

# Thomas Tutorials

Date :

NEET - 2016

TEST ID: 01

Time : 03:00:00

PCB

Marks : 720

## : ANSWER KEY :

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

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## : HINTS AND SOLUTIONS :

### Single Correct Answer Type

1 (a)

Required percentage error

$$= 2 \times \frac{0.01}{15.12} \times 100 + \frac{0.001}{10.15} \times 100 = 4 + 1 = 5$$

2 (a)

Here,  $[f] = \frac{[S]}{[t^3]} = [M^0 L T^{-3}]$ .

3 (c)

(i) A body having constant speed can have varying velocity as direction may change.

(ii) Position-time graphs for two objects with zero relative velocity are parallel.

(iii) For a given time interval,

$$\text{Distance} \geq |\text{displacement}|$$

$$\therefore \text{Average speed} \geq |\text{average velocity}|$$

Therefore, all the options are true.

4 (c)

Average velocity =  $\frac{\text{displacement}}{\text{time}}$

$$V_{av} = \frac{\sqrt{H^2 + \frac{R^2}{4}}}{T/2} \dots (i)$$

Here  $H$  = maximum height =  $\frac{v^2 \sin^2 \theta}{2g}$

$$R = \text{range} = \frac{v^2 \sin 2\theta}{g}$$

$$\text{and } T = \text{time of flight} = \frac{2v \sin \theta}{g}$$

Substituting in Eq. (i), we get

$$v_{av} = \frac{v}{2} \sqrt{1 + 3 \cos^2 \theta}$$

5 (a)

If it is being hit then

$$d = v_0 t + \frac{1}{2} a t^2 = (u \cos \theta) t$$

$$\text{or } t = \frac{u \cos \theta - v_0}{a/2}$$

$$\therefore t = \frac{600 \times \frac{1}{2} - 250}{10} = 5 \text{ s}$$

$$H = (u \sin \theta) t - \frac{1}{2} g t^2$$

$$= 600 \times \frac{\sqrt{3}}{2} \times 5 - \frac{1}{2} \times 10 \times 25$$

$$H = 2473 \text{ m}$$

6 (a)

$$F = u \left( \frac{dm}{dt} \right)$$

$$= 20 \times \frac{50}{60}$$

$$= 16.66 \text{ N}$$

7 (c)

For minimum mass of  $m$ , mass  $M$  breaks off contact when elongation in spring is maximum

At the time of break off, block  $A$  is at lowest position and its speed is zero. At an instant  $t_1$

$$mg - kx = ma$$

$$v \frac{dv}{dx} = \frac{mg - kx}{m}$$

$$\int_0^0 v dv = \int_0^x \left( g - \frac{k}{m} x \right) dx$$

Where  $x_0$  is maximum elongation in spring

$$0 = gx_0 - \frac{kx_0^2}{2m}$$

$$x = \frac{2mg}{k}$$

At the time of break off of block  $B$

$$Mg = kx_0$$

$$Mg = 2mg$$

$$m = \frac{M}{2}$$

- 8 **(d)**  
The rate of doing work by a train is called power.

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

And work = force (F) × displacement (s)

$$\text{Power} = F \times \frac{F \times s}{t}$$

$$\text{Or } P = F \times \frac{s}{t}$$

$$\text{Or } P = F \times v \left[ \because v = \frac{s}{t} \right]$$

- 9 **(b)**  

$$\frac{1}{2} I \omega^2 = 40\% \text{ of } \frac{1}{2} m v^2$$

$$\frac{1}{2} I \omega^2 = \frac{40}{100} \left( \frac{1}{2} m r^2 \omega^2 \right)$$

$$I = \frac{2}{5} m r^2$$

So, the body is solid sphere.

- 10 **(c)**  
Here,  $n_1 = \frac{75}{60} \text{ rps} = \frac{5}{4} \text{ rps}$   
 $n_2 = 0, t = 5 \text{ s}, \alpha = ?$   

$$\alpha = \frac{\omega_2 - \omega_1}{t} = \frac{2\pi(n_2 - n_1)}{t} = \frac{2\pi(0 - 5/4)}{5}$$

$$= -\frac{\pi}{2} = -1.57 \text{ rad s}^{-2}$$

- 11 **(d)**  
Using law of conservation of energy  

$$-\frac{GMm}{r} = \frac{1}{2} m v^2 - \frac{GMm}{R}$$

$$\frac{v^2}{2} = \frac{GM}{R} - \frac{GM}{r}$$

$$= GM \left( \frac{r - R}{rR} \right) = gR \left( \frac{r - R}{r} \right)$$

$$v = \sqrt{2gR(r - R)/r}$$

- 12 **(c)**  

$$Y = \frac{Fl}{A\Delta l} \text{ or } \Delta l \propto \frac{1}{A}$$
 Again,  $m = Alp, m \propto A$   

$$\therefore \Delta l \propto \frac{1}{m}$$

$$\therefore \frac{\Delta l_1}{\Delta l_2} = \frac{m_2}{m_1} = \frac{2}{3}$$

- 13 **(a)**  
Rate of flow of liquid is given by  

$$\frac{dQ}{dt} = \frac{\pi p r^4}{8\eta L}$$
 As capillaries are joined in series, so  $\left( \frac{dQ}{dt} \right)$  will be same for each capillary.  
 Hence, 
$$\frac{\pi p r^4}{8\eta L} = \frac{\pi p' (r/2)^4}{8\eta \left( \frac{L}{2} \right)} = \frac{\pi p' (r/3)^4}{8\eta \left( \frac{L}{3} \right)}$$

So, pressure difference across the ends of 2nd capillary

$$p' = 8p$$

and across the ends of 3rd capillary

$$p' = 27p$$

- 14 **(a)**  
Volume of log of wood  $V = \frac{\text{mass}}{\text{density}} = \frac{120}{600} = 0.2 \text{ m}^3$

Let  $x$  weight that can be put on the log of wood  
 So weight of the body =  $(120 + x) \times 10 \text{ N}$   
 Weight of displaced liquid =  $V_{\sigma g} = 0.2 \times 10^3 \times 10 \text{ N}$

The body will just sink in liquid if the weight of the body will be equal to the weight of displaced liquid

$$\therefore (120 + x) \times 10 = 0.2 \times 10^3 \times 10$$

$$\Rightarrow 120 + x = 200 \therefore x = 80 \text{ kg}$$

- 15 **(a)**  

$$\frac{K_1}{K_2} = \frac{l_1^2}{l_2^2} \therefore K_2 = \frac{K_1 l_2^2}{l_1^2} \approx \frac{0.92 \times (4.2)^2}{(8.4)^2} = 0.23$$

- 16 **(b)**  
Equation of an adiabatic process is

$$pV^\gamma = \text{constant} \quad \text{---(i)}$$

$$\text{Given, } p^3 = \frac{k}{V^4}$$

$$p^3 V^4 = k \quad (\text{constant})$$

$$\Rightarrow pV^{4/3} = k \quad \text{----(ii)}$$

Comparing Eqs. (i) and (ii), we get

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

- 17 **(a)**  
From first law of thermodynamics,

$$Q = \Delta U + W$$

For path *iaf*,

$$50 = \Delta U + 20$$

$$\therefore \Delta U = U_f - U_i = 30 \text{ cal}$$

For path *ibf*,

$$Q = \Delta U + W$$

$$\text{or } W = Q - \Delta U$$

$$= 36 - 30 = 6 \text{ cal}$$

- 18 **(c)**  
S.I. unit of  $R$  is  $\text{J/mol} - \text{K}$

19 (b)

As here two masses are connected by two springs, this problem is equivalent to the oscillation of a reduced mass  $m_r$  of a spring of effective spring constant

$$T = 2\pi \sqrt{\frac{m_r}{K_{eff}}}$$

$$\text{Here } m_r = \frac{m_1 m_2}{m_1 + m_2} = \frac{m}{2} \Rightarrow K_{eff} = K_1 + K_2 = 2K$$

$$\begin{aligned} \therefore n &= \frac{1}{2\pi} \sqrt{\frac{K_{eff}}{m_r}} = \frac{1}{2\pi} \sqrt{\frac{2K}{\frac{m}{2}}} \times 2 = \frac{1}{\pi} \sqrt{\frac{K}{m}} = \frac{1}{\pi} \sqrt{\frac{0.1}{0.1}} \\ &= \frac{1}{\pi} \text{ Hz} \end{aligned}$$

20 (c)

$$n = \frac{1}{2\pi} \sqrt{\frac{K}{m}} \Rightarrow \frac{n_s}{n_p} = \sqrt{\frac{K_s}{K_p}} \Rightarrow \frac{n_s}{n_p} = \sqrt{\frac{\left(\frac{K}{2}\right)}{2K}} = \frac{1}{2}$$

21 (b)

$$n \propto \sqrt{T}$$

22 (c)

Potential at  $P$  due to  $(+q)$  charge

$$V_1 = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{(z-a)}$$

Potential at  $P$  due to  $(-q)$  charge

$$V_2 = \frac{1}{4\pi\epsilon_0} \cdot \frac{-q}{(z+a)}$$

Total potential at  $P$  due (AB) electric dipole

$$\begin{aligned} V &= V_1 + V_2 \\ &= \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{(z-a)} - \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{(z+a)} = \frac{2qa}{4\pi\epsilon_0(z^2 - a^2)} \end{aligned}$$

23 (d)

Electric field due to an electric dipole at axial point

$$E_{axial} = \frac{2kpr}{(r^2 - l^2)^2}$$

$$\text{If } r \gg l, E_a = \frac{1}{4\pi\epsilon_0} \frac{2p}{r^3}$$

$$\Rightarrow E \propto \frac{1}{r^3}$$

(directed from  $-q$  to  $+q$ )

24 (a)

Consider the charge distribution as shown.

Considering the branch on upper side, we have

$$\frac{q}{V_x - V_A} = 4 \times 10^{-6}$$

$$\frac{q}{V_A - V_y} = 2 \times 10^{-6}$$

$$\text{Here, } V_x = 6 \text{ volt, } V_y = 0$$

$$\therefore \frac{q}{6 - V_A} = 4 \times 10^{-6}$$

...(i)

$$\frac{q}{V_A - 0} = 2 \times 10^{-6} \text{ ... (ii)}$$

From Eqs. (i) and (ii), we get

$$\frac{V_A}{6 - V_A} = 2$$

$$\therefore V_A = 4 \text{ volt}$$

Similarly for the lower side branch

$$\frac{q''}{6 - V_B} = 2 \times 10^{-6}$$

...(iii)

$$\frac{q''}{V_B - 0} = 4 \times 10^{-6}$$

...(iv)

From Eqs. (iii) and (iv)

$$\frac{V_B}{6 - V_B} = \frac{1}{2}$$

$$\therefore V_B = 2 \text{ volt}$$

$$\therefore V_A - V_B = 4 - 2 = 2 \text{ volt}$$

25 (b)

$$W = qV = 6 \times 10^{-6} \times 9 = 54 \times 10^{-6} \text{ J}$$

26 (c)

$$V = E - ir = 12 - 60 \times 5 \times 10^{-2} = 9 \text{ V}$$

27 (a)

Resistance of voltmeter should be high

28 (d)

Magnetic field due to current through a linear conductor from the left to right at a point below the conductor is acting horizontally upwards. The electron beam moving from left to right will cause current right to left. The force on the electron will

be vertically downwards according to Fleming's hand rule.

29 (c)

$$R = \frac{H}{\cos\delta} = \frac{0.50}{\cos 30^\circ} = \frac{0.50 \times 2}{\sqrt{3}} = \frac{1}{\sqrt{3}}$$

30 (a)

Geometric length of a magnet is  $\frac{6}{5}$  times its magnetic length.

$$\therefore \text{Geometric length} = \frac{6}{5} \times 10 = 12 \text{ cm}$$

31 (c)

Given, self inductance,  $L = 1.8 \times 10^{-4} \text{ H}$

Resistance,  $R = 6\Omega$

When self inductance and resistance is broken up into identical coils.

Then, self inductance of each coil

$$= \frac{1.8 \times 10^{-4}}{2} \text{ H}$$

Resistance of each coil

$$= \frac{6\Omega}{2} = 3\Omega$$

Coil are then connected in parallel

$$\therefore L' = \frac{\frac{1.8}{2} \times 10^{-4} \times \frac{1.8}{2} \times 10^{-4}}{\frac{1.8}{2} \times 10^{-4} + \frac{1.8}{2} \times 10^{-4}} = 0.45 \times 10^{-4} \text{ H}$$

$$\text{and } R' = \frac{3 \times 3}{3+3} = 1.5\Omega$$

Time constant =  $\frac{L'}{R'}$

$$= \frac{0.45 \times 10^{-4}}{1.5} = 0.3 \times 10^{-4} \text{ s}$$

33 (a)

In L-R circuit, the growing current at time  $t$  is

given by  $i = i_0 \left[ 1 - e^{-\frac{t}{\tau}} \right]$  where  $i_0 = \frac{E}{R}$  and  $\tau = \frac{L}{R}$

$\therefore$  Charge passed through the battery in one time constant is

$$q = \int_0^{\tau} i dt = \int_0^{\tau} i_0 (1 - e^{-t/\tau}) dt$$

$$q = i_0 \tau - \left[ \frac{i_0 e^{-t/\tau}}{-2/\tau} \right]_0^{\tau} = i_0 \tau + i_0 \tau [e^{-1} - 1]$$

$$= i_0 \tau - i_0 \tau + \frac{i_0 \tau}{e}$$

$$q = \frac{i_0 \tau}{e} = \frac{(E/R)(L/R)}{e} = \frac{eL}{eR^2}$$

34 (a)

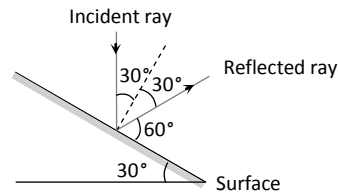
Intensity or power per unit area of the radiations,

$$P = pv$$

$$\Rightarrow p = \frac{P}{v}$$

$$= \frac{0.5}{3 \times 10^8} = 0.166 \times 10^{-8} \text{ Nm}^{-2}$$

35 (c)



36 (d)

$$\frac{1}{f} = \left( \frac{\mu_1}{\mu_2} - 1 \right) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\frac{1}{f} = \left( \frac{3/2}{4/3} - 1 \right) \left( \frac{1}{0.3} + \frac{1}{0.3} \right)$$

$$\text{Or } \frac{1}{f} = \left( \frac{9}{8} - 1 \right) \left( \frac{2}{0.3} \right)$$

$$\text{Or } \frac{1}{f} = \frac{1}{8} \times \frac{2}{0.3} \text{ or } f = 1.20 \text{ m}$$

37 (c)

$$3\lambda_1 = 4\lambda_2$$

$$\Rightarrow \lambda_2 = \frac{3}{4}\lambda_1 = \frac{3}{4} \times 590 = \frac{1770}{4} = 442.5 \text{ nm}$$

38 (c)

$$K.E. = 2E_0 - E_0 = E_0 \text{ (for } 0 \leq x \leq 1) \Rightarrow \lambda_1 = \frac{h}{\sqrt{2mE_0}}$$

$$K.E. = 2E_0 \text{ (for } x > 1) \Rightarrow \lambda_2 = \frac{h}{\sqrt{4mE_0}} \Rightarrow \frac{\lambda_1}{\lambda_2} = \sqrt{2}$$

39 (c)

Light intensity =  $10^{-10} \text{ W m}^{-2}$ . So energy falling on area of point to be perceived

$$= 10^{-10} \times 10^{-4} = nhc/\lambda$$

$$\text{or } n = \frac{10^{-14} \times 5.6 \times 10^{-7}}{6.6 \times 10^{-34} \times 3 \times 10^8} = 3 \times 10^4$$

40 (b)

$$\text{Number of spectral lines} = \frac{n(n-1)}{2} = \frac{4(4-3)}{2} = 6$$

41 (b)

For Lyman series

$$\bar{\nu} = \frac{1}{\lambda} = R \left( \frac{1}{1^2} - \frac{1}{n^2} \right) \text{ here } n = 2, 3, 4, 5 \dots$$

$$\text{For first time } \bar{\nu} = R \left( \frac{1}{1^2} - \frac{1}{2^2} \right) \Rightarrow \bar{\nu} = R \left( 1 - \frac{1}{4} \right) = \frac{3R}{4}$$

42 (b)

Recoil momentum = momentum of photon =  $\frac{h}{\lambda}$

$$= hR \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right) = \frac{hR \times 15}{16} = 6.8 \times 10^{-27} \text{ N} \times \text{s}$$

43 (c)

No. of electrons reaching the collector,

$$n_c = \frac{96}{100} \times 10^{10} = 0.96 \times 10^{10}$$

$$\text{Emitter current, } I_e = \frac{n_e \times e}{t}$$

Collector current,  $I_c = \frac{n_c \times e}{t}$

Current transfer ratio,  $\alpha = \frac{I_c}{I_e} = \frac{n_c}{n_e}$

$$= \frac{0.96 \times 10^{10}}{10^{10}} = 0.96$$

44 (d)

Here,  $h = 150 \text{ km}$ ,  $v = 300 \text{ kHz}$ ,

$v_c = 100 \text{ kHz}$

$$D_{\text{skip}} = 2h \sqrt{\left(\frac{v}{v_c}\right)^2 - 1}$$

$$= 2 \times 150 \times 10^3 \sqrt{\left(\frac{300 \times 10^2}{100 \times 10^3}\right)^2 - 1}$$

$$= 849 \text{ Hz}$$

46 (d)

For water,  $1 \text{ g} = 1 \text{ mL}$  ( $\because d$  for water = 1)

$\therefore 18 \text{ g} = 18 \text{ mL}$

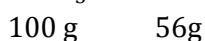
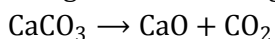
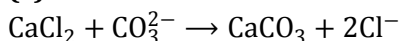
$18 \text{ mL water} = 6.02 \times 10^{23} \text{ molecules} = N_A$   
molecules

$\therefore$  in  $100 \text{ mL}$  number of water molecules

$$= \frac{N_A \times 1000}{18}$$

$$= 55.55 N_A$$

47 (c)



$\therefore 56 \text{ g CaO}$  is obtained by decomposition of

$\text{CaCO}_3 = 100 \text{ g}$

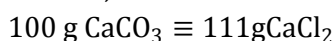
$\therefore 0.959 \text{ g CaO}$  will be obtained by the

decomposition of

$$\text{CaCO}_3 = \frac{100 \times 0.959}{56}$$

$$= 1.71 \text{ g}$$

Further,



$$1.71 \text{ g CaCO}_3 = \frac{111 \times 1.71}{100}$$

$$= 1.89 \text{ g CaCl}_2$$

$$\% \text{ of CaCl}_2 \text{ in the mixture} = \frac{1.89}{4.22} \times 100$$

$$= 44.78$$

$$= 45\%$$

48 (a)

It is impossible to determine simultaneously the exact position and momentum of moving particle like electron, proton, neutron.

$$\Delta x \times \Delta p \geq \frac{h}{4\pi}$$

where,  $\Delta x$  = uncertainty in position.

$\Delta p$  = uncertainty in momentum.

49 (b)

Positron is as heavy as an electron.

50 (b)

Ionisation energy increases in a period from left to right. But  $IE_1$  of Be is greater than B due to its stable configuration ( $1s^2, 2s^2$ ).

Hence, the order of decreasing

$IE_1$  is  $C > Be > B > Li$

51 (a)

Structure of ammonia is pyramidal (Distorted from tetrahedral to pyramidal due to repulsion between lone pair and bond pair of electrons).

52 (a)

The structure of an hydride of  $\text{H}_2\text{SO}_4$  is :

53 (c)

Frenkel defect is observed in the crystals in which the radius ratio is low

55 (b)

$$\Delta S = 16 \text{ J mol}^{-1} \text{K}^{-1}, \Delta H_v = 6 \text{ kJ mol}^{-1}$$

$$T_{\text{bp}} = \frac{\Delta H_{\text{vapour}}}{\Delta S_{\text{vapour}}} = \frac{6 \times 1000}{16} = 375 \text{ K}$$

56 (a)

Formation of

$\text{SO}_3$  (sulphur trioxide) from  $\text{SO}_2$  and  $\text{O}_2$  is

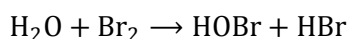
accompanied by decrease in volume. So,

increase in pressure favours  $\text{SO}_3$  formation

(also due to Le-Chatelier's principle).

57 (b)

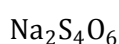
In reaction  $0 \qquad +1 \qquad -1$



The oxidation number of bromine increases from 0 to +1 and decreases from 0 to -1, so due to this reason bromine is both oxidised as well as reduced in the above reaction.

58 (c)

Let the oxidation state of sulphur in  $\text{Na}_2\text{S}_4\text{O}_6$  is  $x$ .



$$1 \times 2 + 4 \times x + (-2) \times 6 = 0$$

$$2 + 4x - 12 = 0$$

$$4x - 10 = 0$$

$$4x = 10$$

$$x = \frac{10}{4} = 2.5$$

59 (a)

Ethylene diaminetetraacetic acid (EDTA) when treated with water, forms stable complex with metal ions and hence, remove hardness of water.

60 (c)

Lithium and magnesium shows diagonal relationship. Some points of similarity are

(i) Polarising power of  $\text{Li}^+$  and  $\text{Mg}^+$  are almost same.

(ii) Like Li, Mg decomposes water very slowly.

(iii)  $\text{LiCl}$  and  $\text{MgCl}_2$  are deliquescent.

(iv) Like Li, Mg do not form solid bicarbonates.

63 (a)

Nucleophilies are those substances which can donate a pair of electrons. They can be neutral or negatively charged. The nucleophilic power depends on the tendency of species to donate the electrons. Due to the presence of  $+I$  effect it increases. Hence, higher the  $+I$  effect, higher the nucleophilic power. The  $+I$  effect of ethyl is greater than  $+I$  effect of methyl group

65 (b)

Only terminal alkynes give precipitate with ammoniacal silver nitrate solution.

Among the given,  $\text{CH}_3 - \text{C} \equiv \text{CH} - \text{CH}_3$  is not a terminal alkyne. Thus, it does not give precipitate with ammoniacal  $\text{AgNO}_3$ .

66 (a)

Methyl isocyanate (MIC) gas was released during Bhopal tragedy

67 (a)

In the given crystal equal number of cations and anions are missing (two  $\text{K}^+$  and two  $\text{Cl}^-$ ) from their normal lattice sites and the crystal maintains electrical neutrality. Hence, this is Schottky defect.

68 (b)

Schottky defects - This defect is due to vacancy at a cation site accompanied by vacancy at an anion site so that the electrical neutrality of the system is maintained. Due to this defect, density decreases.

69 (b)

Given,  $w = 24.5 \text{ g}$

$V = 1 \text{ L} = 100 \text{ mL}$

$M = ?$

Mol. wt. of  $\text{NaOH} = 23 + 16 + 1 = 40$

We know that,

$$M = \frac{w \times 1000}{m \times V} = \frac{24.5 \times 1000}{40 \times 1000}$$

$\therefore$  Molarity of solution = 0.6125 M

71 (d)

Electrochemical cell are based upon the reaction between various electrolytes. The reaction given in option (d) does not involve electrolytes, so it cannot be Abase for electrochemical cell.

72 (b)

We know that,  $\frac{(t_{1/2})}{(t_{1/2})} = \left[ \frac{a_2}{a_1} \right]^{n-1}$

Where,  $n =$  order of reaction

Given,  $(t_{1/2}) = 0.1 \text{ s}$ ,  $a_1 = 400$

$(t_{1/2}) = 0.8 \text{ s}$ ,  $a_1 = 50$

On substituting the values

$$\frac{0.1}{0.8} = \left[ \frac{50}{400} \right]^{n-1}$$

On taking log both sides

$$\log \frac{0.1}{0.8} = (n-1) \log \frac{50}{400}$$

$$\log \frac{1}{8} = (n-1) \log \frac{1}{8}$$

$$0.90 = (n-1) 0.90$$

$$n-1 = 1$$

$$n = 2$$

73 (c)

$$r = k[\text{RCl}]$$

$$\text{If } [\text{RCl}] = \frac{1}{2}, \text{ then rate} = \frac{r}{2}$$

74 (b)

Suspension solution	Colloidal solution	True solution
---------------------	--------------------	---------------

Particle size

>100 nm	1nm-100nm	< 1 nm
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Colloidal solution is a heterogeneous solution which contains particles of intermediate size. The particles of a colloidal solution have diameters between 1 to 100 nm. Colloidal solution shows the optical property (*i.e.*, Tyndall effect and Brownian movement).

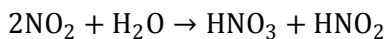
75 (c)

Poling is used for purification of metal which contain their own oxide as impurity, *eg*, Cu<sub>2</sub>O in Cu; SnO<sub>2</sub> in Sn

76 (d)

The fourth –floatation process is based upon the preferential wetting of ore particle by oil

77 (c)



78 (d)

A) There is gradual decrease in the radii of the lanthanoids with increasing atomic number-a case of lanthanide contraction, thus true.

B) Ionization potential for the formation of Lu<sup>3+</sup> is comparatively low, hence +3 state is favourable, thus true.

C) Due to lanthanide contraction –Zr and Hf; Nb and Ta, Mo and W have the same size and thus similar properties and thus separation is not easy, thus true.

D) Formation of +4 state requires very high energy, thus incorrect.

79 (d)

Sc<sup>3+</sup>(3d<sup>0</sup>), Ti<sup>4+</sup>(3d<sup>0</sup>) are diamagnetic due to absence of unpaired electrons. While Pd<sup>2+</sup>(4d<sup>8</sup>), Cu<sup>2+</sup>(3d<sup>9</sup>) contain two, and one unpaired electron respectively. Hence, these are paramagnetic

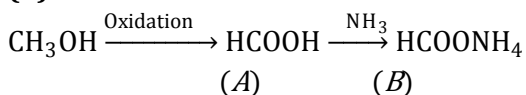
80 (b)

The prefixes erythro and threo are used in systems containing two asymmetric carbons when two of the groups are the same and the third is different. The erythro-isomer has identical groups as the same side when drawn in Fischer projection and threo-isomer has them on opposite side

81 (d)

Wurtz's reaction involves the reduction of alkyl halide with Na in ether.

82 (b)

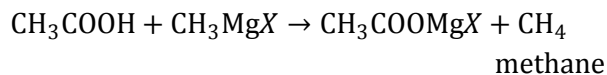


83 (c)

Note: Ethers are functional isomers of alcohols

84 (b)

Carboxylic acids react with Grignard's reagent to give alkanes.

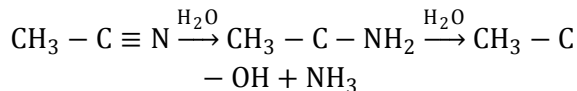


85 (b)

Acetonitriles on hydrolysis produce carboxylic acids with the evolution of ammonia.

OO

|||



Acetonitrile      acetamide      acetic acid

87 (d)

When glucose reacts with Br<sub>2</sub> water, gluconic acid is obtained as main product

88 (d)

Bakelite, due to presence of extensive crosslinking, is an example of thermosetting polymer

89 (c)

Melmac is a condensation polymer of melamine and formaldehyde.

90 (b)

Barbital or varonal is a sleep producing, *ie*, hypnotic tranquillizer. It is used in sleeping pills and cause addiction

91 (a)

The most important function of botanical garden and its importance is that *ex situ* conservation of plant is allowed there. These garden serve site of recreation among nature conscious person especially during flowering

92 (a)

Herbarium/Herbaria (Plu) are place/collection of dried pressed and preserved (FAA solution) specimen of plants

93 (c)

All living organism from prokaryotes to the most complex eukaryotes can respond external stimuli.

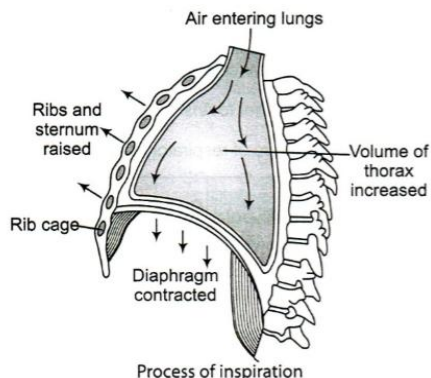


- The non-living things do not have this property at all
- 94 (a) Archaeobacterium cannot live in less than 3M NaCl concentration.
- 95 (b) Symbiosis (living together) is a special condition of mutualism, in which both the organisms (forming association) have close, permanent physical association, *e. g.*, lichens, in which fungi and algae form a close physical association.
- 96 (d) Member of Chlorophyceae are unicellular, colonial or filamentous have definite chloroplast commonly known as green algae
- 97 (a) The unicelled microspore of *Pinus* undergoes three divisions of microgametogenesis, so as to form a four celled pollen grains or male gametophyte. There are two prothallial cells, a generative cell and a tube cell.
- 98 (a) Athick and strong chitinous cuticle covers the whole body of cockroach (*Periplaneta*) as exoskeleton.
- 99 (d) Frogs have three types of pigmentations or chromatophores (melanophores, iridophores and xanthophores). These chromatophores are controlled by the frog's central nervous system and hormones.
- 100 (d) In flies and mosquito, metathorax bears a pair of small drumstick shaped or club-shaped processes called halteres or balancers.
- 101 (c) The unilocular superior ovary is found in **Papaveraceae** family.
- 102 (d) The main functions of the root system are absorption of water and mineral from soil, providing a proper anchorage to plant parts, storing reserve food material and synthesis of plant growth regulators
- 103 (c) Flower is highly condensed and modified shoot meant for sexual reproduction (**Dr. Goethe**; 1790). During the course of evolution, the nodes of the axis of shoot came in contact so, that internodes got reduced, and leaves got modified and specialized to form floral leaves.
- 104 (a) The number of stomata present per cm<sup>2</sup> of a leaf is known as stomatal frequency. Normally, it ranges from 1000-60000 per cm<sup>2</sup> or 10-600 mm<sup>2</sup> in different plant species.
- 105 (a) In monocotyledons, the vascular bundles have no cambium present in them. Hence, they don't form secondary tissue and referred to as closed vascular bundles. Generally, monocotyledons have the closed vascular bundles
- 106 (c) Each vascular bundle is surrounded by a sheath of parenchymatous cells called bundle sheath. They are chlorenchymatous in nature
- 107 (d) **Lymphoid tissue** consists of spleen, tonsils, lymph nodes, thymus gland, Peyer's patches, liver, etc. Such organs secrete lymph, producing lymphocytes so are known as lymphoid organs. The spleen is the largest mass of lymphatic tissue in the body. Lymphoid tissue share responsibility with myeloid tissue (red bone marrow) for producing agranular leucocytes.
- 108 (a) A frog heart is solid muscular organ situated in the upper half of body cavity. It is three chambered with two auricles and one ventricle. The ventricle is incompletely divided by an interventricular spetum, while auricles are completely divided by interauricularspetum. Heart is covered by a membrane called pericardium. The potential space between heart and pericardium is called pericardial space. This space is fluid filled and the fluid here is called pericardial fluid. The heart of frog pumps mixed blood as lungs are not much functional is than and most of the oxygenation of blood takes place throughe skin
- 109 (b) In eukaryotic cells, DNA accommodated by super-coiling in nucleosomes.
- 110 (d) According to Chargaff's rule, in DNA, the proportion of adenine always equals to that of thymine and proportion of guanine always equal to that of cytosine, *i. e.*, A=T and G=C. Thus, in a DNA, if guanine is 20%, cytosine also will be 20%. So, both adenine and thymine together will be 60%, *i. e.*, 30% adenine and 30% thymine.

- 111 (a) Sucrose is a non-reducing sugar. It consists of one glucose and one fructose moiety, and is the main transporting sugar in plants.
- 112 (b) Pepsin is an extracellular enzyme
- 113 (b) It is mitosis, in which both diploid and haploid cells undergoes this process.  
If a diploid cell undergoes mitosis, it results in two identical diploid cells.  $2n \rightarrow n$   
If a haploid cell undergoes mitosis, the result is two identical haploid cells ( $n \rightarrow n$ ).  
In meiosis however, a diploid cell participates that divides twice to produce four haploid cells
- 114 (d) Prophase is generally identified by the initiation of condensation of chromosomal material. The chromosomal material condenses to form chromosomes. The nuclear envelope breaks down and spindles start to assemble at opposite ends of the cell
- 115 (a) Because of low atmospheric pressure which permits more rapid diffusion of water. Such plants develop xerophytic characters to avoid this situation
- 116 (a) The value of osmotic potential of an electrolyte will be greater by the degree of its dissociation into ions at a given temperature and dilution over the one calculated by Van'tHoffs formula  
 $P = CRT \times I$  or ionisation constant
- 117 (a) In both, facilitated diffusion and active transport, there is an involvement of carrier transporter or transporter proteins. These are highly specific enzymes and shows sensitivity to inhibitors
- 118 (a)  $Mn^{+2}$  acts as an activator of nitrogenase during nitrogen fixation
- 119 (b) Hydroponics technique is useful in areas having infertile and dry soils and can regulate pH optimum for a particular crop
- 120 (b)  $C_4$ -pathway occurs in some tropical plants having Kranz anatomy (undifferentiated mesophyll around vascular bundles with chloroplast containing bundle sheath). The final  $CO_2$  fixation occurs in bundle sheath cells.
- 121 (d) Emerson and Arnold (1932) established light and dark phases in photosynthesis with the help of flashing light and Emerson concluded two distinct photochemical process in light reaction of photosynthesis.
- 122 (b) Triolein is unsaturated glyceride, whereas tripalmitin is a saturated glyceride. The required number of oxygen molecule for oxidation of unsaturated glyceride is always more than for saturated glyceride.
- 123 (a) One molecule of pyruvic acid converted in acetyl Co-A for 3 molecule of  $NADH + H^+$
- 124 (d) Rooting on stem cutting is the function of auxin not cytokinin. Rooting on stem cutting is widely used for generation of new plants in short period of time
- 125 (c) **Root Apical Meristem (RAM)**, Shoot Apical Meristem (SAM) and intercalary meristem are responsible for the primary growth to the plants and they principally contributes to the elongation of the plants along their axis.  
In the dicotyledons and gymnosperms, the lateral meristems, vascular cambium and cork cambium appear later in life. These are the meristems that causes increase in the girth of the organ in which they are active. This is known as the secondary growth of the plant
- 126 (b) **Nyctinastic** is found in members of Leguminosae such as *Albizia lebbek* and members of Oxalidaceae.
- 127 (d) Goblet cells are present in the columnar epithelium of the mammalian intestine and secrete mucin, a mucoprotein that forms mucus when in solution. If Goblet cells become non-functional, this will adversely affect smooth movement of food downwards the intestine due to absence of mucin.
- 128 (d) Correct label is A-serosa, B-muscularis, C-submucosa, D-mucosa
- 129 (b) *Pulmonary volume increases by the following*

steps

- (i) Contraction of the diaphragm
- (ii) Contraction of intercostal muscle
- (iii) Lifting of the ribs
- (iv) Sternum causing an increase in the volume of thoracic chamber in dorso ventral axis



130 (a)

Tidal volume is the volume of air inspired or expired with each normal breath. This is about 500 mL (0.5 L) in adult person.

131 (d)

The myocardium (wall) of left ventricle is three times thicker than right ventricle. This is because the ventricles pumps out blood with force away from heart, the right one to pulmonary artery and the left one to aorta.

132 (a)

**Carbonic anhydrase** is an enzyme present in the red blood corpuscles (erythrocytes) of blood. It has a role during CO<sub>2</sub> transportation in plasma. Most of CO<sub>2</sub> produced by tissues diffuses passively into the blood plasma and reacts with water forming carbonic acid. This reaction occurs very rapidly inside RBCs because of the presence of enzyme **carbonicanhydrase**.

133 (b)

The main function of the Henle's loop is to absorb water from the tubular lumen thus, making the urine concentrated. If they have been absent, the urine would have been more dilute.

134 (c)

Renin angiotensin mechanism.

ANF – mechanism therefore, acts as a check on renin-angiotensin mechanism

135 (c)

Proximal Convolved Tubule (PCT)

↓

Descending Lop of Henle (DLH)

↓

Ascending Loop of Henle (ALH)

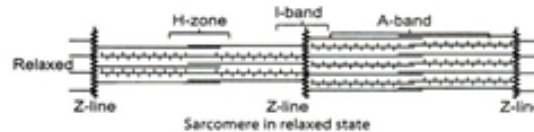
↓

Distal convoluted Tubule (DCT)

↓

Collecting Duct (CD)

136 (b)



The thick filaments lies parallel to one another and thin filaments are present in orderly array between the thick filaments. In the centre of the I-band, there is a band of amorphous material called Z-line. In the middle of the A-band a comparatively less dark zone called H-zone of band is present. The area between the two Z-lines is called sarcomere. M-line is present, in the middle of H-zone

137 (a)

Appendicular skeleton lies laterally and is attached to axial skeleton. It is made up of girdles (pectoral and pelvic) and limb bones (forelimb and hindlimb). Pectoral girdle and pelvic girdle supports forelimb and hindlimb respectively. The appendicular skeleton consists of 126 bones

138 (c)

Synsacrum is the thoracic region of vertebral column in fowl. It consists of about 16 fused vertebrae and provides support to ilia bones of immense pelvic girdle.

139 (b)

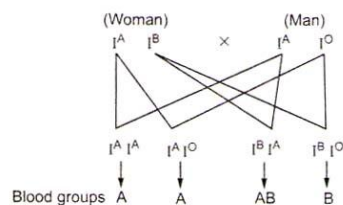
Neurotransmitters.

Synaptic knob possess synaptic vesicles

- containing chemicals called neurotransmitters
- 140 **(d)**  
Gamma amino butyric acid (GABA) is an inhibitory neurotransmitter in the human brain. It is a derivative of glutamic acid.
- 141 **(d)**  
Mineralocorticoides are responsible for regulation of mineral metabolism. **Aldosterone** is one of the important mineralocorticoides in humans. Its main function is to regulate the sodium content of the body. Mineralocorticoides are secreted by zona glomerulosa region of adrenal cortex.
- 142 **(b)**  
Cholecystokinin (CCK) and gastro inhibitory polypeptide (GIP) both are secreted by small intestine. Whereas gastrin by G-cells of pyloric gland and duodenum and secretin by duodenal and jejunum mucosa
- 144 **(d)**  
Old age is the phase in life span which occur before death and after maturity period. In old age almost all of the vital processes starts slowing down. Gamete formation also stops in old age
- 145 **(a)**  
Cross pollination is the transfer of pollen grains from a flower to the stigma of another flower. Cross pollination require the production of a large number of pollen grains and a pollinating agent such as wind (anemophily), water (hydrophily), insect(entomophily), etc.
- 146 **(a)**  
True.  
In coconut endosperm two type of division takes place, cellular and nuclear and it is the female gametophyte not male. In coconut endosperm cellular endosperm surrounds the nuclear endosperm
- 147 **(a)**  
Continued self breeding means there is continuation of genetic material to the progeny from the parents. As they are the product of same genotype of same plant. This leads to less productivity called inbreeding depression
- 148 **(c)**  
Golgi body.  
Acrosome is the part of sperm, which is found at the head region. It is the modified Golgi body that contain many enzymes for the penetration to

ovum.  
Acrosome contains hyaluronidase proteolytic enzymes, which is popularly known as sperm lysin as it is used to penetrate egg (ovum) at the time of fertilisation

- 149 **(a)**  
According to the theory of error catastrophe, the damage to mechanisms that synthesize proteins, results in faulty proteins, which accumulate to a level and causes catastrophic damage to cells, tissues and organs.
- 150 **(c)**  
Graafian follicle is the mature follicle present in the ovary. It consists of an outermost layer called theca externa and inner to it is theca interna.
- 151 **(b)**  
A-Oogonia-46 chromosomes, B-Primary oocyte-46 chromosomes, C-Secondary oocyte-23 chromosomes
- 152 **(b)**  
*The countries with largest population are six.*  
Country – Human population  
China – 1341000000  
India – 1210000000  
USA – 311075000  
Indonesia – 237556363  
Brazil – 190732694
- 153 **(b)**  
A-Vas deferens, B-Vasectomy
- 154 **(b)**



In this case, progeny with blood group-B is produced only when man is heterozygous, i.e.,  $I^A I^O$ .

- 155 **(d)**  
When a pair of contrasting characters are crossed with each other then  $F_1$ -generation has only one type of character. This expressed character is known as **dominant** character, while the character, which could not express in  $F_1$ -generation is known as **recessive** character. In pea plants, tallness, round seed, yellow seed, purple flower, green pod, inflated pod and axial flower are dominant over dwarfness, wrinkled seed,

- green seed, white flower, yellow pod, constricted pod and terminal flower, respectively.
- 156 **(b)**  
The females have **homozygous** XX sex chromosomes, while males have **heterozygous** XY-chromosome. Y-chromosome is shorter than X-chromosome.
- 157 **(b)**  
A-RNA, B-DNA, C-RNA
- 158 **(b)**  
Splicing takes place in eukaryotes because introns are found only in case of eukaryotes. Before processing, exons need to be removed out. This process is called splicing
- 159 **(b)**  
**Anthropology** (from the Greek 'human' or 'person') consists of the study of humanity. This discipline is a holistic study, concerned with all humans, at all times, in all humanity's dimensions. Anthropology is traditionally distinguished from other disciplines by its emphasis on cultural relatively, in-depth examination of context and cross-cultural comparisons
- 160 **(c)**  
**Hardy -Weinberg principle** illustrates that change of frequency of alleles in a population results in evolution.
- 161 **(a)**  
Thymus provides the microenvironment for the development and maturation of T-lymphocytes
- 162 **(d)**  
Myasthenia gravis is an autoimmune disease characterized by the chronic fatigability and weakness of muscles, especially in the face and throat, as result of defect in the conduction of nerve impulses at the myoneural junction.
- 163 **(c)**  
Infective stage of malaria is sporozoite, *Plasmodium* enters the human body as sporozoites (infectious form) through the bite of infected female *Anopheles* mosquito
- 164 **(d)**  
Pomato.  
Pomato is somatic hybrid between potato and tomato and Bomato is somatic hybrid between brinjal and tomato. Somatic hybrid are also produced between rice and carrot
- 165 **(a)**  
Breeding is carried out by the conventional breeding techniques or by mutation breeding. The conventional method of breeding for disease resistance is that of hybridization and selection. Mutation breeding is defined as the process of breeding by artificially inducing mutations using chemicals (like aniline) or radiations like (gamma radiation). This radiation breeding is nothing but the step of Mutation breeding
- 166 **(b)**  
Somatic hybridization or parasexual hybridization involves the fusion of isolated protoplasts of two different species.
- 167 **(a)**  
Wood, agro-industrial residues and petroleum and oil producing plants are the sources of biofuel. Biofuels are the combustible bodies of plants or combustible product derived from biomass. Biofuels are renewable.
- 169 **(c)**  
Bioreactors are considered as vessels in which raw materials are biologically converted into specific products by microbes, plant and animal cells and or their enzymes. Small volume cultures can not give large quantities of the products. Large scale production (100-1000 L) of the products is carried out in bioreactors. A bioreactor provides the optimal conditions for obtaining the desired product by providing optimum growth conditions such as temperature, pH, substrate, vitamins, oxygen and salts. In the sparged stirred tank bioreactor, sterile air bubbles are sparged. The surface area for oxygen transfer is increased
- 170 **(a)**  
Genetic engineering may one day enable the medical scientists to replace the defective genes responsible for heredity diseases (haemophilia, phenylketonuria) with the normal genes. The improved techniques for gene manipulation and deeper understanding of gene function in the body, may some day enable the medical biotechnologists to correct gene disorders in humans. Treatment of a genetic disorder by manipulating genes is called **genetherapy**
- 171 **(a)**  
Introducing foreign genes.  
Animals whose DNA is manipulated to possess and express an extra (foreign) gene are known as transgenic animals. Transgenic rats, rabbits, pigs, sheep and cows have been produced

172 (c)

Somaclonal variation is a variation that occurs in cell and tissue cultures, which may be genetic or epigenetic.

173 (a)

When two related populations occupy geographically or spatially separate areas, they are called **allopatric population**.

174 (d)

Life history traits of organism have evolved to the constraints imposed by biotic and abiotic components of habitat in which they live

175 (b)

A-Decomposition, B-Weathering, C-Producer, D-Soil

176 (a)

Only about 10% is stored at higher trophic level and the remaining 90% is lost in respiration, decomposition and waste in the form of heat. Suppose 2000 J of solar energy is incident on green vegetation. The latter having about 1% efficiency, trap about 20 J of energy and convert it into chemical energy by photosynthesis. The remaining 1980 J would be lost to the environment. The herbivore that feed on producers get 10% of the energy stored in plants, *i.e.*, 2 J. The remaining 18 J are lost to the environment. Carnivores feeding on herbivores would be able to store only 0.2 J of energy as flow

177 (b)

Ecologists believe that the communities with more species tend to more stable than those with

less species. This was confirmed by **David Tilman**

178 (d)

Rivet popper hypothesis suggests the ecosystem are like aeroplane wings where the flight ecosystem functioning may or may not be compromised

This hypothesis assumes the ecosystem to be an aeroplane and the species to be the rivets joining all parts together

If every passenger pops a rivet to take home (resulting in species extinction), it may not affect the flight safety initially (proper ecosystem functioning) but with time as more rivets are removed, the plane will become dangerously weak

179 (b)

In Minamata bay of Japan, a disease was caused by eating fish contaminated by industrial waste containing mercury compounds. This disease was called as Minamata disease.

180 (a)

Biological magnification is the process by which heavy metals and pesticides become more concentrated at higher trophic level of food chain.

Eutrophication is accelerated by introduction of massive amounts of nutrients by human activity.