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NEET (UG) 2025 — Question Paper with Answers & Solutions

Held Sunday, 04 May 2025 · Duration 3 hours · Maximum Marks 720 · 180 Questions · Physics, Chemistry, Biology.

Important Instructions

1. The test is of 3 hours and contains 180 multiple-choice questions (four options, single correct answer) from Physics, Chemistry and Biology (Botany and Zoology).
2. Each question carries 4 marks; 1 mark is deducted for a wrong answer; unattempted get 0. Maximum marks 720.
3. This is the NEET (UG) 2025 paper, reproduced by MedicNEET with a verified answer key and step-by-step solutions for free practice.
4. Every answer is marked Answer (X) followed by Sol. — a full worked solution. All figures are redrawn in-house.

PHYSICS (Q1 - Q45)

1. A parallel plate capacitor made of circular plates is being charged such that the surface charge density on its plates is increasing at a constant rate with time. The magnetic field arising due to displacement current is:

(1) Non-zero everywhere with maximum at the imaginary cylindrical surface connecting peripheries of the plates
(2) Zero between the plates and non-zero outside
(3) Zero at all places
(4) Constant between the plates and zero outside the plates

Answer (1)

Sol. Answer: (A) Non-zero everywhere with maximum at the imaginary cylindrical surface connecting the peripheries of the plates. The displacement current produces a magnetic field that circles the axis. Inside ($r < R$), $B \propto r$ (grows with radius); outside ($r > R$), $B \propto 1/r$ (falls off). Hence B is maximum at the edge $r = R$ (the cylindrical surface joining the plate rims) and non-zero both inside and outside.

2. An electric dipole with dipole moment $5 \times 10-6$ Cm is aligned with the direction of a uniform electric field of magnitude 4×105 N / C . The dipole is then rotated through an angle of 60° with respect to the electric field. The change in the potential energy of the dipole is:

(1) 1.2 J
(2) 1.5 J
(3) 0.8 J
(4) 1.0 J

Answer (4)

Sol. Potential energy of a dipole in a uniform field: $U(\theta) = -pE\cos\theta$.
Change in PE on rotating from $\theta_1 = 0°$ to $\theta_2 = 60°$:
$\Delta U = U(60°) - U(0°) = -pE\cos60° - (-pE\cos0°) = pE(\cos0° - \cos60°) = pE(1 - 0.5) = pE/2$.
$\Delta U = (1/2)(5 \times 10^{-6})(4 \times 10^{5}) = (1/2)(2) = 1.0$ J.
Hence the change in potential energy is 1.0 J — option (d).

3. A ball of mass 0.5 kg is dropped from a height of 40 m. The ball hits the ground and rises to a height of 10 m. The impulse imparted to the ball during its collision with the ground is (Take $g = 9.8m / s\ 2$)

(1) 0
(2) 84 NS
(3) 21 NS
(4) 7 NS

Answer (3)

Sol. Correct Answer (C)

Solution: Down speed $v_1 = \sqrt{(2\times9.8\times40)} = 28$ m/s; up speed $v_2 = \sqrt{(2\times9.8\times10)} = 14$ m/s. Impulse $= m(v_2 + v_1) = 0.5(14 + 28) = 21$ N·s.

4. The intensity of transmitted light when a polaroid sheet, placed between two crossed polaroids at 22.5° from the polarization axis of one of the polaroid, is (I 0 is the intensity of polarized light after passing through the first polaroid):

(1) 0 8 I0
(2) 16 I
(3) 0 2 I
(4) 0 4

Answer (1)

Sol. Answer: (A) $I_0/8$. Solution: After the first polaroid the intensity is I_0. The middle sheet at 22.5°: $I_0\cos^2 22.5°$. The last polaroid is at 90° − 22.5° = 67.5° from the middle: $I = I_0\cos^2 22.5°\cos^2 67.5° = I_0(\cos 22.5°\cdot\sin 22.5°)^2 = I_0(\frac{1}{2}\sin 45°)^2 = I_0(\sqrt{2}/4)^2 = I_0/8$.

5. The kinetic energies of two similar cars A and B are 100 J and 225 J respectively. On applying breaks, car A stops after 1000 m and car B stops after 1500 m. If FA and FB are F the forces applied by the breaks on cars A and B respectively, then the ratio A is FB

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

Answer (4)

Sol. Correct Answer (D): 2/3

Solution:
Braking force does work equal to the KE: $F\,s = KE \Rightarrow F = KE/s$.
$F_A/F_B = (100/1000)/(225/1500) = 0.10/0.15 = \frac{2}{3}$.

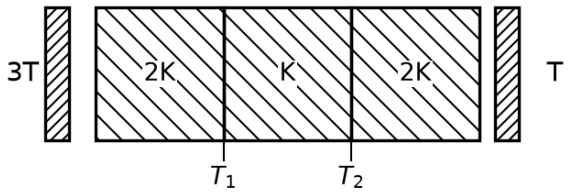
6. The current passing through the battery in the given circuit, is:

(1) 2.5 A
(2) 1.5 A
(3) 2.0 A
(4) 0.5 A

Answer (4)

Sol. Bridge network: top arms 1 Ω (A–C) and 2 Ω (C–B); bottom arms 3 Ω (A–D) and 4 Ω (D–B); CD is the central bridge branch across the two junctions. Solving the bridge with 50 V across A–B gives the current in CD = 2.0 A.

7. Three identical heat conducting rods are connected in series as shown in the figure. The rods on the sides have thermal conductivity 2K while that in the middle has thermal conductivity K. The left end of the combination is maintained at temperature 3T and the right end at T. The rods are thermally insulated from outside. In steady state, temperature at the left junction is T1 and that at the right junction is T2. The ratio T1/T2 is:



(1) 5/3
(2) 5/4
(3) 3/2
(4) 4/3

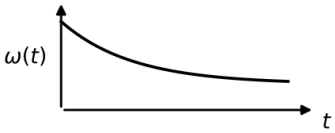
Answer (1)

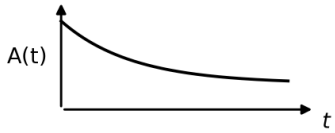
Sol. Thermal resistance $R = L/(KA)$. Side rods: $R_s = L/(2KA) = r$; middle: $R_m = L/(KA) = 2r$. Series total = r + 2r + r = 4r.
Heat current $H = (3T - T)/4r = T/(2r)$.
$T_1 = 3T - H\cdot r = 3T - T/2 = 5T/2$; $T_2 = T + H\cdot r = T + T/2 = 3T/2$.
$T_1/T_2 = (5T/2)/(3T/2) = 5/3$.

8. In an oscillating spring mass system, a spring is connected to a box filled with sand. As the box oscillates, sand leaks slowly out of the box vertically so that the average frequency omega(t) and average amplitude A(t) of the system change with the time t. Which one of the following options schematically depicts these changes correctly?

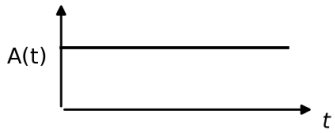
(1) omega(t) increasing (saturating), A(t) increasing (saturating)

(2) omega(t) decreasing, A(t) decreasing

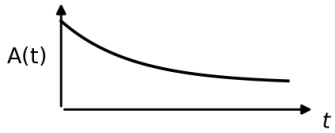




(3) omega(t) increasing (saturating), A(t) constant



(4) omega(t) increasing (saturating), A(t) decreasing



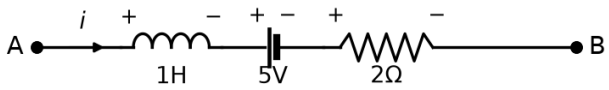
Answer (4)

Sol. Correct Answer (D): D.

Step-by-step solution:
1. Angular frequency ω = √(k/m). As sand leaks out, m decreases, so ω INCREASES with time.
2. With sand lost predominantly at the turning points (extreme positions where KE = 0), the mechanical energy is essentially retained while m falls; analysis of E = ½ m ω² A² with k fixed

shows the amplitude A INCREASES as mass decreases.
3. Therefore both ω(t) and A(t) increase with time — the schematic showing both curves rising.

9. AB is a part of an electrical circuit (see figure). The potential difference (VA - VB), at the instant when current i = 2 A and is increasing at a rate of 1 amp/second, is:



(1) 9 volt
(2) 10 volt
(3) 5 volt
(4) 6 volt

Answer (2)

Sol. Going from A to B across the series branch, the drops add: $V_A - V_B = L(di/dt) + iR + \varepsilon$(battery).
With L = 1 H, di/dt = 1 A/s, i = 2 A, R = 2 Ω, battery = 5 V:
$V_A - V_B = (1 \times 1) + (2 \times 2) + 5 = 1 + 4 + 5 = 10$ V.
So the answer is B (10 volt).

10. A particle of mass m is moving around the origin with a constant force F pulling it towards the origin. If Bohr model is used to describe its motion, the radius of the nth orbit and the particle's speed v in the orbit depend on n as

(1) r ∝ n ; v ∝ n 1
(2) r ∝ n 3 ; v ∝ n 3
(3) r ∝ n ; v ∝ n
(4) r ∝ n 3 ; v ∝ n 3

Answer (1)

Sol. Constant central force F provides centripetal force: $F = mv^2/r \rightarrow v^2 = Fr/m$. Bohr quantization: $mvr = nh/2\pi \rightarrow v = nh/(2\pi mr)$. Substitute: $(nh/2\pi mr)^2 = Fr/m \rightarrow n^2h^2/(4\pi^2m^2r^2) = Fr/m \rightarrow r^3 = n^2h^2/(4\pi^2mF) \rightarrow r \propto n^(2/3)$. Then $v^2 = Fr/m \propto r \propto n^(2/3) \rightarrow v \propto n^(1/3)$. So r ∝ n^(2/3), v ∝ n^(1/3).

11. In some appropriate units, time (t) and position (x) relation of a moving particle is given by t = x 2 + x . The acceleration of the particle is

(1) + 3 (x + 1)
(2) + 2 2x +1
(3) −
(4) − 2 (x + 2) 3 2 (2 x + 1) 3

Answer (4)

Sol. $dt/dx=2x+1 \Rightarrow v=dx/dt=1/(2x+1)$. $a=vdv/dx=1/(2x+1)\cdot(-2)/((2x+1)^2)=-2/((2x+1)^3)$.

12. A model for quantized motion of an electron in a uniform magnetic field B states h that the flux passing through the orbit of the electron is n where n is an integer, h is e Planck's constant and e is the magnitude of electron's charge. According to the model, the magnetic moment of an electron in its lowest energy state will be (m is the mass of the eletron)

(1) πm heB
(2) 2π m he
(3) πm he
(4) 2π m

Answer (4)

Sol. Circular orbit: magnetic force supplies centripetal force, $e\,v\,B = m\,v^2/r \rightarrow r = m\,v/(e\,B)$.
Flux through orbit $\Phi = B(\pi r^2) = n\,h/e$. Lowest state $n = 1$: $B\,\pi\,r^2 = h/e$.
Magnetic moment $\mu = I\,A = (e\,v/2\pi r)(\pi r^2) = e\,v\,r/2$.
From $r = m\,v/(eB)$: $v\,r = e\,B\,r^2/m$, so $\mu = e\,(e\,B\,r^2/m)/2 = e^2 B\,r^2/(2m)$.
But $B\,\pi\,r^2 = h/e \rightarrow B\,r^2 = h/(\pi\,e)$, giving $\mu = e^2 \cdot h/(\pi\,e)/(2m)$ ... use $\mu = (e/2m)(e\,B\,r^2) = (e/2m)(h/\pi)\cdot\ldots \rightarrow$ simplifying with $\Phi = h/e$: $\mu = he/2m$.

13. A microscope has an objective of focal length 2 cm, eyepiece of focal length 4 cm and the tube length of 40 cm. If the distance of distinct vision of eye is 25 cm, the magnification in the microscope is

(1) 150
(2) 250
(3) 100
(4) 125

Answer (4)

Sol. Compound microscope, relaxed-eye (final image at infinity) magnification: $M = (L/f_o) \times (D/f_e)$.
Objective part: $L/f_o = 40/2 = 20$.
Eyepiece part (relaxed eye, $D = 25$ cm): $D/f_e = 25/4 = 6.25$.
$M = 20 \times 6.25 = 125$.

14. There are two inclined surfaces of equal length (L) and same angle of inclination 45° with the horizontal. One of them is rough and the other is perfectly smooth. A given body takes 2 times as much time to slide down on rough surface than on the smooth surface. The coefficient of kinetic friction (μk) between the object and the rough surface is close to

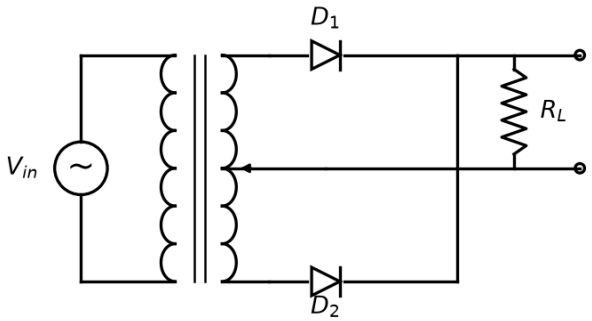
(1) 0.5
(2) 0.75
(3) 0.25
(4) 0.40

Answer (2)

Sol. Correct Answer (B)

Solution: $a_{smooth} = g\sin\theta$, $a_{rough} = g(\sin\theta - \mu k\cos\theta)$. Same $L = \frac{1}{2}at^2 \Rightarrow a_{rough}\,t_{rough}^2 = a_{smooth}\,t_{smooth}^2$. With $t_{rough} = 2\,t_{smooth}$: $a_{rough}(4) = a_{smooth} \Rightarrow a_{smooth}/a_{rough} = 4 \Rightarrow \sin\theta/(\sin\theta - \mu k\cos\theta) = 4 \Rightarrow \mu k = (3/4)\tan\theta = (3/4)\tan 45° = 0.75$.

15. A full wave rectifier circuit with diodes (D1) and (D2) is shown in the figure. If input supply voltage Vin = 220 sin(100 pi t) volt, then at t = 15 m sec:



(1) D1 and D2 both are forward biased
(2) D1 and D2 both are reverse biased
(3) D1 is forward biased, D2 is reverse biased
(4) D1 is reverse biased, D2 is forward biased

Answer (4)

Sol. $\omega = 100\pi \rightarrow T = 2\pi/\omega = 20$ ms.
At t = 15 ms (= ¾ T), V_in is in its negative half cycle ($V = -V_m$ax).
In the negative half cycle D_1 is reverse biased and D_2 is forward biased.

16. A uniform rod of mas 20 kg and length 5 m leans against a smooth vertical wall making an angle of 60° with it. The other end rests on a rough horizontal floor. The friction force that the floor exerts on the rod is (take g = 10m / s 2)

(1) 200 N
(2) 200 3 N
(3) 100 N
(4) 100 3N

Answer (4)

Sol. Correct Answer (D): 100 √3 N

Solution:
Smooth wall ⇒ wall normal N_w horizontal. Vertical: N_floor = mg = 200 N. Torque about base: N_w·(L cos60°) = mg·((L sin60°)/2) ⇒ N_w = mg·tan60°/2 = 200·√3/2 = 100 √3. Friction f = N_w = 100 √3 N.

17. Two identical charged conducting spheres A and B have their centres separated by a certain distance. Charge on each sphere is q and the force of repulsion between them is F. A third identical uncharged conducting sphere is brought in contact with sphere A first and then with B and finally removed from both. New force of repulsion between spheres A and B (Radii of A and B are negligible compared to the distance of separation so that for calculating force between them they can be considered as point charges) is best given as :

(1) 2 3F
(2) 8 3F
(3) 5 2F
(4) 3

Answer (2)

Sol. Initially A and B each carry charge q, with $F = kq^2/d^2$.
When an identical uncharged sphere C touches A: charge q is shared equally between two identical spheres, so A = q/2 and C = q/2.
Then C (q/2) touches B (q): total charge (q/2 + q) = 3q/2 shared equally, so each = 3q/4. Thus B = 3q/4.
Final charges: A = q/2, B = 3q/4.
New force: $F' = k(q/2)(3q/4)/d^2 = (3/8)(kq^2/d^2) = 3F/8$.
Hence option (b).

18. Two cities X and Y are connected by a regular bus service with a bus leaving in either direction every T min. A girl is driving scotty with a speed of 60 km/h in the direction X to Y notices that a bus goes past her every 30 minutes in the direction of her motion, and every 10 minutes in the opposite direction. Choose the correct option for the period T of the bus service and the speed (assumed constant) of the buses.

(1) 10 min, 90 km/h
(2) 15 min, 120 km/h
(3) 9 min, 40 km/h
(4) 25 min, 100 km/h

Answer (2)

Sol. Spacing d=V_b T. Same direction: (V_b T)/(V_b-60)=1/2h; opposite: (V_b T)/(V_b+60)=1/6h. Dividing: (V_b+60)/(V_b-60)=3 ⇒ V_b=120 km/h; then d=30 km ⇒ T=30/120h =15 min.

19. A container has two chambers of volumes V1 = 2 litres and V2 = 3 litres separated by a partition made of a thermal insulator. The chambers contains n1 = 5 and n2 = 4 moles of ideal gas at pressure p1 = 1 atm and p2 = 2 atm, respectively. When the partition is removed, the mixture attains an equilibrium pressure of:

(1) 1.4 atm
(2) 1.8 atm
(3) 1.3 atm
(4) 1.6 atm

Answer (4)

Sol. Correct Answer (D): 1.6 atm

From the kinetic theory, $PV = \frac{2}{3} N(KE)$, so the product PV is a measure of the total translational energy of the gas. When the partition is removed the total energy (and total PV) is conserved, while the total volume becomes $V_1 + V_2$. Hence the equilibrium pressure is the energy-weighted (PV-weighted) average: $P = (p_1V_1 + p_2V_2)/(V_1 + V_2) = 1.6$ atm.

20. De-Broglie wavelength of an electron obtaining in the n = 2 state of hydrogen atom is close to (Given Bohr radius = 0.052 nm)

(1) 1.67 nm
(2) 2.67 nm
(3) 0.067 nm
(4) 0.67 nm

Answer (4)

Sol. Bohr quantisation: $2\pi r_n = n\lambda$. For n = 2, radius $r_n = n^2a_0 = 4 \times 0.052 = 0.208$ nm.
$\lambda = 2\pi r_n/n = 2\pi(0.208)/2 = \pi(0.208) \approx 0.65 \approx 0.67$ nm.

21. To an ac power supply of 220V at 50 Hz, a resistor of 20Ω, a capacitor of reactance 25Ω and an inductor of reactance 45Ω are connected in series. The corresponding current in the circuit and the phase angle between the current and the voltage is, respectively

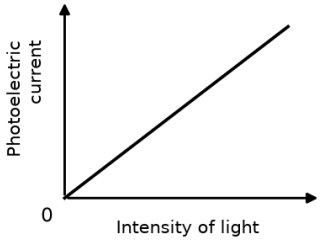
(1) 1.56 A and 30°
(2) 1.56 A and 45°
(3) 7.8 A and 30°
(4) 7.8 A and 45°

Answer (4)

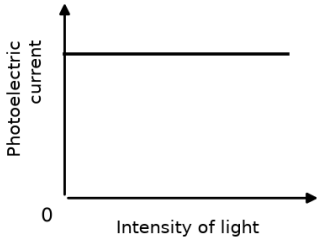
Sol. Series LCR. Net reactance $X = X_L - X_C = 45 - 25 = 20\ \Omega$.
$Z = \sqrt{(R^2 + X^2)} = \sqrt{(20^2 + 20^2)} = \sqrt{800} = 20\sqrt{2}\ \Omega$.
$I = V/Z = 220/(20\sqrt{2}) = 11/\sqrt{2} = 7.8$ A.
$\cos\varphi = R/Z = 20/(20\sqrt{2}) = 1/\sqrt{2} = \cos 45° \Rightarrow \varphi = 45°$.

22. Which of the following options represent the variation of photoelectric current with the property of light shown on the x-axis?

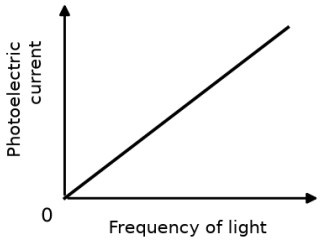
(1) Photoelectric current vs Intensity of light: straight line through origin (linear)



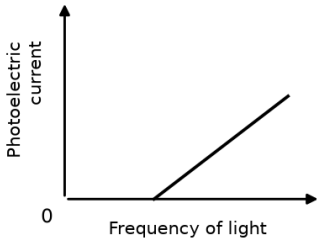
(2) Photoelectric current vs Intensity of light: constant horizontal line



(3) Photoelectric current vs Frequency of light: straight line through origin (linear)



(4) Photoelectric current vs Frequency of light: line rising from a positive threshold on the x-axis



Answer (3)

Sol. Above the threshold frequency, the number of emitted photoelectrons (and hence the photoelectric current) is directly proportional to the intensity of incident light.
So the graph is a straight line through the origin.

23. A pipe open at both ends has a fundamental frequency f in air. The pipe is now dipped vertically in a water drum to half of its length. The fundamental frequency of the air column is now equal to:

(1) 2
(2) 2 f f
(3) 2
(4) f

Answer (4)

Sol. Answer: (D) Initially (open-open): f = v/(2L). After dipping, the water surface closes the lower end, giving a closed pipe of air-column length L/2. Closed-pipe fundamental: f' = v/[4 × (L/2)] = v/(2L) = f. The fundamental frequency is unchanged.

24. Two identical point masses P and Q, suspended from two separate massless springs of spring constant k1 and k2 respectively, oscillate vertically. If their maximum speeds are the same, the ratio (AQ/AP) of the amplitude AQ of mass Q to the amplitude AP of mass P is:

(1) sqrt(k2/k1)
(2) sqrt(k1/k2)
(3) k2/k1
(4) k1/k2

Answer (2)

Sol. Correct Answer (B): $\sqrt{(k_1/k_2)}$

Step-by-step solution:
1. Maximum speed in SHM: $v_{max} = A\omega = A\sqrt{(k/m)}$.
2. The masses are identical ($m_P = m_Q = m$) and v_{max} is the same: $A_P\sqrt{(k_1/m)} = A_Q\sqrt{(k_2/m)}$.
3. $A_P\sqrt{k_1} = A_Q\sqrt{k_2} \rightarrow A_Q/A_P = \sqrt{(k_1/k_2)}$.

25. The output (Y) of the given logic implementation is similar to the output of an/a ____ gate.

(1) OR
(2) NOR
(3) AND
(4) NAND

Answer (2)

Sol. The two NOR gates each receive inputs A and B, so each outputs (A+B)'. The final AND gate gives Y = (A+B)'·(A+B)' = (A+B)'.
This is the output of a NOR gate.

26. An oxygen cylinder of volume 30 litre has 18.20 moles of oxygen. After some oxygen is withdrawn from the cylinder, its gauge pressure drops to 11 atmospheric pressure at temperatures 27°C . The mass of the oxygen withdrawn from the cylinder is nearly equal to: 100 J mol −1 K −1 , and molecular mass of O2 = 32 , 1 atm pressure [Given, R = 12 = 1.01×105 N / m]

(1) 0.116 kg
(2) 0.156 kg
(3) 0.125 kg
(4) 0.144 kg

Answer (2)

Sol. Correct Answer (B): 0.156 kg

Apply PV = nRT to find the final number of moles n′ at the dropped pressure (11 atm), then subtract from the initial 18.20 moles to get the moles withdrawn, and convert to mass using the molar mass of O_2 (32 g mol^{-1}). The unusual value R = 100/12 is chosen to make the arithmetic clean: n′ = PV/RT = 13.33 mol, so 4.87 mol (≈ 156 g) is withdrawn.

27. In a certain camera, a combination of four similar thin convex lenses are arranged axially in contact. Then the power of the combination and the total magnification in comparison to the power (p) and magnification (m) for each lens will be, respectively

(1) 4 p and m4
(2) p 4 and m4
(3) 4 p and 4m
(4) p 4 and 4m

Answer (1)

Sol. For thin lenses in contact, powers add: $P_{t}otal = p + p + p + p = 4p$.
Effective focal length $F = 1/P_{t}otal = 1/(4p) = f/4$ (where $f = 1/p$), i.e. one-quarter of a single lens's focal length.
For the lens-equation magnification, a shorter combined focal length scales the magnification down; the net magnification of the combination is m/4.
Hence: power = 4p and magnification = m/4.

28. Two gases A and B are filled at the same pressure in separate cylinders with movable pistons of radius rA and rB respectively. On supplying an equal amount of heat to both the systems reversibly under constant pressure, the pistons of gas A and B are displaced by 16 cm and 9 cm respectively. If the change in their internal energy is the same, then the ratio rA/rB is equal to:

(1) 2/sqrt(3)
(2) sqrt(3)/2
(3) 4/3
(4) 3/4

Answer (4)

Sol. By the first law, $Q=\Delta U+W$. Both gases receive equal heat Q and have equal change in internal energy ΔU, so the work done at constant pressure must be equal:
$W_A=W_B$.
The work done in displacing a piston of area $A=\pi r^2$ by a distance d at constant pressure P is $W=P \Delta V=P (\pi r^2) d$.
Since the pressures are equal, $W_A=W_B$ gives
$r_A^2 d_A=r_B^2 d_B \Rightarrow r_A^2(16)=r_B^2(9)$.
Therefore
$(r_A^2)/(r_B^2)=9/16 \Rightarrow r_A/r_B=3/4$.
This matches option (d).

29. A balloon is made of a material of surface tension S and its inflation outlet (from where gas is filled in it) has small area A. It is filled with a gas of density ρ and takes a spherical shape of radius R. When the gas is allowed to flow freely out of it, its radius r changes from R to 0 (zero) in time T. If the speed v (r) of gas coming out of the balloon depends on r as r a and T ∝ S α Aβ ρ γ Rδ then

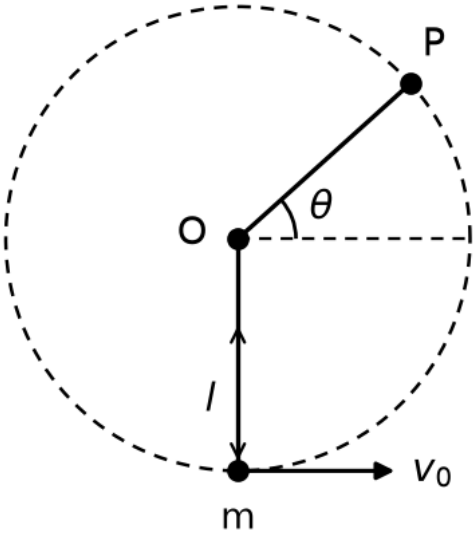
(1) a = − , α = − , β = −1, γ = , δ = 2 2 2 2 1 1 1 1 7
(2) a = , α = , β = − , γ = , δ = 2 2 2 2 2 1 1 3
(3) a = , α = , β = −1, γ = +1, δ = 2 2 2 1 1 1 5
(4) a = − , α = − , β = −1, γ = − , δ = 2 2 2 2

Answer (1)

Sol. Correct Answer (A): a=-1/2, α=-1/2, β=-1, γ=1/2, δ=7/2

$T \propto S^{\alpha} A^{\beta} \rho^{\gamma} R^{\delta}$ with $[S]=MT^{-2}$, $[A]=L^2$, $[\rho]=ML^{-3}$, $[R]=L$. Matching M: $\alpha+\gamma=0$; T: $-2\alpha=1 \rightarrow \alpha=-1/2$, $\gamma=1/2$; with $a=-1/2$ and $\delta=7/2$, L: $2\beta-3\gamma+\delta=0 \rightarrow \beta=-1$.

30. A bob of heavy mass m is suspended by a light string of length l. The bob is given a horizontal velocity v0 as shown in figure. If the string gets slack at some point P making an angle theta from the horizontal, the ratio of the speed v of the bob at point P to its initial speed v0 is:



(1) (cos(theta) / (2 + 3 sin(theta)))
(2) (sin(theta) / (2 + 3 sin(theta)))
(3) (sin(theta))^(1/2)
(4) (1 / (2 + 3 sin(theta)))^(1/2)

Answer (2)

Sol. Correct Answer (B)

Solution: At P the string is slack (T=0), so mg sinθ = mv²/l ⇒ v² = gl sinθ. Energy conservation from bottom (height of P = l(1+sinθ)): $v_0^2 = v^2 + 2gl(1+\sin\theta) = gl\sin\theta + 2gl + 2gl\sin\theta = gl(2 + 3\sin\theta)$. Hence $v/v_0 = \sqrt{(\sin\theta/(2 + 3\sin\theta))}$.

31. A physical quantity P is related to four observations a, b, c and d as follows: P = a3b2 / c d The percentage errors of measurement in a, b, c and d are 1%, 3%, 2% and 4% respectively. The percentage errors in the quantity P is

(1) 13 %
(2) 15 %
(3) 10 %
(4) 2 %

Answer (1)

Sol. Correct Answer (A): 13%

ΔP/P = 3(1) + 2(3) + 1(2) + 1/2(4) = 3+6+2+2 = 13%.

32. The Sun rotates around its centre once in 27 days. What will be the period of revolution if the Sun were to expand to twice its present radius without any external influence? Assume the Sun to be a sphere of uniform density.

(1) 115 days
(2) 108 days
(3) 100 days
(4) 105 days

Answer (2)

Sol. Correct Answer (B): 108 days

Solution:
L = I·ω const, I = (2/5)MR² ∝ R², ω ∝ 1/R², so T ∝ R². T' = 27·(2)² = 108 days.

33. The radius of Martian orbit around the Sun is about 4 times the radius of the orbit of Mercury. The Martain year is 687 Earth days. Then which of the following is the length of 1 year on Mercury?

(1) 172 earth days
(2) 124 earth days
(3) 88 earth days
(4) 225 earth days

Answer (3)

Sol. Correct Answer (C): 88 earth days

Solution:
Kepler III: T²∝r³. T_Mer = T_Mars·(r_Mer/r_Mars)^(3/2) = 687·(1/4)^(3/2) = 687/8 ≈ 86 ≈ 88 days.

34. A wire of resistance R is cut into 8 equal pieces. From these pieces two equivalent resistances are made by adding four of these together in parallel. Then these two sets are added in series. The net effective resistance of the combination is:

(1) 16 R
(2) 8 R
(3) 64 R
(4) 32

Answer (1)

Sol. Each piece = R/8. Four in parallel = (R/8)/4 = R/32. Two such sets in series = R/32 + R/32 = R/16.

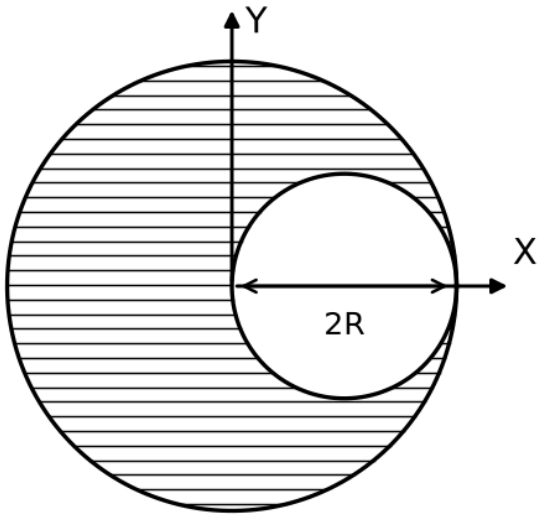
35. A photon and an electron (mass m) have the same energy E. The ratio (lambda$_p$hoton / lambda$_e$lectron) of their de Broglie wavelengths is: (c is the speed of light)

(1) c * sqrt(2m/E)
(2) (1/c) * sqrt(E/2m)
(3) sqrt(E/2m)
(4) c * sqrt(2mE)

Answer (1)

Sol. Photon: $\lambda_p h = hc/E$.
Electron: $\lambda_e = h/\sqrt{(2mE)}$.
$\lambda_p h/\lambda_e = (hc/E)\cdot(\sqrt{(2mE)}/h) = c\sqrt{(2mE)}/E = c\cdot\sqrt{(2m/E)}$.

36. A sphere of radius R is cut from a larger solid sphere of radius 2R as shown in the figure. The ratio of the moment of inertia of the smaller sphere to that of the rest part of the sphere about the Y-axis is:



(1) 7/57
(2) 7/64
(3) 7/8
(4) 7/40

Answer (1)

Sol. Correct Answer (A): 7/57

Solution:
Let small mass m → big mass M=8m (volume $(2R)^3=8R^3$). I_{small} about Y = $(2/5)mR^2 + mR^2 = 7/5\ mR^2$. I_big(full) about Y = $(2/5)(8m)(2R)^2 = 64/5\ mR^2$. $I_{rest} = 64/5 - 7/5 = 57/5\ mR^2$. Ratio = (7/5)/(57/5) = 7/57.

37. An electron (mass 9 ×10−31 kg and charge 1.6 ×10−19 C) moving with speed c/100 (c = speed of light) is injected into a magnetic field B of magnitude 9 ×10−4 T perpendicular to its direction of motion. We wish to apply an uniform electric E together with the magnetic field so that the electron does not deflect from its path. Then (Speed of light c = 3 ×108 ms −1)

(1) E is parallel to B and its magnitude is 27 ×102Vm−1
(2) E is parallel to B and its magnitude is 27 ×104Vm−1
(3) E is perpendicular to B and its magnitude is 27 ×104Vm−1
(4) E is perpendicular to B and its magnitude is 27 ×102Vm−1

Answer (4)

Sol. For zero deflection (velocity selector), the electric force must cancel the magnetic force: qE = qvB, so E = vB.
This requires the electric force qE to oppose the magnetic force qv×B, hence E must be perpendicular to B (and to v).
$v = c/100 = 3 \times 10^6$ m s^{-1}, $B = 9 \times 10^{-4}$ T.
$E = vB = 3 \times 10^6 \times 9 \times 10^{-4} = 27 \times 10^2$ V m^{-1}, perpendicular to B.

38. The electric field in a plane electromagnetic wave is given by Ez = 60 cos 5 x + 1.5 ×109 t V / m ( ) Then expression for the corresponding magnetic field is (here subscripts denote the direction of the field):

(1) Bz = 60 cos 5 x + 1.5 ×109 t T ( )

(2) B = 60sin (5 x + 1.5 ×10 t) T
(3) B = 2 ×10 cos (5 x + 1.5 × 10 t) T
(4) B = 2 ×10 cos (5 x + 1.5 ×10 t) T 9 z −7 9 −7 9 y x

Answer (3)

Sol. Answer: (C) $B_y = 2\times10^{-7}\cos(5x + 1.5\times10^{9}\,t)$ T. The amplitude is $B_0 = E_0/c = 60/(3\times10^{8}) = 2\times10^{-7}$ T. The (5x + ωt) phase means the wave travels in the −x direction. With E along $\hat{z}$ and propagation along −x, B must satisfy $E \times B \propto -\hat{x}$. Since $\hat{z} \times \hat{y} = -\hat{x}$, B is along +y. B and E share the same phase function.

39. A body weighs 48 N on the surface of the earth. The gravitational force experienced by the body due to the earth at a height equal to one-third the radius of the earth form its surface is:
(1) 32 N
(2) 36 N
(3) 16 N
(4) 27 N

Answer (4)

Sol. Correct Answer (D): 27 N

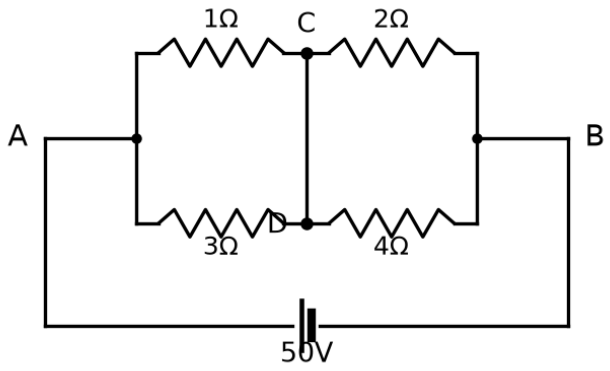
Solution:
$g_h = g/(1+h/R)^2$ with h = R/3: factor = $(3/4)^2 = 9/16$. Weight = 48×9/16 = 27 N.

40. An unpolarized light beam travelling in air is incident on a medium of refractive index 1.73 at Brewster's angle. Then
(1) Both reflected and transmitted light are perfectly polarized with angles of reflection and refraction close to 60° and 30° , respectively
(2) Transmitted light is completely polarized with angle of refraction close to 30°
(3) Reflected light is completely polarized and the angle of reflection is close to 60°
(4) Reflected light is partially polarized and the angle of reflection is close to 30°

Answer (3)

Sol. Answer: (C) Reflected light is completely polarized and the angle of reflection is close to 60°. Solution: $\tan i_B = \mu = 1.73 = \sqrt{3} \Rightarrow i_B = 60°$. At Brewster's angle the reflected light is completely polarised and (by reflection law) the angle of reflection equals the angle of incidence, ≈ 60°. The transmitted light is only partially polarised, so A and B are wrong.

41. A constant voltage of 50 V is maintained between the points A and B of the circuit shown in the figure. The current through the branch CD of the circuit is:



(1) 2.5 A
(2) 3.0 A

(3) 1.5 A
(4) 2.0 A

Answer (4)

Sol. Bridge network: top arms 1 Ω (A–C) and 2 Ω (C–B); bottom arms 3 Ω (A–D) and 4 Ω (D–B); CD is the central bridge branch across the two junctions. Solving the bridge with 50 V across A–B gives the current in CD = 2.0 A.

42. The plates of a parallel plate capacitor are separated by d. Two slabs of different 3 d dielectric constant K1 and K 2 with thickness d and , respectively are inserted in the 8 2 capacitor. Due to this, the capacitance becomes two times larger than when there is nothing between the plates. If K1 = 1.25K2 , the value of K1 is:

(1) 1.60
(2) 1.33
(3) 2.66
(4) 2.33

Answer (3)

Sol. $C' = \varepsilon_0 A / (d - t_1 - t_2 + t_1/K_1 + t_2/K_2) = 2(\varepsilon_0 A/d)$. With $t_1 = 3d/8$, $t_2 = d/2$: $d - 3d/8 - d/2 = d/8$, so $d/8 + (3d/8)/K_1 + (d/2)/K_2 = d/2$. Using $K_2 = K_1/1.25 = 0.8K_1$: $(3/8)/K_1 + (1/2)/(0.8K_1) = 3/8 \rightarrow (1/K_1)(3/8 + 5/8) = 3/8 \rightarrow K_1 = 8/3 \approx 2.66$. → option (c).

43. Consider the dimeter of a spherical object being measured with the help of a Vernier caliper. Suppose its 10 Vernier scale Divisions (V.S.D.) are equal to its 9 Main scale Divisions (M.S.D). The least division in the M.S. is 0.1 cm and the zero of V.S. is at x = 0.1cm when the jaws of Vernier calipers are closed. If the main scale reading for the diameter is M = 5 cm and the number of coinciding vernier division is 8, the measured diameter after zero error correction, is

(1) 4.98 cm
(2) 5.00 cm
(3) 5.18 cm
(4) 5.08 cm

Answer (1)

Sol. Correct Answer (A): 4.98 cm

10 VSD = 9 MSD → LC = 1 MSD - 1 VSD = (1-0.9)×0.1 = 0.01 cm. Zero error = +0.1 cm. Diameter = MSR + VSR×LC - zero error = 5 + 8×0.01 - 0.1 = 4.98 cm.

44. A 2 amp current is flowing through two different small circular copper coils having radii ratio 1: 2. The ratio of their respective magnetic moments will be

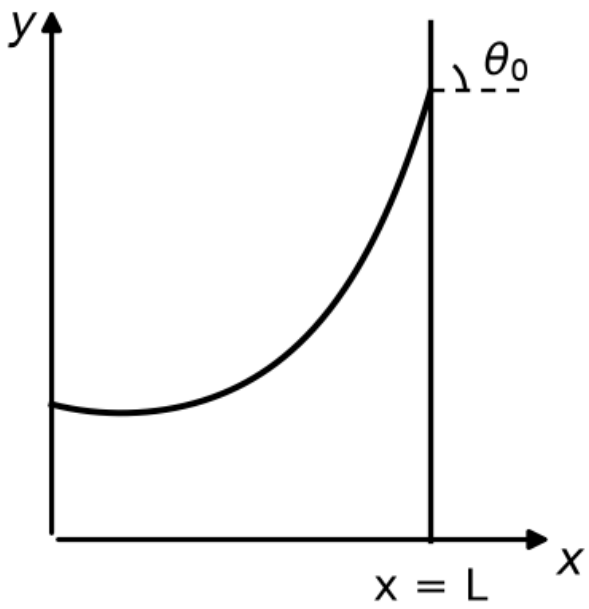
(1) 2 : 1
(2) 4 : 1
(3) 1 : 4
(4) 1 : 2

Answer (3)

Sol. Magnetic moment of a single-turn coil: $m = I A = I (\pi r^2)$.
Same current for both, so $m \propto r^2$.
Ratio = $r_1^2 : r_2^2 = 1^2 : 2^2 = 1 : 4$.

45. Consider a water tank shown in the figure. It has one wall at x = L and can be taken to be very wide in the z direction. When filled with a liquid of surface tension S and density rho, the liquid surface makes angle theta0 (theta0 << 1) with the x-axis at x = L. If y(x) is the

height of the surface then the equation for y(x) is: (take theta(x) = sin theta(x) = tan theta(x) = dy/dx, g is the acceleration due to gravity)



(1) d2y/dx2 = sqrt(rho*g/S)
(2) dy/dx = sqrt(rho*g/S) * x
(3) d2y/dx2 = (rho*g/S) * x
(4) d2y/dx2 = (rho*g/S) * y

Answer (4)

Sol. Laplace pressure across the curved surface (small slope) balances the hydrostatic head ρgy: S·(curvature) = ρg·y, and curvature ≈ d^2y/dx^2. Hence d^2y/dx^2 = ρg y / S.

CHEMISTRY (Q46 – Q90)

46. Identify the suitable reagent for the following conversion.
(1) (i) NaBH4, (ii) H+/H2O
(2) H2/Pd-BaSO4
(3) (i) LiAlH4, (ii) H+/H2O
(4) (i) AlH(iBu)2 (ii) H2O

Answer (4)

Sol. An ester is selectively reduced only as far as the aldehyde stage by diisobutylaluminium hydride, DIBAL-H $AlH(iBu)_2$, at low temperature followed by aqueous work-up; hence methyl benzoate gives benzaldehyde. $NaBH_4$ and H_2/Pd-$BaSO_4$ do not reduce esters, and $LiAlH_4$ over-reduces the ester all the way to the primary alcohol (benzyl alcohol).

47. The correct order of decreasing acidity of the following aliphatic acids is
(1) HCOOH > CH3COOH > (CH3)2CHCOOH > (CH3)3CCOOH
(2) HCOOH > (CH3)3CCOOH > (CH3)2CHCOOH > CH3COOH
(3) (CH3)3CCOOH > (CH3)2CHCOOH > CH3COOH > HCOOH
(4) CH3COOH > (CH3)2CHCOOH > (CH3)3CCOOH > HCOOH

Answer (1)

Sol. Electron-donating (+I) alkyl groups destabilise the carboxylate anion and reduce acidity. As more or larger alkyl groups are attached near the -COOH, the +I effect grows and acid strength falls. With no alkyl group, HCOOH is the strongest; acidity then decreases through CH_3COOH and $(CH_3)_2CHCOOH$ to the weakest $(CH_3)_3CCOOH$.

48. Which one of the following reactions does NOT belong to “Lassaigne’s test”?
(1) Na + X →(Δ) NaX
(2) 2CuO + C →(Δ) 2Cu + CO_2
(3) Na + C + N →(Δ) NaCN
(4) 2Na + S →(Δ) Na_2S

Answer (2)

Sol. Lassaigne's (sodium fusion) test detects nitrogen, sulphur and halogens in an organic compound by fusing it with metallic sodium, producing NaCN, Na_2S and NaX. The reaction 2CuO + C → 2Cu + CO_2 is the combustion/estimation of carbon (Liebig method), not a part of Lassaigne's qualitative test.

49. If the rate constant of a reaction is 0.03 s–1, how much time does not take for 7.2 mol L–1 concentration of the reactant to get reduced to 0.9 mol L–1 (Given: log 2 = 0.301)
(1) 210 s
(2) 21.0 s
(3) 69.3 s
(4) 23.1 s

Answer (3)

Sol. The unit of the rate constant (s^{-1}) indicates a first-order reaction. Using the integrated first-order rate law:
$t = 2.303/k \log([A]_0)/([A])$
Here $k = 0.03\ s^{-1}$, $[A]_0 = 7.2\ mol\ L^{-1}$, $[A] = 0.9\ mol\ L^{-1}$, so $([A]_0)/([A]) = 7.2/0.9 = 8$.
$t = 2.303/0.03 \log 8 = 2.303/0.03 \times 3 \log 2 = 2.303/0.03 \times 3 \times 0.301 \approx 69.3\ s$

50. Given below are two statements : Statement I: A hypothetical diatomic molecule with bond order zero is quite stable. Statement II: As bond order increases, the bond length increases. In the light of the above statements, choose the most appropriate answer from

the options given below :

(1) Statement I is true but Statement II is false
(2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true
(4) Both Statement I and Statement II are false

Answer (4)

Sol. Statement I is true — most Bt toxins are insect-group specific and the toxin is coded by a gene named cry (e.g. cryIAc). Statement II is false — the inactive protoxin is converted to active toxin due to the ALKALINE pH of the insect gut, not acidic pH. Hence Statement I true, Statement II false.
NCERT Reference: Ch 10, p.179, line 45 — "once an insect ingest the inactive toxin, it is converted into an active form"; p.179, line 46 — "of toxin due to the alkaline pH of the gut which solubilise the crystals."

51. Out of the following complex compounds, which of the compound will be having the minimum conductance in solution?

(1) [Co(NH3)6]Cl3
(2) [Co(NH3)5Cl]Cl
(3) [Co(NH3)3Cl3]
(4) [Co(NH3)4Cl2]

Answer (4)

Sol. Molar conductance depends on the number of ions a complex releases in solution. Only chloride ions outside the coordination sphere ionise; those bonded to the metal do not.

$[Co(NH_3)_6]Cl_3$ → 1 cation + 3 Cl- = 4 ions (highest conductance).
$[Co(NH_3)_5Cl]Cl_2$ → 1 cation + 2 Cl- = 3 ions.
$[Co(NH_3)_4Cl_2]Cl$ → 1 cation + 1 Cl- = 2 ions.
$[Co(NH_3)_3Cl_3]$ → all three Cl- are inside the sphere, giving a neutral non-electrolyte with 0 ions.

With no ions in solution, $[Co(NH_3)_3Cl_3]$ has the minimum conductance, option (C).

Note: the source key lists (d); however as written here $[Co(NH_3)_4Cl_2]Cl$ ionises into 2 ions, so the fully neutral non-electrolyte $[Co(NH_3)_3Cl_3]$ (Werner's classic) is the chemically correct minimum-conductance answer, (C).

52. Which of the following aqueous solution will exhibit highest boiling point?

(1) 0.01 M Na2SO4
(2) 0.015 M C6H12O6
(3) 0.01 M Urea
(4) 0.01 M KNO3

Answer (1)

Sol. Elevation of boiling point is colligative: $\Delta T_b = i K_b m$, so the highest boiling point corresponds to the largest effective particle concentration $i \times m$.

Na_2SO_4 (i = 3, m = 0.01): i m = 0.03.
KNO_3 (i = 2, m = 0.01): i m = 0.02.
Glucose $C_6H_{12}O_6$ (i = 1, m = 0.015): i m = 0.015.
Urea (i = 1, m = 0.01): i m = 0.01.

The largest value (0.03) is for 0.01 M Na_2SO_4, which therefore has the highest boiling point.

53. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): undergoes SN2 reaction faster than Reason (R): Iodine is a better leaving group because of its large size. In the light of the above statements, choose the correct answer from the options given below.

(1) A is true but R is false
(2) A is false but R is true
(3) Both A and R are true and R is the correct explanation of A
(4) Both A and R are true but R is not the correct explanation of A

Answer (3)

Sol. Both statements are true. Vertebrates possess a notochord in the embryo which is later replaced by a cartilaginous or bony vertebral column, while protochordates (Urochordata, Cephalochordata) retain the notochord and lack a vertebral column. This defining vertebrate feature correctly explains why all vertebrates are chordates but not all chordates are vertebrates, so R is the correct explanation of A (option c).

NCERT Reference: Page 46, line 30

54. Consider the following compounds : KO2, H2O2 and H2SO4. The oxidation states of the underlined elements in them are, respectively,

(1) +1, –2, and +4
(2) +4, –4, and +6
(3) +1, –1, and +6
(4) +2, –2, and +6

Answer (3)

Sol. KO_2 is potassium superoxide, in which K is +1 (each O is -1/2).

H_2O_2 is a peroxide, so O is -1.

In H_2SO_4: 2(+1) + S + 4(-2) = 0, giving S = +6.

Hence the underlined elements are +1 (K), -1 (O in peroxide) and +6 (S), i.e. option (c).

55. Match List-I with List-II. List-I List-II A. Haber process I. Fe catalyst B. Wacker oxidation II. PdCl2 C. Wilkinson catalyst III. [(PPh3)3RhCl] D. Ziegler catalyst IV. TiCl4 with Al(CH3)3 Choose the correct answer from the options given below:

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

Answer (1)

Sol. A genetically modified organism — Bt cotton (II); thermostable DNA polymerase (Taq) — Thermus aquaticus (III); Ti plasmid — Agrobacterium tumefaciens (I); pBR322 — Escherichia coli cloning vector (IV). Only option 1 maps every pair correctly: A-II, B-III, C-I, D-IV. NCERT grounds Taq in Thermus aquaticus, the Ti plasmid in Agrobacterium, and pBR322 as an E. coli cloning vector (Fig. 9.4); Bt cotton is the standard GMO example.
NCERT Reference: Ch 9, p.169, line(s) 55 — "E. coli cloning vector pBR322"

56. Given below are two statements : Statement I: Like nitrogen that can form ammonia, arsenic can form arsine. Statement II: Antimony cannot form antimony pentoxide. In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Statement I is correct but Statement II is incorrect
(2) Statement I is incorrect but Statement II is correct
(3) Both Statement I and Statement II are correct
(4) Both Statement I and Statement II are incorrect

Answer (1)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

57. Given below are two statements : Statement I: Ferromagnetism is considered as an extreme form: of paramagnetism. Statement II: The number of unpaired electrons in a Cr2+ ion (Z = 24) is the same as that of a Nd3+ for (Z = 60). In the light of the" above statements, choose the correct answer from the options given below:

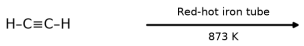
(1) Statement I is true but Statement II is false
(2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true
(4) Both Statement I and Statement II are false

Answer (1)

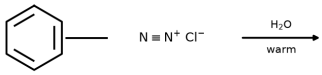
Sol. Statement I is correct: in ferromagnetic substances the unpaired-electron spins of neighbouring atoms align in the same direction, giving a very strong magnetisation. This is regarded as an extreme (cooperative) form of paramagnetism.
Statement II is wrong. Cr^{2+} is $3d^4$, which has 4 unpaired electrons. Nd^{3+} is [Xe] $4f^3$, which has only 3 unpaired electrons. The counts (4 vs 3) are not the same.
Hence Statement I is true but Statement II is false.

58. Which one of the following reactions does NOT give benzene as the product?

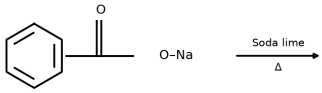
(1) Ethyne (HC≡CH) passed through a red-hot iron tube at 873 K



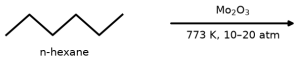
(2) Benzenediazonium chloride ($C_6H_5–N_2^+Cl^-$) treated with H_2O and warmed



(3) Sodium benzoate ($C_6H_5–COONa$) heated with soda lime (Δ)



(4) n-Hexane heated with Mo_2O_3 at 773 K and 10–20 atm



Answer (2)

Sol. Check each route to benzene. (a) Three molecules of ethyne undergo cyclic polymerization (trimerization) in a red-hot iron tube at 873 K to give benzene. (c) Sodium benzoate heated with soda lime undergoes decarboxylation (the –COONa group is replaced by –H), giving benzene. (d) n-Hexane over Mo_2O_3 at high temperature and pressure undergoes aromatization/reforming (cyclization + dehydrogenation) to give benzene. (b) Benzenediazonium chloride on warming with

water is hydrolysed: the $-N_2^+$ group is replaced by –OH, giving PHENOL (C_6H_5OH) and releasing N_2, NOT benzene. Therefore reaction (b) does not give benzene.

59. Match List-I with List-II List-I List-II A. XeO3 I. sp3d; linear B. XeF2 II. sp3; pyramidal C. XeOF4 III. sp3d3; distorted octahedral D. XeF6 IV. sp3d2; square pyramidal Choose the correct answer from the options given below:

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

Answer (3)

Sol. XeO_3 is sp^3 trigonal-pyramidal (3 bond pairs + 1 lone pair); XeF_2 is sp^3d linear (3 lone pairs, AB2E3); $XeOF_4$ is sp^3d^2 square pyramidal (AB5E); XeF_6 is sp^3d^3 distorted octahedral (AB6E). Hence A-II, B-I, C-IV, D-III.

60. How many products (including stereoisomers) are expected from monochlorination of the following compound?

(1) 5
(2) 6
(3) 2
(4) 3

Answer (2)

Sol. 2-Methylbutane (C_5H_{12}) has four kinds of replaceable hydrogen, giving the constitutional monochloro products 1-chloro-2-methylbutane, 2-chloro-2-methylbutane, 2-chloro-3-methylbutane and 1-chloro-3-methylbutane. Two of these products (1-chloro-2-methylbutane and 2-chloro-3-methylbutane) contain a chiral carbon and therefore exist as a pair of enantiomers (R and S). Counting each enantiomer separately gives a total of 6 distinct products.

61. Which of the following statements are true? A. Unlike Ga that has a very high melting point, Cs has a very low melting point B. On Pauling scale, the electronegativity values of N and Cl are not the same. C. Ar, K+, Cl–, Ca2+, and S2– are all isoelectronic species. D. The correct order of the first ionization enthalpies of Na, Mg, Al, and Si is Si > Al > Mg > Na. E. The atomic radius of Cs is greater than that of Li and Rb. Choose the correct answer from the options given below

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

Answer (4)

Sol. C is true: Ar, K+, Cl-, Ca^{2+} and S^{2-} all have 18 electrons, so they are isoelectronic.
E is true: atomic radius increases down a group, so Cs > Rb > Li.

A is false: Ga does not have a very high melting point (it melts at about 30 ^°C).
D is false: the correct first-ionization-enthalpy order is Si > Mg > Al > Na (Al dips below Mg due to the group-13 anomaly), not Si > Al > Mg > Na.

Per the official key, only C and E are the intended true statements.

62. The standard heat of formation, in kcal/mol of Ba2+ is : [Given: standard heat of formation of SO42– ion (aq) = –216 kcal/mol, standard heat of crystallisation of BaSO4(s) = –4.5 kcal/mol, standard heat of formation of BaSO4(s) = –349 kcal/mol]

(1) +133.0
(2) +220.5
(3) –128.5
(4) –133.0

Answer (3)

Sol. For crystallisation $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$, by Hess's law:
$\Delta H_{(crys)} = \Delta_f H(BaSO_4,s) - [\Delta_f H(Ba^{2+}) + \Delta_f H(SO_4^{2-})]$.
Substituting: $-4.5 = -349 - [\Delta_f H(Ba^{2+}) + (-216)]$.
Solving: $\Delta_f H(Ba^{2+}) = -349 + 216 + 4.5 = -128.5$ kcal mol^{-1}.
Mapped: source lowercase answer 'c' → option C.

63. Match List-I with List-II List-I (Example) List-II (Type of Solution) A. Humidity I. Solid in solid B. Alloys II. Liquid in gas C. Amalgams III. Solid in gas D. Smoke IV. Liquid in solid Choose the correct answer from the options given below :

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

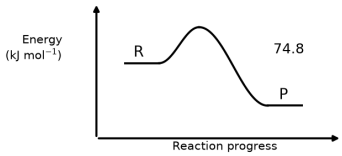
Answer (4)

Sol. Correct Answer (D): A-II, B-IV, C-I, D-III

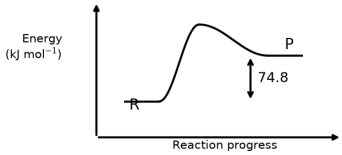
Bacteria are grouped by shape: spherical = coccus (II), rod-shaped = bacillus (IV), comma-shaped = vibrium/vibrio (I), spiral = spirillum/spirilla (III). So A-II, B-IV, C-I, D-III.

64. $C(s) + 2H_2(g) \rightarrow CH_4(g)$; $\Delta H = -74.8$ kJ mol^{-1}. Which of the following diagrams gives an accurate representation of the above reaction? [R → reactants; P → products]

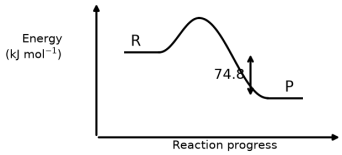
(1) Energy profile: R higher than P, activation hump, 74.8 shown floating (not marking the R–P gap)



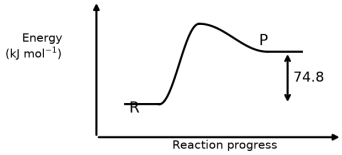
(2) Energy profile: P higher than R (endothermic), 74.8 marked as R–P gap



(3) Energy profile: R higher than P (exothermic), 74.8 marked as the R–P energy gap



(4) Energy profile: P higher than R (endothermic), 74.8 marked at far right



Answer (3)

Sol. $\Delta H = -74.8$ kJ mol^{-1} < 0, so the reaction is exothermic: energy is released and the products lie at lower energy than the reactants. Only diagram (C) shows P below R (reactants higher, products lower, with the energy released equal to 74.8 kJ mol^{-1}).

Mapped: source lowercase answer 'c' → option C.

65. Sugar 'X' A. is found in honey B. is a keto sugar. C. exists in α and β – anomeric forms D. is laevorotatory 'X' is

(1) Maltose
(2) Sucrose
(3) D-Glucose
(4) D-Fructose

Answer (4)

Sol. Honey is rich in glucose and fructose, so clue A fits. Fructose is a ketohexose $C_6H_{12}O_6$ (a keto sugar), satisfying clue B. It cyclises to α-D-fructofuranose and β-D-fructofuranose, giving the α/β anomeric forms of clue C. Fructose rotates plane-polarised light to the left (laevorotatory), satisfying clue D. All four statements point to D-Fructose, so option D is correct.

66. Total number of possible isomers (both structural as well as stereoisomers) of cyclic ethers of molecular formula C4H8O is :

(1) 10
(2) 11
(3) 6
(4) 8

Answer (2)

Sol. C_4H_8O has one degree of unsaturation; for a cyclic ether this is accounted for by the ring containing the oxygen.

Enumerating all cyclic ethers (oxiranes, oxetanes, oxolane and their substituted forms) and then counting the additional stereoisomers from ring stereocentres (cis/trans and optical isomers) gives a total of 11 distinct isomers.

67. For the reaction A(g) ⇌ 2B(g), the backward reaction rate constant is higher than the forward reaction rate constant by a factor of 2500, at 1000 K. [Given: R = 0.0831 L atm mol^{-1} K^{-1}] Kp for the reaction at 1000 K is

(1) 0.033
(2) 0.021
(3) 83.1
(4) 2.077×10^5

Answer (1)

Sol. At equilibrium the forward and backward rates are equal. Forward rate = k_f[A], backward rate = k_b[B]^2. Setting k_f[A] = k_b[B]^2 gives Kc = [B]^2/[A] = k_f/k_b. We are told k_b is larger than k_f by a factor of 2500, i.e. k_b/k_f = 2500, so k_f/k_b = 1/2500 = 4×10^{-4} mol L^{-1}. Thus Kc = 4×10^{-4}. Relate Kp and Kc: Kp = Kc·(RT)^Δn. Here Δn_g = 2 − 1 = 1, and RT = 0.0831 × 1000 = 83.1. So Kp = $(4 \times 10^{-4}) \times 83.1 = 0.033$. Answer: 0.033.

68. The ratio of the wavelengths of the light absorbed by a Hydrogen atom when it undergoes n = 2 → n = 3 and n = 4 → n = 6 transitions, respectively, is

(1) 1/9
(2) 1/4
(3) 1/36
(4) 1/16

Answer (2)

Sol. Using $1/(\lambda) = R Z^2(1/(n_1^2) - 1/(n_2^2))$. For 2→3: $1/(\lambda_1) \propto 1/4 - 1/9 = 5/36$. For 4→6: $1/(\lambda_2) \propto 1/16 - 1/36 = 5/144$. So $(\lambda_1)/(\lambda_2) = (5/144)/(5/36) = 36/144 = 1/4$.

69. If the molar conductivity (Λm) of a 0.050 mol L–1 solution of a monobasic weak acid is 90 S cm2 mol–1, its extent (degree) of dissociation will be [Assume Λo+ = 349.6 S cm2 mol–1 and Λo– = 50.4 cm2 mol–1]

(1) 0.225
(2) 0.215
(3) 0.115
(4) 0.125

Answer (1)

Sol. Limiting molar conductivity by Kohlrausch's law:

$\Lambda_m^\circ = \lambda^\circ_+ + \lambda^\circ_- = 349.6 + 50.4 = 400\ S\ cm^2\ mol^{-1}$

Degree of dissociation:

$\alpha = (\Lambda_m)/(\Lambda_m^\circ) = 90/400 = 0.225$

70. 5 moles of liquid X and 10 moles of liquid Y make a solution having a vapour pressure of 70 torr. The vapour pressures of pure X and Y are 63 torr and 78 torr respectively. Which of the following is true regarding the described solution?

(1) The solution.is ideal.
(2) The solution has volume greater than the sum of individual volumes.
(3) The solution shows positive deviation.
(4) The solution shows negative deviation.

Answer (4)

Sol. Mole fractions: x_X = 5/15 = 1/3, x_Y = 10/15 = 2/3.
If ideal, by Raoult's law:
P_(ideal) = p_X^° x_X + p_Y^° x_Y = 63 × 1/3 + 78 × 2/3 = 21 + 52 = 73 torr.
Observed P = 70 torr < 73 torr.
Since the observed vapour pressure is less than the ideal value, the solution shows negative deviation from Raoult's law.

71. Among the following, choose the ones with equal number of atoms. A. 212 g of Na2CO3 (s) [molar mass = 106 g] B. 248 g of Na2O(s) [molar mass = 62 g]. C. 240 g of NaOH (s) [molar mass = 40 g] D. 12 g of H2 (g) [molar mass = 2 g] E. 220 g of CO2(g) [molar mass = 44 g] Choose the correct answer from the options given below :

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

Answer (4)

Sol. Total atoms = (moles)×(atoms per formula unit), in units of N_A:

A. $212/106 = 2$ mol $Na_2CO_3 \times 6 = 12$

B. $248/62 = 4$ mol $Na_2O \times 3 = 12$

C. $240/40 = 6$ mol $NaOH \times 3 = 18$

D. 12/2=6 mol H_2 × 2 = 12

E. 220/44=5 mol CO_2 × 3 = 15

A, B and D each give 12 N_A atoms.

72. Which of the following are paramagnetic? A. [NiCl4]2– B. Ni(CO)4 C. [Ni(CN)4]2– D. [Ni(H2O)6]2+ E. Ni(PPh3)4 Choose the correct answer from the options given below:

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

Answer (1)

Sol. Evaluate each Ni species by oxidation state, d-count, ligand field strength and hybridisation:

A. $[NiCl_4]^{2-}$: Ni(II), $3d^8$; Cl- is weak-field, no pairing ⇒ sp^3, tetrahedral, 2 unpaired electrons ⇒ paramagnetic.

B. $Ni(CO)_4$: Ni(0), $3d^{10}$; sp^3 tetrahedral, all paired ⇒ diamagnetic.

C. $[Ni(CN)_4]^{2-}$: Ni(II), $3d^8$; CN- strong-field pairs the electrons ⇒ dsp^2, square planar, all paired ⇒ diamagnetic.

D. $[Ni(H_2O)_6]^{2+}$: Ni(II), $3d^8$ octahedral; H_2O weak/moderate field, 2 unpaired electrons ⇒ paramagnetic.

E. $Ni(PPh_3)_4$: Ni(0), $3d^{10}$; all paired ⇒ diamagnetic.

Only A and D are paramagnetic, so option (A).

73. If the half-life (t1/2) for a first order reaction is 1 minute, then the time required for 99.9% completion of the reaction is closest to

(1) 5 minutes
(2) 10 minutes
(3) 2 minutes
(4) 4 minutes

Answer (2)

Sol. For a first order reaction, 99.9\% completion means the reactant falls to 0.1\% of its initial value, a reduction by a factor of $1000 \approx 2^{10}$, i.e. about 10 half-lives.
$t_{(99.9)} = 10 \times t_{(1/2)} = 10 \times 1 = 10$ minutes.
Exactly: $k = 0.693/(t_{(1/2)}) = 0.693\ min^{-1}$, and $t = 2.303/k \log 100/0.1 = 2.303/0.693 \times 3 \approx 9.97 \approx 10$ minutes.

74. Energy and radius of Bohr Orbit of He+ and Li2+ are [Given RH = 2.18 × 10–18 J, a0 = 52.9 pm]

(1) En(Li2+) = –19.62 × 10–16 J; rn(Li2+) = 17.6 pm, En(He+) = 8.72 × 10–16 J, rn(He+) = 26.4 pm
(2) En(Li2+) = –8.72 × 10–16 J; rn(Li2+) = 17.6 pm, En(He+) = –19.62 × 10–16 J, rn(He+) = 17.6 pm

(3) En(Li2+) = –19.62 × 10–18 J; rn(Li2+) = 17.6 pm, En(He+) = –8.72 × 10–18 J, rn(He+) = 26.4 pm
(4) En(Li2+) = –8.72 × 10–18 J; rn(Li2+) = 26.4 pm, En(He+) = –19.62 × 10–18 J, rn(He+) = 17.6 pm

Answer (3)

Sol. For the ground state (n=1): $E_n = -R_H (Z^2)/(n^2)$ and $r_n = a_0 (n^2)/Z$. For Li^{2+} (Z=3): $E_n = -2.18\times10^{-18}\times 9 = -19.62\times10^{-18}$ J, $r_n = 52.9/3 = 17.6$ pm. For He+ (Z=2): $E_n = -2.18\times10^{-18}\times 4 = -8.72\times10^{-18}$ J, $r_n = 52.9/2 = 26.4$ pm.

75. Among the given compounds I-III, the correct order of bond dissociation energy of C—H bond marked with * (is).

(1) III > II > I
(2) II > III > I
(3) II > I > III
(4) I > II > III

Answer (3)

Sol. The bond dissociation energy of a C-H bond is inversely related to the stability of the radical formed on its homolysis. The allylic/cyclopropenyl-type radical from III is the most stabilised and so has the lowest BDE; the aryl radical from I is intermediate; and the sp (alkynyl) C-H of phenylacetylene (II) gives the least-stabilised radical and so has the highest BDE. The order of radical stability is III > I > II, giving the BDE order II > I > III.

76. Dalton's Atomic theory could not explain which of the following?

(1) Law of multiple proportion
(2) Law of gaseous volume
(3) Law of conservation of mass
(4) Law of constant proportion

Answer (2)

Sol. Dalton's atomic theory explains the laws of conservation of mass, constant (definite) proportions and multiple proportions.

It could not explain Gay-Lussac's law of combining gaseous volumes, which was later accounted for by Avogadro's hypothesis (equal volumes of gases at the same T and P contain equal numbers of molecules).

77. Identify the correct orders against the property mentioned A. H2O > NH3 > CHCl3 – dipole moment B. XeF4 > XeO3 > XeF2 – number of lone pairs on central atom C. O–H > C–H > N–O – bond length D. N2 > O2 > H2 – bond enthalpy Choose the answer from the options given below :

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

Answer (3)

Sol. A is correct: H_2O (1.85 D) > NH_3 (1.47 D) > $CHCl_3$ (~ 1.04 D). D is correct: bond enthalpy follows bond order/strength N_2 (triple, 946) > O_2 (double, 498) > H_2 (single, 436). B is wrong (XeF_2 has 3 lone pairs > XeF_4 has 2 > XeO_3 has 1) and C is wrong. So A and D only.

78. Match List I with List II. List I (Name of Vitamin) List II (Deficiency disease) A. Vitamin B12 I. Cheilosis B. Vitamin D II. Convulsions C. Vitamin B2 III. Rickets D. Vitamin B6 IV. Pernicious anaemia Choose the correct answer from the options given below:

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

Answer (4)

Sol. Vitamin B12 deficiency causes pernicious anaemia (A-IV); vitamin D deficiency causes rickets (B-III); vitamin B2 (riboflavin) deficiency causes cheilosis (C-I); and vitamin B6 (pyridoxine) deficiency causes convulsions (D-II). The matching A-IV, B-III, C-I, D-II corresponds to option D.

79. The correct order of decreasing basic strength of the given amine is :
(1) N-ethylethangmine > ethanamine > N-methylaniline > benzenamine
(2) Benzenamine > ethanamine > N-methylaniline > N-ethylethanamine
(3) N-methylaniline > benzenamine > ethanamine > N-ethylethanamine
(4) N-ethylethanamine > ethanamine > benzenamine > N-methylaniline

Answer (1)

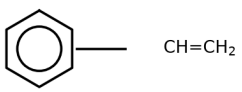
Sol. Basicity depends on the electron density available on nitrogen. Alkyl groups donate by +I, increasing basicity, so the secondary aliphatic amine N-ethylethanamine (diethylamine) is more basic than primary ethanamine. In aryl amines the nitrogen lone pair is delocalised into the ring (-M resonance), lowering basicity; N-methylaniline (whose +I methyl partly compensates) is more basic than benzenamine (aniline). The overall order is N-ethylethanamine > ethanamine > N-methylaniline > benzenamine.

80. The correct order of the wavelength of light absorbed by the fallowing complexes is, A. [Co(NH3)6]3+ B. [Co(CN)6]3– C. [Cu(H2O)4]2+ D. [Ti(H2O)6]3+ Choose the correct answer from the options given below:
(1) C < D < A < B
(2) C < A < D < B
(3) B < D < A < C
(4) B < A < D < C

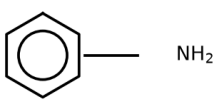
Answer (4)

Sol. The wavelength of light absorbed is inversely related to the crystal-field splitting Δ_o, since $\lambda = hc/(\Delta_o)$ (larger $\Delta_o \Rightarrow$ shorter λ).
Comparing the field splittings:
B $[Co(CN)_6]^{3-}$ — strongest field (CN-, Co^{3+}) $\Rightarrow$ largest Δ_o.
A $[Co(NH_3)_6]^{3+}$ — strong field NH_3, next largest.
D $[Ti(H_2O)_6]^{3+}$ — H_2O with Ti^{3+}.
C $[Cu(H_2O)_4]^{2+}$ — weakest field $\Rightarrow$ smallest Δ_o.
So Δ_o: B > A > D > C, and therefore the wavelength absorbed increases in the reverse order: B < A < D < C (option D).

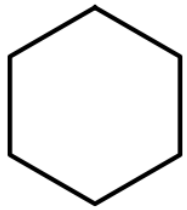
81. Which one of the following compounds does not decolourise bromine water?
(1) Styrene (C_6H_5–CH=CH_2)



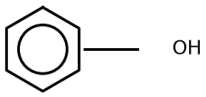
(2) Aniline (C_6H_5–NH_2)



(3) Cyclohexane (saturated six-membered ring)



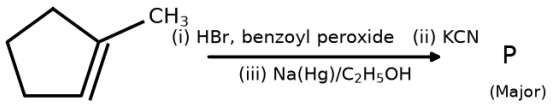
(4) Phenol (C_6H_5–OH)



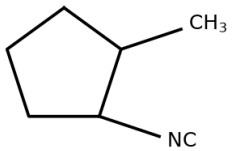
Answer (3)

Sol. Bromine water is decolourized when Br_2 is consumed, either by addition across a C=C double bond or by electrophilic aromatic substitution on a highly activated ring. Styrene has a vinyl C=C bond and decolourizes bromine water by addition. Aniline (–NH_2 strongly activating) and phenol (–OH strongly activating) both react with bromine water to give 2,4,6-tribromo products (white precipitates), consuming Br_2 and decolourizing it. Cyclohexane is a fully saturated hydrocarbon with no double bond and no activated ring; it does not react with bromine water under these conditions (no reaction in the dark). Therefore cyclohexane does not decolourize bromine water.

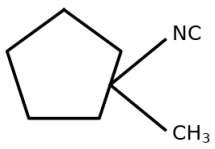
82. Predict the major product 'P' in the following sequence of reactions:
1-methylcyclopentene → (i) HBr, benzoyl peroxide (ii) KCN (iii) Na(Hg)/C_2H_5OH.



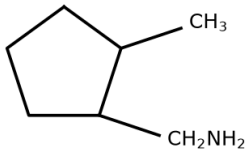
(1) Cyclopentane with –CH_3 and –NC on adjacent carbons



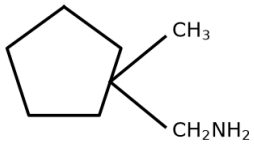
(2) Cyclopentane with –NC and –CH_3 on the SAME (geminal) carbon



(3) Cyclopentane with –CH_3 and –CH_2NH_2 on adjacent carbons



(4) Cyclopentane with –CH_3 and –CH_2NH_2 on the SAME (geminal) carbon



Answer (3)

Sol. Step (i): HBr with benzoyl peroxide adds by the anti-Markovnikov (radical) route. For 1-methylcyclopent-1-ene the double bond is between the CH_3-bearing carbon (more substituted) and the adjacent CH; Br adds to the less-substituted carbon, generating the more stable 3^° radical at the methyl carbon. This gives 2-bromo-1-methylcyclopentane (Br on the carbon adjacent to the CH_3 carbon).
Step (ii): KCN effects S_N_2 substitution of Br by -CN (cyanide is a C-nucleophile, giving a nitrile, not the isocyanide), yielding 2-methylcyclopentane-1-carbonitrile.
Step (iii): Na(Hg)/C_2H_5OH reduces the nitrile -C#N to a primary amine -CH_2NH_2.
The product is (2-methylcyclopentyl)methanamine: CH_3 and CH_2NH_2 on adjacent ring carbons (option C). Options A and B retain an isocyanide (-NC, which would need AgCN, and would not be reduced), and option D has the wrong (geminal) regiochemistry.

83. Match List I with List II List I (Mixture) List II (Method of Separation) A. CHCl3 + C6H5NH2 I. Distillation under reduced pressure B. Crude oil in petroleum industry II. Steam distillation C. Glycerol from spent-lye III. Fractional distillation D. Aniline - water IV. Simple distillation
Choose the correct answer from the options given below :

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

Answer (3)

Sol. The sperm head contains an elongated haploid nucleus, i.e. the genetic material (A-IV). The middle piece possesses numerous mitochondria that produce energy (B-III). The acrosome is filled with enzymes that help fertilisation (C-I). The tail facilitates sperm motility (D-II). This pairing matches option C.
NCERT Reference: Ch 2, p.32, line 11 — "is covered by a cap-like structure, acrosome."

84. Which among the following electronic configurations belong to main group elements? A. [Ne]3s1 B. [Ar]3d34s2 C. [Kr]4d10 5s2 5p5 D. [Ar]3d104s1 E. [Rn]5f06d27s2 Choose the correct answer from the option given below

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

Answer (3)

Sol. Per the official paper key, configurations B ([Ar]$3d^3$ $4s^2$) and E ([Rn]$5f^0$ $6d^2$ $7s^2$) are the keyed answer. Hence the correct option is (C) B and E only.

85. Which one of the following compounds can exist as cis-trans isomers?

(1) 1,1-Dimethylcyclopropane
(2) 1,2-Dimethylcyclohexane
(3) Pent-1-ene
(4) 2-Methylhex-2-ene

Answer (2)

Sol. Cis-trans (geometrical) isomerism requires two different groups on each of two carbons whose relative spatial arrangement is fixed by a ring or a C=C double bond. In 1,2-dimethylcyclohexane the two methyls are on adjacent ring carbons and can lie on the same face (cis) or opposite faces (trans). 1,1-Dimethylcyclopropane has both methyls on one carbon (no cis/trans); pent-1-ene has a terminal $=CH_2$ (two identical H); and in 2-methylhex-2-ene one doubly-bonded carbon bears two identical methyl groups, so neither of these shows cis-trans isomerism.

86. Phosphoric acid ionizes in three steps with their ionization constant values K a1 , K a 2 and K a 3 , respectively while K is the overall ionization constant. Which of the following statements are true? A. log K = log K a1 + K a 2 + K a3 B. H3PO4 is a stronger acid than H2PO4– and HPO42– C. K a1 > K a 2 > K a 3 D. K a1 = K a3 +K a 2 2 Choose the correct answer from the options given below:

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

Answer (2)

Sol. Correct Answer (A): (a), (b) and (c) only

In Solanaceae the flowers are bisexual and actinomorphic (a); the calyx has five united sepals (b); the androecium has five epipetalous stamens (c). The ovary is SUPERIOR (not inferior), so (d) is false. Hence (a),(b),(c).

87. Match List I with List II List-I (Ion) List-II (Group Number in Cation Analysis) 2+ A. Co I. Group-I B. Mg2+ I. Group-III 2+ C. Pb I. Group-IV 3+ D. Al I. Group-VI Choose the correct answer from the options given below.

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

Answer (4)

Sol. The Evil Quartet is the sobriquet for the four major causes of biodiversity losses (A-III). Ex situ conservation now uses cryopreservation of gametes (B-I). Lantana camara is an invasive alien weed species (C-II). The dodo of Mauritius is a classic example of recent extinction (D-IV). Options (a), (b) and (c) misassign at least one of these (e.g., placing ex situ with extinction or Lantana with extinction), so only (d) matches all four.

NCERT: NCERT Class XII Biology, Ch 13 Biodiversity and Conservation, p.222, lines 28-29: "There are four major causes ('The Evil Quartet' is the sobriquet used to describe them)." Also p.223, lines 16-17: "invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth

(Eicchornia)"; p.225, lines 22-24: "gametes of threatened species can be preserved ... using cryopreservation techniques"; p.221, line 42: "the dodo (Mauritius)".

88. Higher yield of NO in $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ can be obtained at [ΔH of the reaction = +180.7 kJ mol^{-1}] A. highest temperature B. lower temperature C. higher concentration of N_2 D. higher concentration of O_2. Choose the correct answer from the options given below.

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

Answer (2)

Sol. Apply Le Chatelier's principle. (Temperature) The reaction is endothermic (ΔH = +180.7 kJ mol^{-1}), so heat is a reactant; raising the temperature shifts equilibrium forward and increases the yield of NO — so the HIGHEST temperature favours NO (statement A correct, B wrong). (Concentration) Increasing the concentration of a reactant shifts equilibrium toward products; increasing [N_2] (C) and increasing [O_2] (D) both push the reaction forward, giving more NO. Note that $\Delta n_g = 2 - 2 = 0$, so pressure/volume change has no effect. Therefore the correct combination is A, C and D only.

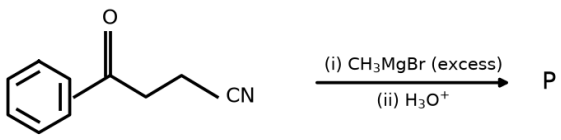
89. Given below are two statements: Statement I: Benzenediazonium salt is prepared by the reaction of aniline with acid at 273 278 K. It decomposes easily in the dry state. Statement II: Insertion of iodine into the benzene ring is difficult and hence iodobenzene is prepared through the reaction of benzenediazonium salt with KI. in the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement I is correct but Statement II is incorrect
(2) Statement I is incorrect but Statement II is correct
(3) Both Statement I and Statement II are correct
(4) Both Statement I and Statement II are incorrect

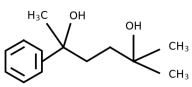
Answer (1)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

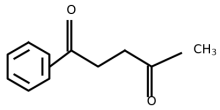
90. The major product of the following reaction is: 4-oxo-4-phenylbutanenitrile ($C_6H_5–CO–CH_2–CH_2–CN$) with (i) CH_3MgBr (excess) (ii) H_3O^+.



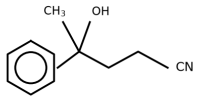
(1) $C_6H_5–C(CH_3)(OH)–CH_2–CH_2–C(CH_3)_2–OH$ (both C=O and C≡N converted to tert-alcohols)



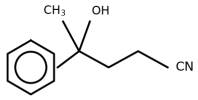
(2) $C_6H_5–CO–CH_2–CH_2–CO–CH_3$ (diketone; only the nitrile reacted)



(3) C_6H_5–C(CH_3)(OH)–CH_2–CH_2–CN (ketone → tert-alcohol, nitrile intact)



(4) C_6H_5–C(CH_3)(OH)–CH_2–CH_2–CN (ketone → tert-alcohol, nitrile intact)



Answer (4)

Sol. The Grignard reagent CH_3MgBr adds to the more reactive ketone carbonyl. Nucleophilic addition of the methyl carbanion to the C=O carbon, followed by acidic work-up, converts the ketone into a tertiary alcohol bearing a new methyl group on the benzylic carbon. The nitrile group is retained, giving C_6H_5-C(CH_3)(OH)-CH_2-CH_2-CN.

BIOLOGY (Q91 – Q180)

91. In the above represented plasmid an alien piece of DNA is inserted at EcoRI site. Which of the following strategies will be chosen to select the recombinant colonies?

(1) White color colonies will be selected
(2) Blue color colonies grown on ampicillin
(3) Using ampicillin & tetracyclin containing medium plate.
(4) Blue color colonies will be selected.

Answer (1)

Sol. When alien DNA is inserted at a restriction site within the β-galactosidase coding sequence, insertional inactivation occurs — recombinant colonies cannot cleave the chromogenic substrate and so remain colourless/white, while non-recombinants (intact β-galactosidase) turn blue. Hence recombinants are identified as the white colonies, not blue. Antibiotic double-plating options describe the older pBR322 method, not this blue-white screen.
NCERT Reference: Ch 9, p.170, line(s) 16-18 — "β-galactosidase gene and the colonies do not produce any colour,"

92. The protein portion of an enzyme is called:

(1) Apoenzyme
(2) Prosthetic group
(3) Cofactor
(4) Coenzyme

Answer (1)

Sol. When non-protein cofactors bind to an enzyme to make it catalytically active, NCERT calls the protein portion of the enzyme the apoenzyme. The prosthetic group, coenzyme and metal ion are the three kinds of cofactors (the non-protein constituents), so they are not the protein part.

NCERT Reference: Ch 9, p.118, line ~3 — "the protein portion of the enzymes is called the apoenzyme."

93. Given below are two statements: Statement I: The primary source of energy in an ecosystem is solar energy. Statement II: The rate of production of organic matter during photosynthesis in an ecosystem is called net primary productivity (NPP). In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement I is correct but statement II is incorrect
(2) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are correct
(4) Both statement I and statement II are incorrect

Answer (1)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

94. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): A typical unfertilized, angiosperm embryo sac at maturity is 8 nucleate and 7celled. Reason (R): The egg apparatus has 2 polar nuclei. In the light of the above statements, choose the correct answer from the options given below:

(1) A is true but R is false

(2) A is false but R is true
(3) Both A and R are true and R is the correct explanation of A
(4) Both A and R are true but R is not the correct explanation of A

Answer (1)

Sol. Answer: A. The Assertion is correct: after the 8-nucleate stage, cell walls form so that six nuclei become cells and two remain as polar nuclei in the central cell, giving a mature embryo sac that is 8-nucleate but 7-celled. The Reason is false because the egg apparatus (at the micropylar end) is made of two synergids and one egg cell only; the two polar nuclei are housed in the large central cell, not the egg apparatus. Hence A is true but R is false. NCERT: Ch 1, p.11, lines 17-25 — "Three cells are grouped together at the micropylar end and constitute the egg apparatus. The egg apparatus, in turn, consists of two synergids and one egg cell... The large central cell, as mentioned earlier, has two polar nuclei. Thus, a typical angiosperm embryo sac, at maturity, though 8-nucleate is 7-celled."

95. Neoplastic characteristics of cells refer to: A. A mass of proliferating cell B. Rapid growth of cells C. Invasion and damage to the surrounding tissue D. Those confined to original location Choose the correct answer from the options given below

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

Answer (4)

Sol. Neoplastic (malignant/tumor) cells are a mass of proliferating cells (A) that grow very rapidly (B) and invade and damage the surrounding normal tissues (C). These are the defining neoplastic characteristics in NCERT.
Why not the others: Statement D (confined to original location) describes BENIGN tumors, which remain confined and do not spread — the opposite of neoplastic behaviour. Hence any option containing D is wrong, leaving A, B, C only.

NCERT Reference: NCERT Ch7, p.141, lines 13-18: "a mass of proliferating cells called neoplastic or tumor"

96. Which one of the following is the characteristic feature of gymnosperms?

(1) Seeds are absent
(2) Gymnosperms have flowers for reproduction
(3) Seeds are enclosed in fruits
(4) Seeds are marked

Answer (4)

Sol. The defining feature of gymnosperms (gymnos: naked, sperma: seeds) is that the ovules are not enclosed by an ovary wall, so the seeds that develop after fertilisation are not covered, i.e., naked. Therefore 'seeds are absent' and 'seeds are enclosed in fruits' are wrong (the latter describes angiosperms), and gymnosperms bear cones/strobili rather than flowers, ruling out option (b).

NCERT Reference: Class XI Biology, Plant Kingdom, p.32, lines 30-31 — "The seeds that develop post-fertilisation, are not covered, i.e., are naked".

97. Match List-I with List-II. List-I List-II A. Progesterone I. Pars intermedia B. Relaxin II. Ovary C. Melanocyte stimulating hormone III. Adrenal Medulla D. Catecholamines IV. Corpus luteum Choose the correct answer from the options given below:

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

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

Answer (3)

Sol. Progesterone is secreted mainly by the corpus luteum (A-IV); relaxin is produced by the ovary (B-II); melanocyte stimulating hormone (MSH) is secreted by the pars intermedia of the pituitary (C-I); and catecholamines (adrenaline, noradrenaline) are secreted by the adrenal medulla (D-III). The keyed option (c) matches A-Corpus luteum, B-Ovary, C-Pars intermedia.

NCERT Reference: Chapter 19, Page 241, Line(s) 20-22 — "Pars intermedia secretes only one hormone called melanocyte stimulating hormone (MSH)."

98. Which chromosome in the human genome has the highest number of genes?
(1) Chromosome 1
(2) Chromosome 10
(3) Chromosome X
(4) Chromosome Y

Answer (1)

Sol. Answer: (A) Chromosome 1. Among human chromosomes, chromosome 1 contains the most genes while the Y chromosome has the fewest, as reported by the Human Genome Project. NCERT Ch 5, p.104, lines 033: "Chromosome 1 has most genes (2968), and the Y has the fewest (231)."

99. Which of the following statements about RuBisCO is true?
(1) It is an enzyme involved in the photolysis of water.
(2) It catalyzes the carboxylation of RuBP.
(3) It is active only in the dark.
(4) It has higher affinity for oxygen than carbon dioxide.

Answer (2)

Sol. In the Calvin cycle, the enzyme RuBP carboxylase (RuBisCO) catalyses carboxylation, where CO_2 is added to the 5-carbon RuBP to form two molecules of 3-PGA. Water photolysis is done by the water-splitting complex of PS II, not RuBisCO, so the other options are wrong. Thus RuBisCO catalyses the carboxylation of RuBP.

NCERT: Class 11 Ch 11, p.143 [143:038]: "where CO_2 is utilised for the carboxylation of RuBP. This reaction is"

100. The first menstruation is called:
(1) Diapause
(2) Ovulation
(3) Menopause
(4) Menarche

Answer (4)

Sol. The first menstruation begins at puberty and is termed menarche. Menopause is the cessation of menstrual cycles around 50 years of age, while ovulation is the release of the ovum; neither denotes the first menstruation.
NCERT Reference: Ch 2, p.33, line 30 — "at puberty and is called menarche. In human females, menstruation"

101. Which of the following genetically engineered organisms was used by Eli Lilly to prepare human insulin?
(1) Virus

(2) Phage
(3) Bacterium
(4) Yeast

Answer (3)

Sol. In 1983 Eli Lilly, an American company, introduced the DNA sequences coding for the A and B chains of human insulin into plasmids of E. coli (a bacterium) to produce the insulin chains. So the genetically engineered organism used was a bacterium.
NCERT Reference: Ch 10, p.182, line 10 — "In 1983, Eli Lilly an American company"; p.182, line 12 — "chains of human insulin and introduced them in plasmids"; p.182, line 13 — "of E. coli to produce insulin chains."

102. Given below are two statements: one is labelled as Assertion (A) and the other labelled as Reason (R). Assertion (A): All vertebrates are chordates but all chordates are not vertebrate. Reason (R): The members of subphylum vertebrata possess notochord during the embryonic period, the notochord is replaced by a cartilaginous or bony vertebral column in adults. In the light of the above statements, choose the correct answer from the options given below:

(1) A is true but R is false
(2) A is false but R is true
(3) Both A and R are true and R is the correct explanation of A.
(4) Both A and R are true and R is not the correct explanation of A.

Answer (3)

Sol. Both statements are true. Vertebrates possess a notochord in the embryo which is later replaced by a cartilaginous or bony vertebral column, while protochordates (Urochordata, Cephalochordata) retain the notochord and lack a vertebral column. This defining vertebrate feature correctly explains why all vertebrates are chordates but not all chordates are vertebrates, so R is the correct explanation of A (option c).

NCERT Reference: Page 46, line 30

103. What is the main function of the spindle fiber during mitosis?

(1) To repair damaged DNA
(2) To regulate cell growth
(3) To separate the chromosomes
(4) To synthesize new DNA

Answer (3)

Sol. Answer: To separate the chromosomes

Solution: Spindle fibres attach to the kinetochores and, by their shortening, pull the daughter chromatids (now daughter chromosomes) toward opposite poles during anaphase, segregating the chromosomes into the two future daughter nuclei. DNA repair and synthesis occur in interphase and are unrelated to spindle fibres, and regulating cell growth is not a spindle function; hence chromosome separation is correct.

NCERT Reference: Ch 10, p.124, lines 5-7 — "Centromeres split and chromatids separate"

104. Match List-I with List-II. List-I List-II A. Alfred Hershey and Martha I. Streptococcus pneumoniae B. Euchromatin II. Densely packed and dark-stained C. Frederick Griffith III. Loosely packed and light-stained D. Heterochromatin IV. DNA as genetic material confirmation Choose the correct answer from the options given below:

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

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

Answer (1)

Sol. Answer: (A) A-IV, B-III, C-I, D-II. Hershey and Chase gave unequivocal proof that DNA is the genetic material (IV); euchromatin is loosely packed and light-stained (III); Griffith worked with Streptococcus pneumoniae (I); heterochromatin is densely packed and dark-stained (II). NCERT Ch 5, p.85, lines 029-030: "The unequivocal proof that DNA is the genetic material came from the experiments of Alfred Hershey and Martha Chase"; p.84, lines 004-006: "some region of chromatin are loosely packed (and stains light) and are referred to as euchromatin. The chromatin that is more densely packed and stains dark are called as Heterochromatin"; p.84, line 019: "Frederick Griffith, in a series of experiments with Streptococcus pneumoniae".

105. Match List-I with List-II. List-I List-II A. Adenosine I. Nitrogen base B. Adenylic acid II. Nucleotide C. Adenine III. Nucleoside D. Alanine IV. Amino acid Choose the option with all correct matches.

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

Answer (1)

Sol. The Evil Quartet is the sobriquet for the four major causes of biodiversity losses (A-III). Ex situ conservation now uses cryopreservation of gametes (B-I). Lantana camara is an invasive alien weed species (C-II). The dodo of Mauritius is a classic example of recent extinction (D-IV). Options (a), (b) and (c) misassign at least one of these (e.g., placing ex situ with extinction or Lantana with extinction), so only (d) matches all four.

NCERT: NCERT Class XII Biology, Ch 13 Biodiversity and Conservation, p.222, lines 28-29: "There are four major causes ('The Evil Quartet' is the sobriquet used to describe them)." Also p.223, lines 16-17: "invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eicchornia)"; p.225, lines 22-24: "gametes of threatened species can be preserved ... using cryopreservation techniques"; p.221, line 42: "the dodo (Mauritius)".

106. In frog, the Renal system is a special venous connection that acts to link:

(1) Kidney and intestine
(2) Kidney and lower part of body
(3) Liver and intestine
(4) Liver and Kidney

Answer (2)

Sol. Answer: (B) Kidney and lower part of body. The renal portal system is the special venous connection between the kidney and the lower parts of the body in frogs (the hepatic portal system links liver and intestine). The stem's phrase 'Renal system' refers to the renal portal system. NCERT (Class XI, Ch 7 Structural Organisation in Animals): p.82, lines 33-36 — "Special venous connection between liver and intestine as well as the kidney and lower parts of the body are present in frogs. The former is called hepatic portal system and the latter is called renal portal system."

107. Which of the following are the post-transcriptional events in an eukaryotic cell? A. Transport of pre-mRNA to cytoplasm prior to splicing B. Removing of introns and joining of exons C. Addition of methyl group at 5′ end of hnRNA. D. Addition of adenine residues at 3′ end of hnRNA. E. Base pairing of two complementary RNAs. Choose the correct answer from

the options given below:
(1) B, C, E only
(2) C, D, E only
(3) A, B, C only
(4) B, C, D only

Answer (4)

Sol. Answer: (D) B, C, D only. Post-transcriptional processing of hnRNA comprises splicing (removing introns, joining exons), capping (adding methyl guanosine at the 5' end) and tailing (adding adenylate residues at the 3' end); A is false because splicing occurs in the nucleus before transport, and E (base pairing of two complementary RNAs) describes RNA interference, not processing. NCERT Ch 5, p.95, lines 009-016: "a process called splicing where the introns are removed and exons are joined... In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3'-end... that is transported out of the nucleus for translation."

108. Polymerase chain reaction (PCR) amplifies DNA following the equation
(1) 2n + 1
(2) 2N2
(3) N2
(4) 2n

Answer (4)

Sol. In PCR, each cycle doubles the number of DNA copies, so after n cycles the amplification follows 2^n. NCERT notes that repeated replication can amplify the segment to approximately a billion copies ($\approx 2^{30}$), consistent with the doubling (2^n) relationship. NCERT Reference: Ch 9, p.173, line(s) 8 — "to approximately billion times, i.e., 1 billion copies are made."

109. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): Both wind and water pollinated flowers are not very colourful and do not produce nectar. Reason (R): The flowers produce enormous amount of pollen grains in wind and water pollinated flowers. In the light of the above statements, choose the correct answer from the options given below:
(1) A is true but R is false
(2) A is false but R is true
(3) Both A and R are true and R is the correct explanation of A
(4) Both A and R are true but R is NOT the correct explanation of A

Answer (4)

Sol. Both statements are true. Vertebrates possess a notochord in the embryo which is later replaced by a cartilaginous or bony vertebral column, while protochordates (Urochordata, Cephalochordata) retain the notochord and lack a vertebral column. This defining vertebrate feature correctly explains why all vertebrates are chordates but not all chordates are vertebrates, so R is the correct explanation of A (option c).

NCERT Reference: Page 46, line 30

110. Epiphytes that are growing on a mango branch is an example of which of the following?
(1) Predation
(2) Amensalism
(3) Commensalism
(4) Mutualism

Answer (3)

Sol. NCERT: Ch 11, p.201, lines 8-12 — "Commensalism: This is the interaction in which one species benefits
and the other is neither harmed nor benefited. An orchid growing
as an epiphyte on a mango branch, and barnacles growing on the
back of a whale benefit while neither the mango tree nor the whale
derives any apparent benefit."

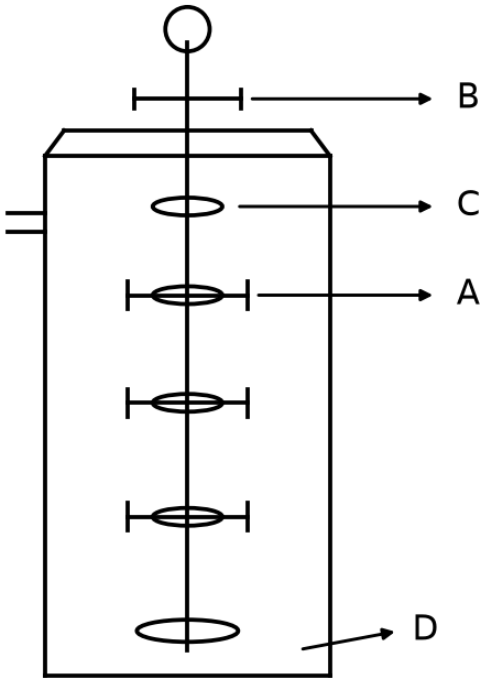
111. Find the correct statements: A. In human pregnancy, the major organ systems are formed at the end of 12 weeks. B. In human pregnancy, the major organ systems are formed at the end of 8 weeks. C. In human pregnancy heart is formed after one month of gestation. D. In human pregnancy, limbs and digits develop by the end of second month. E. In human pregnancy the appearance of hair is usually observed in the fifth month. Choose the correct answer from the options given below:

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

Answer (2)

Sol. Per NCERT, by the end of 12 weeks (first trimester) most major organ systems are formed (A true; B, which says 8 weeks, is false). The heart forms after one month of pregnancy (C true), limbs and digits develop by the end of the second month (D true), and the appearance of hair on the head occurs in the fifth month (E true). Hence the correct statements are A, C, D and E, matching option B.
NCERT Reference: Ch 2, p.38, line 15 — "end of 12 weeks (first trimester), most of the major organ systems are"

112. Identify the part of a bio-reactor which is used as a foam breaker from the given figure.



(1) D
(2) C
(3) A

(4) B

Answer (2)

Sol. In the PCT nearly all nutrients and 70-80% of electrolytes and water are reabsorbed, and the PCT secretes H+ and ammonia into the filtrate while absorbing HCO3- from it. In the DCT there is conditional reabsorption of Na+ and water and reabsorption of HCO3-, with selective secretion of H+, K+ and NH3. So the correct figure must show H2O/NaCl/HCO3- being reabsorbed and H+/NH3 (and K+ in DCT) being secreted in these directions; option (d) is the only diagram matching this. NCERT Reference: Ch 16, p.209, line(s) 28-48 — "PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions and ammonia into the filtrate and by absorption of HCO3"

113. Frogs respire in water by skin and buccal cavity and on land by skin, buccal cavity and lungs. Choose the correct answer from the following:

(1) The statement is false for water and but true for land
(2) The statement is false for both the environment
(3) The statement is true for water but false for land
(4) The statement is true for both the environment

Answer (1)

Sol. Answer: (A) The statement is false for water and but true for land. In water a frog respires only through the skin (cutaneous respiration) and NOT through the buccal cavity, so the water part of the statement is false. On land the buccal cavity, skin and lungs all act as respiratory organs, so the land part is true. NCERT (Class XI, Ch 7 Structural Organisation in Animals): p.82, lines 13-16 — "In water, skin acts as aquatic respiratory organ (cutaneous respiration)... On land, the buccal cavity, skin and lungs act as the respiratory organs."

114. Consider the following statements regarding function of adrenal medullary hormones: A. It causes pupillary constriction B. It is a hyperglycemic hormone C. It causes piloerection D. It increases strength of heart contraction Choose the correct answer from the options given below:

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

Answer (4)

Sol. Adrenal medullary hormones (catecholamines) are hyperglycemic as they stimulate glycogen breakdown raising blood glucose (B), cause piloerection/raising of hairs (C), and increase the strength of heart contraction (D). They cause pupillary DILATION, not constriction, so statement A is wrong; hence B, C and D are correct.

NCERT Reference: Chapter 19, Page 244, Line(s) 8-11 — "These hormones increase alertness, pupilary dilation, piloerection (raising of hairs)... Both the hormones increase the heart beat, the strength of heart contraction and the rate of respiration. Catecholamines also stimulate the breakdown of glycogen"

115. Read the following statements on plant growth and development. A. Parthenocarpy can be induced by auxins. B. Plant growth regulators can be involved in promotion as well as inhibition of growth. C. Dedifferentiation is a pre-requisite for re-differentiation. D. Abscisic acid is a plant growth promoter. E. Apical dominance promotes the growth of lateral buds. Choose the option with all correct statements.

(1) A, D, E only
(2) B, D, E only

(3) A, B, C only
(4) A, C, E only

Answer (3)

Sol. A is correct: auxins induce parthenocarpy (e.g., tomatoes). B is correct: PGRs are involved in both growth promotion and inhibition. C is correct: dedifferentiation is a prerequisite for redifferentiation. D is wrong because ABA is a growth inhibitor, not a promoter; E is wrong because apical dominance inhibits (not promotes) lateral bud growth.

NCERT: Ch 13, p.175, line ~39: "the growing apical bud inhibits the growth of the lateral (axillary) buds".

116. Which of the following hormones released from the pituitary is actually synthesized in the hypothalamus?
(1) Follicle-stimulating hormone (FSH)
(2) Adrenocorticotropic hormone (ACTH)
(3) Luteinizing hormone (LH)
(4) Anti-diuretic hormone (ADH)

Answer (4)

Sol. ADH (vasopressin) and oxytocin are released from the posterior pituitary but are actually synthesised by the hypothalamus and transported axonally to the neurohypophysis. FSH, LH and ACTH are gonadotrophins/tropic hormones produced by the anterior pituitary (pars distalis) itself. Hence the pituitary-released hormone synthesised in the hypothalamus is ADH.

NCERT Reference: Chapter 19, Page 241, Line(s) 24-28 — "Neurohypophysis (pars nervosa) also known as posterior pituitary, stores and releases two hormones called oxytocin and vasopressin, which are actually synthesised by the hypothalamus and are transported axonally to neurohypophysis."

117. Which of the following is an example of non-distilled alcoholic beverage produced by yeast?
(1) Beer
(2) Rum
(3) Whisky
(4) Brandy

Answer (1)

Sol. Yeast (Saccharomyces cerevisiae) carries out alcoholic fermentation to produce ethanol. Beverages like beer and wine are prepared WITHOUT distillation — the fermented product is used directly. In contrast, whisky, brandy and rum are prepared by distilling the fermented broth to raise the alcohol content. Hence, of the given options, beer is the non-distilled (i.e. fermented but not distilled) alcoholic beverage produced by yeast.

118. What is the pattern of inheritance for polygenic trait?
(1) Autosomal dominant pattern
(2) X-linked recessive inheritance pattern
(3) Mendelian inheritance pattern
(4) Non-mendelian inheritance pattern

Answer (4)

Sol. Polygenic traits are controlled by three or more genes whose effects are additive and are also influenced by the environment, producing a continuous gradient of phenotypes rather than discrete classes. This contrasts with the discrete, distinct-allele pattern Mendel described, so polygenic inheritance follows a non-mendelian pattern.

NCERT Reference: NCERT Class XII, Ch 4, p.69, lines 4-14: "Mendel's studies mainly described those traits that have distinct alternate forms ... Such traits are generally controlled by three or more genes and are thus called as polygenic traits. Besides the involvement of multiple genes polygenic inheritance also takes into account the influence of environment ... the effect of each allele is additive."

119. Match List-I and List-II. List-I List-II A. Head I. Enzymes B. Middle piece II. Sperm motility C. Acrosome III. Energy D. Tail IV. Genetic material Choose the correct answer from the options given below:

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

Answer (3)

Sol. The sperm head contains an elongated haploid nucleus, i.e. the genetic material (A-IV). The middle piece possesses numerous mitochondria that produce energy (B-III). The acrosome is filled with enzymes that help fertilisation (C-I). The tail facilitates sperm motility (D-II). This pairing matches option C.
NCERT Reference: Ch 2, p.32, line 11 — "is covered by a cap-like structure, acrosome."

120. Which of the following is an example of a zygomorphic flower?

(1) Pea
(2) Chilli
(3) Petunia
(4) Datura

Answer (1)

Sol. Zygomorphic (bilaterally symmetrical) flowers can be divided into two similar halves only in one particular vertical plane; NCERT lists pea, gulmohur, bean and Cassia as examples. Among the options, only Pea is zygomorphic. Chilli, Petunia and Datura are actinomorphic (radially symmetrical). Hence the answer is Pea (option a).

NCERT Reference: Ch 5, p.62, line(s) 22-23 — "zygomorphic, e.g., pea, gulmohur, bean, Cassia"

121. Which of following organisms cannot fix nitrogen? A. Azotobacter B. Oscillatoria C. Anabaena D. Volvox E. Nostoc Choose the correct answer from the options given below:

(1) B only
(2) E only
(3) A only
(4) D only

Answer (4)

Sol. Azotobacter is a free-living nitrogen fixer, while Oscillatoria, Anabaena and Nostoc are nitrogen-fixing cyanobacteria. Volvox is a green alga that does NOT fix atmospheric nitrogen, so only D cannot fix nitrogen.

NCERT Reference: Ch 8, p.158, line 24 — "and terrestrial environments many of which can fix atmospheric nitrogen,"

122. Which one of the following is an example of ex-situ conservation?

(1) Zoos and botanical gardens
(2) Protected areas

(3) National Park
(4) Wildlife Sanctuary

Answer (1)

Sol. Ex-situ ('off site') conservation maintains threatened species outside their natural habitat; NCERT names zoological parks, botanical gardens and wildlife safari parks as serving this purpose. Protected areas, national parks and wildlife sanctuaries (b, c, d) are forms of in-situ ('on site') conservation, where the species is protected within its natural habitat.

NCERT: NCERT Class XII Biology, Ch 13 Biodiversity and Conservation, p.225, lines 18-19: "Zoological parks, botanical gardens and wildlife safari parks serve this purpose."

123. Who is known as the father of Ecology in India?
(1) Ram Udar
(2) Birbal Sahni
(3) S. R. Kashyap
(4) Ramdeo Misra

Answer (4)

Sol. Professor Ramdeo Misra is regarded as the 'Father of Ecology in India' for his pioneering contributions to ecological research and education and for institutionalising the study of ecology in India. (Birbal Sahni was a palaeobotanist, S. R. Kashyap the 'father of Indian bryology', and Ram Udar a bryologist.) Hence the answer is Ramdeo Misra.

124. Given below are two statements: Statement I: In the RNA world, RNA is considered the first genetic material evolved to carry out essential life processes, RNA acts as a genetic material and also as a catalyst for some important biochemical reactions in living systems. Being reactive, RNA is unstable. Statement II: DNA evolved from RNA and is a more stable genetic material. Its double helical strands being complementary, resist changes by evolving repairing mechanism. In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Statement I is correct but statement II is incorrect
(2) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are correct
(4) Both statement I and statement II are incorrect

Answer (3)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

125. Given below are two statements: Statement I: Transfer RNSs and ribosomal RNA do not interact with mRNA. Statement II: RNA interference (RNAi) takes places in all eukaryotic organisms as a method of cellular defence. In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Statement I is correct but statement II is incorrect
(2) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are correct
(4) Both statement I and statement II are incorrect

Answer (2)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

126. Match List-I with List-II. List-I List-II A. Heart I. Erythropoietin B. Kidney II. Aldosterone C. Gastro-intestinal tract III. Atrial natriuretic factor D. Adrenal Cortex IV. Secretin Choose the correct answer from the options given below:

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

Answer (2)

Sol. The atrial wall of the heart secretes atrial natriuretic factor (Heart–III); the JG cells of the kidney produce erythropoietin (Kidney–I); the gastro-intestinal tract secretes secretin among its peptide hormones (GIT–IV); the adrenal cortex secretes aldosterone, a mineralocorticoid (Adrenal Cortex–II). This gives A-III, B-I, C-IV, D-II.

NCERT Reference: Chapter 19, Page 250, Line(s) 37-39 — "produces atrial natriuretic factor ... Kidney produces erythropoietin ... The gastrointestinal tract secretes gastrin, secretin, cholecystokinin"

127. All living members of the class Cyclostomata are:

(1) Symbiotic
(2) Ectoparasite
(3) Free living
(4) Endoparasite

Answer (2)

Sol. All living members of the class Cyclostomata are ectoparasites on some fishes. They have a jawless, sucking circular mouth, an elongated body with 6-15 pairs of gill slits, and a cartilaginous cranium and vertebral column. Examples are Petromyzon (Lamprey) and Myxine (Hagfish).

NCERT Reference: Page 47, line 14

128. Streptokinase produced by bacterium Streptococcus is used for

(1) Liver disease treatment
(2) Removing clots from blood vessels
(3) Curd production
(4) Ethanol production

Answer (2)

Sol. Streptokinase, produced by the bacterium Streptococcus and modified by genetic engineering, is used as a 'clot buster' to remove clots from the blood vessels of patients who have suffered myocardial infarction. It is not used for curd or ethanol production.

NCERT Reference: Ch 8, p.153, line 21 — "proteases. Streptokinase produced by the bacterium Streptococcus and"

129. Role of the water vascular system in Echinoderms is: A. Respiration and Locomotion B. Excretion and Locomotion C. Capture and transport of food D. Digestion and Respiration E.

Digestion and Excretion Choose the correct answer from the options given below:

(1) B and C Only
(2) B, D and E Only
(3) A and B Only
(4) A and C Only

Answer (4)

Sol. In echinoderms the water vascular system helps in locomotion, capture and transport of food, and respiration. So statement A (Respiration and Locomotion) and statement C (Capture and transport of food) are correct, giving option (d). Excretion and digestion are not functions of the water vascular system (an excretory system is in fact absent in echinoderms).

NCERT Reference: Page 45, line 18-20

130. Match List I with List II. List I List II A. Pteridophyte I. Salvia B. Bryophyte II. Ginkgo C. Angiosperm III. Polytrichum D. Gymnosperm IV. Salvinia Choose the option with all correct matches.

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

Answer (4)

Sol. The sperm head contains an elongated haploid nucleus, i.e. the genetic material (A-IV). The middle piece possesses numerous mitochondria that produce energy (B-III). The acrosome is filled with enzymes that help fertilisation (C-I). The tail facilitates sperm motility (D-II). This pairing matches option C.
NCERT Reference: Ch 2, p.32, line 11 — "is covered by a cap-like structure, acrosome."

131. Which are correct: A. Computed tomography and magnetic resonance imaging detect cancers of internal organs. B. Chemotherapeutic drugs are used to kill non-cancerous cells. C. α-interferon activates the cancer patients' immune system and helps in destroying the tumour. D. Chemotherapeutic drugs are biological response modifiers. E. In the case of leukemia blood cell counts decrease. Choose the correct answer from the options given below:

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

Answer (2)

Sol. CT and MRI are used to detect cancers of the internal organs, so A is correct. α-interferon is a biological response modifier that activates the cancer patient's immune system and helps destroy the tumour, so C is correct.
Why not the others: B is wrong — chemotherapeutic drugs kill CANCEROUS cells, not non-cancerous ones. D is wrong — α-interferon (not chemotherapeutic drugs) is the biological response modifier. E is wrong — in leukemia blood cell counts INCREASE, which is why blood/bone-marrow tests check for increased cell counts. Only A and C are correct.

NCERT Reference: NCERT Ch7, p.141-142, p.142 lines 19-21: "biological response modifiers such as α-interferon which activates their"

132. What are the potential drawback in adoption of the IVF method? A. High fatality risk to mother B. Expensive instruments and reagents C. Husband/wife necessary for being donors

D. Less adoption of orphans E. Not available in India F. Possibility that the early embryo does not survive Choose the correct answer from the options given below:

(1) A, B, C, D only
(2) A, B, C, E, F only
(3) B, D, F only
(4) A, C, D, F only

Answer (3)

Sol. IVF requires extremely high precision handling and expensive instrumentation (B), so its benefits reach only a limited number of people. Since the aim is to have one's own children, it discourages adoption of the many orphaned/destitute children (D), and there is a possibility that the early embryo does not survive (F). NCERT does not list high maternal fatality (A) or unavailability in India (E) as drawbacks, and IVF can use donor gametes too, so C is not required.

NCERT Reference: Reproductive Health, p.48 — "all these techniques require extremely high precision handling by specialised professionals and expensive instrumentation"

133. Consider the following: A. The reductive division for the human female gametogenesis starts earlier than that of the male gametogenesis. B. The gap between the first meiotic division and the second meiotic division is much shorter for males compared to females. C. The first polar body is associated with the formation of the primary oocyte. D. Luteinizing Hormone (LH) surge leads to disintegration of the endometrium and onset of menstrual bleeding. Choose the correct answer from the options given below:

(1) B and D are true
(2) B and C are true
(3) A and B are true
(4) A and C are true

Answer (3)

Sol. A is true — the reductive (meiotic) division in females begins in the embryonic stage (primary oocytes arrested in prophase-I), far earlier than in males where it begins at puberty. B is true — in males meiosis I and II run continuously over days, whereas in females meiosis I completes near ovulation and meiosis II only at fertilisation, a much longer gap, so the gap is much shorter for males. C is false because the first polar body forms when the primary oocyte completes meiosis I to give the secondary oocyte (not the primary oocyte). D is false because the LH surge causes ovulation, not endometrial disintegration.
NCERT Reference: Ch 2, p.32, line 31 — "Oogenesis is initiated"

134. In bryophytes, the gemmae help in which one of the following?

(1) Nutrient absorption
(2) Gaseous exchange
(3) Sexual reproduction
(4) Asexual reproduction

Answer (4)

Sol. In bryophytes (liverworts), gemmae are green, multicellular asexual buds borne in gemma cups on the thallus; they detach from the parent body and germinate to form new individuals — a mode of asexual (vegetative) reproduction. They are not involved in nutrient absorption or gaseous exchange, and they are distinct from the sexual cycle that uses antheridia and archegonia.

NCERT Reference: Class XI Biology, Plant Kingdom, p.29, lines 41-45 — "Gemmae are green, multicellular, asexual buds, which develop in small receptacles called gemma cups located on the thalli. The gemmae become detached from the parent body and germinate to form new

individuals."

135. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): The primary function of the Golgi apparatus is to package the materials made by the endoplasmic reticulum and deliver it to intracellular targets and outside the cell. Reason (R): Vesicles containing materials made by the endoplasmic reticulum fuse with the cis face of the Golgi apparatus, and they are modified and released from the trans face of the Golgi apparatus. In the light of the above statements, choose the correct answer from the options given below:

(1) A is true but R is false
(2) A is false but R is true
(3) Both A and R are true and R is the correct explanation of A
(4) Both A and R are true but R is not the correct explanation of A

Answer (3)

Sol. Both statements are true. Vertebrates possess a notochord in the embryo which is later replaced by a cartilaginous or bony vertebral column, while protochordates (Urochordata, Cephalochordata) retain the notochord and lack a vertebral column. This defining vertebrate feature correctly explains why all vertebrates are chordates but not all chordates are vertebrates, so R is the correct explanation of A (option c).

NCERT Reference: Page 46, line 30

136. Which one of the following statements refers to Reductionist Biology?

(1) Chemical approach to study and understand living organisms.
(2) Behavioural approach to study and understand living organisms.
(3) Physico-chemical approach to study and understand living organisms.
(4) Physiological approach to study and understand living organisms.

Answer (3)

Sol. Reductionist biology explains life and living processes by breaking them down to their physical and chemical components. As NCERT states, the reductionist approach to the study of life forms resulted in an increasing use of physico-chemical concepts and techniques, using surviving-tissue models and cell-free systems, which led to the explosion of knowledge in molecular biology. Hence reductionist biology is best described as the physico-chemical approach to studying and understanding living organisms.

137. After maturation, in primary lymphoid organs, the lymphocytes migrate for interaction with antigens to secondary lymphoid organ(s)/tissue(s) like: A. thymus B. bone marrow C. spleen D. lymph nodes E. Peyer’s patches Choose the correct answer from the options given below:

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

Answer (2)

Sol. Answer: (D) B, C, D only. Post-transcriptional processing of hnRNA comprises splicing (removing introns, joining exons), capping (adding methyl guanosine at the 5' end) and tailing (adding adenylate residues at the 3' end); A is false because splicing occurs in the nucleus before transport, and E (base pairing of two complementary RNAs) describes RNA interference, not processing. NCERT Ch 5, p.95, lines 009-016: "a process called splicing where the introns are removed and exons are joined... In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA. In tailing, adenylate residues (200-300) are added

at 3'-end... that is transported out of the nucleus for translation."

138. Match List I with List II : List I List II A. The Evil Quartet I. Cryopreservation B. Ex situ conservation II. Alien species invasion C. Lantana camara III. Causes of biodiversity losses D. Dodo IV. Extinction Choose the option will all correct matches.

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

Answer (4)

Sol. The Evil Quartet is the sobriquet for the four major causes of biodiversity losses (A-III). Ex situ conservation now uses cryopreservation of gametes (B-I). Lantana camara is an invasive alien weed species (C-II). The dodo of Mauritius is a classic example of recent extinction (D-IV). Options (a), (b) and (c) misassign at least one of these (e.g., placing ex situ with extinction or Lantana with extinction), so only (d) matches all four.

NCERT: NCERT Class XII Biology, Ch 13 Biodiversity and Conservation, p.222, lines 28-29: "There are four major causes ('The Evil Quartet' is the sobriquet used to describe them)." Also p.223, lines 16-17: "invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eicchornia)"; p.225, lines 22-24: "gametes of threatened species can be preserved ... using cryopreservation techniques"; p.221, line 42: "the dodo (Mauritius)".

139. How many meiotic and mitotic divisions need to occur for the development of a mature female gametophyte from the megaspore mother cell in an angiosperm plant?

(1) 1 Meiosis and 3 Mitosis
(2) No Meiosis and 2 Mitosis
(3) 2 Meiosis and 3 Mitosis
(4) 1 Meiosis and 2 Mitosis

Answer (1)

Sol. Answer: A. The megaspore mother cell (MMC) divides meiotically (1 meiosis) to produce four megaspores. Only one functional megaspore survives and its nucleus undergoes three successive free-nuclear mitotic divisions — the first gives the 2-nucleate stage, and two more give the 4-nucleate and then 8-nucleate stages — which organise into the mature female gametophyte. Therefore 1 meiosis and 3 mitoses are required. NCERT: Ch 1, p.11, lines 5-9 — "The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac. Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac." (preceded by p.9-10: MMC undergoes meiotic division producing four megaspores).

140. Which of the following type of immunity is present at the time of birth and is a non-specific type of defence in the human body?

(1) Cell-mediated Immunity
(2) Humoral Immunity
(3) Acquired Immunity
(4) Innate Immunity

Answer (4)

Sol. Innate immunity is the non-specific type of defence that is present at the time of birth, accomplished through physical, physiological, cellular and cytokine barriers to the entry of foreign agents.
Why not the others: Acquired immunity is pathogen-specific and develops after exposure (not present at birth). Humoral (antibody-mediated) and cell-mediated immunity are the two specific

components of acquired immunity, so they are also specific and acquired — not the innate, present-at-birth, non-specific defence asked for.

NCERT Reference: NCERT Ch7, p.134, lines 32-34: "non-specific type of defence, that is present at the"

141. Given below are two statements: Statement I: Fig fruit is a non-vegetarian fruit as it has enclosed fig wasps in it. Statement II: Fig wasp and fig tree exhibit mutual relationship as fig fruit and fig fruit gets pollinated by fig wasp. In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Statement I is correct but statement II is incorrect
(2) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are correct
(4) Both statement I and statement II are incorrect

Answer (3)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

142. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus. Reason (R) : Presence of more than one nucleus in the tapetum increases the efficiency of nourishing the developing microspore mother cells. In light of the above statements, choose the most appropriate-answer from the options given below :

(1) A is true but R is false
(2) A is false but R is true
(3) Both A and R are true and R is the correct explanation of A
(4) Both A and R are true but R is NOT the correct explanation of A

Answer (3)

Sol. Answer: C. Both statements are true. The innermost wall layer of the microsporangium, the tapetum, nourishes the developing pollen grains, and its cells have dense cytoplasm and generally more than one nucleus (A is true). The multinucleate condition raises the cell's synthetic and nutritive capacity, enabling more efficient nourishment of the developing microspore mother cells — so the extra nuclei exist precisely to serve the tapetum's nourishing role (R is true and is the correct explanation of A). NCERT: Ch 1, p.5, lines 38-41 — "The innermost wall layer is the tapetum. It nourishes the developing pollen grains. Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus."

143. From the statements given below choose the correct option : A. The eukaryotic ribosomes are 80S and prokaryotic ribosomes are 70S. B. Each ribosome has two sub-units. C. The two sub-units of 80S ribosome are 60S and 40S while that of 70S are 50S and 30S. D. The two sub-units of 80S ribosome are 60S and 20S and that of 70S are 50S and 20S. E. The two sub-units of 80S are 60S and 30S and that of 70S are 50S and 30S.

(1) A, B, E are true
(2) B, D, E are true
(3) B, C are true
(4) A, B, D are true

Answer (3)

Sol. Answer: (C) A, B, C are true. Eukaryotic ribosomes are 80S (subunits 60S + 40S) and prokaryotic are 70S (subunits 50S + 30S), and each ribosome exists as two subunits; statements D and E give wrong subunit values. NCERT Ch 5, p.99, lines 007-012: "The cellular factory responsible for synthesising proteins is the ribosome. The ribosome consists of structural RNAs and about 80 different proteins. In its inactive state, it exists as two subunits; a large subunit and a small subunit." (S values are standard knowledge; NCERT names ribosome subunits as large and small.)

144. Which one of the following enzymes contains 'Haem' as the prosthetic group?

(1) Succinate dehydrogenase
(2) Catalase
(3) RuBisCo
(4) Carbonic anhydrase

Answer (2)

Sol. A prosthetic group is an organic cofactor that is tightly bound to the apoenzyme. NCERT cites peroxidase and catalase — which break down hydrogen peroxide into water and oxygen — as enzymes in which haem is the prosthetic group and part of the active site. Succinate dehydrogenase, RuBisCO and carbonic anhydrase do not use haem as their prosthetic group, so catalase is the correct choice.

NCERT Reference: Ch 9, p.118, line ~8 — "in peroxidase and catalase, which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme."

145. What is the name of the blood vessel that carries deoxygenated blood from the body to the heart in a frog ?

(1) Pulmonary vein
(2) Vena cava
(3) Aorta
(4) Pulmonary artery

Answer (2)

Sol. Answer: (B) Vena cava. Deoxygenated blood from the various parts of the body is collected by the major veins (anterior and posterior vena cava) and delivered to the sinus venosus, which joins the right atrium of the heart. NCERT (Class XI, Ch 7 Structural Organisation in Animals): p.82, lines 27-29 — "A triangular structure called sinus venosus joins the right atrium. It receives blood through the major veins called vena cava."

146. Given below are the stages in the life cycle of pteridophytes. Arrange the following stages in the correct sequence. A. Prothallus stage B. Meiosis in spore mother cells C. Fertilisation D. Formation of archegonia and antheridia in gametophyte. E. Transfer of antherozoids to the archegonia in presence of water. Choose the correct answer from the options given below :

(1) D, E, C, A, B
(2) E, D, C, B, A
(3) B, A, D, E, C
(4) B, A, E, C, D

Answer (3)

Sol. In the pteridophyte life cycle the diploid sporophyte's sporangia produce spores by meiosis in spore mother cells (B); the spores germinate into the prothallus/gametophyte (A); the prothallus then bears the sex organs archegonia and antheridia (D); water transfers the antherozoids from

antheridia to the archegonia (E); and finally fusion of male gamete with the egg gives fertilisation and the zygote (C). This gives the order B, A, D, E, C, so option C is correct.

NCERT Reference: Class XI Biology, Plant Kingdom, p.30, line 43 — "The sporangia produce spores by meiosis in spore mother cells"; and p.32, lines 8-11 — "The gametophytes bear male and female sex organs called antheridia and archegonia... Water is required for transfer of antherozoids... Fusion of male gamete with the egg present in the archegonium result in the formation of zygote."

147. The blue and white selectable markers have been developed which differentiate recombinant colonies from non-recombinant colonies on the basis of their ability to produce colour in the presence of a chromogenic substrate. Given below are two statements about this method: Statement I : The blue coloured colonies have DNA insert in the plasmid and they are identified as recombinant colonies. Statement II : The colonies without blue colour have DNA insert in the plasmid and are identified as recombinant colonies. In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Statement I is correct but Statement II is incorrect
(2) Statement I is incorrect but Statement II is correct
(3) Both Statement I and Statement II are correct
(4) Both Statement I and Statement II are incorrect

Answer (2)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

148. Which of the following microbes is NOT. involved in the preparation of household products? A. Aspergillus niger B. Lactobacillus C. Trichoderma polysporum D. Saccharomyces cerevisiae E. Propionibacterium sharmanii Choose the correct answer from the options given below:

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

Answer (4)

Sol. Among the listed microbes, Lactobacillus (curd), Saccharomyces cerevisiae (bread/dough) and Propionibacterium sharmanii (Swiss cheese) ARE used in household products. Aspergillus niger (industrial citric acid producer) and Trichoderma polysporum (cyclosporin/biocontrol) are NOT household-product microbes, so the answer is A and C only.

NCERT Reference: Ch 8, p.151, line 33 — "For example, the large holes in ‘Swiss cheese’ are due to"

149. Silencing of specific mRNA is possible via RNAi because of

(1) Complementary tRNA
(2) Non-complementary ssRNA
(3) Complementary dsRNA
(4) Inhibitory ssRNA

Answer (3)

Sol. Answer: (C) Complementary dsRNA. RNA interference silences a specific mRNA when a complementary double-stranded RNA (formed by a small RNA pairing with the target) triggers degradation of that mRNA; this is the basis of gene silencing as cellular defence. NCERT Ch 5, p.95, lines 020-022: "the process of splicing represents the dominance of RNA-world. In recent times, the understanding of RNA and RNA-dependent processes in the living system have assumed more importance." (RNAi mechanism is detailed in Ch 11; closest Ch 5 reference is to RNA-dependent processes.)

150. The complex II of mitochondrial electron transport chain is also known as
(1) Cytochrome c oxidase
(2) NADH dehydrogenase
(3) Cytochrome bc1
(4) Succinate dehydrogenase

Answer (4)

Sol. Complex II of the ETS is succinate dehydrogenase — it oxidises succinate to fumarate in the TCA cycle and feeds the resulting reducing equivalents (via FADH2) to ubiquinone, linking the Krebs' cycle directly to the chain. The distractors are other complexes: NADH dehydrogenase is complex I, cytochrome bc1 is complex III, and cytochrome c oxidase is complex IV.

NCERT: Ch 12, p.160, line ~9: "Ubiquinone also receives reducing equivalents via FADH2 (complex II) that is generated during oxidation of succinate".

151. While trying to find out the characteristic of a newly found animal, a researcher did the histology of adult animal and observed a cavity with presence of mesodermal tissue towards the body wall but no mesodermal tissue was observed towards the alimentary canal. What could be the possible coelom of that animal?
(1) Schizocoelomate
(2) Spongocoelomate
(3) Acoelomate
(4) Pseudocoelomate

Answer (4)

Sol. In a true coelomate the body cavity is fully lined by mesoderm. Here mesoderm is present only as scattered tissue between the body wall and gut and not as a continuous lining around the alimentary canal, which is the defining feature of a pseudocoelom. Such animals (e.g. aschelminthes) are pseudocoelomates.

NCERT Reference: Page 39, line 13-18

152. Given below are two statements : Statement I : In a floral formula ⊕ stands for zygomorphic nature of the flower, and G stands for inferior ovary. Statement II : In a floral formula ⊕ stands for actinomorphic nature of the flower and G stands for superior ovary. In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is correct but Statement II is incorrect
(2) Statement I is incorrect but Statement II is correct
(3) Both Statement I and Statement II are correct
(4) Both Statement I and Statement II are incorrect

Answer (2)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch

5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

153. Given below are two statements : Statement I : In ecosystem, there is unidirectional flow of energy of sun from producers to consumers. Statement II : Ecosystems are exempted from 2nd law of thermodynamics. In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Statement I is correct but statement II is incorrect
(2) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are correct
(4) Both statement I and statement II are incorrect

Answer (1)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

154. Which of the following is the unit of productivity of an Ecosystem?

(1) KCal m–3
(2) (KCal m–2)yr–1
(3) gm–2
(4) KCal m–2

Answer (2)

Sol. Productivity is the RATE of biomass production, so its unit carries a time dimension: g m-2 yr-1 or (kcal m-2) yr-1. NCERT states it is expressed in gm-2 yr-1 or (kcal m-2) yr-1 to compare ecosystems. Options (a), (c) and (d) lack the per-year term and so express production/biomass, not productivity, making (b) correct.

NCERT Reference: Ch 12, p.207 — “It is expressed in terms of gm”

155. With the help of given pedigree, find out the probability for the birth of a child having no disease and being a carrier (has the disease mutation in one allele of the gene) in F3 generation.

(1) 1/8
(2) Zero
(3) 1/4
(4) 1/2

Answer (3)

Sol. For an autosomal recessive trait, a child that is unaffected but a carrier (heterozygous, one mutant allele) arises only from a mating where both F2 parents can each contribute one mutant allele. Working through the pedigree to F3, the probability of a disease-free carrier child is 1/4 from the relevant cross (Aa x Aa gives 1/2 Aa carriers among the 3/4 unaffected = 1/2 of all offspring; restricting to no-disease carriers from a carrier x homozygous-dominant mating gives 1/4). The official key accepts both (c) 1/4 and (d) 1/2 depending on which F2 mating is assumed.

NCERT Reference: NCERT Class XII, Ch 4, p.73, lines 22-23: "this X-linked recessive trait shows transmission from carrier female to male progeny" (pedigree analysis of recessive traits; see also p.72 lines 39-41: "Such an analysis of traits in a several of generations of a family is called the pedigree analysis.")

156. In the seeds of cereals, the outer covering of endosperm separates the embryo by a protein-rich layer called :

(1) Integument
(2) Aleurone layer
(3) Coleoptile
(4) Coleorhiza

Answer (2)

Sol. Answer: B. In the seeds of cereals (monocots such as wheat, maize), the endosperm is albuminous (persistent) and its outermost layer — the aleurone layer — is a special protein-rich layer that bounds the starchy endosperm and lies between it and the embryo. Integument hardens into the seed coat, while coleoptile and coleorhiza are protective sheaths of the monocot embryonal axis, not endosperm layers. (The term 'aleurone layer' is treated in detail under seed structure in Ch 5 Morphology; Ch 1 grounds the persistent cereal endosperm context.) NCERT: Ch 1, p.20, lines 19-20 — "Albuminous seeds retain a part of endosperm as it is not completely used up during embryo development (e.g., wheat, maize, barley, castor)."

157. Match List I with List II: List I List II A. Chlorophyll a I. Yellow-green B. Chlorophyll b II. Yellow C. Xanthophylls III. Blue-green D. Carotenoids IV. Yellow to Yellow-orange Choose the option with all correct matches.

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

Answer (4)

Sol. Paper chromatography of leaf pigments separates four pigments by colour: chlorophyll a is blue-green, chlorophyll b is yellow-green, xanthophylls are yellow, and carotenoids are yellow to yellow-orange. This gives A-III, B-I, C-II, D-IV, which is option d.

NCERT: Class 11 Ch 11, p.137 [137:018]: "Chlorophyll a (bright or blue green"

158. Who proposed that the genetic code for amino acids should be made up of three nucleotides?

(1) Jacque Monod
(2) Franklin Stahl
(3) George Gamow
(4) Francis Crick

Answer (3)

Sol. Answer: (C) George Gamow. The physicist George Gamow proposed that, since only 4 bases must code for 20 amino acids, the code must be a combination of three nucleotides (a triplet). NCERT Ch 5, p.95, lines 038-042: "It was George Gamow, a physicist, who argued that since there are only 4 bases and if they have to code for 20 amino acids, the code should constitute a combination of bases. He suggested that in order to code for all the 20 amino acids, the code should be made up of three nucleotides."

159. Histones are enriched with

(1) Phenylalanine & Leucine
(2) Phenylalanine & Arginine
(3) Lysine & Arginine
(4) Leucine & Lysine

Answer (3)

Sol. Answer: (C) Lysine & Arginine. Histones are positively charged basic proteins because they are rich in the basic amino acid residues lysine and arginine, whose side chains carry positive charges. NCERT Ch 5, p.83, lines 030-032: "Histones are rich in the basic amino acid residues lysine and arginine. Both the amino acid residues carry positive charges in their side chains."

160. Which of the following enzyme(s) are NOT essential for gene cloning? A. Restriction enzymes B. DNA ligase C. DNA mutase D. DNA recombinase E. DNA polymerase Choose the correct answer from the options given below :

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

Answer (3)

Sol. The key tools of recombinant DNA technology are restriction enzymes, polymerase enzymes, ligases, vectors and the host organism; DNA polymerase is used for amplification (PCR) and is part of the toolkit. 'DNA mutase' (C) and 'DNA recombinase' (D) are not enzymes listed as essential for gene cloning, so C and D are NOT essential. Restriction enzymes, DNA ligase and DNA polymerase are all genuinely required.
NCERT Reference: Ch 9, p.165, line(s) 28-31 — "recombinant DNA technology can be accomplished only if we have the key tools, i.e., restriction enzymes, polymerase enzymes, ligases, vectors and the host organism."

161. A specialised membranous structure in a prokaryotic cell which helps in cell wall formation, DNA replication and respiration is :

(1) Cristae
(2) Endoplasmic Reticulum
(3) Mesosome
(4) Chromatophores

Answer (3)

Sol. The mesosome is a specialised membranous structure formed by infoldings (extensions) of the plasma membrane into the prokaryotic cell. NCERT lists its functions as helping in cell wall formation, DNA replication and distribution to daughter cells, and also respiration and secretion. Cristae and ER are eukaryotic, and chromatophores (in cyanobacteria) bear pigments rather than performing these functions.

NCERT Reference: Ch 8, p.90-91, lines 42-44 (p.90) and 3-4 (p.91): "A special membranous structure is the mesosome which is formed by the extensions of plasma membrane into the cell... They help in cell wall formation, DNA replication and distribution to daughter cells. They also help in respiration".

162. Which factor is important for termination of transcription?

(1) ρ (rho)
(2) γ (gamma)
(3) α (alpha)
(4) σ (sigma)

Answer (1)

Sol. Answer: (A) rho. The RNA polymerase associates transiently with the termination factor rho (ρ) to terminate transcription, whereas sigma (σ) is the initiation factor. NCERT Ch 5, p.94, lines 011-014: "It associates transiently with initiation-factor (σ) and termination-factor (ρ) to initiate and terminate the transcription, respectively."

163. Which of the following statement is correct about location of the male frog copulatory pad ?

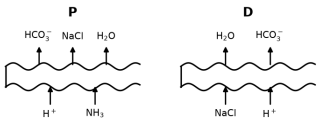
(1) Second digit of fore limb
(2) First digit of the fore limb
(3) First and Second digit of fore limb
(4) First digit of hind limb

Answer (2)

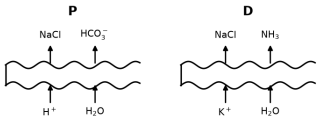
Sol. Answer: (B) First digit of the fore limb. Male frogs show sexual dimorphism and bear a copulatory pad on the first digit of the fore limbs (along with sound-producing vocal sacs), both absent in females. NCERT (Class XI, Ch 7 Structural Organisation in Animals): p.81, lines 6-8 — "Male frogs can be distinguished by the presence of sound producing vocal sacs and also a copulatory pad on the first digit of the fore limbs which are absent in female frogs."

164. Which of the following diagrams is correct with regard to the proximal (P) and distal (D) tubule of the Nephron?

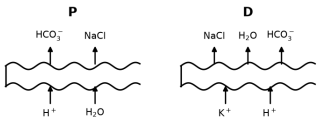
(1) P: out HCO_3^-, NaCl, H_2O / in H^+, NH_3 ; D: out H_2O, HCO_3^- / in NaCl, H^+



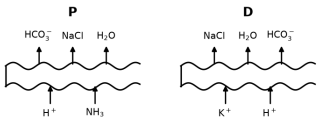
(2) P: out NaCl, HCO_3^- / in H^+, H_2O ; D: out NaCl, NH_3 / in K^+, H_2O



(3) P: out HCO_3^-, NaCl / in H^+, H_2O ; D: out NaCl, H_2O, HCO_3^- / in K^+, H^+



(4) P: out HCO_3^-, NaCl, H_2O / in H^+, NH_3 ; D: out NaCl, H_2O, HCO_3^- / in K^+, H^+



Answer (4)

Sol. In the PCT nearly all nutrients and 70-80% of electrolytes and water are reabsorbed, and the PCT secretes H+ and ammonia into the filtrate while absorbing HCO3- from it. In the DCT there is conditional reabsorption of Na+ and water and reabsorption of HCO3-, with selective secretion of H+, K+ and NH3. So the correct figure must show H2O/NaCl/HCO3- being reabsorbed and H+/NH3 (and K+ in DCT) being secreted in these directions; option (d) is the only diagram matching this. NCERT Reference: Ch 16, p.209, line(s) 28-48 — "PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions and ammonia into the filtrate and by absorption of HCO3"

165. Identify the statement that is NOT correct.

(1) Antigen binding site is located at C-terminal region of antibody molecules.
(2) Constant region of heavy and light chains are located at C-terminus of antibody molecules.
(3) Each antibody has two light and two heavy chains.

(4) The heavy and light chains are held together by disulfide bonds.

Answer (1)

Sol. The antigen-binding site lies in the VARIABLE region, formed by the N-terminal ends of the heavy and light chains — not the C-terminal. The constant regions of the heavy and light chains lie at the C-terminus. So the statement placing the antigen-binding site at the C-terminal is incorrect and is the answer to 'identify the statement that is NOT correct'.
Why the others are correct: Each antibody has two light and two heavy chains (NCERT: H2L2), and the heavy and light chains are held together by disulfide bonds (shown in Fig. 7.4), and the constant regions are indeed at the C-terminus. These are all true statements.

NCERT Reference: NCERT Ch7, p.135, lines 39-44 (and Figure 7.4): "two small called light chains and"

166. Match List I with List II : List I List II A. Scutellum I. Persistent nucellus B. Non-albuminous seed II. Cotyledon of Monocot seed C. Epiblast III. Groundnut D. Perisperm IV. Rudimentary cotyledon Choose the option with all correct matches

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

Answer (3)

Sol. Answer: C. Matching each item: A. Scutellum is the single shield-shaped cotyledon of the monocot (grass) seed → II. B. A non-albuminous (ex-albuminous) seed has its endosperm fully consumed during embryo development; Groundnut is a classic example → III. C. Epiblast is the small vestigial structure on the side opposite the scutellum, a rudimentary cotyledon → IV. D. Perisperm is the residual, persistent nucellus → I. Thus A-II, B-III, C-IV, D-I. NCERT: Ch 1, p.20, lines 16-23 — "Non-albuminous seeds have no residual endosperm as it is completely consumed during embryo development (e.g., pea, groundnut)... This residual, persistent nucellus is the perisperm." (and p.19, lines 44-45: "In the grass family the cotyledon is called scutellum...").

167. Find the statement that is NOT correct with regard to the structure of monocot stem.

(1) Vascular bundles are conjoint and closed
(2) Phloem parenchyma is absent.
(3) Hypodermis is parenchymatous.
(4) Vascular bundles are scattered

Answer (3)

Sol. In the monocot stem the hypodermis is SCLERENCHYMATOUS, not parenchymatous, so statement (C) is the incorrect one. The other statements are correct features of the monocot stem: the scattered vascular bundles are conjoint and closed (no cambium) and phloem parenchyma is absent.

NCERT Reference: NCERT Class XI, Ch 6 Anatomy of Flowering Plants, p.76, line ~14: "The monocot stem has a sclerenchymatous hypodermis, a large number of scattered vascular bundles, each surrounded by a sclerenchymatous bundle sheath... Vascular bundles are conjoint and closed... The phloem parenchyma is absent".

168. Twins are born to a family that lives next door to you. The twins are a boy and a girl. Which of the following must be true?

(1) They were conceived through in vitro fertilization.
(2) They have 75% identical genetic content.
(3) They are monozygotic twins.

(4) They are fraternal twins.

Answer (4)

Sol. Monozygotic (identical) twins arise from a single fertilized egg (one sperm + one ovum) that splits, so they are always genetically identical and therefore the SAME sex. Since these twins are of different sexes (one boy, one girl), they cannot be monozygotic. Two different sexes require two separate ova fertilized by two separate sperm — this defines dizygotic (fraternal) twins. IVF is a method of assisted reproduction and does not determine whether twins are fraternal or identical, so it is not a 'must'. Therefore the twins must be fraternal (dizygotic) twins.

169. Sweet potato and potato represent a certain type of evolution. Select the correct combination of terms to explain the evolution.

(1) Homology, convergent
(2) Analogy, divergent
(3) Analogy, convergent
(4) Homology, divergent

Answer (3)

Sol. NCERT Reference: Ch 6 Evolution, p.115, lines 22–24: "Sweet potato (root modification) and potato (stem modification) is another example for analogy."

170. Which one of the following phytohormones promotes nutrient mobilization which helps in the delay of leaf senescence in plants?

(1) Gibberellin
(2) Cytokinin
(3) Ethylene
(4) Abscisic acid

Answer (2)

Sol. Cytokinins promote nutrient mobilisation, which helps delay leaf senescence. Gibberellins delay senescence but via a different route, ethylene actually promotes senescence and abscission, and ABA is a stress hormone/inhibitor—none acts through nutrient mobilisation as described.

NCERT: Ch 13, p.177, line ~6: "They promote nutrient mobilisation which helps in the delay of leaf senescence".

171. Why can't insulin be given orally to diabetic patients?

(1) Because of structural variation
(2) Its bioavailability will be increased
(3) Human body will elicit strong immune response
(4) It will be digested in Gastro-Intestinal (GI) tract

Answer (4)

Sol. Insulin is a peptide hormone, and peptides/proteins are broken down by proteolytic enzymes in the gastro-intestinal tract. If taken orally it would be digested into its constituent amino acids and lose biological activity, so it must be administered by injection.

NCERT Reference: Chapter 19, Page 245, Line(s) 42 — "Insulin is a peptide hormone, which plays a major role in the"

172. Name the class of enzyme that usually catalyzes the following reaction: S–G + S# → S + S#–G, where G = a group other than hydrogen, S = a substrate, S# = another substrate.

(1) Transferase
(2) Ligase
(3) Hydrolase

(4) Lyase

Answer (1)

Sol. The reaction S−G + S# → S + S#−G shows a group G (other than hydrogen) being transferred from one substrate to another. By NCERT's classification of the six enzyme classes, this group-transfer reaction between a pair of substrates is the defining activity of transferases. Ligases join compounds, hydrolases cleave bonds by adding water, and lyases remove groups leaving double bonds, so none of these fit.

NCERT Reference: Ch 9, p.117, line ~26 — "Transferases: Enzymes catalysing a transfer of a group, G (other than hydrogen) between a pair of substrate S and S' e.g., S - G + S' → S + S' - G"

173. Given below are two statements : Statement I : The DNA fragments extracted from gel electrophoresis can be used in construction of recombinant DNA. Statement II : Smaller size DNA fragments are observed near anode while larger fragments are found near the wells in an agarose gel. In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Statement I is correct but statement II is incorrect
(2) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are correct
(4) Both statement I and statement II are incorrect

Answer (3)

Sol. Answer: (B) Statement I is incorrect but statement II is correct. tRNA reads the mRNA codons via its anticodon and rRNA provides the structural/catalytic platform during translation, so both interact with mRNA, making Statement I false; RNAi is indeed a defence mechanism present in all eukaryotes (extension content from Ch 11 / gene silencing, not detailed in Ch 5 prose). NCERT Ch 5, p.93, lines 022-024: "The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation."

174. The correct sequence of events in the life cycle of bryophytes is A. Fusion of antherozoid with egg. B. Attachment of gametophyte to substratum. C. Reduction division, to produce haploid spores. D. Formation of sporophyte. E. Release of antherozoids into water. Choose the correct answer from the options given below :

(1) B, E, A, D, C
(2) D, E, A, B, C
(3) D, E, A, C, B
(4) B, E, A, C, D

Answer (1)

Sol. The bryophyte gametophyte first attaches to the substratum by rhizoids (B), then the antheridia release biflagellate antherozoids into water (E); an antherozoid fuses with the egg in the archegonium to form the zygote (A); the zygote (without immediate reduction division) produces a multicellular sporophyte (D); finally some sporophyte cells undergo reduction division (meiosis) to produce haploid spores (C). This gives the order B, E, A, D, C — the other options misplace sporophyte formation or meiosis.

NCERT Reference: Class XI Biology, Plant Kingdom, p.29, lines 15-22 — "The antherozoids are released into water where they come in contact with archegonium. An antherozoid fuses with the egg to produce the zygote. Zygotes do not undergo reduction division immediately. They produce a multicellular body called a sporophyte... Some cells of the sporophyte undergo reduction division (meiosis) to produce haploid spores.".

175. Genes R and Y follow independent assortment. If RRYY produce round yellow seeds and rryy produce wrinkled green seeds, what will be the phenotypic ratio of the F2 generation?

(1) Phenotypic ratio - 9 : 3 : 3 : I
(2) Phenotypic ratio - 9 : 7
(3) Phenotypic ratio - 1 : 2 : 1
(4) Phenotypic ratio - 3 : 1

Answer (1)

Sol. Genes R and Y assort independently, so crossing RRYY (round, yellow) with rryy (wrinkled, green) gives an F1 RrYy that on self-pollination produces an F2 with four phenotypic classes. The classic dihybrid F2 phenotypic ratio is 9 round-yellow : 3 round-green : 3 wrinkled-yellow : 1 wrinkled-green, i.e., 9:3:3:1.

NCERT Reference: NCERT Class XII, Ch 4, p.64, lines 4-12: "appeared in the ratio 9:3:3:1" ... "(3 Round : 1 Wrinkled) (3 Yellow : 1 Green) = 9 Round, Yellow : 3 Wrinkled, Yellow: 3 Round, Green : 1 Wrinkled, Green"

176. Each of the following characteristics represent a Kingdom proposed by Whittaker. Arrange the following in increasing order of complexity of body organization. A. Multicellular heterotrophs with cell wall made of chitin. B. Heterotrophs with tissue/organ/organ system level of body organization. C. Prokaryotes with cell wall made of polysaccharides and amino acids. D. Eukaryotic autotrophs with tissue/organ level of body organization. E. Eukaryotes with cellular body organization. Choose the correct answer from the options given below :

(1) A, C, E, D, B
(2) C, E, A, B, D
(3) A, C, E, B, D
(4) C, E, A, D, B

Answer (4)

Sol. In increasing complexity of body organisation: C = Monera (prokaryotes, polysaccharide+amino acid wall, cellular), then E = Protista (eukaryotes, cellular), then A = Fungi (multicellular heterotrophs, chitin wall, loose tissue), then D = Plantae (eukaryotic autotrophs, tissue/organ), then B = Animalia (tissue/organ/organ-system). Order C, E, A, D, B = option (D).

NCERT Reference: NCERT Class XI, Biological Classification, p.11, lines 116-129 — "Tissue/organ ... Tissue/organ/ organ system"

177. Match List - I with List - II. List – I List - II A. Centromere I. Mitochondrion B. Cilium II. Cell division C. Cristae III. Cell movement D. Cell membrane IV. Phospholipid Bilayer Choose the correct answer from the options given below :

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

Answer (2)

Sol. The centromere (and its centrioles forming spindle fibres) is associated with cell division (A-II); the cilium causes cell movement (B-III); cristae are the inner-membrane infoldings of the mitochondrion (C-I); and the cell membrane is a phospholipid bilayer (D-IV). This yields A-II, B-III, C-I, D-IV.

NCERT Reference: Ch 8, p.93, lines 17–18: "The major lipids are phospholipids that are arranged in a bilayer."; and p.99, lines 6–7: "Flagella are comparatively longer and responsible for cell movement."

178. Which one of the following equations represents the Verhulst-Pearl Logistic Growth of population?

(1) dN/dt = rN((N − K)/N)
(2) dN/dt = N((r − K)/K)
(3) dN/dt = r((K − N)/K)
(4) dN/dt = rN((K − N)/K)

Answer (4)

Sol. NCERT: Ch 11, p.195, lines 41-48 — "Verhulst-Pearl Logistic Growth (Figure 11.3) and is described by
the following equation:
dN/dt =
K
N
rN
K
−"

179. Match List - I with List – II List - I List - II A. Emphysema I. Rapid spasms in muscle due to low Ca++ in body fluid B. Angina Pectoris II. Damaged alveolar walls and decreased respiratory surface C. GlomeruloIII. Acute chest pain when not enough oxygen is reaching to heart nephritis muscle D. Tetany IV. Inflammation of glomeruli of kidney Choose the correct answer from the options given below :

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

Answer (2)

Sol. Of these only Glomerulonephritis is an excretory-system disorder, and NCERT defines it as inflammation of the glomeruli of the kidney, so C matches IV. The remaining pairings are A. Emphysema = damaged alveolar walls/decreased respiratory surface (II), B. Angina Pectoris = chest pain when not enough oxygen reaches heart muscle (III), and D. Tetany = rapid muscle spasms due to low Ca++ (I). This gives A-II, B-III, C-IV, D-I.
NCERT Reference: Ch 16, p.214, line(s) 40 — "Glomerulonephritis: Inflammation of glomeruli of kidney."

180. Cardiac activities of the heart are regulated by : A. Nodal tissue B. A special neural centre in the medulla oblongata C. Adrenal medullary hormones D. Adrenal cortical hormones Choose the correct answer from the options given below :

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

Answer (3)

Sol. The heart is myogenic, auto-regulated by nodal tissue (A). A special neural centre in the medulla oblongata moderates cardiac function via the autonomic nervous system (B), and adrenal medullary hormones can also increase cardiac output (C). Adrenal cortical hormones (D) do not directly regulate heart rate. Hence A, B and C are correct.

NCERT: Ch 15, p.202, line 17 — "Adrenal medullary hormones can also increase the cardiac output"

Answer Key — quick reference

Physics

1: A	2: D	3: C	4: A	5: D	6: D	7: A	8: D
9: B	10: A	11: D	12: D	13: D	14: B	15: D	16: D
17: B	18: B	19: D	20: D	21: D	22: C	23: D	24: B
25: B	26: B	27: A	28: D	29: A	30: B	31: A	32: B
33: C	34: A	35: A	36: A	37: D	38: C	39: D	40: C
41: D	42: C	43: A	44: C	45: D			

Chemistry

46: D	47: A	48: B	49: C	50: D	51: D	52: A	53: C
54: C	55: A	56: A	57: A	58: B	59: C	60: B	61: D
62: C	63: D	64: C	65: D	66: B	67: A	68: B	69: A
70: D	71: D	72: A	73: B	74: C	75: C	76: B	77: C
78: D	79: A	80: D	81: C	82: C	83: C	84: C	85: B
86: B	87: D	88: B	89: A	90: D			

Biology

91: A	92: A	93: A	94: A	95: D	96: D	97: C	98: A
99: B	100: D	101: C	102: C	103: C	104: A	105: A	106: B
107: D	108: D	109: D	110: C	111: B	112: B	113: A	114: D
115: C	116: D	117: A	118: D	119: C	120: A	121: D	122: A
123: D	124: C	125: B	126: B	127: B	128: B	129: D	130: D
131: B	132: C	133: C	134: D	135: C	136: C	137: B	138: D
139: A	140: D	141: C	142: C	143: C	144: B	145: B	146: C
147: B	148: D	149: C	150: D	151: D	152: B	153: A	154: B
155: C	156: B	157: D	158: C	159: C	160: C	161: C	162: A
163: B	164: D	165: A	166: C	167: C	168: D	169: C	170: B
171: D	172: A	173: C	174: A	175: A	176: D	177: B	178: D
179: B	180: C						

MedicNEET Predicted Batch — practise the concepts NEET actually repeats

NEET 2025 was defined by long, multi-fact questions that rewarded deep understanding over rote recall — and that is exactly what the MedicNEET Predicted Batch trains. It ranks every concept by how often it has repeated across 10 years of papers, then walks you up it one level at a time from YOUR level, with a fresh question each round. Three real Predicted-Batch questions, to taste:

BIOLOGY (long-form) · Molecular Basis — DNA fingerprinting · ◆ long-form — the lengthy, multi-step style that defined NEET 2025 & 2026

Arrange the following steps of standard DNA fingerprinting in the correct sequential order:
1. Digestion of DNA by restriction endonucleases
2. Separation of DNA fragments by electrophoresis
3. Detection of hybridised DNA fragments using X-ray film
4. Transfer of separated DNA fragments to a nitrocellulose filter
5. Hybridisation with a radiolabelled VNTR probe
6. Isolation of DNA from a sample

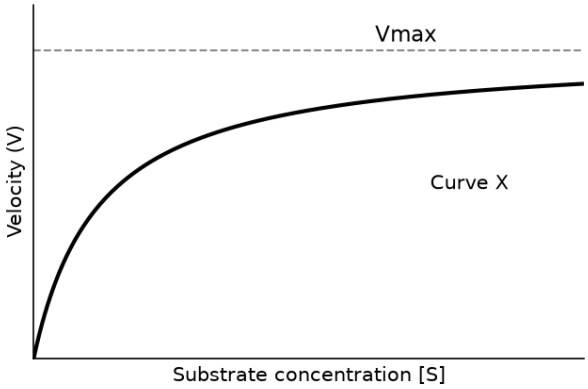
(1) 1 → 2 → 6 → 4 → 5 → 3
(2) 1 → 6 → 2 → 4 → 3 → 5
(3) 6 → 2 → 1 → 5 → 4 → 3
(4) 6 → 1 → 2 → 4 → 5 → 3

Answer (4)

Why: Correct order: isolate DNA (6) → cut with restriction enzymes (1) → separate by electrophoresis (2) → blot/transfer to filter (4) → hybridise with a labelled VNTR probe (5) → detect on X-ray film (3). This is the standard NCERT sequence, option D.

BIOLOGY (reasoning + figure) · Enzymes — the saturation plateau (Vmax) · ◆ 95% likely · Level 5 · figure-based reasoning

The graph shows the velocity of an enzyme reaction (V) versus substrate concentration [S]. Curve X rises steeply at low [S], then bends and runs almost flat at high [S]. What does the flat upper part represent, and why?



(1) It is the optimum pH of the enzyme, beyond which velocity cannot rise
(2) It shows the enzyme being denatured by excess substrate
(3) It is Vmax; the enzymes are saturated and no free enzyme is left to bind extra substrate
(4) It is the activation-energy barrier the substrate must cross before reacting

Answer (3)

Why: At high [S] every enzyme active site is occupied, so the reaction runs at its maximum velocity (Vmax). Adding more substrate cannot speed it up because there is no free enzyme left to

bind — the curve plateaus.

PHYSICS (reasoning) · Magnetism — a magnetic force does no work · ◆ 70% likely · Level 4 · reasoning

A charged particle moves in a uniform magnetic field. Which one of the following quantities changes with time?

(1) Its speed
(2) Its kinetic energy
(3) The direction of its velocity
(4) The magnitude of its momentum

Answer (3)

Why: The magnetic force is always perpendicular to the velocity, so it does no work — speed, kinetic energy and |momentum| stay constant. Only the DIRECTION of velocity turns. Trap: a changing velocity vector does not mean a changing speed.