

# Thomas Tutorials

Date :  
Time : 03:00:00

NEET – 2016  
PCB

TEST ID: 02  
Marks : 720

## : ANSWER KEY :

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

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## : HINTS AND SOLUTIONS :

### Single Correct Answer Type

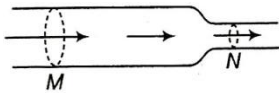
- 2 **(d)**  
 $CV^2 = \text{Energy}$   
The dimensional formula is  $[ML^2T^{-2}]$ .
- 3 **(c)**  
 $\frac{1}{2}gt^2 - \frac{1}{2}g(t-2)^2 = 40$   
or  $\frac{1}{2} \times 10(2t-2)(2) = 40$  or  $2t-2 = 4$  or  
 $t = 3s$
- 4 **(c)**  
Suppose  $t_0$  be the time to reach maximum height in the absence of air resistance, then from the relation  
 $t_0 = \frac{u \sin \alpha}{g} \dots(i)$   
When  $a$  is retardation caused by air resistance, then total retardation will be  $g+a$   
 $t_1 = \frac{u \sin \alpha}{g+a} = \frac{u \sin \alpha}{g + (\frac{1}{10})g} = \frac{10u \sin \alpha}{11g} \dots(ii)$   
Now from equations (i) and (ii), we have  
 $\therefore t_1 = \frac{10}{11}t_0 \Rightarrow t_0 - t_1 = t_0 - \frac{10}{11}t_0 = \frac{1}{11}t_0$   
 $= 0.09 t_0$   
 $\therefore$  Time will decrease by 9%
- 5 **(a)**  
The velocity should be such that the centripetal acceleration is equal to the acceleration due to gravity *ie*,  $v^2/R = g$  or  $v = \sqrt{gR}$
- 6 **(a)**  
Acceleration  
 $a = \frac{F}{m} = \frac{4}{20} = \frac{1}{5} \text{ms}^{-2}$   
Distance covered by body in 3rd second  
 $= \frac{1}{2} \times \frac{1}{5} \times (2 \times 3 - 1) = \frac{5}{10} = \frac{1}{2} \text{m}$   
 $\therefore W = 4 \times \frac{1}{2} = 2J$
- 7 **(d)**  
Momentum of the piece  
 $p = \sqrt{p_x^2 + p_y^2}$

$$= \sqrt{(16)^2 + (12)^2}$$

$$= 20$$

$$v = \frac{p}{m} = \frac{20}{0.5} = 40 \text{ m/s}$$

- 8 **(d)**  
Due to elastic collision of bodies having equal mass, their velocities get interchanged
- 9 **(c)**  
 $K = \frac{L^2}{2I} = \frac{K_1}{K_2} = \frac{L_1^2}{L_2^2} \Rightarrow \frac{K_1}{K_2} = \left(\frac{100}{110}\right)^2 = \frac{100}{121}$   
 $\Rightarrow \frac{100}{K^2} = \frac{100}{121} \Rightarrow K_2 = 121 = 100 + 21$   
Increase in kinetic energy = 21%
- 10 **(a)**  
As we know that at the highest point, the shell has only the horizontal component of velocity which is  $v \cos \theta$ . If  $u$  be the velocity of second exploded piece, then applying conservation of linear momentum along  $x$ -axis  
 $\therefore 2mv \cos \theta = -mv \cos \theta + mu$   
Or  $u = 3v \cos \theta$
- 11 **(d)**  
When earth moves round the sun then according to Kepler's second law, the radius vector drawn from the sun to earth, sweeps out equal areas in equal time, *ie*, its areal velocity (or the area swept out by it per unit time) is constant. While in such motion, angular velocity, kinetic energy and potential energy change.
- 12 **(c)**  
 $W = \frac{YAl^2}{2L} = \frac{2 \times 10^{10} \times 10^{-6} \times (10^{-3})^2}{2 \times 50 \times 10^{-2}}$   
 $= 2 \times 10^{-2} J$
- 13 **(c)**  
The velocity of flow will increase if cross-section decreases and *vice-versa*



$$\text{ie, } A_1 v_1 = A_2 v_2$$

$$\text{or } A_v = \text{constant}$$

Therefore, the rate of liquid flow will be greater at  $N$  than at  $M$ .

14 (c)

If  $V$  is the volume of sphere and  $\rho$  is its density then

$$V \rho = (V/2) \times 0.8 + (V/2) \times 13.6$$

$$= 7.2 V$$

$$\text{Or } \rho = 7.2 \text{ gcc}^{-1}$$

15 (a)

$\frac{C}{5} = \frac{F-32}{9} \Rightarrow C = \left(\frac{5}{9}\right) F - \frac{20}{3}$ . Hence graph between  $^{\circ}\text{C}$  and  $^{\circ}\text{F}$  will be a straight line with positive slope and negative intercept

16 (c)

For isochoric process, internal energy

$$\Delta U = n C_V \Delta T = 420 \text{ J}$$

$$\text{Molar specific heat } C_V = \frac{\Delta U}{n \Delta T}$$

$$= \frac{420}{2 \times 10} = 21 \text{ JK}^{-1} \text{ mol}^{-1}$$

17 (d)

Change in internal energy ( $\Delta U$ ) depends upon initial and final state of the function while  $\Delta Q$  and  $\Delta W$  are path dependent

18 (a)

According to Newton's law of cooling, rate of heat loss Temperature difference

$$\therefore \frac{R_2}{R_1} = \frac{40 - 20}{80 - 20} = \frac{1}{3}$$

$$R_2 = \frac{R_1}{3} = \frac{45}{3} = 15 \text{ cal s}^{-1}$$

19 (b)

$$y = 4 \cos^2\left(\frac{t}{2}\right) \sin 1000 t$$

$$\Rightarrow y = 2(1 + \cos t) \sin 1000 t$$

$$\Rightarrow y = 2 \sin 1000 t + 2 \cos t \sin 1000 t$$

$$\Rightarrow y = 2 \sin 1000 t + \sin 999 t + \sin 1001 t$$

It is a sum of three S.H.M.

20 (a)

As the girl stands up, the effective length of pendulum decreases due to the reason that the centre of gravity rises up. Hence, according to

$$T = 2\pi \sqrt{\frac{l}{g}}$$

$T$  will decrease.

21 (a)

No beat is heard, because frequency received by listener directly from the source and that received on reflection from the wall is same

$$= \frac{256 \times 330}{330 - 5} \text{ Hz}$$

23 (a)

When a lamp is connected to D.C. line with a capacitor. It will form an open circuit. Hence, the lamp will not glow

24 (d)

When two conductors of capacities  $C_1$  and  $C_2$  and potentials  $V_1$  and  $V_2$  are connected by a conducting wire, charge redistributes in these conductors till potential of both the conductors become equal, known as common potential.

$$\text{Common potential} = \frac{\text{net charge}}{\text{total capacity}}$$

$$\text{ie } V = \frac{q_1 + q_2}{C_1 + C_2}$$

$$\text{or } V = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

26 (c)

$$\text{Strength} = 5 \times 18 = 90 \text{ AH}$$

29 (a)

Horizontal component  $B_H = B \cos \phi$

$$\text{Total intensity of earth's magnetic field } B = \frac{B_H}{\cos \phi}$$

$$= \frac{1.8 \times 10^{-5}}{\cos 30^\circ} = \frac{1.8 \times 10^{-5}}{\sqrt{3}/2} = 2.08 \times 10^{-5} \text{ Wb/m}^2$$

30 (d)

$$\text{From figure } B_{\text{net}} = \sqrt{B_a^2 + B_e^2}$$

$$= \sqrt{\left(\frac{\mu_0}{4\pi} \cdot \frac{2M}{d^3}\right)^2 + \left(\frac{\mu_0}{4\pi} \cdot \frac{M}{d^3}\right)^2}$$

$$= \sqrt{5} \cdot \frac{\mu_0}{4\pi} \cdot \frac{M}{d^3} = \sqrt{5} \times 10^{-7} \times \frac{10}{(0.1)^3}$$

$$= \sqrt{5} \times 10^{-3} \text{ tesla}$$

31 (a)

The inductances are in parallel  $\Rightarrow L_{eq} = \frac{L}{3} = \frac{3}{3} = 1 \text{ H}$

33 (c)

(i) In a circuit having  $C$  alone, the voltage lags the current by  $\frac{\pi}{2}$ .

(ii) In a circuit containing  $R$  and  $L$ , the voltage leads the current by  $\frac{\pi}{2}$ .

(iii) In  $L - C$  circuit, the phase difference between current and voltage can have any value between 0 to  $\frac{\pi}{2}$  depending on the values of  $L$  and  $C$ .

(iv) In a circuit containing  $L$  alone, the voltage leads the current by  $\frac{\pi}{2}$ .

34 (c)

Equation second shows that the electromagnetic wave travels along the positive  $x$ -axis

35 (c)

$$\frac{1}{-30} + \frac{1}{v} = \frac{1}{30}$$

$$\text{Or } \frac{1}{v} = \frac{2}{30} = \frac{1}{15}$$

$$\text{Or } v = 15 \text{ cm}$$

36 (b)

For total internal reflection from glass-air interface, critical angle  $C$  must be less than angle of incidence.

ie  $C < i$

or  $C < 45^\circ$  ( $\because \angle i = 45^\circ$ )

but  $n = \frac{1}{\sin C} \Rightarrow C = \sin^{-1}\left(\frac{1}{n}\right)$

$$\therefore \sin^{-1}\left(\frac{1}{n}\right) < 45^\circ$$

$$\Rightarrow \frac{1}{n} < \sin 45^\circ$$

$$\Rightarrow n > \frac{1}{\sin 45^\circ}$$

$$\Rightarrow n > \frac{1}{\left(\frac{1}{\sqrt{2}}\right)}$$

$$\Rightarrow n > \sqrt{2}$$

37 (c)

According to Doppler's principle  $\lambda' = \lambda \sqrt{\frac{1-v/c}{1+v/c}}$  for

$$v = c$$

$$\lambda' = 5500 \sqrt{\frac{(1-0.8)}{1+0.8}} = 1833.3$$

$$\therefore \text{Shift} = 5500 - 1833.3 = -3666.7$$

38 (a)

$$\text{By using } \lambda_{electron} = \frac{h}{m_e v} \Rightarrow v = \frac{h}{m_e \lambda_e}$$

$$= \frac{6.6 \times 10^{-34}}{9.1 \times 10^{-31} \times 10^{-10}} = 7.25 \times 10^6 \text{ m/s}$$

40 (c)

The wavelength of different members of Balmer series are given by

$$\frac{1}{\lambda} = R_H \left[ \frac{1}{2^2} - \frac{1}{n_i^2} \right], \text{ where } n_i = 3, 4, 5, \dots$$

The first member of Balmer series ( $H_\alpha$ )

corresponds to  $n_i = 3$ . It has maximum energy and hence the longest wavelength. Therefore, wavelength of  $H_\alpha$  line (or longest wavelength)

$$\frac{1}{\lambda_1} = R_H \left[ \frac{1}{2^2} - \frac{1}{3^2} \right]$$

$$= 1.097 \times 10^7 \left( \frac{5}{36} \right)$$

$$\text{or } \lambda_1 = \frac{36}{5 \times 1.097 \times 10^7} = 6.563 \times 10^{-7} \text{ m}$$

$$n = 6563 \text{ \AA}$$

The wavelength of the Balmer series limit

corresponds to  $n_i = \infty$  and has got shortest wavelength.

Therefore, wavelength of Balmer series limit is given by

$$\frac{1}{\lambda_\infty} = R_H \left[ \frac{1}{2^2} - \frac{1}{\infty^2} \right] = 1.097 \times 10^7 \times \frac{1}{4}$$

$$\text{or } \lambda_\infty = \frac{4}{1.097 \times 10^7} = 3.646 \times 10^{-7} \text{ m}$$

$$= 3646 \text{ \AA}$$

Only 4861 \AA is between the first and last line of the Balmer series.

42 (c)

When there is an excess of protons in the nucleus and it is not energetically possible to emit an  $\alpha$  - particle,  $\beta^+$  decay occurs.

Resulting in reducing atomic numbers by 1. New atomic number =  $Z - 1$ , mass number =  $A$ .

Gamma ray emission occurs with  $\beta^+$  emission.

Since, gamma rays have no charge or mass their emission does not change the chemical

composition of the atom.

Hence atomic number =  $Z - 1$ ,

mass number =  $A$

43 (c)

Comparing the given equation with standard equation

$$i = AT^2 e^{qv/kT} \Rightarrow V_L = \frac{kT}{V}$$

44 (c)

An antenna is a metallic structure used to radiate or receive EM waves

45 (b)

Multi-mode step index fibers are less expensive and easy to construct

46 (a)

$$\text{Number of atoms in 40 kg} = \frac{40 \times 10^3 \text{ g}}{6.644 \times 10^{-23} \text{ g}}$$

$$(\because \text{Weight of an atom} = 6.644 \times 10^{-23} \text{ g}) \\ = 6.02 \times 10^{26}$$

$\therefore$  Number of gram atoms of element in 40 kg

$$= \frac{6.02 \times 10^{26}}{6.02 \times 10^{23}} = 10^3$$

47 (d)

$$\text{Number of moles of oxygen} = \frac{80}{16}$$

$$\text{Number of atoms of oxygen} = \frac{80}{16} \times N_0 \times 2$$

$$= 5 \times N_0 \times 2$$

$$\text{Number of moles in 5 g of hydrogen} = \frac{5}{1}$$

$$\text{Number of atoms in 5 g of hydrogen} = 5 \times N_0 \times 2$$

Hence, the number of atoms in 80 g of oxygen is equal to the number of atoms in 5 g of hydrogen.

49 (b)

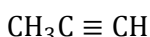
Positron is as heavy as an electron.

50 (a)

In a period, from left to right basic character of oxides decreases, thus  $\text{Na}_2\text{O}$  is most basic

52 (d)

In propyne there are 2  $\pi$  - bonds and six sigma bonds.



53 (c)

Rate of diffusion depends upon the molecular masses of gases. Therefore, the gases which have equal molecular mass, have equal rates of diffusion.

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$$

$$\text{Molecular mass of } \text{N}_2\text{O} = 28 + 16 = 44$$

$$\text{Molecular mass of } \text{CO}_2 = 12 + 32 = 44$$

$$\therefore \frac{r_{\text{N}_2\text{O}}}{r_{\text{CO}_2}} = 1$$

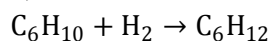
$$\therefore r_{\text{N}_2\text{O}} = r_{\text{CO}_2}$$

54 (b)

$$\text{Given: (i) } \text{H}_2 + \frac{1}{2} \text{O}_2 \rightarrow \text{H}_2\text{O}; \Delta H = -241 \text{ kJ}$$

$$\text{(ii) } \text{C}_6\text{H}_{10} + \frac{17}{2} \text{O}_2 \rightarrow 6\text{CO}_2 + 5\text{H}_2\text{O}; \Delta H = -3800 \text{ kJ}$$

$$\text{(iii) } \text{C}_6\text{H}_{12} + 9\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}; \Delta H = -3920 \text{ kJ for the reaction}$$



[It is infact Eq.(i)+Eq.(ii)-Eq.(iii)]

$$\text{Thus, } \Delta H = -241 - 3800 - (-3920) = -121 \text{ kJ}$$

55 (a)

$$V_1 = 100 \text{ mL}$$

$$V_2 = 250 \text{ mL}$$

$$\text{Pressure } p = 2 \text{ atm or } 2 \times 1.01 \times 10^5 \text{ Nm}^{-2}$$

Work done by the gas

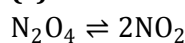
$$W = p\Delta V \text{ or } p(V_2 - V_1)$$

Put the value in given formula

$$W = 2 \times 1.01 \times 10^5 (0.250 \times 10^{-3} - 0.100 \times 10^{-3})$$

$$= 2 \times 1.01 \times 10^5 \times 0.15 \times 10^{-3} \\ = 30.30 \text{ J}$$

56 (c)



$$1 \quad 0 \quad \text{initially}$$

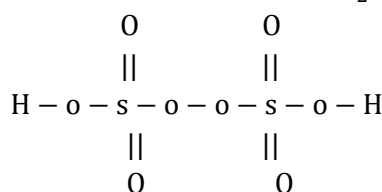
$$(1 - \alpha) \quad 2\alpha \quad \text{at equilibrium}$$

$$\text{Total moles at equilibrium} = (1 - \alpha) + 2\alpha$$

$$= 1 + \alpha$$

57 (c)

The chemical structure of  $\text{H}_2\text{S}_2\text{O}_8$  is as follows



$$2 \times (+1) + 2 \times x + 6 \times (-2) + 2 \times (-1) = 0$$

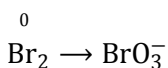
$$\text{for H} \quad \text{for S} \quad \text{for O} \quad \text{for O-O}$$

$$+2 + 2x - 12 - 2 = 0$$

$$2x = +12$$

$$x = +6$$

- 58 (a) Bromine has zero oxidation state because it is in free state.



Let the oxidation number of Br in  $\text{BrO}_3^-$  is  $x$ .

$$x + (-2 \times 3) = -1$$

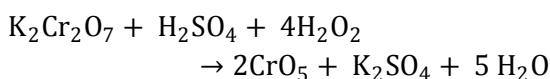
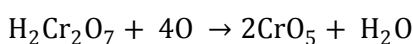
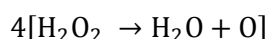
$$x + (-6) = -1$$

$$x = +6 - 1$$

$$x = +5$$

So, oxidation number changes from 0 to +5.

- 59 (c)  $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{H}_2\text{Cr}_2\text{O}_7$



Acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  is oxidised to blue peroxide of chromium ( $\text{CrO}_5$ ) which is soluble in ether and produces blue coloured solution.

- 60 (d) Electropositive character increases as we move down the group because of the increase in atomic size, atoms have more tendency to lose electrons. Hence, Cs is most electropositive element in alkali metals.

- 61 (b) C-60 is called Buckminster fullerene. It is discovered in 1990 as a constituent of soot. Its shape is like a soccer ball.

- 63 (a) The number of stereoisomers =  $2^n$   
(Here,  $n$  = chiral carbon atom)

Thus, number of stereoisomers =  $2^3 = 8$

- 64 (a) The reaction is as follows

- 66 (c) The average residence time of NO is 4 days

- 67 (c)

When coordination number is eight, the radius ratio  $\frac{r^+}{r^-}$  lies between 0.732 to 1.000.

- 68 (c)

Radius ratio	Coordination no	Example
0.155 - 0.225	3	$\text{B}_2\text{O}_3$
0.225 - 0.414	4	ZnS
0.414 - 0.732	6	NaCl
0.732 - 1	8	CsCl

In ionic solids the shape of crystal depends upon relative size of ions.

Given,  $r_{c^+}(\text{Rb}^+) = 1.46 \text{ \AA}$

$r_{a^-}(\text{I}^-) = 2.16 \text{ \AA}$

$$\therefore \frac{r_{c^+}}{r_{a^-}} = \frac{1.46}{2.16} = 0.676$$

$\therefore$  It will have coordination number 6 and structure will be same as of NaCl.

- 69 (a)

Relative lowering of vapour pressure = mole fraction of solute (**Raoult's law**)

$$\frac{p - p_s}{p} = x_2$$

$$\frac{p - p_s}{p} = \frac{wM}{mW}$$

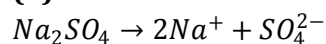
$$0.0125 = \frac{wM}{mW}$$

$$\text{Or } \frac{w}{mW} = \frac{0.0125}{18} = 0.00070$$

$$\text{Hence, molality} = \frac{w}{mW} \times 1000$$

$$= 0.0007 \times 1000 = 0.70$$

- 70 (b)



van't Hoff factor for  $\text{Na}_2\text{SO}_4 = 3$

$$\Delta T_f = i \times k_f \times m$$

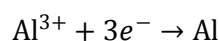
$$= 3 \times 1.86 \times 0.01$$

$$\left[ \because m = \frac{0.01}{1} = 0.01 \right]$$

$$= 0.0558 \text{ K}$$

- 71 (c)

At cathode,



$$E_{\text{Al}} = \frac{27}{3} = 9$$

$$w_{\text{Al}} = E_{\text{Al}} \times \text{no. of faradays}$$

$$= 9 \times 0.1 = 0.9 \text{ g}$$

- 72 (c)

$$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{693} = 0.001 \text{ s}^{-1}$$

73 (c)

The rate of reaction is

$$\text{rate} = k[\text{NO}]^2[\text{O}_2]$$

When the volume is reduced to  $\frac{1}{3}$ , the concentration of each reactant is increased by 3 times

$$\text{rate}' = k[3\text{NO}]^2[3\text{O}_2]$$

$$= 27k[\text{NO}]^2[\text{O}_2]$$

$$\frac{\text{rate}'}{\text{rate}} = \frac{27k[\text{NO}]^2[\text{O}_2]}{k[\text{NO}]^2[\text{O}_2]}$$

$$\text{rate}' = 27 \text{ rate}$$

74 (b)

A catalyst lowers the activation energy and increases the rate of reaction. It is not consumed during reaction.

75 (c)

Wolframite is ferrous tungstate ( $\text{FeWO}_4$ ) which is magnetic in nature

77 (c)

Helium is not used to produce and sustain powerful superconducting magnets. All others are the uses of helium.

78 (a)

$\text{Zn}^{2+}$  ( $Z=30$ ):  $[\text{Ar}]3d^{10}4s^0$ ; zero unpaired electron.

Hence, its magnetic moment is zero.

$$\mu = \sqrt{n(n+2)} = \sqrt{0(0+2)}$$

$$\mu = 0$$

79 (b)

$\text{HgCl}_2$  compound is easily volatile. They are insoluble in water and soluble in acids.

80 (d)

One mole of  $X$  gave depression corresponding to 2 moles of particles, *i.e.*, on ionisation  $X$  gives 2 moles of ions, thus it contains only 1 ion outside the coordination sphere and its structural formula is  $[\text{Cr}(\text{H}_2\text{O})_4\text{Br}_2]\text{Cl} \cdot \text{H}_2\text{O}$  while  $Y$  gives 3 moles of ions, thus it contains two ions outside the coordination sphere and its structural formula is  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Br}_2$

82 (b)

The order of increasing acidic strength is

$p$ -methyl phenol < phenol <  $m$ -nitrophenol <  $p$ -nitrophenol

86 (a)

On direct nitration of aniline, lone pair of electrons present at nitrogen atom will accept proton from the nitrating mixture to give anilium ion which is *meta* directing.

87 (b)

Fats are also known as triglycerides. These triglycerides are the trimesters of fatty acid with glycerol. So, the characteristics feature of fat is **ester group**.

88 (b)

In addition homopolymers such as Teflon, empirical formula resembles with monomer.

89 (a)

Cellulose acetate has been used in the manufacture of non inflammable photographic films.

90 (c)

Antipyretic drugs reduce fever. Analgesic relieves in pain, antibiotics act against bacterial infections while tranquilisers are used against mental disorders.

91 (c)

Bentham and Hooker did not know the affinities of the families placed under Ordines Anomali and these families were tentatively grouped together.

92 (c)

A species is a group of organisms that interbreed freely in their natural setting and do not interbreed with other population. In simple words, members of one species are reproductively isolated from members of other species. Species is the real basic unit for understanding taxonomy as well as evolution.

93 (c)

**Hooker** proposed the concept of genus.

94 (b)

Bacteria are grouped under four categories based on their shape. The spherical coccus, the rod-shaped bacillus, the comma-shaped vibrium and

- the spiral spirillum
- 95 (a) AIDS virus also called reovirus has two single strands of RNA associated with the enzymes reverse transcriptase.
- 96 (a) The bryophytes are divided into liverworts and mosses
- 97 (b) The kingdom-Plantae includes algae, bryophytes pteridophytes, gymnosperms and flowering plants (angiosperms). They are common on land, on sea shore and in freshwater
- 98 (d) The water vascular system in Echinoderms, helps in locomotion together with the tube feet. Echinoderms have an **endoskeleton** made of **calcareous plates** and spines
- 99 (a) The function of clitellum in *Pheretima* is the formation of cocoon.
- 100 (b) Amphibians have opisthonephric kidney. *Lepus* is the generic name for hare, it is a solitary animal
- 101 (b) *Allium*,  $2n=16$  then endosperm has 24 chromosomes.  
*Oryza*,  $2n=24$  then endosperm has 36 chromosomes.  
*Nicotiana*,  $2n=48$  then endosperm has 72 chromosomes.  
*Saccharum*  $2n=82-124$  (Indian cane) then endosperm has 123-186 chromosomes.
- 102 (d) Only one internode long typical phylloclade (*i.e.*, green leaf-like modified stem) is called as cladode, *e.g.*, *Asparagus*.
- 103 (a) Option (a) is correct.
- 104 (b) *Triticale* is the first man made cereal. It is produced by artificial allopolyploidy between wheat (*Triticum* sp.) and rye (*Secale cereale*). Both belong to family-Poaceae.
- 105 (b) Root stem transition occurs in hypocotyl region of axis.
- 106 (b) **Vascular Cambium**  
The meristematic layer that is responsible for cutting off vascular tissues (xylem and phloem) is called vascular cambium. In the young stem. It is present in patches as a single layer between the xylem and phloem. Later, it forms a complete ring
- 107 (b) The keratinised stratified squamous epithelium forms the epidermis of the skin in land vertebrates. Its horny layer prevents the loss of water and mechanical injury
- 108 (d) The alimentary canal is a straight tube and runs between the first to last segments of the body of earthworms
- 109 (b) Within the nucleus, DNA is organised along with proteins into material called **chromatin** and thick condensed chromatin is called chromosome.
- 110 (d) The process of removal of introns (non-coding genes) and joining of exons (coding genes) is called splicing.
- 111 (c) Cellulose is made up of unbranched chain of glucose molecule linked by  $\beta$ -1, 4 glycosidic bond.
- 112 (b) **Isoenzymes** are one of the several forms of an enzyme in an individual or population that catalyse the same reaction but differ from each other in such properties as substrate affinity and maximum rates of enzyme-substrate reaction.
- 113 (a) Colchicine is an antimetabolic drug (alkaloid) which is obtained from *Colchicum* (family-Liliaceae). It binds to one tubulin molecule and prevents its polymerization. The depolymerisation of tubulin results in disappearance of mitotic spindle, blocking the cells mitotic chromosomal division of metaphase and anaphase
- 114 (c) During pachytene substage of prophase-I of meiosis, the non-sister chromatids of homologues exchange segments between themselves. This exchange of chromatid segments is called **crossing over**, which involves proper breakage and then fusion of broken ends oppositely and hence, results in the recombination.
- 115 (a)



- A-Final level  
 C-Initial level  
 E-Potato tuber
- B-Dotpin  
 D-Sugar solution

116 (a)

Graham's law of diffusion can be represented by the following formula

$$\text{Rate of diffusion} \propto \frac{1}{\sqrt{\text{Density of particle}}}$$

117 (a)

Diffusion is process in which uncharged molecules pass easily through a biological membrane. However, water soluble substance face difficulty to cross the membrane and the transport of these hydrophilic molecules are facilitated by carrier proteins, which are possessed by cell membrane. The overall process do not require energy and is referred to as facilitated diffusion

118 (d)

Mg<sup>2+</sup> is an activator of ribulose biphosphate carboxylase oxygenase and phosphoenol pyruvate carboxylase

119 (a)

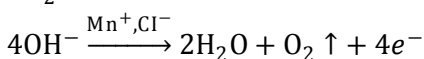
**Phosphorus** is a constituent of nucleic acids, proteins, NADP<sup>+</sup>, etc. its deficiency causes, poor growth, chlorosis (mottled), necrosis and premature falling of leaves and flowers.

120 (d)

Due to the higher value of CO<sub>2</sub> and ATP, the rate of Calvin cycle increases to form carbohydrate (starch). This leads to inhibition of photorespiration (glycolate cycle) and Kreb's cycle

121 (b)

Oxygen, which is liberated during photosynthesis comes from water.



122 (a)

ATP is utilised at two steps – First in the conversion of glucose into glucose – 6 phosphate and second in the conversion of fructose – 6 – phosphate to fructose 1, 6 biphosphate

123 (c)

NAD<sup>+</sup> and NADP<sup>+</sup> accepts two electrons and one proton to get reduced to NADH and NADPH respectively

124 (a)

**Phytochrome** is a pigment universally present in green flowering plants responsible for photomorphogenic changes and developmental processes.

125 (a)

2, 4-D (2, 4-dichloro-phenoxy acetic acid) is a synthetic auxin. It is selective weedicide and kills broad-leaved dicot plants only.

126 (a)

ABA (Abscisic Acid) was discovered for its role in regulating abscission and dormancy. It acts as the general plant growth inhibitor and an inhibitor of plant metabolism. ABA inhibits seed germination

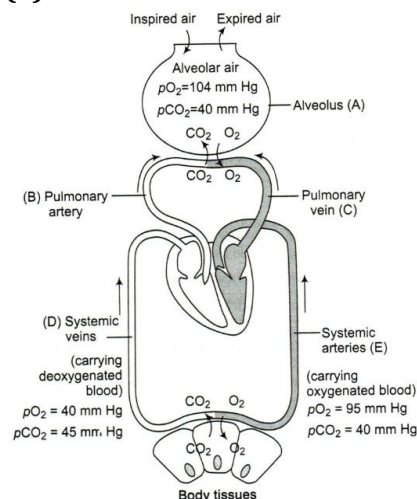
127 (a)

Digestion involves both mechanical and biochemical processing of food. Basically, it is the break down of complex organic substances of food like carbohydrates, proteins and fats (macronutrients) into simple, soluble inorganic substances. So, it can be defined as the conversion of insoluble polymer of food into their soluble monomers

128 (a)

Caecum is a small, pouch-like structure, which ends into a tubular structure called vermiform appendix. In rabbit, caecum is concerned with digestion of cellulose and conduction of food.

129 (a)



Diagrammatic representation of exchange of gases at the alveolus and the body tissues with blood and transport of oxygen and carbon dioxide

130 (b)

*In higher organisms, the sites of aerobic respiration are*

- (i) **Cytoplasm** Where, glycolysis takes place  
 (ii) **Mitochondria** Where, Kreb's cycle takes place

131 (a)

In human heart, right auricle opens into right ventricle and the auriculo-ventricular aperture is guarded by a tricuspid valve. The opening of left auricle into left ventricle is guarded by bicuspid or mitral valve.

132 (a)

Bundle of His.

#### *Auto-Rhythmicity of Heart*

Automatic rhythmicity of the heart is the ability to contract spontaneously. Mammalian heart is myogenic. It means heart beat results from a wave of electrical potential called cardiac impulse arising from sinoatrial node SA node and spreading over cardiac chambers.

SA-node lies in the wall of right atrium near opening of superior vena cava and contract about 72 times per minute. From SA node cardiac impulse travels to atrioventricular node (lies between right atrium and ventricle)

Then pass to AV bundle (also called bundle of His) and its branches reaches to the Purkinje fibres in ventricles.

Bundle of His provides the only route for the transmission of wave of excitation from atria to ventricles. Purkinje fibres conducts the impulses five times more rapidly than surrounding cells. It forms a pathway for conduction of impulse that ensures that the heart muscle contracts in the most efficient manner

133 (c)

Blood enters in glomerulus through afferent arterioles and exits out through efferent arterioles.

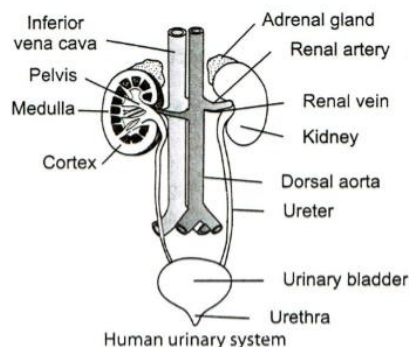
134 (d)

The plasma fluid that filters out from glomerular capillaries into Bowman's capsule of nephrons is called glomerular filtrate. It is a non-colloidal part and possesses urea, water, glucose, amino acids, vitamins, fatty acid, uric acid, creatinine salts, etc. RBCs, WBCs platelets and plasma proteins are the colloidal parts of the blood and do not filtrated out from glomerulus. Thus, plasma proteins are higher in concentration in blood than in glomerular filtrate.

135 (c)

Human excretory system consists of

- (i) a pair of kidney
- (ii) a pair of ureter
- (iii) urinary bladder
- (iv) urethra



136 (a)

Haversian canals are found in long bones of mammals. These canals are interconnected by transverse canals called Volkmann's canals.

137 (a)

There are 12 pairs of ribs in human, which from the bony lateral walls of the thoracic cage. The last two pair of ribs (total four) are called floating ribs because their anterior ends are not attached to either the sternum or the cartilage of another rib. The floating ribs protect the kidneys.

138 (c)

Synovial fluid is present in perfect movable joints. The synovial membrane secretes synovial fluid, which lubricates and provides nourishment to articular cartilage.

139 (a)

During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has first negative charge, then positive and again negative by repolarisation.

140 (b)

There are two types of photoreceptor cells namely, rods and cones. These cells contains the light-sensitive proteins called the photopigments

141 (b)

- A-Ovarian follicle,
- B-Corpus luteum,
- C-Progesterone

142 (d)

- A-Pituitary; B-2

143 (b)

Transfer of male gametes (pollen) to the receptacle (stigma) of the female is called pollination

Generally, the pollination takes place by various means like air/ water / animals / insects, etc.

144 (a)

Bamboo is the monocarpic plant (which reproduce once in their life time). They reproduce

once in 50-100 yrs after their birth and after flowering they die

145 (d)

**Microstyle** is the narrow or passage left by the integuments at one end of the ovule. It allows the entry of pollen tube into the ovule. This phenomenon is known as porogamy, e.g., lily.

146 (a)

Aleurone layer prepare amylase (an enzyme), which acts on the starch and frees the glucose unit for developing embryo

147 (b)

Pollen grains.

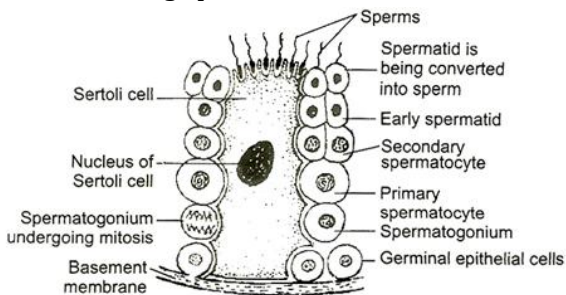
**Microsporogenesis** During developmental phase of anther the cells of sporogenous tissue undergoes meiotic division to form microspore tetrad. The process of formation of microspore from pollen mother cell is called

microsporogenesis. The microspores are formed and arranged in a group of four cells called microspore tetrad. Microspore develops into the pollen grain and represents the male gametophyte

Microspore mother cell and pollen mother cell are the same term and form male gametes (pollens) by the process called microsporogenesis

148 (a)

Wall of each seminiferous tubules is formed of single layered germinal epithelium. Majority of cells in this epithelium are cuboidal called male germ cells (also called spermatogonia). At certain places there present tall Sertoli or sustentacular cells, which functions as nurse cells for differentiating spermatozoa



TS of a part of seminiferous tubule showing Sertoli cell and stages of spermatogenesis

149 (a)

The male humans, if testes fail to descend into the scrotal sac, it is called **cryptorchidism**.

150 (d)

**Neoteny** is the retention of larval or embryonic characters even after sexual maturity. It is shown by **Axolotl larva** or *Ambystoma* (tiger salamander)

found in USA and Mexico.

151 (b)

Mucous (jelly -like) connective tissue is present mostly in embryos with Whartorn's jelly (highly gelatinous) as the ground substance. The tissue is common in umbilical cord, cock's comb and viterous body of eye ball.

152 (a)

'Hum do Humare Do' slogan encourages family planning.

With 1.7% of the growth rate. India's population could double in 33 years. Such an alarming growth rate could lead to an absolute scarcity of even the basic requirement. Therefore, the government was forced to take up serious measures to check the population growth.

The most important step to overcome this problem is to motivate smaller families by using various contraceptive methods. You might have seen advertisements in the media as well as posters/bills, etc., showing a happy couple with two children with a slogan *Hum Do Humare Do* (we two, our two).

Many couples, mostly the young, urban, working ones have even adopted 'one child norm'.

Statutory raising of marriageable age of the female to 18 years and that of males to 21 years and incentives given to couples with small families are two of the other measures taken to tackle this problem

154 (a)

A-Male, B-Female, C-Sex unspecified.

The study of inheritance of genetic traits in several generations of a human family in the form of a family tree diagram is called **pedigree analysis**.

**Advantages**

(i) It helps in genetic counselling to avoid disorders

(ii) It shows the origin of a trait and flow of a trait in a family

(iii) It is important to know the possibility of a recessive allele that can cause genetic disorders like colour blindness, haemophilia, etc.

*Signosed in the pedigree are*

155 (a)

Mendel obtained the recessive character in  $F_2$  by self pollinating the  $F_1$ -plants.

Mendel cross-pollinated a pure tall pea plant (100-120 cm high) and a pure dwarf pea plant. (only 22 to 44 cm high). He called them parental generation, expressed now-a-days by symbol P. This hybridization popularly called as monohybrid cross

This three generations of pea plants after crossing a pure tall plant with a dwarf one. The plants of  $F_1$ -generation are all tall, of  $F_2$ -generation three tall and one dwarf. One third of the tall plants are pure, while the remaining behave as hybrids

**$F_1$ -generation** Seeds collected from the parental generation called first filial generation or  $F_1$ -generation

**$F_2$ -generation**  $F_1$ -plants pollinated among them self (self breeding or inbreeding) and seed produced by  $F_1$ -plants called  $F_2$ -generation. They were in ratio 3:1 (three tall and one dwarf).

**$F_3$ -generation** Mendel allowed  $F_2$ -plant to form seed by self-pollination called  $F_3$ -generation. Mendel observed that tall and dwarf plant behave differently

(i) Dwarf plant produced dwarf plant on self-pollinated

(ii) In tall plants one third plants breed true so they were pure

(iii) Other two third plant behave like parents and give tall to dwarf plants 3 : 1 indicate that their parents have dwarf genes also

156 (d)

Correct statements are

(i) Myotonic dystrophy is an autosomal dominant trait

(ii) Sickle-cell anaemia is autosomal recessive disease

(iii) Failure segregation result in chromosomal loss and gain. One daughter cell get one extrachromosome and other gets one less chromosome

(iv) Cystic fibrosis is Mendelian disorder

157 (b)

Introns are the non-coding sequences found in eukaryotes only. In prokaryotes they are absent

158 (b)

The genetic code inside the cell is said to be **non-ambiguous** because a particular codon always codes for the same amino acid. But in certain rare cases, the genetic code is found to be **ambiguous**.

159 (a)

Almost all modern reptiles, birds and mammals, have forelimbs means, they all have same basic plan of the structure but they perform different functions. This phenomenon is called ancestral homology

160 (b)

Cro -magnon man (*Homo sapiens fossilis*) had a highest cranial capacity, i.e., 1680 cc.

Modern man (*Homo sapiens sapiens*) had cranial capacity 1400-1450 cc.

161 (c)

The correct matching pairs are

pathogen	Disease
<i>Leishmaniadonovani</i>	Kala-azar
<i>Wuchereriabancrofti</i>	Filariasis
<i>Trypanosomagambiense</i>	Sleeping sickness
<i>Entamoebahistolytica</i>	Amoebiasis

162 (c)

- Benign tumour is a non-cancerous Tumour. It does not show metastasis and is non-invasive. It is less fatal to the body
- 163 (a) Toxins released from *Corynebacterium diphtheriae* causes diphtheria. Actually, bacterial cells do not contain gene for toxin production-a phage carries the gene for it. Only those lysogenised cells of *C. diphtheriae* which carry  $\beta$  -phage, can produce the toxin and cause diphtheria.
- 164 (a) A-11 million, B-75 million, C-35 million, D-89.5 million
- 166 (b) All the given symptoms are of infectious coryza disease of poultry birds.
- 167 (a) Carbid beetles, an insect group containing ground and tiger beetles, are important biological agents in agroecosystems. Carbid beetles play a major role in agroecosystems by contributing to the mortality of weed seeds, insects and slugs.
- 169 (a) Autonomously replicating circular extrachromosomal DNA. Manipulation of gene and genetic material by man is a fast emerging branch of science, which started with the formation of recombinant DNA molecule. This branch of science is named as recombinant DNA technology, genetic engineering and DNA manipulation technology, genetic engineering and DNA manipulation technology. This technology involves cutting and pasting of desired DNA fragments into the specified hosts for the benefits of human beings
- 170 (b) Protoplasts are naked cells from which cell wall has been removed. Fusion of protoplast is done with solution of PEG or a very brief high voltage current.
- 171 (c) Removed during the maturation of proinsulin to insulin. Insulin contains two short polypeptide chains, chain A and B-chain linked by disulphide bridge. In mammals, insulin is synthesised as prohormone (that needs to be processed to become mature and functional hormone). It contains an extra stretch called-peptide. C-peptide is absent in mature insulin and is removed during the maturation into insulin
- 172 (c) Automated DNA sequencers, which sequence DNA fragments, work on the principle of a method developed by **Frederick Sanger**.
- 173 (b) Population keeps on changing due to various factors like immigration, emigration, natality and mortality. So, it is dynamic rather than stable phenomena
- 174 (b) Mutualism is called (+) and (+) interaction, where both partners are benefitted.
- 175 (d) Pioneer community is the 1st biotic community, which develops in barren area. Pioneer community is established over a previously bare area
- 176 (b) Organism are classified into trophic levels according to the source of their nutrients
- 177 (c) According to the IUCN (2004), the total number of plants and animals species described, so far is slightly more than 1.5 million but there is no clear idea of how many species are yet to be discovered and described
- 178 (c) Rajaji National park is situated close to Dehradun in **Uttarakhand**. Its main wildlife are elephant, tiger, panther, slothbear, nilgai, cheetal, wild bear, etc.
- 179 (a) Eutrophication is nutrient enrichment of water body resulting in increased growth of algae, other plants and animals. It is often seen in fresh water lakes. Actually it is the natural ageing of a lake by biological enrichment of its water.
- 180 (b) Deforestation is the removal of a forest or stand of trees where the land is thereafter converted to a non-forest use. Examples of deforestation include conversion of forest land to farms, ranches or urban use

