24/03/2026

Code-A Phase-1

Aakash
Medical | IIT-JEE | Foundations

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MM : 720

Final Test Series(P1)_NEET2026_Test-03A

Time : 180 Min.

PHYSICS

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CHEMISTRY

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ZOOLOGY

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158. (4)

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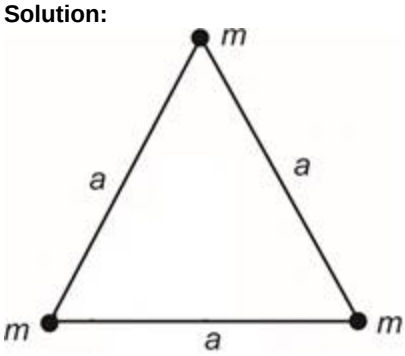
Hints and Solutions

PHYSICS

(1) **Answer :** (1)
Solution:
Gravitational force is always attractive in nature. It is weakest in nature and it is a central force.

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



$U = \frac{-Gm^2}{a} - \frac{Gm^2}{a} - \frac{Gm^2}{a} = \frac{-3Gm^2}{a}$

(3) **Answer :** (4)
Solution:
Kepler's law of area is consequence of conservation of angular momentum

(4) **Answer :** (4)
Solution:
$g = \frac{GMr}{R^3}$
when $r \le R$
For $r = 0 \Rightarrow g = 0$
$g = \frac{GM}{r^2}$
when $r > R$

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

(6) **Answer :** (1)
Solution:
$g_{\text{depth}} = g_{\text{height}}$
$g\left[1 - \frac{d}{R}\right] = g\left[1 - \frac{2h}{R}\right]$
$d = 2h$
$h = \frac{d}{2} = \frac{50}{2} = 25$ km

(7) **Answer :** (1)
Hint:
Hint: Consider Kepler's laws and angular momentum.
Solution:
By conservation of angular momentum
$M v_1 r_1 = M v_2 r_2$
$v \propto \frac{1}{r}$
If $r_1 > r_2$, $v_1 < v_2$

(8) **Answer :** (1)

Solution:

$\frac{F-32}{9} = \frac{C}{5}$

$\frac{104-32}{9} = \frac{C}{5}$

⇒ C = 40°C

(9) **Answer :** (3)
Solution:
The units of specific heat capacity is J/Kg–K

(10) **Answer :** (1)
Solution:
The fastest mode of heat transfer is radiation.

(11) **Answer :** (1)
Solution:
When a solid melts into liquid, its phase changes. It absorbs heat during this process.
Q = *mL*, where *L* is the Latent heat of phase change.

(12) **Answer :** (2)
Solution:
Rate of cooling ∝ mean temperature difference.
In second case, mean temperature difference decreases and the time required is more.

(13) **Answer :** (3)
Solution:
For an isotropic solid ⇒ γ = 3α

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

$\frac{\Delta l}{l} \times 100 = \alpha \Delta \theta \times 100$

Solution:
Percentage change in length due to temperature change

$\frac{\Delta l}{l}$ × 100 = αΔθ ×100= $2\times10^{-5} \times 10^{4}$ = 0.2%

(15) **Answer :** (4)
Solution:
Young's modulus is the property of material.

(16) **Answer :** (2)
Solution:
Energy per unit volume = $\left(\frac{1}{2}\right)$ stress × strain

$= \left(\frac{1}{2}\right) \text{ stress } \times \frac{\text{stress}}{Y} \left[\text{As, } Y = \frac{\text{stress}}{\text{strain}}\right]$

$= \frac{P^2}{2Y}$

(17) **Answer :** (4)
Solution:

$\frac{Y_A}{Y_B} = \frac{\tan 60^\circ}{\tan 45^\circ} = \frac{\sqrt{3}}{1}$

(18) **Answer :** (4)
Solution:
Breaking stress is the property of material of wire.

(19) **Answer :** (1)
Solution:
Pascal's law states that for a liquid in equilibrium, the pressure is same at all points in horizontal plane.
Another form of the Pascal's law says that whenever external pressure is applied in any part of an ideal fluid contained in a vessel, it is transmitted undiminished and equally in all directions.

(20) **Answer :** (1)
Solution:

$E_1 = \frac{GM}{r^2}$ and $E_2 = \frac{Gm}{r^2}$

$\therefore \quad \frac{E_1}{E_2} = \frac{M}{m}$

(21) **Answer :** (2)
Solution:

$v = \sqrt{\frac{GM}{r}} \quad \therefore \quad 3v = \sqrt{\frac{GM}{4R}}$ and $v' = \sqrt{\frac{GM}{R}}$

$\frac{v'}{3v} = \sqrt{\frac{GM}{R}} \times \sqrt{\frac{4R}{GM}} = 2 \therefore v' = 6v$

(22) **Answer :** (2)
Hint:

$V = \frac{-GM}{r}$

Solution:

$V_{net} = \frac{-GM}{r_1} - \frac{GM}{r_2} - \frac{GM}{r_3} + ...$

$V_{net} = \frac{-2G}{1} - \frac{2G}{4} - \frac{2G}{16} + ...$

$V_{net} = \frac{-2G}{1}\left(\frac{1}{1} + \frac{1}{4} + \frac{1}{16} ....\right)$

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

$= \frac{-8G}{3}$ J/kg

(23) **Answer :** (4)
Solution:

$\vec{F} = \frac{Gm_1m_2}{(r\sqrt{2})^2}\left(\frac{-\hat{i}}{\sqrt{2}} + \frac{-\hat{j}}{\sqrt{2}}\right)$

(24) **Answer :** (2)
Solution:

Sol: $V_T = \frac{2}{9} \times \frac{a^2}{\eta}\left(\rho_b - \rho_f\right) \times g$

(25) **Answer :** (4)
Solution:
Since pressure depends only on the vertical height hence pressure at bottom would be same.

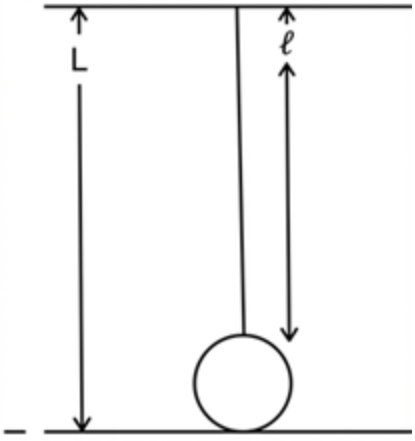
(26) **Answer :** (3)
Solution:
$\rho_y \times g \times 8 + \rho_{Hg} \times g \times 2 = \rho_x \times g \times 10$

$\Rightarrow \rho_y \times 8 = 33.6 - 13.6 \times 2 \Rightarrow \rho_y \times 8 = 6.4 \Rightarrow \rho_y = 0.8$ g/cm^3

(27) **Answer :** (4)
Solution:
Same pressure will be transmitted $\Rightarrow \frac{12}{9} = \frac{F}{15 \times 15}$

$\Rightarrow F = \frac{12}{9} \times 15 \times 15 = 15 \times 20 = 300$ N

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



$\Rightarrow l+\Delta l+2r=L$
$\Delta l=L-l-2r$
We know that, $\Delta l=\frac{F\times l}{A\times y}$
or, $\Delta l=\frac{Tl}{\frac{\pi}{4}D^2y}$
$T=\frac{\pi}{4}D^2y\frac{(L-l-2r)}{l}$, $T-mg=\frac{mv^2}{L-r}$
$\Rightarrow V=\sqrt{\left(\frac{\pi}{4}D^2y\frac{L-l-2r}{l}-mg\right)\frac{(L-r)}{m}}$

(29) **Answer :** (1)
Solution:
A deforming force can produce strain in more than one direction. Hooke's law is applicable when object is under tensile stress, shear stress and volumetric stress.

(30) **Answer :** (4)
Solution:
Energy density $=\frac{1}{2}\times\text{stress}\times\text{strain}=\frac{1}{2}\times\sigma\times\frac{\sigma}{Y}=\frac{\sigma^2}{2Y}$

$\sigma=\frac{F}{A}\Rightarrow\frac{\sigma_1^2}{\sigma_2^2}=\frac{\left(\frac{F}{\pi r_1^2}\right)^2}{\left(\frac{F}{\pi r_2^2}\right)^2}\Rightarrow\frac{\sigma_1^2}{\sigma_2^2}=\frac{r_2^4}{r_1^4}=81$

Ratio of energy stored per unit volume = 81 : 1

(31) **Answer :** (1)
Solution:
The two wires will have same stress as they have same cross-sectional area subjected to same force.

(32) **Answer :** (1)
Solution:
$B=\frac{-\Delta P}{\frac{\Delta V}{V}}=\frac{(1.165-1.01)\times10^5}{10\times10^{-2}}=1.55\times10^5\ \text{Pa}$

(33) **Answer :** (4)
Solution:
$\sigma=\frac{F_x}{A}=\frac{P\times A\times x\times g}{A}=Pgx\ \Rightarrow\ \sigma\propto x$
Variation would be straight line. Since the graph is asked between stress and distance from ceilling hence graph would have negative slope.

(34) **Answer :** (1)
Solution:
$\sigma A_AT_A^4=10^4\sigma A_BT_B^4$
$\Rightarrow R_A^2T_A^4=10^4R_B^2T_B^4$
$\Rightarrow\frac{R_A^2}{R_B^2}=10^4\frac{T_B^4}{T_A^4}=10^4\frac{\lambda_A^4}{\lambda_B^4}$
$\Rightarrow16\times10^4=10^4\frac{\lambda_A^4}{\lambda_B^4}\Rightarrow\frac{\lambda_A}{\lambda_B}=2\Rightarrow\frac{\lambda_B}{\lambda_A}=1/2$

(35) **Answer :** (4)
Solution:
No body can radiate more energy than black body at same temperature.
In Steady State, temperature at a particular point is Constant with time. However different point have different temperature.
Good Conductor of electricity are not good Conductor of heat.

(36) **Answer :** (2)
Solution:
$F-T=ma\Rightarrow F-T=\frac{mF}{M+m}$
$\Rightarrow F-T=\frac{3F}{5}\Rightarrow F-\frac{3F}{5}=T\Rightarrow T=\frac{2F}{5}$
$T\le2.5\times10^9\times0.04\times10^{-6}\Rightarrow T\le2.5\times0.04\times10^3$
$\Rightarrow T\le\frac{25\times4}{10}\times10^3\Rightarrow T\le100\text{N}$

$\Rightarrow \frac{2F}{5} \leq 100 \Rightarrow F \leq 250\text{N}$

(37) Answer : (2)
Solution:
Reaction force of water coming out of hole = ρAV^2

$F_B = \rho AV_B^2,\ F_A = \rho AV_A^2$

$\rightarrow F_{net} = \rho A\left[V_B^2 - V_A^2\right]$

$P_A + \frac{1}{2}\rho V_A^2 + \rho_{gh_1} = P_B + \frac{1}{2}\rho V_B^2 + \rho_g\left(h_1 + h_2\right)$

$P_A = P_B = P_{atm}$

$\frac{1}{2}\rho V_A^2 + \rho gh_1 + \rho gh_2 = \frac{1}{2}\rho V_B^2 + \rho gh_2 + \rho gh_1$

$V_B^2 - V_A^2 = 2gh \rightarrow F_{net} = 2\rho Agh$ (where, $h_2 = h$)

(38) Answer : (1)
Solution:
Rate of emission = Rate of Absorption
$\Rightarrow \sigma A\left[T^4 - T_0^4\right] = I \times A'$
$\Rightarrow \sigma \times 4\pi R^2\left[T^4 - T_0^4\right] = I_0 \times \pi R^2$
$4\sigma\left(T^4 - T_0^4\right) = I_0 \Rightarrow T^4 - T_0^4 = \frac{I_0}{4\sigma}$
$\Rightarrow T^4 = (T_0)^4 + \frac{I_0}{4\sigma} \Rightarrow T = \left((T_0)^4 + \frac{I_0}{4\sigma}\right)^{1/4}$

(39) Answer : (3)
Solution:
Heat lost by water goes for evaporation of water.
$\Rightarrow -MCdT = dM \times L$
$\Rightarrow \int \frac{-dM}{M} = \int \frac{C}{L}dT$
$\Rightarrow -ln\left[\frac{M-\Delta m}{M}\right] = \frac{C}{L} \times \Delta T$
$\Rightarrow -ln\left[\frac{4-40\times10^{-3}}{4}\right] = \frac{1}{540} \times \Delta T$
$\Rightarrow \Delta T = 5.4^{\circ}\text{C}$

(40) Answer : (1)
Solution:
$R_{th} = \frac{1}{KA} \Rightarrow R_{P_b} = \frac{5\times10^{-2}}{350\times2\times3\times10^{-4}} = \frac{5\times10^{-2}\times10^4}{35\times6\times10}$
$= \frac{100}{42\times10} = \frac{10}{42} = \frac{5}{21} = 0.238$ K/W
$R_{Ag} = \frac{5\times10^{-2}}{425\times6\times10^{-4}} = \frac{5\times10^2}{425\times6} = \frac{100}{85\times6} = \frac{10}{51}$ = 0.196 K/W
$\text{R}_{\text{eq}} = \frac{0.238\times0.196}{0.238+0.196} = 0.107$ K/W
Heat current, lead = $\frac{\Delta\text{T}}{R} = \frac{100}{0.238} = 420.16\ \text{W}$
Heat, current silver = $\frac{100}{0.196} = 510.2\ \text{W}$
Total heat current = 930 W
Req $= \frac{R_1R_2}{R_1+R_2} = \frac{\frac{10}{51}\times\frac{5}{21}}{\frac{10}{51}+\frac{5}{21}} = \frac{50}{(210+255)}$
$= \frac{50}{465} = \frac{10}{93}$

(41) Answer : (3)
Solution:
$A_AV_A + A_BV_B = A_CV_C$

$\Rightarrow K\alpha + \frac{2K\times 3\alpha}{2} = 3K \times V_C$

$\Rightarrow K\alpha[1+3] = 3K \times V_C$

$\Rightarrow K\alpha\left(4\right) = 3K \times V_C \Rightarrow V_C = \frac{4\alpha}{3}$

Also, $V_B = \frac{3\alpha}{2}$

$\Rightarrow \text{Ratio} = \frac{\frac{4\alpha}{3}}{\frac{3\alpha}{2}} = 8:9$

(42) Answer : (3)
Solution:
B.Pin foot region $= P_{heart} + \rho gh$

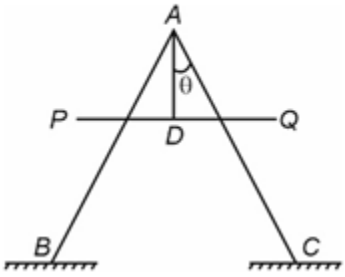
$= 13.3 \times 10^3 + 10^3 \times 10 \times 1.3$
$= (13.3 + 13)\,\text{kPa}$
$= 26.3\,\text{kPa}$
B.Pin head region $= P_{heart} - \rho gh$
$= 13.3 \times 10^3 - 10^3 \times 10 \times 0.4$
$= (13.3 - 4)\text{kPa} = 9.3$
$\text{Ratio} = \frac{26.3}{9.3} \simeq 3$

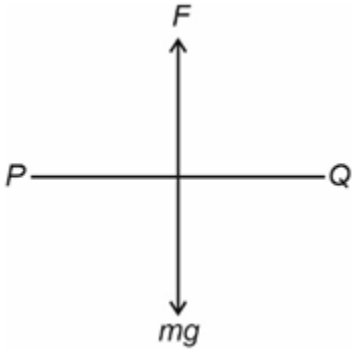
(43) Answer : (3)
Solution:
Since the Block is floating, $\rho \times g \times v = \rho_w \times g \times v$'
$0.9 \times A \times b \times 8 = 1 \times A \times b \times x \Rightarrow x = 0.9 \times 8$
$x = 7.2$ m ⇒ 8 – 7.2 i.e. 0.8 m of thickness is above water. Hence minimum length required would be 0.8 m

(44) Answer : (3)
Solution:

$Range = \sqrt{2\,(g+a) \times h} \times \sqrt{\frac{2(H-h)}{g+a}} \Rightarrow Range$ is independent of acceleration of lift.

(45) Answer : (3)
Solution:





$2T\ell = mg$
$\ell = \frac{mg}{2T}$
$\ell = \frac{\sqrt{3}\times 10^{-3}\times 10}{2\times 1} \times \sqrt{3}$
$\ell = 1.5 \times 10^{-2}$
$\ell = 1.5$ cm

CHEMISTRY

(46) **Answer :** (2)
Solution:
$\underset{\left(\text{Octahedral complex}\right)}{\mathrm{CoCl_3.4\,NH_3}} + \underset{\left(1\text{ mole}\right)}{\mathrm{AgNO_3}} \rightarrow \underset{\left(1\text{ mole}\right)}{\mathrm{AgCl}\downarrow} + \mathrm{[CoCl_2\,(NH_3)_4]^+}$

(47) **Answer :** (2)
Solution:
In brown ring complex, oxidation state of iron is +1.

(48) **Answer :** (3)
Hint:
Intermolecular hydrogen bonding increases the boiling point of the compound.
Solution:
Intermolecular hydrogen bond is present in HF.
Boiling point order is HF > HBr > HCl

(49) **Answer :** (2)
Solution:
$\mathrm{2\,NH_4\,Cl + Ca\,(OH)_2 \rightarrow 2\,NH_3 + 2H_2O + CaCl_2}$

(50) **Answer :** (4)
Solution:
Th show only +4 oxidation state while Fm show only +3 oxidation state.

(51) **Answer :** (3)
Solution:

a. $\mathrm{2\,SO_2 + O_2 \xrightarrow{V_2O_5} 2\,SO_3}$

b. $\mathrm{4HCl + O_2 \xrightarrow{CuCl_2} 2\,Cl_2 + 2H_2O}$

c. $\mathrm{4\,NH_3 + 5O_2 \xrightarrow[500K/9\text{ bar}]{\text{Pt / Rh gauge}} 4NO + 6H_2O}$

d. $\mathrm{N_2 + 3H_2 \xrightarrow[773K]{Fe} 2\,NH_3}$

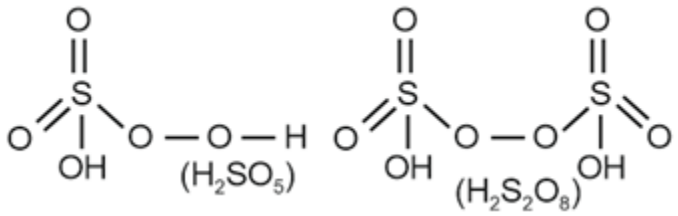
(52) **Answer :** (4)
Hint:
Chlorine on reaction with hot and conc. NaOH gives disproportionation reaction.
Solution:
- $\mathrm{3\,Cl_2 + 6\,NaOH\,(conc.) \underset{\text{Hot}}{\rightarrow} 5NaCl + \underset{\left(\text{Sodium chlorate}\right)}{NaClO_3} + 3H_2O}$

(53) **Answer :** (2)
Solution:
Ne has highest positive electron gain enthalpy among noble gases.

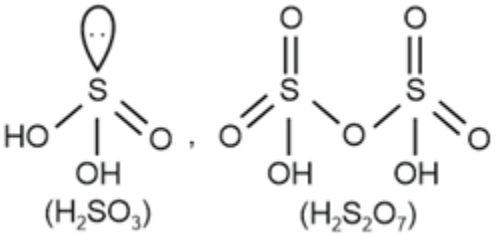
(54) **Answer :** (2)
Solution:
Tetrahedral complexes do not show geometrical isomerism because the relative positions of the unidentate ligands attached to the central metal atom are the same with respect to each other.

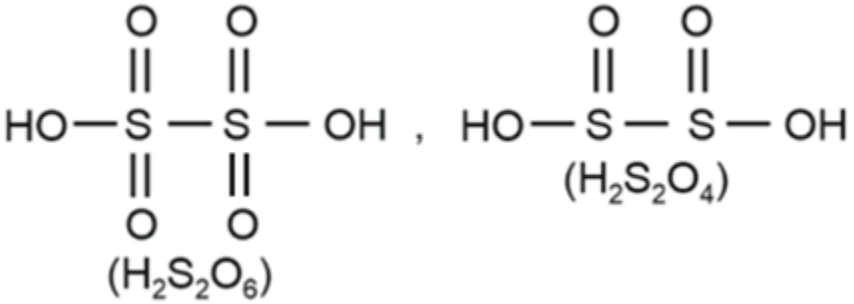
(55) **Answer :** (2)
Solution:
$\mathrm{XeF_2 + PF_5 \rightarrow [XeF]^+[PF_6]^-}$

(56) **Answer :** (4)
Hint:



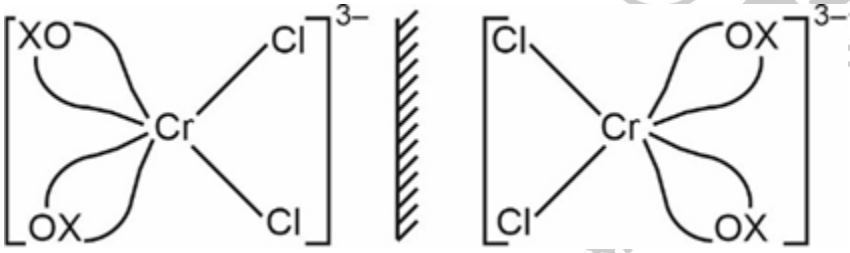
Solution:





(57) Answer : (3)

Solution:



Cis–$[CrCl_2(ox)_2]^{3-}$; optically active

(58) Answer : (3)

Solution:

On going down the group thermal stability order for H_2E decreases because H–E bond energy decreases

∴ Order of stability would be:-

$H_2Po < H_2Te < H_2Se < H_2S < H_2O$

(59) Answer : (1)

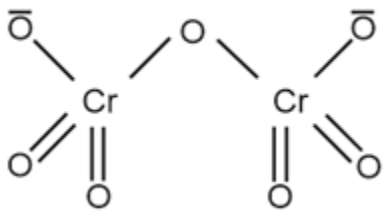
Solution:

Both rhombic and monoclinic sulphur have puckered S_8 molecules which are packed to give different crystal structures.

β-sulphur (monoclinic) is stable above 369 K and α-sulphur (rhombic) is stable below 369 K. At 369 K (transition temp.) both are stable.

(60) Answer : (3)

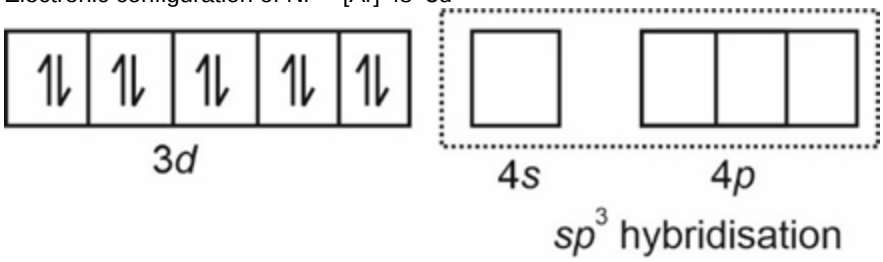
Solution:



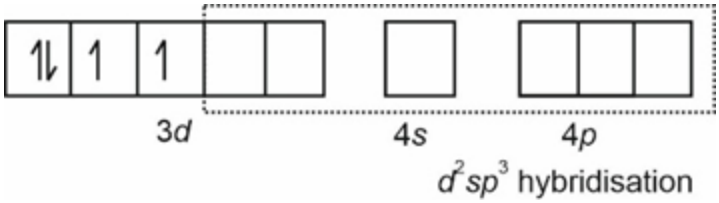
(61) **Answer :** (4)
Solution:
Mn shows the highest oxidation state *i.e* +7

(62) **Answer :** (4)
Solution:
PPh_3 is a neutral ligand

Electronic configuration of Ni ⇒ [Ar] $4s^2 3d^8$

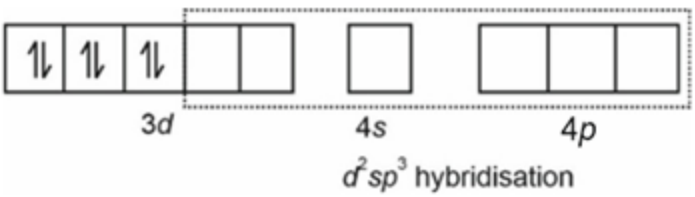


In $[Mn(CN)_6]^{3-}$; Mn^{3+} ⇒ [Ar] $4s^0 3d^4$

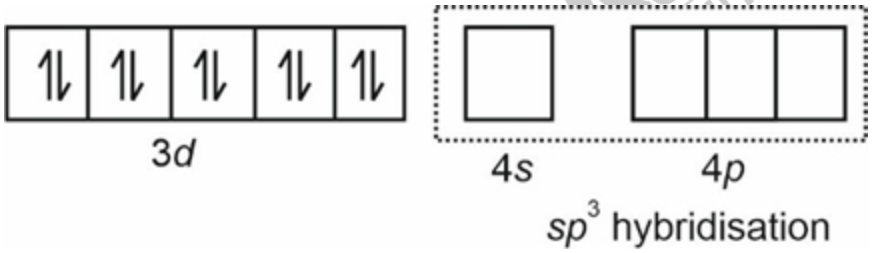


with Co^{3+} ion, H_2O act as strong field ligand

In$[Co(H_2O)_6]^{3+}$; Co^{3+} ⇒ [Ar] $4s^0 3d^6$



In $[Cu(CN)_4]^{3-}$; Cu^+ ⇒ [Ar]$4s^0 3d^{10}$



(63) **Answer :** (2)
Hint:
As the size of lanthanoid ion decreases, the basicity of their hydroxides also decreases.
Solution:
Correct order of size of lanthanoid ions is
$Pr^{3+} > Nd^{3+} > Eu^{3+} > Gd^{3+}$
Therefore order of basicity of lanthanoid hydroxide is
$Pr(OH)_3 > Nd(OH)_3 > Eu(OH)_3 > Gd(OH)_3$

(64) **Answer :** (4)
Solution:
The correct order of oxidising power is $\mathrm{MnO_4^- > Cr_2O_7^{2-} > VO_2^+}$

(65) **Answer :** (2)
Solution:

For octahedral complex; crystal field splitting energy (CFSE) = $-0.4\Delta_0 \times t_{2g}e^- + 0.6\Delta_0 \times e_g e^-$

(66) **Answer :** (2)

Solution:
Higher is the effective nuclear charge, greater is the hydration enthalpy.

M^{2+}	Co^{2+}	Fe^{2+}	Cr^{2+}	V^{2+}
$\Delta_{hyd}H$ (kJ mol^{-1})	–2079	–1998	–1925	–1895

(67) **Answer :** (1)
Solution:
$3\,MnO_4^{2-} + 4H^+ \rightarrow 2\,MnO_4^- + MnO_2 + 2H_2O$
Zinc has minimum value of enthalpy of atomisation (126 kJ mol^{-1}) in 3*d* series.

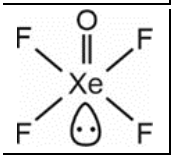
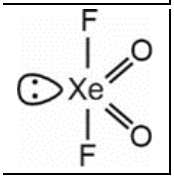
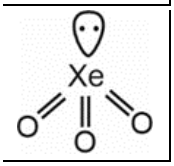
(68) **Answer :** (4)
Solution:
$Cr_2O_7^{2-} + 3S^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 3S + 7H_2O$

(69) **Answer :** (4)
Solution:
Interstitial compounds are chemically inert as well as hard and they retain metallic conductivity.

(70) **Answer :** (2)
Solution:
Gd (Gadolinium) : [Xe] $4f^7\ 5d^1\ 6s^2$

(71) **Answer :** (3)
Hint:
On complete hydrolysis, XeF_6 gives XeO_3.
Solution:
$XeF_6 + H_2O \rightarrow \underset{(A)}{XeOF_4} + 2\,HF$

- $XeF_6 + 2H_2O \rightarrow \underset{(B)}{XeO_2F_2} + 4\,HF$
- $XeF_6 + 3H_2O \rightarrow \underset{(C)}{XeO_3} + 6\,HF$

		Hybridization of Xe
•		sp^3d^2
•		sp^3d
•		sp^3

(72) **Answer :** (3)
Solution:
- Ethane –1, 2-diamine is didentate ligand while $EDTA^{4-}$ is hexadentate ligand
- NO_2^- and SCN^- are ambidentate ligands

(73) **Answer :** (1)
Solution:
Due to lanthanoid contraction, ionic radii from La^{3+} to Lu^{3+} decreases.

(74) **Answer :** (1)
Solution:
Spin only magnetic moment $(\mu) = \sqrt{n(n+2)}$ BM

$[Ni(CN)_4]^{2-}$; is square planar in shape μ = 0

$[Ni(H_2O)_6]^{2+}$; is octahedral in shape $\mu = \sqrt{8}$

$[NiCl_4]^{2-}$; is tetrahedral in shape $\mu = \sqrt{8}$

$[Fe(CN)_6]^{3-}$; is octahedral in shape $\mu = \sqrt{3}$

(75) Answer : (1)
Solution:

The correct order is ⇒ $SCN^- < F^- < C_2O_4^{2-} < NCS^-$

(76) Answer : (3)
Solution:
More is the negative charge on metal centre, more is the back donation and longer is the bond length in C and O of CO and shorter is the bond length of M – C bond.
So, correct order of M – C bond length is
$[Mn(CO)_6]^+ > [Cr(CO)_6] > [V(CO)_6]^- > [Fe(CO)_4]^{2-}$

(77) Answer : (3)
Solution:
$4Zn+10HNO_3(dilute) \rightarrow 4Zn(NO_3)_2+5H_2O+N_2O$

(78) Answer : (2)
Solution:

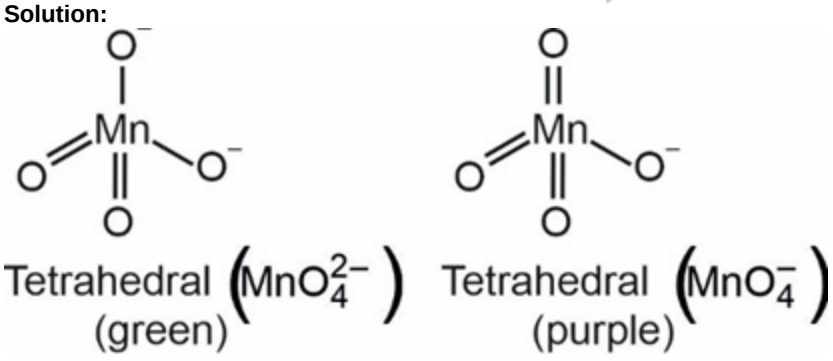
Element	Ionization enthalpy (kJ mol^{-1})
Cr	653
Mn	717
Cu	745
Zn	906

(79) Answer : (1)
Solution:

Species	Colour
Mn^{2+}	Pink
Fe^{3+}	Yellow

Colour arises due to d–d electronic transition.

(80) Answer : (3)
Solution:



$KMnO_4 \xrightarrow{513\ K} K_2MnO_4 + MnO_2 + O_2$

(81) Answer : (4)
Solution:

$$MnO_2 \xrightarrow[\text{oxidised with air}]{\text{Fused with KOH,}} \underset{\text{(A)}}{MnO_4^{2-}} \xrightarrow[\text{oxidation in an alkaline solution}]{\text{Electrolytic}} \underset{\text{(B)}}{MnO_4^-}$$

$$\underset{(B)}{2\,MnO_4^-} + I^- + H_2O \xrightarrow[\text{solution}]{\text{in faintly alkaline}} 2\,MnO_2 + IO_3^- + 2\,OH^-$$

(82) **Answer :** (4)
Solution:

$$\underset{\text{White}}{P_4} + 3NaOH \underset{\text{(Boiling)}}{} + 3H_2O \longrightarrow PH_3 + \underset{\text{(Sodium hypophosphite)}}{3NaH_2PO_2}$$

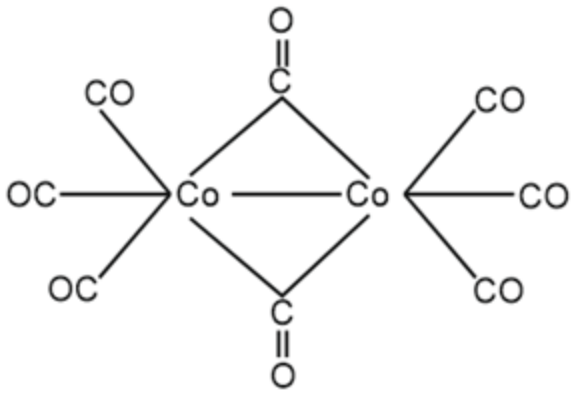
$$3HgCl_2 + 2PH_3 \longrightarrow Hg_3P_2 + 6HCl$$

(83) **Answer :** (4)
Hint:
$HBrO_2$ is least likely to exist among the given compounds

(84) **Answer :** (4)
Solution:

Coordination entity	Wavelength of light absorbed (in nm)
$[Co(CN)_6]^{3-}$	310
$[Co(NH_3)_5\,(H_2O)]^{3+}$	500
$[Cu(H_2O)_4]^{2+}$	600

(85) **Answer :** (4)
Solution:



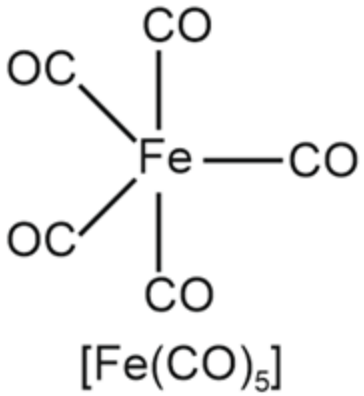
$[CO_2(CO)_8]$

(86) **Answer :** (3)
Solution:
Vitamin B_{12}, cyanocobalamine, the anti-pernicious anaemia factor, is a coordination compound of cobalt.
$[(PPh_3)_3RhCl]$, a Wilkinson catalyst, is used for the hydrogenation of alkenes.

(87) **Answer :** (2)
Solution:

Hydride	Boiling point/K
NH_3	238.5
PH_3	185.5
AsH_3	210.6

(88) **Answer :** (1)
Solution:



(89) **Answer :** (1)
Solution:
· Complexes in which a metal is bound to only one kind of donor groups are known as homoleptic complex.
· In $[Co(NH_3)_4Cl_2]Cl$; primary valences and secondary valences of cobalt are 3 and 6 respectively.

(90) **Answer :** (4)
Solution:
The correct IUPAC name is
Diamminechlorido(methanamine)platinum(II) chloride.

BOTANY

(91) **Answer :** (3)
Solution:
The correct sequence of events are given as follows :
(b) 1856-1863
(c) 1900
(d) 1952
(e) 1990
(a) 2006

(92) **Answer :** (4)
Solution:
· *Drosophila*: First chromosomal map was prepared by Sturtevant
· *E.coli* : Possess DNA gyrase and circular dsDNA
· *Antirrhinum* : Exception to Mendelian principles
· *Vicia faba* : Used by Taylor as experimental model

(93) **Answer :** (4)
Solution:
· In Mendelian disorders like Haemophilia, the trait may also be linked to the sex chromosome
· In β-thalassemia, there is a mutation in HBB gene of chromosome 11. Sickle cell anaemia is a qualitative disorder but thalassemia is quantitative.

(94) **Answer :** (2)
Solution:
· *Streptococcus* : Being a prokaryote, does not require post-transcriptional processing of RNA.
· Grasshopper : Shows male heterogamety
· TMV : RNA is the genetic material
· *Arabidopsis* : Model organism for studying plant developmental genetics.

(95) **Answer :** (1)
Solution:
Lac operon is a prototype operon in bacteria, which codes for genes responsible for lactose metabolism. The operon is regulated by amount of lactose in medium where bacteria are grown and therefore, this regulation can also be viewed as regulation of enzyme synthesis by its substrate.

(96) **Answer :** (3)
Solution:

· Phenylketonuria : Reduction in skin pigmentation
· Haemophilia : Queen Victoria was carrier for the disease
· Klinefelter's syndrome : Tall stature with feminine character
· Colour blindness : Sex-linked recessive disease

(97) Answer : (2)
Solution:
Dominance is not an autonomous feature of a gene or the product that it has information for. It depends as much on the gene product and the production of a particular phenotype from this product as it does on the particular phenotype that we choose to examine.

(98) Answer : (3)
Solution:
The correct sequence is as follows:
Formation of Y-shaped structure
↓
Topoisomerase activity
↓
Primase synthesizes an RNA strand
↓
Formation of Okazaki fragments
↓
Activity of DNA ligase

(99) Answer : (2)
Solution:
Dystrophin is located on X-chromosome, not on chromosome-1. Francis Crick postulated the presence of an adaptor molecule. snRNA is not involved in translation process.

(100) Answer : (3)
Solution:
The sequence of mRNA is :

The release factor will bind to the stop codon during translation.

(101) Answer : (3)
Solution:
(ii) Aa $I^A I^B$ × Aa $I^A i$

$\frac{3}{4}$ (Normal) $\left\{\begin{array}{l} \frac{2}{4}A \Rightarrow \frac{6}{16}A \\ \frac{1}{4}B \Rightarrow \frac{3}{16}B \\ \frac{1}{4}AB \Rightarrow \frac{3}{16}AB \end{array}\right\}$ Normal

$\frac{1}{4}$ (affected) $\left\{\begin{array}{l} \frac{2}{4}A \Rightarrow \frac{2}{16}A \\ \frac{1}{4}B \Rightarrow \frac{1}{16}B \\ \frac{1}{4}AB \Rightarrow \frac{1}{16}AB \end{array}\right\}$ Affected

(102) Answer : (4)
Solution:
Individual $P_2(3)$ is showing sex linked recessive trait, Thus,

Parents : II3 (x′y) × II4 (x′x)

Gametes : (x′) (y) (x′) (x)

F_1

	x′	y
x′	x′x′	x′y (Affected)
x	x′x′	xy

∴ Probability of male child to be affected is 0.5

(103) Answer : (1)
Solution:
The nucleosome consists of 200 base pairs of DNA, wrapped around 8 histone proteins.
It is composed of 4 types of histone proteins in octamer. Histone proteins are synthesized in the S-phase of cell cycle.

(104) Answer : (4)
Solution:
The given bird shows female heterogamety, *i.e.*, it produces gametes of two different genotypes. The female birds have Z and W chromosomes as sex chromosomes.

(105) Answer : (4)
Solution:
Genes for eye colour and wing size in *Drosophila* are not tightly linked.

(106) Answer : (1)
Solution:
Larger sampling size of plants gave credibility to Mendel's results.

(107) Answer : (2)
Solution:
Amino acid binds to the 3′-terminal end of t-RNA. 2-D structure of tRNA is like a clover leaf. These are involved in the translation process.

(108) Answer : (3)
Solution:
After separation of DNA fragments by electrophoresis, these are transferred to synthetic membranes.

(109) Answer : (3)
Solution:
In a typical test cross, an organism showing a dominant phenotype is crossed with recessive parent instead of selfing.

(110) Answer : (3)
Solution:
Thymine (5-methyl uracil) is a pyrimidine and found in DNA.

(111) Answer : (3)
Solution:
Euchromatin is loosely packed, transcriptionally active region of chromatin.

(112) Answer : (2)
Solution:
According to law of dominance, factors occur in pairs. Every character is controlled by discrete units.

(113) Answer : (3)
Solution:
Severo Ochoa enzyme works in templete independent manner.

(114) Answer : (2)
Hint:
Experimental verification of the chromosomal theory of inheritance was given by T.H. Morgan.
Solution:

Chromosomal theory of inheritance was proposed by Sutton and Boveri.

(115) Answer : (4)
Solution:
In capping, an unusual nucleotide (methyl guanosine triphosphate) is added to the 5′-end of hnRNA.

(116) Answer : (4)
Solution:
In a polygenic trait, the phenotype reflects the contribution of each allele.

(117) Answer : (3)
Solution:

Recombination Frequency $= \frac{\text{Number of recombinants}}{\text{Total progeny}} = \frac{224}{2000} \times 100 = 11.2\%$

We know 1% recombination means 1 mapunit between genes. So total distance would be 11.2 mapunits or cM.

(118) Answer : (3)
Solution:
(i) Since in an individual maximum two alleles can be present, multiple alleles can be found only when population studies are made.
(ii) Alleles are different forms of a single gene.

(119) Answer : (1)
Solution:
The traits which are also expressed in their heterozygous condition are dominant traits. Violet coloured flowers produced in axial position are dominant traits.

(120) Answer : (2)
Solution:
Phenotype is an observable morphological appearance.

(121) Answer : (1)
Hint:
Chromosomal aberration includes change in chromosome structure.
Solution:
Transition, frameshift mutation and deletion of two bases are included under gene mutation. Deletion of a part of a chromosome is included in aberration.

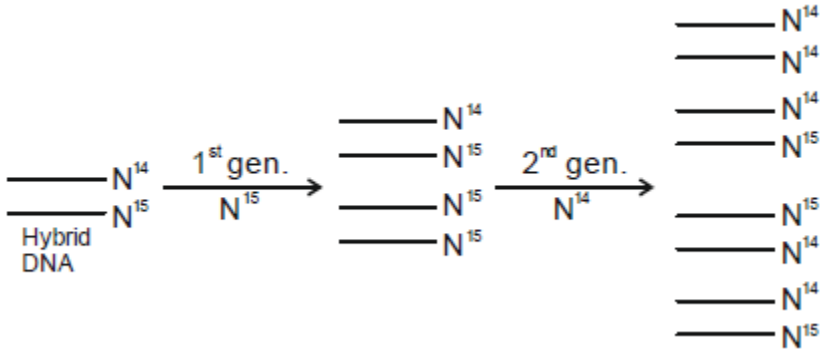
(122) Answer : (4)
Solution:
Sequence annotation involves the process of sequencing the entire genome, which includes both coding and non-coding sequences, and then assigning different regions in the sequence with functions.

(123) Answer : (2)
Solution:
Failure of cytokinesis after telophase stage of cell division results in polyploidy.

(124) Answer : (2)
Solution:
2n + 1 represents trisomy.

(125) Answer : (1)
Solution:
AUG codes for methionine and also acts as initiator codon.

(126) Answer : (1)
Solution:



Heavy DNA = 0%
Hybrid DNA = 75%
Light DNA = 25%

(127) Answer : (2)
Hint:
Nitrogenous base with sugar forms nucleoside.
Solution:
Nitrogenous base is linked to sugar with the help of N-glycosidic linkage.

(128) Answer : (2)
Solution:
Single base DNA difference occurs at about 1.4 million locations in human genome.

(129) Answer : (3)
Solution:
Split-gene arrangement is usually found in eukaryotes.

(130) Answer : (3)
Hint:
Structural gene transcribes mRNA for polypeptide synthesis. *Lac z* gene codes for β-galactosidase.
Solution:
Lac y gene codes for permease which increases the permeability of cell to β-galactosides.

(131) Answer : (4)
Solution:
In double-stranded DNA (dsDNA), the base pairs are as follows: adenine (A) pairs with thymine (T), and guanine (G) pairs with cytosine (C). Thymine and cytosine are pyrimidines, while adenine and guanine are purines (bicyclic N-bases). Given that the proportion of thymine (T) is 43%, the proportion of adenine (A) will also be 43% because A pairs with T. Therefore, the total proportion of A and T together is 86% (43% + 43%). Since the total proportion of all bases in DNA is 100%, the remaining proportion for guanine (G) and cytosine (C) together is 14% (100% - 86%). The bicyclic N-bases in DNA are adenine and guanine. Therefore, the proportion of bicyclic N-bases is the sum of the proportions of adenine and guanine, which is 43% (adenine) + 7% (half of the remaining 14% for guanine) = 50%. Thus, the proportion of bicyclic N-bases in this DNA is 50%.

(132) Answer : (3)
Solution:
Chromosome Y in human has least number of genes (231).

(133) Answer : (2)
Solution:
rRNAs play structural and catalytic role during translation.

(134) Answer : (3)
Hint:
Insertion of one or two base changes the reading frame from the point of insertion or deletion.
Solution:
Insertion or deletion of three or its multiple bases insert or delete one or multiple codon hence, one or multiple amino acids, and reading frame remains unaltered from that point onwards.

(135) Answer : (2)
Hint:
Both DNA and protein contain carbon and hydrogen.
Solution:

In the given case, both supernatant (containing virus) and the bacteria will show the radioactivity of both carbon and hydrogen.

ZOOLOGY

(136) Answer : (2)

Hint:

Exchange of gases occurs here.

Solution:

Each terminal bronchiole gives rise to a number of very thin, irregular walled and vascularised bag-like structures called alveoli where exchange of gases takes place between blood and alveolar air.

(137) Answer : (3)

Solution:

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

(138) Answer : (3)

Solution:

During inspiration, thoracic volume increases causing the air to flow in due to reduced pressure within pulmonary cavity.

(139) Answer : (3)

Hint:

A straight tube extending up to the mid-thoracic cavity.

Solution:

Trachea is a straight tube extending up to the mid-thoracic cavity, which divides at the level of 5^{th} thoracic vertebra into a right and left primary bronchi.

(140) Answer : (2)

Solution:

Diffusion of gases is directly proportional to surface area.

(141) Answer : (4)

Solution:

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

(142) Answer : (1)

Solution:

The nasal chamber opens into the pharynx, a portion of which is the common passage for both food and air.

(143) Answer : (1)

Solution:

Alveoli are the sites of gaseous exchange. Air is inhaled through external nares to reach nasal cavity, from where it passes down to pharynx followed by larynx and trachea. Trachea divides into bronchi and further into bronchioles, which eventually lead to alveoli.

(144) Answer : (3)

Hint:

The term pulmonary refers to lungs.

Solution:

From the ascending aorta, right and left coronary arteries arise, which supply oxygenated blood to the heart muscles.

(145) Answer : (4)

Hint:

Deposition of fibrous tissues affect the blood supply.

Solution:

Angina is also called 'Angina pectoris'. A symptom of acute chest pain appears when not enough oxygen is reaching the heart muscles. Angina can occur in men and women of any age but it is more common among the middle-aged and elderly. It

occurs due to conditions that affect the blood flow.
The normal blood pressure in a man is 120/80 mm Hg.
Heart suddenly stops beating in cardiac arrest.
In atherosclerosis, fibrous tissues accumulate in arteries which makes their lumen narrower.

(146) Answer : (2)
Hint:
Leads to the closure of tricuspid valve.
Solution:
The QRS complex represents the depolarisation of the ventricles which initiates the ventricular contraction.
P-wave represents the electrical excitation (depolarisation) of the atria.
T-wave represents the return of the ventricles from excited to the normal state (repolarisation).

(147) Answer : (3)
Hint:
Fibrous connective tissue is present in external layer.
Solution:
Each artery and vein consists of three layers; an inner lining of squamous endothelium, the tunica intima, a middle layer of smooth muscle and elastic fibres, the tunica media, and an external layer of fibrous connective tissue with collagen fibres, the tunica externa. The tunica media is comparatively thin in the veins.

(148) Answer : (2)
Solution:
Lymph transports oxygen, nutrients, hormones, *etc,* to the body cells and brings CO_2 and other metabolic wastes from the body cells and finally pours the same into the venous system (major vein).

(149) Answer : (3)
Solution:
Ventricle exerts the maximum pressure leading to opening of semilunar valves. During isovolumetric contraction, AV valves as well as semilunar valves remain closed.

(150) Answer : (3)
Solution:
The pulmonary circulation starts by the pumping of deoxygenated blood by the right ventricle which is carried to the lungs where it is oxygenated and returned to the left atrium.
Pulmonary artery carries deoxygenated blood from right ventricle to lungs from where oxygenated blood is being carried by pulmonary vein to the left atrium.

(151) Answer : (2)
Solution:
The hepatic portal vein carries blood from intestine to liver before it is delivered to the systemic circulation.

(152) Answer : (4)
Hint:
Pisces exhibit single circulation.
Solution:
Fishes exhibit single circulation. Mammals and birds exhibit complete double circulation. Reptiles and amphibians exhibit incomplete double circulation.

(153) Answer : (3)
Solution:
Artery carries blood away from the heart whereas vein carries blood towards the heart.

(154) Answer : (2)
Solution:
Right shift of oxygen dissociation curve shows dissociation of oxygen from oxyhaemoglobin.
In the tissues, where low pO_2, high pCO_2, high H^+ concentration, and higher temperature exist, the conditions are favourable for dissociation of oxygen from oxyhaemoglobin.

(155) Answer : (3)
Hint:
Part of hindbrain
Solution:
The cardio-regulatory center of the brain is located in the medulla oblongata. The autonomous nerve fibres connected to the medulla oblongata work to control heart rate with the release of neurotransmitters. Neural signals *via* the sympathetic nerve fibres work to increase the heart rate and neural signals *via* parasympathetic nerve fibres work to decrease the heart rate.

(156) Answer : (1)
Solution:

Pulmonary ventilation or breathing is the flow of air into and out of the lungs with change in pressure and volume of lungs.

(157) Answer : (3)
Solution:
Blood picks up a nearly full load of O_2 from the lungs even when the pO_2 of alveolar air is as low as 60 mm Hg.

(158) Answer : (4)
Solution:
When heart rate increases, the duration of each cardiac cycle decreases, including the contraction and relaxation phases. The duration of the action potential and systole also decrease.

(159) Answer : (3)
Solution:
• AV valves are located between atria and ventricles, while semilunar valves are present between ventricles and arteries
• AV valves are supported by the chordae tendinae unlike semilunar valves.
• AV valves open during ventricular filling (joint diastole) and close during ejection, while semilunar valves open during ventricular ejection and close during diastole.

(160) Answer : (3)
Hint:
In tissue PO_2 = 40 mmHg and PCO_2 = 45 mmHg
Solution:

In lungs, the reaction shifts left, not towards dissociation. Dissociation of H_2CO_3 into H^+ and $HC\bar{O}_3$ mainly occurs in tissues.

(161) Answer : (4)
Solution:
Pressure gradient is important for respiration in humans for inspiration, intrapulmonary pressure is less than the atmospheric pressure.

(162) Answer : (2)
Solution:
Atrial conducting system, specifically the AV node is designed to delay the cardiac impulse at the AV node by 0.1 second for complete emptying of atria before ventricular contraction begins.

(163) Answer : (2)
Hint:
Blood viscocity in mainly because of formed elements.
Solution:
An increase in RBC concentration cause increase in blood viscocity and reduce the rate of blood flow to tissue/organs.

(164) Answer : (2)
Solution:

Vessel	Cross-sectional Area (cm^2)
Aorta	2.5
Capillaries	2500
Venules	250
Vena cava	8

(165) Answer : (2)
Solution:
Presence of B antigen on RBCs indicates that the patient belongs to blood group B.
• Individuals with blood group B naturally possess anti-A antibodies in their plasma.
• When type A blood (containing A antigen) is transfused, anti-A antibodies of the patient react with A antigen.
• This antigen–antibody reaction leads to haemolysis, fever and chills.
Hence, the patient's blood group is B^- and the transfusion reaction occurred due to anti-A antibodies.

(166) Answer : (3)
Solution:
The trachea, primary, secondary and tertiary bronchi and initial bronchioles are supported by incomplete cartilaginous rings. During swallowing, glottis can be covered by a thin elastic cartilaginous flap called epiglottis. Terminal bronchioles lack cartilage.

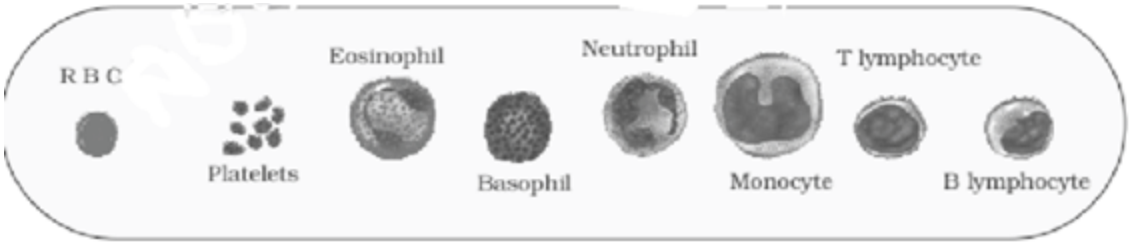
(167) Answer : (2)
Solution:

Within the RBCs, CO binds with the haemoglobin to form carboxyhaemoglobin, as the haemoglobin has higher affinity for CO. This means CO displaces oxygen molecules from haemoglobin, significantly reducing the blood's ability to transport oxygen to vital organs and tissues.

(168) Answer : (4)
Solution:
Residual volume cannot be voluntarily expelled, and cannot measured by simple spirometer.
Residual volume ⇒ 1100 – 1200 mL
Sum of tidal volume and inspiratory reserve volume = 500 mL + 2500 – 3000 mL
⇒ 3000 – 3500 mL.

(169) Answer : (2)
Solution:
Fibrinogens are needed for clotting or coagulation of blood. Globulins primarily are involved in defense mechanisms of the body and the albumins help in osmotic balance.

(170) Answer : (2)
Solution:



A white blood cell with prominent cytoplasmic granules and a bilobed nucleus is most likely an eosinophil.

(171) Answer : (4)
Solution:
Platelets can release a variety of substances most of which are involved in the coagulation or clotting of blood. A reduction in their number can lead to clotting disorders which will lead to excessive loss of blood from the body.

(172) Answer : (2)
Solution:
• The centre of each heme group is an iron ion that can combine reversibly with one oxygen molecule
• Each oxygen molecule picked up from the lungs is bound to each iron ion.

(173) Answer : (3)
Solution:

(a)	Asthma	–	Allergic characterised by wheezing condition
(b)	Emphysema	–	Chronic respiratory condition causing destruction of alveoli
(c)	Heart failure	–	Due to congestion of lungs also known as congestive heart failure
(d)	Atherosclerosis	–	Coronary artery disease affecting the vessels due to deposition of cholesterol, calcium, *etc*.

(174) Answer : (4)
Solution:
As the solubility of CO_2 is 20-25 times higher than that of O_2 , the amount of CO_2 that can diffuse through the diffusion membrane per unit difference in partial pressure is much higher compared to that of O_2.

(175) Answer : (2)
Solution:
Vertebrates possess auto-excitable and muscular heart due to presence of nodal tissue which generates its own contractions through intrinsic mechanisms. Some animals possess neurogenic heart.

(176) Answer : (2)
Solution:
Minute volume is calculated by multiplying the tidal volume by the respiratory rate.

(177) Answer : (3)
Solution:
Plasma without the clotting factors such as fibrinogen is called serum.

(178) Answer : (4)
Solution:
Among vertebrates, fishes use gills whereas amphibians, reptiles, birds and mammals respire through lungs.

(179) Answer : (1)

Solution:

Molluscs possess circulatory system. Coelenterates lack any circulatory system that's why use water from surroundings to facilitate transport of substances. Annelids lack myogenic heart.

(180) Answer : (1)

Solution:

- RBCs transport 20-25% of CO_2.
- Lymphocytes which are agranulocytes constitute 20 – 25% of the total WBCs.