.

D. No heat is exchanged at all (ΔQ = 0), so no heat energy is available to increase internal energy.

Question 110 Physics

Phase shift between voltage and current when AC flows through capacitor is:

- A. V leads I by 90°
- B. I leads V by 90° ✓ **Correct answer**
- C. V and I in phase
- D. V leads I by 45°

A. That is the INDUCTOR case (voltage leads current); reversed for a capacitor.

B. In a pure capacitor, current is proportional to the rate of change of voltage, so current peaks a quarter-cycle before voltage; correct.

C. That is the pure RESISTOR case, not a capacitor.

ift arises for a pure capacitor; the shift is 90°.

Question 111 Physics

A particle with charge 1C moves through potential difference 5V. Energy required:

- A. 5×10−10 J
- B. 8×10−18 J
- C. 8J
- D. 5J ✓ **Correct answer**

A. Off by ten orders of magnitude; no electron-charge factor belongs here (the charge is 1 C, not 1 e).

B. An electron-volt-scale number, irrelevant to a 1 C charge.

C. No valid combination of 1 and 5 gives 8.

D. W = qV = 1 C × 5 V = 5 J; correct.

Question 112 Physics

Equivalent resistance between A and B (three 1Ω resistors in parallel):

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

A. No parallel combination of three 1 Ω resistors gives 1.5 Ω (that would be a series/parallel mix of different values).

B. 1/Req = 1/1 + 1/1 + 1/1 = 3, so Req = 1/3 Ω; correct.

C. The SERIES equivalent of three 1 Ω resistors, not the parallel equivalent.

D. The parallel equivalent of three 1.5 Ω resistors, or of two 1 Ω resistors in series with one

ot this circuit. (The circuit description is carried in the stem as fetched; no diagram appears in the fetched text.)

Question 114 Physics

If electric field intensity between capacitor plates doubles, energy stored becomes:

- A. Double
- B. One half
- C. One Fourth
- D. Quadruple ✓ **Correct answer**

A. Would follow if energy were linear in field/voltage; it is quadratic.

B. The reciprocal error: doubling the field cannot reduce the stored energy.

C. The factor for HALVING the field, not doubling it.

D. $U = \frac{1}{2}CV^2$ and $E \propto V$, so $U \propto E^2$; doubling E multiplies U by $2^2 = 4$; correct.

Question 115 Physics

Horizontal range of projectile will be maximum when:

- A. $\sin\theta = 1/2$
- B. $\sin 2\theta = 1$ ✓ **Correct answer**
- C. $\sin\theta = 0$
- D. $\sin 2\theta = 0$

A. $\theta = 30°$, giving $R = (u^2/g)\sin 60° \approx 0.866$ of maximum, not the maximum.

B. $R = (u^2 \sin 2\theta)/g$ is maximal when $\sin 2\theta = 1$ ($2\theta = 90°$, $\theta = 45°$); correct.

C. $\theta = 0°$: the projectile is launched horizontally along the ground, range zero.

D. $2\theta = 0°$ or $180°$ ($\theta = 0°$ or $90°$): zero range in both cases (along the ground, or straight up).

116 Physics

How many degrees in 2π/5 radians?

- A. 80°
- B. 50°
- C. 72° ✓ **Correct answer**
- D. 20°

A. Corresponds to (4π/9) rad, not 2π/5.

B. Corresponds to (5π/18) rad; a misconversion.

C. (2π/5) × (180°/π) = 360°/5 = 72°; correct.

D. Corresponds to (π/9) rad; far too small.

Question 117 Physics

A transformer uses 220V line and delivers 22A at 1800V. Current drawn from line (100% efficiency)?

- A. 22A
- B. 180A ✓ **Correct answer**
- C. 200A
- D. 50A

A. The secondary current, mistaken for the primary current; a step-up transformer draws MORE current than it delivers.

B. At 100% efficiency, input power = output power: VpIp = VsIs, so Ip = (1800 × 22)/220 = 39,600/220 = 180 A; correct.

C. No power calculation gives 200 A from these numbers.

D. No valid power/turns calculation gives 50 A.

118 Physics

For rectification, transformer used is:

- A. With low input voltage
- B. With low input resistance
- C. Step up
- D. Step down ✓ **Correct answer**

A. The input is the mains (220 V); the transformer does not change the input voltage, it changes the voltage delivered to the rectifier.

B. Input resistance is not the property that selects a rectifier transformer.

C. Step-up transformers are used where HIGH voltage is needed (e.g. X-ray/CRT supplies), not for ordinary low-voltage rectified supplies.

D. Standard practice: the mains voltage is stepped DOWN to a lower, safer AC voltage before rectification to DC; correct for the low-voltage supplies this textbook context assumes. (Step-up rectification exists for high-voltage applications, but it is not the convention this question tests.)

Question 119 Physics

One rem is equal to:

- A. 0.01 Gy / RBE
- B. 0.01 Gy × RBE ✓ **Correct answer**
- C. 0.01 RBE
- D. 0.01 Gy

A. Divides by the quality factor; dose equivalent MULTIPLIES absorbed dose by the factor, it does not divide.

B. 1 rad = 0.01 Gy, and dose equivalent (rem) = absorbed dose (rad) × RBE/quality factor, so 1 rem = 0.01 Gy × RBE; correct.

gray unit entirely, dimensionally incomplete.

D. That is 1 rad (absorbed dose), not 1 rem; it omits the biological-effectiveness factor that distinguishes rem from rad.

Question 120 Physics

1 rad is equal to:

- A. 0.01 J/Kg ✓ **Correct answer**
- B. 0.01 Kg/J
- C. 0.01 J
- D. 0.01 Kg

A. 1 gray = 1 J/kg, and 1 rad = 0.01 Gy = 0.01 J/kg; correct.

B. The reciprocal units (kg per joule); absorbed dose is energy PER mass, not mass per energy.

C. Energy alone, without the per-kilogram: dose is energy absorbed per unit mass.

D. A mass alone; not a dose at all.

Question 121 Physics

60 kg man absorbs lethal dose of 200 rem with RBE factor of 10. Energy absorbed is:

- A. 9J
- B. 8J
- C. 10J
- D. 12J ✓ **Correct answer**

A. No valid step in the rem→rad→energy chain gives 9 J.

B. No valid step gives 8 J.

C. The RBE factor itself, mistaken for the energy.

× RBE, so rad = 200/10 = 20 rad; 20 rad × 0.01 J/kg = 0.2 J/kg; × 60 kg = 12 J; correct.

Question 123 Physics

Each person experiences background radiation dose in one year:

- A. 1mSv ✓ **Correct answer**
- B. 1mGy
- C. 1Gy
- D. 1Sv

A. The figure used in this textbook context for the annual background/public dose (1 mSv per year); the keyed answer. Flagged: measured average natural background worldwide is higher (about 2–3 mSv/year, varying with location); 1 mSv/year is the conventional/public-limit figure the paper uses, so the answer rests on that convention.

B. A milligray is an absorbed-dose unit; the dose-equivalent figure for background is quoted in sieverts, and 1 mGy ≠ 1 mSv in general (they coincide only for a quality factor of 1).

C. A thousand times the stated figure; a whole-body dose of 1 Gy in a year would be a serious exposure, not background.

D. A thousand times the stated figure; 1 Sv/year is far above background and above annual occupational limits.

Question 124 Physics

The wire of mass m carries current I in a uniform magnetic field B at right angles. Force on wire:

- A. 50 N ✓ **Correct answer**
- B. 25 N
- C. 10 N

A. The answer: the mdcatpapers.com marked answer and the second reproduction's key (PDF Q135) agree on stem, options and answer — two independent sources agree on 50 N.

B. Half the keyed value; no source supports it.

C. No source supports it.

D. No source supports it.

Note: Note (kept openly): the B/I/L values are not visible in either text extraction — they presumably stood in a diagram in the original paper — and the PDF key asserts the result "with the given values" without reproducing them. The force on a straight wire at right angles to a uniform field is F = BIL (the mass m is irrelevant to that force), but no worked numbers are presented here because they were never recovered; the verification rests on the two sources' agreement on the answer, as the nearest-papers second-reproduction addendum (8 Nov 2026) records. Do not present this as a worked numerical example.

Question 125 English

The plane ought to be taking off in a minute. The underlined word 'ought to' is:

- A. Linking verb
- B. Modal auxiliary ✓ **Correct answer**
- C. Helping verb
- D. Finite verb

A. A linking verb (be, seem, become) joins a subject to a complement; "ought to" does not do that.

B. "Ought to" expresses duty/expectation and combines with the main verb phrase ("be taking off"), exactly the modal-auxiliary class (can, should, must, ought to); correct on the paper's classification. Flagged: in broad grammar "modal auxiliary" is a KIND of helping

the genus term, the answer rests on this syllabus's distinction between modal auxiliaries and primary helping verbs (be/have/do).

C. In this paper's narrow usage, "helping verb" means a primary auxiliary (be/have/do); "ought to" is classified as modal, not primary, so it is not the keyed class.

D. "Ought to" is not the finite main verb of the clause; the finite verb phrase is headed by "ought" + "be", and "finite" does not identify its modal class.

Question 126 English

After heavy rain, the sky grew dark. The underlined verb 'grew' is:

- A. Non-Finite
- B. Transitive
- C. Di-transitive
- D. Linking ✓ **Correct answer**

A. "Grew" is the past-tense finite form; a non-finite form would be "growing" or "to grow".

B. A transitive verb takes a direct object; "grew" takes no object here — "dark" is a complement, not an object acted on.

C. Requires two objects (indirect + direct); "grew" has neither.

D. "Grew" means "became" and links the subject "sky" to the subject complement "dark"; a linking (copular) verb; correct.

Question 127 English

His courage earned him honour. The underlined verb 'earned' is:

- A. Intransitive
- B. Di-transitive ✓ **Correct answer**
- C. Complex transitive
- D. Linking

takes objects here, an intransitive verb takes none.

B. "Earned" takes TWO objects: the indirect object "him" and the direct object "honour"; correct.

C. A complex-transitive verb takes an object PLUS an object complement (e.g. "They elected him president"); "honour" is a second object, not a complement describing "him".

D. "Earned" is an action verb, not a copular verb joining subject and complement.

Question 128 English

The teacher assigned the students an assignment to be completed during vacation. The underlined verb 'assigned' is:

- A. Mono-transitive
- B. Di-transitive ✓ **Correct answer**
- C. Complex transitive
- D. Intransitive

A. Takes only one object; "assigned" here takes two ("the students" and "an assignment").

B. "Assigned" takes an indirect object ("the students") and a direct object ("an assignment"); correct.

C. Requires an object complement; "an assignment" is a direct object, not a complement describing "the students".

D. Takes no object; plainly false here.

Question 129 English

Of two evils choose the less. The sentence contains an adjective that is:

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

- D. Distributive

A. "Less" is the comparative degree of "little"; it compares exactly TWO evils, which is the comparative's domain (superlative "least" would compare three or more); correct.

B. The positive degree is "little"; "less" is its comparative form.

C. A numeral adjective expresses number (one, two, first); "less" expresses degree of comparison, not a number.

D. A distributive adjective (each, every, either) refers to members of a group singly; "less" does not.

Question 130 English

This is the very thing we want. The underlined word 'very' is a/an:

- A. Emphatic pronoun
- B. Emphasizing adjective ✓ **Correct answer**
- C. Reflexive pronoun
- D. Exclamatory adjective

A. An emphatic pronoun is a -self form (myself, himself) used for emphasis; "very" is not a pronoun at all.

B. "Very" stands before the noun "thing" and intensifies/emphasises it ("the very thing" = the exact thing); an emphasizing (intensifying) adjective; correct.

C. A reflexive pronoun (-self form) reflects the action back on the subject; "very" is not one.

D. "What" in exclamations ("What a day!") is exclamatory; "very" here is not exclamatory.

Question 131 English

Don't be in such a hurry. The sentence contains an adjective of:

- B. Distributive
- C. Quantity ✓ **Correct answer**
- D. Demonstrative

A. An adjective of number answers "how many" (two, several); "such" does not count anything.

B. Distributive adjectives (each, every, either, neither) single out members of a group; "such" does not.

C. In this paper's traditional classification, "such" in "such a hurry" expresses DEGREE/amount (how much hurry) and is classed as an adjective of quantity; the keyed answer. Flagged: "such" is also defensible as a demonstrative adjective ("of that kind/degree") in other classifications; the answer rests on the paper's quantity convention.

D. Demonstratives (this, that, these, those) point to specific things; "such" points to a kind/degree rather than a specific referent, and the paper keys it under quantity, not demonstration.

Question 132 English

Fill in blank with Past Perfect Continuous: He _____ home from work regularly since he joined his office.

- A. Had walked
- B. Had been walking ✓ **Correct answer**
- C. Walked
- D. Has been walking

A. Past perfect SIMPLE, not continuous; the stem explicitly requires the past perfect continuous.

B. "Had been" + present participle is the past perfect continuous, for an action that had been going on regularly since the past starting point (joining the office) up to a later past

orrect as the form the stem asks for.

C. Simple past; it does not give the continuous "had been walking" form and does not pair with "since" for duration in this frame.

D. Present perfect continuous; the right aspect but the wrong tense for the form the stem asks for (past perfect).

Question 133 English

All desire wealth and some acquire it. The sentence exemplifies _____ tense.

- A. Present indefinite ✓ **Correct answer**
- B. Past indefinite
- C. Present perfect
- D. Simple future

A. "Desire" and "acquire" are simple-present forms stating a general truth/habit; the present indefinite (simple present); correct.

B. Would need past forms ("desired", "acquired"); the verbs are present.

C. Would need have/has + past participle ("have desired"); absent here.

D. Would need will/shall + base verb; absent here. (This sentence is repeated, in a different question form, at Q137; both are written as printed, not merged.)

Question 134 English

If I were a doctor, I would serve humanity. The sentence is an example of _____ conditional.

- A. Zero
- B. Type I
- C. Type II ✓ **Correct answer**
- D. Type III

itional states general truths with present simple in both clauses ("If you heat ice, it melts"); this is a hypothetical, not a general truth.

B. Type I is a real/likely present–future condition ("If I am..., I will..."); "were... would" is unreal, not Type I.

C. Unreal/hypothetical present: past-subjunctive "were" in the if-clause + "would" + base verb in the main clause; correct.

D. Type III is unreal PAST ("If I had been..., I would have..."); this sentence is about a present hypothetical, not the past.

Question 135 English

Choose the sentence which is correctly structured:

- A. If we had found him earlier, we could have saved his life. ✓ **Correct answer**
- B. If we had found him earlier, we have saved his life.
- C. If we had found him earlier, we had saved his life.
- D. If we had found him earlier, we could save his life.

A. Correct Type III (past unreal) structure: past perfect in the if-clause + perfect conditional ("could have saved") in the main clause; correct.

B. "Have saved" (present perfect) cannot pair with a past-unreal if-clause; the consequence belongs in the past, not the present.

C. "Had saved" in the main clause states a fact about the past, contradicting the unreal condition; the conditional perfect is required.

D. Mixes a past-unreal condition with a present/future consequence ("could save"); Type III requires "could have saved".

136 English

Choose the sentence with correct Past Perfect Continuous usage:

- A. He had walked home since joining
- B. He had been walking home since he joined ✓ **Correct answer**
- C. He walked home since joining
- D. He has been walking home since joining

A. Past perfect simple, not continuous; wrong aspect for the task.

B. "Had been walking" is the past perfect continuous, with "since he joined" giving the past starting point; correct.

C. Simple past; wrong tense/aspect, and "since joining" does not carry the duration the continuous form expresses.

D. Present perfect continuous; correct aspect but present, not past, tense — wrong for a past-perfect-continuous task. (This sentence repeats Q132's sentence in a different question form; both are written as printed, not merged.)

Question 137 English

All desire wealth and some _____ it — which tense?

- A. Present Indefinite ✓ **Correct answer**
- B. Present Continuous
- C. Present Perfect
- D. Past Indefinite

A. The sentence states a general truth in the simple present (as in Q133, "All desire wealth and some acquire it"); the tense is the present indefinite; correct.

B. Would need be + -ing ("are desiring"); the sentence uses simple-present verb forms for a general statement.

ed have/has + past participle, absent.

D. Would need past-tense verbs; the verbs are present. (Defect: the source page's explanation for this item cross-refers to "question 145", a number that does not exist in this 137-question transcription; the item is written as printed, and its duplicate relationship to Q133 is recorded, not merged.)

Question 138 Biology

Follow the route of pepsinogen secreted by zymogen cells:

- A. SER → RER → Golgi complex → Secretory vesicles
- B. SER → Mitochondria → Golgi complex → Secretory vesicles
- C. RER → SER → Golgi complex → Secretory vesicles ✓ **Correct answer**
- D. Golgi complex → RER → SER → Secretory vesicles

A. Starts at the wrong organelle: secretory proteins are synthesised on the rough ER, not the smooth ER, so a route beginning at the SER cannot be right.

B. Wrong twice over: it starts at the SER and routes through mitochondria, which play no part in the secretory pathway.

C. The keyed answer: synthesis on RER ribosomes, packaging in the Golgi complex, release in secretory vesicles — the only option with the correct start (RER) and the correct end (secretory vesicles). Caveat (kept openly): the SER is not part of the protein secretory route — proteins travel from the RER to the Golgi in transport vesicles — so C is the closest listed option, not a literal itinerary; the second reproduction's key (PDF Q2) is C.

D. Backwards: the Golgi comes after the RER in the pathway, not before it.

Note: RECOVERED: this question was omitted from the mdcatpapers.com transcription and is recovered here from the second reproduction (mdcatguide NUMS 2024 PDF, PDF Q2).

139 Biology

Sucrose is used as a transport carbohydrate instead of glucose because:

- A. It is a disaccharide
- B. It is non-reducing sugar
- C. It is soluble in water
- D. It does not change osmotic potential of water ✓ **Correct answer**

A. True of sucrose, but being a disaccharide is not itself the reason it is chosen for transport; many disaccharides are not transport sugars.

B. True and relevant (a non-reducing sugar does not react with other molecules in transit), but it is a property, not the transport reason the stem asks for.

C. True, and necessary for phloem transport, but glucose is also soluble; solubility alone does not distinguish sucrose.

D. The keyed reason: sucrose carries two hexose units per osmotic particle and does not significantly alter the osmotic potential of the phloem sap during transport, so large amounts can be moved without disturbing water balance; the second reproduction's key (PDF Q4) is D.

Note: RECOVERED: this question was omitted from the mdcatpapers.com transcription and is recovered here from the second reproduction (mdcatguide NUMS 2024 PDF, PDF Q4).

Question 140 Biology

Corona Virus is enveloped virus. Hand sanitizers and surface cleaners were recommended to avoid covid epidemic. Which property of corona virus made these products effective?

- A. pH Sensitivity ✓ **Correct answer**
- B. Heat sensitivity

NA genome

- D. Hypotonicity

A. The keyed answer: the coronavirus envelope (a lipid bilayer with embedded proteins) is sensitive to pH changes and to detergents/surfactants, so alcohol-based sanitisers and soaps disrupt it and destroy the virus. Caveat (kept openly): the operative property is the lipid envelope's susceptibility to surfactants and alcohol; "pH sensitivity" is the listed proxy for that envelope fragility, and it is the only option that points at the envelope at all.

B. Sanitisers and surface cleaners do not work by heat; heat is not the property these products exploit.

C. The genome type (single-stranded RNA) is inside the envelope and is not what sanitisers attack.

D. Hypotonicity describes a solution's tonicity relative to a cell; it is not a property of the virus that sanitisers exploit.

Note: RECOVERED: this question was omitted from the mdcatpapers.com transcription and is recovered here from the second reproduction (mdcatguide NUMS 2024 PDF, PDF Q5).

Question 142 Biology

A lizard detaches its tail when attacked by a predator. This is an example of:

- A. Autophagy
- B. Autolysis ✓ **Correct answer**
- C. Phagocytosis
- D. Intracellular digestion

A. Self-eating of a cell's own worn-out parts (e.g. old organelles) for recycling; it does not detach a tail at a fracture plane.

B. The keyed answer: autotomy (tail detachment) is effected by autolysis — self-digestion

t the pre-formed fracture plane by lysosomal enzymes, letting the tail separate cleanly so the lizard escapes; the second reproduction's key (PDF Q44) is B. Note: the phenomenon is called autotomy; autolysis is the mechanism the options offer.

C. Engulfing of solid particles (e.g. bacteria) by a cell; not the mechanism of tail separation.

D. Digestion inside a cell (e.g. in a food vacuole); a general process, not the specific mechanism that severs the tail.

Note: RECOVERED: this question was omitted from the mdcatpapers.com transcription and is recovered here from the second reproduction (mdcatguide NUMS 2024 PDF, PDF Q44).

Question 143 Chemistry

Identify hybridization of nitrogen in molecule with benzene ring having -N=NCl group:

- A. sp ✓ **Correct answer**
- B. sp2
- C. sp3
- D. dsp2

A. The keyed answer: the –N=NCl group is a benzenediazonium group (Ph–N≡N^+ Cl^-), whose nitrogen is linear and sp hybridised, like a nitrile nitrogen; the second reproduction's key (PDF Q82) is A.

B. The hybridisation of a trigonal-planar nitrogen (as in an ordinary azo –N=N– or an amine), not of the linear diazonium nitrogen.

C. The hybridisation of a tetrahedral nitrogen (as in ammonia/amines); the diazonium nitrogen is linear, not tetrahedral.

D. A square-planar hybridisation used for some transition-metal complexes, not for nitrogen in this group.

/ERED: this question was omitted from the mdcatpapers.com transcription and is recovered here from the second reproduction (mdcatguide NUMS 2024 PDF, PDF Q82).

Question 148 Physics

$^{18}F \rightarrow {}^{18}O + x + y + Q$. Identify x and y:

- A. x = e^-, y = antineutrino
- B. x = e^-, y = neutrino
- C. x = e^-, y = γ
- D. x = β^+, y = neutrino ✓ **Correct answer**

A. The second reproduction's key, but it is wrong: β^- decay (n → p + e^- + antineutrino) would RAISE the atomic number, giving ^{18}Ne (Z = 10), not ^{18}O (Z = 8).

B. Wrong particle: an electron is emitted in β^- decay, which cannot produce ^{18}O from ^{18}F.

C. Wrong on both counts: no electron is emitted, and a gamma photon alone does not balance the decay.

D. The correct answer: ^{18}F is the classic positron emitter (PET scans) — $^{18}F \rightarrow {}^{18}O + e^+ + \nu_e$, a β^+ decay in which a proton converts to a neutron, emitting a positron and an electron neutrino (Vaia textbook problem: "$^{18}F \rightarrow {}^{18}O + e^+ + \nu e$"; BenchChem: positron emission ~97% + neutrino). The PDF key A is corrected to D on that evidence.

Note: RECOVERED: this question was omitted from the mdcatpapers.com transcription and is recovered here from the second reproduction (mdcatguide NUMS 2024 PDF, PDF Q129). KEY CORRECTION: the PDF key A (beta-minus decay) is wrong — beta-minus decay of 18F would give 18Ne, not 18O; 18F undergoes beta-plus decay to 18O + e+ + neutrino, answer D.

Question 149 English

Are there any mango trees in this garden? The underlined word 'any' is:

ective of quantity

- B. Adjective of number ✓ **Correct answer**
- C. Indefinite pronoun
- D. Reciprocal pronoun

A. An adjective of quantity answers "how much" for uncountable things (much, little, some milk); "any" here modifies the countable noun "mango trees", so it is not quantity.

B. The keyed answer: "any" modifies the countable plural noun "mango trees" in a question and functions as an indefinite numeral adjective — an adjective of number; the second reproduction's key (PDF Q141) is B.

C. "Any" is a pronoun only when it stands alone (e.g. "Is any left?"); here it stands before the noun "mango trees", so it is an adjective, not a pronoun.

D. Reciprocal pronouns are "each other" / "one another"; "any" is not one.

Note: RECOVERED: this question was omitted from the mdcatpapers.com transcription and is recovered here from the second reproduction (mdcatguide NUMS 2024 PDF, PDF Q141).

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