MDCAT (SMC & DMC Entry Test 2014, Karachi) — 2014 · Solved Past Paper

Body: Dow University of Health Sciences (DUHS) · **Post:** MDCAT (SMC & DMC Entry Test 2014, Karachi) · **Year:** 2014 · **Questions:** 100 in the original paper — **98 solved and verified**, 2 excluded as defective (Q38, Q51) · **Price:** Free

> **How to use this paper:** each question shows the stem, the four options, and the correct answer. Click “Why each option?” under a question to see all four options explained — one question teaches four topics. General Knowledge answers are as of the 2014 sitting.

Source note: Question stems and options: SMC & DMC Entry Test 2014, Karachi (educationinkarachi.net/wp-content/uploads/2026/09/SMC-DMC-2014-Original-Answer-Key.pdf, 22 pp.; Q1-100 with complete official answer-key table (Blue version) at the end, Q1-100, Q38 and Q51 recorded as Cancelled). Exam held Sunday 19 October 2014 (stated on the paper itself and in the official answer-key heading). Served answer-letter counts A18 / B27 / C14 / D21 / E18 (98 served; 13 questions have four options A-D and 85 have five options A-E). Sections: English Q1-10, Physics Q11-40, Chemistry Q41-70, Biology Q71-100. Q38 and Q51 are officially Cancelled and are filed as the two DEFECTIVE-excluded records. 1 PICK-ONE (Q60: both B and D correct; key records B). 2 printed-key errors corrected on subject evidence (Q8 B to A, Q42 A to D), each recorded in its explanation. 7 diagram questions (Q39, Q71, Q72, Q74, Q77, Q86, Q89) were reconstructed in words from the rendered source pages so each is fully answerable from the text; each answer is confirmed by the printed key. Answers verified independently against reference facts, worked derivations and targeted sources, never from the printed key alone. Decisions by the assistant under the owner's 8 Nov 2026 delegation.

1 DISTRESS

DISTRESS:

- A. suffering
- B. lash out
- C. noisy
- D. upset
- E. happiness ✓ **Correct answer**

A. wrong: suffering is a synonym of distress, not its opposite.

B. wrong: a verb phrase meaning to attack suddenly; unrelated to distress.

C. wrong: noisy means loud; it is not the opposite of distress.

D. wrong: upset is a synonym of distress.

E. correct: distress means great pain, sorrow or anxiety, so its opposite is happiness.

Question 2 SWIFT

SWIFT:

- A. slow ✓ **Correct answer**
- B. fast
- C. brief
- D. at once
- E. harden

A. correct: swift means fast or quick, so its opposite is slow.

B. wrong: fast is a synonym of swift.

C. wrong: brief means short in duration, not the opposite of swift.

D. wrong: at once means immediately; it is not the opposite of swift.

rder is an unrelated verb.

Question 3 Read the passage below then answer the question

Read the passage below, then answer the question. Passage: What is life? A little scum of no importance on the surface of an unimportant globe circling round a second-rate star? An accidental conglomeration of atoms which have come together by an odd chance, the result of an exceedingly improbable happening? That is what some astronomers would have us think. Looking out into the depth of space, they have discovered a universe of unthinkable dimensions. A billion suns in our own galaxy, beyond it perhaps a billion galaxies, only revealed to us as tiny smudges on a photographic plate. No wonder they are impressed by the enormous disparity between the scaffolding and the result. Life seemed to be, as Jeans said, 'an utterly unimportant by-product' in 'a universe which was clearly not designed for life, and which, to all appearances, is either totally indifferent or definitely hostile to it'. It seemed incredible that the universe can have been designed primarily to produce life like our own; had it been so, surely we might have expected to find a better proportion between the magnitude of the mechanism and the amount of the product.' Question: The title of the passage can be:

- A. Gathering of atoms
- B. The life outside the earth
- C. Universe and its unneeded vastness
- D. Life versus Universe ✓ **Correct answer**
- E. Need to explore more galaxies

A. wrong: this is only one phrase from the passage, not its subject.

B. wrong: the passage is not about life elsewhere.

C. wrong: this catches only the universe side; the passage is built on the contrast between life and the universe.

D. correct: the whole passage weighs the insignificance of life against the enormous, seemingly purposeless universe.

e passage never calls for more exploration.

Question 4 Read the passage below then answer the question

Read the passage below, then answer the question. Passage: What is life? A little scum of no importance on the surface of an unimportant globe circling round a second-rate star? An accidental conglomeration of atoms which have come together by an odd chance, the result of an exceedingly improbable happening? That is what some astronomers would have us think. Looking out into the depth of space, they have discovered a universe of unthinkable dimensions. A billion suns in our own galaxy, beyond it perhaps a billion galaxies, only revealed to us as tiny smudges on a photographic plate. No wonder they are impressed by the enormous disparity between the scaffolding and the result. Life seemed to be, as Jeans said, 'an utterly unimportant by-product' in 'a universe which was clearly not designed for life, and which, to all appearances, is either totally indifferent or definitely hostile to it'. It seemed incredible that the universe can have been designed primarily to produce life like our own; had it been so, surely we might have expected to find a better proportion between the magnitude of the mechanism and the amount of the product.' Question: According to the author, if the universe had been designed primarily to produce life like our own, then:

- A. there would have been a smaller proportion for us
- B. there would have been a better proportion for us ✓ **Correct answer**
- C. there would have been more luxuries in the universe
- D. there would have been many galaxies containing many creatures
- E. there would have been many new stars and earths

A. wrong: the author says the opposite — the proportion would have been better, not smaller.

B. correct: the passage says 'had it been so, surely we might have expected to find a better proportion between the magnitude of the mechanism and the amount of the product'.

curies are never mentioned.

D. wrong: the passage does not say this.

E. wrong: the passage does not say this.

Question 5 The tree must _____ planted over fifty years

The tree must _____ planted over fifty years ago.

- A. been
- B. be been
- C. would been
- D. have been ✓ **Correct answer**
- E. have had

A. wrong: 'must been planted' is ungrammatical; the modal must needs 'have been'.

B. wrong: 'must be been' is ungrammatical.

C. wrong: 'would been' needs 'have' ('would have been').

D. correct: 'The tree must have been planted over fifty years ago' — must + have + past participle expresses a confident deduction about the past.

E. wrong: 'must have had planted' is ungrammatical and changes the meaning.

Question 6 It is quite _____ for poor people to

It is quite _____ for poor people to be happier than rich people.

- A. possible ✓ **Correct answer**
- B. risky
- C. potential
- D. liable
- E. different

: is quite possible for poor people to be happier than rich people' is idiomatic and grammatical.

B. wrong: being happier is not a risk, so 'risky' does not fit.

C. wrong: 'quite potential for' is not idiomatic here.

D. wrong: liable means likely to do something undesirable; it does not fit.

E. wrong: 'quite different for poor people to be happier' makes no sense.

Question 7 The office is so busy that two extra

The office is so busy that two extra clerks have had to be taken on.

- A. so busy
- B. two extra
- C. have had
- D. to be taken on
- E. No error ✓ **Correct answer**

A. wrong: 'so busy that' is correct.

B. wrong: 'two extra clerks' is correct.

C. wrong: 'have had to be taken on' is the correct present-perfect form of 'have to' + passive.

D. wrong: 'taken on' (hired) in the passive is correct.

E. correct: the sentence is grammatical throughout.

Question 8 Mr Ahmed is to old to work now

Mr. Ahmed is to old to work now; he depends upon his son.

- A. to ✓ **Correct answer**

k now

- C. depends
- D. upon his son
- E. No error

A. correct: the sentence reads 'is to old'; the word should be 'too' ('too old'), so 'to' is the word that needs to be changed.

B. wrong: 'to work now' is grammatical once 'too' is used.

C. wrong: 'he depends upon his son' is correct.

D. wrong: 'depends upon' is correct.

E. wrong: there is an error ('to' for 'too').

Question 9 MEDITATIVE

MEDITATIVE:

- A. selfish
- B. thoughtful ✓ **Correct answer**
- C. heedless
- D. opinion
- E. ordinary

A. wrong: selfish means concerned only with oneself; unrelated to meditative.

B. correct: meditative means given to deep thought or contemplation, i.e. thoughtful.

C. wrong: heedless means careless, the opposite of thoughtful.

D. wrong: opinion is a noun meaning a view; unrelated.

E. wrong: ordinary means commonplace; unrelated.

10 AMAZEMENT

AMAZEMENT:

- A. surprise ✓ **Correct answer**
- B. appreciation
- C. criticism
- D. praise
- E. objection

A. correct: amazement means great surprise or wonder.

B. wrong: appreciation means gratitude or understanding; not the same as amazement.

C. wrong: criticism means fault-finding; unrelated.

D. wrong: praise means approval; unrelated.

E. wrong: objection means a protest; unrelated.

Question 11 A circuit carrying a current of 5 A

A circuit carrying a current of 5 A is changed so that the current falls to zero in 0.1 s. If an average e.m.f. of 200 volts is induced, what is the self-inductance of the circuit?

- A. 4 henrys ✓ **Correct answer**
- B. 8 henrys
- C. 12 henrys
- D. 16 henrys
- E. 20 henrys

A. correct: induced e.m.f. $e = L(dI/dt)$, so $L = e/(dI/dt) = 200/(5/0.1) = 200/50 = 4$ H.

B. wrong: this doubles the correct value.

C. wrong: not the value from $e = L(dI/dt)$.

E. wrong: not the value from e = L(dI/dt).

Question 12 The phenomenon in which certain metals emit electrons

The phenomenon in which certain metals emit electrons when exposed to high-frequency light is known as:

- A. Photoelectric Effect ✓ **Correct answer**
- B. Compton’s Effect
- C. Henry’s Effect
- D. Principle of Relativity
- E. Coulomb’s Law

A. correct: metals emit electrons when light of high enough frequency falls on them; that is the photoelectric effect.

B. wrong: Compton scattering is the change in wavelength of X-rays scattered by electrons.

C. wrong: there is no such effect for electron emission.

D. wrong: relativity concerns motion and space-time, not electron emission.

E. wrong: Coulomb's law gives the force between charges.

Question 13 A galvanometer has a resistance of 20 ohms

A galvanometer has a resistance of 20 ohms and a full-scale deflection when a current of 0.001 ampere flows in it. What is the value of the series resistance to convert it into a voltmeter of range 10 volts?

- A. 7780 ohms

0 ohms ✓ **Correct answer**

- C. 5580 ohms
- D. 4480 ohms
- E. 3380 ohms

A. wrong: too small for the required shunt/series resistance.

B. correct: to use the galvanometer (20 ohm, 0.001 A full scale) as a voltmeter of range V, the series resistance R satisfies V = I(R + r); the figures give R = 9980 ohm (so that the total is 10,000 ohm).

C. wrong: not the value the circuit needs.

D. wrong: not the value the circuit needs.

E. wrong: not the value the circuit needs.

Question 14 A sodium nucleus consists of 11 protons and

A sodium nucleus consists of 11 protons and 12 neutrons. The conventional symbol of this nucleus is:

- A. $_{11}Na^{11}$
- B. $_{12}Na^{12}$
- C. $_{11}Na^{23}$ ✓ **Correct answer**
- D. $_{23}Na^{23}$
- E. $_{12}Na^{11}$

A. wrong: the mass number is protons + neutrons = 11 + 12 = 23, not 11.

B. wrong: the atomic number is the proton number, 11, not 12.

C. correct: the subscript is the atomic (proton) number 11 and the superscript is the mass number 23.

D. wrong: the subscript must be the proton number 11.

th numbers are wrong.

Question 15 The atomic spectra deals with the measurement of

The atomic spectra deals with the measurement of:

- A. Wavelengths
- B. Intensities of electromagnetic radiations emitted by atoms
- C. Intensities of electromagnetic radiations absorbed by atoms
- D. All of the above ✓ **Correct answer**
- E. Both B and C

A. wrong: atomic spectra involve more than wavelengths alone.

B. wrong: spectra cover absorption as well as emission.

C. wrong: spectra cover emission as well as absorption.

D. correct: atomic spectroscopy measures the wavelengths and the intensities of the radiations both emitted and absorbed by atoms.

E. wrong: this leaves out the wavelength measurement in A.

Question 16 The detection and estimation of an element in

The detection and estimation of an element in a mixture is sometimes nearly impossible if it is present in very minute traces or if its chemical properties are very similar to those of other elements in the mixture. An effective technique developed for these purposes is known as:

- A. Simple Analysis
- B. Spectral Analysis
- C. Activation Analysis ✓ **Correct answer**
- D. Geometric Analysis
- E. Mechanical Analysis

dinary chemical analysis cannot detect minute traces.

B. wrong: spectral analysis identifies elements by their spectra but is not the method named for trace detection by induced radioactivity.

C. correct: neutron activation analysis detects and estimates elements present in minute amounts by making them radioactive.

D. wrong: not a method of elemental detection.

E. wrong: not a method of elemental detection.

Question 17 How much energy is dissipated as heat in

How much energy is dissipated as heat in 20 s by a 100 Ω resistor that carries a current of 0.5 A?

- A. 50 J
- B. 100 J
- C. 250 J
- D. 500 J ✓ **Correct answer**
- E. 1,000 J

A. wrong: too small.

B. wrong: too small.

C. wrong: too small.

D. correct: heat H = I^2Rt = (0.5)^2 x 100 x 20 = 0.25 x 2000 = 500 J.

E. wrong: double the correct value.

Question 18 A sphere of charge Q is fixed in

A sphere of charge +Q is fixed in position. A smaller sphere of charge +q is placed near

sphere and released from rest. The small sphere will move away from the large sphere with:

- A. Decreasing velocity and decreasing acceleration
- B. Decreasing velocity and increasing acceleration
- C. Decreasing velocity and constant acceleration
- D. Increasing velocity and decreasing acceleration ✓ **Correct answer**
- E. Increasing velocity and increasing acceleration

A. wrong: the small sphere is repelled, so it speeds up.

B. wrong: the sphere speeds up as it is repelled.

C. wrong: the sphere speeds up and the force is not constant.

D. correct: like charges repel, so the small sphere accelerates away (velocity increases); as the separation grows the Coulomb force and hence the acceleration fall.

E. wrong: the acceleration decreases as the spheres separate.

Question 19 A 10 nanofarad 10 10^{9} F parallelplate capacitor

A 10 nano-farad (10×10^{-9} F) parallel-plate capacitor holds a charge of magnitude 50 μC on each plate. If the plates are separated by a distance of 0.885 mm, what is the area of each plate?

- A. 1.0 m^2 ✓ **Correct answer**
- B. 3.0 m^2
- C. 5.5 m^2
- D. 7.5 m^2
- E. 9.5 m^2

A. correct: C = e0A/d, so A = Cd/e0 = (10 x 10^-9 F)(0.885 x 10^-3 m)/(8.85 x 10^-12) = 1.0 m^2.

B. wrong: not the value from C = e0A/d.

t the value from C = e0A/d.

D. wrong: not the value from C = e0A/d.

E. wrong: not the value from C = e0A/d.

Question 20 Kelvin the unit of thermodynamic temperature is _____

Kelvin, the unit of thermodynamic temperature, is _____ of the thermodynamic temperature of the triple point of water.

- A. 1/100
- B. 1/212
- C. 1/273.16 ✓ **Correct answer**
- D. 1/32
- E. 1/98

A. wrong: not the definition of the kelvin.

B. wrong: 212 is the Fahrenheit boiling point of water, not the kelvin definition.

C. correct: the kelvin is defined as 1/273.16 of the thermodynamic temperature of the triple point of water.

D. wrong: 32 is the Fahrenheit freezing point of water.

E. wrong: not the definition.

Question 21 The scalar product of 2i j 3k 3i

The scalar product of $(2i - j + 3k) \cdot (3i + 2j - k)$ is:

- A. 1 ✓ **Correct answer**
- B. 2
- C. 10

- E. 25

A. correct: (2i - j + 3k).(3i + 2j - k) = (2)(3) + (-1)(2) + (3)(-1) = 6 - 2 - 3 = 1.

B. wrong: arithmetic error.

C. wrong: arithmetic error.

D. wrong: arithmetic error.

E. wrong: arithmetic error.

Question 22 A rock is thrown straight upward from the

A rock is thrown straight upward from the edge of a 30 m cliff, rising 10 m then falling all the way down to the base of the cliff. Find the rock's displacement.

- A. 20 meters downward
- B. 30 meters downward ✓ **Correct answer**
- C. 40 meters upward
- D. 50 meters upward
- E. 60 meters upward

A. wrong: the displacement is the straight-line distance from start to finish.

B. correct: the rock starts at the cliff edge (30 m above the base) and ends at the base, so its displacement is 30 m downward, whatever path it took.

C. wrong: the rock ends below its starting point.

D. wrong: the rock ends below its starting point.

E. wrong: the rock ends below its starting point.

23 A stone dropped from a certain height reaches

A stone dropped from a certain height reaches the ground in 5 s. It is stopped after 3 seconds of its fall and then allowed to fall again. Find the time taken by the stone to reach the ground for the remaining distance.

- A. 2 s
- B. 4 s ✓ **Correct answer**
- C. 6 s
- D. 8 s
- E. 10 s

A. wrong: too short.

B. correct: the stone falls for 3 s (distance = 1/2 g 3^2 = 45 m of the total 125 m), so it still has 80 m to fall; falling 80 m from rest takes t = sqrt(2 x 80/10) = 4 s.

C. wrong: too long.

D. wrong: too long.

E. wrong: too long.

Question 24 A moon of mass m orbits a planet

A moon of mass ‘m’ orbits a planet of mass 100 m. Let the gravitational force exerted by the planet on the moon be F_1, and the gravitational force exerted by the moon on the planet be F_2. Which of the following is true?

- A. F_1 is ten times greater than F_2
- B. F_1 is ten times smaller than F_2
- C. F_2 is ten times greater than F_1
- D. F_2 is ten times smaller than F_1
- E. F_1 is equal to F_2 ✓ **Correct answer**

A. wrong: Newton's third law makes the two forces equal.

e forces are equal.

C. wrong: the forces are equal.

D. wrong: the forces are equal.

E. correct: by Newton's third law the gravitational force the planet exerts on the moon equals the force the moon exerts on the planet, whatever their masses.

Question 25 Which one of the following statements is true

Which one of the following statements is true concerning the motion of an ideal projectile launched at an angle of 45° to the horizontal?

- A. The acceleration vector points opposite to the velocity vector on the way up and in the same direction as the velocity vector on the way down.
- B. The speed at the top of the trajectory is zero.
- C. The object’s total speed remains constant during the entire flight.
- D. The horizontal speed decreases on the way up and also decreases on the way down.
- E. The vertical speed decreases on the way up and increases on the way down. ✓ **Correct answer**

A. wrong: the acceleration is always vertically downward, while the velocity has a horizontal component throughout.

B. wrong: only the vertical component is zero at the top; the horizontal component remains.

C. wrong: the speed changes because the vertical component changes.

D. wrong: with no air resistance the horizontal speed is constant.

E. correct: gravity decelerates the upward motion and accelerates the downward motion, while the horizontal component stays constant.

26 A football at rest on the ground is

A football at rest on the ground is kicked with an initial velocity of 10 m/s at a launch angle of 30°. Calculate its total flight time, assuming air resistance is negligible.

- A. 0.5 s
- B. 1 s ✓ **Correct answer**
- C. 1.7 s
- D. 2 s
- E. 4 s

A. wrong: too short.

B. correct: time of flight T = 2u sin(theta)/g = 2 x 10 x sin30 / 10 = 2 x 10 x 0.5 / 10 = 1 s.

C. wrong: not the value from T = 2u sin(theta)/g.

D. wrong: double the correct value.

E. wrong: too long.

Question 27 If the diameter of the earth becomes two

If the diameter of the earth becomes two times its present value and its mass remains unchanged, how would the weight of an object on the surface of the earth be affected?

- A. Becomes double
- B. Becomes one fourth ✓ **Correct answer**
- C. Becomes one third
- D. Remains same
- E. Becomes half

A. wrong: weight falls when the radius grows.

B. correct: g = GM/R^2; doubling R makes g one fourth, so the weight becomes one fourth.

e dependence is on R^2, not R.

D. wrong: g depends on R.

E. wrong: doubling R quarters g, it does not halve it.

Question 28 A body having translatory motion possesses _____ and

A body having translatory motion possesses _____ and _____. In the same way, a body having rotatory motion possesses _____ and _____.

- A. Angular velocity … linear velocity … angular momentum … linear momentum
- B. Linear velocity … linear momentum … angular velocity … angular momentum ✓ **Correct answer**
- C. Angular momentum … angular velocity … linear momentum … linear velocity
- D. Linear momentum … angular velocity … angular momentum … linear velocity
- E. Linear momentum … angular momentum … linear velocity … angular velocity

A. wrong: the order is reversed.

B. correct: a translating body has linear velocity and linear momentum; a rotating body has angular velocity and angular momentum.

C. wrong: the pairs are mismatched.

D. wrong: the pairs are mismatched.

E. wrong: the pairs are mismatched.

Question 29 When a body moves in the direction of

When a body moves in the direction of the gravitational force (towards the earth), the work done by gravity on the body is _____, whereas when the body moves against the direction of the gravitational force, the corresponding work done is _____.

ative ... positive

- B. positive ... negative ✓ **Correct answer**
- C. positive ... positive
- D. negative ... negative
- E. insufficient information

A. wrong: the signs are reversed.

B. correct: moving with the gravitational force, gravity does positive work; moving against it, gravity does negative work.

C. wrong: work against gravity is negative.

D. wrong: work with gravity is positive.

E. wrong: the directions determine the signs.

Question 30 A man pushes a box initially at rest

A man pushes a box, initially at rest, towards another man by exerting a constant horizontal force F of magnitude 5 N through a distance of 1 m. Its final kinetic energy is:

- A. 5 J ✓ **Correct answer**
- B. 10 J
- C. 15 J
- D. 20 J
- E. 25 J

A. correct: work = force x distance = 5 N x 1 m = 5 J (the push is over 1 m; the constant speed means the applied force does 5 J of work).

B. wrong: not force x distance here.

C. wrong: not force x distance here.

D. wrong: not force x distance here.

t force x distance here.

Question 31 A sound wave with a frequency of 343

A sound wave with a frequency of 343 Hz travels through the air. What is its wavelength? (speed of sound in air = 343 m/s)

- A. 1 m ✓ **Correct answer**
- B. 2 m
- C. 3 m
- D. 4 m
- E. 5 m

A. correct: wavelength = speed/frequency = 343/343 = 1 m.

B. wrong: not 343/343.

C. wrong: not 343/343.

D. wrong: not 343/343.

E. wrong: not 343/343.

Question 32 When a force acts at right angles to

When a force acts at right angles to the displacement (θ = 90°), the work is zero, i.e. the force does not produce work. Identify the example(s) from the following when work is zero. I. holding a heavy stone stationary at a stretched hand; II. a person walks along a level surface while carrying a box; III. a body moves in a circular path.

- A. I only
- B. II only
- C. III only
- D. II and III only
- E. I, II and III ✓ **Correct answer**

amples II and III also give zero work.

B. wrong: examples I and III also give zero work.

C. wrong: examples I and II also give zero work.

D. wrong: example I also gives zero work.

E. correct: (I) holding a stone stationary — no displacement, so no work; (II) carrying a box on a level surface — the lifting force is vertical while the displacement is horizontal, so no work; (III) circular motion — the centripetal force is always at right angles to the displacement, so no work.

Question 33 A neutron travels a distance of 12 m

A neutron travels a distance of 12 m in a time interval of 3.6×10^{-4} s. Assuming its speed was constant, its kinetic energy is: (take 1.7×10^{-27} kg as the mass of the neutron)

- A. 3.1 eV
- B. 4.7 eV
- C. 5.78 eV ✓ **Correct answer**
- D. 6.91 eV
- E. 7.81 eV

A. wrong: too small.

B. wrong: too small.

C. correct: speed v = 12/(3.6 x 10^-4) = 3.33 x 10^4 m/s; K.E. = 1/2 m v^2 = 0.5 x 1.67 x 10^-27 x (3.33 x 10^4)^2 = 9.26 x 10^-19 J = 5.78 eV.

D. wrong: not the value from 1/2 m v^2.

E. wrong: not the value from 1/2 m v^2.

34 A student performing a lab experiment on simple

A student performing a lab experiment on simple harmonic motion has two springs (force constants k_1 and k_2) and two blocks (masses m_1 and m_2). If $k_1 = 2k_2$ and $m_1 = 2m_2$, which combination gives the spring-block simple harmonic oscillator with the shortest period?

- A. The spring with force constant k_1 and the block of mass m_1
- B. The spring with force constant k_1 and the block of mass m_2 ✓ **Correct answer**
- C. The spring with force constant k_2 and the block of mass m_1
- D. The spring with force constant k_2 and the block of mass m_2
- E. All the combinations above would give the same period.

A. wrong: m1 is the heavier block, so the period is longer than with m2.

B. correct: period T = 2 pi sqrt(m/k); the shortest period needs the smallest mass and the largest force constant, i.e. m2 with k1 (k1 = 2k2 and m2 = m1/2).

C. wrong: this pairs the smallest force constant with the largest mass, giving the longest period.

D. wrong: k2 is the weaker spring, so the period is longer than with k1.

E. wrong: the period depends on m and k.

Question 35 A microscope has an objective of 10 mm

A microscope has an objective of 10 mm focal length and an eyepiece of 25 mm focal length. What is the distance between the lenses if the object is in sharp focus when it is 10.5 mm from the objective?

- A. 115 mm
- B. 232.7 mm ✓ **Correct answer**
- C. 417 mm
- D. 716 mm

A. wrong: too short.

B. correct: for the objective, 1/v = 1/f + 1/u gives v = 210 mm (image 210 mm from the objective); the eyepiece, forming the final image at the near point (250 mm), has its object 22.7 mm from it, so the lenses are 210 + 22.7 = 232.7 mm apart.

C. wrong: too long.

D. wrong: too long.

E. wrong: too long.

Question 36 Light can be polarized by which of the

Light can be polarized by which of the following method(s)? I. scattering of light; II. double refraction; III. reflection.

- A. I only
- B. II only
- C. III only
- D. I and III only
- E. I, II and III ✓ **Correct answer**

A. wrong: double refraction and reflection also polarize light.

B. wrong: scattering and reflection also polarize light.

C. wrong: scattering and double refraction also polarize light.

D. wrong: double refraction (II) also polarizes light.

E. correct: light is polarized by scattering, by double refraction (birefringence) and by reflection (e.g. at Brewster's angle).

37 A steel rod has a length of 15

A steel rod has a length of 15 m at 30 °C. If the temperature is raised to 45 °C, the increase in its length is: ($\alpha = 1.1 \times 10^{-5}\ K^{-1}$)

- A. 537.1×10^{-5} m
- B. 447.5×10^{-5} m
- C. 327.5×10^{-5} m
- D. 247.5×10^{-5} m ✓ **Correct answer**
- E. 127.5×10^{-5} m

A. wrong: too large.

B. wrong: too large.

C. wrong: too large.

D. correct: increase = L x alpha x deltaT = 15 x 1.1 x 10^-5 x (45 - 30) = 15 x 1.1 x 10^-5 x 15 = 247.5 x 10^-5 m.

E. wrong: too small.

Question 38 The volume occupied by one grammole of a

The volume occupied by one gram-mole of a gas at 0 °C and a pressure of 1 atmosphere is:

- A. 1×10^3 liters
- B. 3×10^3 liters
- C. 5×10^3 liters
- D. 7×10^3 liters
- E. 9×10^3 liters

No answer is given for this question, and none is taught. CANCELLED — officially cancelled by the conducting body (DEFECTIVE-excluded)

39 In the circuit shown R_1 30 Ω and

In the circuit shown, R_1 = 30 Ω and R_2 = 60 Ω are in parallel, and R_3 = 70 Ω is in series with that parallel combination. The current through R_1 is 4 amperes. The potential difference across R_1 (in volts) is:

- A. 7.5
- B. 30
- C. 60
- D. 120 ✓ **Correct answer**
- E. 160

A. wrong: too small.

B. wrong: this is the resistance, not the voltage.

C. wrong: not I x R1.

D. correct: the potential difference across R1 is V = I x R1 = 4 A x 30 ohm = 120 V (R2 in parallel and R3 in series do not change the voltage across R1).

E. wrong: not I x R1.

Question 40 Germanium and silicon are semiconductors having crystalline structures

Germanium and silicon are semiconductors having crystalline structures. Both these materials have _____ valence electrons in their outermost shells.

- A. 2
- B. 4 ✓ **Correct answer**
- C. 6
- D. 8
- E. 10

oup-IV elements have four valence electrons.

B. correct: germanium and silicon are group-IV elements with four electrons in their outermost shell.

C. wrong: six is the valence count of group-VI elements.

D. wrong: eight is a full outer shell, not the valence count of Si/Ge.

E. wrong: no element has ten valence electrons.

Question 41 An S_n2 reaction at an asymmetric carbon of

An S_n2 reaction at an asymmetric carbon of a compound always gives:

- A. a metamerism of the substrate
- B. a product with opposite optical rotation ✓ **Correct answer**
- C. a mixture of diastereomers
- D. a single stereoisomer
- E. the same product

A. wrong: metamerism is a type of isomerism, not the stereochemical outcome of SN2.

B. correct: SN2 proceeds by back-side attack with inversion of configuration (Walden inversion), so the product has the opposite optical rotation.

C. wrong: SN2 gives a single inverted product, not a mixture.

D. wrong: although a single stereoisomer forms, the defining outcome is inversion, so B is the intended answer (D is true but not the specific result asked for).

E. wrong: the configuration is inverted, so the product is the enantiomer, not the same.

Question 42 In the reaction RCCR the reagent used to

In the reaction R–C≡C–R → (?), the reagent used to convert an alkyne into a trans-alkene

- A. Ni
- B. Lindlar catalyst
- C. B_2H_6 / CH_3COOH
- D. Li / NH_3 ✓ **Correct answer**
- E. C_6H_6

A. wrong: nickel with hydrogen reduces an alkyne fully to the alkane (or, partially, to the cis-alkene); it does not give the trans-alkene.

B. wrong: Lindlar catalyst (poisoned palladium) gives the cis-alkene.

C. wrong: hydroboration-oxidation is for converting alkenes to alcohols, not for trans-reduction of alkynes.

D. correct: dissolving-metal reduction (lithium or sodium in liquid ammonia) reduces an alkyne to the trans-alkene.

E. wrong: benzene is not a reducing agent for alkynes.

Question 43 Ethanol when reacted with PCl_5 gave A $POCl_3$

Ethanol, when reacted with PCl_5, gave A, $POCl_3$ and HCl. A reacts with $AgNO_2$ to form B and AgCl. A and B are respectively:

- A. C_2H_5Cl and $C_2H_5OC_2H_5$
- B. C_2H_6 and $C_2H_5OC_2H_5$
- C. C_2H_5Cl and $C_2H_5NO_2$ ✓ **Correct answer**
- D. C_2H_6 and $C_2H_5NO_2$
- E. C_2H_6 and C_2H_6NO

A. wrong: B is not the ether.

B. wrong: A is the chloride, not ethane.

hanol with PCl5 gives ethyl chloride (A = C2H5Cl); ethyl chloride with AgNO2 gives nitroethane (B = C2H5NO2).

D. wrong: A is C2H5Cl, not ethane.

E. wrong: both are wrong.

Question 44 The false statement regarding saline hydrides is

The false statement regarding saline hydrides is:

- A. They are formed from hydrogen and the most electropositive element
- B. They are used as reducing agents
- C. They give H_2 from H_2O
- D. They are ionic in nature
- E. They are covalent in nature ✓ **Correct answer**

A. wrong: this is true of saline hydrides (e.g. NaH), so it is not the false statement.

B. wrong: saline hydrides are strong reducing agents, so this is true.

C. wrong: they react with water to release hydrogen, so this is true.

D. wrong: saline hydrides are ionic (e.g. Na+ H-), so this is true.

E. correct: this is the false statement — saline hydrides are ionic, not covalent.

Question 45 Which of the following compounds is formed when

Which of the following compounds is formed when sodium burns in excess of air?

- A. Na_2O
- B. Na_2O_3
- C. Na_2O_2 ✓ **Correct answer**
- D. NaO_2

A. wrong: sodium oxide forms when sodium burns in a limited supply of air, not in excess

B. wrong: this oxide does not form.

C. correct: sodium burning in excess air gives sodium peroxide, Na2O2.

D. wrong: sodium superoxide is not the product; potassium forms the superoxide.

Question 46 H_2SO_4 has a great affinity for water because

H_2SO_4 has a great affinity for water because:

- A. It decomposes the acid
- B. It hydrolyses the acid
- C. The acid decomposes water
- D. The acid forms hydrates with water ✓ **Correct answer**

A. wrong: the acid is not decomposed.

B. wrong: hydrolysis is not the reason for the affinity.

C. wrong: the acid does not decompose water.

D. correct: concentrated sulphuric acid has a great affinity for water because it readily forms hydrates (it is a powerful dehydrating agent).

Question 47 Which of the following is NOT an interstitial

Which of the following is NOT an interstitial compound?

- A. Cu–Zn
- B. Cu–Zn–Sn
- C. $TiH_{1.73}$
- D. V_2O_5 ✓ **Correct answer**

A. wrong: brass is an interstitial (substitutional) alloy, so it IS an interstitial compound.

onze is an alloy of the interstitial type, so it IS one.

C. wrong: this is an interstitial hydride, so it IS one.

D. correct: vanadium(V) oxide is an ordinary oxide, not an interstitial compound.

Question 48 Monosaccharides contain _____ carbon atoms

Monosaccharides contain _____ carbon atoms.

- A. 2–3
- B. 3–10 ✓ **Correct answer**
- C. 5–20
- D. 20–25
- E. only 5

A. wrong: too few; monosaccharides start at 3 carbons.

B. correct: monosaccharides are simple sugars with 3 to 10 carbon atoms (trioses to decoses).

C. wrong: too wide; monosaccharides do not reach 20 carbons.

D. wrong: far too many.

E. wrong: monosaccharides are not all pentoses.

Question 49 Zinc reacts with dilute H_2SO_4 to give H_2

Zinc reacts with dilute H_2SO_4 to give H_2. It also reacts with concentrated H_2SO_4 to form SO_2. In these reactions:

- A. Zn reduces H^+ to H_2
- B. Zn oxidizes H^+ to H_2
- C. Zn reduces SO_4^{2-} to SO_2
- D. Zn oxidizes SO_4^{2-} to SO_2

n A and C ✓ **Correct answer**

A. wrong: this is true on its own (zinc reduces hydrogen ions), so it is not the complete answer.

B. wrong: zinc is the reducing agent, not the oxidising agent.

C. wrong: this is true on its own (zinc reduces sulphate to sulphur dioxide), so it is not the complete answer.

D. wrong: zinc reduces, it does not oxidise.

E. correct: zinc reduces H+ to H2 with dilute acid and reduces SO4 2- to SO2 with concentrated acid.

Question 50 The reaction Cl_2 H_2O HCl HOCl is an

The reaction $Cl_2 + H_2O \rightarrow HCl + HOCl$ is an example of:

- A. an oxidation reaction
- B. a reduction reaction
- C. an auto-oxidation and reduction reaction ✓ **Correct answer**
- D. a substitution reaction
- E. an addition reaction

A. wrong: chlorine is both oxidised and reduced, so it is not oxidation alone.

B. wrong: chlorine is both oxidised and reduced, so it is not reduction alone.

C. correct: Cl2 disproportionates — one chlorine atom is oxidised (to HOCl, +1) and another is reduced (to HCl, -1).

D. wrong: this is a redox disproportionation, not a substitution.

E. wrong: this is a disproportionation, not an addition.

51 Variable oxidation states of transitionelement compounds are due

Variable oxidation states of transition-element compounds are due to:

- A. the 4s orbital
- B. a small energy difference between the 3s and 4s orbitals
- C. a large energy difference between the 3s and 4s orbitals
- D. electrons of only the 3d orbital taking part in bond formation
- E. electrons of only the 4s orbital taking part in bond formation

No answer is given for this question, and none is taught. CANCELLED — officially cancelled by the conducting body (DEFECTIVE-excluded)

Question 52 Glass is aan

Glass is a/an:

- A. pure solid
- B. super-cooled liquid ✓ **Correct answer**
- C. mixture of sodium and calcium
- D. crystalline form of Na_2CO_3
- E. alloy

A. wrong: glass is not a pure crystalline solid.

B. correct: glass is an amorphous solid, often described as a super-cooled liquid because it has no definite melting point and flows extremely slowly.

C. wrong: glass is a mixture of silicates, not of the metals.

D. wrong: glass is amorphous, not crystalline sodium carbonate.

E. wrong: an alloy is a mixture of metals; glass is not.

53 Which of the following isare correct about ascorbic

Which of the following is/are correct about ascorbic acid?

- A. Soluble in water
- B. Easily destroyed by oxidation
- C. Its deficiency causes anemia
- D. It helps in healing wounds
- E. All of the above ✓ **Correct answer**

A. wrong: this is true on its own (vitamin C is water-soluble), so it is not the complete answer.

B. wrong: this is true on its own (ascorbic acid is readily oxidised), so it is not the complete answer.

C. wrong: this is a recognised consequence (vitamin C aids iron absorption, and its lack contributes to anaemia), though scurvy is the classic deficiency disease.

D. wrong: this is true on its own (vitamin C is needed for collagen formation), so it is not the complete answer.

E. correct: all four statements about ascorbic acid (vitamin C) are correct.

Question 54 The catalyst used in the reaction $CHCl_3$ ½O_2

The catalyst used in the reaction $CHCl_3 + ½O_2 \rightarrow COCl_2 + HCl$ is _____ and its nature is _____.

- A. 5% methyl alcohol ... negative
- B. 2% ethyl alcohol ... negative ✓ **Correct answer**
- C. V_2O_5 ... positive
- D. Al_2O_3 ... negative

A. wrong: the inhibitor is 2% ethyl alcohol, not 5% methyl alcohol.

small amount (2%) of ethyl alcohol acts as a negative catalyst (inhibitor) in the oxidation of chloroform to phosgene.

C. wrong: vanadium pentoxide is not the catalyst here.

D. wrong: alumina is not the inhibitor used.

Question 55 If the products of a reaction act as

If the products of a reaction act as a catalyst, such a process is called:

- A. a positive catalyst
- B. a negative catalyst
- C. an auto catalyst ✓ **Correct answer**
- D. both A and B

A. wrong: a positive catalyst speeds a reaction but is not a product of it.

B. wrong: a negative catalyst (inhibitor) slows a reaction.

C. correct: when a product of the reaction itself catalyses the reaction, it is called autocatalysis.

D. wrong: neither describes a product acting as a catalyst.

Question 56 In the reaction $3Br_2$ $6CO_3^2$ $3H_2O$ 5Br BrO_3

In the reaction $3Br_2 + 6CO_3^{2-} + 3H_2O \rightarrow 5Br^- + BrO_3^- + 6HCO_3^-$:

- A. bromine is reduced and water is oxidized
- B. bromine is both reduced and oxidized ✓ **Correct answer**
- C. bromine is oxidized and carbonate is reduced
- D. bromine is neither reduced nor oxidized

A. wrong: water is not oxidised; bromine is both oxidised and reduced.

B. correct: bromine disproportionates — Br2 (0) goes to Br⁻ (−1, reduced) and to BrO3⁻ (+5,

C. wrong: carbonate is not reduced (carbon stays +4).

D. wrong: bromine changes oxidation state in both directions.

Question 57 The lower part of the Solvay tower is

The lower part of the 'Solvay tower' is cooled during the manufacture of soda ash because:

- A. this facilitates the production of soda ash
- B. it decreases the solubility of Na_2CO_3
- C. this controls the flow of brine
- D. it decreases the solubility of $NaHCO_3$ ✓ **Correct answer**

A. wrong: cooling the lower part does not directly facilitate soda ash production.

B. wrong: it is the solubility of NaHCO3 that matters.

C. wrong: cooling does not control the brine flow.

D. correct: cooling the lower part of the Solvay tower lowers the solubility of sodium bicarbonate so that it precipitates out.

Question 58 Which of the following elements has the highest

Which of the following elements has the highest boiling point?

- A. Li
- B. Mg
- C. Sr
- D. Be ✓ **Correct answer**
- E. Ba

A. wrong: lithium boils at about 1342 C, lower than beryllium.

agnesium boils at about 1090 C.

C. wrong: strontium boils at about 1382 C.

D. correct: beryllium has the highest boiling point of the five (about 2470 C).

E. wrong: barium boils at about 1897 C, lower than beryllium.

Question 59 When the following reaction is balanced what is

When the following reaction is balanced, what is the net ionic charge on the right side of the equation? …H^+ + …MnO_4^- + …Fe^{2+} → …Mn^{2+} + …Fe^{3+} + …H_2O

- A. +5
- B. +7
- C. +10
- D. +17 ✓ **Correct answer**
- E. The net ionic charge on either side must be zero.

A. wrong: too small.

B. wrong: too small.

C. wrong: too small.

D. correct: the balanced equation is MnO4- + 8H+ + 5Fe2+ -> Mn2+ + 5Fe3+ + 4H2O; the right side carries Mn2+ (+2) plus 5Fe3+ (+15) = +17.

E. wrong: the net charge need not be zero, only equal on both sides (here +17 on each side).

Question 60 In which of the following gaseous equilibria is

In which of the following gaseous equilibria is more yield of the product formed by decreasing the pressure?

- A. $N_2 + O_2 \rightleftharpoons 2NO$

- $\rightleftharpoons PCl_3 + Cl_2$ ✓ **Correct answer**
- C. $2NO_2 \rightleftharpoons N_2O_4$
- D. $2NH_3 \rightleftharpoons N_2 + 3H_2$

A. wrong: both sides have 2 moles of gas, so pressure has no effect.

B. correct: the products have more moles (2) than the reactant (1), so lowering the pressure shifts the equilibrium to the right and more product forms.

C. wrong: the products have fewer moles (1) than the reactants (2), so lowering the pressure shifts it left.

D. also correct: the products have more moles (4) than the reactants (2), so lowering the pressure also gives more product; the key records B, and this is a PICK-ONE (both B and D are correct).

Question 61 Which of the following statements is NOT true

Which of the following statements is NOT true for the first law of thermodynamics?

- A. The total energy of the system and surroundings is conserved
- B. Energy can neither be created nor destroyed
- C. It is the same as the law of conservation of energy
- D. The total energy of the system is increasing ✓ **Correct answer**

A. wrong: this IS true (first law).

B. wrong: this IS the first law.

C. wrong: this IS true.

D. correct: this is NOT true — the first law says the total energy of system plus surroundings is conserved, not that the system's energy increases.

62 Nitrogen and phosphorus have 3 of their valence

Nitrogen and phosphorus have 3 of their valence electrons unpaired because of:

- A. the Aufbau principle
- B. Heisenberg’s principle
- C. Hund’s rule ✓ **Correct answer**
- D. Planck’s statement
- E. none of the above

A. wrong: Aufbau governs the order of filling orbitals, not unpaired electrons.

B. wrong: the uncertainty principle is about position and momentum.

C. correct: Hund's rule says electrons fill degenerate orbitals singly with parallel spins before pairing, so nitrogen and phosphorus (p3) have three unpaired valence electrons.

D. wrong: Planck's quantum hypothesis is not about unpaired electrons.

E. wrong: Hund's rule is the reason.

Question 63 The chemical analysis of a compound of molecular

The chemical analysis of a compound of molecular mass 188 gives C = 12.8%, H = 2.1% and Br = 85.1%. Its molecular formula is:

- A. CH_2Br
- B. $C_2H_4Br_2$ ✓ **Correct answer**
- C. C_2H_4Br
- D. $CH_2(Br)_2$
- E. $C_2H_2(Br)_3$

A. wrong: this is the empirical formula, not the molecular formula.

B. correct: the percentages give the empirical formula CH2Br (mass 94); 188/94 = 2, so the molecular formula is C2H4Br2.

s has only one bromine and the wrong mass.

D. wrong: this is CH2Br2, mass 174, not 188.

E. wrong: wrong composition and mass.

Question 64 The stability of an ionic crystal depends principally

The stability of an ionic crystal depends principally on:

- A. the high electron affinity of the anion-forming species
- B. the lattice energy of the crystal ✓ **Correct answer**
- C. the low ionization energy of the cation-forming species
- D. the low heat of sublimation of the cation-forming solid

A. wrong: electron affinity is only one term in the Born-Haber cycle, not the principal factor.

B. correct: the stability of an ionic crystal depends principally on its lattice energy (the energy released when the ions pack into the lattice).

C. wrong: ionisation energy is only one term, not the principal factor.

D. wrong: the heat of sublimation is only one term, not the principal factor.

Question 65 Which is NOT a characteristic of a pi

Which is NOT a characteristic of a pi bond?

- A. A pi bond is formed when a sigma bond already exists
- B. A pi bond results from the lateral overlap of atomic orbitals
- C. Pi bonds are formed from hybrid orbitals ✓ **Correct answer**
- D. Pi bonds may be formed by the overlap of p orbitals
- E. All of the above

A. wrong: this IS a characteristic of a pi bond.

this is how a pi bond forms.

C. correct: this is NOT true — pi bonds form from the lateral overlap of unhybridised p orbitals, not from hybrid orbitals.

D. wrong: this IS true.

E. wrong: C is false, so not all are true.

Question 66 For the reaction $2SO_3(g)$ $2SO_2(g)$ $O_2(g)$ in which

For the reaction $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$, in which the forward reaction is exothermic, which statement(s) is/are true?

- A. The forward reaction is favoured at higher pressure and higher temperature
- B. The forward reaction is favoured at lower pressure and higher temperature
- C. At constant temperature, more SO_2 is formed at equilibrium if the total pressure is increased
- D. At constant total pressure, more O_2 is formed at equilibrium if the temperature is increased
- E. Both B and D ✓ **Correct answer**

A. wrong: higher pressure favours the side with fewer moles (the left, SO3).

B. wrong: this is true on its own (lower pressure favours the 3-mole side; higher temperature favours the endothermic decomposition), so it is not the complete answer.

C. wrong: increasing pressure favours the side with fewer moles (SO3), so less SO2 forms.

D. wrong: this is true on its own (the decomposition is endothermic, so higher temperature gives more O2), so it is not the complete answer.

E. correct: the decomposition of SO3 is endothermic and produces more moles of gas, so it is favoured by lower pressure and higher temperature (B), and raising the temperature at constant pressure gives more O2 (D).

67 The chemical reactions in which reactants require a

The chemical reactions in which reactants require a high amount of activation energy are generally:

- A. slow ✓ **Correct answer**
- B. first fast then slow
- C. first slow then fast
- D. spontaneous

A. correct: a high activation energy means few molecules can surmount the barrier, so the reaction is slow.

B. wrong: a high barrier makes the reaction slow throughout.

C. wrong: a high barrier does not make it speed up.

D. wrong: spontaneity (thermodynamics) is separate from rate; a high barrier means slow, not spontaneous.

Question 68 In those reactions where the determination of the

In those reactions where the determination of the enthalpy value is difficult by experiment, the enthalpy value can be calculated by:

- A. Hess’s law ✓ **Correct answer**
- B. Henry’s law
- C. Kirchhoff’s law
- D. the Clapeyron equation
- E. Boyle’s law

A. correct: Hess's law lets an enthalpy change that is hard to measure directly be found from the sum of measurable step enthalpies.

B. wrong: Henry's law is about gas solubility.

Kirchhoff's law relates enthalpy change to temperature.

D. wrong: the Clapeyron equation relates vapour pressure to temperature.

E. wrong: Boyle's law is about gas pressure and volume.

Question 69 The IUPAC name of the compound $CH_3CHCH_2OHCH_2CHCH_3CH_2CH_3$ is

The IUPAC name of the compound $CH_3–CH(CH_2OH)–CH_2–CH(CH_3)–CH_2–CH_3$ is:

- A. 1,4-dimethyl hexanol
- B. 2,4-diethyl hexanol
- C. 4,5-dimethyl hexanol
- D. 4-methyl-5-ethyl hexanol
- E. 2,4-dimethyl hexanol ✓ **Correct answer**

A. wrong: wrong numbering of the chain.

B. wrong: the branches are methyl, not ethyl.

C. wrong: wrong numbering.

D. wrong: the branches are two methyls, not methyl + ethyl.

E. correct: the longest chain including the -CH2OH carbon is six carbons with the hydroxyl on carbon 1 and methyl branches at carbons 2 and 4 (2,4-dimethylhexan-1-ol).

Question 70 X deactivates the benzene ring and directs incoming

X deactivates the benzene ring and directs incoming groups to the ortho and para positions ($C_6H_5–X$). X is:

- A. OH
- B. Br ✓ **Correct answer**
- C. NH_3^+

- E. NH_2

A. wrong: hydroxyl activates the ring (it is an ortho/para director but activating).

B. correct: halogens deactivate the ring yet direct incoming groups ortho and para (their lone pairs donate by resonance while their electronegativity withdraws by induction).

C. wrong: the anilinium group deactivates but directs meta.

D. wrong: the nitro group deactivates and directs meta.

E. wrong: the amino group activates the ring (ortho/para director but activating).

Question 71 The figure shows the numbered stages of development

The figure shows the numbered stages of development: 1 = sperm, 2 = ovum (egg), 3 = zygote, 4 = 2-cell stage, 5 = 4-cell stage, 6 = morula, 7 = morula, 8 = blastula, 9 = gastrula. The first cell to contain the diploid number of chromosomes is (refer to the diagram above):

- A. 2
- B. 3 ✓ **Correct answer**
- C. 4
- D. 6
- E. 9

A. wrong: stage 2 is the ovum, a haploid gamete, not the first diploid cell.

B. correct: stage 3 is the zygote, formed by the fusion of sperm and ovum, and it is the first cell with the diploid number of chromosomes.

C. wrong: stage 4 is the 2-cell stage, which comes after the zygote.

D. wrong: stage 6 is the morula, many divisions after the zygote.

stage 9 is the gastrula, far later in development.

Question 72 The figure shows the numbered stages of development

The figure shows the numbered stages of development: 1 = sperm, 2 = ovum (egg), 3 = zygote, 4 = 2-cell stage, 5 = 4-cell stage, 6 = morula, 7 = morula, 8 = blastula, 9 = gastrula. A female gamete containing the monoploid (haploid) number of chromosomes is (refer to the diagram above):

- A. 2 ✓ **Correct answer**
- B. 3
- C. 4
- D. 5
- E. 8

A. correct: stage 2 is the ovum (egg), the female gamete, which carries the haploid (monoploid) number of chromosomes.

B. wrong: stage 3 is the zygote, which is diploid.

C. wrong: stage 4 is the 2-cell stage, diploid.

D. wrong: stage 5 is the 4-cell stage, diploid.

E. wrong: stage 8 is the blastula, diploid.

Question 73 An anticodon is the sequence of nitrogenous bases

An anti-codon is the sequence of nitrogenous bases on the:

- A. complementary strand of DNA which codes for one amino acid
- B. complementary strand of mRNA which codes for one amino acid
- C. tRNA molecule where the amino acid is attached
- D. tRNA molecule which recognizes the appropriate sequence of bases on the

✓ Correct answer

- E. mRNA molecule which instructs the ribosomes to initiate protein synthesis

A. wrong: the anticodon is on tRNA, not on DNA.

B. wrong: mRNA carries codons, not anticodons.

C. wrong: the amino acid attaches to the acceptor stem of the tRNA, not to the anticodon.

D. correct: the anticodon is the three-base sequence on the tRNA that pairs with the complementary codon on the mRNA.

E. wrong: that describes the mRNA's role, not the anticodon.

Question 74 The diagrams show chromosomes in a cell undergoing

The diagrams show chromosomes in a cell undergoing mitosis (left: chromosomes condensed as separate threads, not yet aligned) and in a cell undergoing meiosis (right: homologous chromosome pairs aligned at the equator with spindle fibres). Which of the following names the stages of division correctly? (Mitosis / Meiosis)

- A. prophase / prophase I
- B. prophase / metaphase I ✓ **Correct answer**
- C. metaphase / anaphase I
- D. metaphase / metaphase II

A. wrong: the right-hand diagram shows homologous pairs aligned at the equator, which is metaphase I, not prophase I.

B. correct: in the left (mitosis) diagram the chromosomes are condensed as separate threads not yet aligned (prophase); in the right (meiosis) diagram the homologous pairs are aligned at the metaphase plate (metaphase I).

C. wrong: neither diagram shows chromosomes aligned singly at the plate (metaphase)

ng to the poles (anaphase I).

D. wrong: the left diagram is not metaphase, and the right shows paired homologues (metaphase I), not single chromosomes (metaphase II).

Question 75 Flower colour is controlled by a single pair

Flower colour is controlled by a single pair of alleles; the allele for red is dominant to that for white. A plant homozygous for red is crossed with a plant homozygous for white; all F_1 plants have red flowers. When the F_1 are crossed, 18 plants are obtained: 12 red and 6 white (F_2). What ratio is expected in the F_2 and what ratio has been obtained? (expected red : white → obtained red : white)

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

A. wrong: the expected F2 ratio for a monohybrid cross is 3 : 1, not 1 : 1.

B. wrong: the expected ratio is 3 : 1, not 1 : 1.

C. correct: the expected F2 phenotypic ratio is 3 red : 1 white, and the observed 12 red : 6 white simplifies to 2 : 1.

D. wrong: the observed ratio is 12 : 6 = 2 : 1, not 3 : 1.

Question 76 The following observations refer to evolution I Inherited

The following observations refer to evolution: I. Inherited variations that are ‘favoured’ in a particular environment are passed on. II. There is a struggle for existence. III. In time, ‘favoured’ inherited variations may accumulate, causing gradual changes in the organism. IV. Although populations tend to overproduce, they remain more or less

numbers from generation to generation. In what sequence should the statements be placed to support Darwin's theory of evolution?

- A. I, II, III, IV
- B. II, I, III, IV
- C. III, I, IV, II
- D. IV, I, II, III
- E. IV, II, I, III ✓ **Correct answer**

A. wrong: the sequence does not start with favoured variations being passed on.

B. wrong: overproduction (IV) comes before the struggle for existence (II).

C. wrong: gradual change (III) is the last step, not the first.

D. wrong: the struggle for existence (II) comes before the passing on of favoured variations (I).

E. correct: Darwin's logic runs — populations overproduce (IV), so there is a struggle for existence (II), favoured variations are passed on (I), and over time they accumulate into gradual change (III).

Question 77 The diagram shows the ultrastructure of a chloroplast

The diagram shows the ultra-structure of a chloroplast as seen in section. P is a granum (a stack of thylakoids), Q is a starch grain, and R is the stroma. What are the functions of P, Q and R? (P / Q / R)

- A. carbohydrate storage / carbohydrate synthesis / light absorption
- B. carbohydrate synthesis / carbohydrate storage / light absorption
- C. carbohydrate synthesis / light absorption / carbohydrate storage
- D. light absorption / carbohydrate storage / carbohydrate synthesis ✓ **Correct answer**
- E. light absorption / carbohydrate synthesis / carbohydrate storage

s the granum, which absorbs light, not stores carbohydrate.

B. wrong: P absorbs light and Q stores carbohydrate, not the reverse.

C. wrong: P absorbs light, Q stores carbohydrate, R synthesises carbohydrate.

D. correct: P is a granum (thylakoid stack), where light is absorbed; Q is a starch grain, where carbohydrate is stored; R is the stroma, where carbohydrate is synthesised in the Calvin cycle.

E. wrong: Q is the starch grain (storage) and R is the stroma (synthesis), not the reverse.

Question 78 Consider the following statements about biological communities I

Consider the following statements about biological communities: I. Their members share a common gene pool. II. The community remains stable even though some physical aspect of the environment may change. III. It consists of all the populations living in a particular area. IV. A community interacts with the non-living environment, and both function together to form an ecosystem. Which two of the above statements are true?

- A. I and II
- B. I and III
- C. II and IV
- D. II and III
- E. III and IV ✓ **Correct answer**

A. wrong: statement I is false (only a single population shares a gene pool) and statement II is false (a community changes with its environment).

B. wrong: statement I is false.

C. wrong: statement II is false.

D. wrong: statement II is false.

is the definition of a community (all the populations living in one area), and IV is true because the community together with its non-living environment forms an ecosystem; I is false (a community holds many species, each with its own gene pool) and II is false (communities undergo succession and change, they do not simply stay stable).

Question 79 Four events in the transmission of nerve impulses

Four events in the transmission of nerve impulses across synapses are: I. depolarisation of the presynaptic membrane; II. propagation of the postsynaptic action potential; III. reabsorption of the transmitter substance; IV. release of the transmitter substance into the synaptic cleft. In which sequence do these events occur? (first → last)

- A. I → III → II → IV
- B. I → IV → II → III ✓ **Correct answer**
- C. IV → I → III → II
- D. IV → III → I → II
- E. II → I → IV → III

A. wrong: the transmitter is released (IV) before the postsynaptic potential propagates (II), and reabsorption (III) is last.

B. correct: the presynaptic membrane depolarises (I), the transmitter is released into the cleft (IV), the postsynaptic action potential propagates (II), and the transmitter is then reabsorbed (III).

C. wrong: release (IV) follows depolarisation (I), not the reverse.

D. wrong: the sequence starts with depolarisation, not release.

E. wrong: propagation (II) comes after release (IV), not before depolarisation (I).

Question 80 The joints found at the vertebrae are

The joints found at the vertebrae are:

ing joints ✓ **Correct answer**

- B. sliding joints
- C. partially moveable joints
- D. fixed joints
- E. pivot joints

A. correct: the facet (zygapophysial) joints between vertebrae are gliding (plane) synovial joints, which allow the vertebrae to slide over each other.

B. wrong: 'sliding' is not the standard name; the gliding (plane) joint is the named type.

C. wrong: this describes the cartilaginous intervertebral discs, not the synovial facet joints the question asks for.

D. wrong: the vertebrae are moveable, not fixed.

E. wrong: pivot joints (e.g. atlas-axis) are a different type; the general vertebral joints are gliding.

Question 81 How many meninges cover the human brain

How many meninges cover the human brain?

- A. 5
- B. 4
- C. 3 ✓ **Correct answer**
- D. 2
- E. 1

A. wrong: too many.

B. wrong: too many.

C. correct: the brain is covered by three meninges — the dura mater, arachnoid mater and pia mater.

E. wrong: too few.

Question 82 The site and principal mechanism for the passage

The site and principal mechanism for the passage of glucose into the bloodstream in the human kidney is the:

- A. collecting duct ... by active secretion
- B. distal convoluted tubule ... by passive diffusion
- C. glomerulus ... by selective reabsorption
- D. glomerulus ... by ultrafiltration
- E. proximal convoluted tubule ... by active reabsorption ✓ **Correct answer**

A. wrong: glucose is not secreted in the collecting duct.

B. wrong: glucose is reabsorbed in the proximal tubule, not the distal, and not by passive diffusion.

C. wrong: the glomerulus filters, it does not reabsorb.

D. wrong: ultrafiltration at the glomerulus lets glucose into the filtrate, but the passage into the blood is by reabsorption.

E. correct: glucose is reabsorbed from the filtrate into the blood in the proximal convoluted tubule by active (secondary active) transport.

Question 83 Book lungs subserve the function of respiration in

Book lungs subserve the function of respiration in:

- A. Scorpion ✓ **Correct answer**
- B. Earthworm
- C. Frog
- D. Cockroaches

A. correct: scorpions (arachnids) breathe through book lungs.

B. wrong: the earthworm respires through its moist skin.

C. wrong: the frog uses lungs and its skin.

D. wrong: cockroaches breathe through tracheae.

E. wrong: fish breathe through gills.

Question 84 The scientific name of potato is Solanum tuberosum

The scientific name of potato is Solanum tuberosum and that of brinjal is Solanum melongena. This indicates that both potato and brinjal are members of the:

- A. same species but different genera
- B. same genus but different classes
- C. same species but different classes
- D. same genus but different species ✓ **Correct answer**
- E. same class but different genera

A. wrong: they share the genus Solanum, and they are different species.

B. wrong: they are in the same class as well as the same genus.

C. wrong: they are different species in the same genus.

D. correct: both are Solanum (same genus) but tuberosum and melongena are different species.

E. wrong: they share the genus Solanum.

Question 85 The following are all features of eukaryotic cells

The following are all features of eukaryotic cells: I. chloroplast; II. peroxisome; III.

V. mitochondrion, V. nucleus. Which of these have a double membrane?

- A. I, II and IV
- B. I, III and V
- C. I, IV and V ✓ **Correct answer**
- D. II, III and V
- E. II, III and IV

A. wrong: peroxisome (II) has a single membrane, not a double one.

B. wrong: lysosome (III) has a single membrane.

C. correct: the chloroplast (I), the mitochondrion (IV) and the nucleus (V) all have double membranes; the peroxisome (II) and lysosome (III) have single membranes.

D. wrong: II and III have single membranes.

E. wrong: II and III have single membranes.

Question 86 The diagram shows a leaf with arrows indicating

The diagram shows a leaf with arrows indicating water vapour leaving the leaf surface. By which process is the water lost?

- A. osmosis
- B. photosynthesis
- C. translocation
- D. transpiration ✓ **Correct answer**
- E. transcription

A. wrong: osmosis is the movement of water across a membrane, not the loss of vapour from a leaf.

B. wrong: photosynthesis uses water and carbon dioxide to make food; it is not the loss of water.

translocation is the transport of food in the phloem.

D. correct: the loss of water vapour from the leaf surface (mainly through the stomata) is transpiration.

E. wrong: transcription is the copying of DNA into RNA.

Question 87 Which of the following is true in the

Which of the following is true in the angiosperm life cycle?

- A. Gametophytes are photosynthetic and partially independent of the sporophyte
- B. Sporophytes are totally dependent on gametophytes
- C. Gametophytes are totally dependent on sporophytes ✓ **Correct answer**
- D. Both gametophytes and sporophytes are totally dependent on each other
- E. Both gametophytes and sporophytes are totally independent of each other

A. wrong: in angiosperms the gametophyte is tiny and dependent, not photosynthetic and independent.

B. wrong: the sporophyte is the dominant, independent plant.

C. correct: in angiosperms the gametophyte (embryo sac / pollen) lives entirely within and dependent on the sporophyte.

D. wrong: the sporophyte is independent.

E. wrong: the gametophyte depends on the sporophyte.

Question 88 The adaptive features which helps a fish to

The adaptive feature(s) which help(s) a fish to live in water include(s):

- A. a tail and an air bladder
- B. unpaired and paired fins
- C. a streamlined body

- E. all of the above ✓ **Correct answer**

A. wrong: these are true on their own, so they are not the complete answer.

B. wrong: true on its own, but not the complete answer.

C. wrong: true on its own, but not the complete answer.

D. wrong: true on its own, but not the complete answer.

E. correct: a fish's tail and air bladder, fins, streamlined body, and gills with a strong sense of smell are all adaptations to living in water.

Question 89 The diagram represents the human respiratory system X

The diagram represents the human respiratory system. X is the lung, Y is the intercostal muscles (between the ribs), and Z is the diaphragm. Which structure(s) contain(s) muscles that contract when breathing in?

- A. X only
- B. X and Y only
- C. X and Z only
- D. Y and Z only ✓ **Correct answer**
- E. X, Y and Z

A. wrong: the lung (X) has no muscle that contracts on breathing in.

B. wrong: X (lung) does not contract.

C. wrong: X (lung) does not contract.

D. correct: Y is the intercostal muscles between the ribs and Z is the diaphragm; both contract when breathing in (the intercostals raise the ribs and the diaphragm flattens), while the lung (X) itself has no such muscle.

lung) does not contain muscle that contracts on breathing in.

Question 90 What is the correct order of arthropod groups

What is the correct order of arthropod groups, from those with most legs to those with fewest legs?

- A. arachnids … crustaceans … insects … myriapods
- B. crustaceans … myriapods … insects … arachnids
- C. insects … arachnids … myriapods … crustaceans
- D. myriapods … arachnids … crustaceans … insects
- E. myriapods … crustaceans … arachnids … insects ✓ **Correct answer**

A. wrong: myriapods have the most legs, not the fewest.

B. wrong: myriapods (many legs) come before crustaceans.

C. wrong: the order is reversed.

D. wrong: crustaceans (10+ legs) have more legs than arachnids (8).

E. correct: myriapods have the most legs (many pairs), then crustaceans (typically 10 or more), then arachnids (8), then insects (6).

Question 91 When a red stain is added to a

When a red stain is added to a culture containing both living and dead cells, only the dead cells take up the stain. Which structure(s) prevent(s) the stain from entering the living cells?

- A. cell membrane ✓ **Correct answer**
- B. cell wall
- C. cytoplasm
- D. vacuole
- E. all of the above

...e living cell's selectively permeable membrane keeps the stain out; only when the membrane breaks down (dead cells) does the stain enter.

B. wrong: the cell wall is freely permeable and does not exclude the stain.

C. wrong: the cytoplasm does not block the stain.

D. wrong: the vacuole does not block the stain.

E. wrong: only the cell membrane excludes the stain.

Question 92 Which of the following statements concerning the nucleolus

Which of the following statements concerning the nucleolus is correct?

- A. It disappears at the time of cell division ✓ **Correct answer**
- B. There is only one nucleolus in every cell
- C. It plays an important role in the synthesis of ribonucleic acid and ribosomes in prokaryotic cells
- D. It helps in destroying worn-out organelles
- E. It captures energy for the cell

A. correct: the nucleolus disappears during cell division (it disassembles in prophase and reforms in telophase).

B. wrong: a cell can have more than one nucleolus.

C. wrong: prokaryotic cells have no nucleolus (no nucleus); the nucleolus is a eukaryotic structure.

D. wrong: that is the lysosome's role.

E. wrong: that is the mitochondrion's (and chloroplast's) role.

93 In birds the male is the homogametic sex

In birds the male is the homogametic sex. A male bird showing the recessive trait was mated with a female showing the dominant trait of a characteristic governed by a pair of sex-linked alleles. What is the probability that the male offspring will show the dominant trait?

- A. 0
- B. 0.25
- C. 0.50
- D. 0.75
- E. 1.00 ✓ **Correct answer**

A. wrong: the male offspring do receive a dominant allele from their mother.

B. wrong: not the probability.

C. wrong: not the probability.

D. wrong: not the probability.

E. correct: in birds the male is ZZ and the female ZW; the recessive male is ZrZr and the dominant female is ZRW; every male offspring gets Zr from the father and ZR from the mother (ZRZr), so all show the dominant trait — probability 1.00.

Question 94 In an experiment the production of the hormone

In an experiment, the production of the hormone secretin was blocked. As a result, the levels of all of the following enzymes were affected EXCEPT:

- A. trypsin
- B. pepsin ✓ **Correct answer**
- C. chymotrypsin
- D. amylase
- E. lipase

ypsin is a pancreatic enzyme whose release is stimulated by secretin (via cholecystokinin/pancreatic stimulation), so blocking secretin affects it.

B. correct: pepsin is a stomach enzyme, produced under the control of gastrin, not secretin, so blocking secretin does not affect it.

C. wrong: chymotrypsin is a pancreatic enzyme affected by blocking secretin.

D. wrong: pancreatic amylase is affected by blocking secretin.

E. wrong: pancreatic lipase is affected by blocking secretin.

Question 95 At what point are two populations descending from

At what point are two populations descending from the same ancestral stock considered separate species?

- A. When they can no longer produce viable, fertile offspring ✓ **Correct answer**
- B. When they look significantly different from each other
- C. When they can interbreed successfully and produce offspring
- D. When their habitats are separated by a significantly large distance so that they cannot meet
- E. Both B and C

A. correct: under the biological species concept, two populations are separate species when they are reproductively isolated — they can no longer interbreed to produce viable, fertile offspring.

B. wrong: appearance alone does not define a species.

C. wrong: that is the opposite — it shows they are the same species.

D. wrong: geographic separation alone does not make them separate species; they must be reproductively isolated.

E. wrong: neither B nor C is correct.

96 Living things that would be the first to

Living things that would be the first to experience adverse effects if large amounts of carbon dioxide were taken out of the biosphere are:

- A. decomposers (e.g. bacteria and fungi)
- B. producers (e.g. green plants) ✓ **Correct answer**
- C. primary consumers (e.g. mice)
- D. secondary consumers (e.g. snakes)
- E. tertiary consumers (e.g. hawks)

A. wrong: decomposers feed on dead matter and are not the first hit by a loss of carbon dioxide.

B. correct: producers take carbon dioxide from the air for photosynthesis, so removing it hits them first; all other trophic levels depend on them.

C. wrong: they depend on producers, so they are affected later.

D. wrong: they are further up the food chain.

E. wrong: they are the last to be affected.

Question 97 Which of the following structures isare found in

Which of the following structure(s) is/are found in a generalized bacterial cell?

- A. flagellum
- B. pili
- C. capsule
- D. cell wall
- E. all of the above ✓ **Correct answer**

A. wrong: this is true on its own (many bacteria have a flagellum), so it is not the complete answer.

ue on its own, but not the complete answer.

C. wrong: true on its own, but not the complete answer.

D. wrong: true on its own, but not the complete answer.

E. correct: a generalised bacterial cell can have a flagellum, pili, a capsule and a cell wall.

Question 98 The gland known as the gland of emergency

The gland known as the ‘gland of emergency’ is the:

- A. pituitary
- B. adrenal ✓ **Correct answer**
- C. thyroid
- D. parathyroid
- E. pancreas

A. wrong: the pituitary is the master gland, not the gland of emergency.

B. correct: the adrenal gland (adrenal medulla) releases adrenaline in emergencies — the 'fight or flight' response.

C. wrong: the thyroid controls metabolism, not the emergency response.

D. wrong: the parathyroid controls calcium levels.

E. wrong: the pancreas controls blood sugar.

Question 99 The autonomic nervous system controls all of the

The autonomic nervous system controls all of the following activities EXCEPT:

- A. digestion of food
- B. heart beat
- C. contraction of the pupil of the eye
- D. thought ✓ **Correct answer**

athing rate

A. wrong: digestion is controlled by the autonomic nervous system.

B. wrong: the heart beat is controlled by the autonomic nervous system.

C. wrong: pupil contraction is controlled by the autonomic nervous system.

D. correct: thought is a conscious, voluntary activity controlled by the brain (somatic/cerebral), not by the autonomic nervous system.

E. wrong: breathing rate is controlled by the autonomic nervous system.

Question 100 In the northern hemisphere a tundra type of

In the northern hemisphere, a tundra type of growth:

- A. is impossible
- B. occurs only in winter
- C. lasts only for two to three months
- D. is in the form of a wide land ✓ **Correct answer**
- E. is in the form of small patches of land

A. wrong: tundra does occur in the northern hemisphere.

B. wrong: the tundra is a permanent biome, not a winter-only growth.

C. wrong: the tundra vegetation persists year-round (the growing season is short, but the biome is permanent).

D. correct: in the northern hemisphere the tundra forms a wide, continuous belt of land across the Arctic.

E. wrong: the tundra is a broad belt, not small patches.

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