18/06/2025

Code-A_(Phase-1)

Aakash
Medical | IIT-JEE | Foundations

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***011-47623456

MM : 720 Term Exam for NEET-2026_CF+OYM(P1)-TE01A (Class-XI & XII) **Time : 180 Min.**

PHYSICS

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CHEMISTRY

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ZOOLOGY

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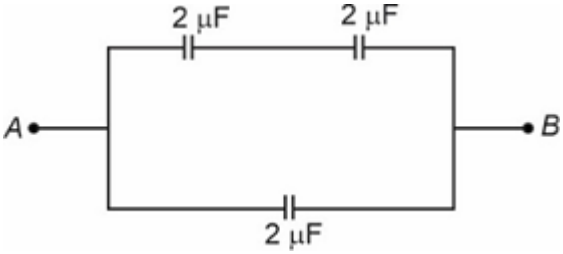
180. (3)

Hints and Solutions

PHYSICS

(1) **Answer :** (3)
Solution:
The circuit can be redrawn as

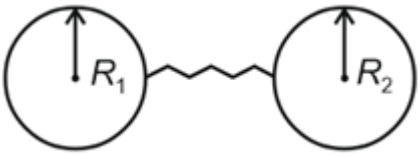


C_{AB} = 3 μF

(2) **Answer :** (1)
Solution:
Since capacitor is connected to battery.
⇒ therefore its potential is same
⇒ capacitance $C' = KC$ ⇒ increases
⇒ $U = \frac{1}{2}C'V^2$ ⇒ increases
⇒ $Q = C'V$ ⇒ increases

(3) **Answer :** (4)
Solution:
From Gauss's law
$\oint \vec{E} . \vec{ds} = \frac{q_{enclosed}}{\varepsilon_o}$
Here E is net electric field due to all charges

(4) **Answer :** (3)
Solution:
$V_1 = V_2$
$\frac{q_1}{R_1} = \frac{q_2}{R_2}$



$\frac{\sigma_1}{\sigma_2} = \frac{\frac{q_1}{4\pi R_1^2}}{\frac{q_2}{4\pi R_2^2}} = \frac{q_1}{q_2}\frac{R_2^2}{R_1^2}$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}\frac{R_2^2}{R_1^2} = \frac{R_2}{R_1}$

(5) **Answer :** (2)
Solution:
$F = \frac{kq_1q_2}{r^2}$
$12 = \frac{K(2)(2)}{r^2}$ ...(i)
$q'_1 = -2\ \text{C},\ \ q'_2 = -6\ \text{C}$
$F' = \frac{K(-2)(-6)}{r^2}$ ...(ii)
$\frac{12}{F'} = \frac{K(2)(2)}{K(2)(6)}$

⇒ F' = 36 N, repulsive because both charges have same sign.

(6) **Answer :** (3)
Solution:
Since $R >> L$, the given arrangement can be treated as electric dipole.
Electric field due to a dipole at any arbitrary point (R, θ) is
$E = \frac{P}{4\pi\varepsilon_0 R^3}\sqrt{3\cos^2\theta + 1}$
$E \propto \frac{1}{R^3}$

(7) **Answer :** (3)
Solution:
$\vec{E} = -\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial z}\hat{k}$
$\vec{E} = -4x\hat{i}$
$= -8\hat{i}$ V/m

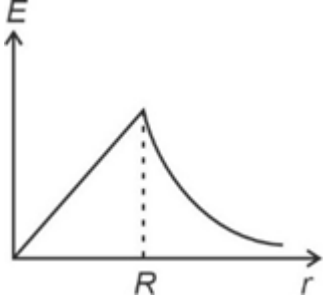
(8) **Answer :** (1)
Solution:
A neutral body is charged positively when it loses electrons and hence the mass of the body will decrease.

(9) **Answer :** (2)
Solution:
Magnitude of charge ∝ number of electric field lines
$\Rightarrow \frac{|q_1|}{|q_2|} = \frac{12}{8}$
$\therefore |q_1| > |q_2|$

(10) **Answer :** (2)
Solution:
Potential energy $(U) = \frac{Kq_1q_2}{r}$
$U_i = \frac{K\times 1\times 2}{1} = 2K$ ...(i)
$U_f = 0$ ...(ii)
$W_{ext} = \Delta U \Rightarrow W_{ext} = U_f - U_i$
$W_{ext} = -2K$

(11) **Answer :** (2)
Solution:
Energy density
$u = \frac{\varepsilon_0 E^2}{2}$

(12) **Answer :** (3)
Solution:
For $r < R$, $E = \frac{kQr}{R^3}$
For $r \geq R$, $E = \frac{kQ}{r^2}$
Therefore, E vs r plot will be



(13) **Answer :** (3)
Solution:
In case of solid sphere,

$V_{\text{centre}} = \frac{3}{2}V_{\text{surface}}$

$= \frac{3}{2} \times 10$

= 15 V

(14) Answer : (3)

Solution:

Gauss's law is based on the inverse-square dependence on distance inherent in Coulomb's law and is true for any closed surface.

(15) Answer : (1)

Solution:

$\phi_{\text{net}} = \frac{q_{\text{en}}}{\varepsilon_0} \Rightarrow \phi_{\text{net}} = 2\phi - \phi = \frac{q}{\varepsilon_0}$

$q = \varphi\varepsilon_0$

(16) Answer : (1)

Solution:

For a point charge : $E = \frac{kq}{r^2}$

For a short dipole : $V = \frac{kP\cos\theta}{r^2}$

(17) Answer : (4)

Solution:

$C = \frac{\varepsilon_0}{d}\{KLx + L(L-x)\}$

$C = \frac{\varepsilon_0 L}{d}\{L + (K-1)x\}$

Now, $F = \frac{-dU}{dx}$

$U = \frac{Q^2}{2C}$

$\frac{du}{dx} = \frac{-Q^2}{2C^2} \times \frac{dC}{dx}$

$\frac{dC}{dx} = \frac{\varepsilon_0 L}{d}(K-1)$

$\therefore \frac{du}{dx} = \frac{-Q^2}{2C^2} \times \frac{\varepsilon_0 L}{d}(K-1)$

$= \frac{-Q^2 d(K-1)}{2\varepsilon_0 L[L+(K-1)x]^2}$

$F = \frac{-dU}{dX}$

$F = \frac{Q^2 d(K-1)}{2\varepsilon_0 L[L+(K-1)x]^2}$

(18) Answer : (2)

Solution:

Electric field due to infinitely long straight wire at a distance *r* is

$E = \frac{2k\lambda}{r}$

$= \frac{2\times 9\times 10^9}{10} \times \frac{3}{2} \times 10^4$

$= 27 \times 10^{12}$ N/C

$F = qE$

$= 10 \times 27 \times 10^{12}$

$= 27 \times 10^{13}$ N

(19) Answer : (2)

Solution:

$V = \frac{k.\vec{p}.\vec{r}}{r^3}$

$= \frac{kp\cos\theta}{r^2}$

$= \frac{9\times 10^9 \times 10^{-9}}{25\times 10^{-4}} \times \frac{3}{5}$

$= \frac{27\times 10^4}{125}$

= 2.16 kV

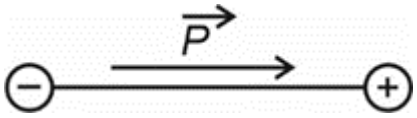
(20) **Answer :** (3)
Solution:
Apply energy conservation,
initial charge on system = final charge on system
$\Rightarrow CV_i = (C_1 + C_2)\, V_C$
$\Rightarrow 6 \times 10 = 9\, V_C$
$\Rightarrow V_C = \frac{60}{9} = \frac{20}{3}\text{V}$
$\Rightarrow$ Final charge on 6 μF capacitor = $6 \times 10^{-6} V_C$
$= 6 \times \frac{20}{3} \times 10^{-6}$
= 40 μ*C*

(21) **Answer :** (3)
Solution:
$E = \frac{-dV}{dr}$ =–(slope of *V* vs *r* curve)
$E_{\text{at } r = 7}$ = –(–5) = 5 V/cm

(22) **Answer :** (1)
Solution:
Distance $\frac{3R}{4}$ lies inside the conducting shell.
$\therefore E = 0$

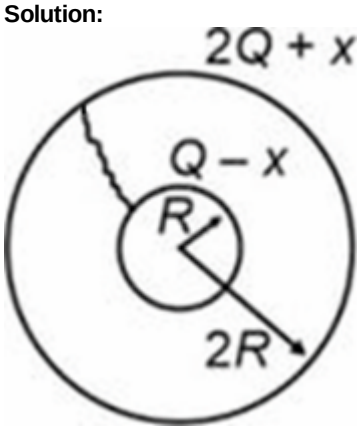
(23) **Answer :** (3)
Solution:
Force on charge one due to another charge is independent of presence and absence of any other charges.

(24) **Answer :** (3)
Solution:



Dipole moment vector points towards the positive charge.

(25) **Answer :** (3)
Hint:
Both shell acquire common potential after connection.
Solution:



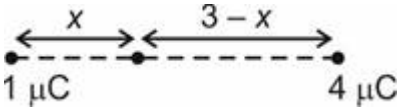
Let *x* charge flow from inner shell to outer shell.
$V_{inner} = \frac{K(Q-x)}{R} + \frac{K(2Q+x)}{2R}$
$V_{outer} = \frac{K(Q-x)}{2R} + \frac{K(2Q+x)}{2R}$
$V_{inner} = V_{outer}$
$\therefore Q = x$
Hence, net charge on outer shell = 3*Q*

(26) **Answer :** (2)
Solution:

$\phi = \int \vec{E} . d\vec{A}$

For a closed surface, in uniform electric field, the flux is zero. This is because number of field lines entering is equal to number of field lines exiting the closed surface.

(27) **Answer :** (1)
Solution:



$\frac{k1}{x^2} = \frac{k4}{(3-x)^2}$

$\frac{1}{x} = \frac{2}{3-x}$

$3 - x = 2x$

$x = 1$ m

(28) **Answer :** (1)
Solution:

$dV = \vec{E} \cdot \vec{d}$

$V_C - V_A = -Ed$

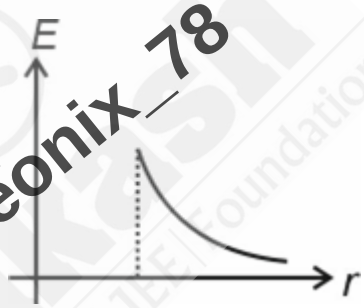
$|V_C - V_A| = Ed$

$V_C = V_B$

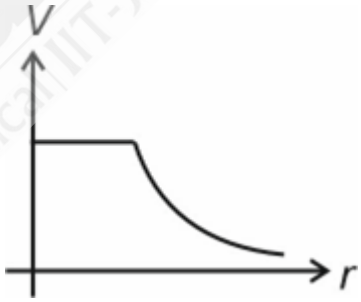
$\therefore |V_B - V_A| = Ed$

(29) **Answer :** (1)
Solution:

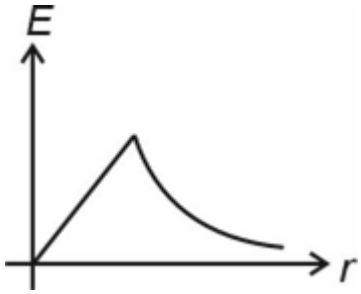
Electric field (*E*) due to charged spherical shell —



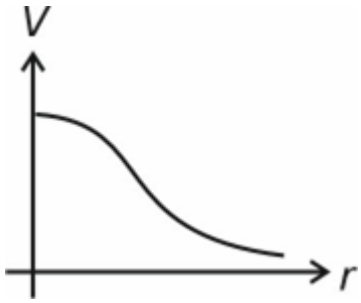
Electric potential (*V*) due to charged spherical shell —



Electric field (*E*) due to uniformly charged solid sphere —



Electric potential (*V*) due to uniformly charged solid sphere —



(30) **Answer :** (4)
Solution:
Force on positive charge in the direction of electric field. So, it will accelerate in the direction of electric field.

(31) **Answer :** (1)
Solution:
$U = \frac{1}{2}CV^2$
$\frac{1}{C_{\text{eff}}} = \frac{1}{4} + \frac{1}{4} + \frac{1}{3}$
$C_{\text{eff}} = \frac{6}{5}$ μF
$U = \frac{1}{2} \times \frac{6}{5} \times (10)^2$
= 60 μJ

(32) **Answer :** (3)
Solution:
$\phi_{total} = \frac{q_{in}}{\varepsilon_0}$
$\frac{q_{in}}{\varepsilon_0} = \frac{3}{2\varepsilon_0}$
$q_{\text{in}} = \frac{3}{2}$ C

(33) **Answer :** (4)
Solution:
$\vec{A} = \pi r^2 \hat{j}$
$\vec{E} = \hat{i} + 3\hat{j} + 10\hat{k}$
$Q = \vec{E} \cdot \vec{A}$
= 3 πr^2

(34) **Answer :** (4)
Solution:
$q\Delta V = \Delta K$
$4 \times 10^{-6} \Delta V = \frac{1}{2} \times 2 \times 10^{-3} \times 100$
$\Delta V = \frac{100 \times 10^{-3}}{4 \times 10^{-6}} = 25$ kV

(35) **Answer :** (2)
Solution:
Both spheres are identical therefore at equal potential, charge on the each sphere will be
$q = \frac{q_1 + q_2}{2}$
$= \frac{-60e + 20e}{2}$
$= -20e$

(36) **Answer :** (3)
Hint:
$v_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2}{R} G \frac{4}{3} \pi R^3 \rho}$
$v_e = R\sqrt{\frac{8}{3}\pi G\rho}$
Solution:
$v_e \propto R\sqrt{\rho}$

$\frac{v_e}{v_p} = \frac{R\sqrt{\rho}}{2R\sqrt{4\rho}} = \frac{1}{4}$

(37) Answer : (1)
Hint:
Use PE = 2 TE = –2KE
Solution:
PE $= E_{0,}$ KE $= \frac{-E_0}{2}$, TE $= \frac{E_0}{2}$

(38) Answer : (1)
Solution:
Amount of energy required = (S × ΔA) × 2
$= 0.03 \times 4\pi \left[r_2^2 - r_1^2\right] \times 2$
$= 0.03 \times 4\pi\left[\left(16-4\right) \times 10^{-4}\right] \times 2$
= 9.04×10^{-4} J

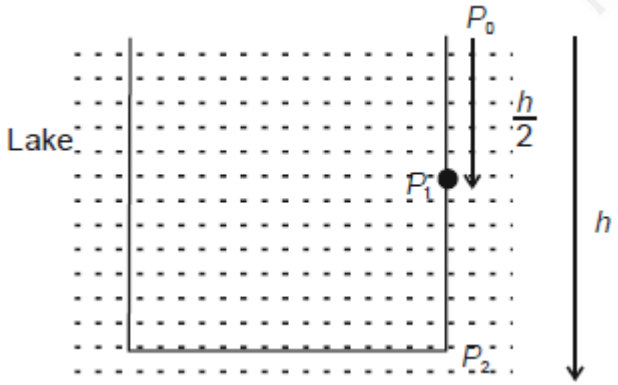
(39) Answer : (4)
Solution:
$g' = \frac{GM}{(R+h)^2} \Rightarrow g' = \frac{9}{\left(1+\frac{h}{R}\right)^2}$ and $g' = \frac{g}{2} \Rightarrow h = \left(\sqrt{2}-1\right)R$

(40) Answer : (3)
Solution:
In a stress vs strain graph, slope gives Young's modulus.
$Y_A = \tan 30^\circ = \frac{1}{\sqrt{3}}$
$Y_B = \tan 60^\circ = \sqrt{3}$
$\frac{Y_A}{Y_B} = \frac{\frac{1}{\sqrt{3}}}{\sqrt{3}} \Rightarrow \frac{Y}{Y_B} = \frac{1}{3} \Rightarrow Y_B = 3Y$

(41) Answer : (2)
Solution:
$\Delta l = \frac{FL}{AY}$
$= \frac{\left(100 \times 10^3 \text{N}\right) \times 1\,\text{m}}{3.14 \times \left(10^{-2}\text{m}\right)^2 \times 2 \times 10^{11}\text{N}/m^2}$
= 1.59 mm

(42) Answer : (3)
Solution:
Breaking stress is the property of material of wire.

(43) Answer : (3)
Solution:



$P_1 = P_0 + \rho g \frac{h}{2}$
$P_2 = P_0 + \rho g h$
Now, $P_1 = \frac{3}{5} \cdot P_2$
$\frac{P_1}{P_2} = \frac{3}{5}$

$\frac{P_0+10^4\frac{h}{2}}{P_0+10^4 h}=\frac{3}{5} \Rightarrow \frac{10^4\left(10+\frac{h}{2}\right)}{10^4(10+h)}=\frac{3}{5}$

$50+5\frac{h}{2}=30+3h$

$\frac{h}{2}=20$

$\boxed{h=40 \text{ m}}$

(44) Answer : (3)
Solution:

$\because \quad \frac{F_1}{A_1}=\frac{F_2}{A_2}$

$\frac{10^3 \text{ N}}{200 \text{ cm}^2}=\frac{10000 \text{ N}}{A_2}$

$\Rightarrow A_2 = 2000 \text{ cm}^2$

(45) Answer : (1)
Solution:
The pressure at the bottom must be same,

$\rho_A \times g \times 15=\rho_B \times g \times 20 \quad \Rightarrow \quad \frac{\rho_B}{\rho_A}=\frac{15}{20}=\frac{3}{4}$

CHEMISTRY

(46) Answer : (2)
Solution:
i = 1 – 0.5 + 2 × 0.5 = 1.5

$\Delta T_b = imK_b$

= 1.5 × 0.4 × 0.52 = 0.31

T_b = 100.31°C

(47) Answer : (2)
Hint:

$\text{Molality}\left(\text{m}\right)=\frac{\text{n}_{\text{solute}}}{\text{W}\left(\text{Kg}\right)} \text{ and } \text{X}=\frac{\text{n}}{\text{n}+\text{N}}$

Solution:

$\text{X}_{\text{Glucose}}=\frac{0.2}{1}=\frac{\text{n}_{\text{Glucose}}}{\text{N}_{\text{total}}}$

$\therefore \quad \text{n}_{\text{Glucose}}=0.2 \text{ and } \text{n}_{\text{H}_2\text{O}}=1-0.2=0.8$

$\therefore \quad \text{Molality}\left(\text{m}\right)=\frac{0.2\times1000}{0.8\times18}=13.88 \text{ m}$

(48) Answer : (2)
Solution:
$p = p_A + p_B = = 120\times\frac{2}{5}+80\times\frac{3}{5}$ = 96 torr

mole fraction of B in the vapour phase,

$Y_B = \frac{p_B}{p_{total}}=\frac{80\times\frac{3}{5}}{96}=\frac{1}{2}$

(49) Answer : (2)
Solution:

$\Delta T_f = k_f \times m$

$0.5=\frac{5.12\times2\times1000}{M\times100}$

$M=\frac{5.12\times2\times1000}{0.5\times100}$

= 204.8 g/mol

(50) Answer : (1)
Solution:
Lesser the Henry's law constant, greater is the solubility of gas.

(51) Answer : (2)
Solution:
Mole fraction of A = $\frac{2}{2+3} = 0.4$
Mole fraction of B = $\frac{3}{5} = 0.6$
$P_A = x_A p_A^0 + x_B p_B^0$
= 0.4 × 300 + 0.6 × 500
= 420 mm Hg

(52) Answer : (3)
Solution:
Hint: Magnitude of osmotic pressure is large even for very dilute solutions.
Sol.: Solubility of polymers in solvent is very poor hence their solution is very dilute. Osmotic pressure is used to determine the molecular mass of such compounds.

(53) Answer : (4)
Solution:
Azeotropic composition : HNO_3 (68% by mass) and H_2O (32% by mass).

(54) Answer : (1)
Solution:
$\text{Molarity} = \frac{\text{n}_{\text{solute}}}{\text{V}_{\text{solution(L)}}}$
$0.2 = \frac{n \times 1000}{400}$
n = 0.08
Mass of HNO_3 = 0.08 × 63
= 5.04 g

(55) Answer : (2)
Hint:
• Higher the value of ΔT_f, lower will be the freezing point of the solution.
• $\Delta T_f = i \times K_f \times m$
$\therefore \Delta T_f \propto i$ (when K_f and molality are constant)
Solution:
• For 0.1 m NaCl (α = 60%), i = 1+(n – 1)α
= 1 + (2 – 1) × 0.6 = 1.6
• For 0.1 m $MgCl_2$ (α = 50%), i = 1 +(n – 1)α
1 + 2 × 0.5 = 2
• For 0.1 m $AlCl_3$ (α = 40%), i = 1+(n – 1)α
= 1 + 3 × 0.4 = 2.2
So the order of ΔT_f is III > II > I
$\therefore$ Order of T_f is I > II > III

(56) Answer : (2)
Hint:
24 g of methanol is present in 100 g of solution.
Solution:
Mass of H_2O = 100 – 24 = 76 g
$\text{Molality} = \frac{\text{Mole of methanol} \times 1000}{\text{Mass of water (in g)}}$
$= \frac{24 \times 1000}{32 \times 76}$
Molality = 9.87 m

(57) Answer : (1)
Solution:
0.1 m NaCl (aq) and 0.1 m KCl will have same boiling point if they are getting 100% ionised.

(58) Answer : (4)
Solution:
For ideal solution $\Delta_{mix} G < 0$

(59) Answer : (3)
Hint:
$\Delta G^o = -nFE^o_{cell}$

Solution:

$E^o_{cell} = E^o_R - E^o_L$

= (0.80 + 0.76) V

= 1.56 V

$\Delta G^o = -2 \times F \times 1.56$ = –3.12 F

(60) Answer : (2)

Hint:

H^+ has exceptionally highest limiting molar conductivity at 298 K in water.

(61) Answer : (1)

Solution:

$2H_2O(l) \rightarrow O_2 + 4H^+ + 4e^-$

$n \times n_F = \frac{q}{F}$

$\frac{16}{32} \times 4 = \frac{q}{F}$

2F = q

(62) Answer : (3)

Solution:

$E_{cell} = E^o_{cell} - \frac{0.059}{2}\log \frac{[Ni^{2+}]}{[Ag^+]^2}$ (at 298 K)

$E_{cell} = \left(0.80 - \left(-0.25\right)\right) - \frac{0.059}{2}\log \frac{(.01)}{(.01)^2}$

= 0.99 V

(63) Answer : (3)

Solution:

Λ°_m (CH_3COOH) = Λ°_m (CH_3COONa) + Λ°_m (HCl) – Λ°_m (NaCl)

= z + y – x

(64) Answer : (2)

Hint:

More the oxidation potential, more will be the reducing power

Solution:

Maximum oxidation potential : $E^\circ_{Mn\,/\,Mn^{2+}}$

(65) Answer : (2)

Solution:

$\Lambda_m = \frac{k \times 1000}{M}$

$= \frac{0.248 \times 10^{-2} \times 1000}{0.04}$

$= \frac{248 \times 10^{-2}}{4 \times 10^{-2}}$

= 62 S cm^2 mol^{-1}.

(66) Answer : (1)

Solution:

	Charge required for 1 mol metal deposition
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	2F
$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$	3F
$Na^+(aq) + e^- \rightarrow Na(s)$	1F
$Pb^{4+} + 4e^- \rightarrow Pb(s)$	4F

(67) Answer : (4)

Hint:

$E^0_{cell} = \frac{0.059}{n}\log K_c$

Solution:

$\log K_c = \frac{n \times E^0_{cell}}{0.059} = \frac{2 \times 2.7}{0.059} = 91.5$

$K_c = 10^{91.5}$

(68) Answer : (2)
Solution:
$G^* = \frac{k}{G} = k \times R$
$= 5 \times 10^{-3} \times 200$
$= 1\ cm^{-1}$

(69) Answer : (3)
Solution:

a.	Dry cell	–	Moist paste of NH_4Cl and $ZnCl_2$
b.	Lead storage Battery	–	38% solution of H_2SO_4
c.	Mercury cell	–	Paste of KOH & ZnO
d.	$H_2 – O_2$ fuel cell	–	Concentrated aqueous NaOH solution

(70) Answer : (3)
Hint:
Λ_m^o (NH_4OH) = Λ_m^o (NH_4NO_3) + Λ_m^o (KOH) – Λ°_m (KNO_3)
$\alpha = \frac{\Lambda_m}{\Lambda_m^o}$
Solution:
Λ°_m (NH_4OH) = 128 + 239 – 125 = 242 S cm^2 mol^{-1}
$\alpha = \frac{14}{242} = 0.0578 \simeq 0.06$

(71) Answer : (3)
Solution:
For isotonic solution, $\pi_1 = \pi_2$
$i_1C_1 = i_2C_2$
$3 \times 0.04 = 1 \times C_2$
$C_2 = 0.12$ M

(72) Answer : (4)
Solution:
Pure ethanol molecules are hydrogen bonded. On adding acetone, its molecules get in between the ethanol molecules and break some of the hydrogen bonds between them. This weakens the intermolecular attractive interactions and the solution shows positive deviation from Raoult's law.

(73) Answer : (3)
Hint:
Molarity of mixture = $\frac{M_1V_1 + M_2V_2}{V_1 + V_2}$
Solution:
$(M_{Mix})_{\text{Before dilution}} = \frac{2 \times 1 + 3 \times 2}{2+3} = \frac{8}{5} = 1.6$

• $M_iV_i = M_fV_f$(dilution)
$1.6 \times 5 = M_f \times 10$
$M_f = \frac{8}{10} = 0.8$ M

(74) Answer : (4)
Hint:
Molarity = $\frac{\text{No. of moles of solute}}{\text{Volume of solution (l)}}$
Solution:
Volume depends on temperature so molarity is temperature dependent.

(75) Answer : (1)
Solution:

Gases are more soluble in water at low temperature.

(76) **Answer :** (2)
Hint:
On adding two reaction their ΔG will be added to obtain ΔG for final reaction.
Solution:
Reverse equation (i) and add it to equation (ii).

$-\left(Cu^{+}+e^{-} \rightarrow Cu\right),\ \Delta G_1 = -1\ F\ E_1^{\circ}$

$+\left(Cu^{2+}+2e^{-} \rightarrow Cu\right),\ \Delta G_2 = -2\ F\ E_2^{\circ}$

$Cu^{2+}+e^{-} \rightarrow Cu^{+},\ \Delta G = -1\ F\ E^{\circ}$

$\Delta G = \Delta G_2 - \Delta G_1$

$-1\ FE^{\circ} = -2\,F\,E_2^{\circ} + 1\ FE_1^{\circ}$

$E^{\circ} = 2\,E_2^{\circ} - E_1^{\circ}$

= 0.674 – 0.52 = 0.154 V

(77) **Answer :** (2)
Hint:
Cathode : grid of Pb packed with PbO_2
Anode : lead plates

(78) **Answer :** (3)
Solution:
$E_{H^+/H_2} = -0\ .0591 \times pH$ = –0.0591 × 10 = –0.591 V

(79) **Answer :** (2)
Solution:
Anode: $Cl^{-}(aq) \rightarrow \frac{1}{2}Cl_2(g) + e^{-}$

Cathode: $H_2O(l) + e^{-} \rightarrow \frac{1}{2}H_2(g) + OH^{-}(aq)$

(80) **Answer :** (2)
Solution:
Number of equivalent of Cu^{2+} deposited $\simeq \frac{5\times1930}{96500} = 0.1$

Mass of Cu^{2+} deposited at cathode = $0.1 \times \frac{63.5}{2}$

= 3.2 g

(81) **Answer :** (2)
Solution:
0.0020 has two significant figures.

(82) **Answer :** (1)
Solution:
For minimum molecular mass one Fe atom should be present in the molecule.
Minimum molecular mass $= \frac{56\times100}{0.1} = 56000\ u$

(83) **Answer :** (3)
Solution:
An empirical formula represents the simplest whole number ratio of various atoms present in a compound. Whereas the molecular formula shows the exact number of different types of atoms present in a molecule of a compound.

(84) **Answer :** (3)
Hint:

% purity = $\frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$

Solution:
$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

100 g 44 g

50 g $\frac{44}{100} \times 50 = 22$

$\therefore$ % purity = $\frac{20}{22} \times 100 = 90.9\% \approx 91\%$

(85) **Answer :** (3)
Solution:

In a homogenous system, all the reactants and products are in the same phase

So, $Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons [Fe(SCN)]^{2+}(aq)$ is an example of homogenous equilibrium.

(86) Answer : (4)

Solution:

$2SO_2(g) + O_2(g) \rightleftharpoons SO_3(g)$ $K_1 = 4 \times 10^{24}$

$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$ $K_2 = \frac{1}{K_1}$

$SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$ $K_3 = \frac{1}{(K_1)^{1/2}}$

$K_3 = \frac{1}{(4\times10^{24})^{1/2}} = \frac{1}{2\times10^{12}}$

$\Rightarrow$ 0.5×10^{-12} or 5×10^{-13}

(87) Answer : (3)

Solution:

$pH = pK_a + \log\frac{[CH_3COO^-]}{[CH_3COOH]}$

$[CH_3COO^-] = 0.2\times2 = 0.4$ M

$[CH_3COOH] = 0.4$ M

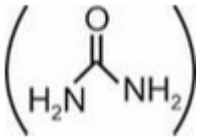
$pH = 4.7 + \log\frac{0.4}{0.4}$

pH = 4.7

(88) Answer : (2)

Solution:

Mole of urea



$= \frac{120}{60} = 2$

Number of atoms = $2 \times 8 \times 6.02 \times 10^{23}$

$= 96.32 \times 10^{23}$

$= 9.6 \times 10^{24}$

(89) Answer : (4)

Hint:

For salt of weak acid and weak base

$pH = 7 + \frac{1}{2}[pK_a - pK_b]$

Solution:

$\Rightarrow$ $7.005 = 7 + \frac{1}{2}[4.76 - pK_b]$

$\Rightarrow 0.005 \times 2 = 4.76 - pK_b$

$\Rightarrow pK_b = 4.76 - 0.01$

$= 4.75$

(90) Answer : (3)

Solution:

$\because$ $K_w = 10^{-10}$

$[H^+] = [OH^-] = 10^{-5}$ M

$\therefore$ pH = 5

BOTANY

(91) Answer : (1)

Solution:

2-celled pollen grain has one generative cell and one vegetative cell. In over 60% angiosperms, pollen grains shed at 2 celled stage.

(92) Answer : (1)
Solution:
The terminal structure of a typical stamen is anther.
The protective envelopes surrounding the body of ovule is called integument.

(93) Answer : (2)
Solution:
Sporogenous tissue forms microspores.

(94) Answer : (4)
Solution:
A – Exine
B – Vegetative cell
C – Intine
D – Generative cell
Generative cell forms male gametes

(95) Answer : (4)
Hint:
Tapetal cells, being polyploid show increase in their DNA content.
Solution:
Endothecium – Fibrous bands absent in hydrophytes.
Middle layer – Protective but ephemeral.
Tapetum – Provide nourishment to developing pollen grains.

(96) Answer : (2)
Solution:
In pollen grain, the generative cell divides mitotically to give rise to the two male gametes before pollen grains are shed.

(97) Answer : (1)
Solution:
Sporopollenin is one of the resistant organic materials known so far in plant kingdom.
Sporopollenin protects pollen grains from hazardous environment and pollen grains remain preserved as fossil due to presence of this chemical in exine. It is absent in germ pores region and have taxonomic significance.

(98) Answer : (2)
Hint:
Mostly embryo sacs are formed by 1 megaspore .
Solution:
Out of 4 megaspores only 1 remains functional in most of the angiosperms (monosporic).
Formed by one meiosis in the MMC and three sequential mitoses in the functional megaspore.

(99) Answer : (3)
Hint:
Egg apparatus in the embryo sac is situated towards micropylar end.
Solution:
Antipodals and egg in the embryo sac are situated towards chalazal end and micropylar end respectively.

(100) Answer : (1)
Solution:
A gynoecium of *Michelia* is multicarpellary and apocarpous.

(101) Answer : (4)
Solution:
In *Vallisneria*, female flowers reach the surface of water by the long stalk and the male flowers or pollen grains are released on to the surface of water.

(102) Answer : (4)
Hint:
In cross pollination, genetically same type of pollens cannot reach to the stigma.
Solution:
Autogamy, geitonogamy and cleistogamy are genetically self pollination.
Xenogamy is cross pollination.

(103) Answer : (4)
Hint:
Seagrasses are completely submerged water plant.

Solution:
In seagrasses, female flowers remain submerged in water and the pollen grains are released inside the water.

(104) Answer : (1)
Hint:
Cleistogamous flowers do not open at all.
Solution:
Only autogamy occurs in cleistogamous flowers. There is no need of nectar or fragrance in case of autogamy. Geitonogamy is possible in chasmogamous flowers.

(105) Answer : (1)
Solution:
The female flower buds are bagged before the flowers open. Bisexual flowers showing dichogamy can be selected for cross pollination.

(106) Answer : (4)
Solution:
The failure of pollen grains to fertilize the ovule of the same flower or other flowers of the same plant by inhibiting pollen germination or pollen tube growth is called self-incompatibility.

(107) Answer : (2)
Solution:
Endosperm in flowering plants are triploid. It is formed due to triple fusion.

(108) Answer : (4)
Solution:
The two types of fusion, *i.e*., syngamy and triple fusion occurs in an embryo sac and is termed as double fertilisation.

(109) Answer : (3)
Solution:
Egg apparatus consists of egg cell and two synergids.
It is 3 celled and 3 nucleated.

(110) Answer : (2)
Solution:
In an embryo sac, synergids and antipodals degenerate after fertilisation.

(111) Answer : (4)
Solution:
In monocot seeds, scutellum is situated towards one side of the embryonal axis. Coleoptile encloses shoot apex and leaf primordia.

(112) Answer : (3)
Solution:
Amorphophallus and *Yucca* are pollinated by insects.

(113) Answer : (4)
Solution:
Dehydration and dormancy of mature seeds are crucial for storage of seeds which can be used as food throughout the year and also to raise crop for next season.

(114) Answer : (3)
Solution:
Seed can be formed without fertilization by apomixis.

(115) Answer : (3)
Solution:
The seed of *Lupinus arcticus* excavated from the Arctic Tundra after an estimate record of 10,000 years of dormancy.

(116) Answer : (4)
Solution:
Parthenocarpic fruits develop without fertilization eg. Banana.

(117) Answer : (2)
Solution:
In the process of double fertilisation, five nuclei are involved (two haploid male gametes, one egg cell and two polar nuclei).

(118) Answer : (4)
Solution:
The part of pistil which forms pericarp in true fruit is wall of ovary.

(119) Answer : (1)
Solution:
In *Citrus*, embryo formed by nucellus and integuments are genetically similar. Therefore seeds are apomictic in nature. Being a dicot, *Citrus* seeds lack coleorhiza. Embryo formed by zygote, integument and nucellus are diploid.

(120) Answer : (4)
Solution:
In the ovule of *Mangifera indica*, additional embryos are formed due to divisions in nucellar cells.

(121) Answer : (1)
Solution:
In wheat, an ovary has single ovule.

(122) Answer : (3)
Solution:
Nucellus is sporophytic tissue.

(123) Answer : (2)
Hint:
Anatropous ovule is the most common type of ovule in angiosperms.
Solution:
It is inverted ovule and turns at 180° angle. Most primitive type of ovule is orthotropous. Members of leguminosae have campylotropous ovule.

(124) Answer : (2)
Solution:
Filiform apparatus is finger-like projection in synergids, present towards the micropylar end.
Filiform apparatus guides the entry of pollen tube into the synergid.

(125) Answer : (2)
Hint:
Mucilaginous covering protects the pollen from wetting.
Solution:
Majority of insect pollinated flowers are large sized with sticky pollen grains.
In most of the water-pollinated species, pollen grains are protected from wetting by a mucilaginous covering.

(126) Answer : (3)
Solution:
Mycelium is aseptate/coenocytic in the members of Phycomycetes.

(127) Answer : (3)
Solution:
a. Diatoms - Their cell wall is embedded with silica.
b. *Euglena* shows mixotrophic mode of nutrition.
c. *Paramoecium* has two types of nuclei.
d. Dinoflagellates - *Gonyaulax* is responsible for red tides.

(128) Answer : (3)
Solution:
Agaricus lacks sex organs.

(129) Answer : (2)
Solution:
During unfavourable conditions, slime moulds plasmodium differentiates and forms fruiting bodies bearing spores at their tips.

(130) Answer : (3)
Solution:
Mumps is a viral disease. Mycoplasma are pathogenic to animals and plants.

(131) Answer : (1)
Solution:
In wheat, primary root is short lived and is replaced by a large number of roots, called fibrous roots.

(132) Answer : (1)
Solution:
In the members of family Brassicaceae, flowers are tetradynamous.

(133) Answer : (2)
Solution:

Hint : Thorns of *Bougainvillea* and tendrils of grapevine are homologous organs.
Sol. : Both thorns in *Bougainvillea* and tendrils in grapevine are modified axillary buds but have different function, *i.e.*, protection and support respectively.

(134) Answer : (2)
Solution:
Mustard, china rose and sunflower have alternate phyllotaxy.
Calotropis has opposite phyllotaxy.
Alstonia has whorled phyllotaxy.

(135) Answer : (3)
Hint:
Cucumber has unisexual flowers.
Solution:
Indigofera has hypogynous flowers, bean shows vexillary aestivation.

ZOOLOGY

(136) Answer : (2)
Solution:
In humans, oogenesis is initiated during the embryonic development stage whereas spermatogenesis begins at puberty.

(137) Answer : (1)
Solution:
Oxytocin works through positive feedback mechanism during parturition. Oxytocin acts on the uterine muscles and causes strong uterine contractions, which in turn stimulates further secretion of oxytocin.

(138) Answer : (3)
Solution:
Entry of the sperm restarts the cell cycle, by breaking down MPF (Metaphase promoting factor) and turning on the APC (Anaphase promoting complex). Completion of meiosis II converts the secondary oocyte into functional haploid ovum (female gamete) and a very small second polar body is produced.

(139) Answer : (4)
Solution:
Leydig cells are regulated by LH. Sertoli cells are regulated by FSH.

(140) Answer : (3)
Solution:
Middle piece of sperm contains spirally arranged mitochondria that provide energy for sperm motility.

(141) Answer : (1)
Solution:
Testis is divided into about 250 compartments called testicular lobules and each mammary gland is divided into 15-20 mammary lobes.

(142) Answer : (3)
Solution:
The reproductive events in human includes:
(1) Formation of gametes (Gametogenesis)
(2) Transfer of sperms into female genital tract (Insemination)
(3) Fusion of male and female gametes (Fertilisation)
(4) Attachment of blastocyst to uterine wall (Implantation)
(5) Development of embryo (gestation) and delivery of the baby (Parturition)

(143) Answer : (3)
Solution:
The anterior portion of sperm is covered by a cap like structure, acrosome. The acrosome is filled with enzymes that help in fertilisation of the ovum.

(144) Answer : (3)
Hint:
23 chromosomes are present in a human sperm.
Solution:
Both ova and sperms in humans have 23 chromosomes each. Sperm is much smaller in size than ova but it is highly motile. Spiral arrangement of mitochondria is observed in sperms.

(145) Answer : (2)
Solution:
Scrotum helps in maintaining the low temperature of the testes (2-2.5°C lower than normal internal body temperature) necessary for spermatogenesis.

(146) Answer : (4)
Solution:
Estrogen peaks twice during the menstrual cycle. LH and FSH peaks during ovulation.

(147) Answer : (2)
Hint:
Thymosin helps in cell differentiation of T-lymphocytes.
Solution:
Placenta acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progestogens, *etc*. In the later phase of pregnancy, a hormone called relaxin is also secreted by the ovary. During pregnancy, the levels of other hormones like estrogen, progestogens, cortisol, prolactin, thyroxine, *etc*, are increased several folds in the maternal blood.

(148) Answer : (1)
Solution:
At puberty, only 60,000-80,000 primary follicles are left in each ovary.

(149) Answer : (3)
Hint:
Exclude the one that is present in primary sex organ
Solution:
The male sex accessory ducts include rete testis, vasa efferentia, epididymis and vas deferens.
Testis is a primary sex organ which contains seminiferous tubules.

(150) Answer : (4)
Solution:
In humans, the placenta produces sufficient estrogen and progesterone from maternal and fetal precursors to take over the functions of the corpus luteum after the 6^{th} week of pregnancy.

(151) Answer : (3)
Solution:
Secretion of seminal vesicle nourishes sperms. Temporary storage of sperms takes place in epididymis.

(152) Answer : (1)
Solution:
'X'-Thymus gland, 'Y'-Thymosin
Thymus gland secretes thymosin. Thymosin plays a major role in differentiation of T-lymphocytes which provide cell-mediated immunity. In addition, thymosin also promotes the production of antibodies to provide humoral immunity. Thymus is degenerated in old individuals resulting in decreased production of thymosins.

(153) Answer : (2)
Solution:
Inner cell mass differentiates into 3 germ layers → **Ectoderm**, **Mesoderm**, **Endoderm**.

(154) Answer : (4)
Hint:
Semen = Seminal plasma + sperms.
Solution:
Seminal plasma is composed of secretions from seminal vesicles, prostate gland and bulbourethral gland. It is therefore rich in fructose, calcium and certain enzymes. Testosterone is released into blood.

(155) Answer : (2)
Solution:
Estrogen is secreted by the Graafian follicles present in ovary.

(156) Answer : (2)
Solution:
The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands.

(157) Answer : (2)
Hint:
Characterised by presence of antrum
Solution:

In human females, oogenesis starts during embryonic development, meiosis I initiates at this stage but this division gets completed within the tertiary follicle. Later, tertiary follicle is transformed into mature Graafian follicle.

(158) Answer : (1)
Solution:
The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation.

(159) Answer : (2)
Solution:
Primary spermatocytes are considered as meiocytes which undergo meiosis-I to form secondary spermatocytes.

(160) Answer : (2)
Solution:
The cavity of cervix is called cervical canal which along with vagina forms the birth canal responsible for passage of foetus during child birth.

(161) Answer : (2)
Solution:
The wall of uterus has three layers of tissues :
(a) An external thin membranous perimetrium
(b) Middle thick muscular myometrium and
(c) Inner glandular endometrium

(162) Answer : (1)
Solution:
In human adults, each testis is oval in shape, with a length of about 4 to 5 cm and a width of about 2 to 3 cm.

(163) Answer : (1)
Solution:
The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

(164) Answer : (4)
Hint:
First sign of growing foetus
Solution:
In human beings, after one month of pregnancy, the embryo's heart is formed. The foetus develops limbs and digits by the end of second month of pregnancy. By the end of 12 weeks, most of the major organ systems are developed, for example, the limbs and external genital organs are well developed.

(165) Answer : (2)
Solution:
The morula transforms into blastocyst as it moves further into the uterus.

(166) Answer : (2)
Solution:
Each primary oocyte results in the formation of 1 ova and 2 polar bodies in humans.

(167) Answer : (4)
Solution:
Hint : Nucleocytoplasmic ratio increases after each successive cleavage.
Sol. : Cleavage is a special type of mitosis in which nucleocytoplasmic ratio increases due to decrease in amount of cytoplasm in each cell. So, cytoplasm nearly remains unchanged but genetic content increases as many folds as number of cells in morula stage.

(168) Answer : (3)
Solution:
Decrease in level of progesterone causes menstruation at the end of luteal phase because progesterone maintains endometrium of uterus.

(169) Answer : (4)
Solution:
Hymen is present in vaginal vestibule and partially covers the vaginal orifice.

(170) Answer : (1)
Solution:
Lack of menstruation may be an indicative of pregnancy. However, it may also be caused due to some underlying causes like stress, poor health, *etc*.

(171) Answer : (2)

Solution:

Catecholamines are secreted from adrenal medulla during emergency situations.

Insulin lowers down the levels of glucose in blood whereas glucagon increases the same. Hence, insulin is called hypoglycemic hormone whereas glucagon is called hyperglycemic hormone.

(172) Answer : (4)

Solution:

Deviation in temperature and pH from optimum levels and presence of inhibitors affect the activity of an enzyme.

Enzyme lowers down the activation energy of a chemical reaction.

(173) Answer : (2)

Solution:

Aldosterone, cortisol and small amounts of androgenic steroids are secreted by the adrenal cortex whereas epinephrine and norepinephrine are secreted by the adrenal medulla.

Melatonin is secreted by the pineal gland. Thymosins are secreted by thymus. Prolactin is secreted by anterior lobe of pituitary gland.

(174) Answer : (1)

Solution:

Pigments	Carotenoids, Anthocyanins, *etc*.
Alkaloids	Morphine, Codeine, *etc*.
Terpenoides	Monoterpenes, Diterpenes *etc*.
Essential oils	Lemon grass oil, *etc*.
Toxins	Abrin, Ricin
Lectins	Concanavalin A
Drugs	Vinblastin, curcumin, *etc*.
Polymeric substances	Rubber, gums, cellulose

(175) Answer : (2)

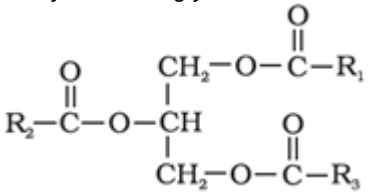
Solution:

Hydrolases are biochemical catalysts that use water to break a chemical bond. Isomerases catalyse interconversion of optical, geometric or positional isomers. Oxidoreductases are enzymes which catalyse the oxidoreduction between two substrates S and S′.

(176) Answer : (3)

Solution:

3 fatty acids + 1 glycerol constitute a molecule of triglyceride (fat).



(177) Answer : (4)

Solution:

Lipid soluble/steroid hormones bind to their intracellular receptors. [Cortisol, estradiol and progesterone]

Insulin, LH and FSH are proteinaceous hormones while epinephrine is an amino acid derivative hormone.

(178) Answer : (1)

Solution:

Option (1) is the correct answer because Statement II is incorrect as the transformation of spermatids into spermatozoa (sperms) are called spermiogenesis. After this, sperm head becomes embedded in the Sertoli cells and are finally released into the lumen of seminiferous tubules by the process called spermiation. Hence, Statement I is a correct statement.

Spermatogenesis is the process of formation of sperms from spermatogonia.

(179) Answer : (1)

Solution:

Cortisol is a glucocorticoid which is involved in carbohydrate metabolism.

(180) Answer : (3)

Solution:

Exopthalmic goitre is a form of hyperthyroidism, characterised by enlargement of the thyroid gland, protrusion of the eyeballs, increased basal metabolic rate, and weight loss, also called Graves' disease.