Date: 09-Apr-2025

Duration: 3 Hours

Max Marks: 720

Physics - Section A

1.

Answer: 1

Sol:

$\Delta U = \Delta Q = \Delta W$
Now $\Delta W = P \Delta V = 50 [4 - 10] = -300$ J
$\Delta Q = 100$ J $\Delta Q = 100$ J
So $\Delta U = 400$ J increased

2.

Answer: 2

Sol:

There are seven fundamental quantities :
Mass, Length, Time, Temperature, Electric current, Luminous intensity, Amount of substance.
Electric charge is not include in these quantities

3.

Answer: 2

Sol:

$F_e = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1 q_2}{r^2}$

For F_e to be minimum, q_1 an q_2 should be minimum, we know that

$(q_1)_{min} = (q_2)_{min} = e = 1.6 \times 10^{-19}$ C

Hence, $(F_e)_{min} = \frac{(9 \times 10^9) (1.6 \times 10^{-19}) (1.6 \times 10^{-19})}{(1.0)^2}$

$= 2.304 \times 10^{-28}$ N

4.

Answer: 2

Sol:

Given

x = 2 + 4t

y = 3t + 8t^2

$v_x = \frac{dx}{dt} = 4 \left(\text{constant}\right)$

$v_y = \frac{dy}{dt} = 3 + 16t$

$a_x = 0$

$a_y = +16$

$a_{net} = +16$ i.e. uniformly accelerated

Also, from given equation $t = \frac{x-2}{4}$

$\therefore y = 3\frac{(x-2)}{4} + 8\left(\frac{x-2}{4}\right)^2$

$= \frac{3}{4}x - \frac{3}{2} + \frac{1}{2}\left(x^2 + 4 - 4x\right)$

$y = \frac{3}{4}x - \frac{3}{2} + \frac{x^2}{2} + 2 - 2x$

$\Rightarrow 4y = 3x - 6 + 2x^2 + 8 - 8x$

$\Rightarrow \boxed{4y = 2x^2 - 5x + 2}$

i.e. parabolic path.

5.

Answer: 4

Sol:

Given :

Kinetic energy of proton, E = 2 MeV = 2 x 10^6 eV = 3.2 x 10^{-13} J

Magnetic field, B = 2.5 T

Kinetic energy is given by :

K = $\frac{1}{2}$mv²

m is the mass of proton, m = 1.67 x 10^{-27} kg

v² = $\frac{2 \times 3.2 \times 10^{-13}}{1.67 \times 10^{27}}$

v² = 3.83 x 10^{14}

v = 1.95 x 10^7 m/s

Force on the proton is given by:

F = qvBsin θ

Here, θ = 90°

F = qvB

= 1.6 × 10^{-19} × 10^7 × 2.5

$F = 7.8 \times 10^{-12} \, N \approx 8 \times 10^{-12} \, N$

6.

Answer: 3

Sol:

By Hooke's law

$Y = \frac{Fl}{A \Delta l}$

$\Delta l \propto \frac{Fl}{A}$

$\frac{\Delta l_2}{\Delta l_1} = \frac{F_2 l_2}{F_1 l_1} \times \frac{A_1}{A_2}$

$= \frac{2f \times 2\,L}{f \times L} \times \frac{\pi (r)^2}{\pi (2r)^2}$

$\Delta l_1 = \Delta l_2$

$\Delta l_2 = l$

Therefore, the correct answer is (3).

7.

Answer: 3

Sol:

By the Newton's law of cooling

$\frac{dT}{dt} = k \left(\frac{T_1 + T_2}{2} - To \right)$

∴ For case -I

$\frac{3T - 2T}{10} = k \left[\frac{3T + 2T}{2} - T \right]$

$\frac{T}{10} = k \left[\frac{3T}{2} \right]$

or $k = \frac{1}{15}$

According to question in next 10 min it cools from 2T to a unknown temperature T' then

$\frac{2T - T'}{10} = k \left[\frac{2T + T'}{2} - T \right]$

$\frac{2T - T'}{10} = \frac{1}{15} \times \frac{T'}{2}$

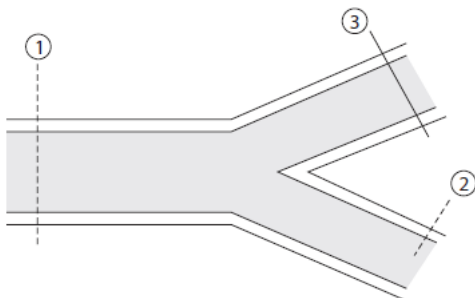$6T - 3T' = T'$

or $T' = \frac{3}{2} T$

8.

Answer: 1

Sol:

Consider any three sections (1), (2) and (3) in the three pipes of different radii, as shown the figure. If v_1 and v_2 be the velocity of water at section (1) and (2) respectively, then :-

$A_1 = \pi \left(10\right)^2 \text{ cm}^2$; $A_2 = \pi(5)^2 \text{ cm}^2$; $A_3 = \pi(3)^2 \text{ cm}^2$

$v_1 = v_2 =?$ and $v_3 = 5 \text{ cm/s}$

The rate of discharge the three pipes are

$A_1 v_1 = 100 \ \pi v_1 \text{ cm}^3/\text{s}$;
$A_2 v_2 = 25 \ \pi v_2 \text{ cm}^3/\text{s}$

and $A_3 v_3 = 9\pi \times 5 = 45 \ \pi \text{ cm}^3/\text{s}$

Now, $Q = A_1 v_1 = A_2 v_2 + A_3 v_3$

$\Rightarrow 600 \ \pi = 100\pi v_1 = 25\pi v_2 + 45\pi$

Solving, we get, $v_1 = 6 \text{ cm/s}$ and $v_2 = 22.2 \text{ cm/s}$

Threfore, the correct answer is (A).

9.

Answer: 1

Sol:

One farad is defined as the capacitance C of a capacitor across which, when charged with Q coulomb, when there is potential difference of 1 volt. So,

$[C] = \left[\dfrac{Q}{V}\right] = \left[\dfrac{Q^2}{W}\right] = \left[\dfrac{A^2 T^2}{M^1 L^2 T^{-2}}\right]$

$[C] = \left[M^{-1}L^{-2}T^4 A^2\right]$

10.

Answer: 3

Sol:

Orbital speed near the earth's surface is
$v_0 = \sqrt{\dfrac{GM}{R}}$

Conserving energy,

$\dfrac{1}{2}mv_0^2 - \dfrac{GMm}{R} = -\dfrac{GMm}{R+h}$

or $\dfrac{1}{2}\dfrac{GM}{R} - \dfrac{GM}{R} = -\dfrac{GM}{R+h} = -\dfrac{GM}{2R}$

$\Rightarrow$ h = R

11.

Answer: 3

Sol:

The horizontal range of the projectile is

$R = \dfrac{u^2 \sin 2\theta}{g}$

{Here $u_1 = 40 \text{ m/s}, \theta_1 = 30°$,
$\qquad\qquad u_2 = 60 \text{ m/s}, \theta_2 = 60°$}

$\dfrac{R_1}{R_2} = \left(\dfrac{u_1}{u_2}\right)^2 \dfrac{\sin 2\theta_1}{\sin 2\theta_2}$

$\dfrac{R_1}{R_2} = \left(\dfrac{40}{60}\right)^2 \dfrac{\sin 60°}{\sin 120°}$

$\Rightarrow \dfrac{R_1}{R_2} = \dfrac{4}{9}$

12.

Answer: 1

Sol:

Given :

Changing rate of radius = 10^{-2} unit

Magnetic field = 10^{-3} unit

Induced emf e = 1μV

The induced emf is given by

$e = -\dfrac{d\phi}{dt} = -\dfrac{BdA}{dt} = -B\left(2\pi r\right)\dfrac{dr}{dt}$

$r = \dfrac{e}{B\left(2\pi\right)\left(\frac{dr}{dt}\right)}$

$\dfrac{1 \times 10^{-6}}{10^{-3} \times 2 \times 3.14 \times 10^{-2}}$

r = 1.6 cm

13.

Answer: 4

Sol:

$\frac{t}{10} = \frac{6^2 - 2^2}{2^2 - 0^2} \Rightarrow t = 80 \text{ h}$

14.

Answer: 3

Sol:

$X = 3 \, YZ^2$

$[Y] = \frac{[X]}{[Z]^2} = \frac{[M^{-1}L^{-2}T^4A^2]}{[MT^{-2}A]^2}$

$= [M^{-3}L^{-2}T^8A^4]$

15.

Answer: 1

Sol:

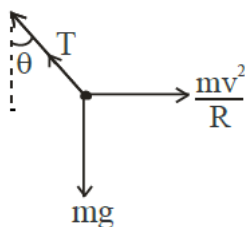Near the earth's surface, $v_0 = \sqrt{\frac{GM}{R}} = \frac{2\pi R}{T}$

$\therefore T^2 = \frac{4\pi^2 R^3}{GM} = \frac{4\pi^2 R^3}{G.\frac{4}{3}\pi R^3 \rho} = \frac{3\pi}{G\rho}$

or $\rho T^2 = \frac{3\pi}{G}$ = Universal constant.

16.

Answer: 3

Sol:

$T\cos\theta = mg$

$T\sin\theta = \frac{mv^2}{R}$

$\tan\theta = \frac{v^2}{Rg}$

$\Rightarrow \tan\theta = \frac{20^2}{40 \times 10}$

$\Rightarrow \tan\theta = 1$

$\Rightarrow \theta = \frac{\pi}{4}$
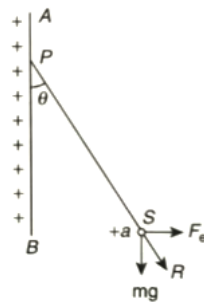
17.

Answer: 1

Sol:

By theory

18.

Answer: 2

Sol:

The electric field due to infinite plane sheet of charge

$E = \frac{\sigma}{2\varepsilon_0}$

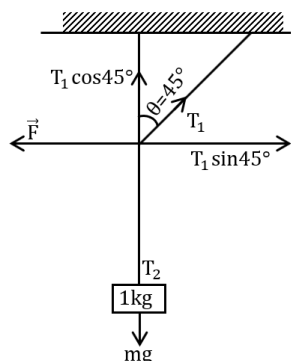The force on sphere S due to electrostatic repulsion is

Hence, from figure $F_e = QE = \frac{\sigma Q}{2\varepsilon_0}$

$\tan\theta = \frac{QE}{mg} = \frac{\sigma E}{2\varepsilon_0 \, mg}$ or $\theta = \tan^{-1}\left(\frac{\sigma Q}{2\varepsilon_0 \, mg}\right)$

19.

Answer: 1

Sol:

From figure

AS system is in equilibrium, therefore

$T_1 \cos 45° = mg$

$T_1 \sin 45° = F$

$\therefore \tan 45° = \dfrac{F}{mg}$

$\Rightarrow F = mg$

F = 10 N

20.

Answer: 1

Sol:

$\omega = \dfrac{P_1V_1 - P_2V_2}{\gamma - 1} = \dfrac{nRT - nRT_2}{\gamma - 1}$

$= \dfrac{nRT_1}{\gamma - 1}\left[1 - \left(\dfrac{V_1}{V_2}\right)^{\gamma - 1}\right]$

21.

Answer: 3

Sol:

In a given scientific notation of a number, all non zero numbers are significant.
Hence in 11.118×10^{-6} significant digita are 5.
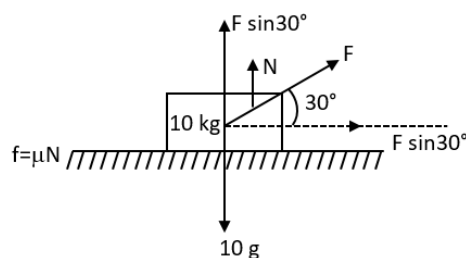
22.

Answer: 3

Sol:

KE = work done $= q\Delta V$

$= e[1V] = 1eV$

23.

Answer: 3

Sol:

Given, m $= 10$ kg $\qquad \mu_S = 0.25$

$\theta = 30°, \ g = 10 \ \text{m/s}$

$F \cos 30° = f$ .... (1)

$F \sin 30° + N = mg$

$N = mg - F \sin 30°$ .... (2)

By equation (1)

$F \cos 30° = \mu_S (mg - F \sin 30°)$

$F (\cos 30° + \mu_S \sin 30°) = \mu_S mg$

$F = \dfrac{0.25 \times 10 \times 10}{\frac{\sqrt{3}}{2} \times 0.25 \times \frac{1}{2}}$

$F = \dfrac{50}{1.98} \Rightarrow 25.2 \ \text{N}$

24.

Answer: 2

Sol:

Given-

$L = 2$ m, r $= 1$ cm $= 10^{-2}$ m

twist $= \theta = 0.8$ rad.

angle of shear $\phi = \dfrac{r\theta}{L} = \dfrac{10^{-2} \times 0.8}{2}$

$= 0.4 \times 10^{-2}$

shear strains$= 0.004$ rad.

25.

Answer: 3

Sol:

Mean time: $t_m = \dfrac{30 + 32 + 35 + 31}{4} = 32$

By rounding off : $\Delta t = \pm 2 \ s$

$\therefore \ t + \Delta t = 32 \pm 2 \ s$

26.

Answer: 1

Sol:

The resistance of wire of length ℓ cross-sectional area A and resistivity ρ is given by

$$R = \rho \frac{\ell}{A}$$

If d is the density and m is the mass of wire, then area of wire

$$A = \frac{m}{\ell d}$$

therefore, $R = \frac{\rho \ell}{\frac{m}{\ell d}} = \frac{\ell d}{m}\ell^2$

Since $\frac{\rho d}{m} = \text{constant}$

$$\frac{\Delta R}{R} \times 100 = 2\left(\frac{\Delta \ell}{\ell} \times 100\right)$$

Now $\frac{\Delta \ell}{\ell} \times 100 = 0.1\%$

$$\frac{\Delta R}{R} \times 100 = 2\left(0.1\right)\%$$
$$= 0.2\%$$

27.

Answer: 4

Sol:

$$R \propto A^{1/3}$$

$$\frac{R_2}{R_1} = \left(\frac{A_2}{A_1}\right)^{1/3} = \left(\frac{162}{6}\right)^{1/3} = \left(27\right)^{1/3} = 3$$

$$R_2 = 3R_1 = 3 \times 3 \times 10^{-15} \text{ m} = 9 \times 10^{-15} \text{ m}$$

28.

Answer: 3

Sol:

The correct option is $C \frac{8}{7} \text{kg}$

Specific heat of copper S_{cu} = 400 J kg^{-1} °C^{-1}

Latent heat of fusion L_f =3.5×105 J kg^{-1}

Mass of copper block M_{cu} = 2 kg

Heat released by cu block = Heat gained by ice to melt.

$$M_{cu}S_{cu} \Delta \theta = ML_f$$
$$\Rightarrow 2 \times 400 \times 500 = M \times 3.5 \times 10^5$$
$$\Rightarrow M = \frac{2 \times 400 \times 500}{3.5 \times 10^5}$$
$$= \frac{8}{7}\text{kg}$$

29.

Answer: 4

Sol:

Least count of vernier calipers

LC = 1 MSD − 1 VSD

$$= \frac{\text{Smallest division on main scale}}{\text{Number of divisions on vernier scale}}$$

20 divisions of vernier scale = 16 divisions of main scale

$$\therefore \ 1\text{VSD} = \frac{16}{20}\text{mm} = 0.8 \text{ mm}$$

$\therefore$ LC = 1 MSD − 1 VSD

= 1 mm − 0.8 mm = 0.2 mm

30.

Answer: 4

Sol:

The maximum current allowed in bulb,
$$i = \frac{P}{V} = \frac{100}{220} = \frac{5}{11}A$$

Resistance of the bulb $R = \frac{V}{i} = \frac{220}{5} = 484\Omega$

When the bulb is connected across voltage V' (=110 V) then power consumed,

$$P' = \frac{(V')^2}{R}$$

$$= \frac{(110)^2}{484} = 25 \text{ W}$$

31.

Answer: 1

Sol:

$\because \lambda \propto \dfrac{1}{\sqrt{m}} \Rightarrow \lambda_e \propto \dfrac{1}{\sqrt{m_e}}, \ \lambda_p \propto \dfrac{1}{\sqrt{m_p}}$

$\therefore \ \dfrac{\lambda_e}{\lambda_p} = \sqrt{\dfrac{m_p}{m_e}}$

32.

Answer: 1

Sol:

→Convex mirror form virtual and diminished image

→Concave mirror may form real and virtual image and may be diminished and inlarge.

33.

Answer: 2

Sol:

From work energy theorem

$W = \Delta KE$

and we know that $P = \dfrac{dW}{dt}$

therefore

$W = \int\limits_{t_1}^{t_2} Pdt = \int\limits_{2}^{4} \left(3t^2 - 2t + 1\right) dt = 46 \ J$

34.

Answer: 2

Sol:

By theory

35.

Answer: 3

Sol:

$B_p\left(x_1 y\right) = 0$

$\dfrac{\mu_0 I}{2\pi y} = \dfrac{\mu_0 (3I)}{2\pi x}$

$x = 3y$

36.

Answer: 2

Sol:

$v_p = - v \times$ slope
$a = - \omega^2 y$

37.

Answer: 3

Sol:

$F = \sqrt{x_1 x_2} = \sqrt{9 \times 25} = \sqrt{225}$

F = 15 cm

38.

Answer: 1

Sol:

$\lambda = \dfrac{hc}{E} = \dfrac{12400}{1.14} Å = 10877 \ Å$

39.

Answer: 2

Sol:

Consider the two coherent sources are I_1 and I_2

$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

$100 = \left(\sqrt{I} + \sqrt{I}\right)^2 = \left(2\sqrt{I}\right)^2 = 4I$

Therefore;

$I = 25 \ \text{units}$ ....(1)

$I_1 = I$ and $I_2 \propto \left(A_2\right)^2$

And $A_2 = A - \dfrac{20}{100}A = \left(\dfrac{4A}{5}\right)$

Therefore;

$I_2 \propto \left(A_2\right)^2 \propto \left(\dfrac{4A}{5}\right)^2$

$I_2 \propto \dfrac{16}{25}A^2$

$I_2 = \dfrac{16}{25}I$

$I'_{max} = \left(\sqrt{I} + \sqrt{\dfrac{16}{25}I}\right)^2 = \left(\sqrt{I} + \dfrac{4}{5}\sqrt{I}\right)^2 = I\left(\dfrac{9}{5}\right)^2$

$= \dfrac{81}{25}I = \dfrac{81}{25} \times 25 = 81$

So, option (B) is correct.

40.

Answer: 4

Sol:

$$\frac{(F_0)_1}{(F_0)_2} = \frac{1}{2} = \frac{\frac{V_1}{2L_1}}{\frac{V_2}{2L_2}} = \frac{V_1}{V_2}\frac{L_2}{L_1} = \frac{V_1}{V_2}\frac{4}{1}$$

$$\frac{V_1}{V_2} = \frac{1}{8} = \frac{\sqrt{\frac{T}{\mu_1}}}{\sqrt{T/\mu_2}}$$

$$\frac{\mu_2}{\mu_2} = \frac{1}{64} = \frac{\rho \cdot A_2}{\rho A_1} = \frac{1}{64}$$

$$\frac{A_1}{A_2} = \frac{\pi r_1^2}{\pi r_2^2} = 64$$

$$\frac{r_1}{r_2} = 8$$

41.

Answer: 1

Sol:

Using formula of Electric field

$$E = \frac{V}{d}$$

$$= \frac{0.5}{5\times10^{-7}}$$

$$= 1 \times 10^6 \ V/m$$

42.

Answer: 3

Sol:

We have,

$$S_2 D = \sqrt{S_1 D^2 + S_1 S_2^2}$$

$$= \sqrt{4^2 + 3^2}$$

$$= 5 \ m$$

$$\Delta x = S_2 D - S_1 D = 5 - 4 = 1 \ m$$

$$\Delta \Phi = \frac{2\pi}{\lambda} \Delta x$$

$$= \frac{2\pi}{4}\left(1\right) = \frac{\pi}{2}$$

Now, $I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$

$I = I_0 + I_0 + 2\sqrt{I_0 I_0} \cos\frac{\pi}{2} = 2I_0$

43.

Answer: 2

Sol:

For 3rd minima $\sin\theta \approx \theta \approx \tan\theta = \frac{y_3}{D} = \frac{3\lambda}{a}$

$$= \frac{y_3}{D} = \frac{3\lambda}{a}$$

Similarly, $y_1 = \frac{\lambda D}{a}$

Now, according to qn. $y_3 - y_1 = 3$ mm

$$\Rightarrow \frac{2\lambda D}{a} = 3 \ mm$$

$$\Rightarrow a = \frac{2\times6000\times10^{-10}\times50\times10^{-2}}{3\times10^{-3}}$$

$$= 20 \times 10^{-5} \ m = 2 \times 10^{-4} \ m$$

44.

Answer: 3

Sol:

Capacitance of capacitor

$$C_0 = \frac{\varepsilon_0 A}{d} \ ... \ (i)$$

If a slab of thickness t is introduced between the plates with new separation d then its new capacitance

$$C' = \frac{\varepsilon_0}{d'-t+\frac{t}{k}} \ ....(ii)$$

As q = CV, charge on the capacitor is same in both cases, therefore to mention same p.d., the capacitance C and C' must be same, i.e., from (i) and (ii)

$$\frac{\varepsilon_0 A}{d} = \frac{\varepsilon_0 A}{d'-t+\frac{t}{k}}$$

$$\Rightarrow d = d'-t + \frac{t}{k}$$

Here, d' = d + 2.4 mm = d + 2.4 × 10⁻³ m

t = 3 mm = 3×10⁻³ m

$$\therefore \ d \ = \ d \ + \ 2.4 \ \times 10^{-3} - 3 \times 10^{-3} + \frac{3\times10^{-3}}{k}$$

$$\Rightarrow -3 + \frac{3}{k} = -2.4$$

$$\Rightarrow k = 5$$

45.

Answer: 2

Sol:

R = 0.25m = $\frac{1}{4}$

m = 2kg

KE = $\frac{1}{2}I^2$

$4 \times 2 \times 10 \times \frac{1}{16} = v^2$

V² = 8
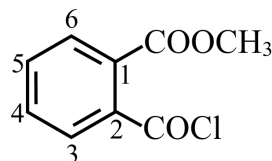
V = $2\sqrt{2}$ m/s

I = $\frac{mR^2}{2} = \frac{2}{2} \times \frac{1}{16} = \frac{1}{16}$

46.

Answer: 3

Sol:

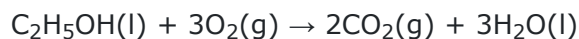(C) Methyl 2-chlorocarbonylbenzoate

47.

Answer: 1

Sol:

$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

$\Delta U = -1500$ kJ mol^{-1}

$\Delta H = ?$

T = 298 K

$\Delta n_g = -1$

R = 8.314 J mol^{-1}

$\Delta H = \Delta U + \Delta n_g RT$

$= -1500 + (-1) \times 8.314 \times 10^{-3} \times 298$

$= -1500 - 2.47 = -1502.47$ kJ mol^{-1}

48.

Answer: 3

Sol:

we know that ; $N_1V_1 = N_2V_2$

$N = M \times n$. ; for H_2SO_4 n=2

$N_1 = 0.10 \times 2$; $N_2 = 0.05 \times 2$

$V_1 = 50$ml ; $V_2 = x$

$N_1V_1 = N_2V_2$

$0.1 \times 2 \times 50 = 0.05 \times 2 \times x$

$x = \frac{0.2 \times 50}{0.1}$

x = 100ml

49.

Answer: 4

Sol:

Noble gases –

(i) colourless

(ii) odourless

(iii) tasteless and non inflammable

Noble gases are colorless, odorless, tasteless, and nonflammable gases under standard conditions. In the periodic table, the noble gases are arranged according to their boiling point. Noble gases are widely used in different fields, from incandescent lighting to excimer lasers.

50.

Answer: 1

Sol:

(A) 16 g of $CH_4(g)$

Molarmass of $CH_4 = 12 + 4 \times 1 = 16$ g mol^{-1}

Moles of $CH_4 = \frac{16}{16} = 1$ mole

1 mole of CH_4 contains 6.022×10^{23} atoms

6.022×10^{23} atoms have 6.022×10^{24} electrons or 60.22×10^{23} electrons

(B) 1 g of $H_2(g)$

At STP 1 g H_2 i. e., $\frac{1}{2}$ mole H_2

at STP 1 mole = 22.4 L

$\frac{1}{2}$ mole = 11.2 L

(C) 1 mole of $N_2(g)$

1 mole of $N_2 = 1 \times 28 = 28$ g

(D) 0.5 mole of $SO_2(g)$

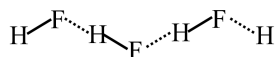0.5 mole $SO_2 = \frac{1}{2} \times 64 = 32$ g

Hence, the correct order is A-II, B-IV, C-I, D-III.

51.

Answer: 3

Sol:

For symmetry

The arrangement of bp and lp around F is tetrahedral. Therefore, angle should appear around F and not around H atom.

52.

Answer: 1

Sol:

As per de-Broglie

$$\lambda = \frac{h}{p}$$

hence $\lambda \propto \frac{1}{p}$ (hyperbola curve)
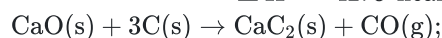
$\lambda \uparrow, P \downarrow$
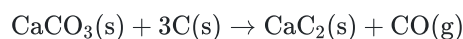
53.

Answer: 3

Sol:

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g);$$
$$\Delta H^\circ = 42.8 \text{ kcal}$$
$$CaO(s) + 3C(s) \rightarrow CaC_2(s) + CO(g);$$
$$\Delta H^\circ = 111 \text{ kcal}$$
$$CaCO_3(s) + 3C(s) \rightarrow CaC_2(s) + CO(g)$$
$$+ CO_2(g) \ \Delta H = 153.8 \text{ kcal}$$

Thus heat required to prepare 1 mole of CaC_2 from $CaCO_3 = 153.8 \text{ kcal}$

Molecular weight of CaC_2 = 40+24 = 64

64 g of CaC_2 requires 153.8 kcal of heat.

128 g of CaC_2 requires 307.6 kcal of heat.

54.

Answer: 4

Sol:

The solution which obey Raoult's law over the entire range of concentration are known as ideal solutions.

Thus, $\Delta P = P_{observed} - P_{Raoult} = 0$.

Since for an ideal solution since the solute-solute and solvent-solvent intermolecular attraction forces are equal to the solute-solvent intermolecular attractive forces, the enthalpy of mixing ($\Delta_{mix}H$) of the pure components to form the solution is zero and the volume of mixing ($\Delta_{mix}V$) is also zero.

However, for an ideal solution, entropy mixing ($\Delta_{mix}S$) is not zero. it positive because a solvent (or solute) in a solution has more molecular disorder.

55.

Answer: 3

Sol:

There are six geome
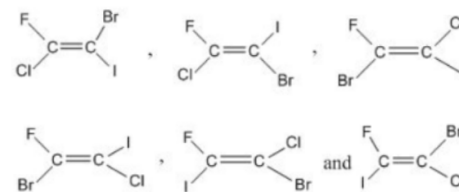
trical isomers possible for $C_2(Cl)(Br)(I)(F)$

56.

Answer: 3

Sol:

Bond energy $\alpha \ \frac{1}{\text{stability of radical}}$

a = resonance + 1°
b = resonance + 2°
c = 1° – carbon
d = 2° – carbon

57.

Answer: 1

Sol:

(Reaction)	(Type of redox reaction)
(A) $N_{2(g)} + O_{2(g)} \rightarrow 2\,NO_{(g)}$	(IV) Combination
(B) $2\,Pb(NO_3)_{2(s)} \rightarrow$ $2\,PbO_{(s)} + 4\,NO_{2(g)} + O_{2(g)}$	(I) Decomposition
(C) $2\,Na_{(s)} + 2H_2O_{(l)} \rightarrow$ $2\,NaOH_{(aq.)} + H_{2(g)}$	(II) Displacement
(D) $2\,NO_{2(g)} + 2^-\,OH\left(aq.\right) \rightarrow$ $NO_{2(aq.)}^- + NO_{3(aq.)}^- + H_2O_{(l)}$	(III) Disproportionation

(A) In this reaction N_2 combine with O_2 gives 2mole of NO gas

(B) when we heated $Pb(NO_3)_2$ decompose and give oxygen gas and NO_2 and PbO

(C) In this reaction Na displaced H^+ ion

(D) Disproportionation reaction is a reaction in which, the same element is simultaneously oxidized and reduced

here NO_2 oxidized as well as reduced

58.

Answer: 1

Sol:

sec^{-1}, M sec^{-1}

59.

Answer: 1

Sol:

$Al_2(SO_4)_3$ gives maximum osmotic pressure because it is gives 5 ion.

60.

Answer: 1

Sol:

(1) $MCl > MCl_2 > MCl_3$ along the period ionic nature of metals decrease

(2) Polarisability of halide ions increases in the order F^- – . Polarisability is directly proportional to the size of the anion.

(3) Na^+ 2+ 3+ . Higher is the charge density, higher is the polarizing power. Charge density is the ratio of charge to size.

(4) Covalent character = LiF

Covalent character increases with anion size increase.

61.

Answer: 4

Sol:

nA → product

rate = $K[A]^n = k[A]^0 = K$

When n = 0, then the rate is equal to K and it is only possible when n is zero.

So, the units of rate and rate constant are identical in zero order reactions.

62.

Answer: 3

Sol:

$pH = \frac{1}{2}pK_a - \frac{1}{2}\log C$

$\Rightarrow 5 = \frac{1}{2}pK_a + \frac{1}{2} \times 2$

$pK_a = 8 \Rightarrow pK_b = 8$;

$pOH = \frac{1}{2}pK_b - \frac{1}{2}\log C = 4 + 2 = 6$

63.

Answer: 2

Sol:
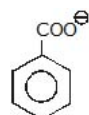
 No −H bonding
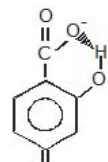
 Intermolecular H- bonding

stabilized conjugate base (or Anion)
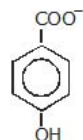
 Less stable conjugate base ⇒

No-intramolecular H-bonding ⇒ least stable
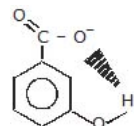
 At meta position sleigh

intramolecular H-bonding stabilized conjugate base.

∴ Acidic strength order : b > d > a > c

64.

Answer: 1

Sol:

Electronegativity, Metallic character do not have any unit

65.

Answer: 4

Sol:
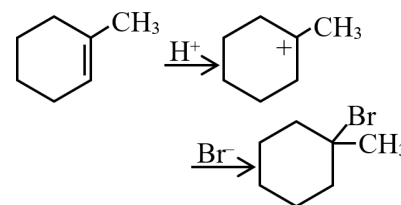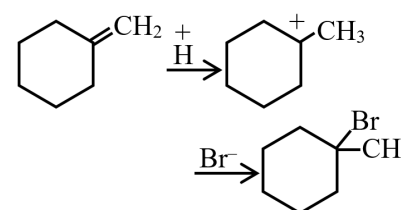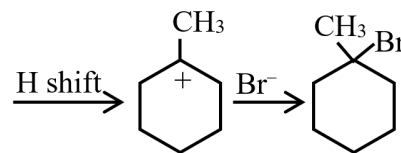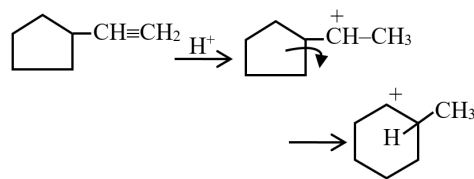
66.

Answer: 4

Sol:

Metal oxide which reacts with both acid as well as bases to produce salts and water is known as amphoteric oxide.

$BeO + H_2SO_4 \rightarrow BeSO_4 + H_2O; \; BeO + NaOH$
$$\rightarrow Na_2\,BeO_2 + H_2O$$

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O\,; \; ZnO + NaOH$
$$\rightarrow Na_2\,ZnO_2 + H_2O$$
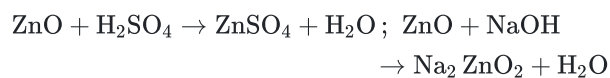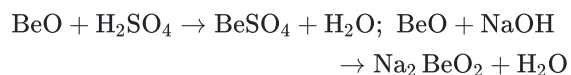
Chronium (III) oxide (Cr_2O_3) is amphoteric. Although is soluble in water, it dissolves in acid to produce hydrated chromium ions, $[Cr(H_2O)_6]^{3+}$ which react with a base to give salt of $[Cr(OH)_6]^3$.

67.

Answer: 2

Sol:

$[OH^-] = \frac{0.04 \times 3 - 0.02 \times 2}{5} = 0.016$

pOH= −log (16×10^{-3})=1.8

pH = 12−1.8=10.2

68.

Answer: 4

Sol:

Phenolphthalein is a weak acid.

69.

Answer: 1

Sol:

$Ph - C \equiv C - CH_3 \xrightarrow{H^+}$ $\xrightarrow{H_2O}$

70.

Answer: 1

Sol:

71.

Answer: 1

Sol:

Water molecule has hydrogen bonding so molecules get dissociated so it is liquid.

72.

Answer: 2

Sol:

E^o_{cell} = 0.25+0.25=0.50

$3\,Ni \ +2\,Au^{+3} \rightarrow \ 3\,Ni^{+2}+ \ 2\,Au$

$\qquad (1\,M) \qquad (0.1)$

$E_{cell} = 0.50 - \frac{0.0591}{6} \log \frac{(0.1)^3}{(1)^2}$

$E_{cell} = 0.50 + \frac{0.0591 \times 3}{6} = 0.529V$

73.

Answer: 3

Sol:

In the given question, the nature of leaving group is the factor responsible for the reactivity of compounds towards S_N2 reaction.

Out of all the alkyl halides,

$CH_3 - CH_2 - F$, $CH_3 - CH_2 - Cl$,
$CH_3 - CH_2 - Br$, $CH_3 - CH_2 - I$

The $CH_3 - CH_2 - I$ will be the more reactive as the electronegativity of iodine is less among all the halogen elements as it is considered as the good leaving group which facilitates the occurrence of S_N2 reaction at a good rate.

74.

Answer: 3

Sol:

75.

Answer: 1

Sol:

$\lambda^\infty_{AgCl} = \lambda^\infty_{AgNO_3} + \lambda^\infty_{NaCl} - \lambda^\infty_{NaNO_3}$

= (116.5+110.3+105.2)

mho cm² mol⁻¹

= 121.6 cm² mol⁻¹

76.

Answer: 2

Sol:

The Force of attraction between the molecular affects the melting point of a compound.

Stronger intermolecular interaction results in higher melting points.

Ionic compounds usually have high melting points because electrostatic forces holding the ion are much stronger.

CsCl has ionic bond thus it has highest M.P.

He gas held together by weak vander Waal bond and NH_3 and $CHCl_3$ have covalent bond.

77.

Answer: 1

Sol:

SD = strong donating

WW = weak withdrawing

WD = weak donating

∴ iv > ii > i > iii

Br_2 reacts with $AlCl_3$ to form an electrophile $\overset{\oplus}{Br}$.
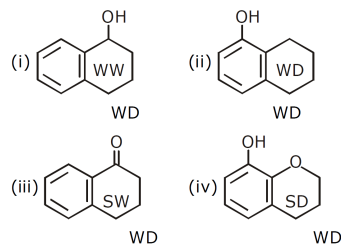
∵Aluminum have vacant d-orbitals are present so, it can easily accommodate the lone pairs of Bromine atom and form $AlCl_3Br^{\ominus}$ complex

Now, $\overset{\oplus}{Br}$ will attack more fastly. at that carbon atom and at that compound where electron density is more

78.

Answer: 3

Sol:

$$K_C = \frac{10^{29}}{\left(5\times10^{52}\right)^2}$$

$$K_C = \frac{10^{29}}{25\times10^{104}}$$

$$= 0.04\times10^{-75}$$

$$= 4\times10^{-77}$$

79.

Answer: 1

Sol:

$$O_2^+ \left(15e^-\right) = K : K^*(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_x)^2$$

$$\left(\pi 2p_y\right)^2(\pi 2p_z)^2\left(\pi^*2p_y\right)^1(\pi^*2p_z)^0$$

Hence, bond order $= \frac{1}{2}\left(10 - 5\right) = 2.5$

$$N_2^+ \left(13e^-\right)$$

$$= KK^*(\sigma 2s)^2\left(\sigma^*2s\right)^2(\sigma 2p_x)^2\left(\pi 2p_y\right)^2(\pi 2p_z)^1$$

Hence, bond order $= \frac{1}{2}\left(9 - 4\right) = 2.5$.

80.

Answer: 2

Sol:

In the pair are should react of the other should not react.

(a) Only aldehyde react with fehlings

(b) $\underset{O}{Ph-\overset{\|}{C}-CH_3}$ does not react with $NaHSO_3$

(c) $\underset{OH}{CH_3-\overset{|}{CH}-CH_3}$ shows iodoform, but other will not

(d) Acid reacts with $NaHCO_3$ but phenol does not
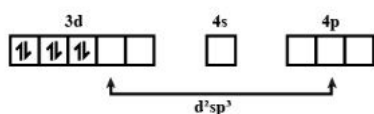
81.

Answer: 4

Sol:

Complex: $[Fe(CN_6)]^{4-}$

Let the oxidation state of Fe = x

$x + 6(-1) = -4$

$x = +2$

The electronic configuration of Fe = [Ar] $3d^6 4s^2$
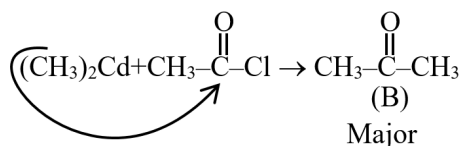
The electronic configuration of Fe^{2+} = [Ar] $3d^6 4s^0$

CN^- is a strong field ligand. So, due to the presence of strong-field ligands, the pairing of 3d-electrons takes place.

Hyridization : d^2sp^3

Magnetic character : Diamagnetic

Spin : Low spin complex

82.

Answer: 3

Sol:

$2CH_3MgBr + CdCl_2 \rightarrow (CH_3)_2Cd$
$$\qquad\qquad\qquad\quad (A)$$
$$\qquad\qquad\quad \text{dimethyl cadmium}$$
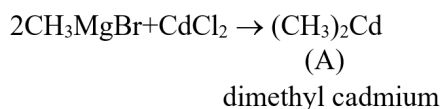
NCERT :- R_2Cd reacts only with $\underset{O}{\overset{\parallel}{-C-}}Cl$ to give respective ketones

83.

Answer: 4

Sol:

Metal carbonyl shows synergic bonding interactions in a carbonyl complex
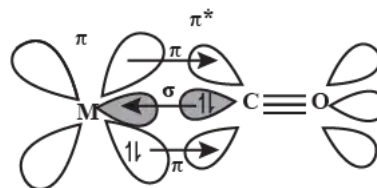
Synergic bonding in metal carbonyls

The $(M-C)\pi$ bond is formed by the donation of a pair of electrons from a filled d orbital of metal into the vacant antibonding π^* orbital of carbon monoxide.

CO is a good π acceptor (lewis acid) due to empty π orbitals and a good σ donor (lewis acid).

84.

Answer: 3

Sol:
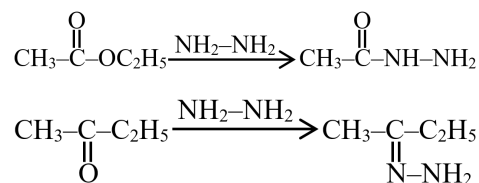
85.

Answer: 4

Sol:

All statement in given question are correct.

86.

Answer: 4

Sol:

Simple distillation is a procedure by which two liquids with different boiling points can be separated. Simple distillation (the procedure outlined below) can be used effectively to separate liquids that have at least $20°C$ difference in their boiling points.
Thus, a mixture of propan-1-ol and propanone can be separated by simple distillation.

Hence, both Assertion and Reason are correct and Reason is the correct explanation for Assertion.

87.

Answer: 1

Sol:

Ion is formed by gaining or losing electrons. To form cation electron are lost from the valency shell, so Zn atoms to Zn^{++} ions there is a decrease in the no. of valency electron.

88.

Answer: 2

Sol:

Sulphides of NH_4^+ IA & IIA are soluble

89.

Answer: 2

Sol:

$$NaCl + K_2Cr_2O_7 \xrightarrow{H_2SO_4}$$

$$CrO_2Cl_2 \left(Chromyl\ chloride \right)$$

$$\left(Orange\ red\ colour \right)$$

90.

Answer: 3

Sol:

2NaCl+$H_2SO_4 \rightarrow$ Na$_2$SO$_4$+2HCl

2KI+$H_2SO_4 \rightarrow$ K$_2$SO$_4$+2HI

2HI+$H_2SO_4 \rightarrow$ 2H$_2$O+SO$_2$+I$_2$

91.

Answer: 2

Sol:

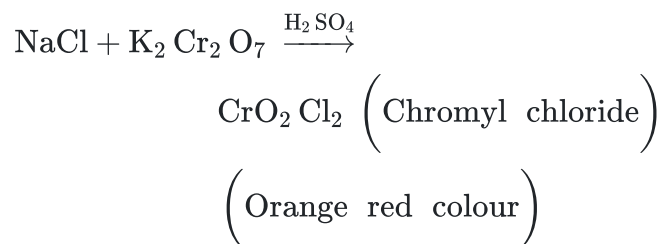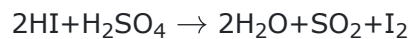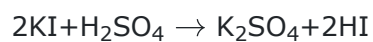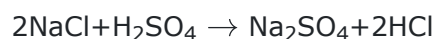Watermelon, cucumber, and pumpkin have modified auxiliary buds that form thin, wiry, leafless and spirally coiled branches and it helps the weak plant to climb the support known as stem tendrils.

92.

Answer: 1

Sol:

- scapula (shoulder blade) is a triangular flat bone of the pectoral girdle located on the dorsal part of the thorax.
- Cranium is made up of flat bones that fuse end-to-end with the help of dense fibrous connective tissues. These joints in the cranium do not allow any movement and are called fibrous joints.
- Sternum, also called as breast bone is a flat bone on the ventral midline of the thorax.
- The joints between the adjacent vertebrae in the vertebral column are an example of cartilaginous joints as these are joined with the help of cartilage.

93.

Answer: 4

Sol:

Photophosphorylation is the synthesis of ATP from ADP and inorganic phosphate in the presence of light. Like in respiration, in photosynthesis too, ATP synthesis is linked to development of a proton gradient across a membrane. Chemiosmosis involves the pumping of protons through special channels in the membranes of mitochondria from the inner to the outer compartment. The pumping establishes a proton (H^+) gradient. After the gradient is established, protons diffuse down the gradient through a transport protein called ATP synthase.

This time these are the membranes of thylakoid. The proton accumulation is towards the inside of the membrane, i.e., in the lumen. The causes that develop proton gradient across the membrane are as follows-

(a) Since splitting of the water molecule takes place on the inner side of the membrane, the protons or hydrogen ions that are produced by the splitting of water accumulate within the lumen of the thylakoids.

(b) As electrons move through the photosystems, protons are transported across the membrane.

(c) The NADP reductase enzyme is located on the stroma side of the membrane. Along with electrons that come from the acceptor of electrons of PS I, protons are necessary for the reduction of NADP+ to NADPH+ H+. These protons are also removed from the stroma.

94.

Answer: 4

Sol:

Each **restriction endonuclease** recognises a specific **palindromic nucleotide sequences** in the DNA. It will **bind to the DNA** and cut each of the **two strands of double helix** at **specific points. Restriction enzymes** cut the strand of **DNA** a little away from the centre of the **palindrome site;** but between the **same two bases on the opposite strands** .

95.

Answer: 1

Sol:

12th NCERT, Page No.- 33

96.

Answer: 1

Sol:

Adaptation is a quality of the organism (morphological, physiological, behavioral) that enables it to survive and reproduce in its habitat. Adaptations allow organisms to live in different types of habits .They develop-due to natural selection of suitable variations appearing in living beings through mutations and recombination.

97.

Answer: 4

Sol:

A taxon is a group of any one rank of organisms. It is a collection of more than one population of the organisms or organisms seen by the taxonomists for forming a unit.

Hence, the correct answer is **a group of any one rank of organisms**.

98.

Answer: 3

Sol:

NCERT 11th Page No.270, 270

99.

Answer: 1

Sol:

A is deoxygenated blood leaving the tissues

11th OLD NCERT, PAGE NO.- 286

100.

Answer: 2

Sol:

Class 11th NCERT Page No. 65 The fruit

101.

Answer: 4

Sol:

Oligodendrocytes are neuroglial cells that produce myelin sheath around axons in CNS.

Schwann cells are neuroglial cells that produce myelin sheath around axons in PNS.

Astrocytes forms blood brain barrier along with blood capillaries present in the brain. This barrier prevents the entry of neurotoxins from blood into tissues of brain.

Osteoclast is a large multinucleated cell responsible for the dissolution and absorption of bone.

102.

Answer: 1

Sol:

Joseph Priestley (1733-1804) in 1770 performed a series of experiments that revealed the essential role of air in the growth of green plants. Joseph Priestley (1770) observed that a candle burning in a closed space - a bell jar, soon gets extinguished. Similarly, a mouse kept in a closed space would soon get suffocated and die. However, when he placed a mint plant in the same bell jar, he found that the mouse stayed alive and the candle continued to burn. Priestly hypothesized that foul air or phlogiston produced during burning of candles or animal (mice) respiration could be converted into pure air by plants (mint).

103.

Answer: 3

Sol:

Genetic engineering, also called recombinant DNA technology, involves the group of techniques used to cut up and join together genetic material, especially DNA from different biological species.

A plasmid or vector is a small, extrachromosomal DNA molecule within a cell that is physical. Artificial plasmids are widely used as vectors in molecular cloning.

Gel electrophoresis is used to separate macromolecules like DNA, RNA and proteins. DNA fragments are separated according to their size. Proteins can be separated according to their size and their charge (different proteins have different charges).

DNA ligases are enzymes that catalyze the joining together of two DNA ends, in a manner that requires either adenosine triphosphate (ATP) or NAD$^+$.

104.

Answer: 4

Sol:

12th NCERT, Page No.- 31,35,38

105.

Answer: 1

Sol:

Organisms, populations, communities and biomes

12th NCERT PAGE NO.- 191

106.

Answer: 2

Sol:

Metabolism

107.

Answer: 4

Sol:

Cruciferae

Class 11th NCERT Page No. 67

108.

Answer: 3

Sol:
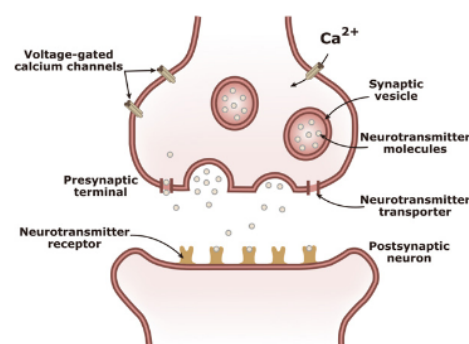
Pre-synaptic membrane- it involves the release of neurotransmitters in chemical synapse.

Post synaptic membrane-Contain receptor sites for neurotransmitters.

109.

Answer: 1

Sol:

The oxygen-evolving complex (OEC), also known as the water-splitting complex, is a water-oxidizing enzyme involved in the photo-oxidation of water during the light reactions of photosynthesis. The splitting of water is associated with the PS II: water is split into H^+, $[0]$ and electrons. This creates oxygen, one of the net products of photosynthesis. The electrons needed to replace those removed from photosystem I are provided by photosystem II. $H_2O \longrightarrow 4H^+ + O_2 + 4e^-$

The NADP reductase enzyme is located on the stroma side of the membrane (Outer surface of thylakoid membrane). Along with electrons that come from the acceptor of electrons of PS I, protons are necessary for the reduction of $NADP+$ to $NADPH + H^+$.

For biosynthesis of chlorophyll, raw materials required are succinyl Co-A and glycine.

The primary electron acceptor of PSII is pheophytin, an organic molecule that resembles chlorophyll

110.

Answer: 4

Sol:

Class 12th NCERT Page No. 165

111.

Answer: 1

Sol:

12th NCERT, Page No.- 27

112.

Answer: 2

Sol:

Most important factor is temperature which directly affects the organisms by affecting their enzymes hence also affects the geographical distribution.

113.

Answer: 2

Sol:

Archaebacteria is called Living Fossils because they are the simplest and oldest living species available on the earth.

114.

Answer: 3

Sol:

Statement I is incorrect but statement II is correct

11th OLD NCERT, PAGE NO.- 283

115.

Answer: 2

Sol:

11th Old NCERT PAGE NO. 84

Incorrect Statement: Tissues in plants are classified into meristematic tissues (responsible for growth) and permanent tissues (which do not divide). Permanent tissues are further classified into simple (made of one type of cell) and complex (made of more than one type of cell).

Correct statements:

A plant is indeed made up of different kinds of tissues, such as meristematic and permanent tissues.

Different organs in a plant (e.g., roots, stems, leaves) show differences in their internal structure.

Monocots and dicots within angiosperms are anatomically different (e.g., vascular bundle arrangement, root structure).

116.

Answer: 1

Sol:

Class 11th New NCERT Page No. 236

117.

Answer: 3

Sol:

During aerobic respiration, O_2 is consumed and CO_2 is released. The ratio of the volume of CO_2 evolved to the volume of O_2 consumed in respiration is called the respiratory quotient (RQ). The respiratory quotient depends upon the type of respiratory substrate used during respiration. When carbohydrates are used as substrate and are completely oxidised, the RQ will be 1, because equal amounts of CO_2 and O_2 are evolved and consumed, respectively.

Though pure fats or proteins cannot be directly used as substrates, they can enter as intermediary substrates of glycolysis and the Krebs' Cycle. Proteins and fats have to undergo a series of chemical reactions to form simple compound and then only they can enter Krebs Cycle. After forming simple compounds only then they can enter the cycle and help to produce energy which takes a lot of time. Due to these reasons pure proteins and fats are not used as respiratory substrates.

118.

Answer: 4

Sol:

Class 12th NCERT Page No. 169

119.

Answer: 2

Sol:

12th NCERT, Page No.- 44

120.

Answer: 2

Sol:

Control of Opuntia by a predator (moth), a type of insect

121.

Answer: 3

Sol:

Among the following:

1) *Paramecium* resembles the shape of shoe and its habitat is freshwater. It is a unicellular organism. It belongs to the Protista kingdom and the genus is ciliated protozoa.

2) *Plasmodium* is the causative organism for malaria. It belongs to the sporozoan subclass of the genus of parasitic protozoans.

3) *Amoeba* belongs to the Amoeboid protozoa.

4) *Trypanosoma* is the causative organism responsible for sleeping sickness. It is a flagellated protozoan.

Hence, the correct option is "3" - A - iii, B - iv, C - i, D - ii.

122.

Answer: 4

Sol:

For safe transfusion, recipient's RBC **should not contain antibodies** against donor's antigens.

Reptiles and amphibia have **incomplete double circulation**.

Eosinophils (2-3 per cent) resist infections and are also associated with **allergic reactions**.

The **hepatic portal system** is the venous system that returns blood from the digestive tract and spleen to the liver.

123.

Answer: 3

Sol:

11th Old NCERT PAGE NO. 85

124.

Answer: 2

Sol:

The antidiuretic hormone released by the pituitary gland stimulates reabsorption of water by the kidneys. The deficiency of this hormone causes increased urine production, a condition called diabetes insipidus.

Graves disease is an immune system disorder that results in the overproduction of thyroid hormones.

Addison's disease is caused by a deficiency of the hormones secreted by the adrenal cortex.

Pancreas is a composite gland which acts as both exocrine and endocrine gland. The deficiency of insulin, a hormone secreted by the pancreas, causes a complex disorder called diabetes mellitus which is associated with loss of glucose through urine and formation of harmful compounds known as ketone bodies.

125.

Answer: 4

Sol:

Human mitochondrial ATP synthase has two functional domains:

1) One domain situated in a mitochondrial matrix known as F_1

2) F_o is located in the inner mitochondrial membrane.

Hence, the correct answer is option "4" - Peripheral membrane protein with ATP synthetase activity.

126.

Answer: 1

Sol:

Adenosine deaminase enzymes are crucial for the **immune system to function**, and their absence is caused by the **deletion of a gene.** It is cured by **gene therapy.**

Insulin consists of **chains A and B** that are **linked** together by **disulfide bridges.**

Transgenic mice are being used to test the safety of the **polio vaccine.**

RNAi involves the **silencing of a specific mRNA** due to a **complementary dsRNA** molecule that binds to and prevents **translation** of the mRNA.

127.

Answer: 3

Sol:

12th NCERT, Page No.- 119

128.

Answer: 3

Sol:

Flow of energy declines as it passes from lower to higher trophic level. The energy decreases from one trophic level to the next trophic level because energy is lost as metabolic heat during transfer of energy. Hence, the pyramid of energy is always upright in any ecosystem and it cannot be inverted in a stable ecosystem. When food energy passes from producers to herbivores to carnivores, only 10% of energy is transferred from one trophic level to another trophic level.

129.

Answer: 1

Sol:

Cell of diatoms are surrounded by cell wall, frustules, which has silica deposits. Shells of diatoms are highly resistant to decomposition due to presence of silica and are deposited in ocean beds leading to formation of diatomaceous earth. Extraction, grounding, sieving and sinteration of diatomaceous earth obtain keiselguhr which is used in filtration techniques.

Diatoms are placed in class Bacillariophyceae which makes Myxophyceae includes slime molds which are characterized by presence of different morphology at different life stages and absence of cell wall. Pheophyceae includes brown algae which are characterized by presence of aliginic acid with cellulose in cell wall and obtains algin, it is used as emulsifying agent and a stabilizer. Rhodophyceae includes red algae which have calcium carbonate in cell wall, it makes the cell permeable to small molecules but impermeable to macromolecules. Red algae secrete calcium carbonate shells which are accumulated in sea bottom and forms red corals. "Diatomite" (Kieselguhr) is obtained from.

130.

Answer: 1

Sol:

In mechanism of concentration of the filtrate, the proximity between the Henle's loop and vasa recta, as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium, i.e., from 300 $mOsmolL^{-1}$ in the cortex to about 1200 $mOsmolL^{-1}$ in the inner medulla.

131.

Answer: 2

Sol:

Endodermis is the innermost layer of dicot stem of cortex and consists of barrel shaped parenchyma cells containing abundant starch grains–known as starch sheath.

132.

Answer: 2

Sol:

Diabetes mellitus leads to a complex disorder called prolonged hyperglycemia, which is associated with the loss of glucose through urine known as **glycosuria**.

When the cell are unable to utilize carbohydrates for energy instead they use fats & proteins. This fat degradation produces ketone bodies. The presence of these ketone bodies in urine is known as **ketonuria**.

Thus, presence of **Ketonuria and Glycosuria** in urine are indicative of Diabetes Mellitus.

133.

Answer: 2

Sol:

264 g of CO_2 **and 108 g of water** are formed from **180 g sugar and 192 g oxygen** during **respiration.** In this process, **686 kcal of energy are released.**

Hence, the correct answer is **option (B): 264 g of** CO_2**, 108 g of water, and 686 cal of energy.**

134.

Answer: 1

Sol:

Bacillus thuringiensis is biopesticide, commonly known as Bt, is a naturally occurring, gram-positive, spore-forming soil bacterium. Bt has been known to be reservoir of several insecticidal proteins, such as endotoxins, cytolytic proteins, vegetative insecticidal proteins, etc.

During sporulation, it synthesizes a cytoplasmic inclusion containing one or more proteins that are toxic to insect larvae. Upon completion of sporulation the parent bacterium lyses to release the spore and the inclusion. In these inclusions, the toxins exist as inactive protoxins. When the inclusions are ingested by insect larvae, the alkaline pH solubilizes the crystal. The protoxin is then converted in to an active toxin after processing by the host proteases present in the midgut.

135.

Answer: 1

Sol:

12th NCERT, Page No.- 111

136.

Answer: 1

Sol:

Up right

12th NCERT PAGE NO.- 212

137.

Answer: 2

Sol:

Pteridophytes are developed plants which can survive on land as they have well developed vascular tissues. The main plant body of these plants is diploid, called sporophyte which produces spores after meiosis. These spores on germination give rise to gametophytic plants which produce gametes. The spores do not develop a hard coating around them and thus are unable to form seeds.

138.

Answer: 1

Sol:

It is initiated by stretch receptors in the ureters

139.

Answer: 3

Sol:

Type of pyramid	Ecosystem
Pyramid of energy	Grassland ecosystem

140.

Answer: 1

Sol:

Mendelism is related to heredity. The three prominent law given by Mendel proved its relationship with inheritance. The law of segregation states that each character is regulated by a gene which exists in two forms for a particular character known as allele which segregates into different gametes. The law of independent assortment states that alleles for separate traits are passed independently of one another from parents to offspring. Law of dominance states that the dominant characters mask the effect of the recessive allele.

141.

Answer: 3

Sol:

11th NCERT, PAGE NO.- 172

142.

Answer: 1

Sol:

Class 12th NCERT Page No. 181, 185

143.

Answer: 2

Sol:

Algae are surrounded by mucilagenous sheath and below the sheath, cell wall is present which is made up of cellulose and pectin, but galactans, mannans and mineral like calcium carbonate are present in cell wall also.
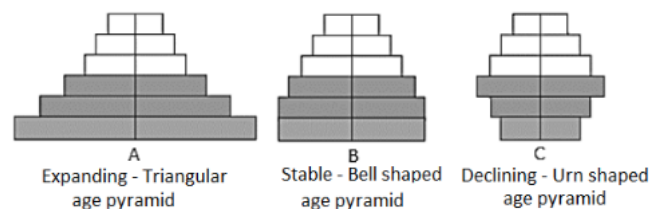
144.

Answer: 2

Sol:

Class XIth NCERT Page No. 213

145.

Answer: 3

Sol:

The age pyramids for human population generally shows age distribution of males and females in a combined diagram. The shape reflects the growth status of the population as shown below.

Expanding - Triangular age pyramid   Stable - Bell shaped age pyramid   Declining - Urn shaped age pyramid

The given age pyramid represents the declining population. A population can shrink due to declining birth rate.

146.

Answer: 3

Sol:

Class 12th NCERT Page No. 67

147.

Answer: 3

Sol:

If assertion is true but reason is false.

11th NCERT, PAGE NO.- 169

148.

Answer: 2

Sol:

Class 12th NCERT Page No. 170, 171

149.

Answer: 3

Sol:

Naked seeds of gymnosperms mean the seeds are not covered inside in an ovary but are present on megasporophyll, the leaf like structures.

150.

Answer: 2

Sol:

Class 12th NCERT Page No. 260

151.

Answer: 2

Sol:

Sickle cell disease (SCD) is a group of blood disorders typically inherited from a person's parents. The most common type is known as sickle cell anaemia (SCA). It results in an abnormality in the oxygen-carrying protein haemoglobin found in red blood cells. Sickle cell disease occurs when a person inherits two abnormal copies of the β-globin gene (HBB) that makes haemoglobin, one from each parent. This gene occurs in chromosome 11. Several subtypes exist, depending on the exact mutation in each haemoglobin gene. An attack can be set off by temperature changes, stress, dehydration, and high altitude. A person with a single abnormal copy does not usually have symptoms and is said to have sickle cell trait.

Hence, the correct answer is **β chain of haemoglobin.**

152.

Answer: 3

Sol:

Gibberellins (Gibberellic Acids) are plant hormones that control, among other things, **stem elongation, germination, dormancy, flowering, floral development, and leaf and fruit senescence.** Gibberellin spraying on juvenile conifers **accelerates maturity, resulting in early seed production**.

153.

Answer: 1

Sol:

In Aschelminthes, the body cavity is not lined by mesoderm, instead, the mesoderm is present as scattered pouches in between the ectoderm and endoderm. Hence, they are called pseudocoelomates.

154.

Answer: 3

Sol:

Class 12th NCERT (New) Page No.157

155.

Answer: 3

Sol:

Class 12th NCERT Page No. 74

156.

Answer: 2

Sol:

Haploid plant cultures can be obtained by pollen grains by the technique of pollen culture. Pollen culture is a technique of production of haploid plants by culture of pollen grains obtained from anther of a plant under aseptic condition on artificial media of known composition. When the anther is used as the explant material for the cultivation of new plants by the tissue culture technique, then there are some plants which are developed as haploid and the other plants are developed as the diploid plants. There are different types of tissues which are present in the anther. The pollen grains and the respective cells like the vegetative cell and generative cell will give rise to the plants which are haploid because they are formed through microsporogenesis. The other cells like the cells of anther wall, endothecium, middle layers are diploid in nature and give rise to diploid plants.

157.

Answer: 2

Sol:

Cephalochordates and vertebrates have a hollow, dorsal nerve cord, pharyngeal gill slits, and a notochord. In most vertebrates, the embryonic notochord is eventually replaced by bony vertebrae or cartilaginous tissue; among cephalochordates, the notochord is retained into adulthood and is never replaced by vertebrae.But urochordates have notochord in the tail region in their larval stage only.

158.

Answer: 4

Sol:

Xerophytes desert plants grow in physical or physiological dryness. The water is not easily available and they need to conserve water. These plants have well developed roots to absorb water. They have other adaptations to reduce transpiration loss of water, like multilayered epidermis, sunken stomata, thick waxy cuticle, stomata are present in lower epidermis sunken in substomatal chambers, which has hairs.

159.

Answer: 1

Sol:

Mutagen is a physical or chemical agent that changes the genetic material, usually DNA, of an organism and thus increases the frequency of mutations above the natural background level. As many mutations can cause cancer, mutagens are therefore also likely to be carcinogens, although not always necessarily so Due to mutation phenotype and genotype of offspring affect.

Toxin - A toxin is a harmful substance produced within living cells or organism

Cytotoxin - Cytotoxic agents are known as all the elements that are toxic to the cells, which include the factors that prevent their growth and sometimes cause death, and are also used to treat certain disorders.

Alkaloid - Alkaloids are a class of basic, naturally occurring organic compounds that contain at least one nitrogen atom. Alkaloids stimulate human organisms, for example, central nervous system, or directly work on the human brain.

160.

Answer: 4

Sol:

In cleistogamous flowers, the anthers and stigma lie close to each other. When anthers dehisce in the flower buds, pollen grains come in contact with the stigma to effect pollination. Thus, cleistogamous flowers are **invariably autogamous** as there is **no chance of cross-pollen** landing on the stigma. **Cleistogamous flowers produce assured seed-set even in the absence of pollinators. eg- viola, oxalis etc.** While in chasmogamous flowers are similar to flowers of other species with exposed anthers and stigma. Their flower are coloured contain aroma and nectar.

161.

Answer: 2

Sol:

Physalia - Portuguese man of war, Pennatula - Sea pen, Gorgonia - Sea fan, and Menandrina - Brain coral.
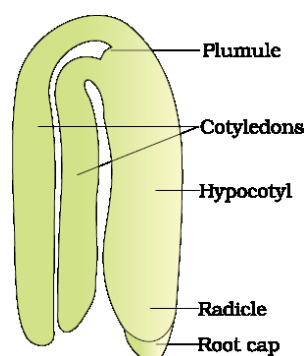
162.

Answer: 2

Sol:

In kingdom Animalia, the outer covering of the cell is known as a cell membrane, while the cell wall is the outer covering of the plant cell, fungal cell, and some bacterial cells.

163.

Answer: 2

Sol:

A is plumule which helps in shoot system formation.

B is Radicle which helps in root system formation.

C is Cotyledon which helps in food storage.
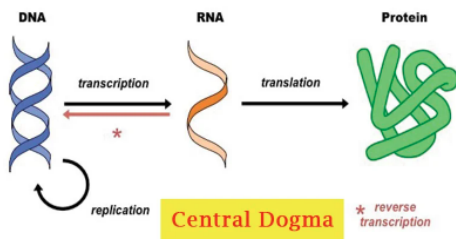
164.

Answer: 2

Sol:

The **central dogma** is the process by which the instruction in the DNA is converted into proteins.

Central dogma was proposed by **Francis Crick**.

The formation of DNA from DNA is called **replication**.

The formation of RNA from DNA is known as **transcription**.

The conversion of RNA into proteins is called **translation**.

165.

Answer: 2

Sol:

Fasciola hepatica, also known as the sheep liver fluke, is a triploblastic organism(first in platyhelminthes to chordates).

Nereis (Annelida) is the first true coelomate, which is a fluid-filled body cavity lined by mesoderm.

Antedon, also known as the sea lily is a member of the phylum Echinodermata is First enterocoelomate.

Adamsia (Cnidarians) are the first organisms to have tissue-level organization, and are considered to be at the tissue grade of organization.

166.

Answer: 3

Sol:

The fluid mosaic model was first proposed by S.J. Singer and Garth L. Nicolson in 1972 to explain the structure of the plasma membrane. The model has evolved somewhat over time, but it still best accounts for the structure and functions of the plasma membrane as we now understand them.
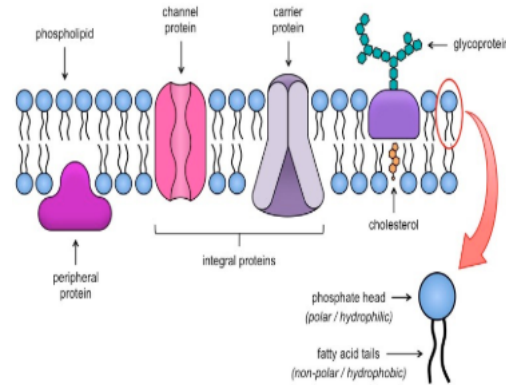
167.

Answer: 2

Sol:

The theory that each gene is responsible for the synthesis of a single polypeptide. It was originally stated as the "one gene, one enzyme hypothesis" by George Beadle, but was later modified when it was realized that genes also encoded non-enzyme proteins and individual polypeptide chains. It is now known that some genes code for various types of RNA involved in protein synthesis.

168.

Answer: 2

Sol:

Biomolecules with molecular weights more than one thousand Dalton are called biomacromolecules. These are found in the acid-insoluble fraction. Lipids are not strictly macromolecules as their molecular weights do not exceed 800 Da but form a part of the acid insoluble pool. The molecules in the insoluble fraction with the exception of lipids are polymeric substances. Lipids are indeed small molecular weight compounds and are present not only as such but also arranged into structures like cell membrane and other membranes. So the acid insoluble fraction has only four types of organic compounds, proteins, polysaccharides nucleic acids and lipids but except for lipids none of them are micromolecules.

169.

Answer: 4

Sol:

 Inside the primary cell wall.

170.

Answer: 1

Sol:

Class 12th NCERT Page No. 102

171.

Answer: 2

Sol:

Different types of epithelial cell junctions are:-

1) Desmosomes (Semi or full).

2) Gap junctions

3) Tight junctions

4) Adheren points.

GAP JUNCTION:- These junctions connect cells with one another for transporting molecules directly into the other cell without moving from the extracellular fluid. These gap junctions are useful at the time of embryonic development, this is the time when every cell should communicate with each other in order to develop fully at the right time. If these are blocked, embryos will not develop normally.

TIGHT JUNCTION - These junctions are narrow junctions that prevent solute leakage and seal the epithelial cells in between.

ADHERING JUNCTION - These are cell adhesion complexes that help in maintaining the structural support against harsh and changing environments against the biogeochemical changes.

172.

Answer: 3

Sol:

Pectate Ca & Mg

11th NCERT PAGE NO.- 94

173.

Answer: 3

Sol:

• **Polymines** maintained DNA coiled in prokaryotes, they did this by binding to the minor groove of DNA.

• Eukaryotes wrap their DNA around the protein called **histone.** It helps in packaging the DNA into smaller pieces.

• **Prokaryotes** do not have histone proteins, they have non-histone protein and they compress their DNA by **supercoiling.**

Hence, the correct option is "3" – Polyamines.

174.

Answer: 1

Sol:

Mushroom glands- 6th 7th abdominal segment.
Testes- 4th 6th abdominal segment.
 Spermathecal- 6th abdominal segment.
Anal cerci- 10th abdominal segment.

Mushroomshaped gland is present in the 6th-7th abdominal segments which functions as an accessory reproductive gland. The external genitalia are represented.Male reproductive system consists of a pair of testes lying one on each lateral side in the 4th -6th abdominal segments. From each testis arises a thin vas deferens, which opens into ejaculatory duct through seminal vesicle.A pair of spermatheca is present in the 6th segment which opens into the genital chamber.Anal cerci are a pair of appendages at the end of the abdomen arising from the 10th segment of the body of the cockroaches in both sexes males and females. Cerci are pincer-shaped.

175.

Answer: 2

Sol:

G, phase is also known as the first gap. It is usually the longest period of the cell cycle. However in some embryonic cells that are rapidly dividing G, might only last a few minutes. It synthesizes MRNA and proteins.

176.

Answer: 3

Sol:

1. **Acquired immunity** is a specific type of defence which is not present at the **time of birth .**
2. **Anamnestic** response or **secondary** immune response is a **highly intensified response due to memory of first encounter.**
3. When our body **encounters a pathogen** for the first time then the body **elicits** the **primary immune response.**
4. When there is **a subsequent encounter** with the same pathogen, secondary or **anamnestic immune** response is elicited.

177.

Answer: 3

Sol:

Mitosis is the process of cell division where a haploid cell has the ability to divide and form two daughter cells. In mitosis, the cell phases are interphase, prophase, metaphase, anaphase, and telophase. Mitosis occurs in all types of cells that are somatic cells but doesn't occur in gamete cells.

It also occur in haploid male honey bee not in female.

178.

Answer: 3

Sol:

(a) Filariasis - (iii) Wuchereria bancrofti
(b) Amoebiasis - (iv) Entamoeba histolytica
(c) Pneumonia - (i) Haemophilus influenzae
(d) Ringworm - (ii) Trichophyton

179.

Answer: 3

Sol:

Karyokinesis has 4 stages

(i) Prophase

(ii) Metaphase

(iii) Anaphase

(iv) Telophase

180.

Answer: 3

Sol:

12th NCERT, PAGE NO.- 157