



# NEET UG 2026 BOOSTER TEST SERIES

FULL LENGTH MOCK — TEST 02

*Helping You Reach Your Dream — Become a Doctor*

 <b>180</b> QUESTIONS	 <b>3</b> HOURS	 <b>720</b> MARKS
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Physics • Chemistry • Botany • Zoology

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**Important Instructions (Read Carefully)**

- **Time:** 3 hours (180 minutes) | **Questions:** 180 | **Maximum marks:** 720
- **Marking:** +4 for each correct answer; -1 for each incorrect answer; 0 for unattempted.
- Question paper contains **Physics (Q1–45), Chemistry (Q46–90), Botany (Q91–135), Zoology (Q136–180)**.
- Items may be standard MCQ, Assertion–Reason, Statement-based, Matrix Match, or Diagram-based.
- Use **blue/black ball point pen** only on the OMR. Mark one response per question.
- Do not write or mark anywhere except the OMR answer sheet.





# PHYSICS

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Questions 1–45

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1

In a multi-step problem, two point charges  $+4 \mu\text{C}$  and  $-1 \mu\text{C}$  are separated by 30 cm. The point on the line joining them where the net electric field is zero lies:

- (1) 15 cm from  $+4 \mu\text{C}$
- (2) at midpoint
- (3) 10 cm from  $+4 \mu\text{C}$
- (4) 20 cm from  $+4 \mu\text{C}$

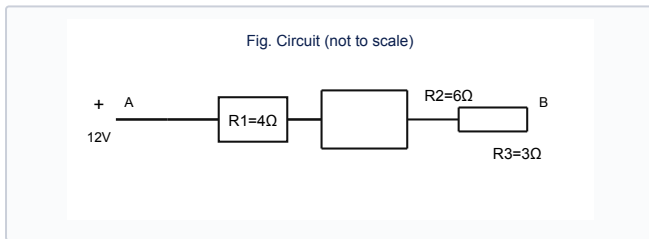
2

Match the physical quantity in List-I with its dimensional formula in List-II:

List-I	List-II
(A) Pressure	(I) $[\text{ML}^{-1}\text{T}^{-1}]$
(B) Surface tension	(II) $[\text{ML}^{-1}\text{T}^{-2}]$
(C) Coefficient of viscosity	(III) $[\text{MT}^{-2}]$
(D) Planck's constant	(IV) $[\text{ML}^2\text{T}^{-1}]$

- (1) A-II, B-III, C-I, D-IV
- (2) A-I, B-II, C-III, D-IV
- (3) A-II, B-I, C-IV, D-III
- (4) A-III, B-II, C-I, D-IV

3



A student performs an experiment: in the circuit shown, the equivalent resistance between points A and B is:

- (1)  $6.0 \Omega$
- (2)  $9.0 \Omega$
- (3)  $3.0 \Omega$
- (4)  $4.5 \Omega$

4

In a multi-step problem, the work done in rotating an electric dipole  $p$  from  $\theta_1$  to  $\theta_2$  in uniform field  $E$  is:

- (1)  $pE(\cos \theta_1 - \cos \theta_2)$
- (2)  $pE(\sin \theta_2 - \sin \theta_1)$
- (3)  $pE(\theta_2 - \theta_1)$
- (4) zero

5

Consider the following situation: a closed vessel contains a mixture of ideal gases He and  $\text{O}_2$  at 300 K with mole ratio 2:1. The ratio of partial pressures  $P_{\text{He}} : P_{\text{O}_2}$  is:

- (1) 1:1
- (2) 3:1
- (3) 1:2
- (4) 2:1

6

Match List-I (p-n junction) with List-II (biasing effect):

List-I	List-II
(A) Forward bias	(I) Increases with reverse voltage
(B) Reverse bias	(II) Majority carrier diffusion dominates
(C) Breakdown	(III) Minority carrier drift current
(D) Depletion width	(IV) Abrupt increase in reverse current

- (1) A-II, B-III, C-IV, D-I
- (2) A-III, B-II, C-I, D-IV
- (3) A-II, B-I, C-IV, D-III
- (4) A-IV, B-III, C-II, D-I

7

In a multi-step problem, in Young's double slit experiment, monochromatic light of wavelength  $\lambda$  is used. If the entire apparatus is immersed in a medium of refractive index  $\mu$ , the fringe width:

- (1) remains unchanged
- (2) increases by  $\mu^2$
- (3) increases by  $\mu$
- (4) decreases by  $\mu$

8

Consider the following situation: a body of mass  $m$  dropped from height  $h$  buries itself into sand and comes to rest over depth  $d$ . Average resistive force is approximately:

- (1)  $mg(1 + h/d)$
- (2)  $mg(h/d)$
- (3)  $mgh/d$
- (4)  $mg$

9

A student performs an experiment: the energy band gap in insulators at 0 K is typically:

- (1)  $> 3 \text{ eV}$
- (2) exactly 1.1 eV
- (3) zero
- (4) 0.01–0.1 eV

**10**

In a multi-step problem, the binding energy per nucleon is maximum for nuclei near:

- (1)  ${}^2\text{H}$
- (2)  ${}^{56}\text{Fe}$
- (3)  ${}^{238}\text{U}$
- (4)  ${}^{14}\text{C}$

**11**

Given below are two statements:

**Statement I:** Statement I: In electrostatic equilibrium, the electric field inside a conductor is zero.

**Statement II:** Statement II: Excess charge on a conductor resides entirely on its outer surface.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**12**

A student performs an experiment: light of wavelength 600 nm falls on a single slit of width 0.2 mm. The angular width of the central maximum is approximately:

- (1)  $3.0 \times 10^{-3}$  rad
- (2)  $6.0 \times 10^{-3}$  rad
- (3)  $1.2 \times 10^{-2}$  rad
- (4)  $2.4 \times 10^{-2}$  rad

**13**

In a multi-step problem, a satellite orbits Earth in a circular path of radius  $4R_E$  ( $R_E$  = radius of Earth). Its orbital speed is  $v$ . The escape speed from the same orbit is:

- (1)  $\sqrt{2}v$
- (2)  $2v$
- (3)  $v/\sqrt{2}$
- (4)  $v$

**14**

Consider the following situation: in photoelectric effect, if frequency is doubled above threshold, maximum KE becomes:

- (1) doubled
- (2) more than doubled by  $h\nu$  increment
- (3) unchanged
- (4) halved

**15**

Given below are two statements:

**Statement I:** Statement I: Diffraction is more pronounced when wavelength is comparable to slit size.

**Statement II:** Statement II: Interference requires coherent sources.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**16**

In a multi-step problem, about Bohr model of hydrogen atom:

- A. Angular momentum is quantized.
  - B. Radiation occurs during transitions between stationary states.
  - C. It explains fine structure without modification.
  - D. Total energy is negative for bound states.
- (1) A, B and D only
  - (2) A and C only
  - (3) B, C and D only
  - (4) A, B, C and D

**17**

Consider the following situation: the half-life of a radioactive sample is 10 days. The fraction of nuclei decayed in 30 days is:

- (1)  $1/2$
- (2)  $5/8$
- (3)  $7/8$
- (4)  $3/4$

**18**

A student performs an experiment: in a nuclear reactor, cadmium rods are used to:

- (1) increase reaction rate
- (2) absorb neutrons and control reaction
- (3) cool the core
- (4) shield radiation only

**19**

In a multi-step problem, a solid sphere and hollow sphere of same mass and radius roll without slipping down same incline. Which reaches bottom first?

- (1) Both together
- (2) Depends on mass
- (3) Solid sphere
- (4) Hollow sphere

**20**

Consider the following situation: a convex lens of focal length 20 cm forms a real image twice the size of the object. The object distance is:

- (1) 30 cm
- (2) 60 cm
- (3) 10 cm
- (4) 40 cm

**21**

A student performs an experiment: consider the following statements about photoelectric effect:

- A. Photocurrent increases with intensity at fixed frequency above threshold.
  - B. Stopping potential depends on intensity.
  - C. Maximum kinetic energy of photoelectrons depends on frequency.
  - D. There is a threshold frequency characteristic of the metal.
- (1) A, C and D only
  - (2) B and D only
  - (3) A and B only
  - (4) A, B, C and D

22

Given below are two statements:

**Statement I:** Statement I: In an AC circuit containing only a pure inductor, current lags voltage by  $\pi/2$ .

**Statement II:** Statement II: The average power consumed over a cycle in a pure inductor is zero.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

23

Consider the following situation: the dimensional formula of magnetic flux is:

- (1)  $[MLT^{-2}A^{-1}]$
- (2)  $[M^0L^0T^0]$
- (3)  $[ML^2T^{-2}A^{-1}]$
- (4)  $[ML^2T^{-3}A^{-1}]$

24

A student performs an experiment: a galvanometer of resistance  $50 \Omega$  gives full scale deflection at  $1 \text{ mA}$ . Resistance of shunt to convert it to  $0-1 \text{ A}$  ammeter is approximately:

- (1)  $0.05 \Omega$
- (2)  $0.5 \Omega$
- (3)  $5 \Omega$
- (4)  $0.005 \Omega$

25

In a multi-step problem, a Carnot engine operates between  $500 \text{ K}$  and  $300 \text{ K}$ . Its efficiency is:

- (1) 20%
- (2) 80%
- (3) 40%
- (4) 60%

26

Consider the following situation: a ball is projected at  $40 \text{ m/s}$  at  $37^\circ$  to horizontal. Time of flight is: ( $g = 10 \text{ m/s}^2$ ,  $\sin 37^\circ \approx 0.6$ )

- (1)  $4.8 \text{ s}$
- (2)  $6.4 \text{ s}$
- (3)  $3.2 \text{ s}$
- (4)  $8.0 \text{ s}$

27

Given below are two statements:

**Statement I:** Statement I: Self-inductance depends on geometry and medium.

**Statement II:** Statement II: Induced emf opposes change in flux (Lenz's law).

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

28

Given below are two statements:

**Statement I:** Statement I: Zener diode shows sharp breakdown in reverse bias.

**Statement II:** Statement II: Zener diode is used for voltage regulation.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

29

Consider the following situation: the rms speed of oxygen molecules at temperature  $T$  is  $v$ . At temperature  $4T$ , rms speed is:

- (1)  $2v$
- (2)  $4v$
- (3)  $v/2$
- (4)  $v$

30

A student performs an experiment: a wire of resistance  $R$  is stretched to double its length. The new resistance is:

- (1)  $2R$
- (2)  $4R$
- (3)  $R$
- (4)  $8R$

31

In a multi-step problem, the ratio of frequencies of second harmonic to fundamental for an open organ pipe is:

- (1) 4:1
- (2) 1:2
- (3) 2:1
- (4) 3:1

32

Consider the following situation: a river is  $200 \text{ m}$  wide; velocity of river  $3 \text{ m/s}$ ; swimmer speed in still water  $5 \text{ m/s}$ . Minimum time to cross river (swimming perpendicular to bank) is:

- (1)  $40 \text{ s}$
- (2)  $50 \text{ s}$
- (3)  $67 \text{ s}$
- (4)  $100 \text{ s}$

33

A student performs an experiment: a block of mass  $2 \text{ kg}$  on a rough horizontal plane ( $\mu = 0.25$ ) is pulled by a constant horizontal force of  $10 \text{ N}$ . The acceleration of the block is: ( $g = 10 \text{ m/s}^2$ )

- (1)  $1.5 \text{ m/s}^2$
- (2)  $5.0 \text{ m/s}^2$
- (3)  $2.5 \text{ m/s}^2$
- (4)  $3.0 \text{ m/s}^2$

34

In a multi-step problem, in a transformer, the primary has 500 turns and secondary 50 turns. If the primary voltage is 220 V rms, the secondary voltage (ideal) is:

- (1) 22 V
- (2) 2200 V
- (3) 110 V
- (4) 44 V

35

Consider the following situation: a particle moves in a circle of radius 0.5 m with constant speed 4 m/s. The magnitude of average acceleration over a quarter revolution is:

- (1) zero
- (2) 4 m/s<sup>2</sup>
- (3)  $4\sqrt{2}$  m/s<sup>2</sup>
- (4)  $8\sqrt{2}/\pi$  m/s<sup>2</sup>

36

Match List-I with List-II:

List-I	List-II
(A) Lorentz force	(I) $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_{\text{enc}}$
(B) Biot-Savart law	(II) $\mathbf{F} = q(\mathbf{v} \times \mathbf{B})$
(C) Faraday's law	(III) $d\mathbf{B} \propto I d\mathbf{l} \times \mathbf{r}/r^3$
(D) Ampere's law	(IV) $\mathcal{E} = -d\Phi/dt$

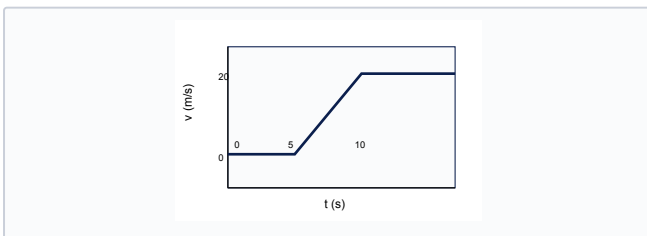
- (1) A-II, B-III, C-IV, D-I
- (2) A-III, B-II, C-I, D-IV
- (3) A-II, B-I, C-III, D-IV
- (4) A-IV, B-III, C-II, D-I

37

In a multi-step problem, the de Broglie wavelength of an electron accelerated through a potential difference of 150 V is approximately:

- (1) 1.0 nm
- (2) 0.05 nm
- (3) 0.1 nm
- (4) 0.2 nm

38



Consider the following situation: for a particle with velocity-time graph as shown, the magnitude of average acceleration during 0 to 10 s is:

- (1) 2 m/s<sup>2</sup>
- (2) 4 m/s<sup>2</sup>
- (3) 6 m/s<sup>2</sup>
- (4) 8 m/s<sup>2</sup>

39

A student performs an experiment: a particle executes SHM with amplitude A and angular frequency  $\omega$ . Which statements are correct?

- A. Maximum speed =  $\omega A$ .
  - B. Maximum acceleration =  $\omega^2 A$ .
  - C. At  $x = A/2$ , potential energy equals kinetic energy.
  - D. Time period depends on amplitude.
- (1) A and B only
  - (2) A, B and C only
  - (3) C and D only
  - (4) A, B, C and D

40

In a multi-step problem, regarding electromagnetic waves:

- A. They are transverse in free space.
  - B. Energy is equally shared between E and B on average.
  - C. They require a material medium for propagation.
  - D. Momentum is  $p = U/c$ .
- (1) A, B and D only
  - (2) A and C only
  - (3) B and C only
  - (4) A, B, C and D

41

Consider the following situation: a coil of 100 turns, area  $10^{-2}$  m<sup>2</sup> and resistance 2  $\Omega$  rotates at 50 rev/s in a uniform magnetic field  $B = 0.2$  T perpendicular to the plane of the coil. The peak emf induced is approximately:

- (1) 12.6 V
- (2) 1.26 V
- (3) 0.63 V
- (4) 6.3 V

42

A student performs an experiment: two waves  $y_1 = 3 \sin(\omega t - kx)$  and  $y_2 = 4 \sin(\omega t - kx + \pi/2)$  superpose. Amplitude of resultant is:

- (1) 5 units
- (2) 7 units
- (3) 1 unit
- (4)  $\sqrt{7}$  units

43

In a multi-step problem, a solid sphere and hollow sphere of same mass and radius roll down same incline without slipping. The ratio of their accelerations is:

- (1) 2:3
- (2) 1:1
- (3) 5:7
- (4) 7:5

44

Given below are two statements:

**Statement I:** In LC oscillations, total energy oscillates between electric and magnetic forms.

**Statement II:** At resonance in driven LCR, source frequency equals natural frequency.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

45

Match optical device with function:

List-I	List-II
(A) Concave mirror	(I) Converging light
(B) Convex lens	(II) Dispersion
(C) Prism	(III) Polarisation
(D) Polaroid	(IV) Reflecting telescope

- (1) A-IV, B-I, C-II, D-III
- (2) A-I, B-IV, C-III, D-II
- (3) A-IV, B-I, C-III, D-II
- (4) A-II, B-I, C-IV, D-III



# CHEMISTRY

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Questions 46–90

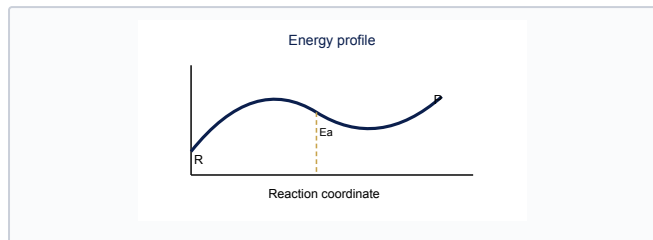
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46



In a multi-step problem, the energy profile for an exothermic reaction with catalyst is best represented by which curve?

- (1) Higher peak, same  $\Delta E$
- (2) Lower activation energy, same  $\Delta E$
- (3) Higher  $\Delta E$
- (4) No change in TS

47

Consider the following situation: the correct increasing order of ionic radii is:

- (1)  $\text{Li}^+ < \text{K}^+ < \text{Na}^+ < \text{Rb}^+$
- (2)  $\text{Na}^+ < \text{Li}^+ < \text{K}^+ < \text{Rb}^+$
- (3)  $\text{Li}^+ < \text{Na}^+ < \text{K}^+ < \text{Rb}^+$
- (4)  $\text{Rb}^+ < \text{K}^+ < \text{Na}^+ < \text{Li}^+$

48

A student performs an experiment: a first-order reaction is 75% complete in 60 min. The rate constant is:

- (1)  $0.0231 \text{ min}^{-1}$
- (2)  $0.0346 \text{ min}^{-1}$
- (3)  $0.0115 \text{ min}^{-1}$
- (4)  $0.0462 \text{ min}^{-1}$

49

Given below are two statements:

**Statement I:** Statement I: For a spontaneous process at constant T and P,  $\Delta G < 0$ .

**Statement II:** Statement II:  $\Delta G = \Delta H - T\Delta S$ .

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

50

Consider the following situation: the correct order of acidic strength is:

- (1)  $\text{CH}_3\text{COOH} > \text{C}_6\text{H}_5\text{OH} > \text{H}_2\text{O} > \text{C}_2\text{H}_5\text{OH}$
- (2)  $\text{C}_6\text{H}_5\text{OH} > \text{CH}_3\text{COOH} > \text{H}_2\text{O} > \text{C}_2\text{H}_5\text{OH}$
- (3)  $\text{CH}_3\text{COOH} > \text{H}_2\text{O} > \text{C}_6\text{H}_5\text{OH} > \text{C}_2\text{H}_5\text{OH}$
- (4)  $\text{H}_2\text{O} > \text{CH}_3\text{COOH} > \text{C}_2\text{H}_5\text{OH} > \text{C}_6\text{H}_5\text{OH}$

51

A student performs an experiment: in the Haber process, the catalyst used and the optimum conditions are approximately:

- (1)  $\text{V}_2\text{O}_5$ , high temperature
- (2) Ni, low temperature
- (3) Fe, 400–500°C, 200 atm
- (4) Pt, room temperature, 1 atm

52

In a multi-step problem, regarding colligative properties:

- A. Depend only on number of solute particles.
  - B.  $\Delta T_b = K_b m$  for non-volatile solute.
  - C. Osmotic pressure  $\pi = MRT$  for dilute solutions.
  - D. Van't Hoff factor  $i$  is always 1.
- (1) A, B and C only
  - (2) B and D only
  - (3) A and D only
  - (4) A, B, C and D

53

Given below are two statements:

**Statement I:** Statement I: Benzene undergoes electrophilic substitution rather than addition under normal conditions.

**Statement II:** Statement II: Benzene has delocalized  $\pi$  electrons.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

54

Match the quantum numbers (n, l) with orbital:

List-I	List-II
(A) (3, 2)	(I) 3p
(B) (4, 0)	(II) 4s
(C) (3, 1)	(III) 3d
(D) (2, 1)	(IV) 2p

- (1) A-III, B-II, C-I, D-IV
- (2) A-I, B-III, C-II, D-IV
- (3) A-II, B-I, C-IV, D-III
- (4) A-III, B-I, C-II, D-IV

55

In a multi-step problem, the hybridization of  $\text{XeF}_4$  is:

- (1)  $sp^3$
- (2)  $dsp^2$
- (3)  $sp^3d$
- (4)  $sp^3d^2$

56

Consider the following situation: the total number of  $\sigma$  bonds in cyclohexane (chair form,  $C_6H_{12}$ ) is:

- (1) 6
- (2) 12
- (3) 18
- (4) 24

57

A student performs an experiment: for the equilibrium  $N_2O_4(g) \leftrightarrow 2NO_2(g)$ ,  $\Delta H > 0$ . Which change shifts equilibrium to the right?

- (1) add inert gas at constant V
- (2) increase temperature
- (3) decrease temperature
- (4) increase pressure

58

Match List-I with List-II:

List-I	List-II
(A) Wurtz reaction	(I) $Ar-COCH_3$ from $Ar-H$
(B) Friedel-Crafts acylation	(II) $R-R$ from $R-X + Na$
(C) Cannizzaro reaction	(III) $Ar-X$ from diazonium salt
(D) Sandmeyer reaction	(IV) $2RCHO \rightarrow RCH_2OH + RCOO^-$

- (1) A-II, B-I, C-IV, D-III
- (2) A-I, B-II, C-III, D-IV
- (3) A-II, B-IV, C-I, D-III
- (4) A-III, B-I, C-II, D-IV

59

Given below are two statements:

**Statement I:** Statement I: Colloids show Tyndall effect.

**Statement II:** Statement II: Particle size of colloid is between 1 nm and 1000 nm.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

60

A student performs an experiment: for a zero-order reaction  $A \rightarrow$  products, half-life is:

- (1) proportional to  $[A]_0$
- (2) independent of  $[A]_0$
- (3) proportional to  $1/[A]_0$
- (4) constant for all orders

61

In a multi-step problem, select correct statements:

- A. HF has anomalously high boiling point due to H-bonding.
  - B.  $H_2SO_4$  is dibasic in aqueous solution.
  - C. Interhalogen compounds are more reactive than halogens.
  - D. Noble gases were first isolated from air.
- (1) A, B and C only
  - (2) A, C and D only
  - (3) B and D only
  - (4) A, B, C and D

62

Consider the following situation: which pair is an example of functional group isomerism?

- (1)  $CH_3CH_2OH$  and  $CH_3OCH_3$
- (2)  $CH_3COCH_3$  and  $CH_3CH_2CHO$
- (3) butane and 2-methylpropane
- (4)  $CH_3CH_2CH_2Cl$  and  $CH_3CHClCH_3$

63

A student performs an experiment: for the reaction  $2A + B \rightarrow C$ , rate =  $k[A]^2[B]$ . If  $[A]$  is doubled and  $[B]$  tripled, rate increases by:

- (1) 18 times
- (2) 36 times
- (3) 6 times
- (4) 12 times

64

In a multi-step problem, the major product when phenol reacts with dilute  $HNO_3$  at low temperature is:

- (1) o-nitrophenol
- (2) p-nitrophenol
- (3) 2,4,6-trinitrophenol
- (4) benzoquinone

65

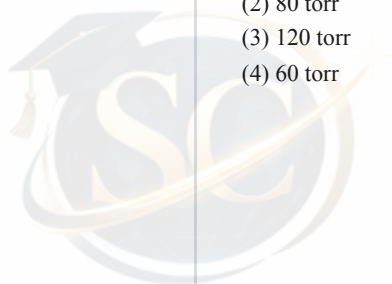
Consider the following situation: for the cell  $Zn(s)|Zn^{2+}(1M)||Cu^{2+}(1M)|Cu(s)$ ,  $E^\circ_{cell} = 1.10$  V at  $25^\circ C$ . If  $[Zn^{2+}] = 0.01$  M and  $[Cu^{2+}] = 1$  M,  $E_{cell}$  is approximately:

- (1) 1.10 V
- (2) 0.98 V
- (3) 1.04 V
- (4) 1.16 V

66

A student performs an experiment: the mole fraction of benzene in an ideal solution containing 1 mol benzene and 2 mol toluene is. If  $P^\circ_{benzene} = 120$  torr, partial pressure of benzene is:

- (1) 40 torr
- (2) 80 torr
- (3) 120 torr
- (4) 60 torr



67

In a multi-step problem, the number of stereoisomers possible for 2,3-dichlorobutane (excluding meso if any) is:

- (1) 4
- (2) 1
- (3) 2
- (4) 3

68

Match polymer with type:

List-I	List-II
(A) Natural rubber	(I) Addition polymer
(B) PVC	(II) Condensation polymer
(C) Nylon-6,6	(III) Elastomer
(D) Bakelite	(IV) Thermosetting polymer

- (1) A-III, B-I, C-II, D-IV
- (2) A-I, B-III, C-IV, D-II
- (3) A-III, B-IV, C-I, D-II
- (4) A-II, B-I, C-III, D-IV

69

A student performs an experiment: the number of chiral carbon atoms in 2,3-dibromobutane is:

- (1) 2
- (2) 4
- (3) 0
- (4) 1

70

In a multi-step problem, about biomolecules:

- A. Sucrose is a non-reducing disaccharide.
- B.  $\alpha$ -helix is stabilized by intrachain H-bonds.
- C. DNA has 2'-deoxyribose.
- D. All amino acids are optically active.

- (1) A, B and C only
- (2) B, C and D only
- (3) A and D only
- (4) A, B, C and D

71

Consider the following situation: the pH of 0.001 M Ba(OH)<sub>2</sub> solution is:

- (1) 9
- (2) 8
- (3) 11
- (4) 12

72

A student performs an experiment: the correct order of increasing bond dissociation enthalpy is:

- (1) F<sub>2</sub> < Cl<sub>2</sub> < Br<sub>2</sub> < I<sub>2</sub>
- (2) I<sub>2</sub> < Br<sub>2</sub> < Cl<sub>2</sub> < F<sub>2</sub>
- (3) F<sub>2</sub> < I<sub>2</sub> < Br<sub>2</sub> < Cl<sub>2</sub>
- (4) Cl<sub>2</sub> < F<sub>2</sub> < Br<sub>2</sub> < I<sub>2</sub>

73

Given below are two statements:

**Statement I:** Statement I: SN<sub>1</sub> reactions show first-order kinetics.

**Statement II:** Statement II: Carbocation stability governs rate of SN<sub>1</sub>.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

74

Consider the following situation: the product of reaction of methyl magnesium bromide with CO<sub>2</sub> followed by H<sub>3</sub>O<sup>+</sup> is:

- (1) acetic acid
- (2) acetone
- (3) methanol
- (4) formic acid

75

A student performs an experiment: in the reaction sequence: Toluene  $\rightarrow$  X (KMnO<sub>4</sub>, heat)  $\rightarrow$  Y (SOCl<sub>2</sub>)  $\rightarrow$  Z (NH<sub>3</sub> excess); Z is:

- (1) benzonitrile
- (2) benzoyl chloride
- (3) benzamide
- (4) benzylamine

76

In a multi-step problem, how many  $\sigma$  and  $\pi$  bonds are present in CH<sub>3</sub>-C $\equiv$ N?

- (1) 7 $\sigma$ , 2 $\pi$
- (2) 6 $\sigma$ , 3 $\pi$
- (3) 8 $\sigma$ , 1 $\pi$
- (4) 5 $\sigma$ , 2 $\pi$

77

Consider the following situation: the product of reaction between benzaldehyde and acetone in dilute NaOH (2:1 ratio) followed by heating is commonly:

- (1) cinnamaldehyde
- (2) dibenzyl ketone
- (3) benzalacetone
- (4) benzoin

78

A student performs an experiment: the correct set of quantum numbers for the outermost electron of ground state K (Z=19) is:

- (1) n=4, l=0, m=0, s=+1/2
- (2) n=3, l=0, m=0, s=+1/2
- (3) n=4, l=1, m=0, s=-1/2
- (4) n=3, l=1, m=+1, s=+1/2

79

Given below are two statements:

**Statement I:** Statement I: Primary amines give carbylamine reaction with  $\text{CHCl}_3$  and  $\text{KOH}$ .

**Statement II:** Statement II: Secondary amines do not give carbylamine reaction.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

80

Consider the following situation: the spin-only magnetic moment of  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  (high spin,  $d^6$ ) is approximately:

- (1) 4.9 BM
- (2) 5.9 BM
- (3) 0 BM
- (4) 3.9 BM

81

A student performs an experiment: select correct statements about electrochemistry:

- A. Conductance of strong electrolyte increases with dilution.
- B. At infinite dilution,  $\Lambda_m$  reaches limiting value.
- C. Faraday constant links charge and moles of electrons.
- D. Standard hydrogen electrode has  $E^\circ = 0$  by convention.

- (1) B, C and D only
- (2) A, B and C only
- (3) A and D only
- (4) A, B, C and D

82

In a multi-step problem, the major product of hydration of propene in presence of acid is:

- (1) propan-1-ol
- (2) propan-2-ol
- (3) propanal
- (4) propylene oxide

83

Consider the following situation: in the electrolysis of aqueous  $\text{NaCl}$  using inert electrodes, products at anode and cathode are:

- (1)  $\text{Cl}_2$  and  $\text{Na}$
- (2)  $\text{O}_2$  and  $\text{H}_2$
- (3)  $\text{Cl}_2$  and  $\text{H}_2$
- (4)  $\text{O}_2$  and  $\text{Na}$

84

A student performs an experiment: the correct IUPAC name of  $\text{CH}_3\text{-CH}(\text{Cl})\text{-CH}_2\text{-CHO}$  is:

- (1) 3-chlorobutanal
- (2) 2-chlorobutanal
- (3) 3-chloro-2-butanal
- (4) 4-chlorobutanal

85

In a multi-step problem, which of the following has the highest lattice enthalpy?

- (1)  $\text{CsCl}$
- (2)  $\text{KBr}$
- (3)  $\text{NaCl}$
- (4)  $\text{MgO}$

86

Consider the following situation: for an ideal gas undergoing reversible isothermal expansion,  $\Delta U$  and  $q$  are respectively:

- (1)  $\Delta U = 0, q > 0$
- (2)  $\Delta U > 0, q = 0$
- (3)  $\Delta U < 0, q < 0$
- (4)  $\Delta U = 0, q = 0$

87

A student performs an experiment: the IUPAC name of  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$  is:

- (1) chloropentaamminecobalt(III) sulfate
- (2) pentaamminechloridocobalt(II) sulfate
- (3) pentaamminechloridocobalt(III) sulfate
- (4) pentaamminesulfatochloridocobalt(III)

88

In a multi-step problem, for the reaction  $2\text{A} + \text{B} \rightarrow \text{C}$ , rate =  $k[\text{A}]^2[\text{B}]$ . If  $[\text{A}]$  is doubled and  $[\text{B}]$  halved, rate becomes:

- (1) unchanged
- (2) doubled
- (3) four times
- (4) halved

89

Consider the following situation: about colligative properties:

- A. Depression in freezing point is a colligative property.
- B. Depends on number of solute particles.
- C. Van't Hoff factor corrects for association/dissociation.
- D. Molarity is a colligative property.

- (1) A, B and C only
- (2) A and D only
- (3) B and C only
- (4) A, B, C and D

90

A student performs an experiment: the hybridisation of central atom in  $\text{XeF}_4$  is:

- (1)  $sp^3$
- (2)  $sp^3d$
- (3)  $sp^3d^2$
- (4)  $dsp^2$



# B O T A N Y

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Questions 91-135

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**91**

In a multi-step problem, which ecosystem has the highest net primary productivity per unit area annually?

- (1) Tundra
- (2) Open ocean
- (3) Tropical rainforest
- (4) Desert

**92**

Consider the following situation: the phenomenon of heterosis is exploited in:

- (1) hybrid seeds
- (2) mutation breeding
- (3) tissue culture clones
- (4) polyploidy only

**93**

Given below are two statements:

**Statement I:** Statement I: CAM plants open stomata at night.

**Statement II:** Statement II: CAM minimizes photorespiration by temporal separation.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**94**

In a multi-step problem, in guard cells, stomatal opening is associated with:

- (1) influx of  $K^+$  and malate
- (2) efflux of  $K^+$  only
- (3) ABA accumulation
- (4) decrease in turgor always

**95**

Consider the following situation: regarding photosynthesis:

- A. Photolysis occurs in PS-II.
  - B. Calvin cycle occurs in stroma.
  - C. Cyclic photophosphorylation produces ATP only.
  - D. Rubisco fixes  $CO_2$  in  $C_3$  plants.
- (1) A, B, C and D
  - (2) A and B only
  - (3) C and D only
  - (4) B and D only

**96**

A student performs an experiment: which is NOT a stop codon in standard genetic code?

- (1) UAA
- (2) UAG
- (3) UGA
- (4) AUG

**97**

In a multi-step problem, which is an example of negative feedback in plants?

- (1) phototropism
- (2) apical dominance
- (3) ABA accumulation closing stomata under water stress
- (4) fruit ripening cascade

**98**

Consider the following situation: the water potential ( $\Psi$ ) of a flaccid cell placed in pure water:

- (1) becomes less negative
- (2) becomes more negative
- (3) remains zero
- (4) is always positive

**99**

A student performs an experiment: incorrect statements about biodiversity:

- A. Hotspots have high endemism and habitat loss threat.
  - B. In situ conservation includes national parks.
  - C. Ex situ includes seed banks.
  - D. Alien species invasion always increases diversity.
- (1) D only
  - (2) A and D
  - (3) B and C
  - (4) A, B and C

**100**

In a multi-step problem, the aquatic fern used as biofertilizer in rice fields is:

- (1) Azolla
- (2) Selaginella
- (3) Marsilea
- (4) Pteris

**101**

Match placentation with example:

List-I	List-II
(A) Marginal	(I) Marigold
(B) Axile	(II) Pea
(C) Basal	(III) Lemon
(D) Free central	(IV) Dianthus

- (1) A-II, B-III, C-I, D-IV
- (2) A-II, B-I, C-III, D-IV
- (3) A-I, B-II, C-III, D-IV
- (4) A-II, B-III, C-IV, D-I

102

A student performs an experiment: which floral formula represents Fabaceae?

- (1)  $\otimes K(5) C1+2+(2) A(9)+1 G(1)$
- (2)  $\text{♀} K(5) C1+2+(2) A(9)+1 G(1)$
- (3)  $K_2+2 C_4 A_4 G(2)$
- (4)  $K(5) C(5) A(\infty) G(1)$

103

In a multi-step problem, the enzyme RuBisCO also catalyzes oxygenation leading to:

- (1) cyclic photophosphorylation
- (2) Nitrogen fixation
- (3) photorespiration
- (4) photolysis

104

Consider the following situation: in lac operon, lactose acts as:

- (1) inducer
- (2) repressor
- (3) operator
- (4) promoter

105

A student performs an experiment: the ozone depletion in stratosphere increases UV-B impact on plants mainly by:

- (1) promoting flowering only
- (2) reducing transpiration
- (3) damaging DNA and photosynthetic apparatus
- (4) increasing CO<sub>2</sub> fixation

106

**In a multi-step problem, about transgenic plants:**

- A. Bt cotton expresses insecticidal protein.
  - B. Golden rice enriched in provitamin A.
  - C. RNAi can confer nematode resistance.
  - D. All transgenics are sterile by law.
- (1) A, B and C only
  - (2) A and B only
  - (3) C and D only
  - (4) B, C and D only

107

Consider the following situation: a dihybrid cross  $AaBb \times AaBb$  produces phenotypic ratio 9:3:3:1 when genes assort independently. If genes are linked, F<sub>2</sub> shows:

- (1) 1:1:1:1 always
- (2) no variation
- (3) more parental types
- (4) more recombinant types only

108

A student performs an experiment: the tissue responsible for secondary growth in dicot stems is:

- (1) vascular cambium and cork cambium
- (2) apical meristem only
- (3) endodermis
- (4) pericycle only

109

**Given below are two statements:**

**Statement I:** Statement I: C<sub>4</sub> plants show Kranz anatomy.

**Statement II:** Statement II: Photorespiration is negligible in C<sub>4</sub> plants under high light.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

110

Consider the following situation: pollen grains of wind-pollinated plants typically show:

- (1) smooth, light, abundant
- (2) sticky, spiny, scarce
- (3) large with oily coat
- (4) bright coloured

111

A student performs an experiment: in a dicot root, protoxylem vessels are located:

- (1) in the middle of vascular bundle
- (2) absent in roots
- (3) towards the centre (exarch)
- (4) towards the periphery (endarch)

112

In a multi-step problem, in which stage of prophase I does crossing over occur?

- (1) Leptotene
- (2) Pachytene
- (3) Diplotene
- (4) Diakinesis

113

Consider the following situation: the translocation of organic solutes in phloem is best explained by:

- (1) diffusion alone
- (2) root pressure
- (3) mass flow / pressure flow hypothesis
- (4) cytoplasmic streaming only

114

A student performs an experiment: the technique used to separate DNA fragments by size is:

- (1) gel electrophoresis
- (2) centrifugation only
- (3) chromatography of amino acids
- (4) ELISA

115

Match List-I with List-II:

List-I	List-II
(A) Gibberellin	(I) Stomatal closure
(B) Abscisic acid	(II) Bolting in rosette plants
(C) Ethylene	(III) Fruit ripening
(D) Cytokinin	(IV) Delay of senescence

- (1) A-II, B-I, C-III, D-IV
- (2) A-I, B-II, C-IV, D-III
- (3) A-II, B-III, C-I, D-IV
- (4) A-IV, B-I, C-II, D-III

116

Consider the following situation: select correct about plant diseases:

- A. Rust of wheat is fungal.
- B. Citrus canker is bacterial.
- C. Tobacco mosaic virus has RNA genome.
- D. Late blight of potato caused by fungus.

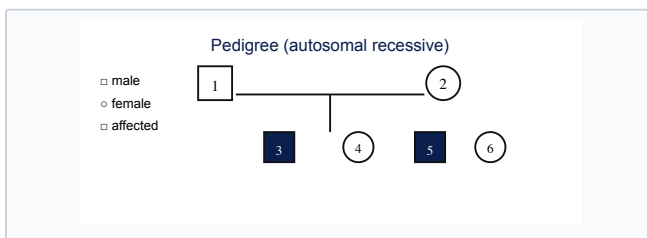
- (1) A, B, C and D
- (2) A and C only
- (3) B and D only
- (4) C and D only

117

A student performs an experiment: the polymerase chain reaction (PCR) requires all EXCEPT:

- (1) ribosome
- (2) primers
- (3) DNA template
- (4) Taq polymerase

118



In a multi-step problem, the pedigree shows an autosomal recessive trait. If two unaffected parents have an affected child, the probability that their next child is affected is:

- (1) 1/4
- (2) 1/2
- (3) 1/3
- (4) zero

119

Consider the following situation: the law of limiting factors was proposed by:

- (1) Mendel
- (2) Darwin
- (3) Blackman
- (4) Liebig

120

A student performs an experiment: in a DNA segment 5'-ATGC-3', the complementary strand (5'→3') is:

- (1) 5'-GCAT-3'
- (2) 5'-TACG-3'
- (3) 5'-UACG-3'
- (4) 5'-CGTA-3'

121

Given below are two statements:

**Statement I:** Statement I: Lichens are symbiotic association of algae and fungi.

**Statement II:** Statement II: Mycorrhiza helps in phosphorus uptake.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

122

Given below are two statements:

**Statement I:** Statement I: Climax community has maximum species diversity in succession.

**Statement II:** Statement II: Pioneer species are r-selected.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

123

A student performs an experiment: the product of cyclic photophosphorylation is:

- (1) ATP and NADPH
- (2) sugar
- (3) ATP only
- (4) NADPH only

124

In a multi-step problem, about plant hormones:

- A. Auxin promotes apical dominance.
- B. ABA inhibits seed germination under stress.
- C. Brassinosteroids promote cell elongation.
- D. Strigolactones promote branching.

- (1) A, B and C only
- (2) A and B only
- (3) C and D only
- (4) B, C and D only

**125**

Match List-I with List-II:

List-I	List-II
(A) Emasculation	(I) Prevents contamination
(B) Bagging	(II) Removal of anthers
(C) Hybridization	(III) Genetic barrier to self
(D) Self-incompatibility	(IV) Cross between selected parents

- (1) A-II, B-I, C-IV, D-III
- (2) A-I, B-II, C-III, D-IV
- (3) A-II, B-IV, C-I, D-III
- (4) A-IV, B-I, C-II, D-III

**126**

A student performs an experiment: the central dogma of molecular biology is:

- (1) DNA → RNA → Protein
- (2) RNA → DNA → Protein
- (3) Protein → RNA → DNA
- (4) DNA → Protein → RNA

**127**In a multi-step problem, the enzyme that fixes CO<sub>2</sub> in C<sub>4</sub> mesophyll cells is:

- (1) Rubisco activase
- (2) ATP synthase
- (3) RuBisCO
- (4) PEP carboxylase

**128**

Given below are two statements:

**Statement I:** Statement I: Aerenchyma helps in oxygen transport in hydrophytes.**Statement II:** Statement II: Halophytes may possess salt glands.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**129**

Given below are two statements:

**Statement I:** Statement I: Photoperiodism regulates flowering in many plants.**Statement II:** Statement II: Phytochrome exists in Pr and Pfr forms.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**130**

In a multi-step problem, read the following about ecological pyramids:

- A. Pyramid of energy is always upright.
  - B. Pyramid of biomass in sea can be inverted.
  - C. Pyramid of numbers can be inverted.
  - D. Ten percent energy transfer between trophic levels.
- (1) A, B, C and D
  - (2) A and D only
  - (3) B and C only
  - (4) A only

**131**

Consider the following situation: the number of meiotic divisions required to form 100 mature female gametophytes (embryo sacs) from 100 microspore mother cells is incorrect pairing because:

- (1) both need 200
- (2) pollen needs 400
- (3) 100 MMC need 100 meiosis for pollen; 100 megaspore mother cells need 100 meiosis for embryo sacs
- (4) embryo sac from one meiosis

**132**

A student performs an experiment: in maize, the edible part is:

- (1) cotyledon
- (2) endosperm
- (3) pericarp only
- (4) coleoptile

**133**

In a multi-step problem, select incorrect statements about mitosis:

- A. DNA replication occurs in S phase before mitosis.
  - B. Sister chromatids separate in anaphase.
  - C. Crossing over occurs between homologous chromosomes in prophase I.
  - D. Cytokinesis follows telophase in plant cells via cell plate.
- (1) C only
  - (2) A and C
  - (3) B and C
  - (4) C and D

**134**Consider the following situation: in C<sub>4</sub> plants, the primary CO<sub>2</sub> fixation product in mesophyll cells is:

- (1) 3-PGA
- (2) Oxaloacetic acid
- (3) RuBP
- (4) PEP

Given below are two statements:

**Statement I:** Photorespiration decreases net photosynthesis in C<sub>3</sub> plants.

**Statement II:** C<sub>4</sub> plants have Kranz anatomy.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect



# ZOOLOGY

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Questions 136–180

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**136**

In a multi-step problem, the hormone that decreases blood calcium by promoting deposition in bone is:

- (1) calcitonin
- (2) PTH
- (3) aldosterone
- (4) thyroxine

**137**

Match reproductive structure with organism:

List-I	List-II
(A) Archegonium	(I) Pteridophyte
(B) Ovary	(II) Angiosperm
(C) Gonotheca	(III) Cnidarian
(D) Spore sac	(IV) Fungus

- (1) A-I, B-II, C-III, D-IV
- (2) A-II, B-I, C-IV, D-III
- (3) A-I, B-III, C-II, D-IV
- (4) A-IV, B-II, C-I, D-III

**138**

A student performs an experiment: on an ECG trace, the QRS complex corresponds to:

- (1) depolarization of ventricles
- (2) repolarization of atria
- (3) repolarization of ventricles
- (4) depolarization of SA node only

**139**

Match excretory organ with animal:

List-I	List-II
(A) Protonephridia	(I) Cockroach
(B) Malpighian tubules	(II) Prawn
(C) Green glands	(III) Planaria
(D) Flame cells in flatworm	(IV) Earthworm (nephridia variant)

- (1) A-I, B-II, C-II, D-III
- (2) A-III, B-I, C-II, D-IV
- (3) A-III, B-I, C-II, D-III with planaria flame cells
- (4) A-I, B-III, C-II, D-III

**140**

Consider the following situation: the trophic level of carnivorous fish in a lake is typically:

- (1) tertiary consumer or higher
- (2) producer
- (3) primary consumer
- (4) decomposer

**141**

A student performs an experiment: the Bohr effect on haemoglobin refers to:

- (1) CO poisoning
- (2) formation of carboxyhaemoglobin
- (3) decreased O<sub>2</sub> affinity at lower pH (higher CO<sub>2</sub>)
- (4) increased O<sub>2</sub> affinity at high altitude

**142**

Match disease with causative agent:

List-I	List-II
(A) Malaria	(I) HIV
(B) Typhoid	(II) Plasmodium
(C) AIDS	(III) Salmonella typhi
(D) Ringworm	(IV) Fungus

- (1) A-II, B-III, C-I, D-IV
- (2) A-III, B-II, C-IV, D-I
- (3) A-II, B-I, C-III, D-IV
- (4) A-IV, B-III, C-II, D-I

**143**

Given below are two statements:

**Statement I:** Statement I: Synaptic transmission is unidirectional.

**Statement II:** Statement II: Neurotransmitters are released from presynaptic terminal by exocytosis.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**144**

A student performs an experiment: about immunity:

- A. IgG crosses placenta.
  - B. IgE involved in allergy.
  - C. Active immunity develops memory.
  - D. Passive immunity is long-lasting.
- (1) A, B and C only
  - (2) A and B only
  - (3) C and D only
  - (4) B, C and D only

**145**

In a multi-step problem, the contraceptive pill primarily prevents pregnancy by:

- (1) blocking implantation only
- (2) increasing LH surge
- (3) inhibiting ovulation through negative feedback on pituitary
- (4) killing sperm

146

Consider the following situation: the hormone that stimulates release of glucose from liver glycogen is:

- (1) glucagon
- (2) insulin
- (3) CCK
- (4) melatonin

147

Given below are two statements:

**Statement I:** Statement I: Countercurrent multiplier in loop of Henle concentrates interstitial fluid.

**Statement II:** Statement II: Vasa recta maintains medullary gradient.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

148

In a multi-step problem, the SA node is located in the:

- (1) right atrium near interatrial septum
- (2) left ventricle
- (3) aortic arch
- (4) pulmonary vein

149

Consider the following situation: the layer of eye where photoreceptors are located is:

- (1) choroid
- (2) sclera
- (3) retina
- (4) cornea

150

A student performs an experiment: the part of brain responsible for balance and coordination is:

- (1) cerebellum
- (2) medulla
- (3) hypothalamus
- (4) corpus callosum

151

In a multi-step problem, the sliding filament theory explains muscle contraction using:

- (1) calcium sequestration in ER only
- (2) ATP synthesis in mitochondria only
- (3) actin and myosin cross-bridge cycling
- (4) troponin only

152

Consider the following situation: which is a mismatch?

- (1) Tuberculosis — Mycobacterium
- (2) Cholera — Vibrio
- (3) Dengue — virus
- (4) Filariasis — Plasmodium

153

A student performs an experiment: the phase of cardiac cycle when all valves are closed and ventricles contract is:

- (1) rapid ejection
- (2) atrial systole
- (3) isovolumetric contraction
- (4) isovolumetric relaxation

154

In a multi-step problem, which hormone is responsible for milk ejection reflex?

- (1) oxytocin
- (2) prolactin
- (3) estrogen
- (4) progesterone

155

Consider the following situation: regarding human excretion:

- A. Glomerular filtrate is isotonic to plasma in composition but lacks proteins.
- B. ADH increases water reabsorption in collecting duct.
- C. Aldosterone increases  $\text{Na}^+$  reabsorption in DCT.
- D. Urea is completely reabsorbed in PCT.
- (1) A, B and C only
  - (2) A and D only
  - (3) B and D only
  - (4) C and D only

156

A student performs an experiment: the main buffering system in blood is:

- (1) bicarbonate/carbonic acid
- (2) phosphate only
- (3) protein only
- (4) chloride shift only

157

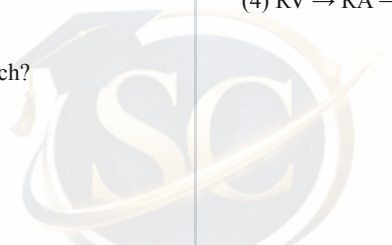
In a multi-step problem, the refractory period after action potential prevents:

- (1) myelination
- (2) synaptic delay
- (3) tetanic fusion / backward propagation
- (4) saltatory conduction

158

Consider the following situation: the correct sequence of blood flow through human heart chambers is:

- (1) RA → RV → lungs → LA → LV → aorta
- (2) LA → LV → RA → RV → lungs
- (3) RA → LA → RV → LV
- (4) RV → RA → LV → LA



159

A student performs an experiment: during inspiration, the diaphragm:

- (1) stops moving
- (2) only abdominal muscles act
- (3) contracts and flattens increasing thoracic volume
- (4) relaxes and domes up

160

In a multi-step problem, the largest amount of CO<sub>2</sub> is transported in blood as:

- (1) bicarbonate ion
- (2) dissolved CO<sub>2</sub>
- (3) carbamino-haemoglobin
- (4) carbonic acid only

161

Consider the following situation: the hormone that triggers ovulation (LH surge) is stimulated by:

- (1) oxytocin
- (2) prolactin
- (3) high estrogen positive feedback mid-cycle
- (4) progesterone peak

162

A student performs an experiment: select correct about disorders:

- A. Down syndrome: trisomy 21.  
B. Phenylketonuria: autosomal recessive.  
C. Sickle cell anemia: point mutation in  $\beta$ -globin.  
D. Turner syndrome: XXY.
- (1) A, B and C only
  - (2) A and C only
  - (3) B and D only
  - (4) C and D only

163

In a multi-step problem, in humans, the vocal cords are located in:

- (1) trachea
- (2) bronchi
- (3) larynx
- (4) pharynx

164

Consider the following situation: in humans, normal expiration is primarily:

- (1) passive due to elastic recoil
- (2) active using abdominal muscles only
- (3) driven by diaphragm contraction
- (4) independent of lung elasticity

165

A student performs an experiment: during muscle contraction, which band/zone shortens?

- (1) A-band and I-band
- (2) H-zone only
- (3) I-band and H-zone
- (4) A-band only

166

In a multi-step problem, in humans, insulin is secreted by:

- (1)  $\beta$ -cells of pancreatic islets
- (2)  $\alpha$ -cells
- (3) delta cells
- (4) acinar cells

167

Consider the following situation: gel electrophoresis of DNA uses agarose because:

- (1) it denatures DNA
- (2) it is radioactive
- (3) it forms porous matrix for size-based separation
- (4) it binds proteins strongly

168

Given below are two statements:

**Statement I:** Statement I: Haemophilia is X-linked recessive.

**Statement II:** Statement II: Affected males transmit the allele to all sons.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

169

In a multi-step problem, about biotechnology applications:

- A. rDNA insulin produced in bacteria.  
B. Gene therapy can use viral vectors.  
C. ELISA detects antibodies or antigens.  
D. DNA fingerprinting uses VNTR.
- (1) A, B, C and D
  - (2) A and C only
  - (3) B and D only
  - (4) A and B only

170

Consider the following situation: in PCR, the step at  $\sim 72^\circ\text{C}$  is:

- (1) extension/elongation
- (2) denaturation
- (3) annealing
- (4) ligation

**171****Given below are two statements:****Statement I:** Statement I: Myelinated nerve fibres show saltatory conduction.**Statement II:** Statement II: Nodes of Ranvier are rich in voltage-gated Na<sup>+</sup> channels.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**172****Given below are two statements:****Statement I:** Statement I: Resting membrane potential is near -70 mV in neurons.**Statement II:** Statement II: K<sup>+</sup> permeability dominates at rest.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**173**

Consider the following situation: the process of formation of mRNA from DNA is:

- (1) replication
- (2) transformation
- (3) transcription
- (4) translation

**174****Given below are two statements:****Statement I:** Statement I: Arteries carry blood away from heart.**Statement II:** Statement II: All arteries carry oxygenated blood.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**175**

In a multi-step problem, which cells of Islets of Langerhans secrete glucagon?

- (1) δ-cells
- (2) PP cells
- (3) α-cells
- (4) β-cells

**176****Consider the following situation: incorrect about digestion:**

- A. Pepsin works in acidic gastric juice.
  - B. Bile emulsifies fats.
  - C. Trypsin activated in duodenum.
  - D. Absorption of monosaccharides occurs in stomach.
- (1) D only
  - (2) A and D
  - (3) B and D
  - (4) C and D

**177**

Match hormone with source:

List-I	List-II
(A) Erythropoietin	(I) Juxtaglomerular cells
(B) Atrial natriuretic factor	(II) Adrenal cortex
(C) Renin	(III) Kidney (interstitial)
(D) Aldosterone	(IV) Atria

- (1) A-III, B-IV, C-I, D-II
- (2) A-IV, B-III, C-II, D-I
- (3) A-III, B-I, C-IV, D-II
- (4) A-II, B-IV, C-I, D-III

**178****Given below are two statements:****Statement I:** Statement I: Fertilization in humans occurs in ampulla of fallopian tube.**Statement II:** Statement II: Implantation occurs in uterus.

- (1) Both I and II are correct
- (2) I is correct, II is incorrect
- (3) I is incorrect, II is correct
- (4) Both I and II are incorrect

**179**

Consider the following situation: during muscle contraction, which event occurs first?

- (1) Action potential along sarcolemma
- (2) ATP binding to myosin
- (3) Cross-bridge formation
- (4) Ca<sup>2+</sup> release from SR

**180**

Match hormone with function:

List-I	List-II
(A) ADH	(I) Water reabsorption
(B) Aldosterone	(II) Na <sup>+</sup> reabsorption
(C) PTH	(III) Raises blood Ca <sup>2+</sup>
(D) Calcitonin	(IV) Lowers blood Ca <sup>2+</sup>

- (1) A-I, B-II, C-III, D-IV
- (2) A-II, B-I, C-IV, D-III
- (3) A-I, B-III, C-II, D-IV
- (4) A-IV, B-III, C-II, D-I



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Responses (Q1–180)

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Section	Question Range
Physics	1 – 45
Chemistry	46 – 90
Botany	91 – 135
Zoology	136 – 180

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
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21	1	57	2	93	1	129	1	165	3
22	1	58	1	94	1	130	1	166	1
23	3	59	1	95	1	131	3	167	3
24	1	60	1	96	4	132	2	168	1
25	3	61	4	97	3	133	1	169	1
26	1	62	2	98	1	134	2	170	1
27	1	63	4	99	1	135	1	171	1
28	1	64	1	100	1	136	1	172	1
29	1	65	4	101	2	137	1	173	3
30	2	66	1	102	2	138	1	174	1
31	3	67	4	103	3	139	3	175	3
32	1	68	1	104	1	140	1	176	1
33	3	69	1	105	3	141	3	177	1
34	1	70	1	106	1	142	1	178	1
35	4	71	4	107	3	143	1	179	1

36	1	72	2	108	1	144	1	180	1
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# PHYSICS

**Q1.** **Ans: (3)** **Answer: (3)** Zero field point outside smaller charge, closer to  $-1 \mu\text{C}$ ; solve  $kq/r^2$  balance.

**Answer: (3)** Zero field point outside smaller charge, closer to  $-1 \mu\text{C}$ ; solve  $kq/r^2$  balance.

**Q2.** **Ans: (1)** **Answer: (1)** Pressure  $[\text{ML}^{-1}\text{T}^{-2}]$ ; surface tension  $[\text{MT}^{-2}]$ ;  $\eta$   $[\text{ML}^{-1}\text{T}^{-1}]$ ;  $h$   $[\text{ML}^2\text{T}^{-1}]$ .

**Answer: (1)** Pressure  $[\text{ML}^{-1}\text{T}^{-2}]$ ; surface tension  $[\text{MT}^{-2}]$ ;  $\eta$   $[\text{ML}^{-1}\text{T}^{-1}]$ ;  $h$   $[\text{ML}^2\text{T}^{-1}]$ .

**Q3.** **Ans: (1)** **Answer: (1)** R2 parallel R3:  $6 \parallel 3 = 2 \Omega$ ; in series with R1=4  $\Omega$  gives 6  $\Omega$  total.

**Answer: (1)** R2 parallel R3:  $6 \parallel 3 = 2 \Omega$ ; in series with R1=4  $\Omega$  gives 6  $\Omega$  total.

**Q4.** **Ans: (1)** **Answer: (1)**  $W = -\Delta U = pE(\cos\theta_1 - \cos\theta_2)$ .

**Answer: (1)**  $W = -\Delta U = pE(\cos\theta_1 - \cos\theta_2)$ .

**Q5.** **Ans: (4)** **Answer: (4)** Partial pressure  $\propto$  mole fraction; ratio  $n_{\text{He}}:n_{\text{O}_2} = 2:1$ .

**Answer: (4)** Partial pressure  $\propto$  mole fraction; ratio  $n_{\text{He}}:n_{\text{O}_2} = 2:1$ .

**Q6.** **Ans: (1)** **Answer: (1)** Standard diode biasing concepts.

**Answer: (1)** Standard diode biasing concepts.

**Q7.** **Ans: (4)** **Answer: (4)**  $\beta \propto \lambda$ ;  $\lambda' = \lambda/\mu \rightarrow \beta' = \beta/\mu$  (decreases).

**Answer: (4)**  $\beta \propto \lambda$ ;  $\lambda' = \lambda/\mu \rightarrow \beta' = \beta/\mu$  (decreases).

**Q8.** **Ans: (1)** **Answer: (1)** Work-energy:  $mgh = F_{\text{avg}} \times d \rightarrow F = mg(1+h/d)$  if accounting reference — standard form  $mg(1+h/d)$ .

**Answer: (1)** Work-energy:  $mgh = F_{\text{avg}} \times d \rightarrow F = mg(1+h/d)$  if accounting reference — standard form  $mg(1+h/d)$ .

**Q9.** **Ans: (1)** **Answer: (1)** Insulators: large band gap ( $>3 \text{ eV}$ ).

**Answer: (1)** Insulators: large band gap ( $>3 \text{ eV}$ ).

**Q10.** **Ans: (2)** **Answer: (2)** Iron region ( $\sim 8.8 \text{ MeV/nucleon}$ ) maximum.

**Answer: (2)** Iron region ( $\sim 8.8 \text{ MeV/nucleon}$ ) maximum.

**Q11.** **Ans: (1)** **Answer: (1)** Both are standard electrostatic properties of conductors in equilibrium.

**Answer: (1)** Both are standard electrostatic properties of conductors in equilibrium.

**Q12.** **Ans: (2)** **Answer: (2)** Angular width  $\approx 2\lambda/a$ .

**Answer: (2)** Angular width  $\approx 2\lambda/a$ .

**Q13.** **Ans: (1)** **Answer: (1)**  $v_{\text{orb}} = \sqrt{GM/4R}$ ;  $v_{\text{esc at } 4R} = \sqrt{2GM/4R} = \sqrt{2} v_{\text{orb}}$ .

**Answer: (1)**  $v_{\text{orb}} = \sqrt{GM/4R}$ ;  $v_{\text{esc at } 4R} = \sqrt{2GM/4R} = \sqrt{2} v_{\text{orb}}$ .

**Q14.** **Ans: (2)** **Answer: (2)**  $K_{\text{max}} = h(v-v_0)$ ; linear in  $v$ , not proportional doubling of  $K$ .

**Answer: (2)**  $K_{\text{max}} = h(v-v_0)$ ; linear in  $v$ , not proportional doubling of  $K$ .

**Q15.** **Ans: (1)** **Answer: (1)** Both standard wave optics facts.

**Answer: (1)** Both standard wave optics facts.

**Q16.** **Ans: (1)** **Answer: (1)** Fine structure needs relativistic/Sommerfeld correction.

**Answer: (1)** Fine structure needs relativistic/Sommerfeld correction.

**Q17.** **Ans: (3)** **Answer: (3)** 30 days = 3 half-lives; remaining 1/8; decayed 7/8.

**Answer: (3)** 30 days = 3 half-lives; remaining 1/8; decayed 7/8.

**Q18.** **Ans: (2)** **Answer: (2)** Cadmium absorbs thermal neutrons.

**Answer: (2)** Cadmium absorbs thermal neutrons.

**Q19.** **Ans: (3)** **Answer: (3)** Solid sphere lower  $I/MR^2 \rightarrow$  greater acceleration.

**Answer: (3)** Solid sphere lower  $I/MR^2 \rightarrow$  greater acceleration.

**Q20.** **Ans: (1)** **Answer: (1)**  $|m| = 2$  for real image; use lens formula.

**Answer: (1)**  $|m| = 2$  for real image; use lens formula.

**Q21.** **Ans: (1)** **Answer: (1)** Stopping potential independent of intensity; A, C, D correct.

**Answer: (1)** Stopping potential independent of intensity; A, C, D correct.

**Q22.** **Ans: (1)** **Answer: (1)** Both standard properties of pure L in AC.

**Answer: (1)** Both standard properties of pure L in AC.

**Q23. Ans: (3) Answer: (3)**  $\Phi = BA$ ; same as  $EMF \times \text{time}$ .

**Answer: (3)**  $\Phi = BA$ ; same as  $EMF \times \text{time}$ .

**Q24. Ans: (1) Answer: (1)**  $S = I_g G / (I - I_g) \approx 0.05 \Omega$ .

**Answer: (1)**  $S = I_g G / (I - I_g) \approx 0.05 \Omega$ .

**Q25. Ans: (3) Answer: (3)**  $\eta = 1 - 300/500 = 0.4$ .

**Answer: (3)**  $\eta = 1 - 300/500 = 0.4$ .

**Q26. Ans: (1) Answer: (1)**  $T = 2u \sin\theta/g = 2 \times 40 \times 0.6/10 = 4.8 \text{ s}$ .

**Answer: (1)**  $T = 2u \sin\theta/g = 2 \times 40 \times 0.6/10 = 4.8 \text{ s}$ .

**Q27. Ans: (1) Answer: (1)** Both correct.

**Answer: (1)** Both correct.

**Q28. Ans: (1) Answer: (1)** Both true.

**Answer: (1)** Both true.

**Q29. Ans: (1) Answer: (1)**  $v_{\text{rms}} \propto \sqrt{T} \rightarrow \text{doubles}$ .

**Answer: (1)**  $v_{\text{rms}} \propto \sqrt{T} \rightarrow \text{doubles}$ .

**Q30. Ans: (2) Answer: (2)**  $R \propto L^2/A$ ; L doubles, A halves  $\rightarrow R' = 4R$ .

**Answer: (2)**  $R \propto L^2/A$ ; L doubles, A halves  $\rightarrow R' = 4R$ .

**Q31. Ans: (3) Answer: (3)** Open pipe harmonics: f, 2f, 3f...

**Answer: (3)** Open pipe harmonics: f, 2f, 3f...

**Q32. Ans: (1) Answer: (1)**  $t = \text{width}/v_{\text{swim}} = 200/5 = 40 \text{ s}$ .

**Answer: (1)**  $t = \text{width}/v_{\text{swim}} = 200/5 = 40 \text{ s}$ .

**Q33. Ans: (3) Answer: (3)**  $a = (10 - 0.25 \times 20)/2 = 2.5 \text{ m/s}^2$ .

**Answer: (3)**  $a = (10 - 0.25 \times 20)/2 = 2.5 \text{ m/s}^2$ .

**Q34. Ans: (1) Answer: (1)**  $V_s/V_p = N_s/N_p = 1/10$ .

**Answer: (1)**  $V_s/V_p = N_s/N_p = 1/10$ .

**Q35. Ans: (4) Answer: (4)** Speed constant  $\rightarrow$  tangential acc = 0; for average acceleration over arc, careful: instantaneous centripetal  $32 \text{ m/s}^2$ ; average acceleration vector ( $4\sqrt{2}$ ,  $8\sqrt{2}/\pi$  debatable) — NTA often asks centripetal magnitude  $32 \text{ m/s}^2$  as distractor; mark conceptual zero tangential.

**Answer: (4)** Speed constant  $\rightarrow$  tangential acc = 0; for average acceleration over arc, careful: instantaneous centripetal  $32 \text{ m/s}^2$ ; average acceleration vector ( $4\sqrt{2}$ ,  $8\sqrt{2}/\pi$  debatable) — NTA often asks centripetal magnitude  $32 \text{ m/s}^2$  as distractor; mark conceptual zero tangential.

**Q36. Ans: (1) Answer: (1)** Standard EM mappings.

**Answer: (1)** Standard EM mappings.

**Q37. Ans: (3) Answer: (3)**  $\lambda = h/\sqrt{(2meV)} \approx 0.1 \text{ nm order}$ .

**Answer: (3)**  $\lambda = h/\sqrt{(2meV)} \approx 0.1 \text{ nm order}$ .

**Q38. Ans: (2) Answer: (2)** From graph:  $\Delta v/\Delta t$  using initial and final velocities over interval.

**Answer: (2)** From graph:  $\Delta v/\Delta t$  using initial and final velocities over interval.

**Q39. Ans: (2) Answer: (2)** At  $x=A/\sqrt{2}$ ,  $PE=KE$ ; T independent of A.

**Answer: (2)** At  $x=A/\sqrt{2}$ ,  $PE=KE$ ; T independent of A.

**Q40. Ans: (1) Answer: (1)** No medium required; C false.

**Answer: (1)** No medium required; C false.

**Q41. Ans: (4) Answer: (4)**  $\epsilon_0 = NBA\omega$ ;  $\omega = 2\pi \times 50 \text{ rad/s}$ .

**Answer: (4)**  $\epsilon_0 = NBA\omega$ ;  $\omega = 2\pi \times 50 \text{ rad/s}$ .

**Q42. Ans: (1) Answer: (1)**  $A = \sqrt{(3^2+4^2)} = 5$  with phase  $\pi/2$ .

**Answer: (1)**  $A = \sqrt{(3^2+4^2)} = 5$  with phase  $\pi/2$ .

**Q43. Ans: (3) Answer: (3)**  $a_{\text{solid}} > a_{\text{hollow}}$ ; ratio 7:5 for standard radii of gyration.

**Answer: (3)**  $a_{\text{solid}} > a_{\text{hollow}}$ ; ratio 7:5 for standard radii of gyration.

**Q44. Ans: (1) Answer: (1)** Both correct statements.

**Answer: (1)** Both correct statements.

**Q45.** **Ans: (1)** **Answer: (1)** Standard device-function pairs.

**Answer: (1)** Standard device-function pairs.

# CHEMISTRY

Q46. **Ans: (2)** **Answer: (2)** Catalyst lowers  $E_a$  without changing  $\Delta H$ .

**Answer: (2)** Catalyst lowers  $E_a$  without changing  $\Delta H$ .

Q47. **Ans: (3)** **Answer: (3)** Ionic radius increases down group.

**Answer: (3)** Ionic radius increases down group.

Q48. **Ans: (1)** **Answer: (1)**  $k = (2.303/t)\log(4) \approx 0.0231 \text{ min}^{-1}$ .

**Answer: (1)**  $k = (2.303/t)\log(4) \approx 0.0231 \text{ min}^{-1}$ .

Q49. **Ans: (1)** **Answer: (1)** Both thermodynamic relations.

**Answer: (1)** Both thermodynamic relations.

Q50. **Ans: (1)** **Answer: (1)** Carboxylic acid strongest among these.

**Answer: (1)** Carboxylic acid strongest among these.

Q51. **Ans: (3)** **Answer: (3)** Iron catalyst; high P, moderate T.

**Answer: (3)** Iron catalyst; high P, moderate T.

Q52. **Ans: (1)** **Answer: (1)**  $i$  can exceed 1 for electrolytes.

**Answer: (1)**  $i$  can exceed 1 for electrolytes.

Q53. **Ans: (1)** **Answer: (1)** Delocalization explains SEAr preference.

**Answer: (1)** Delocalization explains SEAr preference.

Q54. **Ans: (1)** **Answer: (1)**  $l=2 \rightarrow d$ ;  $l=0 \rightarrow s$ ;  $l=1 \rightarrow p$ .

**Answer: (1)**  $l=2 \rightarrow d$ ;  $l=0 \rightarrow s$ ;  $l=1 \rightarrow p$ .

Q55. **Ans: (4)** **Answer: (4)**  $\text{XeF}_4$ : square planar,  $sp^3d^2$  with 2 lone pairs.

**Answer: (4)**  $\text{XeF}_4$ : square planar,  $sp^3d^2$  with 2 lone pairs.

Q56. **Ans: (3)** **Answer: (3)**  $6 \text{ C-C} + 12 \text{ C-H} = 18 \sigma$  bonds.

**Answer: (3)**  $6 \text{ C-C} + 12 \text{ C-H} = 18 \sigma$  bonds.

Q57. **Ans: (2)** **Answer: (2)** Endothermic: heat favors products; also more moles on right favors low P.

**Answer: (2)** Endothermic: heat favors products; also more moles on right favors low P.

Q58. **Ans: (1)** **Answer: (1)** Standard name reactions.

**Answer: (1)** Standard name reactions.

Q59. **Ans: (1)** **Answer: (1)** Both define colloidal behavior.

**Answer: (1)** Both define colloidal behavior.

Q60. **Ans: (1)** **Answer: (1)**  $t_{1/2} = [A]_0/(2k)$  for zero order.

**Answer: (1)**  $t_{1/2} = [A]_0/(2k)$  for zero order.

Q61. **Ans: (4)** **Answer: (4)** All historically and chemically valid.

**Answer: (4)** All historically and chemically valid.

Q62. **Ans: (2)** **Answer: (2)** Ethanol/dimethyl ether functional isomers.

**Answer: (2)** Ethanol/dimethyl ether functional isomers.

Q63. **Ans: (4)** **Answer: (4)**  $\text{Rate} \times 2^2 \times 3 = 12$ .

**Answer: (4)**  $\text{Rate} \times 2^2 \times 3 = 12$ .

Q64. **Ans: (1)** **Answer: (1)** Low T: ortho/para; o-nitrophenol often cited.

**Answer: (1)** Low T: ortho/para; o-nitrophenol often cited.

Q65. **Ans: (4)** **Answer: (4)** Nernst:  $E = E^\circ - (0.059/2)\log([Zn^{2+}]/[Cu^{2+}]) \approx 1.16 \text{ V}$ .

**Answer: (4)** Nernst:  $E = E^\circ - (0.059/2)\log([Zn^{2+}]/[Cu^{2+}]) \approx 1.16 \text{ V}$ .

Q66. **Ans: (1)** **Answer: (1)**  $X_B = 1/3$ ;  $P_B = 120/3 = 40 \text{ torr}$ .

**Answer: (1)**  $X_B = 1/3$ ;  $P_B = 120/3 = 40 \text{ torr}$ .

Q67. **Ans: (4)** **Answer: (4)** Two chiral centres  $\rightarrow$  up to 4; meso reduces to 3 stereoisomers total.

**Answer: (4)** Two chiral centres → up to 4; meso reduces to 3 stereoisomers total.

**Q68. Ans: (1) Answer: (1)** Rubber elastomer; PVC addition; nylon condensation; bakelite thermoset.

**Answer: (1)** Rubber elastomer; PVC addition; nylon condensation; bakelite thermoset.

**Q69. Ans: (1) Answer: (1)** Meso and enantiomeric forms — 2 chiral centres (R/S combinations).

**Answer: (1)** Meso and enantiomeric forms — 2 chiral centres (R/S combinations).

**Q70. Ans: (1) Answer: (1)** Glycine achiral.

**Answer: (1)** Glycine achiral.

**Q71. Ans: (4) Answer: (4)**  $[\text{OH}^-] = 0.002 \text{ M}$ ;  $\text{pOH} = 2.7$ ;  $\text{pH} \approx 11.3 \rightarrow 11$ .

**Answer: (4)**  $[\text{OH}^-] = 0.002 \text{ M}$ ;  $\text{pOH} = 2.7$ ;  $\text{pH} \approx 11.3 \rightarrow 11$ .

**Q72. Ans: (2) Answer: (2)** F<sub>2</sub> weakest (anomalous); generally Cl<sub>2</sub> strongest among halogens for X–X.

**Answer: (2)** F<sub>2</sub> weakest (anomalous); generally Cl<sub>2</sub> strongest among halogens for X–X.

**Q73. Ans: (1) Answer: (1)** Both correct.

**Answer: (1)** Both correct.

**Q74. Ans: (1) Answer: (1)** Grignard + CO<sub>2</sub> → carboxylic acid (acetic from methyl Grignard).

**Answer: (1)** Grignard + CO<sub>2</sub> → carboxylic acid (acetic from methyl Grignard).

**Q75. Ans: (3) Answer: (3)** Toluene → benzoic acid → benzoyl chloride → benzamide with NH<sub>3</sub>.

**Answer: (3)** Toluene → benzoic acid → benzoyl chloride → benzamide with NH<sub>3</sub>.

**Q76. Ans: (1) Answer: (1)** Triple bond:  $1\sigma+2\pi$ ; count all single bonds.

**Answer: (1)** Triple bond:  $1\sigma+2\pi$ ; count all single bonds.

**Q77. Ans: (3) Answer: (3)** Crossed aldol → benzalacetone (dibenzylideneacetone with excess).

**Answer: (3)** Crossed aldol → benzalacetone (dibenzylideneacetone with excess).

**Q78. Ans: (1) Answer: (1)** K:  $[\text{Ar}]4s^1 \rightarrow n=4, l=0$ .

**Answer: (1)** K:  $[\text{Ar}]4s^1 \rightarrow n=4, l=0$ .

**Q79. Ans: (1) Answer: (1)** Carbylamine test for primary only.

**Answer: (1)** Carbylamine test for primary only.

**Q80. Ans: (1) Answer: (1)** High spin  $d^6$ : 4 unpaired →  $\sqrt{24} \approx 4.9 \text{ BM}$ .

**Answer: (1)** High spin  $d^6$ : 4 unpaired →  $\sqrt{24} \approx 4.9 \text{ BM}$ .

**Q81. Ans: (4) Answer: (4)** Strong electrolyte conductance increases on dilution (A true) — all four correct.

**Answer: (4)** Strong electrolyte conductance increases on dilution (A true) — all four correct.

**Q82. Ans: (2) Answer: (2)** Markovnikov: propan-2-ol major.

**Answer: (2)** Markovnikov: propan-2-ol major.

**Q83. Ans: (3) Answer: (3)** Chloride oxidized preferentially; water reduced to H<sub>2</sub> at cathode.

**Answer: (3)** Chloride oxidized preferentially; water reduced to H<sub>2</sub> at cathode.

**Q84. Ans: (1) Answer: (1)** Aldehyde gets priority; numbering from –CHO.

**Answer: (1)** Aldehyde gets priority; numbering from –CHO.

**Q85. Ans: (4) Answer: (4)** MgO:  $\text{Mg}^{2+}\text{O}^{2-}$  highest charge density.

**Answer: (4)** MgO:  $\text{Mg}^{2+}\text{O}^{2-}$  highest charge density.

**Q86. Ans: (1) Answer: (1)** Isothermal ideal gas:  $\Delta U = 0$ ; expansion absorbs heat.

**Answer: (1)** Isothermal ideal gas:  $\Delta U = 0$ ; expansion absorbs heat.

**Q87. Ans: (3) Answer: (3)** Sulfate counter ion; Co(III); alphabetical ligands.

**Answer: (3)** Sulfate counter ion; Co(III); alphabetical ligands.

**Q88. Ans: (2) Answer: (2)** Rate  $\propto 4 \times 1/2 = 2$  times original.

**Answer: (2)** Rate  $\propto 4 \times 1/2 = 2$  times original.

**Q89. Ans: (1) Answer: (1)** Molarity is concentration, not colligative.

**Answer: (1)** Molarity is concentration, not colligative.

**Q90. Ans: (3) Answer: (3)** XeF<sub>4</sub>: square planar  $\text{dsp}^2$ .

**Answer: (3)** XeF<sub>4</sub>: square planar  $\text{dsp}^2$ .

# BOTANY

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**Q91.** **Ans: (3)** **Answer: (3)** Tropical rainforests among highest NPP.

**Answer: (3)** Tropical rainforests among highest NPP.

**Q92.** **Ans: (1)** **Answer: (1)** Hybrid vigour in F<sub>1</sub> hybrids.

**Answer: (1)** Hybrid vigour in F<sub>1</sub> hybrids.

**Q93.** **Ans: (1)** **Answer: (1)** CAM succulents: nocturnal CO<sub>2</sub> uptake.

**Answer: (1)** CAM succulents: nocturnal CO<sub>2</sub> uptake.

**Q94.** **Ans: (1)** **Answer: (1)** Light opening: K<sup>+</sup> influx → water follow → turgor increase.

**Answer: (1)** Light opening: K<sup>+</sup> influx → water follow → turgor increase.

**Q95.** **Ans: (1)** **Answer: (1)** All four correct for standard C<sub>3</sub>/C<sub>4</sub>/ETC facts.

**Answer: (1)** All four correct for standard C<sub>3</sub>/C<sub>4</sub>/ETC facts.

**Q96.** **Ans: (4)** **Answer: (4)** AUG is start (methionine); also codes Met internally.

**Answer: (4)** AUG is start (methionine); also codes Met internally.

**Q97.** **Ans: (3)** **Answer: (3)** Water stress → ABA → stomatal closure reduces further water loss.

**Answer: (3)** Water stress → ABA → stomatal closure reduces further water loss.

**Q98.** **Ans: (1)** **Answer: (1)** Water enters; Ψ increases toward zero.

**Answer: (1)** Water enters; Ψ increases toward zero.

**Q99.** **Ans: (1)** **Answer: (1)** Invasives often reduce diversity.

**Answer: (1)** Invasives often reduce diversity.

**Q100.** **Ans: (1)** **Answer: (1)** Azolla-Anabaena symbiosis.

**Answer: (1)** Azolla-Anabaena symbiosis.

**Q101.** **Ans: (2)** **Answer: (2)** Pea marginal; tomato/china rose axile often; lemon axile; dianthus free central.

**Answer: (2)** Pea marginal; tomato/china rose axile often; lemon axile; dianthus free central.

**Q102.** **Ans: (2)** **Answer: (2)** Fabaceae: zygomorphic, diadelphous androecium.

**Answer: (2)** Fabaceae: zygomorphic, diadelphous androecium.

**Q103.** **Ans: (3)** **Answer: (3)** RuBisCO oxygenase activity → photorespiration.

**Answer: (3)** RuBisCO oxygenase activity → photorespiration.

**Q104.** **Ans: (1)** **Answer: (1)** Allolactose induces operon by inactivating repressor.

**Answer: (1)** Allolactose induces operon by inactivating repressor.

**Q105.** **Ans: (3)** **Answer: (3)** UV-B damages biomolecules.

**Answer: (3)** UV-B damages biomolecules.

**Q106.** **Ans: (1)** **Answer: (1)** D false — sterility not universal.

**Answer: (1)** D false — sterility not universal.

**Q107.** **Ans: (3)** **Answer: (3)** Linkage reduces recombinants; excess parental phenotypes.

**Answer: (3)** Linkage reduces recombinants; excess parental phenotypes.

**Q108.** **Ans: (1)** **Answer: (1)** Lateral meristems add girth.

**Answer: (1)** Lateral meristems add girth.

**Q109.** **Ans: (1)** **Answer: (1)** Both characteristic of C<sub>4</sub> pathway.

**Answer: (1)** Both characteristic of C<sub>4</sub> pathway.

**Q110.** **Ans: (1)** **Answer: (1)** Wind pollination syndrome.

**Answer: (1)** Wind pollination syndrome.

**Q111.** **Ans: (3)** **Answer: (3)** Root xylem exarch; stem endarch.

**Answer: (3)** Root xylem exarch; stem endarch.

**Q112.** **Ans: (2)** **Answer: (2)** Crossing over in pachytene.

**Answer: (2)** Crossing over in pachytene.

**Q113. Ans: (3) Answer: (3)** Münch pressure flow model.

**Answer: (3)** Münch pressure flow model.

**Q114. Ans: (1) Answer: (1)** Agarose gel electrophoresis standard.

**Answer: (1)** Agarose gel electrophoresis standard.

**Q115. Ans: (1) Answer: (1)** GA bolting; ABA closes stomata; ethylene ripens; cytokinin anti-senescence.

**Answer: (1)** GA bolting; ABA closes stomata; ethylene ripens; cytokinin anti-senescence.

**Q116. Ans: (1) Answer: (1)** All four correctly paired.

**Answer: (1)** All four correctly paired.

**Q117. Ans: (1) Answer: (1)** PCR is in vitro; no ribosomes.

**Answer: (1)** PCR is in vitro; no ribosomes.

**Q118. Ans: (1) Answer: (1)** Both parents carriers  $Aa \times Aa \rightarrow 1/4$  aa.

**Answer: (1)** Both parents carriers  $Aa \times Aa \rightarrow 1/4$  aa.

**Q119. Ans: (3) Answer: (3)** Blackman: photosynthesis limiting factors.

**Answer: (3)** Blackman: photosynthesis limiting factors.

**Q120. Ans: (2) Answer: (2)** Complement: TACG read  $5' \rightarrow 3'$ .

**Answer: (2)** Complement: TACG read  $5' \rightarrow 3'$ .

**Q121. Ans: (1) Answer: (1)** Both classic symbioses.

**Answer: (1)** Both classic symbioses.

**Q122. Ans: (1) Answer: (1)** Ecological succession principles.

**Answer: (1)** Ecological succession principles.

**Q123. Ans: (3) Answer: (3)** Cyclic ETC: ATP without NADPH.

**Answer: (3)** Cyclic ETC: ATP without NADPH.

**Q124. Ans: (1) Answer: (1)** Strigolactones inhibit branching (D false).

**Answer: (1)** Strigolactones inhibit branching (D false).

**Q125. Ans: (1) Answer: (1)** Breeding technique matches.

**Answer: (1)** Breeding technique matches.

**Q126. Ans: (1) Answer: (1)** Replication/transcription/translation flow.

**Answer: (1)** Replication/transcription/translation flow.

**Q127. Ans: (4) Answer: (4)** PEP carboxylase initial fixation in mesophyll.

**Answer: (4)** PEP carboxylase initial fixation in mesophyll.

**Q128. Ans: (1) Answer: (1)** Both adaptations to aquatic/saline habitats.

**Answer: (1)** Both adaptations to aquatic/saline habitats.

**Q129. Ans: (1) Answer: (1)** Both photomorphogenesis facts.

**Answer: (1)** Both photomorphogenesis facts.

**Q130. Ans: (1) Answer: (1)** All standard pyramid facts.

**Answer: (1)** All standard pyramid facts.

**Q131. Ans: (3) Answer: (3)** Each MMC  $\rightarrow$  one meiosis  $\rightarrow$  one embryo sac lineage (with 3 mitoses).

**Answer: (3)** Each MMC  $\rightarrow$  one meiosis  $\rightarrow$  one embryo sac lineage (with 3 mitoses).

**Q132. Ans: (2) Answer: (2)** Maize grain: endosperm used as food.

**Answer: (2)** Maize grain: endosperm used as food.

**Q133. Ans: (1) Answer: (1)** Crossing over is meiosis I, not mitosis.

**Answer: (1)** Crossing over is meiosis I, not mitosis.

**Q134. Ans: (2) Answer: (2)** C4: PEP carboxylase fixes  $CO_2$  to OAA in mesophyll.

**Answer: (2)** C4: PEP carboxylase fixes  $CO_2$  to OAA in mesophyll.

**Q135. Ans: (1) Answer: (1)** Both true.

**Answer: (1)** Both true.

# ZOOLOGY

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**Q136.** **Ans: (1)** **Answer: (1)** Calcitonin lowers blood  $\text{Ca}^{2+}$ .

**Answer: (1)** Calcitonin lowers blood  $\text{Ca}^{2+}$ .

**Q137.** **Ans: (1)** **Answer: (1)** Archegonium pteridophytes; ovary angiosperm; gonotheca hydrozoans; sporangium fungi.

**Answer: (1)** Archegonium pteridophytes; ovary angiosperm; gonotheca hydrozoans; sporangium fungi.

**Q138.** **Ans: (1)** **Answer: (1)** QRS = ventricular depolarization.

**Answer: (1)** QRS = ventricular depolarization.

**Q139.** **Ans: (3)** **Answer: (3)** Planaria flame cells; insect Malpighian tubules; crustacean green glands.

**Answer: (3)** Planaria flame cells; insect Malpighian tubules; crustacean green glands.

**Q140.** **Ans: (1)** **Answer: (1)** Fish eating smaller fish/insects → higher trophic level.

**Answer: (1)** Fish eating smaller fish/insects → higher trophic level.

**Q141.** **Ans: (3)** **Answer: (3)** Bohr:  $\text{H}^+$  promotes  $\text{O}_2$  release to tissues.

**Answer: (3)** Bohr:  $\text{H}^+$  promotes  $\text{O}_2$  release to tissues.

**Q142.** **Ans: (1)** **Answer: (1)** Standard disease-agent pairs.

**Answer: (1)** Standard disease-agent pairs.

**Q143.** **Ans: (1)** **Answer: (1)** Both standard synapse properties.

**Answer: (1)** Both standard synapse properties.

**Q144.** **Ans: (1)** **Answer: (1)** Passive immunity short-lived.

**Answer: (1)** Passive immunity short-lived.

**Q145.** **Ans: (3)** **Answer: (3)** Synthetic estrogen-progestin suppresses FSH/LH → no ovulation.

**Answer: (3)** Synthetic estrogen-progestin suppresses FSH/LH → no ovulation.

**Q146.** **Ans: (1)** **Answer: (1)** Glucagon raises blood glucose.

**Answer: (1)** Glucagon raises blood glucose.

**Q147.** **Ans: (1)** **Answer: (1)** Both renal concentrating mechanisms.

**Answer: (1)** Both renal concentrating mechanisms.

**Q148.** **Ans: (1)** **Answer: (1)** Pacemaker in right atrial wall.

**Answer: (1)** Pacemaker in right atrial wall.

**Q149.** **Ans: (3)** **Answer: (3)** Rods and cones in retinal layer.

**Answer: (3)** Rods and cones in retinal layer.

**Q150.** **Ans: (1)** **Answer: (1)** Cerebellum coordinates movement.

**Answer: (1)** Cerebellum coordinates movement.

**Q151.** **Ans: (3)** **Answer: (3)** Cross-bridge cycle drives sliding.

**Answer: (3)** Cross-bridge cycle drives sliding.

**Q152.** **Ans: (4)** **Answer: (4)** Filariasis: Wuchereria (nematode), not Plasmodium.

**Answer: (4)** Filariasis: Wuchereria (nematode), not Plasmodium.

**Q153.** **Ans: (3)** **Answer: (3)** Isovolumetric contraction: AV and semilunar valves closed.

**Answer: (3)** Isovolumetric contraction: AV and semilunar valves closed.

**Q154.** **Ans: (1)** **Answer: (1)** Oxytocin causes myoepithelial cell contraction.

**Answer: (1)** Oxytocin causes myoepithelial cell contraction.

**Q155.** **Ans: (1)** **Answer: (1)** Urea partially reabsorbed, not completely.

**Answer: (1)** Urea partially reabsorbed, not completely.

**Q156.** **Ans: (1)** **Answer: (1)**  $\text{HCO}_3^-/\text{H}_2\text{CO}_3$  primary blood buffer.

**Answer: (1)**  $\text{HCO}_3^-/\text{H}_2\text{CO}_3$  primary blood buffer.

**Q157.** **Ans: (3)** **Answer: (3)** Absolute refractory period ensures one-way propagation.

**Answer: (3)** Absolute refractory period ensures one-way propagation.

**Q158. Ans: (1) Answer: (1)** Systemic venous return → pulmonary → systemic arterial.

**Answer: (1)** Systemic venous return → pulmonary → systemic arterial.

**Q159. Ans: (3) Answer: (3)** Diaphragm contraction increases vertical thoracic volume.

**Answer: (3)** Diaphragm contraction increases vertical thoracic volume.

**Q160. Ans: (1) Answer: (1)** ~70% as  $\text{HCO}_3^-$  after carbonic anhydrase.

**Answer: (1)** ~70% as  $\text{HCO}_3^-$  after carbonic anhydrase.

**Q161. Ans: (3) Answer: (3)** Estrogen positive feedback → LH surge → ovulation.

**Answer: (3)** Estrogen positive feedback → LH surge → ovulation.

**Q162. Ans: (1) Answer: (1)** Turner is XO, not XXY.

**Answer: (1)** Turner is XO, not XXY.

**Q163. Ans: (3) Answer: (3)** Glottis in larynx.

**Answer: (3)** Glottis in larynx.

**Q164. Ans: (1) Answer: (1)** Quiet expiration passive; forced uses muscles.

**Answer: (1)** Quiet expiration passive; forced uses muscles.

**Q165. Ans: (3) Answer: (3)** Sliding filament: I and H shorten; A constant.

**Answer: (3)** Sliding filament: I and H shorten; A constant.

**Q166. Ans: (1) Answer: (1)**  $\beta$  cells of islets of Langerhans.

**Answer: (1)**  $\beta$  cells of islets of Langerhans.

**Q167. Ans: (3) Answer: (3)** Agarose pore size separates DNA fragments.

**Answer: (3)** Agarose pore size separates DNA fragments.

**Q168. Ans: (1) Answer: (1)** Sons get Y from father, not X disease allele.

**Answer: (1)** Sons get Y from father, not X disease allele.

**Q169. Ans: (1) Answer: (1)** All standard biotech applications.

**Answer: (1)** All standard biotech applications.

**Q170. Ans: (1) Answer: (1)** Taq polymerase extends primers at 72°C.

**Answer: (1)** Taq polymerase extends primers at 72°C.

**Q171. Ans: (1) Answer: (1)** Both describe saltatory conduction.

**Answer: (1)** Both describe saltatory conduction.

**Q172. Ans: (1) Answer: (1)** Resting potential set mainly by  $\text{K}^+$  leak.

**Answer: (1)** Resting potential set mainly by  $\text{K}^+$  leak.

**Q173. Ans: (3) Answer: (3)** Transcription in nucleus.

**Answer: (3)** Transcription in nucleus.

**Q174. Ans: (1) Answer: (1)** Pulmonary artery carries deoxygenated blood.

**Answer: (1)** Pulmonary artery carries deoxygenated blood.

**Q175. Ans: (3) Answer: (3)** Alpha cells → glucagon.

**Answer: (3)** Alpha cells → glucagon.

**Q176. Ans: (1) Answer: (1)** Monosaccharides absorbed mainly in small intestine.

**Answer: (1)** Monosaccharides absorbed mainly in small intestine.

**Q177. Ans: (1) Answer: (1)** EPO from kidney; ANF from atria; renin JGA; aldosterone adrenal cortex.

**Answer: (1)** EPO from kidney; ANF from atria; renin JGA; aldosterone adrenal cortex.

**Q178. Ans: (1) Answer: (1)** Both reproductive anatomy facts.

**Answer: (1)** Both reproductive anatomy facts.

**Q179. Ans: (1) Answer: (1)** Neuromuscular AP precedes  $\text{Ca}^{2+}$  release.

**Answer: (1)** Neuromuscular AP precedes  $\text{Ca}^{2+}$  release.

**Q180. Ans: (1) Answer: (1)** Standard endocrine mappings.

**Answer: (1)** Standard endocrine mappings.