07/04/2026

Code-A

Aakash
Medical | IIT-JEE | Foundations

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18,
Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

MM : 720 Final Test Series(P1)_NEET2026_Test-07A **Time : 180 Min.**

PHYSICS

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CHEMISTRY

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ZOOLOGY

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Hints and Solutions

PHYSICS

(1) **Answer :** (2)
Solution:
$\omega_{\text{resonant}} = \sqrt{\omega_1\omega_2}$

(2) **Answer :** (4)
Solution:
$E = E_0\sin(kx - \omega t)$ and $B = B_0\sin(kx - \omega t)$

$U_M = \frac{B_0^2}{2\mu_0}\sin^2(kx - \omega t)$

Since electric and magnetic field have sine or cosine term their average value will be zero for a cycle but it will be non zero for magnetic energy.

(3) **Answer :** (3)
Solution:
$\left(I = 1350\frac{W}{m^2}\right)$

$P = \frac{2I}{C}$

$= \frac{2\times 1350}{3\times 10^8}$

$= 9 \times 10^{-6}$ Pa

(4) **Answer :** (2)
Solution:
$m = \left(\frac{v_0}{u_0}\right) \times \left(\frac{D}{f_e}\right)$ in case of relaxed eye here

$v_0 + f_e = 30$, $f_0 = 2$ cm and $f_e = 4$ cm

So, we have $v_0 = 26$ cm and using lens formula we get

$u_0 = \frac{13}{6}\text{cm}$

$\therefore\ m = 12\left(\frac{25}{4}\right) = 75$

(5) **Answer :** (1)
Hint:
Fringe width in a liquid of refractive index μ is given by $\beta = \frac{\lambda D}{\mu d}$

Solution:
Fringe width in vacuum

$\beta = \frac{\lambda D}{d}$

Fringe width in liquid (μ)

$\beta' = \frac{\lambda D}{\mu d}$

According to question

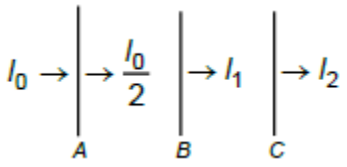
$11\frac{\lambda d}{\mu d} = \frac{(2\times 6-1)}{2}\frac{\lambda d}{d}$

$11\frac{\lambda D}{\mu d} = \frac{\lambda D}{d\times 2}(11)$

μ = 2

(6) **Answer :** (4)
Hint:
Use, Malus law: $I = I_0\cos^2\theta$

Solution:



$I_1 = \frac{I_0}{2}\cos^2(30^\circ) = \frac{I_0}{2} \times \frac{3}{4} = \frac{3I_0}{8}$

$I_2 = I_1\cos^2(45^\circ) = \frac{3I_0}{8} \times \frac{1}{2} = \frac{3I_0}{16}$

(7) **Answer :** (1)
Hint:
Use formula $\delta_{min} = 2i - A$
Solution:
Given $A = 60°$, $\delta_{min} = A$
$\delta_{min} = 2i - A$
$60° = 2i - 60°$
$\Rightarrow i = 60°$

(8) **Answer :** (4)
Solution:

$Q = \frac{\text{Resonant frequency}}{\text{Bandwidth}}$

$Q = \frac{\omega_r}{\Delta\omega} = \frac{\omega_r}{\left(\frac{R}{L}\right)} = \frac{\omega_r L}{R}$

Also $\omega_r L = \frac{1}{\omega_r C} \Rightarrow Q = \frac{1}{\omega_r RC}$

And $\omega_r = \frac{1}{\sqrt{LC}} \Rightarrow Q = \frac{1}{R}\sqrt{\frac{L}{C}}$

(9) **Answer :** (3)
Solution:
$\mu_1 \sin i = \mu_2 \sin r$
$\mu_1 \sin 30° = 1 \sin 90°$
$\mu_1 = 2$

(10) **Answer :** (3)
Solution:

$i_d = \frac{dQ}{dt} = \frac{d(CV)}{dt} = \frac{C\,dV}{dt} = C\left(-6t + 6\right)$

$\therefore$ Correct graph is straight line with negative slope.

(11) **Answer :** (2)
Hint:
$\beta' = \frac{\lambda D}{d\mu}$
Solution:
$\beta' = \frac{6000 \times 10^{-10}}{\frac{4}{3} \times 2 \times 10^{-3}} \times \frac{8}{3} = 6000 \times 10^{-7}$

$= 6 \times 10^{-4}$ m = 0.6 mm
Shift
$y_0 = \frac{D}{d}(\mu - 1)\, t = \frac{\beta'}{2}$
$\mu = \frac{\mu_g}{\mu_w} = \frac{9}{8}$

$\frac{\frac{8}{3}}{2 \times 10^{-3}}\left(\frac{9}{8} - 1\right) t = \left(\frac{0.6}{2}\right) \times 10^{-3}$

$\frac{4}{3} \times 10^3 \left(\frac{1}{8}\right) t = 0.3 \times 10^{-3}$

$\frac{10^3}{3 \times 2}\, t = 3 \times 10^{-4}$

$t = 18 \times 10^{-7}$ m
t = 1800 nm

(12) **Answer :** (4)
Hint:
Path difference for 1st minima $= \frac{\lambda}{2}$
Solution:
Position of 1st minima = $\frac{\lambda D}{2d}$

$\frac{d}{2} = \frac{\lambda D}{2d}$

$d^2 = \lambda D = 900 \times 10^{-9} \times 10^{-1}$

$= 9 \times 10^{-8}$

$d = 3 \times 10^{-4}$ m

= 0.3 mm

(13) **Answer :** (3)

Solution:

$\frac{E_1}{E_2} = \frac{N_1}{N_2}$

$\Rightarrow \frac{200}{E_2} = \frac{1000}{1500}$

$\Rightarrow E_2 = 300$ V

(14) **Answer :** (1)

Solution:

For lens-1

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

$\frac{1}{v_1} + \frac{1}{30} = \frac{1}{10}$

$\frac{1}{v_1} = \frac{1}{10} - \frac{1}{30}$

$v_1 = 15$ cm

For lens-2

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

$\frac{1}{v_2} - \frac{1}{10} = \frac{-1}{10}$

$v_2 = \infty$

For lens-3

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

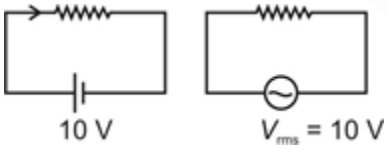
$\frac{1}{v_3} + \frac{1}{\infty} = \frac{1}{30}$

$v_3 = 30$ cm

Final image will be 30 cm right of third lens and 40 cm from second lens

(15) **Answer :** (3)

Solution:



If the bulb is connected to AC source of rms voltage 10 V, then bulb gives same brightness as of 10 V DC.

Therefore $\frac{V_0}{\sqrt{2}} = 10 \Rightarrow V_0 = 10\sqrt{2}$ V

(16) **Answer :** (4)

Solution:

$\frac{E_0}{B_0} = v$, $v = \frac{\omega}{k}$ and $\hat{v} = \frac{\vec{E} \times \vec{B}}{\left|\vec{E} \times \vec{B}\right|}$

$\mathrm{v} = \frac{2\pi \times 10^{11}}{\pi \times 10^3} = 2 \times 10^8 \ \mathrm{m/s}$

$E_0 = 2 \times 10^8 \times 10^{-7} = 20$ V/m

Now, $E_Z = \left(20 \frac{V}{m}\right) \sin\left(\pi 10^3 x + 2\pi \times 10^{11} t\right)$

(17) **Answer :** (1)

Solution:

$t = \frac{d}{\mu}$

$7\mu = 15 - x$ ...(i)

$5\mu = x$ ...(ii)

$\Rightarrow \quad \mu = \frac{5}{4}$

(18) **Answer :** (2)
Solution:
$I = \frac{B_0^2 C}{2\mu_0}$
$= \frac{\left(0.2\times10^{-6}\right)^2\times3\times10^8}{2\times4\pi\times10^{-7}}$
= 4.8 W/m^2

(19) **Answer :** (3)
Hint:
The given coil has both inductor and resistor.
Solution:
$Z = \sqrt{R^2+(\omega L)^2} = 10$ ... (1)
$\tan\phi = \tan 45^\circ = \frac{\omega L}{R}$
$\omega L = R$ ... (2)
From equation (1)
$\omega L\sqrt{2} = 10 \Rightarrow \omega L = 5\sqrt{2}$
$2\pi\times\frac{100}{\pi}L = 5\sqrt{2}$
$L = \frac{5\sqrt{2}}{200} = \frac{1}{20\sqrt{2}}\text{H}$

(20) **Answer :** (2)
Solution:
Total momentum transferred for complete absorption in one minute = $\frac{I\times A\times60}{c} = \frac{24\times50\times60}{3\times10^8}$
= 2.4 × 10^{-4} kg ms^{-1}

(21) **Answer :** (4)
Solution:
Two waves are coherent, if they have same frequency and if their phase difference is constant.

(22) **Answer :** (3)
Solution:
$I = a\ \sin wt\ \cos wt$
$I = \frac{a}{2}\sin\cdot\left(2wt\right)$
$I_{\max} = \frac{a}{2} \Rightarrow I_{\text{rms}} = \frac{a}{2\sqrt{2}}$

(23) **Answer :** (1)
Solution:
For a pure inductive AC circuit:
$X_L \propto f$
For d.c. circuit
$f = 0$
$X_L = \omega L$
$= 2\pi f L$
$= 0$

(24) **Answer :** (1)
Solution:
For a pure Capacitive circuit.
$X_c = \frac{1}{wC}$
& $w = 2\pi f$
$X_c = \frac{1}{2\pi fC}$
$X_c \propto \frac{1}{f}$

(25) **Answer :** (1)
Solution:
If charge *Q* on the capacitor plates changes with time
$i = \frac{dQ}{dt}$
$\frac{d\Phi_E}{dt} = \frac{d}{dt}\left(\frac{Q}{\epsilon_0}\right) = \frac{1}{\epsilon_0}\frac{dQ}{dt}$

$i = \epsilon_0 \left(\frac{d\Phi_E}{dt}\right)$

Displacement current is zero outside capacitor plates.

(26) **Answer :** (1)
Solution:

$f' = \frac{D^2 - d^2}{4D}$

$= \frac{(120)^2 - (60)^2}{4 \times 120}$

$= \frac{180 \times 60}{4 \times 120} = 22.5 \text{ cm}$

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

$u = f_1,\ v = \infty$

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

$\frac{\mu_1}{f_1} = \frac{\mu_2 - \mu_1}{R}$

$f_1 = \frac{\mu_1 R}{(\mu_2 - \mu_1)}$

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

(A) $\frac{1}{f} = \left(\mu - 1\right)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$

$= \left(1.5 - 1\right)\left(\frac{1}{20} + \frac{1}{20}\right) = \frac{1}{20}$

$f = 20 \text{ cm}$

(B) $\frac{1}{f} = \left(\frac{9}{8} - 1\right)\left(\frac{1}{20} + \frac{1}{20}\right) \quad \left(\because\ w_{\mu g} = \frac{\mu_g}{\mu_w} = \frac{\frac{3}{2}}{\frac{4}{3}} = \frac{9}{8}\right)$

$= \frac{1}{80} \Rightarrow f = 80 \text{ cm}$

(C) $\frac{1}{v} - \frac{4}{3u} = \frac{1.5 - \frac{4}{3}}{+20} + \frac{1 - \frac{3}{2}}{-20}$

$\frac{1}{f} = \frac{\frac{3}{2} - \frac{4}{3}}{20} + \frac{1}{40}$

$\frac{1}{f} = \frac{1}{120} + \frac{1}{40}$

$f = \frac{120}{4}$

$= +30\ \text{cm}$

(29) **Answer :** (2)
Solution:

For a convex mirror in case of real object image is always virtual, erect & diminished

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$f = +20\ \text{cm}$

$u = +20\ \text{cm}$

$v = \infty$

But this has nothing to do with Assertion.

(30) **Answer :** (4)
Solution:

The locus of all particles vibrating in same phase is wavefront.

(31) **Answer :** (3)
Solution:

(i) At central maxima, path difference is zero.
(ii) All maximas are equally spaced in YDSE.
(iii) Intensity variation is not linear.

(32) **Answer :** (2)
Solution:

The intensity at maximas are different in diffraction.

Angular divergence of central maxima = $\frac{2\lambda}{b}$

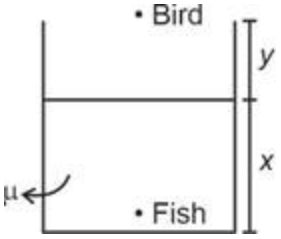
if b↓, angular divergence ↑

Width of central maxima = $2D\left(\frac{\lambda}{b}\right)$

so, it depends on slit width.

(33) Answer : (2)

Solution:



Apparent distance of a bird from water level = μ*y*

Apparent distance from fish = *x* + μ*y*

(34) Answer : (4)

Solution:

As $X_C = \frac{1}{wC}$

$f \uparrow \rightarrow w \uparrow \rightarrow X_C \downarrow \rightarrow I \uparrow$

If mica slab is placed then

$C' > C$

$X_C \downarrow$

$\Rightarrow$Brightness ↑↑

(35) Answer : (4)

Solution:

If lens is cut along yy'

$f' = 2f$

If $\mu_L > \mu_m$, lens remains converging

If $\mu_L = \mu_m$, lens disappears optically and no refraction occurs.

If $\mu_L < \mu_m$, focal length changes and nature of lens reverses.

(36) Answer : (4)

Solution:

$f_{eq} = 24\ \text{cm}$

For one plano convex lens

$\frac{1}{f_g} = \left(\mu_g - 1\right)\left(\frac{1}{R} - 0\right) = \frac{0.5}{R} = \frac{1}{2R}$

$f_g = 2R$

Combination of two identical lenses

$f_A = R = 24\ \text{cm}$

$P_{eq} = P_g + P_l + P_g$

and $f_g = 48\ \text{cm}$

$P_g = \frac{1}{48}\text{cm}^{-1}$

$P_L = \left(\mu_L - 1\right)\left[\frac{-2}{R}\right]$

$= \left(1.6 - 1\right)\left(-\frac{2}{24}\right) = -\frac{0.6}{12} = -\frac{1}{20}\text{cm}^{-1}$

$P_{eq} = \frac{1}{24} - \frac{1}{20}$

$= -\frac{1}{120}\text{cm}^{-1}$

$f_{eq} = -120\ \text{cm}$

(37) Answer : (2)

Solution:

$\frac{dE}{dt} = \frac{I_d}{A\epsilon_0}$

$= \frac{17.7}{\left(8.85\times10^{-12}\right)\left(100\times b^{-4}\right)}$

$= 2\times10^{14}\ V/m/s$

(38) **Answer :** (4)
Solution:
$E = \frac{U}{At}$
$\frac{U}{t} = P$
$E = \frac{P}{A}$
$E \propto P$
$\frac{E'}{E} = \frac{P'}{P}$
$E' = E \times \frac{50}{100}$
$= \frac{E}{2}$

(39) **Answer :** (4)
Solution:
The speed of all electromagnetic waves is same in vacuum.

(40) **Answer :** (2)
Solution:
$6 = I \times 5$
$I = 1.2A$
Voltage across R initially
$V_R = 10 - 6 = 4V$
$R = \frac{10}{3}$
Voltage across $5\ \Omega$
= 1.2 × 5
= 6 V
Voltage across inductor $= V_L$
$(10)^2 = (6)^2 + {V_L}^2$
$V_L = 8V$

(41) **Answer :** (4)
Solution:
Just after the closing of switch inductor offer maximum resistance $\therefore A_1 < A_2$
After a long time interval inductor behaves like a wire. $\therefore A_1 = A_2$

(42) **Answer :** (3)
Solution:

$I_{RMS} = \frac{\text{Power demand}}{\text{rms voltage}}$, R remains fixed for a line.

Power loss = $I^2_{RMS} \times R$

Power loss = $\left(\frac{\text{Power demand}}{\text{rms voltage}}\right)^2 \times R$

If RMS voltage increase *n* times, power loss will become $\frac{1}{n^2}$ times.

(43) **Answer :** (4)
Solution:
At resonance
$Z = R \Rightarrow I = \frac{V}{R}$
Increasing *R*, decreases current
$V_L = IX_L$
Changes with *R*
$V_C = IX_C$
Changes with the *R*
$V_{LC} = V_L - V_C = 0$
Remains zero

(44) **Answer :** (3)
Solution:
$\lambda = 5.4 \times 10^{-5}\text{cm} = 5.4 \times 10^{-7}\text{m}$
$c = 3 \times 10^8\ \text{m/s}$

$T = \frac{1}{f} = \frac{\lambda}{c} = \frac{5.4\times10^{-7}}{3\times10^{8}} = 1.8\times10^{-15} s$

$v = \frac{c}{\mu} = \frac{3\times10^{8}}{1.5} = 2\times10^{8}\,\mathrm{m/s}$

$\lambda = \frac{v}{f} = vT = 2\times10^{8}\times1.8\times10^{-15} = 3.6\times10^{-7}\,\mathrm{m}$

(45) **Answer :** (1)
Solution:
Interference required two coherent sources, with the one slit closed, no interference will be observed.
On introducing transparent glass on slit in YDSE the fringe pattern will shift.
Stable interference fringes form only when sources are coherent.

CHEMISTRY

(46) **Answer :** (2)
Solution:
• $\Delta H° = \Delta U° + \Delta n_g RT$
$= -10 + (0)RT = -10$ kJ
$\Delta G° = \Delta H° - T\Delta S°$
• $\Delta G° = (-10 - (298 \times 10^{-3} \times (-40) = 1.92$ kJ

(47) **Answer :** (2)
Hint:
$\Delta U = nC_V\Delta T$
Solution:
For isothermal process, T = constant
so $\Delta T = 0$
$\therefore \Delta U = 0$

(48) **Answer :** (3)
Hint:
q and w are path functions.
Solution:
$\Delta U = q + w$; ΔU is a state function

(49) **Answer :** (3)
Solution:
Standard enthalpy of formation is the enthalpy change in the formation of one mole of a compound from its elements in their most stable states of aggregations.

(50) **Answer :** (2)
Hint:
$\Delta G° = -2.303\ RT \log K_c$
Solution:
$\Delta G° = -2.303 \times R \times 300 \times \log 100$
$= -2.303 \times 2 \times 300 \times R$
$= -1381.8\ R$

(51) **Answer :** (4)
Solution:
Hint: $C_5H_{12}(g) + 8O_2(g) \rightarrow 5CO_2 + 6H_2O(l)$
$\Delta H = \Delta H_{f(\text{products})} - \Delta H_{f(\text{reactants})}$
Sol. :
$-3500 = [5 \times (-390) + 6 \times (-285)] - \Delta H_{f(C_5H_{12})}$
or $\Delta H_{f(C_5H_{12})} = -3660 + 3500 = -160$ kJ mol^{-1}

(52) **Answer :** (2)
Hint:
At equilibrium, $\Delta G = 0$
Solution:
$\Delta G = \Delta H - T\Delta S$

$\Delta H = T\Delta S$

$\Delta S = \frac{\Delta H}{T} = \frac{149 \times 1000}{298} = 500$ J/K-mol

(53) **Answer :** (2)
Solution:
$\Delta U = Q + W$
$= 40 - 20 = 20$ J

(54) **Answer :** (1)
Hint:
For an adiabatic free expansion, gas is contained in an insulated container and allowed to expand in a vacuum.
Solution:
For an adiabatic free expansion, work done is zero and heat exchanged is zero, i.e., w = 0 and q = 0.
So, $\Delta U = q + w$
$\Delta U = 0$

(55) **Answer :** (1)
Hint:
Heat of neutralization for strong acid and strong base is 13.7 kcal/eq.
Solution:
meq of $H_2SO_4 = 200 \times 0.2 = 40$
meq of NaOH = $200 \times 0.15 = 30$
Heat evolved = $13.7 \times 30 \times 10^{-3} \times 10^3$ cal = 411 cal

(56) **Answer :** (4)
Hint:
For isothermal process; $\Delta T = 0$
For adiabatic process; q = 0
Solution:
$T_S = T_Q$ (for isothermal process)
$T_Q > T_R$ because for isothermal process temperature remains constant while for adiabatic expansion, cooling of gas takes place.
Work done is calculated as area under the curve in P - V diagram.
For expansion, work is done by the system so
W = –ve
$\Delta U = q + w$ (For adiabatic)
$\Delta U = w$
ΔU = –ve
so, $U_Q > U_R$

(57) **Answer :** (1)
Hint:
On sublimation, entropy of the system increases.

(58) **Answer :** (4)
Hint:
$\Delta H^\circ_{sub} = \Delta H^\circ_{fus} + \Delta H^\circ_{vap}$
Solution:
$\Delta H^\circ_{vap} = \Delta H^\circ_{sub} - \Delta H^\circ_{fus}$
$\Delta H^\circ_{vap} = b - a$

(59) **Answer :** (4)
Hint:
ΔG is the net energy available to do useful work.
Solution:
$T\Delta S_{system}$ is the energy which is not available to do useful work

(60) **Answer :** (2)
Hint:
$Q = ms\Delta T$
Solution:
$Q = 25 \times 0.39(80 - 35) = 438.75$ J

(61) **Answer :** (4)
Hint:

$$\text{Enthalpy change} = \begin{bmatrix}\text{Sum of bond energy of}\\ \text{reactants}\end{bmatrix} - \begin{bmatrix}\text{Sum of bond energy of}\\ \text{product}\end{bmatrix}$$

Solution:

$H_2(g) + I_2(g) \rightarrow 2HI(g)$ $\Delta H = -8$ kJ mol^{-1}

$\Delta H = \Sigma(BE)_R - \Sigma(BE)_P$

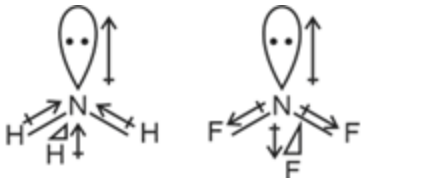
$= (BE_{H-H}) + (BE_{I-I}) - 2(BE_{H-I})$.

$-8 = (435) + (151) - 2(BE_{H-I})$

$BE_{H-I} = \frac{8+435+151}{2} = 297 \text{ kJ mol}^{-1}$

(62) **Answer :** (1)

Solution:



$\mu_{net} = 4.9 \times 10^{-30}$ cm $\mu_{net} = 0.8 \times 10^{-30}$ cm

(63) **Answer :** (3)

Hint:

For cyclic process, the change in state functions are zero.

Solution:

ΔH, ΔS and ΔU are state functions:

Hence, for cyclic process, $\Delta H = 0$

$\Delta S = 0$

$\Delta U = 0$

(64) **Answer :** (1)

Hint:

Third law permits the calculation of absolute value of entropy of pure crystalline substance.

(65) **Answer :** (1)

Hint:

$\Delta H = \Delta U + \Delta(PV)$

Solution:

$\Delta H = \Delta U + (P_2V_2 - P_1V_1)$

40 L-atm = ΔU + {(4 × 10) – (2 × 3)} L-atm

40 L-atm = ΔU + 34 L-atm

ΔU = (40 – 34) L-atm = 6 L-atm

(66) **Answer :** (4)

Solution:

$\Delta S_r^o = \Sigma\nu_i S_P^o - \Sigma\nu_i S_R^o = -40$ J/k-mole

$\Delta G = \Delta H - T\Delta S$, at eq. $\Delta G = 0$

$T = \frac{\Delta H}{\Delta S} = \frac{-30\times10^3}{-40} = 750$ K

(67) **Answer :** (2)

Hint:

For isothermal reversible process

$q = -w = 2.303\ nRT \log \frac{V_f}{V_i}$

Solution:

$q = \frac{2.303\times2\times2\times300}{1000}\log\frac{10}{100}$

= – 2.76 kcal

(68) **Answer :** (2)

Solution:

$q = n\Delta H_{Vapourization}$

$q = 1 \times 40.66 \times 10^3$ J $= 40.66 \times 10^3$ J

$w = -\Delta n_g RT$

$= -1 \times 8.314 \times 373 = -3101.12$ J

$\Delta U = q + w = (40.66 \times 10^3 - 3101.12)$ J

$= 37558.878$ J $= 37.56 \times 10^3$ J

(69) Answer : (4)

Solution:

If $\Delta_r H > 0$ and $\Delta_r S < 0$ and then process will be non-spontaneous at all possible temperatures.

(70) Answer : (2)

Solution:

ΔH(kJ mol^{-1})

$\left(\frac{1}{2}A \rightarrow B\right) \times 2 \ \Delta H = -200$

$3B \rightarrow 2C + D \quad \Delta H = +120$

$2D \rightarrow E + A \quad \Delta H = +325$

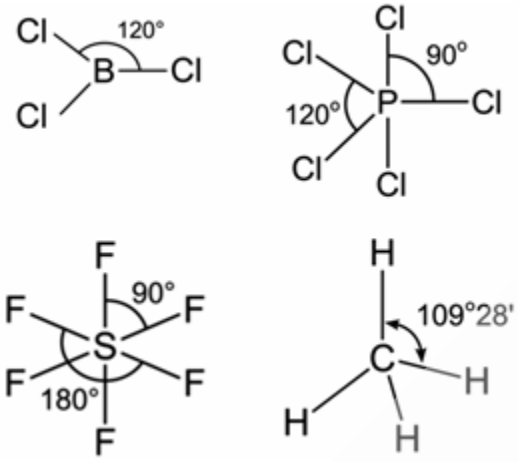
ΔH for B + D → E + 2C

= (–200 + 120 + 325) kJ mol^{-1}

= +245 kJ mol^{-1}

(71) Answer : (4)

Solution:

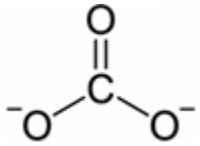


(72) Answer : (3)

Solution:

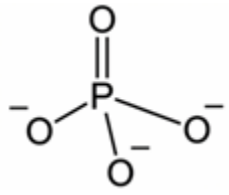
(i) O = C = O

CO Bond order = 2



Bond order $= \frac{4}{3} = 1.33$

CO bond length in CO_2 < CO bond length in CO_3^{2-}

(ii) 

Bond order $= \frac{5}{4} = 1.25$

(iii) B.E. is higher for C ≡ C (in ethyne) than C = C (in ethene)

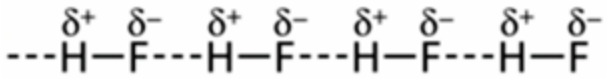
(iv) Size of O is smaller than that of C Bond length C – H > Bond length O – H

(v) $\Delta H_{BE}(H_2) = 435.8$ kJ mol^{-1} $\Delta H_{BE}(HCl) = 431$ kJ mol^{-1}

(73) Answer : (3)

Solution:

There is no hydrogen bonding in case of HCl while in case of NH_3 and H_2O linear polymeric structure is not formed.



(74) **Answer :** (1)
Solution:
Na^+ has larger size and less charge as compared to Al^{3+} and hence has more ionic nature
Cs^+ is larger in size hence it forms more ionic compound with I^- ion as compared to Na^+
Al^{3+} is smaller with more charge and hence it forms more covalent compound than Mg^{2+}

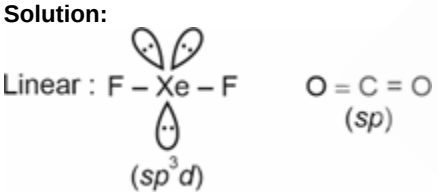
(75) **Answer :** (3)
Solution:
- Incomplete octet : $AlCl_3$, $BeCl_2$
- Expanded octet : H_2SO_4, PCl_5
- CH_4 is not an exception to octet rule.

(76) **Answer :** (4)
Solution:

Species	Hybridisation of central atom
NH_3	sp^3
H_2O	sp^3
CCl_4	sp^3
SF_4	sp^3d

(77) **Answer :** (4)
Solution:
There is no equilibrium between canonical forms as these have no real existence.

(78) **Answer :** (2)
Solution:

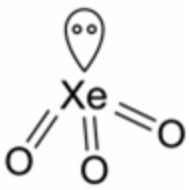
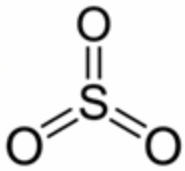
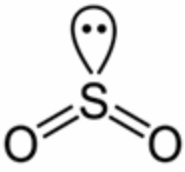
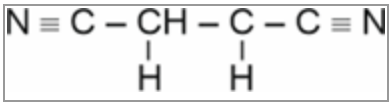


(79) **Answer :** (2)
Solution:
Bond length increases as bond order decreases

Species	Bond order	Magnetic Behaviour
C_2	2	Diamagnetic
C_2^-	2.5	Paramagnetic
O_2	2	Paramagnetic
O_2^-	1.5	Paramagnetic
N_2	3	Diamagnetic
N_2^+	2.5	Paramagnetic
B_2	1	Paramagnetic
B_2^+	0.5	Paramagnetic

(80) **Answer :** (3)
Solution:

	σ bonds	π bonds
	3	3

		
	3	3
	2	2
	6	4

(81) **Answer :** (1)
Solution:
BF_3 is a Lewis acid and accept electron pair from Lewis base (NH_3) in its vacant orbital and results in coordinate bond formation. It leads to change in hybridisation of B from sp^2 to sp^3 while hybridisation of N remain same

$$\underset{sp^2}{BF_3} + : \underset{sp^3}{NH_3} \rightarrow \underset{sp^3}{H_3N} \rightarrow \underset{sp^3}{BF_3}$$

(82) **Answer :** (3)
Solution:
$N_2^+ = \sigma s^2 \sigma^* s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \pi 2p_y^2 \underset{\text{HOMO}}{\sigma 2p_z^1}$

$C_2 = \sigma s^2 \sigma^* s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \pi 2p_y^2$

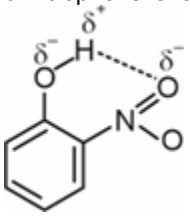
$O_2^+ = \sigma s^2 \sigma^* s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2 \pi 2p_y^2 \pi^* 2p_x^1$

$Be_2^+ = \sigma s^2 \sigma^* s^2 \sigma 2s^2 \sigma^* 2s^1$

(83) **Answer :** (4)
Solution:
Dipole moment depends on bond dipole moment based on electronegativities of bonded atoms.
For polyatomic molecules, it also depends on the spatial arrangement of various bonds.

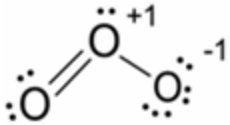
Species	Dipole moment (D)
HCl	1.07
CH_4	0
HBr	0.79
HI	0.38

(84) **Answer :** (2)
Solution:
θ-Nitrophenol shows intramolecular hydrogen bonding

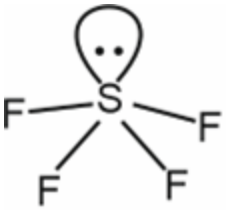


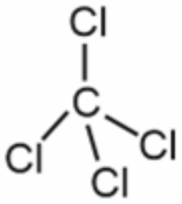
(85) **Answer :** (2)

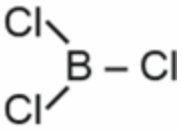
Solution:



(86) **Answer :** (2)
Solution:

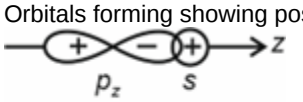






(87) **Answer :** (2)
Solution:
B_2 and C_2 has only πbonds.

(88) **Answer :** (4)
Solution:
Orbitals forming showing positive overlap (in phase) should have same sign and orientation in space.



Out of phase overlap

(89) **Answer :** (1)
Solution:

Due to highest hydration enthalpy of F^-, HF has highest enthalpy of neutralisation with NaOH.

(90) **Answer :** (3)
Solution:
C_p and C_v are intensive properties and irrespective of the amount of the gas taken $C_p - C_v = R$.

BOTANY

(91) **Answer :** (1)
Solution:
The epidermis is the outermost layer of the primary plant body. It is made up of elongated, compactly arranged cells, which form a continuous layer.

(92) **Answer :** (1)
Solution:
In basal placentation, the placenta develops at the base of ovary and a single ovule is attached to it, as in sunflower, marigold.

(93) **Answer :** (1)
Hint:
The innermost layer of the cortex is rich in starch grains.
Solution:
The cells of endodermis in dicot stem are rich in starch grains and the layer is also referred to as the starch sheath.

(94) **Answer :** (4)
Hint:
Xylem and phloem are present in vascular bundles.
Solution:
Vascular bundles are included in vascular tissue system.

(95) **Answer :** (4)
Solution:
Zone of maturation shows maximum absorption of water and minerals due to the presence of root hairs. This region is found proximal to the region of elongation towards the base of stem.

(96) **Answer :** (3)
Solution:
In monocot stem, water cavities within vascular bundles are present.

(97) **Answer :** (4)
Solution:
Mesophyll cells are not included in stomatal apparatus.

(98) **Answer :** (2)
Solution:
Figure A represents a dicot seed and figure B represents a monocot seed.

(99) **Answer :** (2)
Solution:

Aestivation of petals:	**Examples**
Valvate	*Calotropis*
Twisted	*Hibiscus rosa-sinensis*
Imbricate	*Cassia*
Vexillary	*Trifolium*

(100) **Answer :** (1)
Solution:
The terms apocarpous and bilocular are related to gynoecium.

(101) **Answer :** (3)
Solution:
Hint: Conjunctive tissue is present in between the patches of xylem and phloem.
Sol.: The parenchymatous cells which lie between the xylem and the phloem of both monocotyledonous and dicotyledonous roots are called conjunctive tissue.

(102) **Answer :** (3)
Solution:
Ray florets of sunflower are pistilate flowers and have basal placentation in gynoecium and inferior ovary.

(103) **Answer :** (3)
Solution:
In *Solanum*, the main axis has determinate growth, ending in a flower at the tip.

(104) **Answer :** (2)
Hint:
In monocot stems, vascular bundles are scattered.
Solution:
A large number of vascular bundles are arranged in a ring; the 'ring' arrangement of vascular bundles is a characteristic of a dicot stem.

(105) **Answer :** (2)
Solution:
When the conjoint vascular bundle has cambium, it is called open vascular bundle.

(106) **Answer :** (1)
Solution:
Monocots usually lack phloem parenchyma.

(107) **Answer :** (1)
Solution:
Cortex is the region present between epidermis and stele.

(108) Answer : (4)
Solution:
Monocotyledonous stems have sclerenchymatous hypodermis.

(109) Answer : (3)
Solution:
Lateral roots are formed by pericycle.

(110) Answer : (4)
Solution:
Dicot leaves show the presence of differentiation of ground tissue in palisade and spongy parenchyma, unlike the monocot leaves.

(111) Answer : (2)
Solution:


represents epipetalous condition of stamen

(112) Answer : (4)
Hint:
Flower is said to be zygomorphic (bilateral symmetry) when it can be divided into two similar halves only in a particular vertical plane. e.g., pea and gulmohur.
Solution:
The flower of mustard is actinomorphic (radial symmetry)

(113) Answer : (4)
Solution:
The oval or round and loosely arranged spongy parenchyma is situated below the palisade cells and extends to abaxial epidermis. The parallel venation in monocot leaves is reflected in the near similar sizes of vascular bundles (except in main veins).

(114) Answer : (2)
Solution:
In monocot stems, pith is absent.

(115) Answer : (2)
Solution:
Small pore present above hilum is called micropyle.

(116) Answer : (2)
Solution:
Trichomes (epidermal appendages of stem) help in preventing water loss due to transpiration. Root hairs (epidermal appendages of roots) help in absorption of water and minerals from the soil.

(117) Answer : (2)
Solution:
Radial vascular bundles are found in roots of angiosperms.

(118) Answer : (1)
Solution:
Tomato shows the presence of epipetalous stamen. Both maize and tomato shows the presence of endospermous seeds.

(119) Answer : (1)
Solution:
The leaf base may bear two lateral small leaf like structures called stipules. Bracts are reduced leaf found at the base of the pedicel.

(120) Answer : (1)
Solution:
Petunia - Hypogynous flower
Plum - Perigynous flower
Ashwagandha - Axile placentation
Argemone - Parietal placentation
Belladonna - Valvate aestivation of petals
Lady's finger - Twisted aestivation of petals
Chilli - Alternate phyllotaxy
Calotropis - Opposite phyllotaxy

(121) Answer : (3)

Solution:
When bulliform cells are flaccid due to water stress, they make the leaves curl inwards to minimise water loss.

(122) Answer : (3)
Solution:
In bean flower, petals show vexillary aestivation.
In bean flower, petals are of three types.
(1) **Standard :** largest posterior one.
(2) **Keel :** smallest anterior petals.
(3) **Wings :** smaller lateral petals.

(123) Answer : (2)
Hint:
Endodermis has a deposition of waxy material suberin in the form of casparian strips.
Solution:
In dicot roots, the innermost layer of the cortex is endodermis. The tangential as well as radial walls of the endodermal cells have a deposition of water-impermeable, waxy material suberin, in the form of casparian strips.

(124) Answer : (2)
Solution:
The observed plant is mustard having floral formula is $\oplus K_{2+2} C_{X4}\ A_{2+4}\ \underline{G}_{(2)}$

(125) Answer : (4)
Solution:
A flower is a modified shoot, wherein the shoot apical meristem changes to floral meristem. Internodes do not elongate and the axis gets condensed.

(126) Answer : (3)
Solution:
Both floral and vegetative characteristics form the basis of classification and identification of flowering plants. The morphological features of stem, like the presence of nodes and internodes, multicellular hairs and positively phototropic nature, help to differentiate the stems from roots.

(127) Answer : (2)
Solution:
The arrangement of flowers on the floral axis is termed as inflorescence.

(128) Answer : (4)
Hint:
All tissues on the inner side of the endodermis constitute stele.
Solution:
Stele includes pericycle, pith and vascular bundles.

(129) Answer : (1)
Solution:
Parallel venation can be seen in the leaves of banana.

(130) Answer : (3)
Solution:
If more than two leaves arise at a node and form a whorl, it is called whorled, as in *Alstonia*. In palmately compound leaves, the leaflets are attached at a common point, at the tip of petiole, as in silk cotton.

(131) Answer : (3)
Solution:
P- Medulla — Medullary rays are extensions of medulla, which extend between the vascular bundles and are in contact with the pericycle.
Q- Cambium — assist in the formation of secondary tissues.
R- Pericycle — It is the outermost layer of stele
S- Hypodermis — outermost layer of cortex

(132) Answer : (2)
Solution:
The three basic tissue system, namely, epidermal, ground and vascular tissue system contain parenchymatous cells which are capable of storing food.

(133) Answer : (2)
Solution:
⊕ symbol represents an actinomorphic flower.

(134) Answer : (1)

Solution:
A dicot root can exhibit secondary growth.

(135) Answer : (4)
Solution:
The correct arrangement of these structures is as follows:
b → Epidermis → Single layer of parenchymatous cells having unicellular appendages.
a → Endodermis → Cells having deposition of suberin in radial and tangential walls.
d → Pericycle → Layer of thick walled parenchymatous cells which initiate lateral roots and vascular cambium formation during secondary growth.
c → Vascular tissues → Two to four patches of phloem.

ZOOLOGY

(136) Answer : (3)
Solution:
Symptoms of AIDS develop in a person infected with HIV, when HIV enters helper T-lymphocytes causing decrease in their number beyond a certain level.

(137) Answer : (1)
Solution:
Bone marrow and thymus gland are considered as primary lymphoid organs and here immature lymphocytes differentiate into antigen-sensitive lymphocytes. Other given organs are included under the category of secondary lymphoid organs.

(138) Answer : (2)
Hint:
Thrice the number of eyes present in humans
Solution:
Smoking is associated with increased incidences of cancer of lungs, throat and urinary bladder. Bronchitis, emphysema and coronary heart diseases are also the consequences of smoking.

(139) Answer : (3)
Solution:
Lymph nodes are secondary lymphoid organs. Antigens trapped in the lymph nodes are responsible for the activation of lymphocytes present there and cause the immune response.

(140) Answer : (4)
Solution:
A monomeric antibody is represented as H_2L_2. They are involved in humoral immunity and are produced by B-lymphocytes.

(141) Answer : (4)
Solution:
The parasites multiply within mosquito's gut to form sporozoites that are stored in their salivary glands. When these mosquitoes bite a human, the sporozoites are introduced into his/ her body.

(142) Answer : (2)
Solution:
Cocaine is a stimulant. Tobacco contains an alkaloid named nicotine that stimulates the adrenal gland to release adrenaline and noradrenaline.

(143) Answer : (4)
Hint:
Cellular barrier of innate immunity.
Solution:
(i) **Physical barriers:** Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts helps in trapping microbes entering our body.
(ii) **Physiological barriers:** Acid in the stomach, saliva in the mouth and tears from eyes-all prevent microbial growth.
(iii) **Cellular barriers:** Certain types of leukocytes (WBCs) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils), monocytes and natural killer cells (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes.

(144) Answer : (4)
Solution:
The use of drugs like anti-histamine, adrenaline and steroids quickly reduce the symptoms of allergy.

(145) Answer : (2)

Solution:
HCl in stomach, saliva and tears are included under the physiological barriers of innate immunity.

(146) Answer : (1)
Hint:
Regular dose of drugs is discontinued
Solution:
Individuals who take drugs regularly, start getting dependent on the drugs, and this is known as drug addiction.
If the regular dose of drugs / alcohol is suddenly discontinued, then the addict will experience anxiety, shakiness, nausea and sweating, which may be relieved when drug use is resumed.
In some cases, withdrawal symptoms can be severe and even life threatening and the person may need medical supervision.

(147) Answer : (3)
Hint:
Produce cannabinoids
Solution:
Natural cannabinoids are obtained from the inflorescences of the plant *Cannabis sativa*. The flower tops, leaves and the resin of *Cannabis* plant are used in various combinations to produce marijuana, hashish, charas and ganja.
Erythroxylum coca produces cocaine, *Papaver somniferum* produces morphine.

(148) Answer : (4)
Solution:
Mood swings, increased aggressiveness and depression are some common side-effects which are observed in both male and female.
Breast enlargement is observed in human males as side-effect of misuse of anabolic steroids.

(149) Answer : (3)
Solution:
During snakebite, preformed antibodies are given against the snake venom, which is an example of artificial passive immunity.

(150) Answer : (3)
Solution:
The spleen is a large bean-shaped organ. It mainly contains lymphocytes and phagocytes. It acts as a filter of the blood by trapping blood-borne microorganisms. Spleen also has a large reservoir of erythrocytes. The primary lymphoid organs are the bone marrow and thymus where immature lymphocytes differentiate into antigen-sensitive lymphocytes.

(151) Answer : (2)
Solution:
X-rays, UV rays and gamma rays are physical carcinogens.

(152) Answer : (3)
Solution:
Pathogens have to adapt to life within the host.

(153) Answer : (2)
Solution:
Following measures would be useful for preventing and control of alcohol and drug abuse among adolescents.
- A child should not be pushed unduly to perform beyond his/her threshold limits.
- Parents and teachers need to look for and identify the danger signs.
- Educating him/her to face problems and stress, and to accept disappointments and failures as a part of life.

(154) Answer : (4)
Hint:
Ringworm is a fungal infection.
Solution:

Column I	Column II
(a) Ringworms	(iii) Generally acquired from soil or by using infected towels
(b) Amoebiasis	(i) Faeco-oral transmission
(c) Ascariasis	(ii) Helminthic disease

(155) Answer : (3)
Solution:
AIDS was first reported in 1981 and in the last twenty-five years or so, it has spread all over the world killing more than 25 million individuals.

(156) Answer : (1)
Solution:

Athletes misuse narcotic analgesics to mask pain from injuries. They also (mis)use anabolic steroids, diuretics and certain hormones in sports to increase muscle strength and bulk and to promote aggressiveness, as a result increase athletic performance.

(157) Answer : (3)
Solution:
Hepatitis-B and AIDS are both viral infections that can be transmitted through shared infected needles and syringes. Both are chronic infections and ultimately fatal.

(158) Answer : (1)
Solution:
Acquired immunity is pathogen specific. The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood.

(159) Answer : (2)
Solution:
With repeated use of drugs, the tolerance level of the receptors present in our body increases. Consequently the receptors respond only to higher doses of drugs or alcohol leading to greater intake and addiction.

(160) Answer : (3)
Solution:
Muscular dystrophy is a genetic disorder, while gout is caused due to deposition of uric acid crystals in joints.
Rest all the diseases mentioned in the question are autoimmune diseases.

(161) Answer : (3)
Solution:
In vaccination, a preparation of antigenic proteins of pathogen or inactivated weakened pathogen (vaccine) are introduced into the body.

(162) Answer : (4)
Solution:
Each antibody is specific for a particular antigen. This characteristic is a result of the unique structural organization of amino acids in the variable portions of the light and heavy chains.

(163) Answer : (3)
Solution:
Salmonella typhi is a pathogenic bacterium which causes typhoid fever in human beings. These pathogens generally enter the small intestine through food and water contaminated with them and migrate to other organs.

(164) Answer : (3)
Solution:
Thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained, it reduces to a very small size.
Spleen is a large bean shaped organ and provides the site for interaction of lymphocytes with the antigen.

(165) Answer : (2)
Solution:
Ringworm is a common infection of the skin and nails that is caused by a fungus.
Roundworm is a nematode, especially a parasitic one found in the intestine of mammals.

(166) Answer : (4)
Solution:
Entamoeba histolytica is a protozoan parasite in the large intestine of human which causes amoebiasis (amoebic dysentery). Symptoms of this disease include constipation, abdominal pain and cramps, stools with excess mucus and blood clots.

(167) Answer : (2)
Solution:
The discovery of blood circulation by William Harvey using experimental method and the demonstration of normal body temperature in persons with black bile using thermometer disproved the ‘good humor’ hypothesis of health.

(168) Answer : (3)
Solution:
A classic case in medicine, that of Mary Malon nicknamed Typhoid Mary. She was a cook by profession and was a typhoid carrier who continued to spread typhoid for several years through the food she prepared.

(169) Answer : (3)
Solution:
As a result of pneumonia, the alveoli get filled with fluid leading to severe problems in respiration. The symptoms of pneumonia include fever, chills, cough and headache.

(170) Answer : (3)

Solution:

A healthy person acquires the pneumonia by inhaling the droplets/aerosols released by an infected person or even by sharing glasses and utensils with an infected person.

(171) Answer : (3)

Solution:

Plague – *Yersinia pestis*
Tetanus – *Clostridium tetani*
Filariasis – *Wuchereria malayi*
Amoebic dysentery – *Entamoeba histolytica*

(172) Answer : (3)

Solution:

In AIDS, HIV shows high mutagenicity. Activated cytotoxic or killer T-cells attack on virus invaded helper T-cells. Progressive decrease in the number of helper T-lymphocytes in the body of the infected person, due to which the person starts suffering from infections that could have been otherwise overcome such as those due to bacteria especially *Mycobacterium*, viruses fungi and even parasites.

(173) Answer : (4)

Solution:

T_1 represents primary response

T_2 represents secondary response

Memory cells may remain for decades. Every new encounter with the same antigen results in a rapid proliferation of memory cells. After subsequent encounter with the same pathogen/antigen, the antibody titre is far greater than during a primary response.

(174) Answer : (4)

Solution:

Physiological barriers : Acid in the stomach, saliva in the mouth, tears from eyes, all prevent microbial growth.
Cellular barriers : PMNL, NK Cells, monocytes
Physical barriers : Skin and mucus coating of GIT

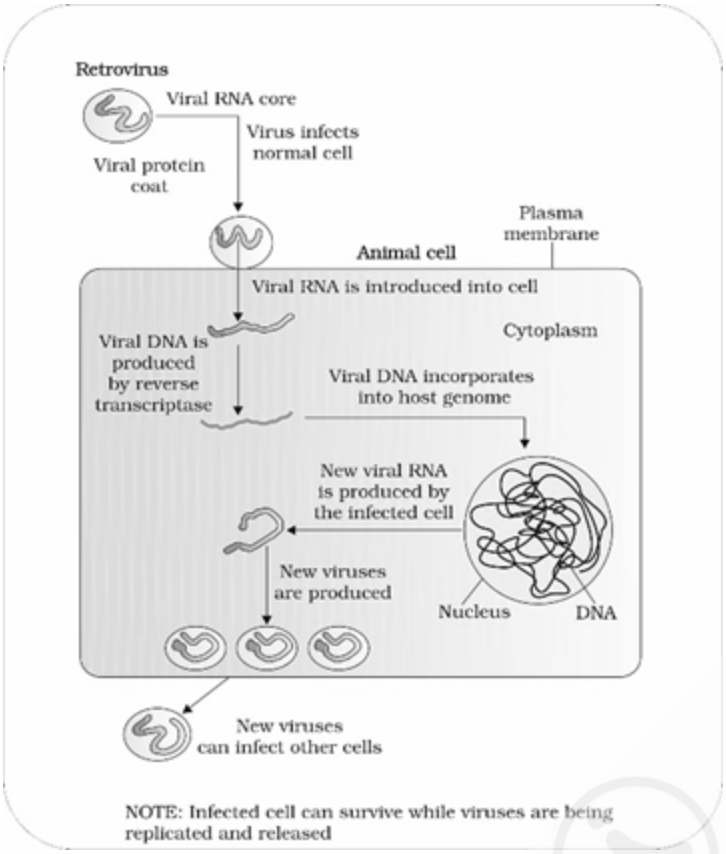
(175) Answer : (1)

Solution:

There is lymphoid tissue also located within the lining of the major tracts (respiratory, digestive and urogenital tracts) called MALT. It constitutes about 50 per cent of the lymphoid tissue in human body.
Peyer's patches and appendix are secondary lymphoid organs which provide the site for interaction of lymphocytes with the antigen.

(176) Answer : (2)

Solution:



(177) Answer : (3)

Solution:

Breakdown of growth regulation → Loss of contact inhibition → Malignant tumour characteristics → Metastasis

(178) Answer : (4)

Solution:

Several therapeutic drugs are used to kill cancerous cells. Some of these are specific for particular tumours. Majority of drugs have side effects.

(179) Answer : (2)

Solution:

Natural cannabinoids are obtained from the inflorescences of the plant *Cannabis sativa*. The flower tops, leaves and the resin of cannabis plants are used in various combinations.

(180) Answer : (1)

Solution:

Heroin – Depressant
Cocaine – Stimulant
Barbiturates – Sleep inducing