NEET 2020
FULL TEST-8 SOLUTIONS

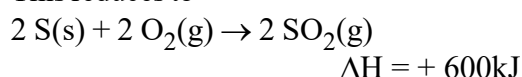|							STANDARD ANSWER KEY				
Q	1	2	3	4	5	6	7	8	9	10	11
A	4	1	3	4	4	3	4	2	2	3	3
Q	12	13	14	15	16	17	18	19	20	21	22
A	4	2	2	3	3	2	3	1	1	2	3
Q	23	24	25	26	27	28	29	30	31	32	33
A	2	1	4	3	2	1	1	4	4	2	2
Q	34	35	36	37	38	39	40	41	42	43	44
A	2	3	2	4	3	4	1	2	1	1	2
Q	45	46	47	48	49	50	51	52	53	54	55
A	3	2	4	4	1	3	1	2	3	2	2
Q	56	57	58	59	60	61	62	63	64	65	66
A	1	2	1	1	3	3	2	1	4	3	1
Q	67	68	69	70	71	72	73	74	75	76	77
A	3	2	4	2	3	2	1	4	3	1	2
Q	78	79	80	81	82	83	84	85	86	87	88
A	2	3	2	2	2	1	4	2	2	1	3
Q	89	90	91	92	93	94	95	96	97	98	99
A	4	1	1	3	2	2	1	4	3	3	3
Q	100	101	102	103	104	105	106	107	108	109	110
A	2	3	1	2	3	4	2	1	2	4	4
Q	111	112	113	114	115	116	117	118	119	120	121
A	3	2	2	2	2	4	4	2	4	4	4
Q	122	123	124	125	126	127	128	129	130	131	132
A	3	4	2	1	1	3	3	2	3	4	4
Q	133	134	135	136	137	138	139	140	141	142	143
A	4	4	3	3	1	3	2	4	4	4	4
Q	144	145	146	147	148	149	150	151	152	153	154
A	1	2	1	4	1	3	2	2	2	1	1
Q	155	156	157	158	159	160	161	162	163	164	165
A	1	3	3	4	2	2	4	4	4	2	3
Q	166	167	168	169	170	171	172	173	174	175	176
A	2	1	3	4	4	4	2	3	4	3	1
Q	177	178	179	180							
A	2	2	2	4							

(1) **(4).** According to the ideal gas laws, at constant temperature and pressure, the volume of a gas is directly proportional to the number of moles. We increased the number of grams by a factor of 5 ([0.16] [5] = [0.80]). That's the same as increasing the number of moles by a factor of 5. So we must have increased the volume by a factor of 5. Therefore, (5) (1 L) = 5 L.
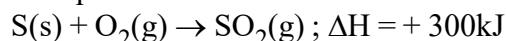
(2) **(1).** We can use Hess's law. Add the two reactions together, and cancel things that appear on both sides.

$2 S(s) + 3 O_2(g) \rightarrow 2 SO_3(g)$
$$\Delta H = +800 \text{ kJ / mol}$$
$2 SO_3(g) \rightarrow 2 SO_2(g) + O_2(g)$
$$\Delta H = -200 \text{ kJ / mol}$$
$2 S(s) + 3 O_2(g) + 2 SO_3(g)$
$$\rightarrow 2 SO_2(g) + 2 SO_3(g) + O_2(g)$$

This reduces to

$2 S(s) + 2 O_2(g) \rightarrow 2 SO_2(g)$
$$\Delta H = + 600 \text{kJ}$$
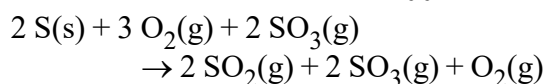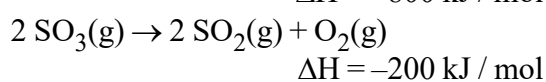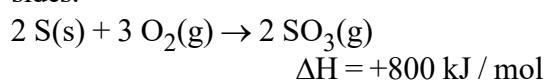
Now we can cut everything in half to get the equation we want.

$S(s) + O_2(g) \rightarrow SO_2(g)$; $\Delta H = + 300 \text{kJ}$

(3) **(3).** From Raoult's law, the vapour pressure of an ideal solution depends on the mole fractions of the components of the solution. The vapour pressure of a solution with equal amounts of benzene and toluene will look like as follows.

$$(P_{solution}) = \frac{1}{2} (P_{benzene}) + \frac{1}{2} (P_{toluene})$$

That's just the average of the two vapour pressures.

(4) **(4).** Use a table to see how the partial pressures change. Based on the balanced equation, we know that if 2 atm of CO(g) were formed, then 2 atm of $H_2O(g)$ must also have formed. We also know that the reactants must have lost 2 atm each.

	$H_2(g)$	$CO_2(g)$	$H_2O(g)$	$CO(g)$
Before	6 atm	4 atm	0	0
Change	−2	−2	+2	+2
At equilibrium	4 atm	2 atm	2 atm	2 atm

Now plug the numbers into the equilibrium expression.

$$K_{eq} = \frac{P_{H_2O} P_{CO}}{P_{H_2} P_{CO_2}} = \frac{(2)(2)}{(4)(2)} = \frac{1}{2}$$

(5) **(4).** From the rate law given in the question (Rate = k $[H_2] [I_2]$), we can see that increasing the concentration of H_2 will increase the rate of reaction. The rate constant, k, is not affected by changes in the concentration of the reactants.

(6) **(3).** Halogen are most electronegative element.

(7) **(4).** $\ddot{P}H_3$ (polor no.)

P — H
2.1   2.1
$\Delta EN = 0$
Non-polar bonds

;

H—O—H
(Polar molecule)

O=S=O
(Polar molecule)
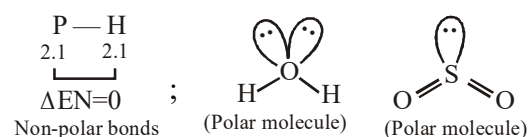
(8) **(2).** $\underset{\text{H-bonding}}{HF} < \underset{\text{mol. mass }(\downarrow)\text{ volatile nature }(\uparrow)}{HI < HBr < HCl}$

(9) **(2).** $\mu \neq 0 \rightarrow$ Unsymmetrical-non-linear.

(10) **(3).** $\overset{+1}{H}ClO$ $\overset{+3}{H}ClO_2$ $\overset{+5}{H}ClO_3$ $\overset{+7}{H}ClO_4$

n ($\uparrow$) ; Acidic nature ($\uparrow$)
Thermal stability ($\uparrow$)
Oxygen releasing tendency ($\downarrow$)
Oxidising nature ($\downarrow$)

(11) **(3).** NH_3 can be dried by CaO.

(12) **(4).** $PH_4I + KOH \rightarrow KI + PH_3 + H_2O$

(13) **(2).** The process is spontaneous, so ΔG must be negative. The intermolecular forces become stronger and the substance moves to a lower energy level when it freezes, so ΔH must be negative. The substance becomes more orderly when it freezes, so ΔS must be negative.

(14) **(2).** The tetrasubstituted alkene is E. The parent chain, location numbers and substituents are listed correctly.

(15) **(3).** Potassium permanganate oxidizes a double bond by adding two hydroxyl groups to it. Both hydroxyl groups will add to the same side of the double bond (syn addition) to give a syn diol. The structure of potassium permanganate will help to visualize the mechanism of syn addition to an alkene.

(16) (3). Hydrogen halides like HBr will cleave an ether to form an alkyl halide and an alcohol. Typically, the least hindered alkyl group on the ether becomes the alkyl halide.

(17) (2). With the excess base and electrophile, the β-ketoester can be alkylated twice.

(18) (3). The precursor of the ylide is formed from the S_N2 attack of phosphorus on an alkyl halide so methyl and primary halides would work best.
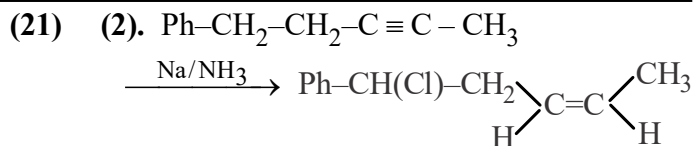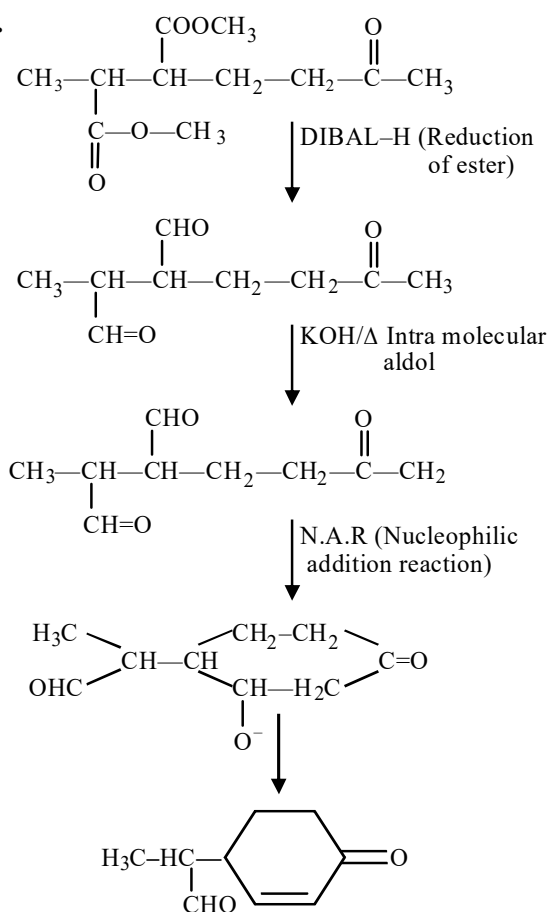
(19) (1). $E°_{cell} = \dfrac{0.059}{2} \log K$

$E°_{B^+/B} - E°_{A^{+2}/A} = \dfrac{0.059}{2} \log K$

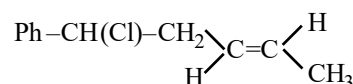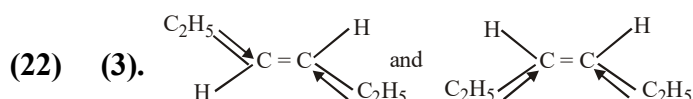$E°_{B^+/B} - 0.34 = \dfrac{0.059}{2} \times 15.6$

$E°_{B^+/B} = 0.80$

(20) (1).

(21) (2). $Ph–CH_2–CH_2–C \equiv C–CH_3$

$Na/NH_3(l)$ this is Birch reduction reduce only alkyne into trans alkene and $Cl_2/h\nu$ is free radical substitution reaction.

(22) (3).

Trans-3-Hexene   C is -3 - Hexene

$\mu = 0$ $\mu > 0$

M. P. of Trans isomer High than cis isomer.

(23) (2). The pi electrons are acting as the nucleophile in this mechanism so a double headed arrow should be drawn from the bond to the electrophile under attack (the hydrogen here). The hydrogen-bromine bond will break with the electrons going to bromine so a double headed arrow needs to be drawn from the bond to the bromine.

(24) (1). This secondary carbocation will rearrange to form a tertiary benzylic carbocation. Compared to the rearranged carbocations created by the other choices, this is the most stable one.

(25) (4). This compound is a ketone and ketones are good electrophiles due to the presence of the electron poor carbonyl carbon.

(26) (3). m –cresol has electron releasing group (CH_3). Hence it decreases the acidic strength. Both nitro and chloro are having – I effect. Hence, they show higher acidic strength. But nitro is a stronger – I group than chloro group. Hence m-Nitro phenol is more acidic than m-chlorophenol.

(27) (2). To prepare a silicone containing n $Si – O – Si$ linkages, the total number of units required are (n + 1), of which 2 are chain blocking units, R_3SiOH and (n – 1) are chain building units, $R_2Si\,(OH)_2$. Thus, the number of $R_2Si(OH)_2$ units needed are 9.

(28) (1). Gadolinium $(_{64}Gd) = [Xe]^{54}\,4f^7 5d^1 6s^2$

(29) **(1).**

$$AX_3 \rightleftharpoons A^{3+} + 3X^-$$
$$\quad\quad\quad S \quad\quad 3S$$
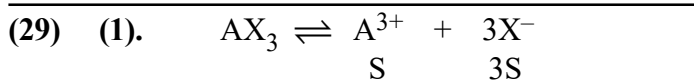
$$K_{sp} = [A^{3+}][X^-]^3 = (S) \cdot (3S)^3 = 27S^4$$

(30) **(4).** Higher the electrode potential, better is the oxidising agent. Since, the electrode potential decreases in the order:

$Ag^+ | Ag$ (+0.80 V) $> Fe^{3+} | Fe^{2+}$ (+0.77 V) $> I_2(s) | I^-$ (+0.54 V) $> Cu^{2+} | Cu$ (+0.34 V)
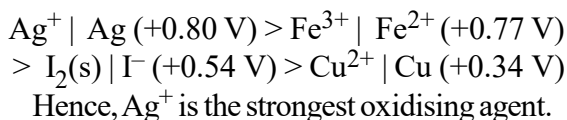
Hence, Ag^+ is the strongest oxidising agent.

(31) **(4).** Acids which contain P – H bonds have strong reducing properties. Hypophosphorus acid (H_3PO_2) is a good reducing agent as it contains two P – H bonds. It has one P–OH bond, so it is monobasic.

(H_3PO_2)
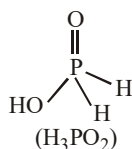
(32) **(2).** Dissociation constant is the reciprocal of the stability constant ($\beta = 1/K$).

Overall complex dissociation equilibrium constant,

$$K = \frac{1}{\beta^4} = \frac{1}{2.1 \times 10^{13}} = 4.76 \times 10^{-14}$$

(33) **(2).** Using expression, $\mu = \sqrt{n(n+2)}$ B.M.

(where, n = No. of unpaired electrons)

Ion	Outer Configuration	n	μ
$_{22}Ti^{2+}$	$3d^2$	2	2.84
$_{24}Cr^{2+}$	$3d^4$	4	4.90
$_{27}Co^{3+}$	$3d^6$	4	4.90
$_{25}Mn^{2+}$	$3d^5$	5	5.92

(34) **(2).** The ring attached to the nitrogen atom in benzanilide is strongly activated towards electrophilic substitution reaction.

∴ Nitration occurs at p-position to the ring attached to 'N' atom.
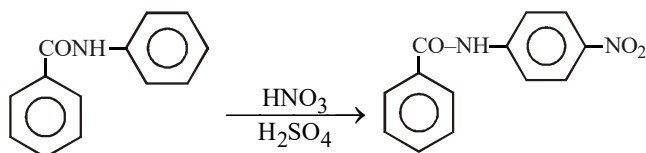
(35) **(3).** The disaccharide maltose (malt sugar) is formed by the condensation of two molecules of α-D-glycopyranose in which C_1 of one glucose unit is connected to C_4 of the other glucose unit.

structure of α-D-maltose
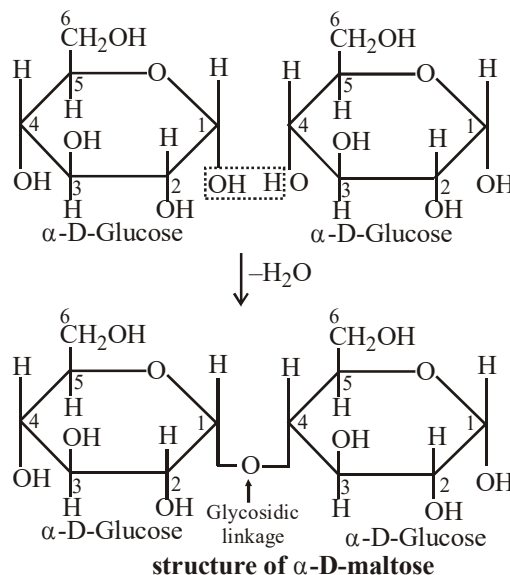
(36) **(2).** BF_3 forms complex halides of the type $[BF_4^-]$ in which B atom has C.N. 4, it cannot extend its C.N. beyond 4 due to the non-availability of d-orbitals in its configuration. Hence, BF_6^{3-} ion (sp^3d^2 hybridisation) is not formed. On the other hand, Al can extend its C.N. beyond 4 due to the availability of d-orbitals in its configuration.

(37) **(4).**

(38) **(3).** Na, Mg, Al and Si are in period 3 and as we move across the period, the atomic size decreases and hence ionisation enthalpy increases. So, the order is Na<Mg<Al< Si Hence, IE of Al is greater than that of Mg (737 kJ/mol) and lower than that of Si (776 kJ/mol).
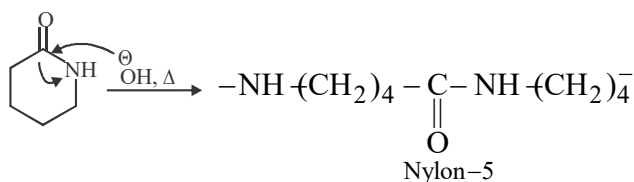
(39) **(4).** Greater the valency of the flocculating ion, greater is its flocculating power.

(40) **(1).** Volume of unit cell in ccp $= \left(\frac{4a}{\sqrt{2}}\right)^3$

So volume per spheric/atom

$$= \frac{1}{4} \times \frac{64a^3}{2\sqrt{2}} = 5.66\, a^3$$

(41) (2).

$$-NH\!-\!(CH_2)_4 - \overset{O}{\underset{\|}{C}}-NH\!-\!(CH_2)_4^{-}$$

Nylon–5

(42) (1).

(i) The amino acids exists as a zwitterions.
$$H_3N^+ - CHR - COO^-$$
Due to this dipolar salt like character they have strong dipole attractions or electrostatic attractions. Therefore, their melting points are higher than that of corresponding halo acids. Due to salt like character of amino acids their solubility is higher than the corresponding halo acids.

(ii) Monosaccharides are carbohydrates that cannot be hydrolysed further to give simpler units of polyhydroxy aldehyde or ketone.
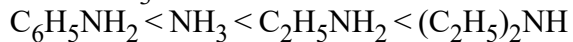
(iii) Reducing sugars are carbohydrates that reduce Fehling's solution and Tollen's reagent.

(iv) Glycogen is a carbohydrate (polysaccharide). In animals, carbohydrates are stored as glycogen.
Starch is a carbohydrate consisting of two components - amylose (15 - 20%) and amy-lopectin (80 - 85%).

(43) (1). Considering the inductive effect of alkyl groups, NH_3, $C_2H_5NH_2$, and $(C_2H_5)_2NH$ can be arranged in the increasing order of their basic strengths as:
$$NH_3 < C_2H_5NH_2 < (C_2H_5)_2NH$$
Again, $C_6H_5NH_2$ has proton acceptability less than NH_3. Thus, we have:
$$C_6H_5NH_2 < NH_3 < C_2H_5NH_2 < (C_2H_5)_2NH$$
Due to the -I effect of C_6H_5 group, the electron density on the N-atom in $C_6H_5CH_2NH_2$ is lower than that on the N-atom in $C_2H_5NH_2$, but more than that in NH_3. Therefore, the given compounds can be arranged in the order of their basic strengths as:
$$C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2$$
$$< C_2H_5NH_2 < (C_2H_5)_2NH$$
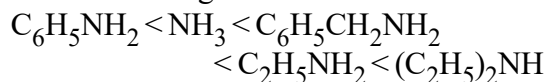
(44) (2).

(i) Cr^{2+} is stronger reducing agent than Fe^{2+}
Reason: $d^4 \rightarrow d^3$ occurs in case of Cr^{2+} to Cr^{3+}. But $d^6 \rightarrow d^5$ occurs in case of Fe^{2+} to Fe^{3+}.

(ii) The most common oxidation state of Lanthanoids is +3. However, some lanthanoids also show an oxidation states of + 2 and +4. For example, Eu shows an oxidation state of + 2 and Ce shows an oxidation state of +4.

(iii) The electronic configuration of Ce^{3+} (atomic no. of Ce = 58) is
$1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^6\, 4s^2\, 3d^{10}\, 4p^6\, 5s^2\, 4d^{10}\, 5p^6\, 6s^1$
There is only one unpaired electron in Ce^{3+} ion. The spin-only formula for calculating the magnetic moment is $\mu = \sqrt{n(n+2)}$ BM, where n is the number of unpaired electrons in the species. Here, n = 1,
So, $\mu = \sqrt{1 \times 3}$ BM = 1.73 BM

(45) (3). It is due to chelation effect of $C_2O_4^{2-}$ ligand.

(46) (2). Torque $\vec{\tau} = \vec{r} \times \vec{F}$
In magnitude, $\tau = rF \sin\theta$
Where θ is the angle between $\vec{r}$ and $\vec{F}$
Here, F = 2.0 N, r = 3m, $\theta = 30°$

∴ The magnitude of torque on P with respect to origin O is
$\tau = (3m)(2.0N)\sin 30° = (3m)(2.0N)(1/2)$
= 3Nm.

(47) (4). Particle velocity $(v_p) = -v \times$ slope of the graph at that point
At point 1 : Slope of the curve is positive, hence particle velocity is negative or downward ($\downarrow$)
At point 2 : Slope negative, hence particle velocity is positive or upwards ($\uparrow$)
At point 3 : Again slope of the curve is positive, hence particle velocity is negative or downward ($\downarrow$).

(48) (4). The voltage V_L and V_C are equal and opposite so voltmeter reading will be zero.
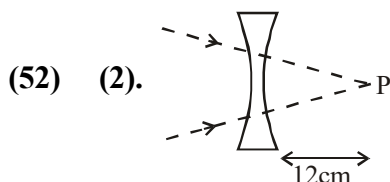Also R = 30Ω, $X_L = X_C = 25Ω$
$$i = \frac{V}{\sqrt{R^2 + (X_L - X_C)^2}} = \frac{V}{R} = \frac{240}{30} = 8A$$

(49) (1). $E = h\nu_0 + K_{max}$
$\Rightarrow h(4\nu_0) = h\nu_0 + K_{max}$
$\Rightarrow K_{max} = 3h\nu_0$

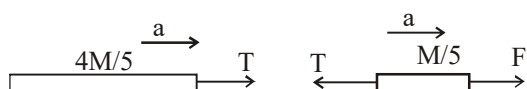**(50)** **(3).** T = tension, W = weight and F = centrifugal force.

(51) **(1).** $\vec{A} = 4\hat{i} + 6\hat{j}$ and $\vec{B} = 2\hat{i} + 3\hat{j}$

$\dfrac{4}{2} = \dfrac{6}{3} \Rightarrow \vec{A}$ is parallel to $\vec{B}$

(52) **(2).**

$\dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{f}$; $\dfrac{1}{v} - \dfrac{1}{12} = \dfrac{1}{-16}$; $v = 48$ cm.

(53) **(3).**

Equation of motion

$F - T = \dfrac{M}{5} \times a$ .... (1)

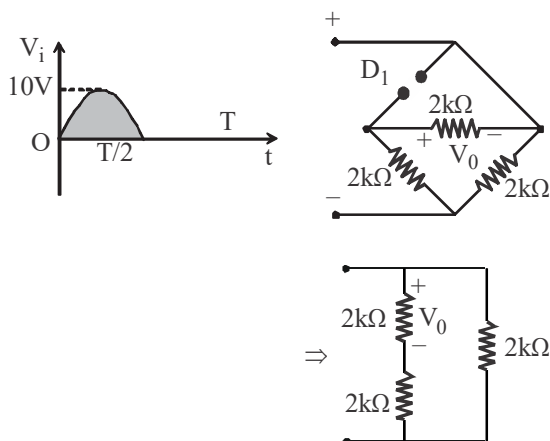$T = \dfrac{4M}{5} \times a$ .... (2)

Solving eq. (1) and (2), $T = 4N$

(54) **(2).** $\Delta x = x_{7d} - x_{3d}$

$= \dfrac{13\lambda D}{2d} - \dfrac{5\lambda D}{2d} = \dfrac{4\lambda D}{d}$

$= \dfrac{4 \times 6.5 \times 10^{-7} \times 1}{1 \times 10^{-3}} = 2.6$ mm

(55) **(2).** For the positive half cycle of input the resulting network is shown below

$(V_0)_{max} = \dfrac{1}{2}(V_1)_{max} = \dfrac{1}{2} \times 10 = 5V$

(56) **(1).** During the growth of voltage in a C-R circuit the voltage across a capacitor at time t is given by $V = V_0(1 - e^{-t/CR})$ for the given circuit as per given conduction at time t.

$V = 3/4^{th}$ of the voltage applied across

$C = \dfrac{3}{4}V_0$. So, $\dfrac{3}{4}V_0 = V_0(1 - e^{-t/RC})$

$\Rightarrow e^{-t/RC} = \dfrac{1}{4} \Rightarrow e^{t/RC} = 2^2$

$\Rightarrow t = 2RC \ln 2$
$= 2 \times (2.5 \times 10^6) \times (4 \times 10^{-6}) \times (0.693)$
$= 13.86$ s

(57) **(2).** Amplitude of electric field and magnetic field are related by the relation, $\dfrac{E_0}{B_0} = c$

Average energy density of the magnetic field

is, $u_B = \dfrac{1}{4}\dfrac{B_0^2}{\mu_0} = \dfrac{1}{4}\dfrac{E_0^2}{\mu_0 c^2}$ $\left[\because B_0 = \dfrac{E_0}{c} \right]$

$= \dfrac{1}{4}\varepsilon_0 E_0^2$ $\left[\because c = \dfrac{1}{\sqrt{\mu_0\varepsilon_0}} \right]$

$= \dfrac{1}{4} \times 8.854 \times 10^{-12} \times (2)^2$
$= 8.854 \times 10^{-12}$ Jm^{-3}
$= 8.86 \times 10^{-12}$ J m^{-3}

(58) **(1).** $X_{cm} = \dfrac{m_1 x_1 + m_2 x_2 + m_3 x_3}{m_1 + m_2 + m_3}$

$X_{cm} = \dfrac{300 \times (0) + 500 \times 40 + 400 \times 70}{300 + 500 + 400}$

$X_{cm} = \dfrac{500 \times 40 + 400 \times 70}{1200} = 40$ cm

(59) **(1).** $h' = H - \dfrac{4H}{10} = \dfrac{6H}{10} = \dfrac{6}{10} \times 10 = 6m$

(60) **(3).** Period of PE $= \dfrac{1}{2}$ period of position

(61) **(3).** Initial P.E = mgh = 0.1 × 10 × 4 = 4J

Energy loss per 2m on rough surface

= μmg s = 0.1 × 0.1 × 10 × 2 = 0.2 J

So total No of rounds from B to C and C to B will be 10.

Total distance travelled = 20 × 3 – 1

$= 60 - 1 = 59$

(62) **(2).** Initially ice will absorb heat to raise it's temperature to 0°C then it's melting takes place

If m_i = Initial mass of ice, m_i' = Mass of ice that melts and m_W = Initial mass of water

By Law of mixture,

Heat gained by ice = Heat lost by water

$\Rightarrow$ $m_i \times c \times (20) + m_i' \times L = m_W c_W [20]$

$\Rightarrow$ $2 \times 0.5 (20) + m_i' \times 80 = 5 \times 1 \times 20$

$\Rightarrow$ $m_i' = 1$ kg

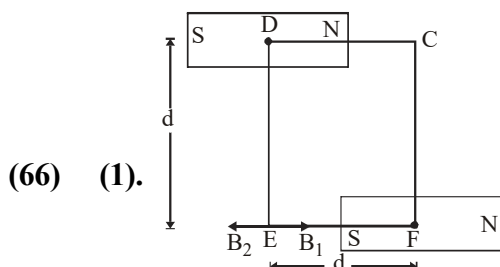Final mass of water = Initial mass of water + Mass of ice that melts = 5 + 1= 6 kg.

(63) **(1).** Fm = BIℓ sin θ

$F_m = BI\ell_\perp$

$= 3 \times 5 \times \dfrac{5}{100} = 0.75$ N

(64) **(4).** $F \propto \dfrac{1}{R^{5/2}} \Rightarrow F = \dfrac{GMm}{R^{5/2}} = m\omega^2 R$

$\dfrac{GMm}{R^{5/2}} = m \left(\dfrac{2\pi}{T}\right)^2 R$

$T^2 \propto R^{7/2} \Rightarrow T \propto R^{7/4}$

(65) **(3).** $\dfrac{P_2}{P_1} = \left(\dfrac{V_1}{V_2}\right)^\gamma = (8)^{5/3} = 32$

(66) **(1).**

Magnetic induction at point E due to magnet at F (axial point) is

$B_1 = \dfrac{\mu_0}{4\pi} \dfrac{2m}{d^3}$

It acts along EF.

Magnetic induction at point E due to magnet at D (equatorial point) is, $B_2 = \dfrac{\mu_0}{4\pi} \dfrac{m}{d^3}$

It acts along FE.

Resultant magnetic induction at point E is

$B = B_1 - B_2 = \dfrac{\mu_0 m}{4\pi d^3}$

(67) **(3).** Here, distance of point from the centre of the sphere, r = 20 cm = 0.2 m

Electric field, E = –1.2 × 10³ N C⁻¹

As $E = \dfrac{q}{4\pi\varepsilon_0 r^2}$

$q = (4\pi\varepsilon_0 r^2) E = \dfrac{(0.2)^2 \times (-1.2 \times 10^3)}{9 \times 10^9}$

$= -5.3 \times 10^{-9}$ C

(68) **(2).** When a wire of irregular shape turns into a circular loop, area of the loop tends to increase. Therefore, magnetic flux linked with the loop increases. According to Lenz's law, the direction of induced current must oppose the magnetic flux, for which induced current should flow along adcba.

(69) **(4).** Radius of the circular path of a charged particle in a magnetic field is given by

$R = \dfrac{mv}{Bq}$ or mv = RBq

Here, R = 0.83 cm = 0.83 × 10⁻² m

B = 0.25 Wb m⁻²

q = 2e = 2 × 1.6 × 10⁻¹⁹ C

$\therefore$ mv = (0.83 × 10⁻²) (0.25)(2 × 1.6 × 10⁻¹⁹)

de Broglie wavelength,

$\lambda = \dfrac{h}{mv} = \dfrac{6.64 \times 10^{-34}}{0.83 \times 10^{-2} \times 0.25 \times 2 \times 1.6 \times 10^{-19}}$

$= 0.01$Å

(70) **(2).** The velocity of outflow of water remains unchanged because it depends upon the height of water level and is independent of the size of the hole. The volume depends directly on the size of the hole.

(71) **(3).** From the given equation, $v = at + \dfrac{b}{t+c}$

(i) $[at] = v \Rightarrow [a] = \dfrac{[LT^{-1}]}{[T]} = [LT^{-2}]$

(ii) $[c] = [t] = [T]$
$[b] = [v] \times [T] = [LT^{-1}][T] = [L]$

(72) **(2).** Let T be the temperature at the junction.
Let L and A be the length and area of cross-section of each rod respectively.
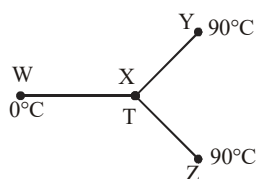
Heat current from Y to X is

$H_1 = \dfrac{KA(90°C - T)}{L}$

Heat current from Z to X is

$H_2 = \dfrac{KA(90°C - T)}{L}$

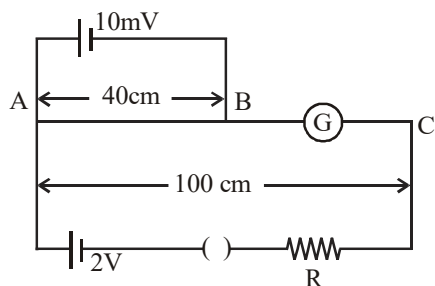Heat current from X to W is

$H_3 = \dfrac{KA(T - 0°C)}{L}$

At the junction X, $H_1 + H_2 = H_3$
$90°C - T + 90°C - T = T$

or $3T = 180°C$ or $T = 60°C$

(73) **(1).** The current in the potentiometer wire AC is

$I = \dfrac{2}{10+R}$.

The potential difference across the potentiometer wire is

$V = \text{current} \times \text{resistance} = \dfrac{2}{10+R} \times 10$

The length of the wire is $\ell = 100$ cm

So, the potential gradient along the wire is

$\phi = \dfrac{V}{\ell} = \left(\dfrac{2}{10+R}\right) \times \dfrac{10}{100}$ ...(i)

The source of emf 10 mV is balanced against a length of 40 cm of the potentiometer wire
i.e. $10 \times 10^{-3} = \phi \times 40$

or $10 \times 10^{-3} = \dfrac{2}{10+R} \times \dfrac{40}{10}$ (Using (i))

or $R = 790 \ \Omega$

(74) **(4).** With radius half as large, speed should be smaller by a factor of $1/\sqrt{2}$, so that $a = v^2/r$ can be the same.

(75) **(3).** The time for a projectile to reach the ground depends only on the y component (or vertical component) of its variables, i.e., y, v_{0y}, and a_y. These variables are the same for both balls. The fact that Ball 1 is moving horizontally at the top of its trajectory does not play a role in the time it takes for it to reach the ground.

(76) **(1).** Answer : $E > D > C > B > A$.
Recall that for and ideal gas, $PV = nRT$,
and $C_v = 3R/2$ and $C_p = 5R/2$.
Process A: Isobaric, volume V goes to 0.5V, so temperature T goes to 0.5T,
$dQ = nC_p dT$, so $dS = nC_p dT/T$; therefore

$\Delta S = -\dfrac{5}{2} nR \ln 2$.

Process B: isothermal, volume V goes to 0.5V, so temperature T is constant and pressure P goes to 2P,
$dQ = pdV = nRT(dV/V)$,
so $dS = nR(dV/V)$;
therefore $\Delta S = -nR \ln 2$.
Process C: Adiabatic, Q = 0; therefore $\Delta S = 0$.
Process D: Isovolumetric, pressure P goes to 2P, so temperature T goes to 2T,
$dQ = nC_v dT$, so $dS = n C_v dT / T$;

therefore $\Delta S = \dfrac{3}{2} n R \ln 2$.

Process E: isobaric, volume V goes to 2V;

therefore $\Delta S = \dfrac{5}{2} n R \ln 2$.

(77) **(2).** Radius of nth orbit in hydrogen like atoms is

$r_n = \dfrac{a_0 n^2}{Z}$, where a_0 is the Bohr's radius

For hydrogen atom, $Z = 1$

$\therefore$ $r_1 = a_0$ ($\because$ $n = 1$ for ground state)

For Be^{3+}, $Z = 4$

$\therefore$ $r_n = \dfrac{a_0 n^2}{4}$

According to given problem

$r_1 = r_n$, $a_0 = \dfrac{n^2 a_0}{4}$, $n = 2$

(78) **(2).**

(79) **(3).** $M = \pi R^2 h \rho$

$h \propto \dfrac{1}{R}$; $M \propto R$

$\therefore$ $\dfrac{M_1}{M_2} = \dfrac{R_1}{R_2}$; $\dfrac{5 \times 10^{-3}}{M_2} = \dfrac{r}{r/2}$

$M_2 = 2.5 \times 10^{-3}$ kg

(80) **(2).** From the conservation of momentum

$mv + m \times 0 = (m + m) v'$

$\Rightarrow$ $v' = \dfrac{mv}{(m + m)} = \dfrac{v}{2}$

and we knows, $h = \dfrac{u^2}{2g}$, Here, $u = v'$

So, $h = \dfrac{(v')^2}{2g} = \dfrac{v^2}{8g}$

(81) **(2).** Closing the switch lights lamp C. The action increases the battery current so it decreases the terminal voltage of the battery. Lamps A and B are in series, so they carry the same current, but when the terminal voltage of the battery drops, the total voltage drops across lamps A and B combined, thus reducing the potential difference across each. Total power delivered to the lamps increases because the current through the battery increases.

(82) **(2).** Here, $r_1 = 1 m$, $r_2 = 2$ m

Mutual inductance,

$M = \dfrac{\mu_0 \pi r_1^2}{2r_2} = \dfrac{\mu_0 \pi \times 1}{2 \times 2} = \dfrac{\mu_0 \pi}{4}$

(83) **(1).** The ranking is

$\Delta V_L > \Delta V_{1200\,\Omega} > 12.0\,V > \Delta V_{12\Omega}$.

Just before the switch is thrown, the voltage across the 12Ω resistor is very nearly 12 V (we assume the resistance of the inductor is small). Just after the switch is thrown, the current is nearly the same, maintained by the inductor, but this current is diverted through the 1200Ω resistor; thus, the voltage across the 1 200Ω resistor is much more than 12 V, about 1200V, because the same current in the 12Ω resistor now passes through a resistor 100 times as large. By Kirchhoff's loop rule, the voltage across the coil is larger still.

(84) **(4).** If length of the wire between the two bridges is ℓ, the frequency of vibration,

$n = \dfrac{1}{2\ell} \sqrt{\dfrac{T}{m}}$ $\therefore$ $n \propto \dfrac{1}{\ell}$

Therefore, $n_1 : n_2 : n_3 = \dfrac{1}{\ell_1} : \dfrac{1}{\ell_2} : \dfrac{1}{\ell_3}$

$n_1 : n_2 : n_3 = \dfrac{1}{\dfrac{114 \times 1}{8}} : \dfrac{1}{\dfrac{114 \times 3}{8}} : \dfrac{1}{\dfrac{114 \times 4}{8}}$

or $n_1 : n_2 : n_3 = 8 : \dfrac{8}{3} : 2$

or $n_1 : n_2 : n_3 = 72, 24, 18$

(85) **(2).** In the sum and difference method of vibration magnetometer, $\dfrac{M_1}{M_2} = \dfrac{T_2^2 + T_1^2}{T_2^2 - T_1^2}$

Here, $T_1 = \dfrac{1}{n_1} = \dfrac{1}{6} s$, $T_2 = \dfrac{1}{n_2} = \dfrac{1}{2} s$

$\dfrac{M_1}{M_2} = \dfrac{\dfrac{1}{4} + \dfrac{1}{36}}{\dfrac{1}{4} - \dfrac{1}{36}} = \dfrac{\dfrac{9+1}{36}}{\dfrac{9-1}{36}} = \dfrac{10}{8} = \dfrac{5}{4}$

$M_1 : M_2 = 5 : 4$

(86) **(2).** Apparent frequency, $n' = n\left(\dfrac{v}{v + v_s}\right)$

v = velocity of sound, v_s = velocity of source

$\therefore \quad n' = 300\left(\dfrac{332}{332 + 30}\right) = 275$ Hz

(87) **(1).** $\dfrac{f_o}{f_e} = 10$; $f_o + f_e = 1.1$;

$f_o = 100$ cm and $f_e = 10$ cm
Final magnification

$= f_o\left(\dfrac{1}{D} + \dfrac{1}{f_e}\right) = 100\left[\dfrac{1}{25} + \dfrac{1}{10}\right] = 14$

(88) **(3).** $I = Mv_{cm}$; $I(h + r) = \dfrac{7}{5} Mr^2\omega$

{Angular impulse equation about point of

contact}. $v_{cm} = \omega r$; $\dfrac{h}{r} = \dfrac{2}{5}$

(89) **(4).** Here, $\eta_1 = 1 - \dfrac{T_2}{T_1}$

or $\quad 0.25 = 1 - \dfrac{T_2}{T_1} \Rightarrow \dfrac{1}{4} = 1 - \dfrac{T_2}{T_1}$

$\dfrac{T_2}{T_1} = 1 - \dfrac{1}{4} = \dfrac{3}{4}$ .... (i)

According to question,
$\eta_2 = 2\eta_1$, and $T_2 = T_2 - 58°C$

$2 \times \dfrac{1}{4} = 1 - \dfrac{(T_2 - 58°C)}{T_1} \Rightarrow 1 - \dfrac{1}{2} = \dfrac{T_2 - 58°C}{T_1}$

$\dfrac{1}{2} = \dfrac{T_2}{T_1} - \dfrac{58°C}{T_1} \Rightarrow \dfrac{3}{4} - \dfrac{1}{2} = \dfrac{58}{T_1} \Rightarrow T_1 = 232°C$

(90) **(1).** Clearly it is open organ pipe

$\dfrac{4v}{2\ell} = \dfrac{5v}{2\ell} - 33 \Rightarrow \dfrac{v}{2\ell} = 33$

$\Rightarrow \quad 2\ell = 10 \Rightarrow \ell = 5$

(91) **(1).** **(92)** **(3).**
(93) **(2).** **(94)** **(2).**
(95) **(1).** **(96)** **(4).**
(97) **(3).** **(98)** **(3).**

(99) **(3).** **(100)** **(2).**
(101) **(3).** **(102)** **(1).**
(103) **(2).** **(104)** **(3).**
(105) **(4).** **(106)** **(2).**
(107) **(1).** **(108)** **(2).**
(109) **(4).** **(110)** **(4).**
(111) **(3).** **(112)** **(2).**
(113) **(2).** **(114)** **(2).**
(115) **(2).** **(116)** **(4).**
(117) **(4).**

(118) **(2).** Deuteromycetes are commonly known as imperfect fungi because only the asexual or vegetative stages of these fungi are known. The deuteromycetes reproduce only by asexual spores known as conidia. The mycelium is septate and branched. Some members are saprophytes or parasites while a large number of them are decomposers of litter and help in mineral cycling. Some examples are *Alternaria, Colletotrichum* and *Trichoderma*.

(119) **(4).** **(120)** **(4).**
(121) **(4).**

(122) **(3).** Endosperm is the food laden tissue which is meant for nourishing the embryo in seed plants. In gymnosperms, it represents the female gametophyte and thus is haploid(n). In angiosperms, the endosperm is a special tissue which is formed as a result of fusion of a male gamete with diploid secondary nucleus of the central cell (vegetative fertilisation or triple fusion). The fusion product is primary endosperm cell having a triploid (3n) endosperm nucleus.

(123) **(4).** **(124)** **(2).**
(125) **(1).** **(126)** **(1).**
(127) **(3).** **(128)** **(3).**
(129) **(2).** **(130)** **(3).**

(131) **(4).** The diagram shows that one section of the chromosome has been flipped or inverted. This type of chromosomal mutation is an inversion.

(132) **(4).** Genome marker maps are assembled using gene linkage information. Gene linkage occurs when genes are located next to each other in the genome and do not assort independently.

(133) (4). The vascular cambium and the cork cambium are forms of lateral meristem, which increase the thickness (secondary growth) of woody plants. The apical meristem increases the length of a plant (primary growth) only.

(134) (4). Pituitary hormones cause a follicle in the ovary to mature and release an egg. The maturing follicle secretes estrogen and progesterone, causing the uterine lining to build up. After the egg is released, the follicle forms a corpus luteum, which disintegrates if pregnancy does not occur. This loss of the corpus luteum causes estrogen and progesterone levels to drop, which in turn causes the uterine lining to be shed.

(135) (3). The individual indicated exhibits the trait, but neither of her parents do. This indicates that the trait is due to recessive alleles and that the daughter must have inherited two copies of this allele.

(136) (3). Cyanobacteria are prokaryotes, and so do not contain membrane-bound organelles such as chloroplasts or a nucleus. All prokaryotes, however, do contain ribosomes.

(137) (1). B cells and immature T cells are produced in the marrow of the long bones, such as the femur or thigh bone.

(138) (3). The ATP synthase enzyme, present in membranes, uses the power of hydrogen ions moving down their concentration gradient to add a phosphate group to ADP, producing ATP.

(139) (2). The citric acid cycle breaks down glucose, producing carbon dioxide (II). The electron transport chain uses oxygen as a final electron acceptor (III). Most of the ATP in respiration (I) is produced by chemiosmosis, the movement of hydrogen ions down their concentration gradient to power ATP synthase.

(140) (4). Carbon dioxide is converted to a three-carbon sugar as part of the Calvin cycle, or dark reactions, which take place in the fluid stroma of the chloroplast. The remaining answer choices take place in the light reactions of photosynthesis, which take place in the thylakoids of the chloroplast.

(141) (4). Urey and Miller simulated the conditions found early in Earth's history (reducing atmosphere, water vapour, lightning) and showed that organic molecules, such as amino acids, could form spontaneously. Their results support the Oparin hypothesis that life on Earth originated from molecules that formed in such conditions.

(142) (4). A long loop of Henle allows more water to be removed from the filtrate before it is excreted as urine. This causes the urine to be even more hyperosmotic and conserves water.

(143) (4). Presence of photorespiration is considered as a wasteful and energy consuming process in crop plants which ultimately leads to reduction in final yield of crops. It is estimated that during C_3 photosynthesis, upto 50% of the CO_2 fixed may have to pass through photorespiratory process, thereby resulting in considerable decrease in photosynthetic productivity.
In C_3 plants,k there is a loss of photosynthetic activity on account of photorespiration which is absent in C_4 plants and hence they have better productivity.

(144) (1). Directional selection results in a shift in the mean value for a continuous trait, such as body size, with no change in the variation among individuals. The curve shifts to the left or right without changing shape.

(145) (2). Auxins promote root initiation at a concentration which otherwise is inhibitory for growth of intact root. Auxins are often employed for inducing flowering in litchi and pineapple. Application of auxins to unpollinated pistils make them develop into seedless fruits or parthenocarps.

(146) (1). The chemiosmotic coupling hypothesis of oxidative phosphorylation proposed by Mitchell, explains the process of ATP formation and states that it is linked to development of a proton gradient across the mitochondrial membrane. ATP synthase, required for ATP synthesis is located in F_1 particles present in the inner mitochondrial membrane and becomes active only when there is high concentration of proton on F_0 side as compared to F_1 side.

The flow of proton through F_0 channel induces F_1 particle to function as ATP synthase and the energy of proton gradient produces ATP by attaching a phosphate radical to ADP.

(147) (4). A hiccup can be described as a jerky incomplete inspiration. It is an involuntary contraction of the diaphragm that may repeat several times per minute. In medical terms, it is known as synchronous diaphragmatic flutter (SDF).

(148) (1).

(149) (3). a - Troponin, **b** - Tropomyosin, **c** - F-actin

Two filaments of protein tropomyosin run close to F-actins throughout its length.

A complex protein troponin is distributed at regular intervals on the tropomyosin. In the resting state, a subunit of troponin masks the active binding sites for myosin on the actin filaments.

(150) (2). Parathyroid hormone (PTH) stimulates the reabsorption of Ca^{2+} by renal tubules and increases Ca^{2+} absorption from digested food. It means PTH increases the blood Ca^{2+} level. Old aged persons have weak immunity because thymus is degenerated in old individuals resulting in a decreased production of thymosin. Oestoporosis in women occurs due to decreased level of oestrogen.

(151) (2). Double fertilisation is the fusion of two male gametes brought about by a pollen tube fusing to two different cells of the same female gametophyte in order to produce two different structures. It is found only in angiosperms. In angiosperms, the pollen tube bursts open in one of the two synergids to release the two male gametes. One male gamete fuses with the egg or oosphere to form a diploid zygote or oospore. It is called generative fertilisation. The second male gamete descends down and fuses with the diploid secondary nucleus of the central cell to form a triploid primary endosperm cell. It is known as vegetative fertilisation. Thus, after double fertilisation, a mature angiospermous ovule contains one diploid cell (zygote) and one triploid cell (endosperm). The haploid cells of the ovule such as antipodals and synergids degenerate after fertilisation.

(152) (2).

(153) (1). All the options are examples of intra-uterine contraceptive devices (IUCDs). These are plastic or metal objects which are inserted by doctors in the uterus through vagina. Lippe's loop is non-medicated IUCD. CuT and Multiload are copper releasing IUCDs, which suppress motility and fertilising capacity of sperms. Progestasert is a hormone releasing IUCD which makes the uterus unsuitable for implantation and cervix hostile to the sperms.

(154) (1). During follicular phase (proliferative phase), follicle stimulating hormone (FSH) secreted by anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete estrogens. Corpus luteum secretes large amount of progesterone in secretory phase. Both LH & FSH attain a peak level in the ovulatory phase.

(155) (1). Taxonomical hierarchy shows arrangement in ascending order.

Species → Genus → Family → Order → Division → Kingdom

(156) (3). Macrophages are cells produced by differentiation of monocytes in tissues. They are present throughout the body with large numbers in the lymph nodes, bone marrow and spleen. These are specialized phagocytic cells that attack foreign substances.

(157) (3).

(158) (4). The biodiversity of bryophytes is less than that of angiosperms. Bryophytes are plants that can live in soil but are dependent on water for sexual reproduction.

Angiosperms are much advanced plant species which consist of male sex organ (stamen) and female sex organ (pistil) borne in a flower.

(159) (2).

(160) (2). The various greenhouse gases are CO_2 (warming effect 60%), CH_4 (effect 20%), chlorofluorocarbons or CFCs (14%) and nitrous oxide (N_2O, 6%). Others of minor significance are water vapour and ozone.

(161) (4). *Aspergillus niger* caries out fermentation to form citric acid. Fungus *Trichoderma polysporum* produces cyclosporin through fermentative activity. It has antifungal, anti-inflammatory and immunosuppressive properties. *Saccharomyces cerevisiae* (baker's yeast/brewer's yeast) is used in production of bread / alcohol. Methanogenic bacteria carry out microbial decomposition of organic matter and aids in gobar gas production.

(162) (4). *Streptomycin* is obtained from *Streptomyces griseus*. It is found useful in meningitis, pneumonia, tuberculosis and local infections.

(163) (4). Oxygen serves as the final electron and hydrogen acceptor to form water. The end goal of cellular respiration and oxidative phosphorylation is the production of ATP.

(164) (2)   **(165)** (3)

(166) (2)

(167) (1). Roots in *Cycas* are of two types - normal and coralloid roots. Coralloid roots are irregular, negatively geotropic, dichotomously branched coral like roots which do not possess root hair and root caps. Coralloid roots have a symbiotic association with blue-green algae like *Nostoc* and *Anabaena* species.

(168) (3). Genera like *Selaginella* and *Salvinia* which produce two kinds of spores, macro (large) and micro (small) spores, are known as heterosporous pteridophytes *Lycopodium* and *Equisetum* are homosporous pteridophytes i.e., they produce only one type of spores.

(169) (4). Liver fluke has an incomplete alimentary canal.

(170) (4). Retrogressive metamorphosis occurs in Urochordates (e.g., *Herdmania, Ascidia, Doliolum*, etc.), in which better developed (advanced) larva changes to less developed (primitive) adult.

(171) (4). In poriferans, the body is supported by a skeleton made up of spicules or spongin fibres. *Sycon* and *Spongilla* are examples of poriferans, whereas *Adamsia* is a coelenterate. In platyhelminths, specialised cells called flame cells help in excretion. *Taenia* and *Fasciola* are platyhelminths whereas *Ancylostoma* is an aschelminth. In molluscs, mouth contains a file-like rasping organ for feeding called radula. *Dentalium* and *Octopus* are molluscs whereas *Ophiura* is an echinoderm. Arthropods have jointed appendages. *Limulus, Apis* and *Laccifer* all three are arthropods.

(172) (2). Fasciculated root is a type of adventitious root. In this case, roots are swollen which occur in clusters from lower nodes of stems, e.g., *Asparagus, Dahlia*, etc.

(173) (3). Nucleus contains nucleoli and chromatin network. Chromatin contains DNA and some basic proteins called histones, some non-histone proteins and also RNA.

(174) (4). Secondary metabolites are derivatives of primary metabolites which have no direct function in growth and development of plants. These compounds are accessory rather than central to the functioning, e.g., arbrin, cellulose, gums, diterpenes, carotenoids, curcumin, rubber etc. Arginine, tyrosine, glycine, serine and phenylalanine are amino acids, which are primary metabolites.

(175) (3). Carotenoids are a group of yellow, brown to reddish pigments. These are of two types - carotenes and xanthophylls, and serve as accessory photosynthetic pigments. Abrin and ricin are natural protein toxins isolated from plant seeds i.e., they are phytotoxins. Concanavalin A is a lectin (carbohydrate-binding protein) originally extracted from the jack-bean, *Canavalia ensiformis*. Morphine and codeine are the alkaloids derived from opium, and are called as opioid narcotics.

(176) (1). The "beads-on-a-string" structure is seen in electron microscope of isolated metaphase chromosomes. The chromonema form the gene bearing portions of the chromosome. Basically chromonema is made up of nucleosome chains. Nucleosome chain gives a beads on string appearance under electron microscope. Nucleosome is the fundamental packaging unit in eukaryotic chromosomes.

(177) (2). Tobacco Mosaic Virus (TMV) contains single stranded RNA (ss RNA) as genetic material.

(178) (2). *Saccharomyces cerevisae* or yeast is a unicellular organism that lacks chlorophyll and shows saprotrophic mode of nutrition.

It is eukaryotic having chitinous cell wall. All these features are assigned to fungi, hence yeast is included in Kingdom Fungi.

(179) (2).

(180) (4). Unlike *Cycas* and *Pinus, Gnetum* shows the occurrence of vessel elements and the complete absence of archegonia in female gametophyte. Thus, *Gnetum* shows affinities with angiosperms. Besides its resembles with angiosperms in several other aspects like presence of tetrasporic embryo sac, free nuclear divisions in the embryo sac, two cotyledonous embryo, etc.