NUMS MDCAT — 2022 · Solved Past Paper

Body: National University of Medical Sciences (NUMS) · **Exam:** MDCAT (Medical & Dental College Admission Test), national (separate test) · **Year:** 2022 · **Questions:** 150 in the original paper — **148 solved and verified**, 2 excluded as defective · **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. Answers are as of the 2022 sitting.

Source note: Fold 8 Nov 2026: the true total is 150, not 144 — NUMS MDCAT 2022 Part A is 150 one-best-option MCQs in 150 minutes (Biology 55, Chemistry 40, Physics 40, English 15; no negative marking), per the NUMS notice as quoted by the pattern pages and the PDF header, and the recovered split of this file is Biology 55, Physics 40, English 15, Chemistry 40 = 150. The 6 questions missing from the mdcatpapers transcription (PDF Q8/Q19/Q32/Q109/Q118/Q126) were recovered from the second reproduction and verified from independent reference facts. Key corrections (Q64 A->C, Q84 C->D, Q85 D->B, Q88 B->C, Q91 C->B, plus Q71/Q93/Q96/Q109/Q139 already folded) rest on the PDF key + a derivation or reference fact; the 9 SINGLE-SOURCE items were promoted on the PDF key + an independent source each. Q79 and Q136 are DEFECTIVE-excluded (no correct option / two true options). All decisions by the assistant under the owner's 8 Nov 2026 delegation. The mdcatpapers transcription is the primary source; its garbling is disclosed, not hidden. The exam date (16 Oct 2022, reported by the pattern pages) is not printed as a paper date because no official source states it.

Excluded as defective (2) — no answer is taught for these:

Q79 (PDF 82): No correct option as printed: H = R needs tan θ = 4, i.e. θ ≈ 76°, and no listed option is 76°; the PDF key's 70° is only the closest listed angle. A key cannot make a factually wrong value right (PDF Q82).

Q136 (PDF 142): Two options are both true as printed: the rate of a reaction depends on

AND on concentration (the rate law, rate = $k[A]^m[B]^n$); the stem says 'depends upon' with no 'most' or 'only', so no unique answer exists. The PDF key A cannot remove B's truth (PDF Q142).

Question Q1 (PDF 1) Biology

Which organelle would be more abundant in the se-cretory cell than the non-secretory cell:

- A. Lysosome
- B. Golgi complex ✓ **Correct answer**
- C. Vacuole
- D. Centrioles

A. Lysosomes digest material inside the cell; they are not the packaging organelle whose abundance marks a secretory cell.

B. Secretory cells make, modify, sort and package large amounts of material for export, and the Golgi complex does that packaging; it is characteristically abundant in them; correct.

C. Vacuoles store water and solutes (large in plant cells); they do not package secretory products.

D. Centrioles organise the spindle in cell division; they have no secretory packaging role. (Stem misprint as fetched: "se-cretory" for secretory; meaning unaffected.)

Question Q2 (PDF 2) Biology

The structure which disappeared during cell division is:

- A. Vacuole
- B. Lysosome
- C. Nucleus ✓ **Correct answer**
- D. Endoplasmic reticulum

persist as membrane-bound compartments through division; they do not vanish.

B. Lysosomes remain present as cytoplasmic organelles during division.

C. In mitosis the nuclear envelope breaks down and the nucleus is no longer visible as an intact structure, so it is described as disappearing; correct.

D. The ER fragments into vesicles during mitosis but its membranes persist; it does not disappear as a structure.

Question Q3 (PDF 3) Biology

The enzyme ATP synthase is located on the mem-brane of the organelle:

- A. Nucleus
- B. Mitochondria ✓ **Correct answer**
- C. Lysosome
- D. Vacuole

A. The nuclear membrane carries pores and the envelope, not ATP synthase.

B. ATP synthase sits in the inner mitochondrial membrane, where the proton gradient drives ATP formation in oxidative phosphorylation; correct.

C. Lysosomes contain hydrolytic enzymes for digestion, not ATP synthase.

D. Vacuoles store and maintain turgor; they do not carry ATP synthase. (Stem misprint as fetched: "mem-brane" for membrane.)

Question Q4 (PDF 4) Biology

------ are spherical sacs surrounded by a single membrane and containing hydrolytic enzymes:

- A. Mitochondria

- C. Lysosome ✓ **Correct answer**
- D. Chloroplast

A. Double-membraned, rod-shaped energy organelles with cristae; not single-membrane digestive sacs.

B. Stacks of flattened cisternae that modify and package; not spherical hydrolytic sacs.

C. Single-membrane spherical sacs filled with acid hydrolases for intracellular digestion; correct.

D. Double-membraned, green, photosynthetic organelles; not digestive sacs.

Question Q5 (PDF 5) Biology

Except during nuclear division, the nucleus has the chromosome in a loosely coiled state known as:

- A. Genes
- B. Ribosomes
- C. DNA
- D. Chromatin ✓ **Correct answer**

A. Genes are units of heredity carried on DNA, not the name of the loosely coiled state.

B. Ribosomes are protein-synthesis organelles in the cytoplasm; unrelated to chromosome coiling.

C. DNA is the molecule the chromosome is made of, but the loosely coiled structural state itself is not called DNA.

D. The decondensed, loosely coiled DNA–protein complex present between divisions, allowing transcription and replication; correct.

Q6 (PDF 6) Biology

Within the nucleus ------ are made by the nucleolus:

- A. Ribosomes ✓ **Correct answer**
- B. mRNA
- C. Protein
- D. Enzymes

A. The nucleolus synthesises ribosomal RNA and assembles ribosomal subunits, i.e. it makes ribosomes; correct.

B. Messenger RNA is transcribed from DNA by RNA polymerase in the nucleoplasm, not made by the nucleolus.

C. Proteins are synthesised by ribosomes in the cytoplasm, not by the nucleolus.

D. Enzymes are proteins; they are made at ribosomes, not by the nucleolus itself.

Question Q7 (PDF 7) Biology

Which of the following is correct for the cell wall:

- A. Semi-permeable
- B. Differentially permeable
- C. Permeable ✓ **Correct answer**
- D. Not permeable

A. Semi-permeability (allowing some substances through selectively) describes the plasma membrane, not the cell wall.

B. Differential/selective permeability is the plasma membrane's property; the wall does not select in this way.

C. The (plant) cell wall freely lets water and most solutes pass to the membrane; correct on the textbook convention.

er and solutes cross the wall readily; it is not a barrier.

Question 8 — recovered from the second reproduction Biology

Why is it said that plasma membrane is asymmetrical?

- A. proteins are not fixed at their position
- B. hydrophobic tail facing inward and hydrophilic head facing outward
- C. the two surfaces and halves are not identical ✓ **Correct answer**
- D. cholesterol molecules are only present inside

A. Membrane proteins do move laterally (fluid mosaic), but that is fluidity, not what makes the membrane asymmetrical.

B. That describes the orientation of phospholipids in the bilayer (tails in, heads out on both leaflets); it is true of the bilayer's construction, not the reason it is called asymmetrical.

C. The two leaflets differ in composition: different lipids, proteins and carbohydrates are distributed unequally between the inner and outer surfaces (e.g. carbohydrates only on the exterior); correct.

D. Cholesterol is present in both leaflets (enriched outside in many cells); it is not "only inside". VERIFIED: the second reproduction (PDF Q8) keys C; LibreTexts (Membrane Asymmetry): "The two surfaces of biological membrane are not exactly similar in their composition"; PrepGo: "The two layers (leaflets) of the membrane are not identical." Recovered from the PDF (absent from the mdcatpapers transcription); stem and options as printed in the PDF.

Note: RECOVERED QUESTION: absent from the mdcatpapers transcription; recovered from the second reproduction (educationinkarachi PDF Q8) and verified 8 Nov 2026 from the PDF key + an independent reference fact. See the question's verification note in the reviewed file.

Q8 (PDF 9) Biology

Cell membrane also contain through which movement of materials take place by active and passive transport:

- A. Lipid
- B. Corner
- C. Charge pores ✓ **Correct answer**
- D. Carbohydrates

A. Lipids form the bilayer itself, but the stem is about structures through which materials move, not the bilayer fabric.

B. As printed, "Corner" is not a recognised membrane term; it is evidently a misprint (compare NUMS 2023 Q89, "Corner Proteins", evidently for carrier proteins, which DO mediate transport) — see flag below.

C. Channel/pore proteins in the membrane let charged particles and other substances cross by passive and (with pumps) active transport; the keyed answer.

D. Membrane carbohydrates form the glycocalyx for recognition and identity; they are not transport structures. VERIFIED 8 Nov 2026: the second reproduction (PDF Q9) prints the clean stem with option B "carrier" (exposing the file's "Corner" as a misprint) and keys C; LibreTexts Biology 5.5 confirms channel/pore proteins as the transport structures ("Channel proteins form hydrophilic pathways through which selected ions or water move down an existing gradient"; "channels (sometimes called pores)"). (Stem ungrammatical as printed; option B a misprint — meaning unaffected.)

Question Q9 (PDF 10) Biology

The part of plasma membrane controls the fluidity of the membrane:

- A. Glycoprotein
- B. Carrier protein
- C. Lipid ✓ **Correct answer**

bohydrates

A. Glycoproteins serve as receptors and cell-surface markers; they do not set fluidity.

B. Carrier proteins transport substances across the membrane; they do not control its fluidity.

C. The phospholipid composition, including cholesterol (a lipid) and fatty-acid saturation, controls how fluid the bilayer is; correct.

D. Carbohydrates on the membrane surface are recognition markers; they do not control fluidity.

Question Q10 (PDF 11) Biology

A group of ribosomes attached to mRNA is known as a polysome and the attachment is controlled by:

- A. Na+ ions
- B. Mg++ ions ✓ **Correct answer**
- C. Ca++ ions
- D. K+ ions

A. Sodium ions set osmotic balance and nerve impulses; they do not control ribosome attachment to mRNA.

B. Mg^{2+} stabilises ribosome structure and the association of ribosomal subunits with mRNA in polysomes; correct.

C. Calcium ions act in signalling, muscle contraction and blood clotting, not in polysome attachment.

D. Potassium ions are the main intracellular cation for osmotic and electrical balance, not the polysome control ion.

Q11 (PDF 12) Biology

An automatic, involuntary response to any change, external or internal is called:

- A. Reflex ✓ **Correct answer**
- B. Instinct
- C. Taxis
- D. Tropism

A. A reflex action is a rapid, automatic, involuntary response to a stimulus, e.g. the knee-jerk; correct.

B. An instinct is a complex innate behaviour pattern, not a single automatic response to a change.

C. Taxis is directed locomotor movement towards or away from a stimulus (e.g. phototaxis), not an involuntary reflex response.

D. Tropism is a directional growth response in plants (e.g. phototropism), not an animal reflex.

Question Q12 (PDF 13) Biology

Resting membrane potential measures:

- A. -70 mv ✓ **Correct answer**
- B. -70 Volt
- C. 70 mv
- D. -90 mv

A. The textbook resting potential of a typical neuron is about −70 mV (inside negative relative to outside); correct.

B. A thousand times too large and the wrong scale: −70 V across a membrane is physically impossible for a resting cell.

n. the inside is negative at rest, not positive.

D. About the potassium equilibrium potential, not the usual quoted resting potential of the neuron; the textbook value keyed here is −70 mV.

Question Q13 (PDF 14) Biology

Touch receptors are

- A. Paccinian's corpuscles
- B. Olfactory receptors
- C. Miessner's corpuscles ✓ **Correct answer**
- D. Nociceptors

A. Pacinian corpuscles detect deep pressure and vibration, not light touch.

B. Olfactory receptors detect smell, not touch.

C. Meissner's corpuscles in the skin detect light touch; correct (option prints "Miessner's" for Meissner's).

D. Nociceptors detect pain (harmful stimuli), not touch.

Question Q14 (PDF 15) Biology

Which one is NOT a function of the large intestine:

- A. Absorption of electrolytes
- B. Absorption of water
- C. Production of vitamins
- D. Absorption of amino acids ✓ **Correct answer**

A. The large intestine does absorb electrolytes (e.g. Na^+, Cl^-), so this IS a function.

B. The large intestine's main absorptive job is reclaiming water from undigested residue; this IS a function.

ria in the large intestine produce vitamins (e.g. vitamin K and some B vitamins), so this IS a (bacterial) function.

D. Amino acids are absorbed in the small intestine after protein digestion, not significantly in the large intestine; correct as the NOT-a-function option.

Question Q15 (PDF 16) Biology

The following part is common in both the digestive system and respiratory systems of human beings

- A. Trachea
- B. Pharynx ✓ **Correct answer**
- C. Larynx
- D. Oesophagus

A. The trachea (windpipe) carries air only; it is respiratory, not digestive.

B. The pharynx is the shared passage: air passes through it to the larynx and food passes through it to the oesophagus; correct.

C. The larynx is part of the airway only (voice box); food does not pass through it.

D. The oesophagus carries food only; it is digestive, not respiratory.

Question Q16 (PDF 17) Biology

Heartbeat is normally regulated by:

- A. Purkinje fibers
- B. AV bundle
- C. Sinoatrial node ✓ **Correct answer**
- D. Bundle of His

A. Purkinje fibres spread the impulse through the ventricles; they conduct, they do not set the rate.

node (bundle of His) conducts the impulse from atria to ventricles; it does not normally set the rate.

C. The SA node is the heart's primary pacemaker, initiating each beat and setting the rate; correct.

D. Same structure as the AV bundle; a conducting pathway, not the pacemaker.

Question Q17 (PDF 18) Biology

The method which helps in developing immunity against bacteria is:

- A. Radiotherapy
- B. Chemotherapy
- C. Vaccination ✓ **Correct answer**
- D. Antibiotics

A. Radiotherapy treats cancers with radiation; it does not develop immunity.

B. Chemotherapy treats disease (e.g. cancer) with drugs; it does not develop immunity.

C. Vaccination exposes the immune system to antigens so it develops lasting protective immunity; correct.

D. Antibiotics kill or inhibit bacteria during an infection but do not develop lasting immunity against them.

Question 19 — recovered from the second reproduction Biology

Normal gestation period in humans is about ____ days:

- A. 300–320
- B. 322–350
- C. 270–280 ✓ **Correct answer**
- D. 240–250

nd the normal range, a pregnancy lasting 300+ days is far post-term.

B. Far beyond any normal gestation; no human pregnancy normally lasts this long.

C. The standard figure: about 280 days (40 weeks) from the last menstrual period, about 270 days from conception; correct.

D. Too short: 240–250 days is about 34–36 weeks, preterm, not the normal period. VERIFIED: the second reproduction (PDF Q19) keys C; Testbook: "The normal pregnancy period in humans is approximately 280 days, which is equivalent to about 40 weeks"; LibreTexts (OpenStax): "A full-term pregnancy lasts approximately 270 days (approximately 38.5 weeks) from conception to birth." Recovered from the PDF (absent from the mdcatpapers transcription); stem and options as printed in the PDF.

Note: RECOVERED QUESTION: absent from the mdcatpapers transcription; recovered from the second reproduction (educationinkarachi PDF Q19) and verified 8 Nov 2026 from the PDF key + an independent reference fact. See the question's verification note in the reviewed file.

Question Q18 (PDF 20) Biology

During the menstrual cycle, after the female gamete is released from the ovary is ovulation, the remains of the follicle secrets:

- A. Progesterone ✓ **Correct answer**
- B. FSH
- C. LH
- D. Testosterone

A. After ovulation the follicle remnant becomes the corpus luteum, which secretes progesterone to prepare and maintain the uterine lining; correct.

B. Follicle-stimulating hormone is a pituitary hormone that matures the follicle before ovulation; it is not secreted by the follicle remnant.

g hormone is a pituitary hormone that triggers ovulation; it is not secreted by the follicle remnant.

D. Testosterone is the male androgen; it is not secreted by the ovarian follicle remnant. (Stem wording is garbled as printed — "the remains of the follicle secrets" — read as the corpus luteum secreting.)

Question Q19 (PDF 21) Biology

In the male reproductive system, the hormone involved in the regulation of the rate of spermatogenesis is called:

- A. Luteinizing hormone
- B. Follicle-stimulating hormone
- C. Testosterone
- D. Inhibin ✓ **Correct answer**

A. LH stimulates Leydig cells to make testosterone; it does not directly regulate the rate of spermatogenesis by feedback.

B. FSH stimulates Sertoli cells and spermatogenesis, but it is the hormone being regulated, not the feedback regulator named here.

C. Testosterone supports spermatogenesis, but it is not the feedback hormone that regulates its rate.

D. Inhibin, from Sertoli cells, feeds back to suppress FSH and thereby regulates the rate of spermatogenesis; the keyed answer. VERIFIED 8 Nov 2026: the second reproduction (PDF Q21) keys D; Lumen Learning (Biology for Majors II): "The Sertoli cells produce the hormone inhibin, which is released into the blood when the sperm count is too high. This inhibits the release of GnRH and FSH, which will cause spermatogenesis to slow down"; MDPI review: inhibin "exerts negative feedback on pituitary FSH secretion, thereby regulating follicular development and spermatogenesis". FSH and testosterone also regulate spermatogenesis in the looser sense — inhibin is the feedback regulator the

Question Q20 (PDF 22) Biology

Cervix is the part of:

- A. Vagina
- B. Oviduct
- C. Uterus ✓ **Correct answer**
- D. Ovary

A. The cervix opens INTO the vagina, but it is not part of the vagina; it is the neck of the uterus.

B. The oviduct (fallopian tube) carries the egg from the ovary; the cervix is not part of it.

C. The cervix is the lower, narrow neck of the uterus; correct.

D. The ovary produces eggs and hormones; the cervix is not part of it.

Question Q21 (PDF 23) Biology

Which of the following is most abundant in human body:

- A. Fibrous
- B. Hyaline ✓ **Correct answer**
- C. Elastic
- D. Flexible

A. Fibrocartilage (e.g. intervertebral discs) is strong but limited in distribution; not the most abundant.

B. Hyaline cartilage is the most widespread type (articular surfaces, nose, trachea, embryonic skeleton); correct. The stem omits the word "cartilage", supplied by the options.

tilage (e.g. ear pinna, epiglottis) is the least widespread of the three real types.

D. "Flexible" is not a recognised type of cartilage; a distractor.

Question Q22 (PDF 24) Biology

Which of the following is an example of a joint called suture:

- A. Intervertebral disc
- B. Skull bone ✓ **Correct answer**
- C. Costal cartilage
- D. Pubic symphysis

A. Intervertebral discs are cartilaginous joints between vertebrae, not sutures.

B. Sutures are the immovable fibrous joints between the bones of the skull; correct.

C. Costal cartilage joins ribs to the sternum (a cartilaginous joint), not a suture.

D. The pubic symphysis is a cartilaginous joint, not a suture.

Question Q23 (PDF 25) Biology

Which event does not occur during muscle contraction:

- A. I-band shorten
- B. A-band shortens ✓ **Correct answer**
- C. H-zone disappear
- D. Z-lines move closer

A. The I-band (thin filaments only) DOES shorten as the sarcomere shortens, so this event occurs.

B. The A-band is the length of the thick (myosin) filaments, which stays constant during contraction; it does not shorten; correct as the event that does NOT occur.

e (thick filaments only) narrows and may disappear as thin filaments slide in; this DOES occur.

D. Z-lines are pulled together as the sarcomere shortens; this DOES occur.

Question Q24 (PDF 26) Biology

Smooth muscles are long and spindle-shaped with nucleus ---- per cell:

- A. One ✓ **Correct answer**
- B. Two
- C. Three
- D. Many

A. A smooth muscle cell is spindle-shaped with a single central nucleus; correct.

B. Smooth muscle cells are uninucleate, not binucleate.

C. No smooth muscle cell carries three nuclei.

D. Many nuclei per cell describes skeletal muscle fibres, not smooth muscle.

Question Q25 (PDF 27) Biology

Blood group which is known as a universal donor is:

- A. A+ve
- B. O+ve
- C. AB+ve
- D. O-ve ✓ **Correct answer**

A. Group A red cells carry A antigens, so they cannot be given to all recipients.

B. O positive red cells lack A/B antigens but carry Rh(D), so they cannot be given to Rh-negative recipients.

C. AB positive is the universal RECIPIENT (plasma), not donor; its red cells carry both

D. O negative red cells lack A, B and Rh(D) antigens and can be transfused to recipients of any group; the textbook universal donor; correct.

Question Q26 (PDF 28) Biology

Which one can be considered as living characteristic of a virus:

- A. Can be crystallized
- B. No cellular respiration
- C. Mutate their genetic ✓ **Correct answer**
- D. Lack biosynthetic machinery

A. Crystallisation is a property of non-living chemicals, counting AGAINST viruses being alive.

B. Having no respiration is a non-living feature of viruses.

C. Viruses mutate and evolve their genetic material, a characteristic associated with living things; correct on the textbook convention.

D. Lacking their own protein-synthesis machinery is a non-living feature of viruses.

Question Q27 (PDF 29) Biology

A group of organisms with similar morphology and physiology, which can breed together to produce fertile offspring is called:

- A. Species ✓ **Correct answer**
- B. Domain
- C. Kingdom
- D. diversity

A. The biological species concept: a group that interbreeds and produces fertile offspring; correct.

is the highest taxonomic rank (Bacteria, Archaea, Eukarya), far above a breeding group.

C. A kingdom is a high taxonomic rank (e.g. Animalia), not a breeding group.

D. Diversity is a measure of variety, not a taxonomic group that breeds together.

Question Q28 (PDF 30) Biology

oxygen is available, the complete breakdown of glucose produces ----- ATP molecules in prokaryotes:

- A. 20
- B. 36
- C. 38 ✓ **Correct answer**
- D. 40

A. Far below any textbook yield for complete glucose oxidation; no accounting gives 20.

B. 36 is the classical textbook yield for EUKARYOTES (2 ATP spent transporting reducing equivalents into mitochondria), not prokaryotes.

C. Under the classical textbook accounting (glycolysis 8 + Krebs/ETC 30), prokaryotes, which have no mitochondrial transport cost, net 38 ATP per glucose; correct on that accounting.

D. Above the classical gross yield; no standard accounting gives 40 net ATP. (Stem as fetched begins mid-sentence, "oxygen is available" — read as "When oxygen is available..."; modern P/O-ratio accounting gives a lower yield, but the question uses the classical 38/36 convention, flagged here.)

Question Q29 (PDF 31) Biology

What are the products of light dependent reactions of photosynthesis?:

- A. ATP, RuBP and reduced NAD

, oxygen and reduced NADP ✓ **Correct answer**

- C. GP, oxygen and reduced NAD
- D. GP reduced NADP and RuBP

A. RuBP is a Calvin-cycle substrate (regenerated, not a light-reaction product) and NAD (not NADP) is the wrong coenzyme.

B. Photolysis of water releases O_2, the electron flow makes ATP, and $NADP^+$ is reduced to NADPH (reduced NADP); correct.

C. GP (glycerate-3-phosphate) is a Calvin-cycle intermediate, and reduced NAD is the wrong coenzyme.

D. Both GP and RuBP belong to the Calvin cycle, not to the light reactions.

Question 32 — recovered from the second reproduction Biology

In the process of photosynthesis water acts as:

- A. Proton acceptor
- B. electron donor ✓ **Correct answer**
- C. CO2 reducer
- D. CO2 acceptor

A. Water does not accept protons in photosynthesis; it is split and gives them up.

B. In photolysis, water is split in photosystem II and supplies the electrons that feed the electron transport chain; correct.

C. CO_2 is the substance reduced (it gains the electrons), not the reducer; water is the donor.

D. CO_2 is fixed by RuBP in the Calvin cycle; water is not a CO_2 acceptor. VERIFIED: the second reproduction (PDF Q32) keys B; "Water serves as the electron donor that powers the light-dependent reactions of photosynthesis" (photolysis in photosystem II).

on the PDF (absent from the mdcatpapers transcription); stem and options as printed in the PDF.

Note: RECOVERED QUESTION: absent from the mdcatpapers transcription; recovered from the second reproduction (educationinkarachi PDF Q32) and verified 8 Nov 2026 from the PDF key + an independent reference fact. See the question's verification note in the reviewed file.

Question Q30 (PDF 33) Biology

During photosynthesis, CO2 works as:

- A. Proton donor
- B. electron donor
- C. proton acceptor ✓ **Correct answer**
- D. source of O2

A. CO_2 does not donate protons in photosynthesis; water is the donor that is split.

B. Water donates the electrons (photolysis); CO_2 is the substance reduced, not the donor.

C. In the Calvin cycle CO_2 is reduced, gaining hydrogen/electrons (protons plus electrons); the keyed "acceptor" reading, best fit by elimination.

D. The O_2 released in photosynthesis comes from water, not from CO_2. VERIFIED 8 Nov 2026: the second reproduction (PDF Q33) keys C; Brainscape NUMS biology: "CO2 - proton acceptor — in light independent reaction (Calvin cycle), CO2 is fixed into glucose. during this process, CO2 accepts electrons & protons"; PNAS (Koroidov et al. 2014): bicarbonate "acts as a mobile proton acceptor" in photosynthetic water oxidation; a third reproduction (mdcat1.com NUMS 2022 p.8) lists the same item with "Proton acceptor" first. Strictly, CO_2 is an electron acceptor (it is reduced); "proton acceptor" is the paper's loose wording — the key + sources agree on C.

Q31 (PDF 34) Biology

End product of Calvin cycle is:

- A. 3-phosphoglycerate
- B. 1,3-biphosphoglycerate
- C. Glyceraldehyde-3-phosphate ✓ **Correct answer**
- D. Glucose

A. 3-phosphoglycerate (PGA) is the first stable intermediate after CO_2 fixation, not the cycle's end product.

B. 1,3-bisphosphoglycerate is a mid-cycle intermediate, reduced on the way to G3P.

C. G3P (triose phosphate) is the net 3-carbon product exported from the Calvin cycle; correct.

D. Glucose is made later, outside the cycle, by combining triose phosphates; it is not the cycle's direct end product.

Question Q32 (PDF 35) Biology

Which of the following molecule contains amino acid?:

- A. Cellulose
- B. Collagen ✓ **Correct answer**
- C. Sucrose
- D. Ascorbic acid

A. Cellulose is a polysaccharide of glucose units; it contains no amino acids.

B. Collagen is a fibrous protein built from amino acids (glycine, proline, hydroxyproline); correct.

C. Sucrose is a disaccharide (glucose + fructose); it contains no amino acids.

D. Ascorbic acid (vitamin C) is a small organic acid, not built from amino acids.

Q33 (PDF 36) Biology

Hydrolysis is the breakdown of polymer into its monomers by the addition of:

- A. Hydroxyl group
- B. Hydrogen
- C. Water ✓ **Correct answer**
- D. Nitrogen

A. Water supplies both H and OH across the broken bond; "hydroxyl group" alone is not what is added.

B. Hydrogen alone does not split the bond; the whole water molecule is consumed.

C. Hydrolysis (hydro- + -lysis) cleaves a bond by adding a water molecule, H to one fragment and OH to the other; correct.

D. Nitrogen plays no part in hydrolysis.

Question Q34 (PDF 37) Biology

Which of the following is not a carbohydrate:

- A. Glucose ($C_6H_{12}O_6$)
- B. Sucrose ($C_{12}H_{22}O_{11}$)
- C. Rhamnose ($C_6H_{12}O_5$)
- D. Lactic acid ($C_2H_4O_2$) ✓ **Correct answer**

A. Glucose is a monosaccharide carbohydrate.

B. Sucrose is a disaccharide carbohydrate.

C. Rhamnose is a deoxy sugar, a carbohydrate.

D. Lactic acid is an organic (hydroxy) acid, the product of anaerobic respiration, not a carbohydrate; correct. (Formula misprint as fetched: lactic acid is $C_3H_6O_3$, not $C_2H_4O_2$ — $C_2H_4O_2$ is acetic acid. The identity of the substance is clear and the misprint does not

nswer.)

Question Q35 (PDF 38) Biology

Due to its high heat of vaporization water plays important role in living organism as:

- A. Being an excellent solvent
- B. Cooling agent ✓ **Correct answer**
- C. Membrane stabilizer
- D. Thermal shock resistor

A. Water's solvent power comes from its polarity, not from its heat of vaporisation.

B. Evaporating water absorbs a large amount of heat, so sweating/transpiration cools the body; correct — this is the specific consequence of a high heat of vaporisation.

C. Not a role explained by heat of vaporisation.

D. Resistance to temperature change is water's high SPECIFIC HEAT, not its heat of vaporisation.

Question Q36 (PDF 39) Biology

Which molecules do not contribute to the formation of biological membranes?

- A. Glycoproteins
- B. Lipids
- C. Phospholipids
- D. Nucleoproteins ✓ **Correct answer**

A. Glycoproteins are membrane proteins with carbohydrate chains; they are membrane components.

B. Lipids (including cholesterol) are part of the membrane fabric.

C. Phospholipids form the bilayer itself, the membrane's foundation.

otems are protein–nucleic-acid complexes (e.g. in chromosomes/ribosomes); they are not membrane components; correct.

Question Q37 (PDF 40) Biology

Which of the following molecules would yield glucose and fructose on hydrolysis?

- A. Starch
- B. Maltose
- C. Sucrose ✓ **Correct answer**
- D. Lactose

A. Starch hydrolyses to many glucose units only.

B. Maltose hydrolyses to two glucose molecules.

C. Sucrose is glucose + fructose joined by a glycosidic bond, so hydrolysis yields one of each; correct.

D. Lactose hydrolyses to glucose + galactose, not fructose.

Question Q38 (PDF 41) Biology

The terminal ends of the chromosomes are called:

- A. Satellite
- B. Kinetochore
- C. Nucleolar organizer
- D. Telomere ✓ **Correct answer**

A. A satellite is a small chromosomal segment separated by a secondary constriction, not the chromosome end.

B. The kinetochore is the protein structure at the centromere where spindle fibres attach, not the end.

olar organiser region (NOR) is a chromosomal region carrying rRNA genes, not the terminal end.

D. Telomeres are the repetitive DNA caps at chromosome ends that protect them from shortening; correct.

Question Q39 (PDF 42) Biology

The gap between neurons at a synapse is:

- A. Synaptic knob
- B. Synaptic cleft ✓ **Correct answer**
- C. Synaptic delay
- D. Synaptic vesicle

A. The synaptic knob (bouton) is the swollen presynaptic terminal, a structure, not the gap.

B. The cleft is the small extracellular gap between the presynaptic and postsynaptic membranes; correct.

C. Synaptic delay is the TIME taken for transmission across the synapse, not a space.

D. Synaptic vesicles are the transmitter-containing sacs inside the presynaptic terminal, not the gap.

Question Q40 (PDF 43) Biology

The part of the brain which controls the body temperature in human beings is called:

- A. Thalamus
- B. Hypothalamus ✓ **Correct answer**
- C. Pones
- D. Cerebellum

A. The thalamus relays sensory information to the cortex; it is not the temperature-control centre.

halamus contains the thermoregulatory centre that holds body temperature at its set point; correct.

C. As printed, "Pones" is a misprint for pons, a brainstem relay structure; it does not control body temperature.

D. The cerebellum coordinates movement and balance, not temperature.

Question Q41 (PDF 44) Biology

A long extension of a nerve cell is called:

- A. Axon ✓ **Correct answer**
- B. Auxin
- C. Schwann cell
- D. Dendrites

A. The axon is the neuron's long fibre that carries impulses away from the cell body; correct.

B. Auxin is a plant growth hormone; a distractor with a similar sound.

C. Schwann cells are glial cells that myelinate axons; they are not the extension itself.

D. Dendrites are the (usually shorter, branched) processes that receive signals; they are not the long extension.

Question Q42 (PDF 45) Biology

Which is a steroid hormone?

- A. Cortisone ✓ **Correct answer**
- B. Adrenaline
- C. Insulin
- D. Thyroxin

is a corticosteroid, synthesised from cholesterol; correct.

B. Adrenaline (epinephrine) is an amine/catecholamine derived from tyrosine, not a steroid.

C. Insulin is a peptide (protein) hormone, not a steroid.

D. Thyroxine is an iodinated amino-acid derivative, not a steroid.

Question Q43 (PDF 46) Biology

The molecules responsible for conveying messages from one neuron to the next are called:

- A. Hormones
- B. Activators
- C. Neurotransmitters ✓ **Correct answer**
- D. Enzymes

A. Hormones are chemical messengers carried in the blood to distant targets, not the neuron-to-neuron synaptic messengers.

B. "Activators" is not the name of the synaptic messenger class.

C. Neurotransmitters (e.g. acetylcholine) are released at synapses to carry the signal to the next neuron; correct.

D. Enzymes catalyse reactions; they do not carry the synaptic message (some enzymes break transmitters down afterwards).

Question Q44 (PDF 47) Biology

Which enzyme works in alkaline pH?

- A. Pepsin
- B. Sucrose

- D. Pancreatic lipase ✓ **Correct answer**

A. Pepsin works in the acidic stomach (optimum pH ≈ 2); it is denatured in alkaline conditions.

B. Sucrose is a sugar (a substrate), not an enzyme at all.

C. Enterokinase (enteropeptidase) acts in the small intestine, whose contents are alkaline, so it too works in an alkaline medium — see flag below.

D. Pancreatic lipase is secreted into the alkaline small intestine (optimum pH ≈ 8) and is the textbook "alkaline-pH enzyme" keyed here. VERIFIED 8 Nov 2026: the second reproduction (PDF Q47) keys D; Fiveable: pancreatic lipase "works best in the slightly alkaline pH, around 7 to 8"; Aakash: optimum pH 7.5–8.5. Enterokinase also acts in alkaline intestinal fluid — the key arbitrates the textbook "alkaline-pH enzyme" reading (pancreatic lipase).

Question Q45 (PDF 48) Biology

Considering enzyme action minimum temperature is the term used when:

- A. Enzymes start denaturing
- B. Enzyme becomes hyperactive
- C. Enzyme work at their best
- D. Inactive enzyme getting reactivated ✓ **Correct answer**

A. Denaturing on heating is associated with the MAXIMUM/optimum-exceeding temperature, not the minimum.

B. No such defined term; activity rises with temperature up to the optimum, it does not become "hyperactive" at the minimum.

C. Working at their best defines the OPTIMUM temperature, not the minimum.

minimum temperature the enzyme is inactive; warming to the minimum temperature reactivates it — the keyed reading of the paper's terminology. VERIFIED 8 Nov 2026: the second reproduction (PDF Q48) keys D; AAT Bio: "Enzyme activity is the least at its minimum temperature limit and stops completely when the temperature reaches 0°C. It gets reactivated if the temperature increases." A gauthmath solver page quibbles that D "does not specifically define the term" — a dissenting quibble, not a contradiction; it does not overturn the key + textbook.

Question Q46 (PDF 49) Biology

Which option is correct about non-competitive inhibition:

- A. Malonate act as inhibitor
- B. Enzyme shape distorted ✓ **Correct answer**
- C. Competition for active site
- D. Inactive enzyme getting reactivated

A. Malonate is the classic COMPETITIVE inhibitor of succinate dehydrogenase; it is not an example of non-competitive inhibition.

B. A non-competitive inhibitor binds at an allosteric site and distorts the enzyme's shape (including the active site), lowering activity; correct.

C. Competing for the active site defines COMPETITIVE inhibition, the opposite class.

D. This is the Q45 terminology, unrelated to inhibition type.

Question Q47 (PDF 50) Biology

Which type of enzyme would be most active in your gut after eating the loaf of bread?

- A. Amylase ✓ **Correct answer**
- B. Erypsin
- C. Lactase
- D. Carboxypeptidase

ch in starch, and amylase digests starch; correct.

B. As printed, "Erypsin" is a misprint for erepsin (a mixture of peptidases, related to trypsin action) acting on proteins, not on bread starch.

C. Lactase digests lactose (milk sugar), which bread does not principally contain.

D. Carboxypeptidase digests proteins (peptides), not starch.

Question Q48 (PDF 51) Biology

He presented the theory of "origin of species by means of natural selection":

- A. Lamark
- B. Linnaeus
- C. Hardy- Weinberg
- D. Darwin ✓ **Correct answer**

A. Lamarck (option prints "Lamark") proposed inheritance of acquired characteristics, not natural selection.

B. Linnaeus devised the binomial system of classification, not the theory of natural selection.

C. The Hardy–Weinberg principle describes allele frequencies in equilibrium, not natural selection.

D. Charles Darwin presented natural selection in *On the Origin of Species* (1859); correct.

Question Q49 (PDF 52) Biology

Which is not a mode of action of an antibody?

- A. Precipitating an antigen
- B. Neutralizing an antigen

- -eting cytokines ✓ **Correct answer**
- D. Enhancing phagocytosis

A. Antibodies cross-link soluble antigens into precipitates; this IS a mode of action.

B. Antibodies neutralise toxins and viruses by blocking them; this IS a mode of action.

C. Antibodies do not secrete cytokines; cytokines are signalling proteins secreted by immune CELLS (e.g. T cells, macrophages); correct as the NOT-a-mode option.

D. Antibodies opsonise pathogens, enhancing phagocytosis; this IS a mode of action.

Question Q50 (PDF 53) Biology

Magnesium is an important nutrient in plants for the formation of:

- A. Proteins
- B. Lipids
- C. Chlorophylls ✓ **Correct answer**
- D. Enzymes

A. Magnesium is a cofactor for some enzymes of protein synthesis, but it is not a structural component of proteins.

B. Magnesium is not a component of plant lipids.

C. Magnesium is the central atom of the chlorophyll molecule and is essential for chlorophyll formation; correct.

D. Mg^{2+} activates many enzymes, but the defining structural role asked for is in chlorophyll.

Question Q51 (PDF 54) Biology

Which of the following parts of the respiratory system has no cartilage?

- A. Larynx

- C. Bronchioles ✓ **Correct answer**
- D. Bronchi

A. The larynx is built of cartilages (thyroid, cricoid, arytenoid); it HAS cartilage.

B. The trachea is held open by C-shaped cartilage rings; it HAS cartilage.

C. Bronchioles are small airways whose walls contain smooth muscle but no cartilage; correct.

D. The bronchi still contain cartilage plates; they HAVE cartilage.

Question Q52 (PDF 55) Biology

Enzymatic portion of the gastric juices secreted by which mucosal cells?

- A. Oxyntic cells
- B. Chief cells ✓ **Correct answer**
- C. Mucus cells
- D. Endocrine cells

A. Oxyntic (parietal) cells (option prints "Oxyntic") secrete hydrochloric acid and intrinsic factor, not the enzymatic portion.

B. Chief (zymogenic) cells secrete pepsinogen, the enzyme precursor of gastric juice; correct.

C. Mucus (goblet) cells secrete protective mucus, not enzymes.

D. Endocrine (G) cells secrete hormones such as gastrin, not the enzymatic portion of gastric juice.

Question Q53 (PDF 56) Physics

The horizontal distance travelled by wave during one complete cycle is called

- B. Wavelength ✓ **Correct answer**
- C. Amplitude
- D. Time period

A. Frequency is the number of cycles per second, a rate in time, not a distance.

B. The distance the wave travels in one complete cycle (crest to crest) is the wavelength λ; correct.

C. Amplitude is the maximum displacement from the mean position, not the distance per cycle.

D. The time period is the TIME for one cycle, not the distance travelled in it.

Question Q54 (PDF 57) Physics

If the period of oscillation of man (M) suspended from a spring is 1s, then the period of 16M will be:

- A. 1s
- B. 2s
- C. 3s
- D. 4s ✓ **Correct answer**

A. That would require the period to be independent of mass, which it is not for a spring.

B. 2 s would be the result for 4× the mass (√4 = 2), not 16×.

C. No mass ratio in T ∝ √m gives 3 s here.

D. T = 2π√(m/k), so T ∝ √m: mass ×16 gives period ×√16 = ×4, i.e. 1 s × 4 = 4 s; correct. (Stem's "man (M)" is read as a mass M suspended from the spring.)

Q55 (PDF 58) Physics

Loudness of the sound is directly rotated to:

- A. Intensity of sound ✓ **Correct answer**
- B. Frequency of sound
- C. Wavelength of sound
- D. Pitch of sound

A. Loudness (perceived volume) increases with the sound's intensity (energy per unit area per second); correct.

B. Frequency determines pitch, not loudness.

C. Wavelength is set by frequency and wave speed; it does not determine loudness.

D. Pitch is the perceived high/low quality set by frequency, distinct from loudness. (Stem misprint as fetched: "rotated" for related.)

Question Q56 (PDF 59) Physics

The increase in the speed of sound in air for each degree rise above 0°C is:

- A. 0.40 m/s
- B. 0.51 m/s
- C. 0.81 m/s
- D. 0.61 m/s ✓ **Correct answer**

A. Too small: the speed rises by about 0.6 m/s per °C, not 0.40.

B. Below the accepted ≈0.6 m/s per °C coefficient.

C. Too large for the per-degree coefficient near 0 °C.

D. The standard textbook value ($v \approx 331 + 0.61 \cdot T$ °C m/s); correct.

Q57 (PDF 60) Physics

First law of thermodynamics is based on:

- A. Law of conservation of momentum
- B. Law of conservation of mass
- C. Law of conservation of charge
- D. Law of conservation of energy ✓ **Correct answer**

A. Momentum conservation follows from Newton's laws; it is not the basis of the first law.

B. Mass conservation is a separate classical principle; the first law concerns energy.

C. Charge conservation governs electromagnetism, not thermodynamics.

D. The first law ($\Delta U = Q - W$) is conservation of energy applied to heat and work; correct.

Question Q58 (PDF 61) Physics

The thermodynamic process during which the pressure is kept constant is called:

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

A. Isochoric means constant VOLUME, not constant pressure.

B. Adiabatic means no heat exchange with the surroundings; pressure is not held constant (option prints "proms" for process).

C. Isobaric means constant pressure (Greek *baros*, weight/pressure); correct (option prints "proem" for process).

D. Isothermal means constant TEMPERATURE, not constant pressure (option prints "proem" for process).

Q59 (PDF 62) Physics

Energy stored in a capacitor is given by:

- A. E = ½ cv^2 ✓ **Correct answer**
- B. E.2 cv^2
- C. E . cv^2
- D. E = 2 cv^2

A. The energy stored is U = ½CV² (work done charging the capacitor against its own field); correct.

B. A garbled form as printed (no equals sign, factor 2); it is not the stored-energy formula.

C. Missing the ½ factor: CV² is twice the stored energy, not the stored energy.

D. Four times too large; the factor is ½, not 2. (Options B–D are garbled/ill-formed as fetched; only A states a recognisable formula.)

Question Q60 (PDF 63) Physics

Electric field intensity is:

- A. Force per unit mass
- B. Force per unit tesla
- C. Force per unit charge ✓ **Correct answer**
- D. Force per unit watt

A. Force per unit mass is acceleration (g-field strength), not electric field.

B. The tesla is the unit of magnetic flux density, not a quantity to divide force by here.

C. E = F/q, force experienced per unit test charge; correct.

D. The watt is power; force per watt is not electric field.

Q61 (PDF 64) Physics

Q.64 It stores electrical potential energy:

- A. Capacitor ✓ **Correct answer**
- B. Conductor
- C. Inductor
- D. Generator

A. A capacitor stores energy in the electric field between its plates as electrical potential energy; correct.

B. A conductor merely carries charge/current; it does not store potential energy in this way.

C. An inductor stores energy in a MAGNETIC field, not as electrical potential energy.

D. A generator converts mechanical energy to electrical energy; it does not store it. (Stem carries the printed number Q.64 — see numbering note.)

Question Q62 (PDF 65) Physics

Q.65 A magnitude of the current in metals is proportional to the applied voltage as long as temperature of conductor is kept constant. It is statement of:

- A. Joule's law
- B. Gauss's law
- C. Ohm, law ✓ **Correct answer**
- D. Ampere's law

A. Joule's law concerns heating ($H = I^2Rt$), not the proportionality of current and voltage.

B. Gauss's law relates electric flux through a closed surface to the enclosed charge, not current–voltage proportionality.

C. Ohm's law: $V = IR$, current proportional to voltage at constant temperature; correct

s "Ohm, law" for Ohm's law).

D. Ampère's law relates magnetic fields to currents, not current to voltage. (Stem carries the printed number Q.65 — see numbering note.)

Question Q63 (PDF 66) Physics

Q.66 The resistance of pure metal increases with:

- A. Increase in temperature ✓ **Correct answer**
- B. Increase in pressure
- C. Decrease in temperature
- D. Decrease in pressure

A. In pure metals, lattice vibrations increase with temperature and scatter conduction electrons more, raising resistance; correct.

B. Pressure is not the primary factor in the usual temperature dependence of metallic resistance.

C. Decreasing temperature LOWERS a pure metal's resistance (towards superconductivity in some metals).

D. Pressure change is not the primary factor here. (Stem carries the printed number Q.66 — see numbering note.)

Question Q64 (PDF 67) Physics

Q.67 The magnetic field inside the current carrying wire varies

- A. inversely with r
- B. inversely with r^2
- C. directly with r ✓ **Correct answer**
- D. Directly with r^2

A. The printed key, but WRONG for the stem as printed: $B \propto 1/r$ is the field OUTSIDE a long

(Ampère's law, $B = \mu_0 I/2\pi r$), not inside it.

B. A $1/r^2$ fall-off is the field of a point-like source (e.g. Coulomb/Biot–Savart for a point), not the field of a long wire inside or outside.

C. INSIDE a wire carrying uniformly distributed current, Ampère's law gives $B = \mu_0 Ir/2\pi R^2$, i.e. $B \propto r$, increasing linearly from the axis to the surface; correct for the stem AS PRINTED ("inside").

D. No region of a uniform-current wire gives $B \propto r^2$. VERIFIED: the second reproduction (PDF Q67) keys D — its option order differs (PDF C = directly r^2, D = directly r), so PDF key D IS "directly with r", the file's C — and Ampère's law gives $B \propto r$ inside the wire. Decided by the assistant under the owner's 8 Nov 2026 delegation. (Stem carries the printed number Q.67 — see numbering note.)

Note: FILE CORRECTION: the mdcatpapers marked key A (inversely with r) is the OUTSIDE-wire law; the stem says 'inside', where Ampère's law gives $B \propto r$. Corrected to C on the PDF key (PDF Q67 keys D = 'directly with r'; the PDF's option order differs) + the derivation. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Question Q65 (PDF 68) Physics

Q.68 Magnetic flux is maximum when Angle between magnetic field and vector area is:

- A. 0° ✓ **Correct answer**
- B. 90°
- C. 30°
- D. 45°

A. Flux $\Phi = BA\cos\theta$ is maximal when $\cos\theta = 1$, i.e. $\theta = 0°$ (field parallel to the area vector, perpendicular to the surface); correct.

B. At 90°, $\cos\theta = 0$ and the flux is ZERO, the minimum, not the maximum.

C. $\cos 30° \approx 0.87$, less than the maximum.

0.71, less than the maximum. (Stem carries the printed number Q.68 — see numbering note.)

Question Q66 (PDF 69) Physics

Q.69 Lenz's law is based on the law of conservation of:

- A. Mass
- B. Energy ✓ **Correct answer**
- C. Charge
- D. Momentum

A. Mass conservation is unrelated to the direction of an induced current.

B. Lenz's law (induced effects oppose the change producing them) guarantees no energy is created from nothing: a current aiding the change would feed itself and violate energy conservation; correct.

C. Charge conservation is a separate law; Lenz's law does not state it.

D. Momentum conservation is unrelated to induced-emf direction. (Stem carries the printed number Q.69 — see numbering note.)

Question Q67 (PDF 70) Physics

Q.70 In Fleming's right hand rule, the thumb indicates

- A. Force ✓ **Correct answer**
- B. Magnetic field
- C. Induced current
- D. Electric field

A. In the generator (right-hand) rule the thumb shows the direction of the motion/force applied to the conductor; the keyed answer.

B. The magnetic field is shown by the forefinger (first finger), not the thumb.

ed current is shown by the middle (second) finger, not the thumb.

D. No finger in Fleming's rule denotes the electric field. VERIFIED 8 Nov 2026: the second reproduction (PDF Q70) keys A and prints option A itself as "Force (motion of the conductor)" — the PDF's own wording resolves the labelling: the thumb denotes the motion/force direction. (Stem carries the printed number Q.70 — see numbering note.)

Question Q68 (PDF 71) Physics

Q.71 Transformer works on the principle of:

- A. Half wave rectification
- B. Self-Induction
- C. Mutual Induction ✓ **Correct answer**
- D. Full wave rectification

A. Half-wave rectification converts AC to DC using a diode; it is not how a transformer works.

B. Self-induction is a coil inducing an emf in ITSELF; a transformer needs induction in a SECOND coil.

C. A changing current in the primary induces a voltage in the secondary by mutual induction; correct.

D. Full-wave rectification is also AC-to-DC conversion, unrelated to transformer action. (Stem carries the printed number Q.71 — see numbering note.)

Question Q69 (PDF 72) Physics

Q.72 A device that converts AC into DC is called:

- A. Diode ✓ **Correct answer**
- B. Transistor
- C. Capacitor

A. A diode conducts in one direction and is the basic rectifying device used to convert AC into DC; correct as the only rectifying device listed.

B. A transistor amplifies or switches signals; it is not the AC-to-DC converting device.

C. A capacitor stores charge and smooths a rectified output; it does not itself convert AC to DC.

D. An inductor opposes changes in current and filters ripple; it does not convert AC to DC. (Stem carries the printed number Q.72 — see numbering note.)

Question Q70 (PDF 73) Physics

Q.73 The conversion of alternating current into direct current is called:

- A. Amplification
- B. Rectification ✓ **Correct answer**
- C. Magnification
- D. Resolution

A. Amplification increases a signal's amplitude; it does not convert AC to DC.

B. Rectification is the conversion of AC into (pulsating) DC; correct.

C. Magnification enlarges an image or object; unrelated.

D. Resolution is the ability to distinguish detail; unrelated. (Stem carries the printed number Q.73 — see numbering note.)

Question Q71 (PDF 74) Physics

Q.74 1 Gy is equal to:

- A. 1 Jkg
- B. 1 JKg-1 ✓ **Correct answer**

Kg

- D. J-1Kg-1

A. The printed key, but WRONG: as printed "1 Jkg" (joule-kilogram), read literally it is J·kg, dimensionally wrong for absorbed dose.

B. As printed, 1 $J \cdot kg^{-1}$ = 1 joule per kilogram, which IS the definition of the gray (absorbed dose = energy absorbed per unit mass); dimensionally correct; correct.

C. As printed, $J^{-1} \cdot kg$, the reciprocal of energy times mass; meaningless as a dose unit.

D. As printed, $J^{-1} \cdot kg^{-1}$, also meaningless as a dose unit. VERIFIED: the NUMS 2022 PDF (Q74, same stem/options) keys B, and the University of Toronto physics notes define 1 Gy = 1 J/kg (1 joule deposited per kilogram of matter). (Stem carries the printed number Q.74 — see numbering note.)

Question Q72 (PDF 75) Physics

Q.75 A 32g radioactive element decays and remains 2g after 60 days. What is the half-life of radioactive element?

- A. 2 days
- B. 6 days
- C. 10 days
- D. 15 days ✓ **Correct answer**

A. 60 days at 2 days per half-life would be 30 half-lives, leaving an immeasurably small fraction, not 2 g.

B. 10 half-lives would reduce 32 g by 2^{10}, far below 2 g.

C. 6 half-lives would reduce 32 g to 0.5 g, not 2 g.

D. 32 g → 16 → 8 → 4 → 2 g is 4 half-lives; 60 ÷ 4 = 15 days per half-life; correct. (Stem carries the printed number Q.75 — see numbering note.)

Q73 (PDF 76) Physics

Q.76 An elastic collision is the one in which:

- A. Kinetic energy and momentum is conserved ✓ **Correct answer**
- B. Kinetic energy is conserved but total energy is not con-served
- C. Momentum is conserved but kinetic energy is not con-served
- D. Both kinetic energy and momentum are not conserved

A. In an elastic collision both kinetic energy and momentum are conserved; correct.

B. Total energy is always conserved; a collision cannot conserve kinetic energy while violating total-energy conservation.

C. That describes an INELASTIC collision, not an elastic one.

D. Momentum is conserved in every collision; this option is false on both counts. (Options print "con-served" for conserved. Stem carries the printed number Q.76 — see numbering note.)

Question Q74 (PDF 77) Physics

Q.77 The time rate of change of velocity is called:

- A. Force
- B. Acceleration ✓ **Correct answer**
- C. Power
- D. Energy

A. Force is mass × acceleration (F = ma), not the rate of change of velocity itself.

B. Acceleration is defined as a = dv/dt, the time rate of change of velocity; correct.

C. Power is the rate of doing work, not the rate of change of velocity.

D. Energy is the capacity to do work; it is not defined as a rate of change of velocity. (Stem carries the printed number Q.77 — see numbering note.)

Q75 (PDF 78) Physics

Q.78 In projectile motion, the rage of projectile will be maximum at an angle of:

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

A. Range $R = u^2\sin 2\theta/g$ gives $\sin 60° \approx 0.87$ of the maximum, not the maximum.

B. $\sin 2\theta$ is maximal (1) when $2\theta = 90°$, i.e. $\theta = 45°$, giving maximum range on level ground (no air resistance); correct.

C. $\sin 120° \approx 0.87$ of the maximum, the same range as 30°, not the maximum.

D. A vertical launch gives zero horizontal range. (Stem misprint as fetched: "rage" for range. Stem carries the printed number Q.78 — see numbering note.)

Question Q76 (PDF 79) Physics

Q.79 Which of the following is NOT TRUE?

- A. Action and reaction have same nature
- B. Action and reaction have same line of action
- C. Action and reaction never act on same body
- D. Action and reaction can cancel each other ✓ **Correct answer**

A. True: if the action is gravitational, the reaction is gravitational, etc.; the pair are of the same kind.

B. True: the pair act along the same line, in opposite directions.

C. True: the two forces act on DIFFERENT bodies, which is why they never cancel.

D. NOT true: because they act on different bodies, they cannot cancel each other; correct as the NOT-TRUE statement. (Stem carries the printed number Q.79 — see numbering

Question Q77 (PDF 80) Physics

Two buses moving at 100 km/h and 80 km/h respectively cross each other while moving in opposite direction. Velocity of one bus relative to other bus is:

- A. 100 km/h
- B. 20 km/h
- C. 80 km/h
- D. 180 km/h ✓ **Correct answer**

A. That is one bus's own speed, not the relative speed.

B. 20 km/h is the DIFFERENCE of the speeds, which would be the relative speed if they moved in the SAME direction.

C. That is the other bus's own speed, not the relative speed.

D. Moving in opposite directions, relative speed is the sum: 100 + 80 = 180 km/h; correct.

Question Q78 (PDF 81) Physics

Which of the following pair of angles have same rang for a projectile?

- A. 10° and 20°
- B. 75° and 15° ✓ **Correct answer**
- C. 45° and 60°
- D. 0° and 30°

A. 10° + 20° = 30°, not 90°, so the ranges differ.

B. Ranges are equal for complementary angles (θ and 90° − θ), since sin 2θ = sin(180° − 2θ); 75° + 15° = 90°; correct.

C. 45° + 60° = 105°, not complementary; the ranges differ.

30°, not complementary, a 0° launch has zero range. (Stem misprint as fetched: "rang" for range.)

Question Q80 (PDF 83) Physics

The explosion of explosive material is application of:

- A. Law of conservation of energy
- B. Law of conservation of mass
- C. Law of conservation of momentum ✓ **Correct answer**
- D. Newton's third law of motion

A. Total energy is conserved in an explosion, but the textbook application illustrated by an explosion (fragments flying apart from rest) is momentum conservation.

B. Mass is conserved, but mass conservation is not the law the explosion example is used to illustrate.

C. In an isolated explosion the vector sum of fragment momenta stays zero (as before), the standard textbook application; correct.

D. Action–reaction pairs act during the explosion, but the system-wide application keyed here is momentum conservation.

Question Q81 (PDF 84) Physics

1hp is equal to:

- A. 476 watts
- B. 647 watts
- C. 746 watts ✓ **Correct answer**
- D. 487 watts

A. No standard horsepower definition gives 476 W.

B. No standard definition gives 647 W (metric horsepower is 735.5 W).

anical (imperial) horsepower = 746 W by definition; correct.

D. No standard definition gives 487 W.

Question Q82 (PDF 85) Physics

The product of force and velocity is equal to:

- A. Kinetic energy
- B. Potential energy
- C. Power ✓ **Correct answer**
- D. Work done

A. Kinetic energy is ½mv^2, not F·v.

B. Potential energy is stored energy (e.g. mgh), not F·v.

C. Instantaneous power P = F·v (work rate); correct.

D. Work is F·s (force × displacement), not F·v.

Question Q83 (PDF 86) Physics

One kilowatt-hour is equal to:

- A. 36 MJ
- B. 3.6 MJ ✓ **Correct answer**
- C. 36 KJ
- D. 3.6 KJ

A. Ten times too large: 1 kWh is 3.6 × 10^6 J, not 36 × 10^6 J.

B. 1 kWh = 1000 W × 3600 s = 3,600,000 J = 3.6 MJ; correct.

C. A thousand times too small (and mis-scaled): 36 kJ is 36 seconds at 1 kW.

D. A thousand times too small: 3.6 kJ is 3.6 seconds at 1 kW.

Q84 (PDF 87) Physics

The amount of work done in moving a body at certain point in a gravitational field to a position of zero potential such that the body is never accelerated is called:

- A. Kinetic energy
- B. Potential energy
- C. Gravitational potential energy
- D. Absolute potential energy ✓ **Correct answer**

A. The body is never accelerated, so its kinetic energy does not change; the work is not stored as kinetic energy.

B. Correct in general, but the stem specifies the gravitational field AND the zero-potential reference with no acceleration, which names a specific term, not the general one.

C. The printed key, but WRONG as the specific term: gravitational potential energy is the general concept (U = mgh near the surface, U = −GMm/r in general); the stem's wording is the definition of a narrower term.

D. The FSc textbook definition, verbatim: "The absolute potential energy of an object at a certain point is the work done by the gravitational force in displacing the object from that position to infinity (where the force of gravity becomes zero)" — infinity is the position of zero potential, and "never accelerated" is the no-acceleration condition of the definition; correct. VERIFIED: the second reproduction (PDF Q87) keys D, and the Punjab/Federal textbook definition (FSc Part I ch. 4; Sabaq 11th Physics) matches the stem word for word. The mdcatpapers marked key C is corrected openly. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Note: FILE CORRECTION: the mdcatpapers marked key C (gravitational potential energy) is the general concept; the stem's wording ('to a position of zero potential', 'never accelerated') IS the FSc textbook definition of ABSOLUTE potential energy. Corrected to D on the PDF key (PDF Q87 keys D) + the textbook definition. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Q85 (PDF 88) Physics

If the speed of a body is doubled, its kinetic energy becomes:

- A. Mv^2
- B. $2mv^2$ ✓ **Correct answer**
- C. ½ mv^2
- D. $4mv^2$

A. mv^2 is twice the ORIGINAL kinetic energy ($½mv^2$), not the energy after doubling the speed.

B. Correct by derivation: KE = $½m(2v)^2 = ½m \cdot 4v^2 = 2mv^2$, i.e. four times the original $½mv^2$.

C. That is the ORIGINAL kinetic energy, before doubling the speed.

D. The marked value, but WRONG: $4mv^2$ is EIGHT times the original kinetic energy ($½mv^2$), not four times; it would be correct only if the original energy were mv^2 (without the ½). VERIFIED: the second reproduction (PDF Q88) keys B, and the derivation gives B. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Note: FILE CORRECTION: the mdcatpapers marked key D ($4mv^2$) is eight times the original kinetic energy, not four times; doubling the speed gives $2mv^2$. Corrected to B on the PDF key (PDF Q88 keys B) + the derivation. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Question Q86 (PDF 89) Physics

An electric motor of power 2hp is installed in an industrial unit. Its power is:

- A. 1500 w
- B. 742 w
- C. 148 w
- D. 1492 w ✓ **Correct answer**

A. A rough round-number estimate, not the conversion from 746 W per hp (2 × 746 =

B. About 1 hp, not 2 hp.

C. Ten times too small; a decimal-place error.

D. 2 hp × 746 W/hp = 1,492 W; correct.

Question Q87 (PDF 90) Physics

1 radian =

- A. 5.7°
- B. 73.5°
- C. 57.3° ✓ **Correct answer**
- D. 37.5°

A. Ten times too small; a decimal-place error.

B. No radian conversion gives 73.5°.

C. 1 rad = 180/π ≈ 57.2958°, i.e. 57.3°; correct.

D. No radian conversion gives 37.5°.

Question Q88 (PDF 91) Physics

The minimum required velocity to put a satellite into the orbit is called:

- A. Terminal velocity
- B. Escape velocity
- C. Critical velocity ✓ **Correct answer**
- D. Average velocity

A. Terminal velocity is the constant falling speed when drag balances weight; unrelated to orbiting.

ed value, but WRONG for the stem: escape velocity (≈11.2 km/s from Earth) is the speed needed to ESCAPE Earth's gravity entirely, not to enter orbit.

C. In the textbooks "critical velocity" (vc = √(GM/r)) IS the orbital velocity, the minimum speed to put a satellite into a (circular) orbit (≈7.9 km/s in low Earth orbit); correct for the stem as printed.

D. Average velocity is total displacement over total time; not a named orbital speed. VERIFIED: the second reproduction (PDF Q91) keys C, and the textbook names the minimum orbital speed the critical velocity. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Note: FILE CORRECTION: the mdcatpapers marked key B (escape velocity) is the speed to ESCAPE Earth's gravity entirely, not to enter orbit; the minimum orbital speed is the critical velocity. Corrected to C on the PDF key (PDF Q91 keys C) + the textbook. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Question Q89 (PDF 92) Physics

A rotating wheel coincides 12 rev in 4s. find the average angular velocity in rad/sec:

- A. 24.6 rad/s
- B. 16.8 rad/s
- C. 10.4 rad/s
- D. 18.8 rad/s ✓ **Correct answer**

A. No division of 12 rev / 4 s gives this value.

B. Too small: 3 rev/s × 2π is about 18.8, not 16.8.

C. Far too small for 3 revolutions per second.

D. 12 rev in 4 s = 3 rev/s; ω = 3 × 2π = 6π ≈ 18.85 rad/s, i.e. 18.8 rad/s; correct. (Stem's "coincides" is read as "completes/rotates through".)

Q90 (PDF 93) Physics

When an object experience circular motion, the direction of centripetal acceleration is:

- A. Towards center ✓ **Correct answer**
- B. Along tangent
- C. Along the direction of motion
- D. Opposite of the direction of motion

A. Centripetal ("centre-seeking") acceleration always points radially inward to the centre of the circle; correct.

B. Tangential direction is the direction of velocity and of any TANGENTIAL acceleration, not centripetal acceleration.

C. The direction of motion is tangential; centripetal acceleration is perpendicular to it.

D. Also tangential (backwards); centripetal acceleration is radial, not tangential.

Question Q91 (PDF 94) Physics

Crest of a wave acts as:

- A. Concave lens
- B. Convex lens ✓ **Correct answer**
- C. Convex mirror
- D. Plane mirror

A. A concave (diverging) lens is the trough analogy in the ripple tank, not the crest.

B. In the standard ripple-tank analogy a water-wave crest refracts light convergently and acts as a CONVEX LENS (a trough acts as a concave lens).

C. The marked value, but WRONG: a convex mirror diverges reflected light, but a wave crest's action on transmitted light is refractive (lens-like), not reflective (mirror-like).

D. A plane mirror reflects without convergence or divergence; a crest is curved, not plane.

e second reproduction (PDF Q94) keys B, and the ripple-tank textbook analogy gives B (crest = convex lens, trough = concave lens). Decided by the assistant under the owner's 8 Nov 2026 delegation.

Note: FILE CORRECTION: the mdcatpapers marked key C (convex mirror) is reflective, but a wave crest's action on transmitted light is refractive (lens-like); the ripple-tank analogy gives a convex lens. Corrected to B on the PDF key (PDF Q94 keys B) + the analogy. Decided by the assistant under the owner's 8 Nov 2026 delegation.

Question Q92 (PDF 95) Physics

The speed of sound in air does not depend on:

- A. Density of medium
- B. Pressure ✓ **Correct answer**
- C. Temperature
- D. Moisture

A. The speed of sound depends on the medium's density and elasticity ($v = \sqrt{(\gamma P/\rho)}$, and via temperature for a gas).

B. For an ideal gas at fixed temperature, $v = \sqrt{(\gamma RT/M)}$ is independent of pressure (density rises with pressure in step); correct as the quantity it does NOT depend on.

C. The speed of sound in air rises with temperature (≈0.61 m/s per °C); it DOES depend on temperature.

D. Humidity raises the speed of sound (moist air is less dense and sound travels faster in it); it DOES depend on moisture.

Question Q93 (PDF 96) English

Choose the correct option: He had no worries his pension was adequate and there was a little money saved up besides.

had no worries his pension was adequate and there was a little money saved up besides.

- B. He had no worries, his pension was adequate and there was a little money saved up besides.
- C. He had no worries; his pension was adequate, and there was a little money saved up besides. ✓ **Correct answer**
- D. He had no worries; his pension was adequate and there was a little money saved up besides.

A. Two independent clauses run together with no punctuation: a run-on sentence.

B. Joining two independent clauses with a comma alone is a comma splice.

C. The semicolon correctly separates the first clause, and the comma before "and" correctly joins the two independent clauses "his pension was adequate" and "there was a little money saved up besides"; grammatically correct; correct.

D. The printed key, but WRONG: the two clauses after the semicolon ("his pension was adequate" / "there was a little money saved up besides") are independent, so Purdue OWL requires a comma before "and"; omitting it is an error here. VERIFIED: the NUMS 2022 PDF (Q96, same stem/options) keys C, and Purdue OWL requires a comma before the coordinating conjunction joining two independent clauses.

Question Q94 (PDF 97) English

Identify the errors and choose the correct option: There's mr. Hashim whom they say is the best portrait painter in the town

- A. There's mr. Hashim whom they say is the best portrait painter in the town.
- B. There's Mr. Hashim who they say is the best portrait painter in the town. ✓ **Correct answer**
- C. Theres' Mr. Hashim which they say is the portrait painter in the town.
- D. There's Mr. Hashim who they say is best portrait painter in the town.

two counts: "mr." must be capitalised ("Mr."), and "whom" (object form) is wrong as the subject of "is" — "who" is required.

B. "Mr." capitalised, and "who" is the subject of "is" ("they say" is parenthetical); correct. (Reproduction variance: the second reproduction prints option B with "whom" where the file prints "who"; both reproductions key B, and the file's "who" follows the mdcatpapers transcription and the grammar.)

C. "Theres'" is mis-punctuated for "There's", "which" cannot refer to a person, and "the best" has lost "best" (it reads "the portrait painter").

D. Omits the article "the" before the superlative "best"; "is best portrait painter" is ungrammatical.

Note: REPRODUCTION VARIANCE: the second reproduction prints option B with 'whom' where this file prints 'who'; both reproductions key B, and the file's 'who' follows the mdcatpapers transcription and the grammar.

Question Q95 (PDF 98) English

A full description of car accidents _____ reported.

- A. Are
- B. Have been
- C. Was ✓ **Correct answer**
- D. Were

A. Plural present verb; the subject "a full description" is singular.

B. Plural perfect form; it does not agree with the singular subject.

C. Singular past verb agreeing with "a full description" in the passive "was reported"; correct.

D. Plural past verb; it does not agree with the singular subject (the plural "accidents" is

epositional phrase "of car accidents" and does not govern the verb).

Question Q96 (PDF 99) English

Ahmad _____ me for a long time.

- A. Know
- B. Have known
- C. Knows
- D. Knew ✓ **Correct answer**

A. "Know" does not agree with the third-person singular subject "Ahmad".

B. The present-perfect meaning fits "for a long time", but "have" does not agree with singular "Ahmad" (it would need "has known").

C. The printed key, but WRONG: it agrees with "Ahmad", but the simple present "knows ... for a long time" is not correct English for a duration; that meaning needs the present perfect ("has known", absent) or the past simple.

D. The past simple with "for" + duration for a finished past state ("Ahmad knew me for a long time" = the knowing lasted a long time and is over); by elimination the only correct option; correct. VERIFIED: the NUMS 2022 PDF (Q99, same stem/options) keys D; B fails agreement (Ahmad + have), C fails duration, A fails agreement — D uniquely correct by elimination.

Question Q97 (PDF 100) English

He is appreciated for being ambidextrous. The underlined word means:

- A. Active and skillful
- B. Uses skills and wisdom
- C. Uses both hands for same skills ✓ **Correct answer**
- D. Remains to the point

trous" is sometimes used figuratively for skill, but its literal meaning is specifically about both hands, not general activity.

B. Wisdom is not part of the meaning of "ambidextrous".

C. Ambidextrous (Latin *ambi-*, both + *dexter*, right hand) means able to use both hands equally well; correct.

D. Unrelated to the meaning of "ambidextrous".

Question Q98 (PDF 101) English

He visited the ghettos for the first time. The underlined word means:

- A. Clean area
- B. Under privileged area ✓ **Correct answer**
- C. Privileged area
- D. Modernly constructed

A. "Ghetto" carries no meaning of cleanliness; ghettos are typically described as deprived, not clean.

B. A ghetto is a poor, socially and economically deprived/underprivileged area; correct.

C. The opposite of the meaning of "ghetto".

D. "Ghetto" says nothing about modern construction.

Question Q99 (PDF 102) English

My friend has a fine _____ of old stamps.

- A. Group
- B. Bridge
- C. Band
- D. Collection ✓ **Correct answer**

of stamps" is possible English but not the standard collocation for a hobbyist's stamps.

B. "Bridge" is not a collective noun for stamps.

C. "Band" is not a collective noun for stamps.

D. "A collection of stamps" is the standard collocation for stamps kept as a hobby; correct.

Question Q100 (PDF 103) English

Choose the correct option:

- A. Every one of the prisons are full.
- B. Every one of the prisons had full.
- C. Every one of the prisons have full.
- D. Every one of the prisons is full. ✓ **Correct answer**

A. "Every one" is singular and needs "is", not "are".

B. "Had full" is ungrammatical (it needs "was full"/"had become full"); "had" does not fit.

C. "Have" is plural (disagrees with "every one") and "have full" is ungrammatical.

D. Singular "is" agrees with "every one"; correct.

Question Q101 (PDF 104) English

The head master _____ to speak to you.

- A. Wants ✓ **Correct answer**
- B. is wanting
- C. was wanting
- D. Want

A. "Want" is a stative verb, used in the simple present ("wants") for a present wish; correct.

verbs are not normally used in the progressive; "is wanting" is non-standard here.

C. Past progressive of a stative verb, and it changes the time needlessly.

D. The base form does not agree with the singular subject "the head master".

Question Q102 (PDF 105) English

Knowledge and wisdom _____ no time for connection.

- A. Has
- B. Have ✓ **Correct answer**
- C. Had
- D. Are

A. Singular "has" would treat "knowledge and wisdom" as a single unit; the keyed convention treats the compound subject as plural — see flag below.

B. Two nouns joined by "and" normally take a plural verb, so "knowledge and wisdom have..."; the keyed answer.

C. Past tense "had" does not fit the present-tense general statement.

D. "Are" is a copular verb; it does not fit the verb phrase needed here ("have no time"). VERIFIED 8 Nov 2026: the second reproduction (PDF Q105) keys B; the compound-subject rule (Study.com / FIU / Testbook): "Compound subjects joined by 'and' take a plural verb" — "knowledge and wisdom" is two subjects joined by "and", so "have". The stem's wording ("no time for connection") is odd as printed, and "knowledge and wisdom" can be read as one combined quality taking a singular verb — the key + the rule arbitrate the plural reading.

Question Q103 (PDF 106) English

Each of three boys _____ to ride.

es ✓ Correct answer

- B. Love
- C. Are loving
- D. Have loved

A. "Each" is a singular distributive pronoun and takes a singular verb ("loves"); correct.

B. Plural verb; it does not agree with singular "each".

C. Plural progressive, disagreeing with "each" and odd for the stative preference "love".

D. Plural perfect form; it disagrees with "each" and changes the meaning to past experience.

Question Q104 (PDF 107) English

Choose the correctly structured sentence.

- A. Mr. Shan, with his family together goes to England
- B. Mr. Shan, together with his family, goes to England. ✓ **Correct answer**
- C. Mr. Shan, together with his family, go to England.
- D. Mr. Shan, with his family, go to England together.

A. The parenthetical phrase is not set off with commas and "together" is misplaced; punctuation is wrong.

B. The parenthetical "together with his family" is correctly comma-enclosed and the singular verb "goes" agrees with "Mr. Shan"; correct.

C. Punctuation is right but "go" is plural and disagrees with singular "Mr. Shan".

D. "Go" is plural and disagrees with singular "Mr. Shan", and "together" is redundant/misplaced.

Q105 (PDF 108) English

Identify the errors and choose the correct option. The english man thinks that he and his country are the best.

- A. The english man thinks that he and his country are the best.
- B. The English man think that he and his country are the best.
- C. The English man thinks that he and his country are the best ✓ **Correct answer**
- D. The English man think that he and his country are best.

A. "english" as a proper adjective must be capitalised ("English").

B. "Think" is plural and disagrees with the singular subject "the English man".

C. "English" capitalised, singular "thinks" agreeing with the singular subject, and "are the best" correct for the compound "he and his country"; correct (no full stop as printed).

D. "Think" disagrees with the singular subject, and "are best" omits the required article "the" before the superlative.

Question 109 — recovered from the second reproduction English

Pick the word with correct spelling.

- A. Appratus
- B. Aprattus
- C. Appretis
- D. Apparatus ✓ **Correct answer**

A. Misspelt: missing the second "a" ("Appr-" for "Appa-").

B. Misspelt: "Apr-" for "App-".

C. Misspelt: "-retis" for "-ratus".

D. The correct spelling of "apparatus" (equipment for a particular purpose); correct.

VERIFIED: the second reproduction (PDF Q109) keys D; Merriam-Webster / Oxford.

(ap·pa·ra·tus). Recovered from the PDF (absent from the mdcatpapers transcription); stem and options as printed in the PDF.

Note: RECOVERED QUESTION: absent from the mdcatpapers transcription; recovered from the second reproduction (educationinkarachi PDF Q109) and verified 8 Nov 2026 from the PDF key + an independent reference fact. See the question's verification note in the reviewed file.

Question Q106 (PDF 110) English

Pick the word with correct spelling.

- A. Mercenery
- B. Mersanary
- C. Mercenary ✓ **Correct answer**
- D. Mersenary

A. Misspelt: "-enery" for "-enary".

B. Misspelt: "Mers-" for "Merc-".

C. The correct spelling of "mercenary" (a soldier working for pay); correct.

D. Misspelt: "Mers-" for "Merc-".

Question Q107 (PDF 111) Chemistry

Which of the following molecule is covalent in nature?

- A. NaCl
- B. MgCl2
- C. AlCl3 ✓ **Correct answer**
- D. KCl

A. Sodium chloride is a predominantly ionic solid (Na^+/Cl^- lattice).

m chloride is predominantly ionic.

C. Aluminium chloride has substantial covalent character: the small, highly charged Al^{3+} ion strongly polarises the chloride electron clouds (Fajans' rules), and $AlCl_3$ exists as covalent dimers; correct as the covalent one of the list.

D. Potassium chloride is a predominantly ionic solid.

Question Q108 (PDF 112) Chemistry

Which of the following property increases down the group in alkali metals?

- A. Ionization energy
- B. Reactivity ✓ **Correct answer**
- C. Electron affinity
- D. Electronegativity

A. Ionisation energy DECREASES down the group (outer electron further from the nucleus, more shielding).

B. Reactivity INCREASES down the group: the outer electron is lost ever more easily (e.g. Li < Na < K < Rb < Cs); correct.

C. Electron affinity generally decreases down the group (less attraction for an added electron).

D. Electronegativity decreases down the group.

Question Q109 (PDF 113) Chemistry

The solubility of alkaline earth metal:

- A. Decreases down the group ✓ **Correct answer**
- B. Increases down the group
- C. Remains constant throughout the group
- D. First increases then decreases down the group

lkaline-earth SULPHATES and CARBONATES, whose solubility decreases down the group (lattice enthalpy falls more slowly than hydration enthalpy for the large anions); the keyed trend, for the sulphates; correct.

B. True for alkaline-earth HYDROXIDES, whose solubility increases down the group; the printed key, on the unstated assumption that hydroxides are meant — but the PDF key is A (sulphates).

C. False for every common salt family: solubility changes markedly down the group.

D. No common alkaline-earth salt family follows this pattern. VERIFIED: the NUMS 2022 PDF (Q113, same stem/options) keys A; askIITians/NCERT: the solubility of the sulphates decreases down the group (Be > Mg > Ca > Sr > Ba). Caveat: hydroxides do increase down the group, so the answer rests on the sulphate reading the key intends.

Question Q110 (PDF 114) Chemistry

Geometric isomerism is exhibited by:

- A. Alcohol
- B. Ethers
- C. Alkynes
- D. Alkenes ✓ **Correct answer**

A. Alcohols have free rotation about single bonds and no C=C double bond to restrict rotation; they do not show cis–trans isomerism as a class.

B. Ethers likewise have single bonds with free rotation; no geometric isomerism.

C. Alkynes have a linear triple bond with only one substituent per carbon, so cis–trans isomerism about the multiple bond is impossible.

D. Alkenes have restricted rotation about the C=C double bond, and with different substituents on each carbon they show cis–trans (geometric) isomerism; correct.

Q111 (PDF 115) Chemistry

Benzene can be formed from phenol in which of the following reactions?

- A. Reduction with hydrogen in the presence of Ni
- B. Reduction with zinc ✓ **Correct answer**
- C. Reduction with alkali
- D. Reduction with acids

A. Catalytic hydrogenation (H_2/Ni) reduces the aromatic ring itself (towards cyclohexane derivatives), not simply the C–O bond to give benzene.

B. Distilling phenol with zinc dust reduces it (removes the –OH as water) to benzene; the classical textbook reaction; correct.

C. Alkali converts phenol to phenoxide (a salt); it does not reduce phenol to benzene.

D. Acids do not reduce phenol to benzene (phenol is not reduced by ordinary acids to the hydrocarbon).

Question Q112 (PDF 116) Chemistry

Lucas test is used for the identification of:

- A. Alkyl halides
- B. Alcohols ✓ **Correct answer**
- C. Alkene
- D. Carboxylic acids

A. Alkyl halides are the PRODUCTS formed in the Lucas test, not what the test identifies.

B. The Lucas test (conc. HCl + anhydrous $ZnCl_2$) distinguishes primary, secondary and tertiary alcohols by how fast turbidity (alkyl chloride) appears; correct.

C. Alkenes are identified by bromine-water decolourisation, not by the Lucas test.

D. Carboxylic acids are identified by effervescence with carbonates, not by the Lucas test.

Q113 (PDF 117) Chemistry

Phenol has following characteristics and physical properties:

- A. colorless crystalline solid
- B. colorless crystalline deliquescent solid ✓ **Correct answer**
- C. Colorless amorphous solid
- D. Colorless amorphous deliquescent solid

A. True as far as it goes: phenol is a colourless crystalline solid — see flag below.

B. The fuller textbook description: phenol is colourless and crystalline and absorbs moisture from the air (deliquescent/hygroscopic, liquefying on exposure); the keyed answer.

C. False: phenol is crystalline, not amorphous.

D. False on "amorphous": phenol is crystalline. VERIFIED 8 Nov 2026: the second reproduction (PDF Q117) keys B; the Punjab textbook states verbatim "Phenol is a colourless, crystalline, deliquescent solid" (PreMed FSc notes, ch. Alcohols Phenols and Ethers) — the exact wording of option B. Option A is true but less complete than B; the key arbitrates the fullest-description reading.

Question 118 — recovered from the second reproduction

Chemistry

Cannizzaro's reaction is given by:

- A. Formaldehyde ✓ **Correct answer**
- B. Acetaldehyde
- C. Acetone
- D. Butanone

A. Formaldehyde (HCHO) has no α-hydrogen, so with concentrated alkali it undergoes the Cannizzaro disproportionation ($2HCHO + NaOH \rightarrow CH_3OH + HCOONa$); correct — the

B. Acetaldehyde has α-hydrogens, so with alkali it undergoes aldol condensation, not Cannizzaro.

C. Acetone is a ketone, not an aldehyde, and has α-hydrogens; it does not give the Cannizzaro reaction.

D. Butanone is a ketone with α-hydrogens; it does not give the Cannizzaro reaction. VERIFIED: the second reproduction (PDF Q118) keys A; Testbook/Aakash: "The aldehydes which do not have alpha-hydrogen such as formaldehyde or benzaldehyde are the main compounds that give Cannizzaro reaction"; "When formaldehyde reacts with Conc. NaOH, it undergoes a Cannizzaro reaction." Recovered from the PDF (absent from the mdcatpapers transcription); stem and options as printed in the PDF.

Note: RECOVERED QUESTION: absent from the mdcatpapers transcription; recovered from the second reproduction (educationinkarachi PDF Q118) and verified 8 Nov 2026 from the PDF key + an independent reference fact. See the question's verification note in the reviewed file.

Question Q114 (PDF 119) Chemistry

The identification test for Ketone is:

- A. Benedict's Solution Test
- B. Tehling's Solution Test
- C. Sodium Nitro Prusside Test ✓ **Correct answer**
- D. Town's Test

A. Benedict's test detects reducing sugars/aldehydes (Cu^{2+} reduced to Cu_2O); ketones do not generally respond.

B. As printed, "Tehling's" is a misprint (for Fehling's solution); Fehling's test detects aldehydes/reducing sugars, not ketones.

troprusside gives the characteristic colour test for ketones/ketone bodies (e.g. acetone/acetoacetate, Legal/Rothera-type test); correct.

D. As printed, "Town's" is a misprint for Tollens' test; Tollens' reagent (ammoniacal silver nitrate) detects aldehydes, not ketones.

Question Q115 (PDF 120) Chemistry

Carboxylic acids are water soluble because they:

- A. Are more reactive
- B. Have hydrogen bonding ✓ **Correct answer**
- C. Have low melting point
- D. Have high density

A. Reactivity does not explain solubility in water.

B. The –COOH group forms hydrogen bonds with water molecules (donor and acceptor), which makes short-chain carboxylic acids soluble; correct.

C. Melting point does not determine water solubility.

D. Density does not determine water solubility.

Question Q116 (PDF 121) Chemistry

Which of the following represents equation for ideal gas?

- A. PV=nRT ✓ **Correct answer**
- B. PT=nRv
- C. P=nRT
- D. T=npv/R

A. The ideal gas equation: pressure × volume = amount × gas constant × temperature; correct.

nally wrong (P·T on the left, a volume symbol on the right); not the ideal gas law.

C. Missing the volume term; dimensionally wrong.

D. A garbled rearrangement (lowercase p/v mixed with n); it does not state PV = nRT.

Question Q117 (PDF 122) Chemistry

How should the condition be changed to prevent the value of a given gas from expanding when its mass is increased?

- A. Temperature is lowered & pressure is increased ✓ **Correct answer**
- B. Temperature is increased & pressure is lowered
- C. Temperature & pressure both are lowered
- D. Temperature & pressure both are increased

A. From PV = nRT: more mass (more moles n) at fixed V raises P; lowering T and raising the external pressure oppose the expansion, holding the volume; correct as the best-fit combination.

B. Both changes favour expansion, the opposite of what is asked.

C. Lowering the pressure favours expansion, offsetting the benefit of lowering temperature.

D. Raising the temperature favours expansion, offsetting the benefit of raising pressure. (Stem prints "value" for volume — read as volume throughout; the stem is garbled as fetched.)

Question Q118 (PDF 123) Chemistry

Which variable mentioned in ideal gas is assumed to be constant in other gas laws?

- A. Volume
- B. Temperature

- D. Number of moles ✓ **Correct answer**

A. Volume is HELD constant only in Gay-Lussac's law; it varies in Boyle's and Charles's laws.

B. Temperature is held constant only in Boyle's law; it varies in Charles's and Gay-Lussac's laws.

C. Pressure is held constant only in Charles's law; it varies in the others.

D. Boyle's, Charles's and Gay-Lussac's laws are all derived from PV = nRT with the AMOUNT of gas (n) fixed throughout; correct.

Question Q119 (PDF 124) Chemistry

Which of the following molecules will show a higher rate of evaporation?

- A. Acetone ✓ **Correct answer**
- B. Ethanol
- C. Water
- D. Ethylene glycol

A. Acetone has the weakest intermolecular forces of the list (no O–H hydrogen-bond donation, high vapour pressure) and evaporates fastest; correct.

B. Ethanol hydrogen-bonds (O–H), so it evaporates more slowly than acetone.

C. Water has extensive hydrogen bonding and evaporates more slowly than acetone or ethanol.

D. Ethylene glycol has two –OH groups and very strong hydrogen bonding (high boiling point); it evaporates slowest.

Question Q120 (PDF 125) Chemistry

Specific heat of water is:

- s J/g/°C ✓ **Correct answer**
- B. 9.82 J/g/°C
- C. 6.04 J/g/°C
- D. 8.47 J/g/°C

A. The standard specific heat capacity of liquid water, 4.18 J g^{-1} $°C^{-1}$ (1 cal g^{-1} $°C^{-1}$); correct.

B. More than double the true value; no accepted figure gives 9.82.

C. No accepted figure gives 6.04.

D. About double the true value; no accepted figure gives 8.47.

Question 126 — recovered from the second reproduction

Chemistry

The boiling point of a compound is mostly raised by:

- A. Dipole induced dipole interaction
- B. London dispersion forces
- C. Intra molecular H-bonding
- D. Inter molecular H-bonding ✓ **Correct answer**

A. A weak interaction between a polar molecule and a non-polar one; it raises boiling point only slightly.

B. Present in all molecules but the weakest intermolecular force; they raise boiling point far less than hydrogen bonding for comparable molecules.

C. Hydrogen bonding WITHIN one molecule; it does not hold molecules together, so it does not raise the boiling point (it can even lower it by reducing intermolecular contact).

D. Hydrogen bonds BETWEEN molecules are the strongest common intermolecular force (10–40 kJ/mol); more energy is needed to separate the molecules, so the boiling point is raised most; correct. VERIFIED: the second reproduction (PDF Q126) keys D; Pearson:

apable of hydrogen bonding have much higher boiling points than those with only London dispersion forces"; "As the number of hydrogen bonds increases, so does the boiling point." Recovered from the PDF (absent from the mdcatpapers transcription); stem and options as printed in the PDF.

Note: RECOVERED QUESTION: absent from the mdcatpapers transcription; recovered from the second reproduction (educationinkarachi PDF Q126) and verified 8 Nov 2026 from the PDF key + an independent reference fact. See the question's verification note in the reviewed file.

Question Q121 (PDF 127) Chemistry

Which of the following statement explains solubility of ionic substance in water?

- A. Water molar mass is 18.02
- B. Water forms dative bonding
- C. Water molecule is polar ✓ **Correct answer**
- D. Water has high density

A. Molar mass does not explain why ionic lattices dissolve.

B. Water solvates ions by ion–dipole interactions, not by forming dative (coordinate) bonds to the ions as the explanation.

C. Polar water molecules orient around ions (ion–dipole forces) and stabilise them in solution, overcoming the lattice energy; correct.

D. Density does not explain ionic solubility.

Question Q122 (PDF 128) Chemistry

Nature of diamond as solid is:

- A. Covalent ✓ **Correct answer**
- B. Ionic

ecular

- D. Metallic

A. Diamond is a giant covalent (network) solid: every carbon is covalently bonded to four others in a continuous lattice; correct.

B. Diamond contains no ions and no ionic bonding.

C. Diamond is not made of discrete molecules held by weak forces; it is one continuous network.

D. Diamond has no delocalised electrons or metallic bonding (it is an insulator).

Question Q123 (PDF 129) Chemistry

Which one of the following is as light as a feather and as strong as iron?

- A. Graphite
- B. Graphene ✓ **Correct answer**
- C. Mercury
- D. Diamond

A. Graphite (stacked graphene layers) is strong in-plane but soft and slippery between layers; it is not the "light as a feather, strong as iron" material of the popular description.

B. A single atomic layer of carbon, exceptionally light and (per weight) far stronger than steel/iron; the standard popular description; correct.

C. Mercury is a dense liquid metal; neither light nor strong in this sense.

D. Diamond is extremely hard but dense and brittle, not "light as a feather".

Question Q124 (PDF 130) Chemistry

The pH of human blood is:

- A. 7.35 to 7.45 ✓ **Correct answer**

- C. 6.35 to 7.45
- D. 5.57 to 6.57

A. Normal arterial blood pH is tightly regulated at 7.35–7.45 (slightly alkaline); correct.

B. Far too alkaline; blood at this pH is incompatible with life.

C. Extends into acidity well below the regulated range; normal blood never sits at 6.35.

D. Acidic throughout; incompatible with normal blood pH.

Question Q125 (PDF 131) Chemistry

Proton number of 23Na11 is:

- A. 23
- B. 11 ✓ **Correct answer**
- C. 12
- D. 34

A. 23 is the MASS number (protons + neutrons), not the proton number.

B. The subscript 11 is the atomic/proton number: sodium has 11 protons; correct.

C. 12 is the NEUTRON number (23 − 11), not the proton number.

D. 23 + 11 = 34 has no meaning here; it is not the proton number. (Nuclide notation is printed in reversed order as fetched, "23Na11" — read as $^{23}_{11}Na$, mass number 23, atomic number 11.)

Question Q126 (PDF 132) Chemistry

One mole of ethanol and one mole of ethane have an equal:

- A. Mass
- B. Number of atoms

nber of electrons

- D. Number of molecules ✓ **Correct answer**

A. Ethanol (C_2H_6O, M = 46) and ethane (C_2H_6, M = 30) have different molar masses, so one mole of each has a different mass.

B. An ethanol molecule has 9 atoms, an ethane molecule 8, so equal moles contain different numbers of atoms.

C. Ethanol has 26 electrons per molecule, ethane 18, so equal moles contain different numbers of electrons.

D. One mole of ANY substance contains Avogadro's number of particles; correct.

Question Q127 (PDF 133) Chemistry

The 1' step involved in the determination of Empirical Formula of chemical compound is:

- A. Finding number of gram atoms of each element
- B. Percentage composition of each element ✓ **Correct answer**
- C. Atomic ratio of each element
- D. Multiplication of atomic ratio with whole number

A. Converting masses to gram-atoms (moles) is a LATER step, done after the percentage composition is known.

B. The textbook first step: find the mass percentage of each element present (by analysis); the keyed answer.

C. The atomic (mole) ratio is derived from the percentages; it is a later step.

D. Multiplying to whole numbers is the FINAL step to the empirical formula. VERIFIED 8 Nov 2026: the second reproduction (PDF Q133) keys B; LibreTexts (Determining Empirical Formulas): elemental analysis determines "the percentages of each element contained within it. These percentages can be transformed into the mole ratio of the elements,

to the empirical formula — percentage composition is the starting point. (Stem prints "1'" for 1st.)

Question Q128 (PDF 134) Chemistry

The number of moles of CO2 which contains 16 g of oxygen is:

- A. 0.25
- B. 0.5 ✓ **Correct answer**
- C. 1
- D. 2

A. 0.25 mol CO_2 contains 0.5 mol O atoms = 8 g O, half the stated amount.

B. One mole of CO_2 contains 2 mol O atoms = 32 g O; 16 g O is half that, i.e. 0.5 mol CO_2; correct.

C. 1 mol CO_2 contains 32 g O, double the stated amount.

D. 2 mol CO_2 contains 64 g O, four times the stated amount.

Question Q129 (PDF 135) Chemistry

Percentage composition of mass in CO2, is:

- A. 30.45% Carbon & 69.54% Oxygen
- B. 24.22% Carbon & 75.78% Oxygen
- C. 27.37% Carbon & 72.72% Oxygen ✓ **Correct answer**
- D. 41.68% Carbon & 58.12% Oxygen

A. Does not match the 12:32 mass ratio of C:O in CO_2.

B. Does not match the 12:32 mass ratio.

C. CO_2: C = 12/44 = 27.27%, O = 32/44 = 72.73%; option C is the only option at this ratio (27.37% prints 27.27% with a 0.1 misprint — see below); correct.

he 12.32 ratio. (Percentage misprint as fetched: 27.37% for the computed 27.27%; the option's percentages also sum to 100.09%. No other option is within 3 percentage points, so the misprint does not change the answer.)

Question Q130 (PDF 136) Chemistry

Maximum electrons that can be placed in p subshell are:

- A. 2
- B. 6 ✓ **Correct answer**
- C. 10
- D. 14

A. 2 is the capacity of an s subshell (one orbital), not p.

B. A p subshell has 3 orbitals (m = −1, 0, +1), each holding 2 electrons: 3 × 2 = 6; correct.

C. 10 is the capacity of a d subshell (5 orbitals).

D. 14 is the capacity of an f subshell (7 orbitals).

Question Q131 (PDF 137) Chemistry

Apply n+l rule and calculate which of the following orbital has maximum energy?

- A. 4s ✓ **Correct answer**
- B. 2p
- C. 2d
- D. 3s

A. n + l = 4 + 0 = 4, the joint-highest value listed, and with the higher n it outranks 2d; correct.

B. n + l = 2 + 1 = 3, lower than 4, so lower energy.

C. n + l = 2 + 2 = 4, tied with 4s on the rule, but (i) the tie-break gives the higher-n orbital

er energy and (ii) a 2d orbital does not exist (for n = 2, l can only be 0 or 1); it cannot be the maximum-energy real orbital.

D. n + l = 3 + 0 = 3, lower than 4, so lower energy.

Question Q132 (PDF 138) Chemistry

The mass of electron is:

- A. 1836 times more than mass of proton
- B. 1836 times less than mass of proton ✓ **Correct answer**
- C. 1836 times more than mass of neutron
- D. 1836 times more than mass of hydrogen atom

A. Reversed: the electron is far LIGHTER than the proton, not heavier.

B. $m_p/m_e \approx 1836$, so the electron's mass is about 1/1836 of the proton's; correct.

C. Reversed: the neutron is, like the proton, about 1836 times heavier than the electron.

D. Reversed: the hydrogen atom (≈ proton + electron) is about 1836 times heavier than the electron alone.

Question Q133 (PDF 139) Chemistry

The shape of an orbital is determined by which quantum number?

- A. n
- B. l ✓ **Correct answer**
- C. m
- D. s

A. The principal quantum number n sets the size and energy level (shell), not the shape.

B. The azimuthal (subsidiary) quantum number l sets the subshell and hence the orbital SHAPE (s spherical, p dumb-bell, d cloverleaf, f complex); correct.

etic quantum number m sets the ORIENTATION of the orbital in space, not its shape.

D. The spin quantum number s sets the electron's spin direction, not orbital shape.

Question Q134 (PDF 140) Chemistry

The electronic configuration for degenerate orbitals is explained by:

- A. Aufbau Principle
- B. n+l Rule
- C. Hund's Rule ✓ **Correct answer**
- D. Paul's Exclusion Principle

A. The building-up principle orders subshell filling by increasing energy; it does not govern filling WITHIN a degenerate set.

B. The n + l rule orders subshell energies; it does not govern filling within one degenerate set.

C. Degenerate orbitals are filled singly, with parallel spins, before any pairing occurs (maximum multiplicity); correct.

D. Pauli's exclusion principle (option prints "Paul's") forbids two electrons sharing all four quantum numbers, limiting each orbital to two opposite-spin electrons; it does not state the singly-first filling pattern. (Option prints "Paul's" for Pauli's.)

Question Q135 (PDF 141) Chemistry

Which term describes a solution in which dissolved solute is in equilibrium with undissolved solute?

- A. Dilute
- B. Saturated ✓ **Correct answer**
- C. Unsaturated

A. "Dilute" means a low concentration; a dilute solution need not be in equilibrium with undissolved solid.

B. A saturated solution holds the maximum dissolved solute at that temperature and is in dynamic equilibrium with undissolved solute; correct.

C. An unsaturated solution can dissolve MORE solute; it is not in equilibrium with undissolved solid.

D. A supersaturated solution holds MORE than the equilibrium amount (unstable); it is not the equilibrium-with-solid state.

Question Q137 (PDF 143) Chemistry

What is "NOT TRUE" about rate of a reaction?

- A. Concentration of reactants does not affect the rate of a reaction ✓ **Correct answer**
- B. Surface area of reactants affects rate of reaction
- C. Concentration affects rate of reaction
- D. Catalyst affects rate of a reaction

A. FALSE: concentration does affect rate (higher concentration → more collisions → faster rate for most reactions); correct as the NOT-TRUE statement.

B. TRUE: greater surface area (e.g. powdered solid) increases rate.

C. TRUE, the direct opposite of A.

D. TRUE: a catalyst changes (usually increases) the rate without being consumed. (Options B and C state overlapping truths; that redundancy does not change which statement is NOT true.)

Q138 (PDF 144) Chemistry

Enthalpy change of combustion is exothermic because:

- A. Energy released in bond breaking is greater
- B. Energy released in bond making is greater ✓ **Correct answer**
- C. Energy absorbed in bond breaking is greater
- D. Energy absorbed in bond making is greater

A. Bond breaking ABSORBS energy; it never releases it, so this is backwards.

B. Combustion is exothermic because forming the product bonds (CO_2, H_2O) releases MORE energy than breaking the reactant bonds absorbs; correct.

C. If bond-breaking absorption exceeded bond-making release, the reaction would be endothermic, not exothermic.

D. Bond making RELEASES energy; it never absorbs it, so this is backwards.

Question Q139 (PDF 145) Chemistry

One Calorie is equivalent to:

- A. 4.184 J ✓ **Correct answer**
- B. 4.184 kJ
- C. 0.4184 J
- D. 0.4184 kJ

A. 1 small calorie (1 cal) = 4.184 J; correct.

B. 1 large Calorie (1 Cal = 1 kcal, the food calorie) = 4,184 J = 4.184 kJ.

C. Ten times too small for either a calorie or a Calorie.

D. Ten times too small for a kilocalorie (418.4 J). VERIFIED: the NUMS 2022 PDF (Q145) prints "One calorie" (lowercase) and keys A; NIST: 1 cal (thermochemical) = 4.184 J exact. The capital-C reading (food calorie = 4.184 kJ, option B) does not apply to the PDF's

Question Q140 (PDF 146) Chemistry

Potential of Standard Hydrogen Electrode (SHE) is arbitrarily taken as:

- A. 10
- B. +1
- C. -1
- D. Zero ✓ **Correct answer**

A. No convention assigns the SHE a potential of 10 (units unstated as printed).

B. No convention assigns +1 (volt) to the SHE.

C. No convention assigns −1 (volt) to the SHE.

D. By definition/convention the SHE potential is taken as 0 V (zero volts) at standard conditions, and all other electrode potentials are measured relative to it; correct. (Options print bare numbers with no unit; read as volts.)

Question Q141 (PDF 147) Chemistry

During electrolysis, reduction always occurs at:

- A. Anode
- B. Cathode ✓ **Correct answer**
- C. SHE
- D. Salt bridge

A. Oxidation always occurs at the anode, not reduction.

B. Reduction (gain of electrons) always occurs at the cathode, in electrolytic and galvanic cells alike; correct.

C. The standard hydrogen electrode is a reference electrode, not the site of reduction in a

trolysis.

D. The salt bridge completes the circuit and maintains charge balance; no reduction occurs in it.

Question Q142 (PDF 148) Chemistry

Type of hybridization of carbon in Ethene (H2C=CH2) is:

- A. Sp3
- B. sp2 ✓ **Correct answer**
- C. Sp
- D. dsp2

A. sp^3 is for carbon with four single bonds (e.g. ethane/methane), not ethene.

B. Each ethene carbon bonds to three atoms (one double + two single bonds) with trigonal-planar geometry, i.e. sp^2 hybridised, leaving one p orbital for the π bond; correct.

C. sp is for carbon with a triple bond (e.g. ethyne), linear geometry, not ethene.

D. dsp^2 involves d orbitals (transition-metal complexes); it does not apply to carbon in ethene.

Question Q143 (PDF 149) Chemistry

Which of the following molecule is polar?

- A. CCl4
- B. AlCl3
- C. CO2
- D. HCl ✓ **Correct answer**

A. Carbon tetrachloride has polar C–Cl bonds, but its tetrahedral symmetry cancels the dipoles: overall nonpolar.

gonal planar (monomer) with cancelling bond dipoles: overall nonpolar.

C. Carbon dioxide has polar C=O bonds, but its linear symmetry cancels them: overall nonpolar.

D. Hydrogen chloride is a diatomic molecule with a large electronegativity difference and no symmetry to cancel the dipole: polar; correct.

Question Q144 (PDF 150) Chemistry

Electron affinity decreases down the group because:

- A. Proton number increases
- B. Atomic radius increases ✓ **Correct answer**
- C. Shielding decrease
- D. Rate constant

A. Proton number does increase down a group, but that alone would INCREASE attraction; it is outweighed by distance and shielding, so it is not the stated reason.

B. Down a group each new shell puts the added electron further from the nucleus, so the nucleus attracts it less strongly and electron affinity falls; correct.

C. Shielding INCREASES down a group (more inner shells), not decreases; the direction is wrong.

D. The rate constant is a kinetics term from Q136's topic; it has nothing to do with electron-affinity trends.

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