Aakash

Medical | IIT-JEE | Foundations

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FINAL TEST SERIES for NEET-2024

MM : 720   **Test - 9**   Time : 3 Hrs. 20 Mins.

Answers

#	Ans	#	Ans	#	Ans	#	Ans	#	Ans
1.	(3)	41.	(3)	81.	(1)	121.	(3)	161.	(1)
2.	(1)	42.	(2)	82.	(4)	122.	(2)	162.	(2)
3.	(2)	43.	(3)	83.	(3)	123.	(1)	163.	(1)
4.	(3)	44.	(1)	84.	(3)	124.	(4)	164.	(1)
5.	(4)	45.	(2)	85.	(2)	125.	(4)	165.	(1)
6.	(1)	46.	(3)	86.	(4)	126.	(4)	166.	(4)
7.	(2)	47.	(4)	87.	(1)	127.	(3)	167.	(3)
8.	(4)	48.	(1)	88.	(1)	128.	(2)	168.	(2)
9.	(4)	49.	(1)	89.	(3)	129.	(4)	169.	(4)
10.	(4)	50.	(2)	90.	(4)	130.	(2)	170.	(4)
11.	(3)	51.	(1)	91.	(4)	131.	(2)	171.	(3)
12.	(3)	52.	(4)	92.	(4)	132.	(2)	172.	(2)
13.	(1)	53.	(2)	93.	(4)	133.	(1)	173.	(1)
14.	(4)	54.	(1)	94.	(2)	134.	(4)	174.	(3)
15.	(1)	55.	(3)	95.	(4)	135.	(2)	175.	(4)
16.	(1)	56.	(2)	96.	(1)	136.	(3)	176.	(4)
17.	(1)	57.	(3)	97.	(2)	137.	(4)	177.	(4)
18.	(3)	58.	(2)	98.	(3)	138.	(2)	178.	(2)
19.	(3)	59.	(4)	99.	(2)	139.	(3)	179.	(4)
20.	(3)	60.	(1)	100.	(1)	140.	(4)	180.	(3)
21.	(1)	61.	(2)	101.	(3)	141.	(1)	181.	(3)
22.	(1)	62.	(3)	102.	(3)	142.	(3)	182.	(2)
23.	(4)	63.	(3)	103.	(3)	143.	(4)	183.	(1)
24.	(4)	64.	(2)	104.	(4)	144.	(3)	184.	(4)
25.	(4)	65.	(2)	105.	(3)	145.	(1)	185.	(2)
26.	(2)	66.	(3)	106.	(4)	146.	(3)	186.	(4)
27.	(2)	67.	(2)	107.	(3)	147.	(2)	187.	(2)
28.	(2)	68.	(4)	108.	(1)	148.	(2)	188.	(1)
29.	(3)	69.	(2)	109.	(4)	149.	(4)	189.	(3)
30.	(4)	70.	(4)	110.	(2)	150.	(4)	190.	(2)
31.	(1)	71.	(4)	111.	(3)	151.	(1)	191.	(1)
32.	(3)	72.	(3)	112.	(4)	152.	(2)	192.	(2)
33.	(3)	73.	(1)	113.	(2)	153.	(2)	193.	(2)
34.	(4)	74.	(2)	114.	(4)	154.	(4)	194.	(2)
35.	(3)	75.	(3)	115.	(2)	155.	(2)	195.	(3)
36.	(1)	76.	(4)	116.	(3)	156.	(4)	196.	(4)
37.	(1)	77.	(2)	117.	(4)	157.	(4)	197.	(2)
38.	(1)	78.	(4)	118.	(1)	158.	(2)	198.	(3)
39.	(1)	79.	(4)	119.	(2)	159.	(4)	199.	(1)
40.	(1)	80.	(1)	120.	(1)	160.	(4)	200.	(3)

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Answers and Solutions

PHYSICS

SECTION-A

1. **Answer (3)**

   Equation of displacement of particle executing SHM is given by $x = A\sin(\omega t + \phi)$ ...(I)

   Potential energy of particle executing SHM is given by

   $$U = \frac{1}{2}kx^2$$

   $$= \frac{1}{2}kA^2\sin^2(\omega t + \phi)$$ ...(II)

   From (I) and (II), it is clear that

   Time period of $x = A\sin(\omega t + \phi)$ is

   $$T_1 = \frac{2\pi}{\omega} \quad \Rightarrow \text{ frequency } n_1 = \frac{\omega}{2\pi}$$

   while time period of $x^2 = A^2\sin^2(\omega t + \phi)$ is

   $$T_2 = \frac{\pi}{\omega} \quad \Rightarrow \text{ frequency } n_2 = \frac{\omega}{\pi}$$

   Hence $n_2 = 2n_1$

2. **Answer (1)**

   In polar molecules, the centre of positive charges does not coincide with the centre of negative charges.

   Hence, these molecules have a permanent electric dipole moment of their own.

3. **Answer (2)**

   Drift velocity, $v_d = \dfrac{eE\tau}{m}$

   Electrical resistivity, $\rho = \dfrac{1}{\sigma} = \dfrac{E}{J}$

   Relaxation period, $\tau = \dfrac{m}{ne^2\rho}$

   Current density, $J = \dfrac{I}{A} = nev_d$

   (A) - (R), (B) - (S), (C) - (P), (D) - (Q)

4. **Answer (3)**
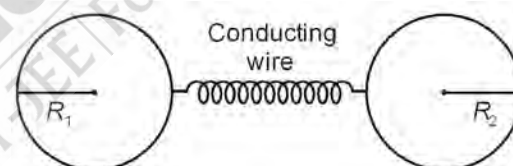
   When two conductors are connected by a conducting wire, then the two conductors should have same potential.

   so, $V_1 = V_2$

   $$\therefore \quad \frac{1}{4\pi\varepsilon_0}\frac{Q_1}{R_1} = \frac{1}{4\pi\varepsilon_0}\frac{Q_2}{R_2}$$

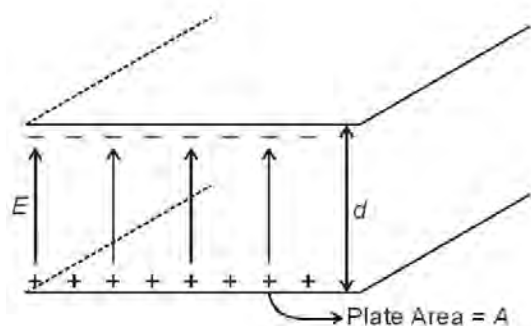 $$\Rightarrow \quad \frac{1}{4\pi\varepsilon_0}\frac{Q_1}{R_1} \times \frac{R_1}{R_1} = \frac{1}{4\pi\varepsilon_0}\frac{Q_2}{R_2} \times \frac{R_2}{R_2}$$

   $$\Rightarrow \quad \frac{Q_1 R_1}{4\pi R_1^2 \varepsilon_0} = \frac{Q_2 R_2}{4\pi R_2^2 \varepsilon_0}$$

   $$\Rightarrow \quad \frac{\sigma_1 R_1}{\varepsilon_0} = \frac{\sigma_2 R_2}{\varepsilon_0}$$

   $$\Rightarrow \quad \frac{\sigma_1}{\sigma_2} = \frac{R_2}{R_1}$$
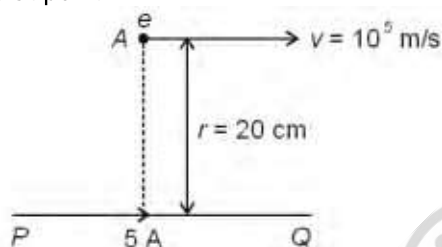
5. Answer (4)

$$U = \frac{1}{2}CV^2 = \frac{1}{2}\frac{\varepsilon_0 A}{d}(Ed)^2 = \frac{1}{2}\varepsilon_0 E^2 Ad$$

6. Answer (1)

Magnetic field produced due to current carrying wire at point 'A'

$$B = \frac{\mu_0}{4\pi}\frac{2I}{r}$$

$$B = \frac{10^{-7} \times 2 \times 5}{20 \times 10^{-2}} = \frac{1}{2} \times 10^{-5} \quad \text{(Tesla)}, \text{ upward to}$$

the plane of paper

Now, force acting on electron due to this field

$$\vec{F} = q(\vec{v} \times \vec{B})$$

$$|\vec{F}| = 1.6 \times 10^{-19} \times 10^5 \times \frac{1}{2} \times 10^{-5}$$

= 0.8 × 10⁻¹⁹ N

$$|\vec{F}| = 8 \times 10^{-20} \text{ N}$$

7. Answer (2)

$$[E] = \left[\frac{GMm}{r}\right]$$

$$\left[\frac{E}{G}\right] = \left[M^2 L^{-1}\right]$$

= [M²L⁻¹T⁰]

8. Answer (4)

With larger aperture of objective lens, the light gathering power in telescope is high.

Also, the resolving power or the ability to observe two objects distinctly also depends on the diameter of the objective. Thus objective of large diameter is preferred.

Also, with large diameters fainter objects can be observed. Hence it also contributes to the better quality and visibility of images.

Hence, all options are correct.

9. Answer (4)

Root mean square speed of gas molecule

$$= \sqrt{\frac{3RT}{M}}$$

Pressure exerted by ideal gas $= \frac{1}{3}nm\bar{v}^2$

Average kinetic energy of a molecule $= \frac{3}{2}k_B T$

Total internal energy of a gas is $(U) = \frac{1}{2}nfRT$

Here, $n = 1$

$f = 5$

$$U = \frac{5}{2}RT$$

Hence, (A) - (Q), (B) - (P), (C) - (S), (D) - (R)

10. Answer (4)

•   In reverse biased, after breakdown, voltage across the zener diode becomes constant. Therefore zener diode is connected in reverse biased when used as voltage regulator.

•   Potential barrier of silicon diode is nearly 0.7 V statement A is correct and statement B is incorrect.

11. Answer (3)

Potential energy of electric dipole in external electric field $U = -\vec{P} \cdot \vec{E}$
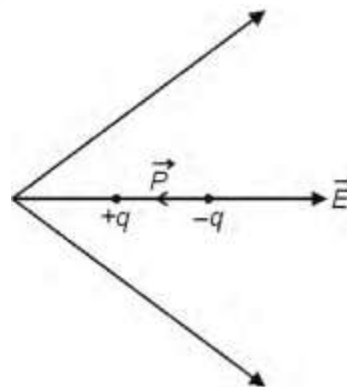
Angle between electric field and electric dipole is 180°

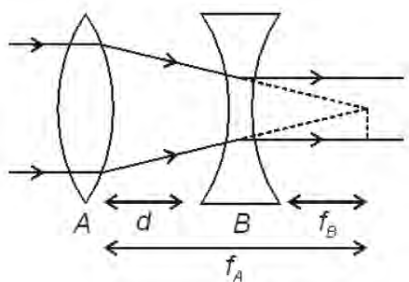$U = -PE\cos\theta$

$U = -PE\cos 180°$

$U = +PE$

On moving towards right electric field strength decrease therefore potential energy decrease.

Net force on electric dipole is towards right and net torque acting on it is zero.

So, it will more towards right.

12. **Answer (3)**

Parallel beam of light after refraction from convex lens converge at the focus of convex lens. In question it is given light after refraction pass through concave lens becomes parallel. Therefore light refracted from convex lens virtually meet at focus of concave lens.

According to above ray diagram $d = f_A - f_B$

$= 20 - 5 = 15$ cm

13. **Answer (1)**

Escape velocity from the Earth's surface

$$v_e = \sqrt{\frac{2GM}{R}}$$

$$= \sqrt{\frac{2G\rho \frac{4}{3}\pi R^3}{R}}$$

$$= \sqrt{\frac{8G\rho\pi}{3}R^2}$$

$v_e \propto R$ (For same density)

$$\frac{v}{v_1} = \frac{R}{4R}$$

$v_1 = 4v$

14. **Answer (4)**

On β^+ decay atomic number decreases by 1

On β^{-1} decay atomic number increases by 1

On α decay atomic number decreases by 2

$$_Z^A X \xrightarrow{\beta^+ \text{ decay}} _{Z-1}B \xrightarrow{\alpha \text{ decay}} _{Z-3}C \xrightarrow{\beta^- \text{ decay}} _{Z-2}D$$
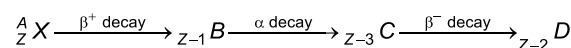
Hence correct order of decay are β^+, α, β^-

15. **Answer (1)**

Here, pitch of the screw gauge, $P = 1$ mm

Number of circular division, $n = 100$

Thus least count $LC = \frac{P}{n} = \frac{1}{100} = 0.01$ mm

$= 0.001$ cm

So, diameter of the wire $= MSR + (CSR \times LC)$

$= 0 + (52 \times 0.001 \text{ cm})$

$= 0.052$ cm

16. **Answer (1)**

$V_L = 40$ volt

$V_R = 40$ volt

$V_C = 10$ volt

Now, $V_{RMS} = \sqrt{V_R^2 + (V_L - V_C)^2}$

$= \sqrt{(40)^2 + (40 - 10)^2} = 50$ V

$I_{RMS} = \frac{I_0}{\sqrt{2}} = \frac{10\sqrt{2}}{\sqrt{2}} = 10$ A

$\because \ V_{RMS} = I_{RMS} \times Z$

$\therefore \ Z = \frac{V_{RMS}}{I_{RMS}} = \frac{50}{10} = 5 \ \Omega$

17. **Answer (1)**

Let required height of body is y.

When body from rest falls through height $(H - y)$

Then under constant acceleration

$v^2 = 0^2 + 2g(H - y)$

$v = \sqrt{2g(H - y)}$ ...(1)

When body is at height y above ground. Potential energy of body of mass m

$U = mgy$

As per given condition kinetic energy, $K = 3U$

$\frac{1}{2}m(v)^2 = 3 \times mg(y)$

$\frac{1}{2} \times m \times 2g(S - y) = 3 \times mgy$ (using (1))

$H - y = 3y$

$\therefore \ y = \frac{H}{4}$ ...(2)

$\therefore \ v = \sqrt{2 \times g\left(H - \frac{H}{4}\right)} = \sqrt{\frac{3gH}{2}}$ ...(3)

18. **Answer (3)**

Suppose θ is inclination of inclined plane acceleration along inclined plane $a = g\sin\theta$

S_n = distance travelled by object during n^{th} second.

Initial speed $u = 0$

By equation of uniformly accelerated motion

$S_n = u + \frac{a}{2}(2n - 1)$

$S_n = 0 + \frac{g\sin\theta}{2}(2n - 1) = \frac{g\sin\theta}{2}(2n - 1)$ ...(i)

Distance travelled during $(n + 1)^{th}$ second.

$$S_{n+1} = 0 + \frac{g\sin\theta}{2}[2(n+1) - 1] = \frac{g\sin\theta}{2}(2n+1)$$

...(ii)

Dividing equations (i) and (ii)

$$\frac{S_n}{S_{n+1}} = \frac{(2n-1)}{(2n+1)}$$

19. **Answer (3)**

The activity of a radioactive substance is given as

$$A = A_0\left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$$

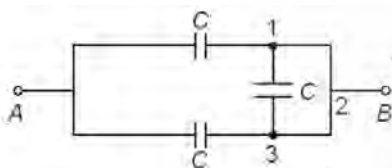Now, $\dfrac{A}{A_0} = \left(\dfrac{1}{2}\right)^{\frac{t}{T_{1/2}}}$

$$\Rightarrow \frac{A}{A_0} = \left(\frac{1}{2}\right)^{\frac{150}{100}}$$

$$\Rightarrow \frac{A}{A_0} = \left(\frac{1}{2}\right)^{\frac{3}{2}}$$

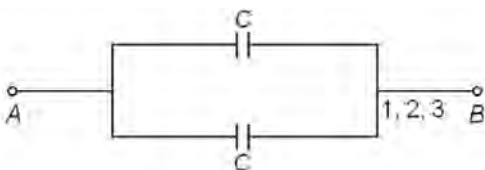$$\Rightarrow \frac{A}{A_0} = \frac{1}{2\sqrt{2}}$$

20. **Answer (3)**

Given circuit is

Points 1, 2, 3 are at same potential (as they are connected by conducting wire)

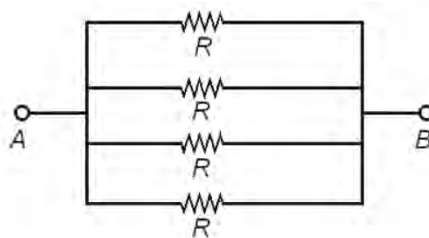So the capacitor is short circuited. It does not store any charge.

The circuit can be redrawn as

$C_{AB} = C + C = 2C$ (Parallel combination)

21. **Answer (1)**

All the wires are identical and of same material so they will have same value of resistance. Let it be R. When these are (four) connected in parallel.
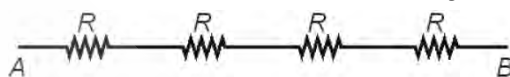

$$R_P = \frac{R}{4} \qquad \left(\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}\right)$$

Given $R_P = 0.25\ \Omega$

$$\therefore\ 0.25 = \frac{R}{4}$$

$\therefore\ R = 1\ \Omega$

Now these four resistances are arranged in series

$R_S = R + R + R + R = 4R$

$\therefore\ R_S = 4 \times 1 = 4\ \Omega$

22. **Answer (1)**

Mass number of reactant = 240

BE per nucleon = 7.6 MeV

Mass number of products = 120

BE per nucleon of product = 8.5 MeV

Total gain in BE = (BE) of products − (BE) of reactants.

= [120 + 120] × 8.5 − [240] × 7.6

= (240) × 8.5 − 240 × 7.6

= (2040 − 1824) MeV

Gain in BE = 216 MeV

23. **Answer (4)**

The current through a semiconductor is

$I = neAv_d$

$I = neA\mu E$

$$\frac{I_n}{I_p} = \frac{n_e eA\mu_e E}{n_h eA\mu_h E}$$

$$\frac{I_n}{I_p} = \frac{\mu_e}{\mu_h}$$

$\because\ \mu_e > \mu_h$

$\Rightarrow I_n > I_p$

24. **Answer (4)**

The power of a source is given as

$$P = \frac{E}{t} = \frac{n}{t}\left(\frac{hc}{\lambda}\right)$$

$$\Rightarrow \frac{n}{t} = \frac{P}{\left(\frac{hc}{\lambda}\right)}$$

(Here $\frac{n}{t}$ is number of photons emitted per second)

$$\Rightarrow \frac{n}{t} = \frac{3.3 \times 10^{-3} \times 6 \times 10^{-7}}{6.6 \times 10^{-34} \times 3 \times 10^{8}}$$
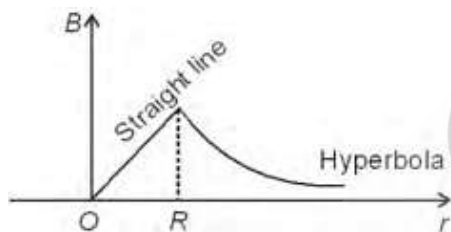
= 10^{16} photons per second

25. **Answer (4)**

From Ampere's circuital law

$$B = \frac{\mu_0 I}{2\pi R^2} \cdot r \qquad \text{if } r < R \Rightarrow B_{\text{inside}} \propto r$$
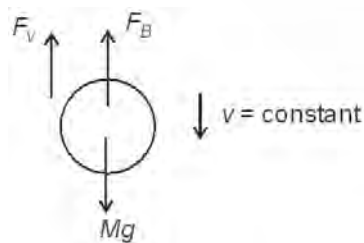
$$B = \frac{\mu_0 I}{2\pi r} \qquad \text{if } r \geq R \Rightarrow B_{\text{outside}} \propto \frac{1}{r}$$

Hence the correct plot of magnetic field B with distance r from axis of cable is given as

26. **Answer (2)**

Let F_v be the viscous force and F_B be the Buoyant force acting on the ball.

Then, when body moves with constant velocity

$Mg = F_B + F_v \qquad [a = 0]$

$F_v = Mg - F_B$

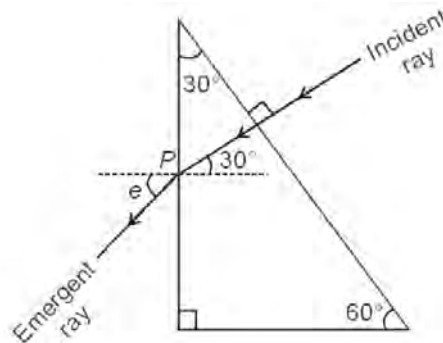$= dVg - \frac{d}{2} \cdot Vg \quad (M = dVg)$ V = volume of ball.

$= \frac{d}{2} Vg$

$F_v = \frac{M}{2} g$

27. **Answer (2)**

From the ray diagram shown in the figure.

At point P, from Snell's law

$$\frac{\sin i}{\sin r} = \frac{\mu_{\text{air}}}{\mu_{\text{Prism}}}$$

$$\Rightarrow \frac{\sin 30°}{\sin e} = \frac{1}{\sqrt{3}} \qquad (\angle r = \angle e \text{ emergent angle})$$

$$\Rightarrow \sin e = \sqrt{3} \cdot \frac{1}{2}$$

$$\Rightarrow \angle e = 60°$$

28. **Answer (2)**

Given $V = V_0 \sin \omega t$ …(1)

Now displacement current I_d is given by

$$I_d = C \frac{dV}{dt}$$

$$= C \frac{d}{dt}(V_0 \sin \omega t) \quad \text{(using equation 1)}$$

$$= C(V_0 \omega) \cos \omega t$$

$$I_d = V_0 \omega C \cos \omega t$$

29. **Answer (3)**

Energy, $E \propto F^a A^b T^c$

$[E] = [F^a][A^b][T^c]$

$\Rightarrow [ML^2 T^{-2}] = [MLT^{-2}]^a [LT^{-2}]^b [T]^c$

$[ML^2 T^{-2}] = [M^a L^{a+b} T^{-2a-2b+c}]$

Comparing dimensions on both sides.

$\Rightarrow a = 1; \ a + b = 2 \text{ and } -2 = -2a - 2b + c$

$\Rightarrow b = 1 \qquad \Rightarrow -2 = -2 - 2 + c$

$\Rightarrow c = 2$

$[E] = [FAT^2]$

30. **Answer (4)**

$$V_d = \frac{i}{neA}$$

$$V_d = \frac{10}{10^{22} \times 1.6 \times 10^{-19} \times \pi \left(10^{-3}\right)^2}$$

$$V_d = \frac{10}{1.6\pi \times 10^{-3}}$$

$$= \frac{6.25}{\pi} \times 10^3 \text{ m/s}$$

31. **Answer (1)**

    For a spring, $kx = F$

    given $x = 5$ cm, $F = 10$ N

    $\Rightarrow k(5 \times 10^{-2}) = 10$

    $\Rightarrow k = \dfrac{1000}{5} = 200$ N/m

    Now, for spring-mass system undergoing SHM

    $T = 2\pi\sqrt{\dfrac{m}{k}}$

    given, $m = 2$ kg

    $\Rightarrow T = 2\pi\sqrt{\dfrac{2}{200}} = \dfrac{2\pi}{10} = 0.628$ s

32. **Answer (3)**

    Direction of propagation of electromagnetic waves is along $\vec{E} \times \vec{B}$

    Given that direction of propagation is along x-axis

    (1) $\left(-\hat{j} + \hat{k}\right) \times \left(-\hat{j} + \hat{k}\right) = 0$

    (2) $\left(\hat{j} + \hat{k}\right) \times \left(\hat{j} + \hat{k}\right) = 0$

    (3) $\left(-\hat{j} + \hat{k}\right) \times \left(-\hat{j} - \hat{k}\right) = 2\hat{i}$

    (4) $\left(\hat{j} + \hat{k}\right) \times \left[-\left(\hat{j} + \hat{k}\right)\right] = 0$

    $\therefore$ Option (3) is correct.

33. **Answer (3)**

    From average form of Newton's law of cooling

    $-\left(\dfrac{T_1 + T_2}{2} - T_s\right)K = \dfrac{T_1 - T_2}{\Delta t}$

    T_1 and T_2 are initial and final temperature and T_s is surrounding temperature.

    $\Rightarrow -K\left[\dfrac{(90 + 80)}{2} - 20\right] = \dfrac{90 - 80}{t}$

    $\Rightarrow -K(65) = \dfrac{10}{t}$

    $\Rightarrow K = \dfrac{-2}{13t}$

    In second case,

    $-K\left(\dfrac{80 + 60}{2} - 20\right) = \dfrac{(80 - 60)}{t_1}$

    $\Rightarrow -K(50) = \dfrac{20}{t_1}$

    $\Rightarrow \dfrac{2}{13t}(50) = \dfrac{20}{t_1}$

    $\Rightarrow t_1 = \dfrac{13t}{5}$

34. **Answer (4)**

    As per Einstein's photoelectric equation

    $\dfrac{hc}{\lambda} = \phi_0 + k$

    ϕ_0: work function

    k = maximum kinetic energy of photoelectrons

    As per question, $\phi \to 0$

    $\therefore \dfrac{hc}{\lambda} = k = \dfrac{P^2}{2m} \Rightarrow P = \sqrt{\dfrac{2mhc}{\lambda}}$

35. **Answer (3)**

    Incident power on turbine $= \dfrac{d(mgh)}{dt}$

    $= gh\dfrac{dm}{dt}$

    $= 10 \times 60 \times 15$

    $= 9000$ W

    Now, losses are 10%

    $\therefore$ power generated $= \left(1 - \dfrac{10}{100}\right) \times 9000$

    $= 8100$ W

    $= 8.1$ kW

SECTION-B

36. **Answer (1)**

    Electric potential due to a charged sphere $= \dfrac{kQ}{R}$

    $k = 9 \times 10^9$ N–m^2/C^2

    Q : charge on sphere

    R : Radius of sphere

    Let charge and radius of smaller drop is q and r respectively

    For smaller drop, $V = \dfrac{kq}{r} = 220$

    Let R be radius of bigger drop,

    As volume remains the same

    $\left(\dfrac{4}{3}\pi r^3\right) \times 27 = \dfrac{4}{3}\pi R^3$

    $\Rightarrow R = \sqrt[3]{27}\, r = 3r$

    Now, using charge conservation,

    $\Rightarrow Q = 27q$

    $V_{\text{big drop}} = \dfrac{kQ}{R} = \dfrac{k(27q)}{3r} = 9\left(\dfrac{kq}{r}\right)$
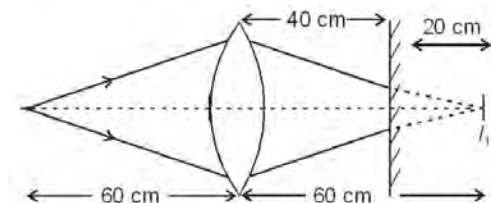
    $= 9 \times 220 = 1980$ V

37. Answer (1)

Using lens formula for first refraction from convex lens

$$\frac{1}{v_1} - \frac{1}{u} = \frac{1}{f}$$

$v_1 = ?$, $u = -60$ cm, $f = 30$ cm

$$\Rightarrow \frac{1}{v_1} + \frac{1}{60} = \frac{1}{30} \Rightarrow v_1 = 60 \text{ cm}$$

here I_1 is first image by lens

The plane mirror will produce an image at distance 20 cm to left of it.

For second refraction from convex lens,

$u = -20$ cm, $v = ?$, $f = 30$ cm

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} + \frac{1}{20} = \frac{1}{30}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{30} - \frac{1}{20} \Rightarrow v = -60 \text{ cm}$$

Thus the final image is virtual and at a distance, $60 - 40 = 20$ cm from plane mirror.

38. Answer (1)

given $v = kV_e$

where, $k < 1$

Thus, $v < V_e$

From conservation of mechanical energy,

$$\frac{1}{2}mv^2 - \frac{GmM}{R} = -\frac{GmM}{(R+h)}$$

$$\Rightarrow \frac{v^2}{2} = \frac{GM}{R} - \frac{(GM)}{(R+h)} = \frac{h}{R(R+h)}GM$$

$$\Rightarrow \frac{1}{2}k^2V_e^2 = \frac{GMh}{R(R+h)}$$

We know, $V_e = \sqrt{\frac{2GM}{R}}$

$$\Rightarrow \frac{1}{2}k^2\left(\frac{2GM}{R}\right) = \frac{GMh}{R(R+h)}$$

$$k^2 = \frac{h}{(R+h)}$$

$Rk^2 + hk^2 = h$

$Rk^2 = h(1 - k^2)$

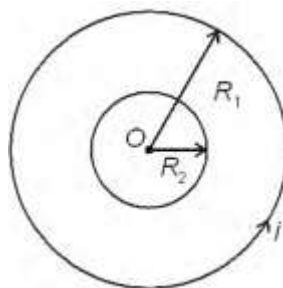$$\therefore h = \frac{Rk^2}{(1 - k^2)}$$

39. Answer (1)

$\tau = MB\sin 90°$

$= IL^2B_0$

40. Answer (1)

Two concentric coils are of radius R_1 and R_2 as shown

Let current in outer loop be i

Magnetic field at centre $= B = \dfrac{\mu_0 i}{2R_1}$

Magnetic flux through inner coil $= B \times \pi R_2^2$

$$\phi = \frac{\mu_0 i}{2R_1} \times \pi R_2^2$$

$$\phi = \frac{\mu_0 i}{2} \times \frac{\pi R_2^2}{R_1}$$

as per definition, $\phi = Mi$

$$\Rightarrow M = \left(\frac{\mu_0 \pi}{2}\right)\frac{R_2^2}{R_1}$$

$$\therefore M \propto \frac{R_2^2}{R_1}$$

41. Answer (3)

Output of combination of logic gates is given as

$y = A \cdot B + \overline{B \cdot C}$

Time duration	Input Signals					Output Signal
	A	B	C	AB	$\overline{B \cdot C}$	$y = A \cdot B + \overline{B \cdot C}$
$0 - t_1$	0	0	1	0	1	1
$t_1 - t_2$	1	0	1	0	1	1
$t_2 - t_3$	0	1	0	0	1	1
$t_3 - t_4$	1	1	0	1	1	1
$t_4 - t_5$	0	0	1	0	1	1
$t_5 - t_6$	1	0	1	0	1	1
$t_6 - t_7$	0	0	1	0	1	1

So the output y is high (1) that is $v_0 = 5$ V

42. Answer (2)
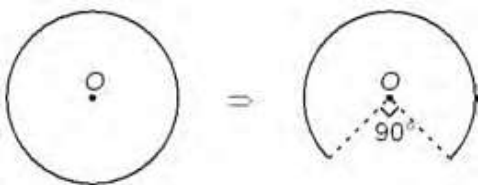
Given that,

Mass of ring = M; Radius of ring = R

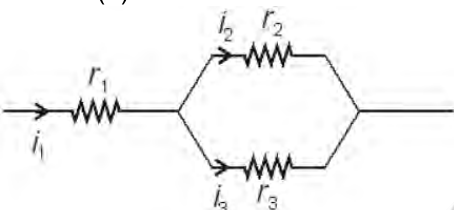Now 90° arc is removed from circular ring, then mass removed = $\dfrac{M}{4}$

Mass of remaining portion = $\dfrac{3M}{4}$

Moment of inertia of remaining part = $\int dm r^2$

$\Rightarrow I = R^2 \int dm \qquad (\because r = R)$

$\Rightarrow I = \dfrac{3MR^2}{4}$. So the value of K is $\dfrac{3}{4}$

43. **Answer (3)**

In parallel combination of resistances r_2 and r_3, potential difference will be equal across both resistance.

So, $i_2 r_2 = i_3 r_3 \Rightarrow i_2 = \dfrac{i_3 r_3}{r_2}$ ...(1)

As per Kirchhoff's first law

$\Rightarrow i_1 = i_2 + i_3$

$\Rightarrow i_1 = \left(\dfrac{r_3}{r_2} + 1\right) i_3$ (from equation 1)

$\Rightarrow \dfrac{i_3}{i_1} = \dfrac{r_2}{r_2 + r_3}$

44. **Answer (1)**

Initial velocity of car = 0

Acceleration of car = 5 m/s²

Velocity of car at $t = 4$ s; $v = u + at$

$\Rightarrow v = 0 + 5 \times 4 = 20\ \text{ms}^{-1}$

At $t = 4$ s, A ball is dropped out of a window so velocity of ball at this instant is 20 ms⁻¹ along horizontal.

After 2 seconds of motion :

Horizontal velocity of ball = 20 ms⁻¹ ($\because a_x = 0$)

Vertical velocity of ball $(v_y) = u_y + a_y t$

$v_y = 0 + 10 \times 2 = 20\ \text{ms}^{-1}$ ($\because a_y = g = 10\ \text{m/s}^2$)

So magnitude of velocity of ball

$(v) = \sqrt{v_x^2 + v_y^2} = 20\sqrt{2}$ m/s

Acceleration of ball at $t = 6$ s is $g = 10\ \text{m/s}^2$

As ball is under free fall.

45. **Answer (2)**

In ideal transformer:

Input power = Output power

$\Rightarrow V_P I_P = V_S I_S =$ Given power

$\Rightarrow 220 \times I_P = 44$

$\Rightarrow I_P = 0.2$ A

46. **Answer (3)**

Given that :

Mass of ball = 0.15 kg

Height from which ball is dropped = 10 m

Impulse, $\vec{I}$ = Change in linear momentum = $\Delta \vec{P}$

$= \overline{P_f} - \overline{P_i}$

Velocity of ball at ground $(v) = \sqrt{2gh}$

$= \sqrt{2 \times 10 \times 10} = 10\sqrt{2}$ m/s

$\vec{I} = 0.15 \times 10\sqrt{2}\left(-\hat{j}\right) - 0.15 \times 10\sqrt{2}\left(\hat{j}\right)$

$\vec{I} = 2 \times 0.15 \times 10\sqrt{2}\left(-\hat{j}\right) = 4.2\left(-\hat{j}\right)$

$\Rightarrow$ magnitude of impulse = 4.2 kg m/s

47. **Answer (4)**

The resonance frequency of LCR series circuit is given as $\omega_0 = \dfrac{1}{\sqrt{LC}} = \dfrac{1}{\sqrt{5 \times 80 \times 10^{-6}}} = 50$ rad/s

Now half power frequencies are given as

$\omega = \omega_0 \pm \dfrac{R}{2L}$

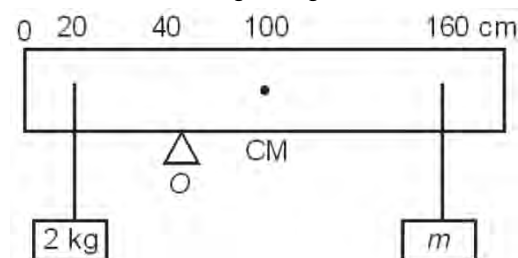i.e. $\omega_L = 50 - \dfrac{40}{2 \times 5} = 46$ rad/s

$\omega_H = 50 + \dfrac{40}{2 \times 5} = 54$ rad/s

48. **Answer (1)**

Given that

Mass of rod = 500 g; Length of rod = 200 cm

Rod will be in equilibrium, when net torque about point O will be zero.

Torque at point O due to 2 kg mass

$\vec{\tau} = \vec{r} \times \vec{F} = rF \sin\theta(\hat{n})$

$\tau_1 = 20 \times 20 \times 10^{-2} \times \sin 90^\circ\left(\hat{k}\right) = 4\ \text{N m}\left(\hat{k}\right)$

Torque due to mass of rod :

$$\tau_2 = 5 \times 60 \times 10^{-2} \times \sin 90° \left(-\hat{k}\right) = 3 \text{ N m}\left(-\hat{k}\right)$$

Torque due to mass m

$$\tau_3 = mg \times 120 \times 10^{-2} \times \sin 90° \left(-\hat{k}\right) = 12m \text{ N m}\left(-\hat{k}\right)$$

Net torque about point O will be zero

So $\overline{\tau_1} + \overline{\tau_2} + \overline{\tau_3} = 0$

$\Rightarrow 4 - 3 - 12m = 0$

$\Rightarrow 12m = 1$

$m = \dfrac{1}{12}$ kg

49. **Answer (1)**

To complete a circular path of radius R, time period is T.

So speed of particle $(U) = \dfrac{2\pi R}{T}$ ......(1)

Now the particle is projected with same speed at angle θ to horizontal.

So maximum height $(H) = \dfrac{U^2 \sin^2 \theta}{2g}$

Given that : $H = 4R$

$\Rightarrow \dfrac{U^2 \sin^2 \theta}{2g} = 4R$

$\Rightarrow \sin^2 \theta = \dfrac{8gR}{U^2}$ ...(2)

$\Rightarrow \sin^2 \theta = \dfrac{8gRT^2}{4\pi^2 R^2} = \dfrac{2gT^2}{\pi^2 R}$ (using equation 1)

$\Rightarrow \theta = \sin^{-1} \left(\dfrac{2gT^2}{\pi^2 R}\right)^{1/2}$
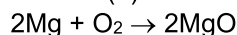
50. **Answer (2)**

Magnetic moment of triangle loop = NIA

$$M_1 = \left(\dfrac{12a}{3a}\right) \cdot I \cdot \dfrac{\sqrt{3}}{4} a^2 = \sqrt{3} I a^2$$

CHEMISTRY

SECTION-A

51. **Answer (1)**
$2Mg + O_2 \rightarrow 2MgO$

$\therefore$ 48 g magnesium reacts with 32 g oxygen.

$\therefore$ 1 g magnesium reacts with $= \dfrac{32}{48} = 0.6 \text{ g } O_2$

(Given $O_2 = 0.32$ g)
Hence O_2 is the limiting reactant.
32 g O_2 reacts with 48 g magnesium

0.32 g O_2 reacts $= \dfrac{48}{32} \times 0.32$

= 0.48 g
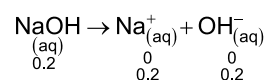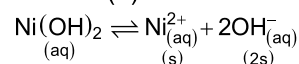Mg left = (1 – 0.48) g
= 0.52 g

52. **Answer (4)**
- The cumulative effect of the contraction of the lanthanoid series, known as lanthanoid contraction, causes the radii of the members of the third transition series to be very similar to those of the corresponding members of the second series.
- The almost identical radii of Zr (160 pm) and Hf (159 pm) is a consequence of the lanthanoid contraction.

53. **Answer (2)**

$$\underset{\text{(aq)}}{Ni(OH)_2} \rightleftharpoons \underset{\text{(s)}}{Ni^{2+}_{(aq)}} + \underset{\text{(2s)}}{2OH^-_{(aq)}}$$

$$\underset{\underset{0.2}{\text{(aq)}}}{NaOH} \rightarrow \underset{\underset{0.2}{0}}{Na^+_{(aq)}} + \underset{\underset{0.2}{0}}{OH^-_{(aq)}}$$

Due to common ion effect,
Concentration of OH^- in the solution
= $(2s + 0.2)$
$k_{sp} = [Ni^{2+}][OH^-]^2$
= $(s)(2s + 0.2)^2$
$2 \times 10^{-15} = (s)(0.2)^2$ [As $2s + 0.2 \approx 0.2$ M]

$s = \dfrac{2 \times 10^{-15}}{(0.2)^2}$

$= \dfrac{2 \times 10^{-15}}{(4 \times 10^{-2})} = 0.5 \times 10^{-13}$

= 5×10^{-14} M

54. **Answer (1)**

Species	Conjugate Base
HCO_3^-	CO_3^{2-}
H_2O	OH^-

55. **Answer (3)**
At constant volume, $q_V = C_V \Delta T = \Delta U$

At constant pressure, $q_P = C_P \Delta T = \Delta H$

For a mole of an ideal gas,
$\Delta H = \Delta U + \Delta(PV)$
$= \Delta U + \Delta(RT)$
$= \Delta U + R\Delta T$
On putting the values of ΔH and ΔU, we have
$C_P \Delta T = C_V \Delta T + R\Delta T$
$C_P = C_V + R$
$C_P - C_V = R$

56. **Answer (2)**

   A negative $E^{\ominus}$ means that the redox couple is a stronger reducing agent.

57. **Answer (3)**

    With warm dilute sulphuric acid, sulphide salt gives hydrogen sulphide gas which can be identified by it's rotten egg like smell.

58. **Answer (2)**

    Major product formed in dehydrohalogenation reaction of 2-bromopentane is pent-2-ene because according to Saytzeff's rule, in dehydrohalogenation reactions, the preferred product is that alkene which has greater number of alkyl group(s) attached to the doubly bonded carbon atoms.
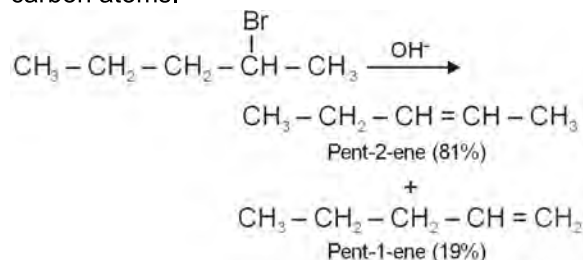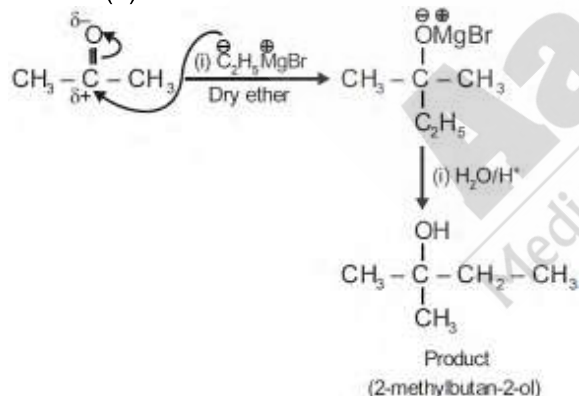

59. **Answer (4)**
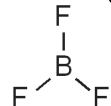
    - Number of electrons around boron atom is 6.
    - Hybridization of B is sp^2.
    - Shape is trigonal planar.

60. **Answer (1)**

61. **Answer (2)**

    - Deficiency of vitamin B_2 (Riboflavin) causes cheilosis, digestive disorders and burning sensation of the skin.
    - Deficiency of vitamin B_{12} causes Pernicious anaemia which is RBC deficiency in haemoglobin.
    - Deficiency of vitamin B_6 (Pyridoxine) causes Convulsions.
    - Deficiency of vitamin B_1 (Thiamine) causes Beri-Beri (loss of appetite and retarded growth).

62. **Answer (3)**

    According to Kohlrausch law of independent migration of ions.

    $\Lambda_m^o(CH_3COOH)$

    $= \Lambda_m^o(CH_3COONa) + \Lambda_m^o(HCl) - \Lambda_m^o(NaCl)$

    $= 91.0\ S\ cm^2\ mol^{-1} + 426.16\ S\ cm^2\ mol^{-1} - 126.45\ S\ cm^2\ mol^{-1}$

    $= 390.71\ S\ cm^2\ mol^{-1}$

63. **Answer (3)**

    - Actinoids are highly reactive metals, especially when finely divided
    - Actinoid contraction is greater from element to element than lanthanoid contraction resulting from poor shielding by $5f$ electrons
    - Many trivalent lanthanoids ions are coloured both in the solid state and in aqueous solutions.
   - Lanthanoids have typical metallic structure and are good conductors of heat and electricity

64. **Answer (2)**

    In the modern periodic table, moving down the group as the size of halogen atom increases, the H – X bond length also increases as a result the bond enthalpy decreases. Hence, The acidic strength also increases.

    So, the correct order of acidic strength is

    HI > HBr > HCl > HF

65. **Answer (2)**

    2, 6-Dimethyldec-4-ene
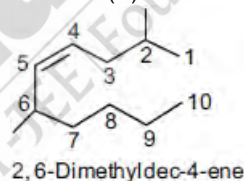
66. **Answer (3)**

    The size of halogen atom increases from F to I hence bond length from C – F to C – I increases

    ∴ Bond enthalpy from $CH_3 - F$ to $CH_3 - I$ decreases

C – X Bond	Bond dissociation enthalpies/kJ mol⁻¹
$CH_3 - F$	452
$CH_3 - Cl$	351
$CH_3 - Br$	293
$CH_3 - I$	234

67. **Answer (2)**

    Energy of electromagnetic radiation (E)

    $= \dfrac{hc}{\lambda} = h\gamma$

    So, $\dfrac{c}{\lambda} = \gamma \Rightarrow \lambda = \dfrac{c}{\gamma}$

    $\lambda = \dfrac{3 \times 10^8}{1368 \times 10^3} = 219.3\ m$

68. Answer (4)

Dimethylammonium acetate is a salt of weak acid and weak base whose pH can be calculated as

$$pH = 7 + \frac{1}{2}(pK_a - pK_b)$$

$$= 7 + \frac{1}{2}(4.77 - 3.27)$$

$$= 7.75$$

69. Answer (2)

- Osmotic pressure (π) = $iCRT$ where C is molar concentration of the solution

- With increase in molar concentration of solution osmotic pressure increases.

- Since, weight of all solutes and its solution volume are equal, so higher will be the molar mass of solute, smaller will be molar concentration and smaller will be the osmotic pressure.

- Order of molar mass of solute decreases as

  Sucrose > Glucose > Urea

- So, correct order of osmotic pressure of solution is $P_3 < P_1 < P_2$

70. Answer (4)

Noble gas being monoatomic have no interatomic forces except weak dispersion forces.

71. Answer (4)

For organic liquids, intermolecular dipole-dipole interactions are significantly weaker. Hence, it requires less heat to vaporise 1 mol of acetone than it does to vaporise 1 mole of water.

72. Answer (3)

- $\Delta H_{rxn} = (E_a)_f - (E_a)_b$

  $-4.2 = (E_a)_f - (E_a)_b$

  $-4.2 = 9.6 - (E_a)_b$

  $(E_a)_b = 9.6 + 4.2 = 13.8$ kJ mol^{-1}

- Since reaction is exothermic, so possible graph is (3) only.
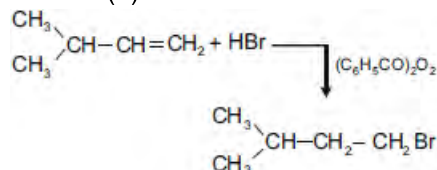
- Also $(E_a)_f < (E_a)_b$, so answer is option (3).

73. Answer (1)

Compounds with formula $C_4H_{10}O$ can be ethers which may exhibit metamerism. For example

$CH_3 - CH_2 - O - CH_2 - CH_3$, $CH_3 - O - \underset{\underset{CH_3}{|}}{CH} - CH_3$
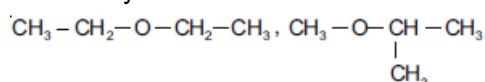
and $CH_3—O—CH_2—CH_2—CH_3$ are metamers as structure of alkyl chains are different around the functional group.

74. Answer (2)

Mechanism : Peroxide effect proceeds via free radical chain mechanism.
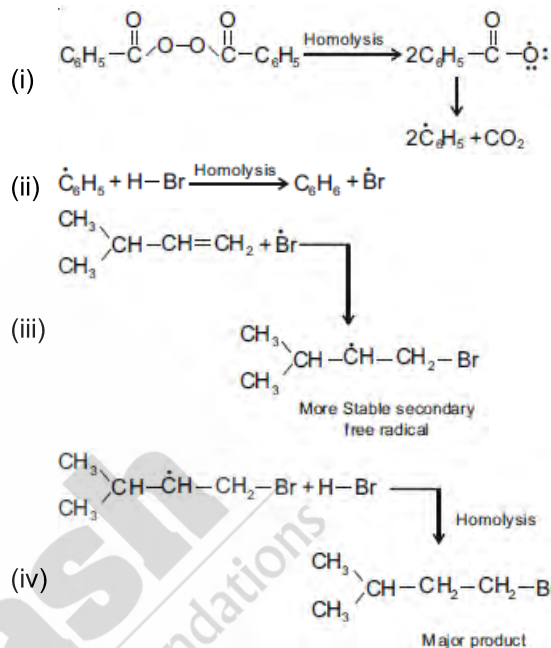
75. Answer (3)

- Both reactions (1) and (2) are examples of decomposition reactions.

- Reactions (3) and (4), both are examples of displacement reactions, while reaction (3) is an example of metal displacement reaction.

76. Answer (4)

(–COOH) group is carboxylic acid is an electron withdrawing group causing deactivation of benzene ring.

Hence, bonding of anhyd. $AlCl_3$ with carboxylic group takes place.

77. Answer (2)

Ethylene diaminetetraacetate (EDTA) ion is a hexadentate ligand having four donor oxygen atoms and two donor nitrogen atoms
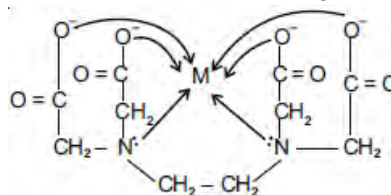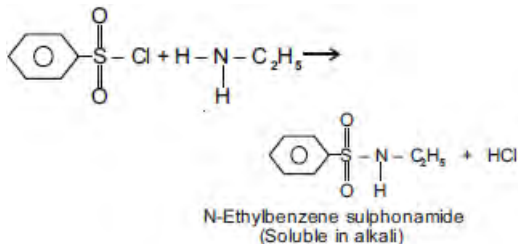

78. Answer (4)

Colour of the flame observed by naked eye- Crimson red.

Ion – Sr^{2+}

79. **Answer (4)**
- Benzenesulphonyl chloride ($C_6H_5SO_2Cl$) is also known as Hinsberg's reagent.
- The reaction of Hinsberg's reagent ($C_6H_5SO_2Cl$) with primary amine ($CH_3CH_2NH_2$) yields N-ethylbenzene sulphonamide.

N-Ethylbenzene sulphonamide
(Soluble in alkali)

- The reaction of Hinsberg's reagent ($C_6H_5SO_2Cl$) with secondary amine ($C_2H_5NHCH_3$) gives, N-Ethyl-N-Methyl benzene sulphonamide

Insoluble in alkali due to absence of H-atom
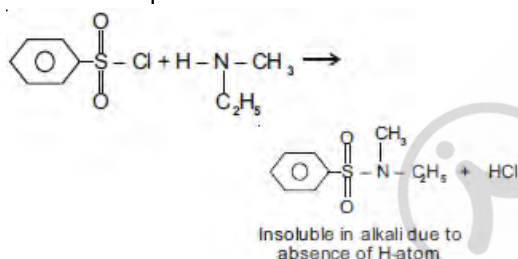
- 3° amine do not react with Hinsberg reagent

80. **Answer (1)**
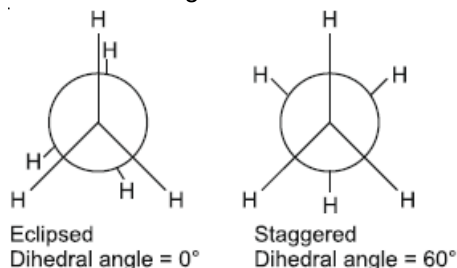Lassaigne's test is used to detect Nitrogen, Sulphur and Halogens.

81. **Answer (1)**
Ethane has two conformers
(i) Eclipsed
(ii) Staggered
Eclipsed conformer is least stable while staggered conformer is most stable. In eclipsed conformer the dihedral angle is 0°
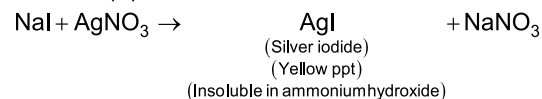

Eclipsed
Dihedral angle = 0°

Staggered
Dihedral angle = 60°

82. **Answer (4)**

Element	Mass percentage	No. of mole	Mole ratio
C	80%	$\dfrac{80}{12} = 6.6$	$\dfrac{6.6}{6.6} = 1$
H	20%	$\dfrac{20}{1} = 20$	$\dfrac{20}{6.6} \simeq 3$

Based on above calculation, possible empirical formula is CH_3.

83. **Answer (3)**
Noble gases have weak dispersion forces hence they have low melting and boiling points.

84. **Answer (3)**
$$NaI + AgNO_3 \rightarrow \underset{\substack{(Silver\ iodide) \\ (Yellow\ ppt) \\ (Insoluble\ in\ ammonium\ hydroxide)}}{AgI} + NaNO_3$$

85. **Answer (2)**

(a)		sp^3d hybridised and trigonal bipyramidal in shape
(b)		sp^3d^2 hybridised and octahedral in shape
(c)		sp^3d^2 hybridised and square pyramidal in shape
(d)		sp^2 hybridised and trigonal planar in shape

SECTION-B

86. **Answer (4)**
- For a spontaneous process, $\Delta S_{total} > 0$ and since irreversible process is always spontaneous therefore $\Delta S_{total} > 0$.
- Since $\Delta U = nC_V\Delta T$ and $\Delta T = 0$ for isothermal process therefore $\Delta U = 0$.

87. **Answer (1)**
Magnetic moment, $\mu = \sqrt{n(n+2)}$ BM where n = number of unpaired electrons)

|	Complex	No. of unpaired electron(s)	μ(BM)
(a)	$[Fe(CN)_6]^{3-}$	1	1.73
(b)	$[Fe(H_2O)_6]^{3+}$	5	5.92
(c)	$[Fe(CN)_6]^{4-}$	0	0
(d)	$[Fe(H_2O)_6]^{2+}$	4	4.90

88. **Answer (1)**
$NaBH_4$ is a reducing agent. It reduces carbonyl group into alcohols but does not reduce esters.
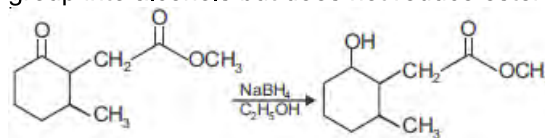
89. Answer (3)

Stronger is the acid, lower is the value of pK_a. On moving down the group, bond dissociation enthalpy of hydrides of group 16 elements decreases hence acidity increases and pK_a value decreases. Correct order of pK_a value will be
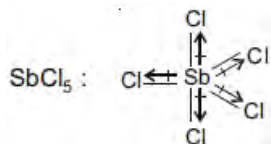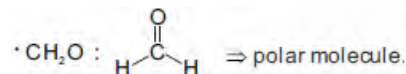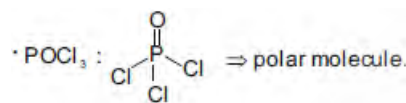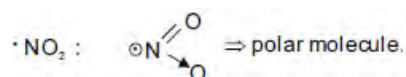
$H_2O > H_2S > H_2Se > H_2Te$
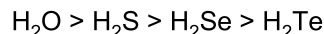
90. Answer (4)

Alkane is produced by heating sodium salt of carboxylic acid with soda lime (NaOH and CaO in the ratio of 3 : 1)

$$CH_3CH_2COO^-Na^+ \xrightarrow{\underset{Heat}{NaOH+CaO}} CH_3CH_3 + Na_2CO_3$$
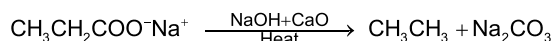
91. Answer (4)

$SbCl_5$:

Net vector summation of bond moments will be zero so $SbCl_5$ is a non-polar molecule.

NO_2 :

 ⇒ polar molecule.

$POCl_3$:

 ⇒ polar molecule.

CH_2O :

 ⇒ polar molecule.

92. Answer (4)

Group	Cations	Group reagent
Group – II	Pb^{2+}, Cu^{2+}, As^{3+}	H_2S gas in presence of dil. HCl
Group – II	Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}	H_2S gas in presence of NH_4OH

93. Answer (4)

$\Lambda_m = 20 \text{ S cm}^2 \text{ mol}^{-1}$

$\Lambda^o_{m\ CH_3COOH} = \Lambda^o_{CH_3COO^-} + \Lambda^o_{m\ H^+}$

$= 50 + 350 = 400 \text{ S cm}^2 \text{ mol}^{-1}$

$\alpha = \dfrac{\Lambda_m}{\Lambda^o_m} = \dfrac{20}{400} = \dfrac{1}{20}$

$K_a = \dfrac{C\alpha^2}{1-\alpha} \simeq C\alpha^2 = 7\times10^{-3}\times\left(\dfrac{1}{20}\right)^2$

$= 7\times10^{-3}\times\dfrac{1}{4}\times10^{-2}$

$= 1.75 \times 10^{-5} \text{ mol L}^{-1}$

94. Answer (2)

$t_{1/2} = \dfrac{A_0}{2k}$

$t_{1/2}$ for zero order reaction is directly proportional to the initial concentration of the reactant.

95. Answer (4)

Given : $n_{C_6H_6} : n_{C_8H_{18}} = 3 : 2$

So, $\chi_{C_6H_6} = \dfrac{3}{5}$, $\chi_{C_8H_{18}} = \dfrac{2}{5}$

$p_s = p^o_{C_6H_6}\chi_{C_6H_6} + p^o_{C_8H_{18}}\chi_{C_8H_{18}}$

$= 280\times\dfrac{3}{5} + 420\times\dfrac{2}{5}$

$= 168 + 168$

$= 336$ mm of Hg

96. Answer (1)

- Isoelectronic species have same number of electrons.

Species	Number of electrons
Fe^{2+}	$26 - 2 = 24$
Mn^{2+}	$25 - 2 = 23$
O^{2-}	$8 + 2 = 10$
F^-	$9 + 1 = 10$
Na^+	$11 - 1 = 10$
Mg^{2+}	$12 - 2 = 10$
Fe^{3+}	$26 - 3 = 23$

97. Answer (2)

Etard's reaction
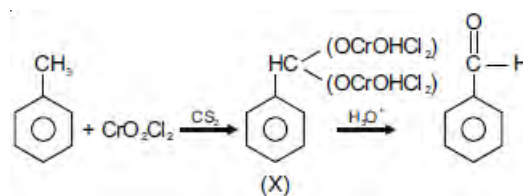
98. Answer (3)
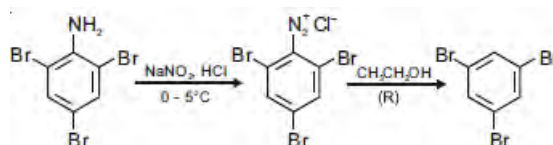
Reagent R is C_2H_5OH with diazonium salt.

99. Answer (2)

Arrhenius equation

$k = Ae^{-E_a/RT}$

$\ln k = \ln A + \ln e^{-E_a/RT}$

$$\ln k = \ln A - \frac{E_a}{R}\left(\frac{1}{T}\right) \longrightarrow \quad (1)$$

Slope of $\ln k$ vs $\frac{1}{T}$ curve,

$$m = -\frac{E_a}{R}$$

$$-5 \times 10^3 = -\frac{E_a}{R}$$

$E_a = 5 \times 10^3 \times 8.314$ J/mol

$= 41.57 \times 10^3$ J/mol

$\simeq 41.5$ kJ/mol

100. **Answer (1)**

• Gattermann-Koch reaction:
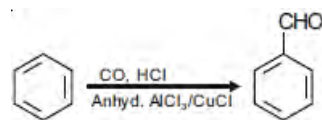
• Haloform reaction:
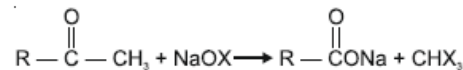
• Esterification:
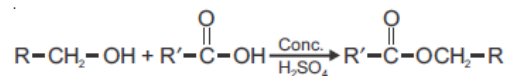
• Hell-Volhard-Zelinsky reaction:
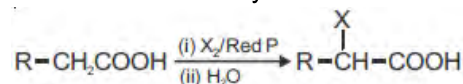
BOTANY

SECTION-A

101. **Answer (3)**

Pyramid of biomass in sea is inverted. For example, biomass of zooplanktons is higher than that of phytoplanktons as life span of former is longer and the latter multiply much faster though having shorter life span.
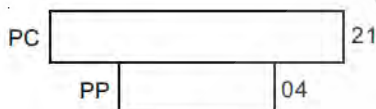
Small standing crop of phytoplanktons supports large standing crop of zooplankton

102. **Answer (3)**

Male and female flowers are produced on two separate plants. It prevents autogamy as well as geitonogamy.

103. **Answer (3)**

• *Sorghum* is a C_4 plant. The first stable product of CO_2 fixation in *Sorghum* is oxaloacetic acid.

• The first stable product in C_3 cycle is 3-phosphoglyceric acid.

• Pyruvic acid is the end product of glycolysis.

• Succinic acid is an intermediate product in Krebs cycle.

104. **Answer (4)**

• Stamens are said to be diadelphous when these are united in two bundles e.g. Pea.

• China rose has monoadelphous stamens while, *Citrus* has polyadelphous stamens. Monoadelphous stamens are grouped in single bundle whereas polyadelphous stamens occur in more than two bundles.

105. **Answer (3)**

After the DNA bands are stained, they are viewed under the UV light. The bands appear bright orange in colour. Ethidium bromide is an intercalating agent that stacks in between the nitrogenous bases.

106. **Answer (4)**

Plants follow different pathways in response to environment or phase of life to form different kinds of structures. This ability is called plasticity.

107. **Answer (3)**

• In parietal placentation, the ovules develop on the inner wall of the ovary or on peripheral part e.g., *Argemone*.

• When the placenta is axial and the ovules are attached to it in a multilocular ovary, the placentation is said to be axile, as in tomato.

• In basal placentation, the placenta develops at the base of ovary and a single ovule is attached to it, as in marigold.

• When the ovules are borne on central axis and septa are absent, as in *Dianthus*.

108. **Answer (1)**

In the equation,

GPP – R = NPP

R refers to respiratory loss

GPP is gross primary productivity

NPP is net primary productivity

109. **Answer (4)**

The production of gametes (n) by the parents (2n), the formation of the zygote (2n), the F_1 and F_2 plants can be understood from a diagram called Punnett square.

110. **Answer (2)**

A mature sieve tube element possess a peripheral cytoplasm and a large central vacuole but lacks a nucleus.

111. **Answer (3)**
   - Lenticels permit the exchange of gases between the outer atmosphere and the internal tissue of the stem.
   - Phellogen is also known as cork cambium.
   - Phelloderm is also called secondary cortex because it is the cortex that develops during secondary growth.
   - As the cork cell mature, there is a gradual loss of living matter and their cell walls become thick due to deposition of a waxy substances called suberin.

112. **Answer (4)**
   - Amount of all the inorganic substances or nutrients, such as carbon, nitrogen, phosphorus and calcium present in soil at any given time, is referred as standing state.
   - Amount of living material present in different trophic levels at a given time, is referred as standing crop.
   - Climax community is the last community in biotic succession which is relatively stable and is in near equilibrium with the environment of that area.

113. **Answer (2)**
   - Xenogamy refers to the transfer of pollen grains from anthers of one plant to stigma of a different plant which during pollination, brings genetically different types of pollen grains to stigma.
   - Cleistogamy is a condition is which bisexual flower does not open throughout the life.
   - Geitonogamy refers to the transfer of pollen grain from anther to stigma of another flower of the same plant.
   - Chasmogamy is a condition in which flowers remain open.

114. **Answer (4)**
   - Division of centromere occurs in anaphase II.
   - Telophase II is the last stage of meiosis II. During this phase, the chromatids reach the poles and start uncoiling.
   - Chromosomes form two parallel plates in metaphase I and one plate in metaphase II.

115. **Answer (2)**

   The first step in the polymerase chain reaction is denaturation. During this step, the strands of dsDNA separate from each other. This step requires temperature around 94°C.

   Denaturation is followed by annealing, in which, the primers anneal to 3' end of the template DNA strand.

   Annealing is followed by extension, in which, *Taq* polymerase adds nucleotides to 3'OH end of the primers.

116. **Answer (3)**
   - Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in an individual.
   - Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.
   - Molecular diagnosis refers to the act or process of determining the nature and cause of a disease.

117. **Answer (4)**
   - The inner membrane of mitochondria forms infoldings called cristae.
   - Thylakoids are flattened membranous sacs in stroma of plastids. Cisternae are disc shaped sacs in Golgi apparatus.
   - Primary constriction in chromosome that holds two chromatids together is called centromere.

118. **Answer (1)**
   - Change in gene frequency in a small population by chance is known as genetic drift. Genetic drift has two ramifications, one is bottle neck effect and another is founder's effect.
   - When accidentally a few individuals are dispersed and act as founders of a new isolated population, founder's effect is said to be observed.
   - Crossing over during gamete formation results in genetic recombination.
   - Mutations are random and directionless.

119. **Answer (2)**

   When the centromere is situated in the middle of two equal arms of chromosomes, the chromosome is referred as Metacentric.

   When the centromere is present slightly away from the middle, it is called sub-metacentric chromosome.

   When the centromere is present very close to one end of the chromosome, it is called acrocentric chromosome.

   When the centromere is present at terminal position, the chromosome is called telocentric.

120. **Answer (1)**
   - Gemmae are green, multicellular asexual buds that are produced by some liverworts like *Marchantia*.
   - Mosses reproduce vegetatively by fragmentation and budding of protonema.
   - Pteridophytes and Gymnosperms normally do not reproduce asexual spores.

121. Answer (3)

Various enzymes like protease, RNase, *etc.*, are added to break down substances like proteins, RNA, *etc*. Once all these substances are broken down, DNA is left which is precipitated out by adding chilled ethanol.

Histones are basic proteins that help condense DNA in a cell.

122. Answer (2)

- Ethylene promotes formation of female flowers in cucumbers thereby increasing the yield.
- Abscisic acid stimulates the closure of stomata.
- Cytokinins helps to produce new leaves, chloroplasts in leaves, lateral shoot growth and adventitious shoot formation.
- GA_3 is used to speed up the malting process in brewing industry.

123. Answer (1)

- The site of perception of light in plants during photoperiodism is leaf.
- The site of perception of low temperature stimulus during vernalisation is shoot apex and embryo.
- Axillary bud are not sites of perception of photoperiod.

124. Answer (4)

Some synthetic auxins are used as weedicides. 2,4-D is widely used to remove broad leaved weeds or dicotyledonous weeds.

IAA and IBA are natural auxins.

NAA is a synthetic auxin.

125. Answer (4)

- The cell wall of red algae is composed of agar, carrageen and funori along with cellulose.
- In brown algae, cell wall is covered by gelatinous coating of algin while in green algae cell wall is composed of inner layer of cellulose and an outer layer of pectose.
- In blue green algae, cell wall is composed of mucopeptides.

126. Answer (4)

- Formation of DNA from DNA is replication.
- Formation of mRNA from DNA is called transcription.
- Formation of protein from mRNA is called translation.
- So, (a) is Replication
    - (b) is Transcription
    - (c) is Translation
    - (d) is Protein
- Transduction is transfer of genetic material from one bacterium to another with the help of virus or a bacteriophage.

127. Answer (3)

- Amino acids and glucose are included under the category of primary metabolites as they have identifiable functions and play known roles in normal physiological processes.
- Rubber, gums, morphine, codeine, vinblastin and curcumin are included under the category of secondary metabolites as their role or functions in host organisms is not known yet. However, many of them are useful to human welfare.

128. Answer (2)

- Inspite of interspecific competition, the competing species may co-exist by doing resource partitioning.
- In mutualism, two organisms are equally benefitted.
- In predation, one organism (Predator) eats the another one (Prey).
- In competition release, there occurs dramatical increase in population of a less distributed species when its superior competitor is removed.

129. Answer (4)

PCR is Polymerase Chain Reaction.

It is used for making multiple copies of the desired genes.

Hence, PCR can be used for:

- Gene amplification
- PCR-based assays have been developed that detect the presence of gene sequences of the infectious agents.
- Detecting mutations PCR cannot be used for isolation or purification of proteins.

130. Answer (2)

(a) Meristematic tissues are those tissues which have cells with active cell division capacity.

(b) Simple tissues are those tissues which have all the cells similar in structure and function.

(c) Vascular tissues are complex permanent tissues hence they have different types of cells.

(d) Sclereids are sclerenchymatous cells which are dead with highly thickened walls and narrow lumen.

131. Answer (2)

A typical angiospermic embryo sac has seven cells that are three antipodals, one central cell, one egg cell and two synergids.

The central cell has two polar nuclei, hence the embryo sac is eight nucleated.

132. **Answer (2)**

Ectocarpus is a brown alga belongs to the class Phaeophyceae. Members of this class have mannitol and laminarin as stored food material.

Ulothrix and *Volvox* belong to Chlorophyceae (green algae). Members of this class have starch as reserve food material. *Gracilaria* is a member of red algae (Rhodophyceae). This class is characterised by having floridean starch as stored food material.

133. **Answer (1)**

Plants like *Selaginella* and *Salvinia* produce two kinds of spores i.e., microspores and macrospores. They are known as heterosporous. Most of the pteridophytes produce single type of spores and are called homosporous.

Sorus (Sori) are brownish or yellowish cluster of spore producing structures located on the lower surface of fern leaves.

134. **Answer (4)**

- Several kinds of radiations like gamma rays, X-rays, UV-rays cause mutations. These are physical mutagens.
- Such induced mutation in plants is done to develop improved varieties.
- The first natural cytokinin was isolated from unripe maize grain known as zeatin. The cytokinin that was obtained from degraded product of autoclaved herring sperm DNA was kinetin (N^6-furfuryl aminopurine).
- Infrared rays cause heating effect.

135. **Answer (2)**

- Amensalism is an interaction between two organisms of different species in which one species inhibits the growth of other species by secreting certain chemicals. The first species is neither benefited nor harmed.
- (+) ; (0) interaction is observed in commensalism.
- (+) ; (+) interaction is observed in mutualism.
- (−) ; (−) interaction is seen in competition.

SECTION-B

136. **Answer (3)**

- RNA polymerase III transcribes tRNA, ScRNA, 5S rRNA and SnRNA.
- RNA polymerase I transcribes 5.8S, 18S and 28S rRNA.
- RNA polymerase II transcribes hnRNA which is precursor of mRNA

137. **Answer (4)**

- When the cells of medullary rays differentiate, they give rise to the new cambium called interfascicular cambium.
- Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in bark are called complementary cells.
- Large colourless empty cells in the epidermis of grass leaves are called bulliform cells.
- In dicot leaves, vascular bundles are surrounded by large thick walled cells called bundle sheath cells.

138. **Answer (2)**

pBR322 is a commonly used cloning vector. When the gene for β-galactosidase is inserted in the ampicillin resistance gene by using *Pst* the recombinant *E.coli* loses ampicillin resistance due to insertional inactivation of the antibiotic resistance gene.

The host (recombinant) cell will produce β-galactosidase which is not a novel protein nor does it show dual ability.

The transformed recombinant cannot resist ampicillin as they have lost ampicillin resistance.

A recombinant *E. coli* is produced and the host cell will not undergo lysis due to the insertion of β-galactosidase gene.

139. **Answer (3)**

- DNA fingerprinting involves identifying differences in some specific regions in DNA sequence called as repetitive DNA.
- The basis of DNA fingerprinting is VNTR (a satellite DNA as probe that show very high degree of polymorphism)
- Polymorphism is the variation at genetic level. Allelic sequence variation has traditionally been described as a DNA polymorphism.

140. **Answer (4)**

In the exponential growth equation $N_t = N_0 e^{rt}$,

e represents the base of natural logarithms

N_t = Population density after time t

N_0 = Population density at time zero

r = Intrinsic rate of natural increase called biotic potential.

141. **Answer (1)**

- Cyclic photophosphorylation involves only PS I. Both PS I and PS II are involved in non-cyclic photophosphorylation where both ATP and NADPH + H^+ are synthesized.
- Both PS I and PS II are found on grana lamellae whereas stroma lamellae have PS I only and lack NADP reductase.

142. **Answer (3)**

- In some blue-green algae specialised cells called heterocyst fix atmospheric nitrogen into ammonia.
- Fusion of two nuclei is called Karyogamy.
- Organisms that depend on living plants are parasites. Saprophytes grow on dead material.
- Fusion of protoplasts of two cells is called plasmogamy.

143. **Answer (4)**

- *Albugo* is a member of phycomycetes. The mycelium is aseptate and coenocytic.

- *Claviceps* is a member of Ascomycetes. Mycelium is septate and branched.
- Viroids are found to be free RNA infectious agent which causes potato spindle tuber disease.
- *Trypanosoma* causes sleeping sickness.

144. Answer (3)
- During respiration, process of ATP synthesis is explained by chemiosmotic model. It says that a proton gradient is required for ATP synthesis that is established by oxidation-reduction reactions.
- In ETC, one NADH + H$^+$ produces 3 ATP while one FADH$_2$ produces 2 ATP molecules.
- ATP is synthesised via complex V.
- In ETS, oxygen acts as terminal electron acceptor.

145. Answer (1)
- In members of some plant families like Solanaceae, Rosaceae and Leguminosae, the pollen grains retain their viability for several months.
- In cereals (Poaceae), pollen grains retain viability for around 30 minutes.

146. Answer (3)
- Split gene arrangement is characteristic of eukaryotes.
- In capping 5-methyl guanosine triphosphate is added at 5′ end of hnRNA.
- At 3′ end poly-A tail is added.
- The non coding or template strand is copied to an mRNA. RNA polymerase associate with ρ factor (Rho factor) and it alters the specificity of the RNA polymerase to terminate the processes.

147. Answer (2)

The floral formula of

Brassicaceae family	–	$\oplus ⚥ K_{2+2} C_4 A_{2+4} \underline{G}_{(2)}$
Solanacae family	–	$\oplus ⚥ K_{(5)} \overparen{C_{(5)} A_5} \underline{G}_{(2)}$
Fabaceae family	–	$\% ⚥ K_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$
Liliaceae family	–	$Br \oplus ⚥ \overparen{P_{(3+3)}} A_{3+3} \underline{G}_{(3)}$

148. Answer (2)
- In a polypeptide or a protein, amino acids are linked by peptide bonds. A peptide bond is formed when the carboxyl (–COOH) group of one amino acid reacts with the amino (–NH$_2$) group of the next amino acid with the elimination of a water moiety.
- Unsaturated fatty acids are with one or more C = C double bonds.
- In nucleic acids, a phosphate moiety links the 3'-carbon of one sugar of one nucleotide to the 5'-carbon of the sugar of the succeeding nucleotide. The bond between the phosphate and hydroxyl group is an ester bond. As there is one such ester bond on either side, it is called phosphodiester bond.
- In a polysaccharide, the individual monosaccharides are linked by a glycosidic bond.

149. Answer (4)
- In S phase DNA replication takes place.
- In G$_2$ phase there is synthesis of proteins, RNA etc.
- Quiescent stage is inactive stage of cell cycle but cells remain metabolically active in this stage.
- G$_1$ phase is the interval between mitosis and initiation of DNA replication.

150. Answer (4)

Autoradiography allows the detection/localisation of radioactive isotope within a biological sample. Probe is a radiolabelled ssDNA or ssRNA depending on the technique. To identify the mutated gene, the probe is allowed to hybridise to its complementary DNA in a clone of cells followed by its detection using autoradiography. The mutated gene will not appear on the photographic film, because the probe does not have complementarity with the mutated gene.

ZOOLOGY

SECTION-A

151. Answer (1)
- Juxtaglomerular cells of kidney secrete erythropoietin hormone which stimulates RBC formation.
- Alpha cells of pancreas produce glucagon.
- The cells of bone marrow are responsible for the formation of formed elements.

152. Answer (2)
- A ring of gastric caeca is present at the junction of foregut and midgut. At the junction of midgut and hindgut, Malpighian tubules are present.
- Hypopharynx lies within the cavity enclosed by mouthparts.
- In a female cockroach, the 7th sternum is boat shaped and together with the 8th and 9th sterna forms a genital pouch.
- 10th abdominal segment in both sexes bears a pair of anal cerci.

153. Answer (2)

In male frogs, the Bidder's canal is located in the kidney. It plays a significant role in the pathway of

sperm transport. Vasa efferentia enter the kidneys on their side and open into Bidder's canal.

154. **Answer (4)**
- In meiosis I, chiasmata (X shaped structure) is formed in diplotene stage while terminalisation of chiasmata is seen in diakinesis stage.
- Bivalents are formed in zygotene stage and crossing over takes place in pachytene stage.
- Compaction of chromosomal material occurs in leptotene stage.

155. **Answer (2)**
- pO_2 in alveoli is 104 mm Hg and pCO_2 in alveoli is 40 mm Hg.
- In atmosphere, pO_2 is 159 mm Hg and pCO_2 is 0.3 mm Hg.
- In deoxygenated blood, pO_2 is 40 mm Hg and pCO_2 is 45 mm Hg.
- In oxygenated blood, pO_2 is 95 mm Hg and pCO_2 is 40 mm Hg.

156. **Answer (4)**
- *Physalia* is commonly known as the Portuguese man of war.
- *Limulus* is considered as a living fossil and is commonly known as king crab.
- *Ancylostoma* is a roundworm and is commonly known as hookworm.
- *Pinctada* is a mollusc and is commonly known as pearl oyster.

157. **Answer (4)**
- High temperature about 94°C is required for the process of denaturation which is the first step of PCR.
- Annealing is performed at 50°-60°C which is the second step that can get affected.
- Addition of nucleotides to the primer, synthesizing a new DNA strand using only the template sequences with the help of enzyme DNA polymerase is called primer extension/ polymerisation.

158. **Answer (2)**
Aspergillus niger is involved in production of citric acid. *Acetobacter aceti* is involved in production of acetic acid. *Clostridium butylicum* is involved in production of butyric acid whereas *Lactobacillus* is involved in the production of lactic acid.
So a(iii), b(i), c(iv), d(ii) is correct matching.

159. **Answer (4)**
- Intercalated discs are found only in cardiac muscle tissues.
- Smooth muscle fibres are non-striated and involuntary in nature and are present in the wall of blood vessels, uterus, gall bladder, alimentary canal *etc.*

160. **Answer (4)**
- Myasthenia gravis is a chronic auto immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle.

- Gout is caused due to deposition of uric acid crystals in joints leading to its inflammation.
- Inflammation of joints is commonly known as arthritis.
- Muscular dystrophy is a genetic disorder which results in progressive degeneration of skeletal muscle.

161. **Answer (1)**
Individuals with 'AB' blood group contain antigens 'A' and 'B' but lack antibodies anti-A and anti-B in plasma. So, they can accept blood from individuals with AB as well as the other blood groups due to the absence of antibodies in their blood. Therefore, such individuals are called 'Universal recipients'.

162. **Answer (2)**
In S phase, there is duplication of DNA. So amount of DNA increases but not the chromosome number.
So, if the number of chromosomes at G_1 phase is 8 in fruit fly then the number of chromosomes will be same in S phase that is 8 only.

163. **Answer (1)**
- Zona pellucida has receptors for sperm binding (ZP3 receptors) in mammals.
- Corona radiata is a layer of radially arranged granulosa cells.
- Perivitelline space is present in between vitelline membrane and zona pellucida.

164. **Answer (1)**
- Housefly belongs to the family Muscidae, class Insecta and phylum Arthropoda.
- Fire flies are placed in family Lampyridae of class Insecta.
- Grasshopper is also an insect placed in family Acrididae.
- Cockroach is also an insect placed in family Blattidae.

165. **Answer (1)**
- Ricin is a toxin obtained from 'Ricinus' plant. Vinblastin and curcumin are drugs.
- Morphine and codeine are alkaloids.
- Abrin is also a toxin obtained from plant 'Abrus'.
- Concanavalin A is a lectin.

166. **Answer (4)**
- Venereal diseases or sexually transmitted diseases or infections are transmitted by sharing of infected needles, surgical instruments with infected person, transfusion of blood or from an infected mother to foetus.
- Venereal diseases are not transmitted through kissing or inheritance.

167. **Answer (3)**
- Endomembrane system consists of endoplasmic reticulum, Golgi complex, vacuoles and lysosomes.
- Mitochondria is a semi-autonomous cell organelle.
- Ribosome is a non-membranous cell organelle.

168. **Answer (2)**

   - ELISA can be used for early detection of an infection either by detecting the presence of pathogenic antigen or by detecting the antibodies synthesized against the pathogen.

   - Using conventional methods of diagnosis (serum and urine analysis), early detection is not possible.

169. **Answer (4)**

   - Insulin is synthesized as a pro-hormone which contains A-chain, B-chain and an extra stretch called the C-peptide.

   - C-peptide is not present in the mature insulin.

   - Chains A and B are connected by interchain disulphide bridges.

170. **Answer (4)**

   - Each restriction endonuclease recognizes a specific palindromic nucleotide sequence in the DNA. Once it finds its specific recognition sequence, it bind to DNA and cuts each of the two strands of DNA.

   - During post transcriptional modification in eukaryotes, poly(A) tail (200–300 adenylate residues) are added at 3' end of hnRNA.

   - During DNA replication, Okazaki fragments are synthesized discontinuously and joined by DNA ligases.

   - A PCR primer sequence is termed degenerate if some of its position have several possible bases.

171. **Answer (3)**

   - In prokaryotes, the DNA dependent RNA polymerase is a holoenzyme that is made of polypeptides $(\alpha_2\beta\beta'\omega)$ σ. It transcribe all types of RNAs i.e., mRNA, tRNA and rRNA.

   - DNase degrades DNA.

   - DNA dependent DNA polymerase is involved in replication of DNA.

   - DNA ligase joins the discontinuously synthesised fragments of DNA.

172. **Answer (2)**

   - Hollow and pneumatic long bones are present in animals that belong to the class Aves *e.g., Neophron* (vulture).

   - *Ornithorhynchus* (Platypus) and *Macropus* (Kangaroo) belong to the class Mammalia.

   - *Hemidactylus* (Wall lizard) is a member of class Reptilia.

173. **Answer (1)**

   - Metagenesis (alternation of generation) is observed in the members of the phylum Coelenterata (Cnidaria).

   - Echinoderms are triploblastic and coelomate animals as true coelom is observed in them.

   - Roundworms (Aschelminths) have organ system level of organization.

   - Comb plates present in ctenophores help in locomotion.

   - Water vascular system is seen in echinoderms which helps in locomotion, capture and transport of food and respiration.

174. **Answer (3)**

   - Diaphragms, cervical caps and vaults are barrier methods of contraception for female. They work by blocking the entry of sperms through the cervix.

   - IUDs increase phagocytosis of sperms within the uterus.

   - Vasectomy is a surgical method of contraception in males in which a small part of the vas deferens is removed or tied up through a small incision on the scrotum.

   - Tubectomy is a surgical method of contraception in females where a small part of the fallopian tube is removed or tied up through a small incision in the abdomen or through vagina.

175. **Answer (4)**

   In frogs, the digested food is absorbed by the numerous finger-like folds in the inner wall of intestine called villi and microvilli.

176. **Answer (4)**

   According to Chargaff's rule, for a double stranded DNA,

   $\because$ [A] = [T],

   [A] = 30% $\Rightarrow$ [T] = 30%

   Since [C] = [G]

   $\therefore$ 100 – [A + T]

= 100 − [30 + 30]

= 100 − 60 = 40%

and C = G = 20% each

∴   [A] = 30%

[T] = 30%

[G] = 20%

[C] = 20%

177. **Answer (4)**

Metamerism is commonly seen in the members of the phylum Annelida where the body is externally and internally divided into segments with a serial repetition of atleast some organs.

Water canal system is present in the members of the phylum Porifera.

The body of ctenophores bears 8 external rows of ciliated comb plates which help in locomotion.

Cnidoblasts or cnidocytes are characteristic feature of cnidarians (Coelenterata).

178. **Answer (2)**

During coagulation of blood, an enzyme complex thrombokinase helps in the conversion of prothrombin (present in plasma) into thrombin.

Thrombin further helps in the conversion of inactive fibrinogens into fibrins which form network of threads.

Renin is secreted by JG cells in response to fall in glomerular blood flow, which converts angiotensinogen in blood to angiotensin-I.

Epinephrine or adrenaline is secreted by adrenal medulla in response to stress of any kind and during emergency.

179. **Answer (4)**

Tropical regions have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.

180. **Answer (3)**

Trichoderma species are free-living fungi that are very common in the root ecosystems. They are effective biocontrol agents of several plant pathogens.

181. **Answer (3)**

- LNG-20 is a hormone releasing IUD which makes the uterus unsuitable for implantation and the cervix hostile to sperms.

- Multiload 375, CuT and Cu7 are copper releasing IUDs which suppress sperm motility and the fertilizing capacity of sperms.

182. **Answer (2)**

- During S phase of cell cycle replication of DNA takes place. In animal cells during S phase, centriole duplicates in the cytoplasm.

- In G_2 phase there is duplication of mitochondria, chloroplast and Golgi bodies. Tubulin protein is also synthesized during this phase.

- During prophase, condensation of chromatin starts.

- During metaphase, chromosomes get aligned at equator to form metaphasic plate.

183. **Answer (1)**

- siRNA are small interfering RNA also called silencing RNA. It is a class of double-stranded RNA, non-coding RNA molecules.

- mRNA is messenger RNA that carries genetic information provided by DNA.

- tRNA carries amino acids to the mRNA during translation.

- rRNA is structural RNA that is a part of ribosomes which are involved in translation.

184. **Answer (4)**

According to given question;
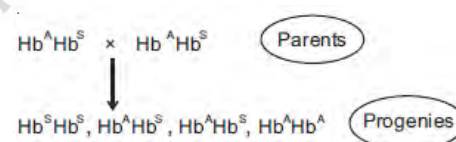
Total number of affected progenies = 1

∴   Percentage of diseased/affected progenies

$$= \frac{1}{4} \times 100 = 25\%$$

185. **Answer (2)**

- The factors favourable for the formation of oxyhaemoglobin at the alveolar level are: High pO_2, low pCO_2, less H^+ concentration and lower temperature.

- The conditions favourable for the dissociation of oxygen from oxyhaemoglobin at the tissue level are: Low pO_2, high pCO_2, high H^+ concentration and high temperature.

SECTION-B

186. Answer (4)

- Polar seal generally has shorter ears and limbs (extremities) to minimise heat loss. This is with reference to Allen's rule.

- Kangaroo rat exhibits physiological adaptation.

- Desert lizard shows behavioural adaptation. They lack the physiological ability to cope-up with extreme temperature but manage the body temperature by behavioural means.

- Marine fishes at depth are adapted biochemically to survive in great depths in ocean.

187. Answer (2)

- Adaptive radiation is the process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography. For example, Darwin's finches.

- Analogous organs are not anatomically similar structures though they perform similar functions. They are a result of convergent evolution, for example, Wings of butterfly and birds.

- Homologous organs which are anatomically similar structures but perform different functions according to their needs, are a result of divergent evolution, for example: Bones of forelimbs in man and whale.

- Evolution by anthropogenic action means evolution due to human interference, for example, Antibiotic resistant microbes, herbicides resistant varieties and pesticide resistant varieties.

188. Answer (1)

- At the end of gestation, the completely developed foetus is expelled out. This process is called parturition.

- Parturition is controlled by a complex neuroendocrine mechanism.

- Estrogen and progesterone ratio increases as estrogen levels rise significantly.

- Prostaglandins, which stimulate uterine contractions, are also produced and they act on the myometrial lining of uterus.

- Oxytocin, the main hormone (also called birth hormone), is released by maternal pituitary. Oxytocin brings about strong uterine contractions.

- Prolactin is a lactation hormone that has no role in initiation of parturition.

189. Answer (3)

- Histones are rich in basic amino acids residue lysine and arginine with charged side chain.

- There are five types of histone proteins i.e., H1, H2A, H2B, H3 and H4. Four of them occur in pairs to produce a unit of 8 molecules (histone octamer)

- The pH of histones is basic.

190. Answer (2)

During muscle contraction, the following events occur:

(1) The globular head of myosin acts as ATPase and hydrolyses ATP molecule and eventually leads to the formation of cross bridge.

(2) This pulls the actin filament towards the centre of 'A-band'.

(3) The Z-line attached to these actins are also pulled inwards, thereby, causing a shortening of the sarcomere.

(4) The thin myofilaments move past the thick myofilaments due to which the H-zone narrows. This reduces the length of I-band but retains the length of A-band.

(5) The myosin then releases ADP+Pi, and goes back to its relaxed state.

191. Answer (1)

- Scapula is a large triangular flat bone situated in the dorsal part of the thorax between the second and the seventh ribs.

- Fibrous joint is shown by the flat skull bones which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures, to form the cranium.

- Sternum is a flat bone on the ventral midline of thorax.

- Cartilaginous joints between the adjacent vertebrae in the vertebral column permits limited movements.

192. Answer (2)

Altitude sickness can be experienced at high altitudes where the body does not get enough oxygen due to the low atmospheric pressure and It leads to nausea, fatigue and heart palpitations.

193. Answer (2)

Adenosine deaminase (ADA) enzyme is crucial for the immune system to function. Hence, its deficiency results in the dysfunctioning of the immune system.

- Hyposecretion of hormones of the adrenal cortex causes Addison's disease.
- Parkinson's disease is a long-term degenerative disorder of the central nervous system.
- Disorders which affect GIT and associated glands are called digestive disorders.

194. Answer (2)

The brain of frogs is divided into fore-brain, mid-brain and hind brain. Forebrain includes olfactory lobes, paired cerebral hemispheres and unpaired diencephalon. The midbrain is characterised by a pair of optic lobes. Hind brain consists of cerebellum and medulla oblongata. The medulla oblongata passes out through the foramen magnum and continues into spinal cord, which is enclosed in the vertebral column.

195. Answer (3)

- Filariasis is the disease caused by *Wuchereria bancrofti*, a filarial worm.
- Amoebiasis/Amoebic dysentery is caused by a protozoan parasite *Entamoeba histolytica* in the large intestine of human.
- Pneumonia is caused by bacteria like *Streptococcus pneumoniae* and *Haemophilus influenzae*.
- Ringworm is caused by fungi belonging to the genera *Microsporum*, *Trichophyton* and *Epidermophyton*.

196. Answer (4)

- Lipids having only single bonds are called saturated fatty acids and lipids having one or more C = C double bonds are called unsaturated fatty acids.
- Palmitic acid has 16 carbon atoms including the carboxyl carbon.
- Arachidonic acid has 20 carbon atoms including the carboxyl carbon.
- Lecithin is a phospholipid found in cell membrane.
- Glycerol has 3 carbons, each bearing a hydroxyl (–OH) group.

197. Answer (2)

- The anterior end of the earthworm has a mouth which has a covering called the prostomium.
- Prostomium acts as a wedge to force open cracks in the soil.
- Prostomium has receptors, so it is sensory in function.
- The first body segment of earthworm is the peristomium.

198. Answer (3)

The hormone relaxin is produced in the later phase of pregnancy. It is produced by the ovary.

- Graafian follicle is not formed when a woman is pregnant.
- Uterus and foetus do not produce relaxin.

199. Answer (1)

- AUG has dual functions, it codes for methionine. It also acts as initiator codon.
- AUG does not code for phenylalanine.
- Statement II is true.

200. Answer (3)

Three types of junctions are found in tissues:

- Tight junctions stop leakage of substances from leaking across a tissue.
- Adhering junctions cement and keep neighbouring cells together.
- Gap junctions or communication junctions facilitate communication between cells by connecting the cytoplasm of adjoining cells.

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