20/08/2025

Code-B

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 Fortnightly Test for NEET-2026_RM(P2)_FT-03B **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:
KE of system can be changed by internal force and external force but momentum can be changed by only external force.

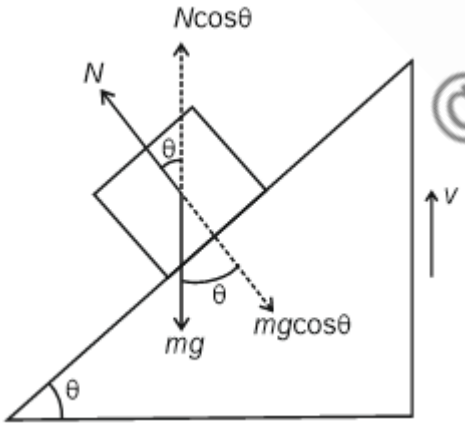
(2) **Answer :** (2)
Solution:
$\overrightarrow{W} = \overrightarrow{F} \cdot \overrightarrow{S} = \left(-\hat{i} + 2\hat{j} + 3\hat{k}\right) \cdot \left(4\hat{j}\right) = 8\,\text{J}$

(3) **Answer :** (3)
Solution:
May be positive, negative or zero

(4) **Answer :** (2)
Hint:
$T = m\,(g - a)$
Solution:
$T = m\left(g - \frac{g}{4}\right) = \frac{3mg}{4}$
Displacement = $\frac{1}{2}\left(\frac{g}{4}\right)(3)^2 = \frac{90}{8}m$
$W = TS\cos 180°$
$W = -\frac{3mg}{4} \times \frac{90}{8} = -\frac{3\times6\times10\times90}{4\times8} = -\frac{2025}{4} = -506.25\,\text{J}$

(5) **Answer :** (2)
Solution:
$W = -mgH = -mg \times \frac{u^2\sin^2\theta}{2g} = \frac{-mu^2\sin^2\theta}{2}$

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



As block is at rest w.r.t. lift
$N = mg\cos\theta$ ...(1)
Displacement of block w.r.t. ground
$S = vt$ vertically upward ...(2)
Work done by normal contact force
$W = N \times S \times \cos\theta$
$= (mg\cos\theta)(vt)\cos\theta$
$= mgvt\cos^2\theta$

(7) **Answer :** (2)
Solution:
Work done by all the forces is equal to change in kinetic energy.

(8) **Answer :** (2)
Hint:
Work done = change in kinetic energy
Solution:
$x = \frac{1}{4}t^3$
Velocity $= \frac{dx}{dt} = \frac{3}{4}t^2$
$v_{(t=1\text{s})} = \frac{3}{4}$ m/s
$v_{(t=3\text{s})} = \frac{27}{4}$ m/s
Work done = $\frac{1}{2}(4)\left\{\left(\frac{27}{4}\right)^2 - \left(\frac{3}{4}\right)^2\right\} = 90\,\text{J}$

(9) **Answer :** (2)
Solution:
$Fx = \frac{1}{2}Kx^2 \Rightarrow x = \frac{2F}{K}$
i.e. maximum elongation is $\frac{2F}{K}$

(10) **Answer :** (2)
Solution:
ΔKE = $\int_0^1 F dx$
= $\int_0^1 (2+2x)dx$
$= \left[2x + x^2\right]_0^1 = 2\left(1\right) + (1)^2$
= 3 J

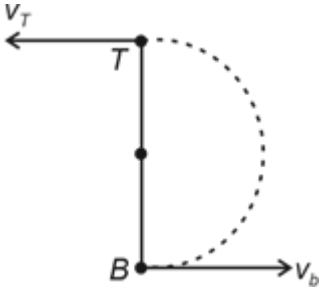
(11) **Answer :** (2)
Solution:
$W = \frac{1}{2} \times 10 \times 10 - \frac{1}{2} \times 5 \times 10$
W = 25 J

(12) **Answer :** (4)
Solution:
Hint : $F = -\frac{dU}{dx}$
Sol.: $F = -\frac{dU}{dx} = -\left(2x+1\right)$

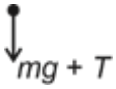
(13) **Answer :** (1)
Solution:
W.D.$_{\text{min}}$ = [ΔP.E.] hanging part = $\left[\frac{M}{4}\right] g \frac{1}{2}\left[\frac{1}{4}\right]$
$= \frac{MgL}{32}$

(14) **Answer :** (2)
Solution:
W.D. = –ΔU

(15) **Answer :** (1)
Solution:



At top most point
FBD



$\Rightarrow \quad mg+T=\frac{mv_T^2}{R}$

$10+15=\frac{v_T^2}{2}$

$\Rightarrow \quad v_T=\sqrt{50}$ m/s

Now applying energy conservation between points *B* and *T*

$0+\frac{1}{2}mv_b^2=\frac{1}{2}mv_T^2+2mgR$

$\Rightarrow \quad \frac{1}{2}\times 1\times v_b^2=\frac{1}{2}\times 1\times 50+2\times 1\times 10\times 2$

$v_b^2=50+80$

$v_b=\sqrt{130}$ ms^{-1}

(16) **Answer :** (4)
Solution:
In perfectly elastic collision both momentum and kinetic energy is conserved. Momentum being zero during collisions is not necessarily true but total momentum is conserved of system.

(17) **Answer :** (3)
Solution:

$P=\frac{3}{2}t^2$

$\Delta k=\int_0^3 P\,dt=\frac{3}{2}\int_0^3 t^2\,dt$

$=\frac{3}{2}\times\left[\frac{t^3}{3}\right]_0^3=\frac{1}{2}[3]^3=\frac{27}{2}$

$\frac{1}{2}mv^2-\frac{1}{2}m(0)^2=\frac{27}{2}$

$\frac{1}{2}\times 1\times v^2=\frac{27}{2}$

$v^2 = 27$

$v=3\sqrt{3}\,\text{ms}^{-1}$

(18) **Answer :** (1)
Solution:
Hint: $P=\frac{W}{t}$
Sol.: Now, $P=\frac{300\times 10\times 20}{60}=1$ kW

$P_{\text{motor}}=\frac{P}{\eta}=\frac{1\,\text{kW}}{0.8}=1.25$ kW

(19) **Answer :** (1)
Solution:
Hint: $P=\vec{F}\cdot\vec{v}$
Sol.: $P=\left(4\hat{i}+\hat{j}-3\hat{k}\right)\cdot\left(2\hat{i}+2\hat{j}+2\hat{k}\right)$
= 8 + 2 – 6 = 4 W

(20) **Answer :** (3)
Solution:
CGS unit of work is erg.

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

$P=Fv=\frac{mdv}{dt}v$

$\int mvdv=P\int dt$

$\frac{mv^2}{2}=Pt$

$\therefore\ v^2\propto t\ or\ v\propto\sqrt{t}$

(22) **Answer :** (2)
Hint:
$h' = he^{2n}$

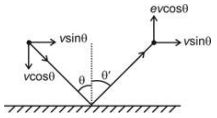
Solution:

$h' = 20\ e^{2\times1}$

$= \frac{20}{4} = 5$ m

(23) Answer : (2)

Solution:



$\tan\theta' = \frac{v\sin\theta}{ev\cos\theta}$

$\tan\theta' = \frac{\tan\theta}{e}$

$\theta' = \tan^{-1}\left(\frac{\tan\theta}{e}\right)$

(24) Answer : (1)

Hint:

Use loss of energy concept in collision

Solution:

$\frac{K_2}{K_1} = \frac{K_1 - \text{loss of energy}}{K_1}$

$= \frac{\frac{1}{2}mv^2 - \frac{1}{2}\left(\frac{m\times m}{m+m}\right)(v)^2}{\frac{1}{2}mv^2}$

$= \frac{\frac{1}{2}mv^2\left(\frac{1}{2}\right)}{\frac{1}{2}mv^2}$

$= \frac{1}{2}$

(25) Answer : (2)

Solution:

$X_{cm} = \frac{4\times1+6\times3}{10} = 2.2 = \frac{11}{5}$

$Y_{cm} = \frac{4\times2+6\times4}{10} = 3.2$

(26) Answer : (2)

Solution:

Velocity of particle after 2 s will be 30 m/s

By conservation of linear momentum after 2 s

$12 \times 30 = 3v + 9 \times 0$

$360 = 3v$

$v = 120$ m/s

(27) Answer : (2)

Solution:

$\vec{\tau} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 2 & 2 \\ 2 & 3 & 4 \end{vmatrix}$

$= \hat{i}(8-6) - \hat{j}(8-4) + \hat{k}(6-4)$

$\vec{\tau} = 2\hat{i} - 4\hat{j} + 2\hat{k}$

$\left|\vec{\tau}\right| = \sqrt{2^2+4^2+2^2}$ N-m

$\left|\vec{\tau}\right| = \sqrt{4+16+4} = \sqrt{24}$

$= 2\sqrt{6}$ N-m

(28) Answer : (2)

Solution:

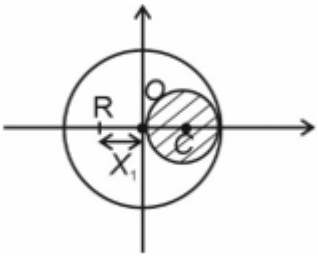
$x = \frac{ml}{M+m}$

$= \frac{60\times3}{60+60}$

$= \frac{180}{120} = \frac{3}{2}$
= 1.5 m

(29) Answer : (3)
Solution:
$\sum m_i r_i = 0$ (about centre of mass)
For small bodies, on earth surface, centre of mass coincides with centre of gravity.

(30) Answer : (4)
Solution:



$X_1 A_1 = X_2 A_2$
$X_1 \left(\pi R^2 - \frac{\pi R^2}{4}\right) = \frac{R}{2} \frac{\pi R^2}{4}$
$3\frac{X_1}{4} = \frac{R}{8}$
$X_1 = \frac{R}{6}$ (Shift to left)

(31) Answer : (3)
Solution:
$v_{cm} = \frac{m_1 v_1 + m_2 v_2}{m_1 + m_2}$ = Zero

(32) Answer : (4)
Solution:

$$x_{cm} = \frac{\int x\, dm}{\int dm} - \frac{\int_0^1 x\left(3x^2+2\right)dx}{\int_0^1 \left(3x^2+2\right)dx} = \frac{7}{12}\ \text{m}$$

(33) Answer : (1)
Solution:
Required MOI:
a. of a thin rod = $\frac{ML^2}{12}$
b. of a uniform ring = MR^2
c. of a solid sphere = $\frac{2}{5}MR^2$
d. of a uniform disc = $\frac{MR^2}{4}$

(34) Answer : (2)
Hint:
Torque on rigid body (τ) = $I\alpha$
Solution:
Torque on rigid body (τ) = 100 = 20α
$\Rightarrow \alpha$= 5 rad/s^2 = $\frac{\Delta\omega}{\Delta t}$
$\omega = \omega_0 + \alpha t$
$\Rightarrow \omega = 0 + 5 \times 4 = 20$ rad/s

(35) Answer : (2)
Solution:
$\alpha = \omega\frac{d\omega}{d\theta}$
$= (\theta^2 + 2\theta + 1).(2\theta + 2)$
α at θ = 1 rad
$\alpha = (1 + 2 + 1).(2 + 2)$

$\alpha = 16$ rad/s^2

(36) Answer : (3)
Solution:

$\because \quad \vec{v} = \text{constant}$

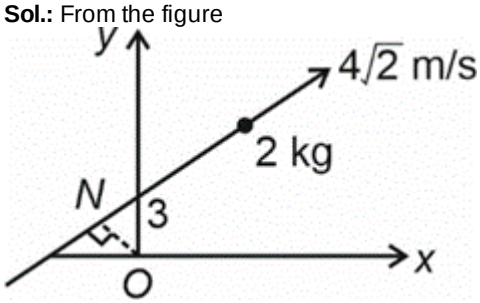
$mg\sin\theta = \mu N$

Torque of friction = $\mu N \cdot \frac{l}{2} = mg\sin\theta\left(\frac{l}{2}\right)$

So torque of normal reaction = $\frac{1}{2}mgl\sin\theta$

(37) Answer : (2)
Solution:

Hint : $\vec{L} = \vec{r} \times \vec{p}$
Sol.: From the figure



$r_\perp = ON = 3\cos45°$ (as the inclination of line $y = x + 3$ is 45°)

$r_\perp = \frac{3}{\sqrt{2}}$

$\left|\vec{L}\right| = mvr_\perp = 2 \times 4\sqrt{2} \times \frac{3}{\sqrt{2}}$

= 24 kg m^2 s^{-1}

(38) Answer : (1)
Solution:

$I_{remain} = I_{whole} - I_{removed}$

$I = \frac{1}{2}\left(9M\right)R^2 - \left[\frac{1}{2}M\left(\frac{R}{3}\right)^2 + M\left(\frac{2R}{3}\right)^2\right]$

$I = 4MR^2$

(39) Answer : (3)
Solution:

$I = \frac{Ma^2}{2} = Mk^2$

$\Rightarrow \quad k = \frac{a}{\sqrt{2}}$

(40) Answer : (1)
Solution:

By conservation of energy

$mg\frac{l}{2} = \frac{1}{2}I\omega^2$

$\frac{mgl}{2} = \frac{1}{2}\frac{ml^2}{3}\omega^2$

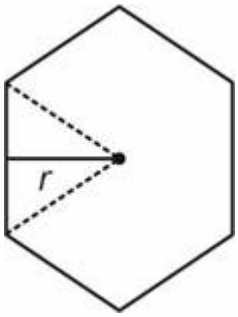
$\omega = \sqrt{\frac{3g}{l}}$

(41) Answer : (4)
Hint:

Use theorem of parallel axis
Solution:

$I = \left(I_C + mr^2\right)6$

$r = \frac{\sqrt{3}}{2}L$



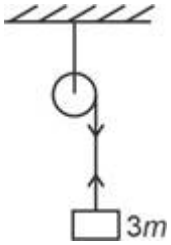
$I = \left(\frac{ML^2}{12} + \frac{M3L^2}{4}\right)6$

$= \frac{10ML^2}{12} \times 6$

$= 5ML^2$

(42) Answer : (3)

Solution:



$3mg - T = 3ma$ ...(i)

$T \times R = I\alpha$

$T = \frac{ma}{2}$ ...(ii)

$3mg = \frac{7ma}{2}$

$a = \left(\frac{6g}{7}\right)$

(43) Answer : (1)

Solution:

Mass of each of the four parts = $\frac{m}{3}$

Mass of the plate including the cut piece = $\frac{4m}{3}$

MI of the whole plate (including the cut piece) about the said axis = $\left(\frac{4m}{3}\right)\frac{l^2}{6}$

Now, M.I. of the remaining portion should be $\frac{3}{4}\left(\frac{4m}{3}\right)\frac{l^2}{6} = \frac{ml^2}{6}$

(44) Answer : (1)

Solution:

$I = \frac{mR^2}{2}$

$I_1 = \left(\frac{mR^2}{2} + mR^2\right) \times 2$

$I_1 = \frac{3mR^2}{2} \times 2$

$I_1 = 6I$

(45) Answer : (2)

Solution:

Use law of conservation of angular momentum $L_i = L_f$

As no net external torque acts :

$L_i = L_f$

$L_i = \frac{MR^2}{2} \cdot \omega$

$L_f = \left[\frac{MR^2}{2} + M(R)^2 \times 2\right] \cdot \omega'$

$= \left[\frac{MR^2}{2} + 2MR^2\right] \omega' = \left[\frac{5}{2}MR^2\right] \omega'$

$\therefore \; L_i = L_f$

$\Rightarrow \frac{5}{2}MR^2\omega' = \frac{MR^2}{2}\cdot\omega$

$\therefore \quad \omega' = \frac{\omega}{5}$

CHEMISTRY

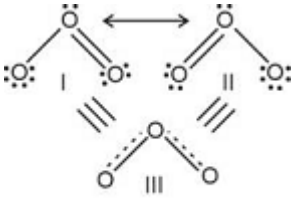
(46) Answer : (4)

Hint:

Energy of O_3 resonance hybrid is lower than either of the two canonical forms

Solution:

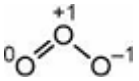
O_3 is a resonance hybrid of two canonical structures



Resonance hybrid

(47) Answer : (2)

Solution:



$$\text{Formal charge} = \left[\begin{matrix}\text{Total number}\\ \text{of valence}\\ \text{electrons}\\ \text{in free atom}\end{matrix}\right] - \left[\begin{matrix}\text{Total}\\ \text{number}\\ \text{of lone}\\ \text{pair(s)}\end{matrix}\right] - \frac{1}{2}\left[\begin{matrix}\text{Total}\\ \text{number}\\ \text{of bonding}\\ \text{electrons}\end{matrix}\right]$$

(48) Answer : (3)

Solution:

In molecules with an odd number of electron like NO and NO_2 act as odd electron species.

(49) Answer : (3)

Solution:

Bond	Bond length
C–C	154 pm
C–O	143 pm
C–H	107 pm
O–H	96 pm

(50) Answer : (2)

Solution:

Higher the size of cation higher is the ionic character.

For cations of the same size and charge, the one with electronic configuration $(n-1)d^{1-10}ns^0$ has higher polarising power and covalent character. So ionic character $ZnCl_2 < CaCl_2$.

(51) Answer : (3)

Solution:

Dipole moment of NH_3 is greater than that of NF_3. This is because is case of NH_3 the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N–H bonds.

(52) Answer : (1)

Solution:

Species	Bond angle
CH_4	109.5°
NH_3	107°

BF_3	120°
H_2O	104.5°

(53) Answer : (3)
Solution:

$\mu_{observed} = 1 \times 3.33 \times 10^{-30}$ Cm

$\mu_{calculated} = 1.602 \times 10^{-19} \times 100 \times 10^{-12}$ Cm

$= 1.6 \times 10^{-29}$ Cm

Percentage ionic character = $\frac{1 \times 3.33 \times 10^{-30} \times 100}{1.6 \times 10^{-29}}$

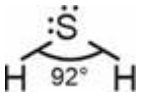
= 20.81%

(54) Answer : (1)
Solution:
If there are more than eight valence electrons around the central atom, termed as the expanded octet

SO_3, PF_5, IF_7, H_3PO_4 and SF_4 have 12, 10, 14, 10 and 10 electrons in their valence shell so they are termed as expanded octet.

(55) Answer : (3)
Hint:
Higher charge increases the energy and decreases stability of the species.
Solution:
Formal charge helps in the selection of lowest energy structure from a number of possible Lewis structures. Generally the lowest energy structure is the one with the smallest formal charges on atoms.

(56) Answer : (4)
Hint:
Net dipole moment is determined by bond dipole and shape of the molecule.
Solution:

Molecule	Shape	Dipole moment μ(D)
H_2O		1.85
H_2S		0.95
CO_2	O=C=O	0

(57) Answer : (3)
Solution:

Bond order = $\frac{N_b - N_a}{2}$

N_b = number of electrons in bonding molecular orbital

N_a = Number of electrons in anti-bonding molecular orbital.

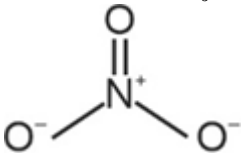
$N_2^- \Rightarrow \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2$
$= \pi 2p_y^2 < \sigma 2p_z^2 < \pi^* 2p^1$

$B.O = \frac{10-5}{2} = 2.5$

$O_2^- \Rightarrow \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_z^2 < \pi 2p_x^2$
$= \pi 2p_y^2 < \pi^* 2p_x^2 = \pi^* 2p_y^1$

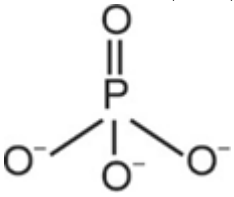
$B.O = \frac{10-7}{2} = 1.5$

(58) Answer : (1)
Solution:
Bond order in NO_3^- ion



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

Bond order in $\left(PO_4^{3-}\right)$ ion



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

(59) Answer : (1)
Solution:

$$\text{Lattice energy} \propto \frac{\text{Charge on ion}}{\text{Size of ion}}$$

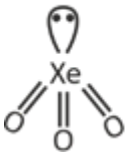
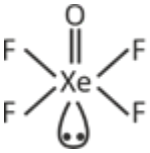
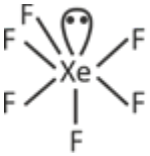
(60) Answer : (1)
Solution:

$\underset{sp^3}{CH_3}-\underset{sp}{C} \equiv \underset{sp}{C}-\underset{sp^2}{CH}=\underset{sp^2}{CH_2}$

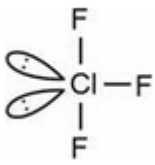
So, two C atoms are *sp* hybridized

(61) Answer : (2)
Solution:
Charge carried by cation is equal to its electrovalency.

(62) Answer : (4)
Solution:

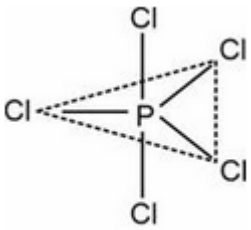
Molecule	Hybridisation	Shape
	sp^3	Pyramidal
	sp^3d	Linear
	sp^3d^2	Square Pyramidal
	sp^3d^3	Distorted Octahedral

(63) Answer : (3)
Solution:



Number of lone pair = 2
Bent T-shape

(64) Answer : (2)
Solution:
All three equatorial bonds in a plane.



sp^3d hybridization

(65) **Answer :** (3)
Solution:

Species	Bond enthalpy/(kJ mol^{-1})
O_2(O = O)	498
N_2(N ≡ N)	946
HCl	431
H_2	435.8

(66) **Answer :** (3)
Solution:
The hybridised orbitals have equal shape and energy.

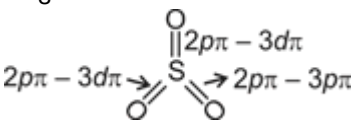
(67) **Answer :** (2)
Solution:

$\overset{1}{CH_2} = \overset{2}{CH} - \overset{3}{CH_2} - \overset{4}{C} \equiv \overset{5}{CH}$

Priority is given to alkene over alkyne.

$\therefore C_2 - C_3$; Hybrid orbitals are $sp^2 - sp^3$.

(68) **Answer :** (2)
Hint:
Sulphur atom has two unpaired electrons in ground state.
Solution:
SO_3 :



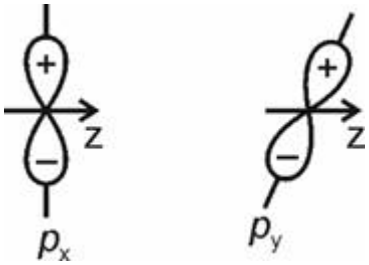
(69) **Answer :** (4)
Solution:
There are 12, 90° bonds in SF_6

(70) **Answer :** (1)
Solution:
The decreasing order of the repulsive interaction of electron pair is Lone pair–lone pair > Lone pair –bond pair > bond pair–bond pair

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

$\%p \text{ character} = \frac{3}{5} \times 100 = 60\%$

(72) **Answer :** (3)
Solution:



It results into zero overlap due to different orientation direction of approach.

(73) Answer : (4)
Solution:

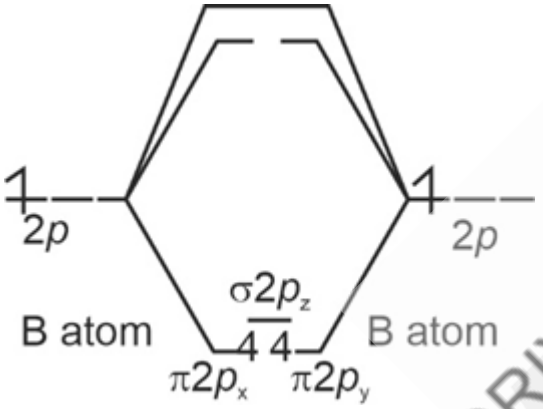
Polarising power depends on $\left(\frac{\text{charge}}{\text{size}}\right)$ ratio of the cation.

Smaller the size of cation and more charge on it leads to more covalent character.

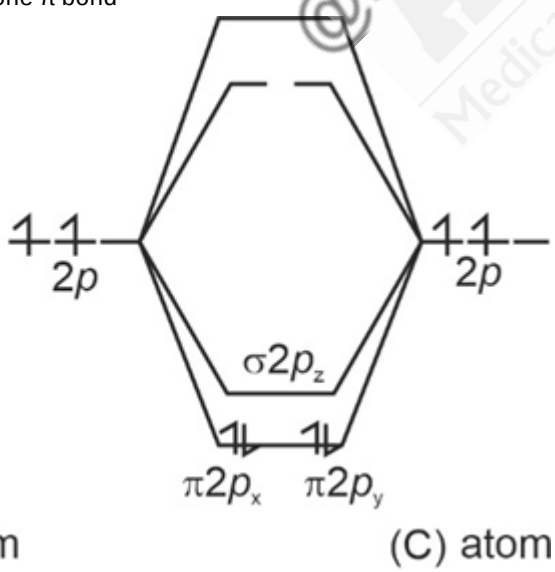
(74) Answer : (4)
Solution:

- O_2 Molecule has 2 unpaired electron So it is paramagnetic
- N_2^+ has bond order 2.5
- Li_2^{2+} has bond order zero so it doesnot exist

(75) Answer : (3)
Solution:



B_2 has only one π bond



C_2 has only 2π bonds

(76) Answer : (3)
Hint:

As the Bond order increases, the stability also increases.

Solution:

- $Li_2 \rightarrow Li_2^+$

BO 1 0.5

$(Diamagnetic$ $(Paramagnetic)$

- $O_2 \rightarrow O_2^+$

BO 2 2.5

$Paramagnetic$ $Paramagnetic$

- $N_2^+ \rightarrow N_2$

BO 2.5 3

$paramagnetic$ $Diamagnetic$

- $H_2 \rightarrow H_2^+$

BO 1 0.5

$Diamagnetic$ $Paramagnetic$

(77) Answer : (4)

Solution:

Species	B.O.
CO_3^{2-}	1.33
CO_2	2
CO	3

(78) Answer : (1)

Solution:

As the bond order increases bond strength also increases.

(79) Answer : (4)

Hint:

$O_2^- : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z{}^2, \pi 2p_x{}^2$

$= \pi 2p_y^2, \pi^* 2p_x^2 = \pi^* 2p_y^1$

(80) Answer : (1)

Hint:

For see-saw shape, central atom should be sp^3d hybridised.

Solution:

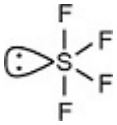
Species	Hybridisation	Shape
SF_2Cl_2	sp^3d	See-saw
ICl_4^-	sp^3d^2	Square -planar
PCl_5	sp^3d	Trigonal-bipyramidal
BrF_5	sp^3d^2	Square pyramidal

(81) Answer : (3)

Hint:

Sulphur in SF_4 is sp^3d hybridised.

Solution:



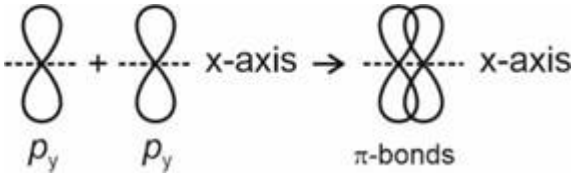
see-saw structure

(82) Answer : (4)

Solution:

Isostructural species have the same shape so I_3^- and XeF_2 are isostructural of each other.

(83) Answer : (3)
Solution:
Hint: Side by side overlapping of atomic orbitals forms π-bond.
Sol.:

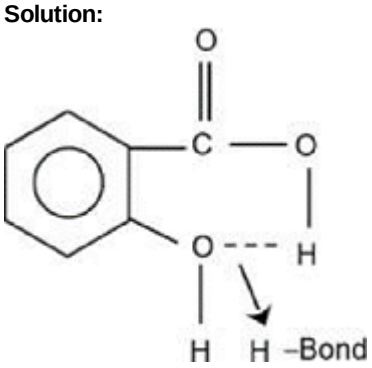


(84) Answer : (1)
Solution:
Electronic configuration of

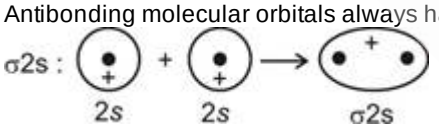
$$F_2(18e^-):(\sigma 1s^2)(\sigma^* 1s^2)(\sigma 2s^2)(\sigma^* 2s^2)(\sigma 2p_z^2)\begin{pmatrix}\pi 2p_x^2\\ \pi 2p_y^2\end{pmatrix}\begin{pmatrix}\pi^* 2p_x^2\\ \pi^* 2p_y^2\end{pmatrix}$$

Total number of antibonding electrons is $F_2 = 8$

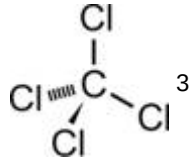
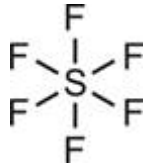
(85) Answer : (3)
Solution:



(86) Answer : (2)
Solution:
Antibonding molecular orbitals always have nodal planes.



(87) Answer : (2)
Hint:
CCl_4 is tetrahedral in shape while SF_6 is octahedral in shape.
Solution:

Molecule	Maximum number of atoms in plane
	3
	5

(88) Answer : (1)
Solution:
Magnitude of H-bonding is maximum in solid state but minimum in the gaseous state.

(89) **Answer :** (3)
Hint:
Molecule with zero bond order does not exist.
Solution:
He_2 = 4 electrons
$B.O. = \frac{1}{2}(2-2) = 0$

(90) **Answer :** (1)
Hint:
Intermolecular hydrogen bond is formed between two different molecules of the same or different compounds.
Solution:
Intramolecular hydrogen bond is formed when hydrogen atom is in between two highly electronegative atoms present within the same molecule. o-nitrophenol forms intramolecular H-bond, while ethanol forms intermolecular hydrogen bond.

BOTANY

(91) **Answer :** (1)
Hint:
The virus which was first crystalized by W.M. Stanley was TMV (Tobacco Mosaic Virus)
Solution:
It has ssRNA as genetic material and capsomeres arranged in helical manner in protein coat (capsid). TMV is an obligate parasite of tobacco.

(92) **Answer :** (3)
Solution:
Basidiomycetes are club fungi, which are most commonly seen fungi. Mushroom, toadstool, puff balls etc are club fungi.

(93) **Answer :** (3)
Solution:
Crystallization of virus-W. M. Stanley, D. J. Ivanowsky. – recognised certain microbes as causal organism of mosaic disease of tobacco.
Contagium vivum fluidum by M.W. Beijerinck

(94) **Answer :** (2)
Solution:
Methanogens are chemoautotrophic and are found in guts of ruminants.
Halophiles are heterotrophic and are found in extreme saline environment. Thermoacidophiles are found in hot water springs.
Cyanobacteria are photoautotrophic.

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

Amoeboid protozoans	– *Entamoeba*
Ciliated protozoans	– *Paramoecium*
Flagellated protozoans	– *Trypanosoma*

(96) **Answer :** (4)
Solution:
(a) *Spirulina* is a blue-green algae
(b) It is a prokaryotic organism
(c) It belongs to the kingdom Monera
(d) It is used for making SCP.

(97) **Answer :** (2)
Solution:
Being a member of basidiomycetes, *Puccinia* lacks sex organs.

(98) **Answer :** (2)
Solution:
In lichens, algae prepare food for fungi and fungi provide shelter and absorb mineral nutrients and water for its partner.

(99) **Answer :** (1)
Solution:

Neurospora crassa is often employed in biochemical and genetic work.

(100) Answer : (2)
Solution:
• The given figure is of *Agaricus*. It belongs to class basidiomycetes. Commonly known form of this class of fungi are mushroom, bracket fungi or puffball.
• They lack sex organs but plasmogamy occur by fusion of somatic cells.
• Basidiospores are exogenously produced on the basidium.

(101) Answer : (2)
Hint:
Red dinoflagellates undergo such rapid multiplication that they make the sea appear red called red tides.
Solution:
Euglenoids have a protein-rich layer called pellicle which makes their body flexible.

(102) Answer : (4)
Solution:
BGA are photosynthetic bacteria.

(103) Answer : (3)
Solution:
Membrane bound cell organelles are found in eukaryotes.

(104) Answer : (3)
Solution:
Double stranded DNA is usually present in bacteriophages.

(105) Answer : (4)
Solution:
In five kingdom classification, unicellular eukaryotes are placed in kingdom Protista.

(106) Answer : (4)
Solution:
Protozoans are unicellular heterotrophic organisms, and believed to be primitive relatives of animals.

(107) Answer : (3)
Solution:
Aspergillus belongs to the class Ascomycetes which has fruiting body called ascocarp.

(108) Answer : (2)
Solution:
Members of Fungi Kingdom are generally multicellular. Yeast is unicellular.

(109) Answer : (1)
Hint:
Bovine spongiform encephalopathy is caused by prions.
Solution:
Prions are abnormally folded proteins. They lack any nucleic acid.

(110) Answer : (3)
Solution:
Prion is an infectious proteinaceous particle. It is devoid of nucleic acid.

(111) Answer : (2)
Hint:
Dead diatoms are nearly indestructible.
Solution:
Silica deposited cell wall of diatoms make them indestructible.

(112) Answer : (3)
Hint:
These belong to the class ascomycetes.
Solution:
Morels and truffles are edible and are considered delicacies.

(113) Answer : (1)
Solution:
In sac fungi, sex organs are present. Ascospores are endogenous sexual spores.

(114) Answer : (1)
Solution:

Protozoans show heterotrophic mode of nutrition.

(115) Answer : (2)
Solution:
In diatoms, cell walls form two thin overlapping shells, which fit together as in a soap box.

(116) Answer : (2)
Hint:
Chemoautotrophic bacteria can synthesize their own food as they are autotrophic.
Solution:
They obtain energy by oxidising inorganic substances and not from sun.

(117) Answer : (4)
Solution:
Diatoms are chief producers in oceans.

(118) Answer : (2)
Hint:
Fusion of two nuclei is called karyogamy.
Solution:
Members of Ascomycetes and Basidiomycetes are characterized by the presence of dikaryophase in their sexual life cycle.

(119) Answer : (3)
Hint:
Slime moulds are saprophytic protists.
Solution:
Slime moulds move along decaying twigs and leaves engulfing organic material. Under suitable conditions, they form an aggregation called plasmodium which may grow and spread over several feet. During unfavourable conditions, the plasmodium differentiates and forms fruiting bodies bearing spores at their tips. The spores possess true walls.

(120) Answer : (3)
Solution:
Methanogens are methane producing bacteria abundant in marshy area and gut of ruminants.

(121) Answer : (4)
Solution:
Lichen is a mutualistic relationship between algae and fungi, where algae are autotrophs while, fungi are heterotrophs.

(122) Answer : (4)
Solution:
Protista are unicellular eukaryotes. All protista do not have cell wall. Membrane bound cell organelles are present. Boundaries are not well defined.

(123) Answer : (3)
Solution:
Euglena is photoautotrophic and saprophytic in mode of nutrition i.e., Mixotrophic.

(124) Answer : (2)
Solution:
Coprophilous fungi grow on cow dung.

(125) Answer : (1)
Solution:
Most of the bacteria are heterotrophs.

(126) Answer : (2)
Solution:
Nostoc is a N_2 fixing cyanobacterium.

(127) Answer : (3)
Solution:
Bracket fungi belong to class basidiomycetes.

(128) Answer : (2)
Solution:
Class : Basidiomycetes

(129) Answer : (3)
Solution: Answer (3)
Cellulosic cell wall is found in plants.

Cell wall in monerans (except Archaebacteria and *Mycoplasma*) is made up of peptidoglycan and cell wall in fungi is made up of chitin.

(130) Answer : (1)
Solution:
1. Envelope is the outer thin loose covering.
2. It is composed of proteins (from virus) lipids and carbohydrates (both from host).

(131) Answer : (3)
Solution:
Bladderwort and Venus fly trap are the examples of insectivorous plants. They are partially heterotrophic.
The viruses are non-cellular organisms that are characterised by having an inert crystalline structure, outside the living cell.

(132) Answer : (3)
Solution:
Cyanobacteria perform photosynthesis, similar to higher plants. They have chlorophyll *a* and phycobilins.

(133) Answer : (1)
Solution:
Sporangiospores are endogenous and nonmotile spores produced inside sporangia.

(134) Answer : (4)
Solution:
Lichens are very good pollution indicator, they do not grow in polluted area. Their algal component is known as phycobiont and fungal component is mycobiont.

(135) Answer : (3)
Solution:
Mycoplasma lacks cell wall, and can survive without oxygen.

ZOOLOGY

(136) Answer : (2)
Solution:
Silicosis and asbestosis involve fibrosis of upper parts of lungs. Asthma patients suffer from inflammation of bronchi and bronchioles.

(137) Answer : (1)
Hint:
Number of eyes in human
Solution:
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 the oxyhaemoglobin. In alveoli, high pO_2, low pCO_2, lesser H^+ concentration and lower temperature, all are the factors that favour the formation of oxyhaemoglobin.

(138) Answer : (1)
Hint:
Lower most part of the brain stem.
Solution:
A specialised centre present in the medulla region of the brain called respiratory rhythm centre is primarily responsible for the regulation of respiration.
A chemosensitive area is situated adjacent to the respiratory rhythm centre, which is highly sensitive to pCO_2 and concentration of hydrogen ions.

(139) Answer : (2)
Hint:
Haemoglobin has a quaternary structure.
Solution:
Adult human haemoglobin consists of 4 subunits-2α subunits and 2β subunits that can carry a maximum of four molecules of oxygen.

(140) Answer : (4)
Hint:
Initiates the ventricular contraction
Solution:

Each peak in the ECG is identified with a letter from P to T that corresponds to a specific electrical activity of the heart.

P-wave	– Depolarisation (excitation) of the atria
QRS-complex	– Depolarisation of the ventricles
T-wave	– Repolarisation of the ventricles
End of T- wave	– End of the ventricular systole

(141) Answer : (1)

Solution:

RBCs are formed in the red bone marrow of adults.
In humans, the mature RBCs are enucleated and biconcave disc shaped.
Absence of nucleus provides more space for oxygen binding pigment haemoglobin and biconcave shape increases the total surface area for exchange of gases.

(142) Answer : (2)

Hint:

PMNLs are phagocytic cells.

Solution:

Most abundant cells of the total WBCs are neutrophils.
An agranulocyte that forms 6-8% of the total WBCs is monocyte. Neutrophils and monocytes are phagocytes. These are categorized under cellular barrier of innate immunity.

(143) Answer : (3)

Hint:

Cardiac output is the volume of blood pumped out by each ventricle per minute.

Solution:

Cardiac output = Stroke volume × Heart rate
For a normal human, cardiac output = 70 mL × 72 beats/minute = 5040 mL/min $\simeq$5 L/min.

(144) Answer : (2)

Hint:

End of T-wave marks the end of systole

Solution:

In ECG, the T-wave represents the return of the ventricles from excited to normal state (repolarisation).
P-wave represents electrical excitation/ depolarisation of atria
QRS complex represents depolarisation of the ventricles

(145) Answer : (4)

Solution:

$\underset{\text{(Carbon dioxide)}}{CO_2} + \underset{\text{(Haemoglobin)}}{Hb} \rightarrow$ Carbamino - haemoglobin

$\underset{\text{(Carbon monoxide)}}{CO} + \underset{\text{(Haemoglobin)}}{Hb} \rightarrow$ Carboxyhaemoglobin

$\underset{\text{(Oxygen)}}{O_2} + \underset{\text{(Haemoglobin)}}{Hb} \rightarrow$ Oxyhaemoglobin

Myoglobin is a red coloured oxygen storing pigment present in muscles.

(146) Answer : (4)

Solution:

Option (4) is the correct answer because every 100 mL of oxygenated blood can deliver around 5 mL of O_2 to the tissues, under normal physiological conditions.
Option (1), (2) and (3) are incorrect because every 100 mL of deoxygenated blood delivers approximately 4 mL of CO_2 to the alveoli.

(147) Answer : (2)

Hint:

Air sacs of lungs

Solution:

Alveoli are the primary site of exchange of gases. The part starting with the external nostrils up to the terminal bronchioles constitute the conducting part that transports the atmospheric air to the alveoli, clean it from foreign particles and humidifies it.

(148) Answer : (4)

Solution:

The heart, like any other muscle, becomes stronger through regular exercise. A stronger heart is expected to have a greater stroke volume, which would lead to decrease in heart rate.

(149) Answer : (2)
Solution:
Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2.

(150) Answer : (2)
Solution:
The value of pO_2 is 40 mm Hg and pCO_2 is 45 mm Hg in systemic veins and pulmonary arteries.

(151) Answer : (4)
Hint:
Diffusion rate of CO_2 is greater.
Solution:
As 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 higher compared to O_2.

(152) Answer : (2)
Hint:
Duration of cardiac cycle = $\frac{60 \text{ seconds}}{\text{Heart rate}}$
Solution:
We know,
Cardiac output = Heart rate × Stroke volume
5250 mL = HR × 70 mL
$\therefore$ HR = $\frac{5250}{70}$
= 75 beats min^{-1}
Duration of cardiac cycle = $\frac{60}{75}$
= 0.80 sec

(153) Answer : (3)
Solution:
Neural signals through the sympathetic nerve fibres (part of ANS) can increase the rate of heart beat, the strength of ventricular contraction and thereby cardiac output. On the other hand, parasympathetic neural signals decrease the rate of heart beat, speed of conduction of action potential and thereby the cardiac output. Adrenal medullary hormones can also increase the cardiac output.

(154) Answer : (1)
Solution:
Plasma without clotting factors is called serum.

(155) Answer : (2)
Solution:
In hepatic portal system, the hepatic portal vein carries blood from intestine to the liver before it is delivered to the systemic circulation.

(156) Answer : (4)
Solution:
In humans, about 70 mL of blood is pumped out by each ventricle during a cardiac cycle and it is called stroke volume.
Volume of blood pumped out by each ventricle of heart per minute is called cardiac output.
Heart rate × stroke volume = cardiac output

(157) Answer : (3)
Solution:
Tunica intima – Squamous endothelium.
Tunica media – Smooth muscle and elastic fibres.
Tunica externa – Fibrous connective tissue

(158) Answer : (2)
Solution:
Monocytes = 6-8% of the total WBCs
Basophils = 0.5-1% of the total WBCs
Neutrophils = 60-65% of the total WBCs

(159) Answer : (3)
Hint:
Megakaryocytes get fragmented.
Solution:

Thrombocytes or platelets are cell fragments produced from megakaryocytes (special cells in the bone marrow). Only leucocytes are nucleated cells among all the formed elements.

(160) Answer : (1)

Solution:

Blood Group	Antigens on RBCs	Antibodies in Plasma	Donor's Group
A	A	anti-B	A, O
B	B	anti-A	B, O
AB	A, B	nil	AB, A, B, O
O	nil	anti-A, B	O

(161) Answer : (3)

Solution:

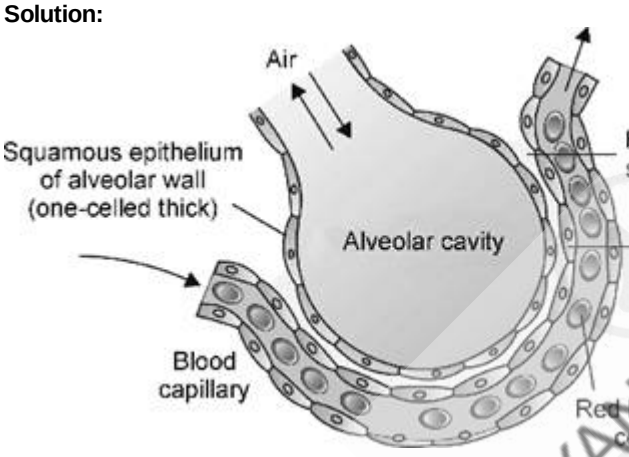
Asthma is a difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles.
Emphysema leads to reduced respiratory surface. Fibrosis occurs in occupational lung diseases.

(162) Answer : (4)

Hint:

Squamous epithelium forms the diffusion boundary.

Solution:



(163) Answer : (1)

Hint:

It is an important factor that affects exchange of gases.

Solution:

Partial pressure of a gas is the pressure contributed by an individual gas in a mixture of gases.
Exchange of gases by simple diffusion is mainly based on the pressure/concentration gradient of gases.

(164) Answer : (3)

Hint:

Equal to the number of prostrate gland in human male.

Solution:

In humans, the diffusion membrane of lungs is formed of three major layers.
They are:
• Thin squamous epithelium of alveoli.
• Endothelium of alveolar capillaries.
• Basement substance (acellular layer) in between the above mentioned layers.

(165) Answer : (3)

Solution:

Blood is the medium of transport for O_2 and CO_2.

%	Gas	Carried by
97	O_2	RBCs in blood
3	O_2	Plasma in dissolved state
20-25	CO_2	RBCs in blood
70	CO_2	Plasma as bicarbonate
7	CO_2	Plasma in dissolved state

(166) Answer : (1)

Solution:

Peroxidase is responsible for the breaking of hydrogen peroxide.

(167) Answer : (3)

Solution:

About 97 per cent of O_2 is transported by RBCs in the blood. The remaining 3 per cent of O_2 is carried in a dissolved state through the plasma. Nearly 20-25 per cent of CO_2 is transported by RBCs whereas 70 per cent of it is carried as bicarbonate ions. About 7 per cent of CO_2 is carried in a dissolved state through plasma.

(168) Answer : (1)

Hint:

Stroke volume

Solution:

During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the stroke volume. The stroke volume multiplied by the heart rate (number of beats per minute) gives the cardiac output. Therefore, the cardiac output can be defined as the volume of blood pumped out by each ventricle per minute and averages 5000 mL or 5 litres in a healthy individual.

(169) Answer : (3)

Hint:

Portal system involving kidneys.

Solution:

Hepatic and hypophyseal portal system are well developed in humans.

(170) Answer : (4)

Solution:

Blood is a specialized (fluid) connective tissue which is devoid of fibres.

(171) Answer : (1)

Solution:

The life span of human RBCs is 120 days after which they are destroyed in the spleen.

(172) Answer : (1)

Solution:

Deoxygenated blood from the wall of heart is provided to the right atrium by coronary sinus.

(173) Answer : (3)

Solution:

During atrial systole, both the atria undergo simultaneous contraction, that increases the blood flow into the ventricles by about 30%.

(174) Answer : (1)

Hint:

Phase in which AV valves are open

Solution:

During joint diastole, all the four chambers of heart are in a relaxed state. Blood from the pulmonary veins and vena cava flows into the left and right ventricle respectively through the left and right atria.

• During ventricular systole, there is increase in the ventricular pressure causing the closure of AV valves due to attempted back flow of blood into the atria. As the ventricular pressure increases further, the semilunar valves guarding the pulmonary artery and the aorta are forced open, allowing the blood in the ventricles to flow through these vessels into the circulatory pathways.

(175) Answer : (4)

Solution:

Mitral valve or bicuspid valve is present between left atrium and left ventricle.

(176) Answer : (4)

Solution:

During each cardiac cycle two prominent sounds are produced which can be easily heard through a stethoscope. The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves.

(177) Answer : (4)

Solution:

Hypertension, or high blood pressure, is typically caused by vasoconstriction, which is the narrowing of blood vessels. This narrowing increases resistance to blood flow, forcing the heart to pump harder to circulate blood, thus elevating blood pressure.

(178) Answer : (4)

Hint:

Diffusion occurs along pressure gradient.

Solution:

Partial pressure (in mm Hg) of O_2 and CO_2 at different parts involved in diffusion in comparison to those in atmosphere

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

(179) Answer : (1)

Hint:

4-chambered heart

Solution:

Two separate pathways *i.e*., pulmonary and systemic circulation are present in mammals and birds. Mixing of oxygenated and deoxygenated blood does not occur in double circulation. In fishes, single circulation is present while in amphibians and reptiles, incomplete double circulation is present.

(180) Answer : (1)

Hint:

Gasping centre

Solution:

The centre present in the pons region of the brain called pneumotaxic centre can moderate the function of respiratory rhythm centre. Neural signals from this centre can reduce the duration of inspiration and thereby alter the respiratory rate. Hunger and thirst centres are present in hypothalamus.