Date: 02-Apr-2025

Duration: 3 Hours

Max Marks: 720

Physics - Section A

1.

Answer: 1

Sol:

$$n_e n_h = (n_i)^2$$

n_e is concentration of electron,

n_h is concentration of holes and n_i is the concentration of electron pairs in the intrinsic semi-conductor.

Here;

$n_h = 10^{21}$, $n_e = ?$, $n_i = 10^{19}$

$10^{21} \times n_e = 10^{19} \times 10^{19}$

$n_e = \frac{10^{38}}{10^{21}} = 10^{17} \text{ m}^{-3}$

2.

Answer: 3

Sol:

Displacement = Area of graph with sign

Displacement =

$\left(\frac{1}{2} \times 10 \times 5\right) + \left(10 \times 5\right) + \left(\frac{1}{2} \times 5 \times 30\right)$
$+ \left(\frac{1}{2} \times 5 \times 20\right) - \frac{1}{2}\left(5\right)\left(20\right)$

$= 25 + 50 + 75 + 50 - 50$

$= 150 \text{ m}$

Distance $\rightarrow$ Area of graph with positive value

Distance = 25 + 50 + 75 + 50 + 50 = 250

$\frac{\text{Distance}}{\text{Displacement}} = \frac{250}{150} = \frac{5}{3}$

3.

Answer: 1

Sol:

Here from the graph we see that both x,y are at same temperature but they are varying w.r.t time, so

$\left(\frac{dT}{dt}\right)_x > \left(\frac{dT}{dt}\right)_y$

Now from the Kirchoff's law, we know that emissivity is equal to absorptivity, so the body which emits more will also absorb more.

Therefore, $e_x > e_y$ and $A_x > A_y$

4.

Answer: 2

Sol:

$\lambda = \frac{2\pi}{2\pi} = 1m$

$\frac{\lambda}{2} = \frac{1}{2}m$

5.

Answer: 3

Sol:

The Magnetic force is given by

$F = Bil$
$where\ l = displacement\ length$
$l = length\ AB$

$here\ l = \sqrt{L^2 + (2r)^2}$

$l = \sqrt{L^2 + 4r^2}$

then, force is equal to

$F = Bi\sqrt{L^2 + 4r^2}$

6.

Answer: 3

Sol:

From the formula of Bulk modulus

$\beta = \frac{-\Delta P}{\left(\frac{\Delta V}{V}\right)}$

$\therefore \frac{\Delta V}{V} = -\frac{\Delta P}{\beta} = -\frac{(0-1\times10^5)}{1.25\times10^{11}} = 8\times10^{-7}$

7.

Answer: 1

Sol:

By Kepler's third law, $T^2 \propto R^3$

$\therefore \frac{T_1^2}{T_2^2} = \frac{T_1^3}{T_2^3}$ or $\left(\frac{T_2}{T_1}\right)^2 = \left(\frac{R_2}{R_1}\right)^3$

$\Rightarrow T_2^2 = T_1^2\left(\frac{3.5R}{7R}\right)^3$

$(\therefore R_2 = R + 2.4R$ and $R_1 = R + 6R)$

or $T_2^2 = \frac{T_1^2}{8} \Rightarrow T_2 = \frac{T_1}{2\sqrt{2}}$

$\Rightarrow T_2 = \frac{24}{2\sqrt{2}}$

$\therefore T_2 = 6\sqrt{2}h$

8.

Answer: 4

Sol:

According to given pattern of wave, the wavelength can be gives as:

$\frac{3\lambda}{2} = 6$

$\lambda = \frac{12}{3} = 4m.$

So, option (4) is correct.

9.

Answer: 4

Sol:

Given,

$K_{Ag} \Rightarrow 11K_{fe}$

$\frac{dQ}{dt} = \frac{\Delta T}{\left(\frac{L}{K_{eq}A}\right)}$

Let the temp. at the intersection be T

$H \Rightarrow \frac{100-T}{\frac{L}{K_{fe}A}} = \frac{T-0}{\frac{L}{K_{Ag}A}}$

$K_{fe}(100 - T) = K_{Ag}(T - 0)$
$K_{fe}(100 - T) = 11K_{fe}(T - 0)$
$100 - T = 11T$

$T \Rightarrow \frac{100}{12} \Rightarrow 8.3\ °C$

10.

Answer: 3

Sol:

Velocity of train A

$v_A = 90 \frac{km}{hr} = 90 \times \frac{5}{18} = 25 \text{ m/s}$

Velocity of train B

$v_B = 54 \frac{km}{hr} = 54 \times \frac{5}{18} = 15 \text{ m/s}$

Velocity of train B w.r.t. train A

$= \left| \vec{v}_B \right| - \left| \vec{v}_A \right|$

$= 15 - (-25) \text{ m/s} = 40 \text{ m/s}$

$\text{Time of crossing} = \frac{\text{length of train}}{\text{relative velocity}}$

$(8) = \frac{\ell}{40}$

$\ell = 8 \times 40 = 320 \text{ meter}$

11.

Answer: 2

Sol:

The rise of a liquid in a capillary is given as,

$h = \frac{2T\cos\theta}{\left(\frac{D}{2}\right)\rho g}$

Since, we know that height of capillary rise is inversely proportional to radii of tube, i.e.,

$\text{height} \propto \frac{1}{\text{radius}}$

$\Rightarrow \frac{h_1}{h_2} = \frac{D_2}{D_1} = \frac{22}{66}$

$\Rightarrow D_1 : D_2 = 3 : 1$

12.

Answer: 4

Sol:

$2V_0 = \sqrt{v_0^2 + v_x^2}$

$4V_0^2 = v_0^2 + v_x^2$

$V_x^2 = 3V_0^2$

$\therefore \sqrt{3}v_0 = \frac{qE_0 t}{m}$

$t = \frac{\sqrt{3}\, m v_0}{qE_0}$

13.

Answer: 2

Sol:

At depth, $g' = g\left(1 - \frac{h}{R}\right)$ or $g\left(1 - \frac{d}{R}\right)$

$\Rightarrow \frac{g}{n} = g\left(1 - \frac{d}{R}\right)$

or $d = R\left(\frac{n-1}{n}\right)$

14.

Answer: 3

Sol:

$I_{net} = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$ ----(1)

Here, $I_1 = I_2 = I_o$ and $\cos 60^o = \frac{1}{2}$

in equation (1), resultant intensity

$I_{net} = I_o + I_o + \left(2I_o \times \frac{1}{2}\right) = 3I_o$

$\Rightarrow I_{net} = 3I_o$

15.

Answer: 3

Sol:

$$\vec{r} = 10t\hat{i} + 15t^2\hat{j} + 7\hat{k}$$

$$\vec{v} = \frac{d\vec{r}}{dt} = 10\hat{i} + 30t\hat{j}$$

$$\vec{a} = \frac{d\vec{v}}{dt} = 30\hat{j}$$

$$\vec{F} = \left(m\right)\vec{a} = \left(m\right)\left(30\hat{j}\right)$$
$$= \text{along positive } y - \text{axis}$$

16.

Answer: 2

Sol:

Kinetic energy of N moluecule of gas
$$E = \frac{3}{2}NkT$$

Initially $E_1 = \frac{3}{2}N_1kT_1$ and finally
$E_2 = \frac{3}{2}N_2kT_2$

But according to proble $E_1 = E_2$ and $N_2 = 2N_1$

$$\therefore \frac{3}{2}N_1kT_{11} = \frac{3}{2}\left(2N\right)kT_2 \Rightarrow T_2 = \frac{T_1}{2}$$

Since the kinetic energy constant
$\frac{3}{2}N_1kT_1 = \frac{3}{2}N_2kT_2$

$N_1T_1 = N_2T_2 \therefore NT = \text{constant}$

From ideal gas equation of N molecule PV = NkT

$$P_1V_1 = P_2V_2 \therefore P_1 = P_2$$

[As $V_1 = V_2$ and NT = constant]

17.

Answer: 2

Sol:

$$e = \left|\frac{d\phi}{dt}\right| = \left|\frac{-Ldi}{dt}\right|$$

$$e = \left|\frac{-L\Delta I}{\Delta t}\right| \Rightarrow L = \left|\frac{e\Delta t}{\Delta I}\right| = \frac{5\times 10^{-3}}{1} = 5 \text{ mH}$$

18.

Answer: 2

Sol:

There is silence at point D, o it is a point of destructive interference.

For Minima,

$$\Delta y = \left(n - \frac{1}{2}\right)\lambda$$

$$2\ell - \ell = \frac{1}{2}\lambda$$

$$\lambda = 2\ell$$

19.

Answer: 3

Sol:

We have, me = qE

$$q = \frac{mg}{E} = \frac{mg}{V/d}$$

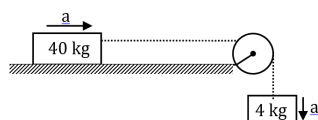$$= \frac{1.96\times 10^{-15}\times 10}{(400/0.02)}$$

$$= \frac{1.96\times 10^{-14}}{20\times 10^4} = 0.98 \times 10^{-18}$$
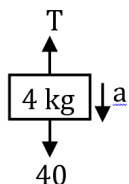
$$= 9.8\times 10^{-19} \approx 6e$$
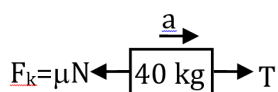
20.

Answer: 4

Sol:

Let the acceleration of both blocks is a.

For 4 kg block applying second law :

$40 - T = 4a$

$F_k = 0.02 \times 40 \times 10 = 8N$

For 40 kg block applying Newton's second law

$T - 8 = 40\,a$

Solving above equations

$a = \frac{8}{11} ms^{-2}$

21.

Answer: 1

Sol:

Dω = −DU

Dω = −DU = −2J

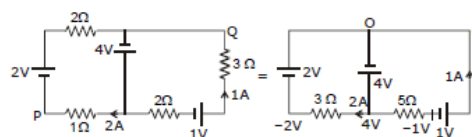**22.**

Answer: 3

Sol:

$$Z = \sqrt{R^2 + (2\pi vL)^2}$$

$$= \sqrt{(40)^2 + 4\pi^2 \times (50)^2 \times (95.5 \times 10^{-3})^2}$$

$\simeq 50$ ohm

23.

Answer: 2

Sol:

Now, $V_p = +2 - 4 + V_Q$

$V_P - V_Q = 2\ V$

24.

Answer: 2

Sol:

The velocity of sound can be mathematically expressed as

$$v = \sqrt{\frac{\gamma P}{d}}$$

where is γ specific heat ratio, P is the pressure of gas and d is the density of the medium.

According to this, the velocity of sound in a medium is inversely proportional to the square of the density of that medium,
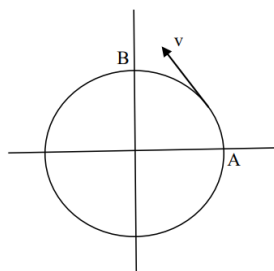
$$v \propto \frac{1}{\sqrt{d}}$$

So, the velocity will be lower for denser medium and higher for rarer medium.

25.

Answer: 2

Sol:

$$\overrightarrow{v_A} = v\hat{j}$$

$$\overrightarrow{v_B} = -v\hat{i}$$

Time to reach from A to B $= \dfrac{2\pi R}{4} \times \dfrac{1}{v} = \dfrac{\pi R}{2v}$

Displacement from A to B $= R\sqrt{2}$

Now, Average velocity from A to B

$$= \dfrac{\text{Displacement}}{\text{Time}} = \dfrac{R\sqrt{2}}{\frac{\pi R}{2v}} = \dfrac{2\sqrt{2}v}{\pi}$$

Instantaneous velocity at B is $-v\hat{i}$

According to question,

$$\dfrac{\text{instantaneous velocity}}{\text{average velocity}} = \dfrac{\pi}{x\sqrt{2}}$$

$$\dfrac{v}{\frac{2\sqrt{2}v}{\pi}} = \dfrac{\pi}{x\sqrt{2}}$$

$$\dfrac{\pi}{2\sqrt{2}} = \dfrac{\pi}{x\sqrt{2}}$$

$$\Rightarrow x = 2$$

26.

Answer: 2

Sol:

$$P = \dfrac{T_2}{T_1 - T_2}$$

$$5 = \dfrac{265}{T_1 - 265}$$

$$T_1 - 265 = 53$$

$$T_1 = 318\ K$$

$$T_1 = 45°C$$

27.

Answer: 4

Sol:

The Einstein's equation for photoelectric effect is given by,

$$KE_{max} = hf - hf_0$$

where, $KE_{max} = maximum\ kinetic$ $energy\ of\ photo\ electron,$

$f = frequency\ of\ incident\ light$

$and\ f_0 = threshold\ frequency.$

Since maximum kinetic energy of photo electrons is greater than zero so

$$hf - hf_0 > 0$$

28.

Answer: 3

Sol:

The electrical potential producd by the nucleus at the position of the electron,

$$V = 9 \times 10^9 \times \dfrac{q}{r}$$

$$= 9 \times 10^9 \times \dfrac{(+1.6 \times 10^{-19})}{0.53 \times 10^{-10}} = 27.2V$$

29.

Answer: 2

Sol:

For prism use have,
$$Li + Le = LA + LD \qquad \ldots(i)$$
if $i = 15°$, then $e = 60°$
and $D = 30°$
From eq.(i),
$$15° + 60° = A + 30°$$
$$\Rightarrow A = 45°$$

30.

Answer: 3

Sol:

$$\omega^2 x = V_\circ = \omega\sqrt{A^2 - x^2}$$

$$A^2 - x^2 = x^2\omega^2$$

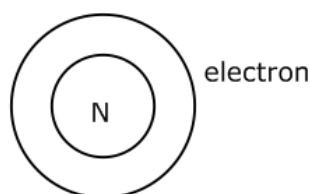$$(3)^2 - (2)^2 = \left(\tfrac{2\pi}{T}\right)^2 \times 4$$

$$T^2 = \tfrac{16\pi^2}{5}$$

$$T = \tfrac{4\pi}{\sqrt{5}}$$

31.

Answer: 2

Sol:

Energy to remote electron is very low because electron is bounded to nucleus at outside.

So $E_e < E_n$

32.

Answer: 4

Sol:

Potential difference across C si 10 V.

$\therefore$ q = CV = 6×10 = 60 μC

33.

Answer: 2

Sol:

$$I = 2\left[5(0.2)^2 + 2(0.4)^4\right]$$

34.

Answer: 1

Sol:

We have,

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

Here u = −25 cm , R = 20 cm,
$\mu_1 = 1.0$ and $\mu_2 = 1.5$

Putting the values in (i),

$$\frac{1.5}{v} + \frac{1.0}{25 \text{ cm}} = \frac{1.5 - 1.0}{20 \text{ cm}}$$

or, $\frac{1.5}{v} = \frac{1}{40 \text{ cm}} - \frac{1}{25 \text{ cm}}$

or, v =− 100 cm.

As v is negative, the image is formed to the left of the separating surface at a distance of 100 cm from it.

35.

Answer: 2

Sol:

We have

$$\vec{B} = \left(\tfrac{\sqrt{3}}{2}\hat{i} + \tfrac{1}{2}\hat{j}\right)30\sin\left[\omega\left(t - \tfrac{z}{c}\right)\right]$$

$$\vec{E} = \vec{B} \times \vec{c} \; and \; E = B_0 c$$

here, $\vec{E}\left(\tfrac{\sqrt{3}}{2}\left(-\hat{j}\right) + \tfrac{1}{2}\hat{i}\right)$

and $E_0 = 30c$

$$\vec{E} = \left(\tfrac{1}{2}\hat{i} - \tfrac{\sqrt{3}}{2}\hat{j}\right)30\,c\sin\left[\omega\left(t - \tfrac{z}{c}\right)\right]$$

36.

Answer: 4

Sol:

Zero (No potential difference across voltmeter).

37.

Answer: 3

Sol:

KE of rotation $= \frac{1}{2}I\omega^2 = \frac{1}{2} \times \left(\frac{2}{5}mr^2\right)\omega^2$

$= \frac{1}{2} \times \frac{2}{5} \times 1 \times \left(\frac{3 \times 3}{100 \times 100}\right)(50 \times 50)$

$\frac{9}{20}$ Joule

38.

Answer: 2

Sol:

$a\sin\theta = n\lambda$ where n=1

$\theta = \sin^{-1}\left(\frac{\lambda}{a}\right)$ .... (1)

According to question

λ= 2 × 10^{-3} m

a = 4 × 10^{-3} m   .... (2)

From equation (1) and (2)

θ = sin^{-1}(1/2) ⇒ θ = 30°.

39.

Answer: 4

Sol:

Wheatstone bridge is balancd.

$\frac{P}{Q} = \frac{R}{S}$

$\Rightarrow \frac{40}{10} = \frac{60}{15} = \frac{4}{1}$

$\Rightarrow V_{AB} = V_{AD}$

So,

$40I_1 = 60I_2$

$\Rightarrow I_1 = 1.5\,I_2$

Heat produced in AB $= I_1^2\,Rt$

$=$

$(1.5I_2)^2 \times 40 \times t = 90I_2^2 t$

Heat produced in BC, $= I_1^2\,Rt$

$=$

$(1.5I_2)^2 \times 10 \times t = 22.5I_2^2 t$

Heat produced in AD $= I_2^2\,Rt$

$=$

$I_2^2 \times 60 \times t = 60I_2^2 t$

Heat produced in DC $= I_2^2\,Rt$

$=$

$I_2^2 \times 15 \times t = 15I_2^2 t$

40.

Answer: 3

Sol:

3×16 = 6 ×v$_2$

v$_2$ = 8 m/s

KE = $\frac{1}{2}$× 6 × (8)^2

41.

Answer: 4

Sol:

Fringe width : $\beta = \frac{D\lambda}{d}$

According to question, $\frac{\beta_2}{\beta_1} = \frac{\lambda_2}{\lambda_1} \frac{D_2}{D_1} \frac{d_1}{d_2}$

Here, $D_2 = 2D_1$ & $d_2 = \frac{d_1}{2}$

$\frac{\beta_2}{\beta_1} = \frac{\lambda_2}{\lambda_1} \frac{(2D_1)}{D_1} \frac{d_1}{\left(\frac{d_1}{2}\right)} = 4\frac{\lambda_2}{\lambda_1}$

$\frac{\beta_2}{\beta_1} = 4\frac{\lambda_2}{\lambda_1} = \frac{4 \times 4 \times 10^{-7}}{6.4 \times 10^{-7}} = 2.5$

$\beta_2 = 2.5\beta_1 = 2.5 \times 10^{-4}$

42.

Answer: 1

Sol:

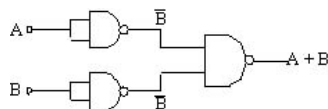T.E. = K.E. + P.E.

$= \frac{1}{2} \times mv^2 + mgh$

$= \frac{1}{2} \times 10 \times (10)^2 + 10 \times 10 \times 20$

= 2500 J

43.

Answer: 2

Sol:

44.

Answer: 2

Sol:

Stress is on x-axis

∵ slope of B is more

∴ B is more elastic

45.

Answer: 3

Sol:

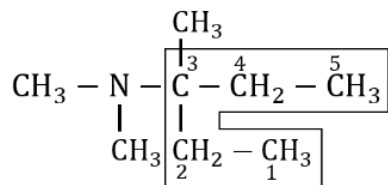$[v] = [M^0 L^1 T^{-1}]$; $[a] = [M^0 L^1 T^{-2}]$

$[F] = [M^1 L^1 T^{-2}]$; $[W] = [M^1 L^2 T^{-2}]$

46.

Answer: 3

Sol:

3, N, N–trimethylpentan-3-amine

47.

Answer: 3

Sol:

Given $V_1 = 8cm^3$

$V_2 = 80\ cm^3$

n = 5

T = 27 + 273 = 300K

$$\boxed{\Delta S_T = 2.303\ nRlog\frac{V_2}{V_1}}$$

on substituting the above value,

we get,

$\Delta S_T = 2.303 \times 5 \times 8.314 \times \log\frac{80}{8}$

$\Delta S_T = 2.303 \times 5 \times 8.314$

$\Delta S_T = 19.14 \times 5$

$$\boxed{\Delta S_T = 95.74\ JK^{-1}}$$

48.

Answer: 4

Sol:

Element	% of element	Atomic mass	Atomic ratio	Simplest ratio
C	80	12	$\frac{80}{12} = 6.67$	$\frac{6.67}{6.67} = 1$
H	20	1	$\frac{20}{1} = 20$	$\frac{20}{6.67} = 3$

Empirical formula = CH_3

49.

Answer: 2

Sol:

$P_S = \frac{1}{3} \times 100 + 50 \times \frac{2}{3} = \frac{200}{3}$

$X_B = \frac{100/3}{200/3} = \frac{1}{2}$

50.

Answer: 3

Sol:

a) $NaCl \rightarrow Na^+\ (10e^-)\ +\ Cl^-(18e^-)$

b) $BeCl_2 \rightarrow Be^{2+}\ (2e^-)\ + 2\ Cl^-(18e^-)$

c) $MgF_2 \rightarrow Mg^{2+}\ (10e^-)\ + 2F^-(10e^-)$

d) $CaS \rightarrow Ca^{2+}\ (18e^-)\ + S^{2-}\ (18e^-)$
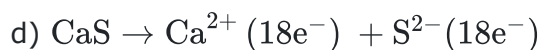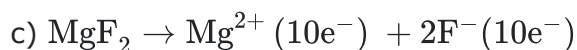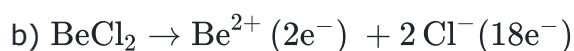
51.

Answer: 2

Sol:
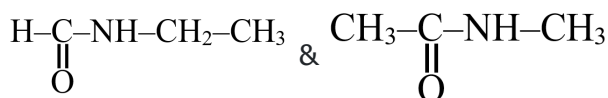
Have different alkyl grouping around polyvalent finctional group

Metamers

52.

Answer: 1

Sol:

Part 1: Enthalpy
Enthalpy is a thermodynamics quantity that measure heat changes at constant pressure. It is useful to define a new state function and it is refer as (H).

Part 2: Calculation of bond enthalpy
The reaction is proceed in the following ways-

$$P(s) + \tfrac{3}{2}Cl_2(g) \rightarrow PCl_3(g)$$

The above given reaction results in the formula -

$$\Delta_f H(PCl_3, g) = \Delta H_{atomization}(P, s) + 3 \times \Delta_f H(Cl, g) - (B.E(P - Cl) \times 3)$$

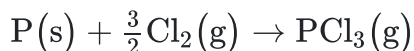Substituting the value in above formula-

$$306 \text{ kJ/mol} = 314 \text{ kJ/mol} + 3 \times 121 \text{ kJ/mol} - (B.E(P - Cl) \times 3)$$

$$B.E(P - Cl) = 123.66 \text{ kJ/mol}$$

53.

Answer: 2

Sol:

Third excites state n=4

$n - \ell - 1 = 2$

$4 - \ell - 1 = 2$

$\ell = 1$

$$= \sqrt{\ell(\ell + 1)}\,\hbar$$

$$= \sqrt{1(1 + 1)}\,\hbar = \sqrt{2}\,\hbar$$

54.

Answer: 1

Sol:

OSMOTIC PRESSURE

$\pi = iCRT$

$[\pi \propto i]$

For NaCl, i = 2 max.

for urea, glucose and sucrose, i = 1

NaCl gives maximum ion hence it will show highest osmotic pressure.

55.

Answer: 4

Sol:

I_2 is solid and sublimes at ordinary temperature because of weak vanderwaal's force between I_2 molecules.

56.

Answer: 3

Sol:

According to Bronsted-Lowry theory, acid is a substance which donates an H^+ ion or a proton and forms its conjugate base and the base is a substance which accepts an H^+ ion or a proton and forms its conjugate acid.

$$CO_3^{2-} + H^+ \rightarrow HCO_3^-$$
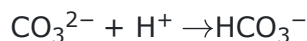
57.

Answer: 1

Sol:

$$\log\left[\frac{k_2}{k_1}\right] = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$k_2/k_1 = 2; T_2 = 308, T_1 = 298K$

$$\therefore \log 2 = \frac{E_a}{2.303 \times 8.314} \times \frac{10}{308 \times 298}$$

$$E_a = 52.903 \times 10^3 J$$

or $E_a = 52.903 \text{ kJ}$

58.

Answer: 3

Sol:

$Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

Here we can see that, aluminium metal displaces chromium metal and therefore this is metal displacement reaction.

59.

Answer: 2

Sol:

Geometrical isomers are the compounds having same molecular formula but different arrangements of atoms in space. There are two necessary conditions for a compound to possess geometrical isomerism.
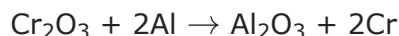
(i) It must have restricted rotation of bond. It can be due to double bond or ring.

(ii) There must be two unlike atoms or groups linked to each double bonded C-atom.

e.g. XYC = CXY and YXC = CXZ

Alkenes containing identical groups are atoms on doubly bonded C-atom do not show geometrical isomerism.

eg. AAC = CAA, AAC = BB, AAC = AB etc.

(i) Compound $\underset{H}{\overset{Cl}{>}}C=C\underset{Br}{\overset{Br}{<}}$ contain identical Br atoms on one doubly bonded carbon, hence does not show geometrical isomerism.

(ii) Compound $\underset{Br}{\overset{Cl}{>}}C=C\underset{H}{\overset{CH_3}{<}}$ contains all different groups/atoms on doubly bonded C-atoms, hence it cannot show geometrical isomerism.

Compound (iii) and (iv) follow all the conditions of geometrical isomerism and are geometrical isomers of each other.

(iii) $\underset{Cl}{\overset{H}{>}}C=C\underset{CH_3}{\overset{H}{<}}$ cis-isomer   (iv) $\underset{H}{\overset{Cl}{>}}C=C\underset{CH_3}{\overset{H}{<}}$ trans-isomer
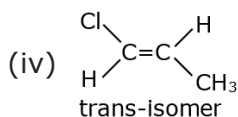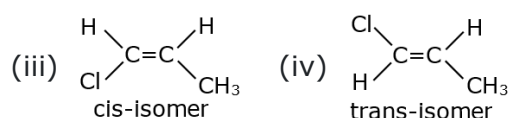
60.

Answer: 4

Sol:

MnS is pink and the rest of them are black.

61.

Answer: 1

Sol:

Initial Rate = k [A] [B]^2

Rate$_1$ = k [0.60] [0.80]^2 .....(i)

Rate$_2$ = k [A$_t$] [B$_t$]]^2 .....(ii)

Given reaction,

$A_{(g)}$ + $2B_{(g)} \longrightarrow C_{(g)} + D_{(g)}$
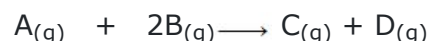
0.60atm   0.80atm   0   0   t = 0

(0.6 – 0.2) (0.8–0.4)   0.2   0.2atm

0.40atm   0.40 atm   0.2atm 0.2 atm   t = t

Put value of pressure of t = t in rate equation (II)

Rate$_2$ = k [.40] [.40]^2

$\dfrac{Rate_2}{Rate_1} = \dfrac{k[0.4][0.4]^2}{k[0.6][0.8]^2}$

$\dfrac{Rate_2}{Rate_1} = \dfrac{2 \times 1}{3 \times 4} = \dfrac{1}{6}$

62.

Answer: 3

Sol:

For WAWB type of salt

$$pH = \tfrac{1}{2}[pK_w + pK_a - pK_b]$$

pK_w of water at 25° C is 14.

pK_a of acetic acid

$$pK_a = -\log K_a$$

$pK_a = -\log 1.8 \times 10^{-5} = -(\log 1.8 + \log 10^{-5})$

$= -(0.255 - 5) = 4.745$

pK$_b$ of ammonium hydroxide

$$pK_b = -\log K_b$$

$pK_b = -\log 1.8 \times 10^{-5} = -(\log 1.8 + \log 10^{-5})$

$= -(0.255 - 5) = 4.745$

As we know

$$pH = \tfrac{1}{2}[pK_w + pK_a - pK_b]$$

$= \tfrac{1}{2}[14 + 4.745 - 4.745] = 7$

So pH = 7 (Neutral solution)

63.

Answer: 4

Sol:
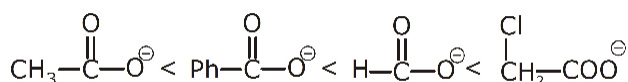
64.

Answer: 3

Sol:

(1) Nitrogen can not form pentahalide due to the absence of vacant d- d-orbitals in outermost orbitals

(2) EN=N>P

65.

Answer: 1

Sol:

Conjugate acid of (II) is stabilized by charge delocalization.

66.

Answer: 4

Sol:

Acidic buffer solution: Acidic buffer are solution of a mixture of weak acid and salt of its conjugate base of that acid with a strong base.

a) $HCN + NaCN$

Basic bufer solution: Basic buffer are solution of a mixture of weak base and salt of its conjugate acid of that base with a strong acid.

c) $NH_4OH + (NH_4)_2SO_4$

d) $HCOOH + NaOH$ is not a buffer solution.
Since formic acid is not present in excess amount.

67.

Answer: 3

Sol:

$S = [Ne]$ $3s^2$ $3p^4$ $3d^0$

$S^* =$ $3s^2$ $3p^3$ $3d^1$

$O = [He]$ $2s^2$ $2p^4$

Sp^2 with 1 l.p.   1(pπ-pπ) and 1(pπ-dπ) with O-atom
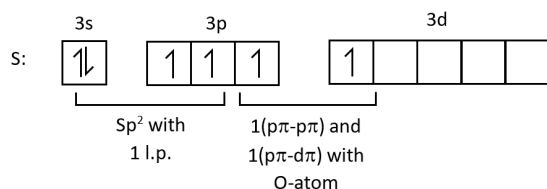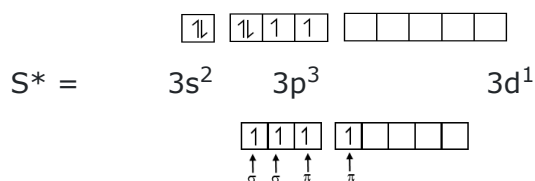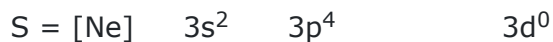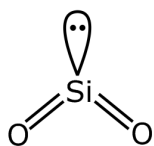
68.

Answer: 3

Sol:

69.

Answer: 2

Sol:

$$E = E^o - \frac{0.0591}{2}\log\frac{1}{\left[Zn^{+2}\right]}$$

$$E = E^o + \frac{0.0591}{2}\log\left[Zn^{+2}\right]$$

$$E = E^o + \frac{0.0591}{2}\times(-2)$$
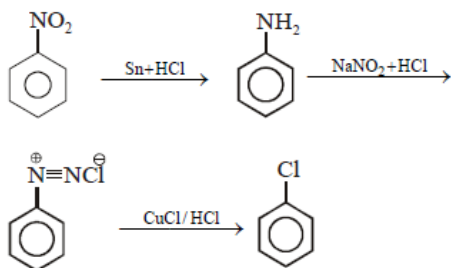
$E = E^o - 0.0591$

70.

Answer: 1

Sol:

Both Assertion and Reason are correct and Reason is correct for the Assertion.

71.

Answer: 2

Sol:

In the given reaction

$2AgCl(s) + H_2(g)$ (1 bar) $\rightarrow$ 2HCl (aq) + 2Ag
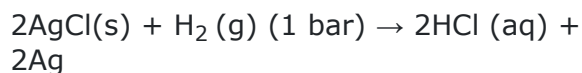
Silver is undergoing reductino $Ag^+ \rightarrow Ag$

Hence it will act as cathode in following cell.

Pt(s) | H$_2$(g), 1bar | 1m HCl (aq) |1mAg$^+$ (aq) | Ag(s).
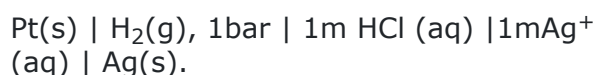
72.

Answer: 1

Sol:
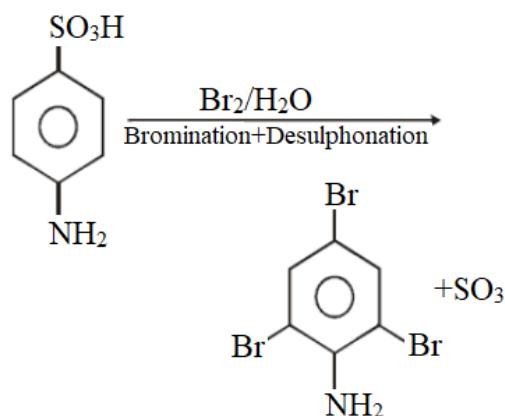
73.

Answer: 3

Sol:

Anhydrous aluminium chloride is hydrolysed partly with the moisture in the atmosphere to give HCl gas. This HCl combines with the moisture in the air and appears white in colour.

Hydrolysis of AlCl$_3$ gives HCl which fumes in the air.

$$AlCl_3 + 3H_2O \rightarrow Al(OH)_3 + 3\,HCl$$
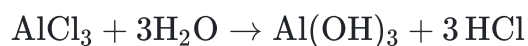
74.

Answer: 4

Sol:

Given that -

$\Lambda_m^\circ(H_2SO_4) = x\ S\ cm^2\ mol^{-1}$

$\Lambda_m^\circ(K_2SO_4) = y\ S\ cm^2\ mol^{-1}$

$\Lambda_m^\circ(CH_3COOK) = z\ S\ cm^2\ mol^{-1}$

$\Lambda_m^\circ(H_2SO_4) =$

$\quad 2\Lambda_m^\circ(H^+) + \Lambda_m^\circ(SO_4^{2-})\ ....(1)$

$\Lambda_m^\circ(K_2SO_4) = 2\Lambda_m^\circ(K^+)$

$\quad\quad\quad\quad + \Lambda_m^\circ(SO_4^{2-})\ ...(2)$

$\Lambda_m^\circ(CH_3COOK) =$
$\quad \Lambda_m^\circ(CH_3COO^-) + \Lambda_m^\circ(K^+)\ ....(3)$

$\Lambda_m^\circ(CH_3COOH) =$
$\quad \Lambda_m^\circ(CH_3COO^-) + \Lambda_m^\circ(H^+)\ ....(4)$

$2 \times$ Equation $(4) =$ Equation(3)
$\times 2 +$ Equation$(1) -$ Equation(2)

$2\Lambda_m^\circ(CH_3COOH) = 2z + x - y$

$\Lambda_m^\circ(CH_3COOH) = \frac{2z+x-y}{2}$

$\Lambda_m^\circ(CH_3COOH) = z + \frac{x-y}{z}$

75.

Answer: 2

Sol:

Geometrical Isomers
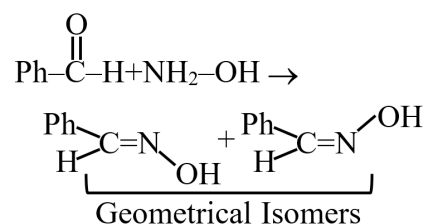
76.

Answer: 1

Sol:

Bond order of $N_2 = 3$

Bond order of $N_2^+ = 2.5$

Bond order of $N_2^- = 2.5$

Therefore, the correct answer is (A)

77.

Answer: 3

Sol:

Mole at equilibrium

$K_C = \frac{x^2}{(a-x)V}$

Addition of inert gas at constant V has no effect on reactions having $\Delta n=0$ or $\Delta n \neq 0$. But addition of inert gas at constant P has effect on reactions having $\Delta n \neq 0$; and no effect if $\Delta n=0$. The given reaction has $\Delta n \neq 0$ and thus choice (c) is correct. Also, the effect may be shown as : on addition of inert gas at constant P, volume increases. To have K_C constant, x must increase.

78.

Answer: 3

Sol:

Methyl Cyanide on reacting with a Grignard's reagent produces a ketone

79.

Answer: 4

Sol:

Structure of $[Cu(NH_3)_4]SO_4$ is as follows:

Thus, we can see, this molecule contains covalent bond between N and H atoms, coordinate bond between N and Cu atom and electrovalent bond between SO_4^{2-} and $[Cu(NH_3)_4]^{2+}$ ion. Thus,

80.

Answer: 1

Sol:

81.

Answer: 4

Sol:

Square planer complex do not show optical isomerism due to presence of plane of symmetry.

82.

Answer: 3

Sol:

Valine is one of the 20- essential amino acid for metabolism.

83.

Answer: 1

Sol:

Tetrahedral complex rarely formed low spin complex because Δ_t is not large enough to facilitete back pairing

84.

Answer: 2

Sol:

85.

Answer: 2

Sol:

The Mond process, sometimes known as the carbonyl process, This process converts nickel oxides into nickel metal with very high purity being attainable in just a single process.

$$\underset{\text{Impure Nickel}}{Ni} + 4\,CO \xrightarrow{330-350K} Ni\,(CO)_4$$

$$\xrightarrow{450-470} \underset{\text{pure}}{Ni} + 4\,CO$$

86.

Answer: 2

Sol:

In aqueous solution, more than 99% of glucose molecules, exist in cyclic isomeric form. This conversion to a ring form arises from the open-chain form by a nucleophilic addition reaction between the aldehyde group at C-1 and the hydroxyl group at C-4 or C-5, yielding a hemiacetal group -C(OH)-O-, at C-1. The reaction between C-1 and C-5 creates a molecule with a six-membered ring, called pyranose. The position of the hydroxyl on the C-1 determines the alpha or the beta form of the pyranose. In general, β-D-glucopyranose may also be called as β-D-glucose.
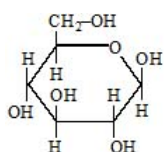
87.

Answer: 3

Sol:

Other than La^{3+} and Lu^{3+} all other lanthanides are paramagnetic in +3 state.

88.

Answer: 2

Sol:

Prussian blue is a dark blue complex. Synthetic pigment by oxidation, of ferrous ferrocyanide salts. It contains ferric hexacynoferrate (II) in a cubic lattice crystal structure.

$$2Fe_2(SO_4)_3 + 3K_4\left[Fe(CN)_6\right]$$
$$\rightarrow Fe_4\left[Fe(CN)_6\right]_3 + 6K_2SO_4$$
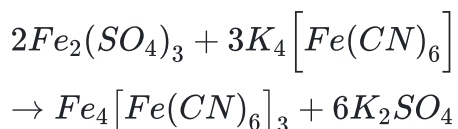
89.

Answer: 3

Sol:

i) H can't precipitate the salt of Zn from its solution because H has less reducing property as compared to Zn.

ii) H can't precipitate the salt of Cu from its solution because H has less reducing property/power as compared to Cu.

iii) H can precipitate the salt of Ag from its solution because H has higher reducing property/power as compared to Ag.

iv) H can't precipitate the salt of Fe from its solution because H has less reducing property/power as compared to Fe.

90.

Answer: 4

Sol:

As Cu^{+2} ion test in excess of KCN means this form complex in presence of excess KCN .

This is due to the formation of the complex ion $\left[Cu\left(CN\right)_4\right]^{3-}$.

$$CuSO_4 + KCN \rightarrow K_3\left[Cu\left(CN\right)_4\right]^{3-}$$
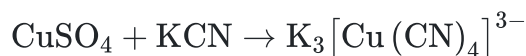
91.

Answer: 3

Sol:

Skeletal system consists of a framework of bones and a few cartilages. In human beings, this system is made up of 206 bones and a few cartilages. It is grouped into two principal divisions – the axial and the **appendicular skeleton**.

Axial skeleton comprises 80 bones distributed along the main axis of the body. **The skull**, **vertebral column, sternum and ribs** constitute axial skeleton.

The bones of the **limbs alongwith their girdles** constitute the **appendicular skeleton**.

92.

Answer: 4

Sol:

Perianth is the collective name of the nonessential floral organs. Calyx and corolla are called as accessory whorls. In some plants they are not differentiated from one another, in such case they are termed as perianth. Hence, the perianth is the term used when calyx and corolla are similar.

93.

Answer: 4

Sol:

Ecology is the study of living organisms (plants, animals, microbes) and their interaction with the environment.

Physiological ecology ;Physiological ecology refers to the study of physiology of different organisms. This in turn helps to explore their mechanism of adaptation to the respective environment in terms of reproduction and survival.

94.

Answer: 1

Sol:

Accessory pigments like carotenoids and chlorophyll b enhance the efficiency of photosynthesis by absorbing a broader spectrum of light wavelengths, which allows plants to capture more energy from sunlight compared to relying solely on chlorophyll a.

If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.

95.

Answer: 1

Sol:

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96.

Answer: 4

Sol:

Column-I	Column-II
(a) Making multiple copies of any template DNA	(iii) Cloning
(b) Technique to alter the chemistry of genetic material	(iv) Genetic engineering
(c) Technique of using live organisms or enzymes to produce products	(i) Biotechnology
(d) Separate bands of DNA are cut from agarose gel	(ii) Elution

97.

Answer: 2

Sol:

ALVEOLAR PRESSURE-

Inspiration is an active process whereas expiration is a passive process.

It is the pressure of the air which is moving inside your lungs or outside. This pressure is negative at the time of Inspiration as the air moves out from the mouth to the lungs where the alveoli are situated at a lower level.

And at the time of Expiration, this value of pressure is positive as air flows out from the region of alveoli in the lungs at lower pressure to the higher pressure outside. During expiration, muscles of the diaphragm relax.

Inspiration occurs via the active contraction of muscles – such as the diaphragm.

Hence, the correct option is "2" - Inspiration is an active process whereas expiration is a passive process.

98.

Answer: 1

Sol:

(A) Family - (5) Solanaceae

(B) Kingdom - (4) Plantae

(C) Order - (2) Polymoniales

(D) Species - (1) nigrum

99.

Answer: 3

Sol:

Nerves arising from brain are called cranial nerves. There are 12 - pairs of cranial nerves found in reptiles, birds and mammals but amphibians and fishes have only 10 - pairs of cranial nerves (Accessory spinal and hypoglossal nerves are absent).

So Fifth cranial nerve of frog is calledTrigeminal nerve.

The vagus nerve, is the tenth cranial nerve or CN X, and interfaces with the parasympathetic control of the heart, lungs, and digestive tract. The vagus nerves are normally referred to in the singular.

The ophthalmic nerve (CNV1) is a terminal branch of the trigeminal nerve (along with the maxillary and mandibular nerves). It provides sensory innervation to the skin, mucous membranes and sinuses of the upper face and scalp.

The optic nerve connects the eye to the brain. The optic nerve carries the impulses formed by the retina, the nerve layer that lines the back of the eye and senses light and creates impulses. These impulses are dispatched through the optic nerve to the brain, which interprets them as images.

100.

Answer: 2

Sol:

In solanaceae family, ovary is superior, oblique ovary. The gynoecium is located in an oblique position relative to the flowers median plane. Carpels are obliquely placed and ovules on swollen axile placenta.

In Cruciferae family, parietal placentation are occurs.

In Malvaceae family, axial placentation are occurs.

In Poaceae family, basal placentation are occurs.

Hence, the correct answer is **Solanaceae**.

101.

Answer: 4

Sol:

same ecological niche, Explanation: An ecological niche is the role and position
a species has in its environment and how it meets its needs of food and shelter,
how it surviveand reproduce. Two different species cannot share same
ecological niche as theirrequirement is different from each other.

102.

Answer: 2

Sol:

Photosynthetically active radiation (PAR) is light of wavelengths **400-700 nm** and is the portion of the light spectrum utilised by plants for photosynthesis. Hence statement I is false.

Mineral ions required for photolysis of water are **manganese, calcium and chlorine**. Oxygen is released as the byproduct of photosynthesis in the photolysis process. Hence statement II is false.

In **Cyclic Photophosphorylation plant** cells **only** accomplish the **ADP to ATP** for immediate energy for the cells. This process usually takes place in the thylakoid membrane and uses Photosystem I and the chlorophyll P700.Hence statement III is true.

103.

Answer: 3

Sol:

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104.

Answer: 4

Sol:

Biotechnology is the branch of biology that comprises of living systems and organisms for developing new and useful products.

The definition given by the European Federation of Biotechnology is a comprehensive one and comprise of traditional and modern view.

The definition is as follows- Integration of natural science and organism cells, parts thereof and molecular analogies for products and services.

Hence, the correct answer is option "4" - The integration of natural science and organisms cells, parts thereof and molecular analogies for products and services.

105.

Answer: 2

Sol:

The amine group of haemoglobin is reacted by about 20–25% of CO_2 resulting in the formation of carboxyhaemoglobin. The deoxygenated blood, when it reaches the alveoli of the lungs, then there occurs the dissociation of the carbaminohaemoglobin and sodium bicarbonate due to low PCO_2 and high level of PO_2 in the alveoli.

The stimulation of this dissociation is done by oxyhaemoglobin. The CO_2, thus freed from the blood, goes into the atmosphere. Haldane effect is the effect of oxyhaemoglobin on the dissociation of these compounds. The oxyhaemoglobin acts like a strong acid in this reaction (i.e., it frees H^+ ion in the medium).
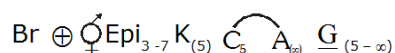
106.

Answer: 1

Sol:

In binomial nomenclature, the components "X" and "Y" are the **generic name** and the **specific epithet.** 'Z' indicates **Carolus Linnaeus** that introduced the binomial system of nomenclature in 1751.

107.

Answer: 3

Sol:

$Br \oplus \lightning Epi_{3-7} K_{(5)} \overset{\frown}{C}_5 A_{(\infty)} \underline{G}_{(5-\infty)}$

108.

Answer: 3

Sol:

Sensory nerves found in the epidermis mediate touch reception, pain, and thermal sensation. The skin is innervated by two types of nerve fibers, sensory and autonomic. Nerve fibers innervating the skin originate from dorsal root ganglia nerve cell bodies of sensory nerves .The sensory nerves elongate from the dorsal root ganglion and migrate toward the skin.Sensory nerves penetrate the basement membrane and innervate the epidermis by moving vertically, terminating at the granular layer of the epidermis.

109.

Answer: 2

Sol:

E.P. Odum (1969) defined ecology as "the study of structure and function of nature" .

American biologist at the University of Georgia known for his pioneering work on ecosystem ecology

110.

Answer: 4

Sol:
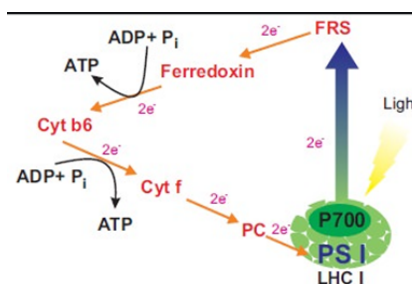
Cyclic Photophosphorylation	Non-Cyclic Photophosphorylation
Only PS I is involved	PS I and PS II are both involved
Water is not required	Photolysis of water is required
Oxygen is not evolved	Oxygen is evolved
NADPH is not synthesized	NADPH is synthesized
Used to produce additional ATP in order to meet cell energy demands	Products can be used for the light independent reactions

In **cyclic photophosphorylation** only photosystem I is active. movement of the electrons in a *cyclic* manner for synthesizing ATP molecules.occur in both stroma and grana thylakoid.

111.

Answer: 1

Sol:

Parturition (giving birth after the full development of the fetus) is induced by the signals released through the developing fetus when the oxytocin hormone is released from the pituitary gland. This is known as fetal ejection reflex.

This causes contractions in the uterine walls that trigger the release of oxytocin hormone which further increases the contraction rate.

These contractions with the help of oxytocin hormone helps in the expulsion of the fetus out of the uterine cavity of the mother.

Hence, the correct answer is option "1" - II→I →IV→ V→ III

112.

Answer: 4

Sol:

Correct statements

Origin of replication' is a sequence from where replication starts by binding of polymerase enzyme.

DNA ligase acts on cut DNA molecules and joins their ends.

Plasmid is autonomously replicating circular extra-chromosomal DNA.

More than 900 restriction endonucleases have been discovered from over 230 strains of bacteria.

113.

Answer: 3

Sol:

The amount of blood pumped by heart per minute is called cardiac output or heart output.

114.

Answer: 2

Sol:

Mucor and Rhizopus are fungi that belong to the class Phycomycetes.

While other option are not :-

Ascomycetes → Includes **sac fungi** like *Penicillium* and *Saccharomyces*; they reproduce sexually with **ascospores** in an **ascus**.

Basidiomycetes → Includes **club fungi** like *Agaricus* (mushrooms) and *Puccinia* (rust fungi); reproduce by **basidiospores**.

Deuteromycetes → Also called **Fungi Imperfecti**, these fungi (e.g., *Alternaria*) reproduce only **asexually** by **conidia**.

115.

Answer: 3

Sol:

Here the hormone can be ADH . Because, here the target tissue is kidney cell and the ADH mainly acts on collecting ducts of the kidney and increases the water reabsorption in this part.

116.

Answer: 2

Sol:

A is **desert.**

B is **grassland.**

C stands for **tropical forest.**

D is a **temperate forest.**

E stands for **coniferous forest.**

F stands for **Arctic and Alpine Tundra.**

117.

Answer: 2

Sol:

The above given figure is norplant.

Norplant is placed subcutenous and having levonorgestral.

These having 6 match stick like cyclinder which is effective up to 5 years.

Norplant having 2 cyclinder are effective till 2 years.

118.

Answer: 4

Sol:

Dicot stem

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119.

Answer: 2

Sol:

In **anaerobic respiration**, sugar (typically glucose) undergoes incomplete breakdown due to the absence of oxygen. The products differ depending on the organism:

- **In yeast and some bacteria**: The process produces **alcohol and CO₂** (alcoholic fermentation).
  - Equation:
    $$C_6H_{12}O_6 \rightarrow 2\,C_2H_5OH + 2\,CO_2$$
- **In muscle cells during intense exercise**: **Lactic acid** is produced (lactic acid fermentation).

120.

Answer: 4

Sol:

B–galactosidase acts on it, Explanation: X-gal is an analog of lactose, and therefore may be hydrolyzed by the β-galactosidase enzyme which cleaves the β-glycosidic bond in D-lactose.
X-gal, when cleaved by β-galactosidase, yields galactose and 5-bromo-4-chloro-3-hydroxyindole. The latter then spontaneously dimerizes and is oxidized into 5,5'-dibromo-4,4'-dichloro-indigo, an intensely blue product which is insoluble. X-gal itself is colorless, so the presence of blue-colored product may therefore be used as a test for the presence of active β-galactosidase. This easy identification of an active enzyme allows the gene for β-galactosidase (the lacZ gene) to be used as a reporter gene in various applications.

121.

Answer: 2

Sol:

The total cardiac cycle is for 0.8 seconds

Atrial systole is for 0.1 sec.

Atrial diastole is 0.7 sec.

The closure of semilunar valve is at end of ventricular systole (0.3 sec).

Ventricular diastole is 0.5 sec.

AV valves close at the end of atrial systole and beginning of ventricular systole (0.1 second) now the time gap between these two events is 0.5 seconds.

122.

Answer: 2

Sol:

Euglenoids are single celled organism i.e. mostly autotrophic (is the organism which behaved like plants in the presence of light) but they can be heterotrophic (in the absence of organic food, it behaves like a heterotrophs). They share the characteristics of both plants and animals.

Archaebacteria live in some of the harshest habitats such as extreme salty areas, hot springs etc. Nostoc is true bacteria that help in atmospheric nitrogen. Paramecium has cilia on the surface of the body included in protozoa.

Hence the correct answer is **Euglena**.

123.

Answer: 2

Sol:

C – Generates ATP through substrate level phosphorylation

During the conversion of succinyl-CoA to succinic acid a molecule of GTP is synthesised. This is a substrate level phosphorylation. In a coupled reaction GTP is converted to GDP with the simultaneous synthesis of ATP from ADP. Also there are three points in the cycle where NAD^+ is reduced to $NADH + H^+$ and one point where FAD^+ is reduced to $FADH_2$.
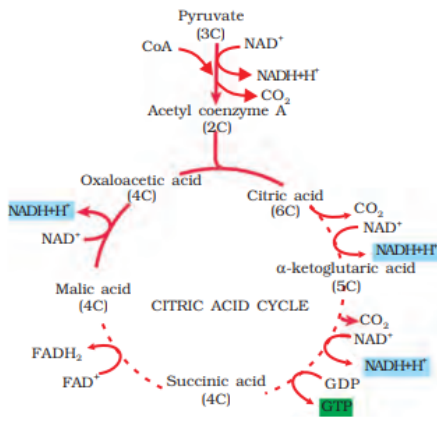
124.

Answer: 1

Sol:

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125.

Answer: 2

Sol:

Vascular bundles of monocot stem are scattered in the ground tissue and V.B. are generally oval shape. Vascular bundles lie towards the center are large in size and less in number. Vascular bundles situated towards the periphery are small in size but more in number. Each vascular bundle is conjoint collateral and closed (cambium is absent between the xylem and phloem) and xylem is endarch (xylem is centrifugal).

126.

Answer: 4

Sol:

Tropical rainforests have a very dense plant cover and experience a large amount of precipitation, thus the forest floor is always damp.

Thus, the conditions there have led animals to get adapted to arboreal habitats. Most animals found there are tree dwellers as almost every space on the forest floor is occupied by vegetation.

Hence, the correct answer is option "4".

127.

Answer: 1

Sol:

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128.

Answer: 1

Sol:

Golden rice is a genetically modified crop which is highly nutritive and have high content of vitamin-A

129.

Answer: 4

Sol:

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Correct statements

4. Angiotensin II also activates the adrenal cortex to release Aldosterone. Aldosterone causes reabsorption of Na+ and water from the distal parts of the tubule. This also leads to an increase in blood pressure and GFR.

Incorrect statements

1. ADH facilitates water reabsorption from latter parts of the tubule, thereby preventing diuresis.

2. The JGA plays a complex regulatory role. A fall in glomerular blood flow/glomerular blood pressure/GFR can activate the JG cells to release renin which converts angiotensinogen in blood to angiotensin I and further to angiotensin II.

3. An increase in blood flow to the atria of the heart can cause the release of Atrial Natriuretic Factor (ANF) and It acts as a check on the renin angiotensin mechanism.

130.

Answer: 2

Sol:

Heterocysts, which are specialized cells found in the cyanobacterium Nostoc, are specifically adapted for nitrogen fixation. Nitrogen fixation is the process by which atmospheric nitrogen is converted into a form that can be used by living organisms, such as ammonia or nitrate.

Heterocysts are specialized cells within Nostoc that are involved in nitrogen fixation. They have thick cell walls and lack photosynthetic pigments like chlorophyll, making them different from the other cells in the filamentous cyanobacteria.

131.

Answer: 3

Sol:

LH and FSH are collectively called **gonadotropins. Luteinizing hormone (LH)** plays a key role in **gonadal** function. LH, in synergy with follicle-stimulating hormone (FSH), stimulates follicular growth and ovulation.

Growth hormone (GH), also called **somatotropin,** It stimulates the growth of essentially all tissues of the body, including bones.

Oxytocin is a hormone that acts on organs in the body (including the breast and uterus) and as a chemical messenger in the brain.

Prolactin, also called **luteotropic hormone (LTH) or luteotropin,** is a protein hormone produced by the pituitary gland of mammals that acts with other hormones to initiate the secretion of milk by the mammary glands.

132.

Answer: 4

Sol:

Bulliform cells(motor cells) are found in the epidermis.These cells work to reduce the rate of transpiration.Their main function is to store the water. It results in rolling of leaf to prevent the water loss due to transcription under stress. When water is abundant, water and bulge are absorbed and shrink when less water is present, curling the leaf which helps to reduce water loss due to evaporation. This is important because folding the leaf changes its exposure to light and the amount of water it retains.

133.

Answer: 2

Sol:

The Tropical Savanna biome is located in **South America and Australia.** It is also called **tropical grassland.** The rainfall is seasonal and very high. In this biome, **grass** is found along with a few **scattered trees.**

134.

Answer: 3

Sol:

Oxygen is required in cellular respiration in the electron transport chain. The presence of oxygen is vital since it drives the whole process by removing hydrogen from the system.

It serves as the final electron acceptor of the electron transport chain, facilitating the movement of electrons down the chain and hence producing ATP, or adenosine triphosphate.

Carbon dioxide is a waste byproduct of cellular respiration. This is removed from the body by respiration. All plants and animals respire by reducing carbohydrates in their cells to produce energy and give out carbon dioxide into the atmosphere.

135.

Answer: 1

Sol:

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136.

Answer: 4

Sol:

Insulin consists of two short polypeptide chains: chain A and chain B, that are linked together by disulphide bridges.

Insulin is in pro-hormone form(it contains extra stretch called c-peptide) and needs to be processed before it becomes fully functional hormone(C-peptide is not present).

The main challenge for production of insulin using rDNA techniques was getting insulin assembled into a mature form.

Hence according to the given situation it will **not be a functional insulin** and will not treat pateint sucessfully and in addition may cause allergic reactions.

Hence, the correct answer is option "4" - Only (iii).

137.

Answer: 4

Sol:

Distal convoluted tubule (DCT) and collecting duct allow extensive reabsorption of water and certain electrolytes, which help in osmoregulation.

Approximately 7 –10 % of filtered calcium is reabsorbed in the DCT.

The proximal convoluted tubule helps in maintaining the pH and ionic balance by reabsorbing hydrogen ions, ammonia, and potassium ions into the filtrate.
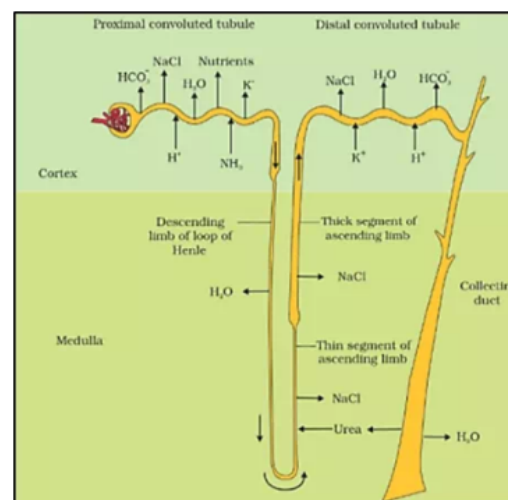
138.

Answer: 2

Sol:

Most of the members of green algae have one or more storage bodies called Pyrenoids located in the chloroplasts. It contains protein besides starch.

Hence, the correct answer is **algae**.

139.

Answer: 2

Sol:

Geometric growth is the growth where the successive change in population differs by constant ration. It is characterised by a slow growth in the initial stages and a rapid growth during the later stages. The daughter cells derived from mitosis retain the ability to divide, but slow down because of a limited nutrient supply.

The exponential growth can be expressed as:

$W_1 = W_0$ ert

W_1 = final size (weight, height, number etc.)
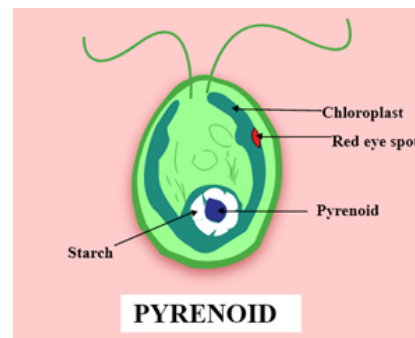
W_0 = initial size at the beginning of the period

r = growth rate

t = time of growth

e = base of natural logarithms

140.

Answer: 4

Sol:

	YR	Yr	yR	yr
YR	YYRR	YYRr	YyRR	YyRr
Yr	YYRr	YYrr	YyRr	Yyrr
yR	YyRR	YyRr	yyRR	yyRr
yr	YyRr	Yyrr	yyRr	yyrr

Phenotypic ratio :

Yellow	Yellow	Green	Green
Round	Wrinkled	Round	Wrinkled
9	: 3	: 3	: 1

Genoypic ratio :

YYRR YYRr YyRR YyRr YYrr Yyrr
yyRR yyRr yyrr

1 : 2 : 2 : 4 : 1
: 2 : 1 : 2 : 1

So as in this above-given dihybrid cross, we can see that YYRR, YYrr, yyRR and yyrr is coming only one time so overall 4 genotype is there which represented only once in a dihybrid cross.

141.

Answer: 3

Sol:

Geographical location, Explanation: The marine biome is the biggest biome in the world. It covers about 70% of the earth. It includes five main oceans: the Pacific, Atlantic, Indian, Arctic, and Southern, as well as many smaller Gulfs and Bays. Marine biomes remain almost same for all geographical location. It is affected by temperature, salinity and types of sea floor or stratification.

142.

Answer: 4

Sol:

All the given options are correct for Bt transgenic plant except option (d). It can be corrected as follows Bttransgenic plants are genetically engineeredplants that contain genes from Bacillus thuringiensis. These are resistant to various diseases, pests, insects and possess other important characteristics.

143.

Answer: 1

Sol:

i) Process of tubular secretion helps to secrete the urea from the blood to the collecting duct which is finally excreted in form of urine. The purified blood comes from the kidney through the renal vein which has the blood with the least amount of urea.

iii) The kidney conserves water by first diluting urine as it moves through the loop of Henle and then concentrating urine in the distal tubules and collecting ducts.

iv) Glomerular filtrate contains all the components of blood plasma except the proteins.

144.

Answer: 3

Sol:

Haploid

145.

Answer: 3

Sol:

For one of the progeny to have O blood group parents will have have heterozygous blood group for A and B.

In ABO blood grouping A and B are dominant and O is recessive hence need to be in pair if expressed.

Hence, the correct answer is option "3".

blood group of parents	A	O
B	AB	BO
O	AO	OO

146.

Answer: 1

Sol:

We must remember that the **physico-chemical** (**abiotic**) **components alone do not characterise the habitat of an organism completely; the habitat includes biotic components also** – pathogens, parasites, predators and competitors – of the **organism** with which they interact constantly.

147.

Answer: 1

Sol:

Cytokinin is a plant hormone which promote nutrient mobilisation which helps in the delay of leaf senescence.

148.

Answer: 1

Sol:

A human protein that is obtained from transgenic animals and is widely used to treat emphysema is α −1-antitrypsin. Transgenic animals produce a lot of useful biological products which are used to create several protein molecules. This is done by the introduction of a portion of DNA which codes for particular products such as human proteins.

149.

Answer: 1

Sol:

Cytotaxonomy that is based on cytological information like chromosome number, structure, behaviour and chemotaxonomy that uses the chemical constituents of the plant to resolve confusions, are also used by taxonomists these days.

150.

Answer: 3

Sol:

$x^a x^a \times x^A y$

	x^A	y
x^a	$x^A x^a$	$x^a y$
	50%	50%

151.

Answer: 2

Sol:

A larger protected area meant for conservation of biodiversity and culture of that area is called Biosphere Reserve.

A national park is a park in use for conservation purposes, created and protected by national governments.

A wildlife sanctuary is an area where animals and birds can live protected and safe in their natural habitats, away from poaching or trafficking.

To take care of natural heritage of India, government has set-up 90 national parks and 448 wild life sanctuaries. The Indian government has established 14 biosphere reserves to protect larger areas of natural habitat.

152.

Answer: 3

Sol:

Ethylene promotes the elongation of internodes in deep-water rice plants so that the leaves and upper parts of the plant remain above water.

153.

Answer: 3

Sol:

The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs and are involved in functions like forming a diffusion boundary.

Cuboidal/Columnar involved in functions like secretion and absorption.

154.

Answer: 2

Sol:

Dragonflies are the natural predators of mosquitoes. Hence, they can be used as biocontrol agents to protect the crops from mosquitoes.

155.

Answer: 1

Sol:

Crossing over is the process of exchange of genetic material between non-sister chromatids of homologous chromosomes which produce new genetics combinations.

Further, the independent assortment is segregation of factors for a trait independent of other factors during gamete formation followed by their random rearrangement in progeny thereby producing both parental and new combinations. The linkage is the tendency of closely placed genes on a chromosome to stay together during inheritance (no crossover and independent assortment); it produces more parental combination and less/no new combinations of the gene.

Completely linked genes do not show crossover and independent assortment, thereby produce only parental combinations;

A number of recombinant types in a population depends on upon crossover frequency between the genes; the higher the crossover frequency, the higher is the number of recombinant types.

156.

Answer: 1

Sol:

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157.

Answer: 3

Sol:

Two male gametes are produced from a single pollen grain in flowering plants. Pollen grains released from pollen-sacs at the two-celled stage, wherein the generative cell divides further to form two male gametes. They are then released into the embryo sac. They fuse with the female gametes for the formation of the embryo (egg) and endosperm (central cells). Once pollination is achieved, the pollen tube grows up through the style and stigma and towards the ovules in the ovaries. In the pollen grains, the germ cells divide. This releases two sperm cells that move down the pollen tube.

One meiosis gives rise to four pollen grains. Each of these pollen grain gives rise to 2 male gametes. **Consequently, the overall outcome of meiosis is 8 male gametes.** In given question, there are 21MMC in an anther then the number of male gametes produced from them, is -

21 x 8 = 168.

158.

Answer: 4

Sol:

NCERT 11th Page No.116

The body of the frog is divisible into head and trunk. Neck and tail are absent in a frog.

Frog's forelimbs and hind limbs help in leaping, swimming, burrowing, and walking. The hind limbs of frogs have five digits while the forelimbs end in four digits. Hind limbs are more muscular and larger when compared to forelimbs.

159.

Answer: 2

Sol:

Lysosomes release the enzymes on activation by intracellular environment. In plants cells, particularly at the time of seed germination, lysosomal enzymes degrade macromolecules like starch and reserve proteins into glucose and amino acids respectively.

160.

Answer: 4

Sol:

12th NCERT PAGE NO.- 106

161.

Answer: 3

Sol:

In seed plants, fertilization is called Siphonogamy because the male gametes are brought to the egg present in female gametophyte by a pollen tube.

Internal fertilization: Syngamy occurs inside the body of organisms. It is present in the majority of plants like Bryophytes to **Angiosperms**. In all these organisms egg is formed inside the female body where syngamy occurs. The male gametes either through water or pollen tube, are transferred to female gametes. In order to enhance the chances of syngamy large number of sperms are produced in these organisms and to compensate for this, there is a significant reduction in the number of eggs produced.

162.

Answer: 3

Sol:

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163.

Answer: 2

Sol:

An informosome is a particle found in animal cells that is made up of a special protein and macromolecular ribonucleic acid (RNA). The protein in informosomes may help move mRNA from the nucleus to the cytoplasm, protect mRNA from destruction, and control the rate of protein synthesis.

164.

Answer: 2

Sol:

Ribosomes are the cell organelle which is non- membranous and found in both Prokaryotes and Eukaryotes. Prokaryotes and eukaryotes are the two different types of cells.

Eukaryotic cells contain membrane-bound organelles, such as the nucleus, endoplasmic reticulum, mitochondria while prokaryotic cells do not.

165.

Answer: 3

Sol:

Hybrid varieties of several of our food and vegetable crops are being extensively cultivated. Cultivation of hybrids has tremendously increased productivity. One of the problems of hybrids is that hybrid seeds have to be produced every year.

If the seeds collected from hybrids are sown, the plants in the **progeny will segregate** and do **not maintain hybrid characters.** Production of hybrid seeds is costly and hence the cost of hybrid seeds become too expensive for the farmers. **Apomictics** can also help preventing seggregation.

166.

Answer: 1

Sol:

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167.

Answer: 4

Sol:

Synthesis of DNA from RNA occurs by reverse transcriptase enzyme in reverse transcription, discovered by Temin & Baltimore

168.

Answer: 3

Sol:

The **main difference** is -

The endoplasmic reticulun bearing ribosomes on their surface is called rough endoplasmic reticulum (RER). In the absence of ribosomes they appear smooth and are called smooth endoplasmic reticulum (SER).

169.

Answer: 3

Sol:

12th NCERT Page No. 138

170.

Answer: 4

Sol:

Class 12th NCER Page No. 90

171.

Answer: 3

Sol:

Class 11th NCERT Page No. 168

During the pachytene stage of prophase I in meiosis, homologous chromosomes pair up to form bivalents (also called tetrads).

Each bivalent consists of:

Four chromatids: Two chromatids from each homologous chromosome.

Two centromeres: One centromere from each homologous chromosome.

172.

Answer: 4

Sol:

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Column I		Column II	
(a)	AIDS	(iii)	Don't die of ignorance
(b)	Cancer	(iv)	Metastasis
(c)	Biological Response modifier	(i)	α-Interferon
(d)	HIV factory	(ii)	Macrophages

173.

Answer: 3

Sol:

Each strand has a backbone made of alternating groups of sugar (deoxyribose) and phosphate groups. Attached to each sugar is one of four bases: adenine (A), cytosine (C), guanine (G), and thymine (T). The two strands are held together by bonds between the bases, adenine forming a base pair with thymine, and cytosine forming a base pair with guanine. If a DNA nucleotide chain has AGCTTCGA sequence, then nucleotide sequence of other chain would be TCGAAGCT.

The correct answer is option C

174.

Answer: 2

Sol:

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In meiosis, the centromere divides during anaphase II. During anaphase II, the centromere of each chromosome splits, allowing the sister chromatids to move to opposite poles of the cell.

175.

Answer: 2

Sol:

11th NCERT, Page No.- 54

176.

Answer: 4

Sol:

Anaphase, Anaphase-II

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177.

Answer: 4

Sol:

Anopheles is the vector of malaria.

Lac insect (Laccifer) is not a vector.

Culex. Culex, a large group of mosquitoes also known as common house mosquitoes, are the principal vectors that spread the viruses that cause West Nile fever, St. Louis encephalitis, and Japanese encephalitis,

Aedes aegypti is a known vector of several viruses including yellow fever virus, dengue virus chikungunya virus and Zika virus.

178.

Answer: 4

Sol:

Chromosome synapsis is accompanied by the formation of complex structure called **synaptonemal complex**.

The complex formed by a pair of synapsed **homologous chromosomes(one from paternal and one from maternal)** is called a bivalent or a tetrad.

179.

Answer: 1

Sol:

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The members of subphylum Vertebrata possess notochord during the embryonic period. The notochord is replaced by a cartilaginous or bony vertebral column in the adult.

All vertebrates are chordates, but not all chordates are vertebrates. This is because vertebrates are a subphylum within the phylum Chordata, meaning all vertebrates are classified as chordates, but there are other chordates (like tunicates and lancelets) that are not vertebrates.

A is true but R is false

180.

Answer: 2

Sol:

Ostrich and **Corvus** = Scales on hind limbs

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