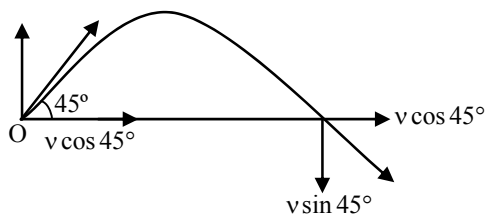


**ANSWER KEY (AIPMT-2008)**

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	1	1	1	3	3	4	2	3	2	4	3	3	1	4	4	4	2	1	2
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	4	1	3	1	4	4	2	3	1	3	4	4	3	1	1	2	2	3	1	3
Ques.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	1	3	2	2	2	3	3	4	3	1	1	4	3	1	1	4	3	3	2
Ques.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	4	4	3	3	2	3	1	2	2	3	3	1	1	1	4	2	4	3	2	4
Ques.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	4	1	3	2	4	3	2	4	2	4	3	1	2	2	4	4	2	1	1	3
Ques.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	3	4	4	3	4	3	4	3	2	1	3	1	3	1	3	4	4	1	2	3
Ques.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
Ans.	3	2	3	1	2	2	4	3	3	4	4	4	3	2	2	1	3	4	3	4
Ques.	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
Ans.	4	3	2	4	1	2	2	2	2	4	3	2	2	4	1	4	2	1	1	2
Ques.	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
Ans.	3	4	1	4	3	2	1	3	3	3	2	4	3	2	1	3	2	1	1	1
Ques.	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
Ans.	2	4	1	1	2	3	2	4	3	4	4	3	3	1	4	4	1	4	3	3

**HINTS & SOLUTIONS**

1. Only vertical component of velocity changes during projectile motion so, there is change in momentum in vertical direction only.



$$\begin{aligned} \text{Change in momentum} &= \Delta \vec{P} \\ &= \Delta P_x \hat{i} + \Delta P_y \hat{j}, \text{ since } \Delta P_x = 0 \\ &= \Delta P_y \hat{j} = \vec{P}_{fy} - \vec{P}_{iy}; \end{aligned}$$

$$P_{iy} = mv \sin 45^\circ, P_{fy} = -mv \sin 45^\circ$$

$$\Delta \vec{P} = -mv \sin 45^\circ \hat{j} - mv \sin 45^\circ \hat{j}$$

$$= -2mv \sin 45^\circ = -\sqrt{2}mv \hat{j} \left| \Delta \vec{P} \right|$$

$$= \sqrt{2}mv$$

-ve sign shows the direction of change in momentum in -ve y-direction.

2. Flux linkage = Flux through each turn  $\times$  number of turns

$$\phi = 500 \times 4 \times 10^{-3} = 2 \text{ Wb}$$

$$\text{since } \phi = Li$$

$$\Rightarrow L = \frac{\phi}{i} = \frac{2}{2} = 1 \text{ H}$$

3.  $\vec{F} = q(\vec{v} \times \vec{B})$ , i.e. magnetic force is perpendicular to both velocity and magnetic field. A force  $\perp_r$ , to  $\vec{V}$  does no work or no power delivered by force which is  $\perp_r$ ,  $\vec{V}$  hence no kinetic energy or speed will change.

$$\text{since } P = \vec{F} \cdot \vec{V} = 0$$

$$\text{As } \vec{F} \perp_r, \vec{V} \perp_r, d\vec{r}.$$

$$\text{or } dW = \vec{F} \cdot d\vec{r} = 0$$

4. Distance covered in  $n^{\text{th}}$  second,

$$S_n = u + \frac{1}{2}a(2n - 1);$$

$$= 0 + \frac{1}{2} \times \frac{4}{3} (2 \times 3 - 1)$$

$$= \frac{1}{2} \times \frac{4}{3} \times 5 = \frac{10}{3} \text{ m}$$

5. de-Broglie wavelength associated with electron moving with velocity  $v$ ,  $\lambda = \frac{h}{mv}$

$$\text{So, } \lambda_e = \frac{h}{9.1 \times 10^{-31} \times 3 \times 10^6}$$

Wavelength of particle of mass 1 mg moving with velocity  $v$ .

$$\lambda_p = \frac{h}{10^{-3} \times v}$$

As given,  $\lambda_e = \lambda_p$

$$\Rightarrow \frac{h}{10^{-3} \times v} = \frac{h}{9.1 \times 10^{-31} \times 3 \times 10^6}$$

$$v = \frac{27.3 \times 10^{-25}}{10^{-3}} \text{ m/s} = 2.73 \times 10^{-21} \text{ m/s}$$

6.  $F_{\text{ext.}} = \frac{dp}{dt} = \frac{d(mv)}{dt}$ ,

$m$  = mass of system as conveyor belt with sand drops at time  $t$ .

$$F_{\text{ext.}} = m \frac{dv}{dt} + v \frac{dm}{dt}$$

but  $v \rightarrow$  constant, so,  $\frac{dv}{dt} = 0$

$$F_{\text{ext}} = v \frac{dm}{dt} = Mv$$

$F_{\text{ext.}}$  is in direction of  $\vec{v}$  of belt.  
OR

$$\text{Since } m \cdot \frac{dv}{dt} = F_{\text{ext}} + F_{\text{reaction}} \quad \dots\dots(i)$$

Consider belt as a system with variable mass

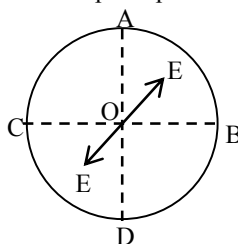
$$\frac{dv}{dt} = 0, m = \text{mass of system at time } t$$

$$F_{\text{reaction}} = v_{\text{rec}} \cdot \frac{dm}{dt} = -v \frac{dm}{dt} \quad \dots\dots(ii)$$

$$\Rightarrow F_{\text{ext.}} = v \cdot \frac{dm}{dt} = Mv.$$

$F_{\text{ext}}$  is in direction of  $\vec{v}$  to keep belt moving with constant velocity.

7. Electric field due to the given charged ring is zero at centre 'O'. So electric field due to AKB is equal and opposite to electric field due to ACDB, from the principle of superposition.



Since  $\vec{E}$  is field strength of O along KO So electric field strength due to ACDB along  $\vec{OK}$  and it is equal to E.

8.  $R = R_0 \cdot A^{1/3}$

So nuclear density =  $\frac{A \cdot m}{v}$

$m$  = mass of each nucleon,  $A$  = mass number  
=  $\frac{3m}{4\pi R_0^3}$  = independent of  $A$ .

9. Mass defect

$$\Delta m = ZM_p + (A - Z)M_n - M(A, Z)$$

Binding energy =  $\Delta m C^2$

$$BE = [ZM_p + (A - Z)M_n - M(A, Z)] C^2$$

$$M(A, Z) = ZM_p + (A - Z)M_n - \frac{BE}{C^2}$$

10. For constant acceleration

$$v^2 = u^2 + 2as$$

$$(20)^2 = (10)^2 + 2 \times a \times 135$$

$$a = \frac{300}{270} \text{ ms}^{-2}$$

As  $v = u + at$

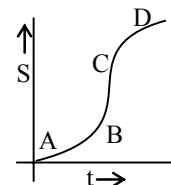
$$20 = 10 + a \times t$$

$$10 = at$$

$$10 = \frac{300}{270} \times t$$

$$t = 9 \text{ sec}$$

11. In distance-time graph, the speed at instant is expressed by slope at that instant. The slope is maximum at C.



12. Heat required to boil water

$$Q = mc\Delta T$$

$$= 1 \times 1 \times (100 - 20) = 80 \text{ kcal}$$

Heat given by supply

$$H = V \cdot i \cdot t = 220 \times 4 \times t$$

$$H = Q$$

$$\Rightarrow 220 \times 4 \times t = 80,000$$

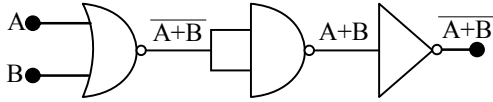
$$t = \frac{80,000}{220 \times 4}$$

$$= \frac{1000}{11} \text{ sec}$$

$$= \frac{1000}{11 \times 60} = 1.5 \text{ min}$$

13. In the phenomenon of electric discharge tube through gases at low pressure, the coloured glow in the tube appears as a result of collisions between the charged particles emitted from cathode and the atoms of the gas.

14. The output is the output of NOR gate hence the combination will act as a NOR gate.

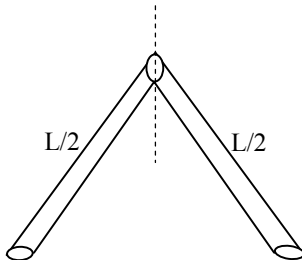


15.  $V = \frac{4}{3} \pi r^3$

$$\frac{\Delta V}{V} \times 100 = 3 \times \left( \frac{\Delta r}{r} \times 100 \right)$$

% error in volume =  $3 \times \% \text{ error in radius}$   
 $= 3 \times 2 = 6\%$

- 16.



Moment of inertia of the system

$$I = \frac{M(L/2)^2}{3} + \frac{M(L/2)^2}{3}$$

$$= \frac{ML^2}{12} + \frac{ML^2}{12} = \frac{ML^2}{6}$$

17. Frequency corresponding to 2eV is given by

$$E = hv$$

$$\Rightarrow 2 \times 1.6 \times 10^{-19} = 6.6 \times 10^{-34} \times v$$

$$v = \frac{3.2 \times 10^{-19}}{6.6 \times 10^{-34}} = 5 \times 10^{14} \text{ Hz}$$

18.  $I = I_1 + I_2 + 2\sqrt{I_1 I_2} \cos \phi$

$$I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2$$

$$I_{\min} = (\sqrt{I_1} - \sqrt{I_2})^2$$

$$I_{\max} + I_{\min}$$

$$= (\sqrt{I_1} + \sqrt{I_2})^2 + (\sqrt{I_1} - \sqrt{I_2})^2$$

$$= (I_1 + I_2 + 2\sqrt{I_1 I_2}) + (I_1 + I_2 - 2\sqrt{I_1 I_2})$$

$$= 2(I_1 + I_2)$$

19. In cyclic process since initial and final states are same internal energy is a state function therefore initial and final internal energies are also same. So change in internal energy is zero hence  $E = 0$ .

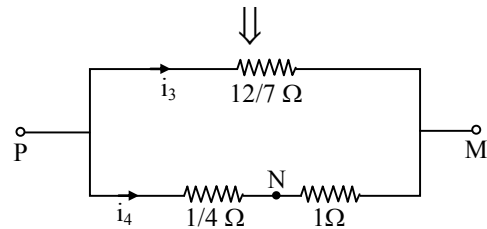
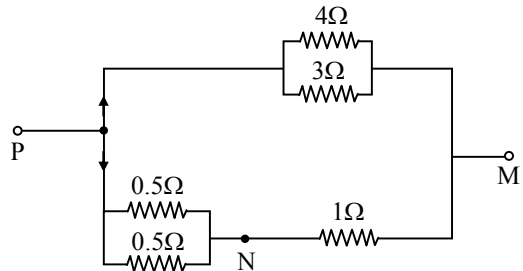
20.  $i_1 = 1 \text{ amp} = \text{current through } 4\Omega$

$i_2 = \text{current through } 3\Omega \text{ and}$

$$\frac{i_1}{i_2} = \frac{3}{4} \Rightarrow i_2 = \frac{4}{3} \text{ amp}$$

$$i_3 = i_1 + I_2 = 1 + \frac{4}{3} = \frac{7}{3} \text{ amp}$$

$$\text{and } \frac{i_3}{i_4} = \frac{3/4}{12/7} \Rightarrow \frac{7}{3} \times \frac{12}{7} = i_4 \times \frac{5}{4}$$



$$\therefore i_4 = \frac{16}{5} \text{ amp} = 3.2 \text{ amp}$$

$$V_{NM} = \text{P.D. across N and M} = i_4 \times 1\Omega = 3.2 \times 1 = 3.2 \text{ volt}$$

**Second approach.**

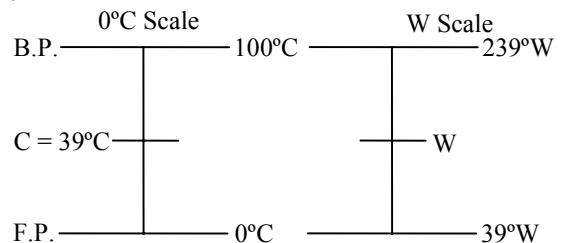
$$V_{PM} = 1 \text{ A} \times 4\Omega = 4 \text{ volt}$$

$$\frac{V_{PN}}{V_{NM}} = \frac{1}{4} \text{ and } V_{PN} + V_{NM} = 4 \text{ V}$$

$$\frac{1}{4} \cdot V_{NM} + V_{NM} = 4$$

$$\therefore V_{NM} = \frac{16}{5} \text{ V} = 3.2 \text{ V}$$

- 21.



W is the temperature on new scale corresponding to 39°C on °C scale.

$$\text{So, } \frac{C - 0}{100 - 0} = \frac{W - 39}{239 - 39}$$

$$\Rightarrow \frac{C}{100} = \frac{W - 39}{200}$$

$$\text{or } W = \frac{C}{100} \times 200 + 39 \\ = \frac{39}{100} \times 200 + 39 = 78 + 39 = 117$$

So, temperature on new scale is  $117^\circ\text{W}$  corresponding to  $39^\circ\text{C}$ .

22. Given  $y = 0.25 \sin(10\pi x - 2\pi t)$   
Comparing with equation of wave  
 $y = A \sin(kx - \omega t)$   
 $A = 0.25, k = 10\pi, \omega = 2\pi$   
 $\frac{2\pi}{\lambda} = 10\pi \quad 2\pi f = 2\pi$   
 $f = 1 \text{ Hz}$   
 $\lambda = \frac{1}{5} = 0.2 \text{ m}$

When sign of coefficient of  $t$  and  $x$  are opposite it means  $\frac{dx}{dt} = V > 0$  i.e., wave is propagating in the direction of growing  $x$ .

23. Since  $V = \frac{Q}{4\pi\epsilon_0 r}$  and  $E = \frac{Q}{4\pi\epsilon_0 r^2}$  ;

Given  $V = Q \times 10^{11} = Q 4\pi\epsilon_0 r$   
 $\Rightarrow r = \frac{1}{4\pi\epsilon_0 \times 10^{11}}$

i.e.,  $E = \frac{V}{r}$   
 $\Rightarrow E = \frac{QV}{r} = Q \times 10^{11} \times 4\pi\epsilon_0 \times 10^{11}$   
 $= 4\pi\epsilon_0 Q \times 10^{22} \text{ volt m}^{-1}$

24.  $C = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$  = velocity of em wave through medium having permittivity ( $\epsilon_0$ ) and permeability ( $\mu_0$ ).

25. Path difference  $\Delta x = x_1 - x_2 = 15 - 10 = 5 \text{ m}$   
 $\lambda = vT = 300 \times 0.05 = 15 \text{ m}$   
 $\Delta\phi = \frac{2\pi}{\lambda} \cdot \Delta x = \frac{2\pi}{15} \times 5 = \frac{2\pi}{3}$

26. Maximum acceleration  $a = -\omega^2 A$   
 $\frac{a_1}{a_2} = \frac{\omega_1^2 A}{\omega_2^2 A} = \frac{(100)^2}{(1000)^2} = \frac{1}{10^2}$

27. Lattice parameter  
 $a = \frac{4r}{\sqrt{2}}$   
 $r = \frac{\sqrt{2}a}{4} = \frac{\sqrt{2} \times 3.6}{4}$   
 $= 0.9 \times 1.41 = 1.27 \text{ \AA}$

28. Energy used per  $\text{sec}^{-1}$  to operate turbine  
 $= mgh = 15 \times 10 \times 60 \text{ joule}$   
 $= 9000 \text{ joule}$   
Power supplied to turbine =  $9000 \text{ joule sec}^{-1}$   
Power loss due to friction =  $900 \text{ joule sec}^{-1}$   
Power generated by turbine  
 $= (9000 - 900) \text{ joule sec}^{-1}$   
 $= 8100 \text{ joule sec}^{-1} = 8.1 \text{ kW}$

Second approach

$$P_{\text{generated}} = P_{\text{input}} \times \frac{90}{100} = \frac{mgh}{t} \times \frac{90}{100}$$

$$= \frac{15 \times 10 \times 60 \times 90}{100} = 8.1 \text{ kW}$$

29. Energy stored in capacitor for field  
 $E = \frac{1}{2} CV^2$

$$= \frac{1}{2} \left( \frac{\epsilon_0 A}{d} \right) (E \cdot d)^2$$

$$= \frac{1}{2} \epsilon_0 A E^2 d$$

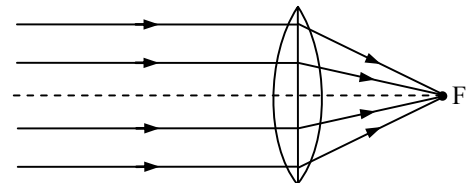
Energy stored in capacitor + Energy loss in the process of charging = Energy given by cell.

$$= \left( \frac{A \epsilon_0}{d} \right) V^2$$

$$= 2 \times \text{Energy stored in capacitor}$$

Since energy stored in capacitor = Energy loss in the process of storing the charge in capacitor.

30.



$$u = 1.5 \times 10^{11} \text{ m}$$

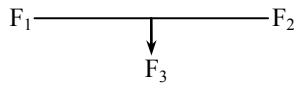
$$u = f = 10 \text{ cm} = 0.1 \text{ m}$$

$$\frac{v}{u} = \frac{h_i}{h_0}$$

$$\Rightarrow \frac{0.1}{1.5 \times 10^{11}} = \frac{h_i}{1.39 \times 10^9}$$

$$h_i = \frac{1.39 \times 10^8}{1.5 \times 10^{11}} = 9.2 \times 10^{-4} \text{ m}$$

31. Total force on the current carrying closed loop should be zero, if placed in uniform magnetic field.



$$F_{\text{horizontal}} = (F_3 - F_1)$$

$$F_{\text{vertical}} = F_2$$

Resultant of  $\vec{F}_1$ ,  $\vec{F}_2$  and  $\vec{F}_3$  is  $\vec{F}$

where  $F = \sqrt{(F_3 - F_1)^2 + F_2^2}$

Since total force = 0, hence force on QP is equal

to  $\vec{F}$  in magnitude but opposite direction.

$$F_{QP} = \sqrt{(F_3 - F_1)^2 + F_2^2}$$

32.  $R = \frac{\rho l}{A}$

Now,  $l = l + \frac{l}{10} = \frac{11l}{10}$

and therefore,  $A = \frac{10A}{11}$

$$\text{So } R' = \frac{P \times \left(\frac{11l}{10}\right)}{\left(\frac{10A}{11}\right)} = \frac{\rho l}{A} \times \frac{(11)^2}{(10)^2} = 1.21 R$$

Now resistance becomes 1.21 times of initial and specific resistance is the intrinsic property so remains same.

33. Curie temperature is that temperature above which a ferromagnet becomes paramagnet.

34. Energy density and Young's modulus have same dimensions and equal to  $[ML^{-1}T^{-2}]$   
Dielectric constant and refractive index are dimensionless.

35. Since  $E_0 = -13.6 \text{ eV}$ ; Energy in the excited state

$$= \frac{-13.6}{4} = -3.4 \text{ eV}$$

$\Delta E =$  Excitation energy  
= Energy needed to raise the electron from ground state to higher level  
=  $-3.4 + 13.6 = 10.2 \text{ eV}$

36. Voltage gain =  $\frac{A_V}{1 + \beta \cdot A_V}$ ,

where  $\beta = \frac{9}{100} = 0.09$ , voltage gain = 10

$$\Rightarrow 10 = \frac{A_V}{1 + \frac{9}{100} \cdot A_V}$$

$$\Rightarrow A_V = \frac{10}{0.1} = 100$$

37. Current through galvanometer

$$I = \frac{3V}{50\Omega + 2950\Omega} = 10^{-3} \text{ A}$$

Current for 30 division =  $10^{-3} \text{ A}$

Current for 20 division =  $\frac{20}{30} \times 10^{-3}$

$$= \frac{2}{3} \times 10^{-3} \text{ A} = \frac{3}{50 + R}$$

$$\Rightarrow R = 4450 \Omega$$

38.  $m_1 v_1 = m_2 v_2$   
gun shell

$$4 \times v_1 = \frac{200}{1000} \times v_2$$

$$\frac{v_2}{v_1} = 20 \quad \dots(1)$$

$$\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = 1.05 \times 10^3$$

$$2 v_1^2 + \frac{1}{10} v_2^2 = 1.05 \times 10^3 \quad \dots(2)$$

By equation (1) and (2)  
 $v_2 = 100 \text{ m/s}$

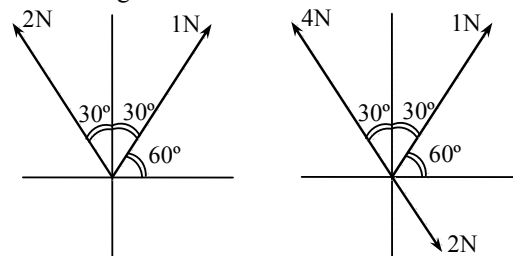
39.  $e = E_0 \sin \omega t$

$$i = I_0 \sin (\omega t - \phi)$$

$$P_{\text{av.}} = E_{\text{rms}} \cdot I_{\text{rms}} \cdot \cos \phi$$

$$= \frac{E_0}{\sqrt{2}} \cdot \frac{I_0}{\sqrt{2}} \cdot \cos \phi = E_0 I_0 \cos \phi$$

40. 4N and 2N are opposite  
So net =  $4 - 2 = 2\text{N}$   
Now figure becomes



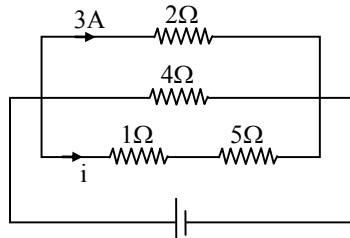
Horizontal component of 2N along -ve x-direction is  $x_1 = 2 \sin 30^\circ = 1 \text{ N}$

Horizontal component of 1 N along +ve x-direction is  $x_2 = 1 \cos 60^\circ = \frac{1}{2} \text{ N}$

So, net horizontal force is  $\frac{1}{2} \text{ N}$  along -ve

x-direction, hence  $\frac{1}{2} \text{ N}$  is required in +ve x-direction

41. Voltage across all three branches are same, i.e.,



$$3 \times 2 = i \times (5 + 1)$$

$$i = 1 \text{ A}$$

Power dissipated in  $5\Omega$

$$P = i^2 R$$

$$= (1)^2 \times 5 = 5 \text{ watt}$$

42.  $x_1 = N_0 e^{-5\lambda t}$   
 $x_2 = N_0 e^{-\lambda t}$

$$\frac{x_1}{x_2} = e^{-5\lambda t + \lambda t}$$

$$\frac{1}{e} = e^{-4\lambda t}$$

$$e^{-1} = e^{-4\lambda t} \Rightarrow t = \frac{1}{4\lambda}$$

43.  $E_{\text{incident}} = W + K_{\text{max}} ; K_{\text{max}} = eV_0$   
 $h\nu = h\nu_0 + eV_0 ; \text{stopping potential} = V_0$   
 $\frac{hc}{\lambda} = 6.2e + 5e$

$$\lambda = \frac{h \times c}{11.2 \times 1.6 \times 10^{-19}} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{11.2 \times 1.6 \times 10^{-19}}$$

$$= 1.1 \times 10^{-7} \text{ m}$$

Hence the wavelength of ultraviolet region.

44.  $x = a \sin\left(\omega t + \frac{\pi}{6}\right)$

$$v = \frac{dx}{dt} = a\omega \cos\left(\omega t + \frac{\pi}{6}\right)$$

$$v_{\text{max}} = a\omega$$

$$\frac{a\omega}{2} = a\omega \cos\left(\omega t + \frac{\pi}{6}\right)$$

$$\omega t + \frac{\pi}{6} = \frac{\pi}{3} \Rightarrow \omega t = \frac{\pi}{6}$$

$$t = \frac{\pi}{6\omega} = \frac{\pi \times T}{6 \times 2\pi} = \frac{T}{12}$$

45.  $P = P_1 + P_2 = \frac{1}{f_1} + \frac{1}{f_2}$

$$P = \frac{f_1 + f_2}{f_1 \cdot f_2}$$

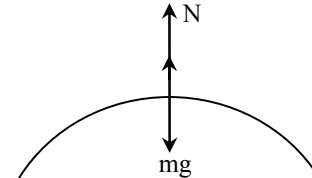
46.  $PV = nRT$  or  $\frac{PV}{M} = \frac{1}{M_0} RT$

$$\text{or } \frac{P}{\rho} = \frac{RT}{M_0} \Rightarrow \frac{\rho}{P} \propto \frac{1}{T}$$

$$\Rightarrow \frac{\rho_1 / \rho_2}{P_1 / P_2} = \frac{T_2}{T_1} \quad \text{or} \quad \frac{x}{\rho_2 / P_2} = \frac{383}{283}$$

$$\text{or } \frac{\rho_2}{P_2} = \frac{283}{383} x$$

47.  $mg - N = \frac{mv^2}{r}$



When  $N = 0$ , for weightlessness

$$\frac{mv^2}{r} = mg$$

$$\Rightarrow v^2 = rg = 20 \times 10 = 200$$

$$v = 14.14$$

48.  $A = \pi r^2 = 0.04\pi$   
 $\phi = BA \cos \theta$   
 $= \frac{1}{\pi} \times 0.04 \pi \times \cos 60^\circ = 0.02 \text{ Wb}$

49.  $MK_1^2 = MR^2$   
 $K_1 = R$

$$MK_2^2 = \frac{MR^2}{2}$$

$$K_2 = \frac{R}{\sqrt{2}}$$

$$\frac{K_2}{K_1} = \frac{\sqrt{2}}{R} = \frac{1}{\sqrt{2}}$$

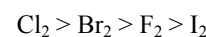
50.  $E \propto l_1$  and  $E = \frac{E}{R+r} \cdot r \propto l_2$

$$\Rightarrow \frac{r+R}{R} = \frac{l_1}{l_2}$$

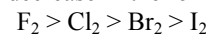
$$\Rightarrow r = \left(\frac{l_1}{l_2} - 1\right) \cdot R$$

$$= \frac{110 - 100}{100} \times 10 = 1\Omega$$

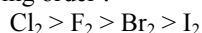
51. In case of diatomic molecules ( $X_2$ ) of halogens the bond dissociation energy decreases in the order :



The oxidizing power, electronegativity and reactivity decrease in the following order :



Electron gain enthalpy of halogens decreases in the following order :



The low value of electron gain enthalpy of fluorine is due to small size of fluorine atom.

52. The average translational KE of one molecule of an ideal gas is as follows :

$$K_t = \frac{KE}{N_A} = \frac{3/2 RT}{N_A} = \frac{3}{2} KT$$

When  $R/N_A =$  Boltzmann constant

i.e.,  $E_t \propto T$

Thus, at constant temperature KE of molecules remains same.

53.  $2\text{AB}_2(\text{g}) \rightleftharpoons 2\text{AB}(\text{g}) + \text{B}_2(\text{g})$
- |                    |                |               |           |
|--------------------|----------------|---------------|-----------|
| $\frac{2}{2(1-x)}$ | $\frac{0}{2x}$ | $\frac{0}{x}$ | initially |
|                    |                |               | at eq.    |

Total amount of moles at equilibrium

$$= 2(1-x) + 2x + x = 2+x$$

$$K_p = \frac{[\text{P}_{\text{AB}}]^2 [\text{P}_{\text{B}_2}]}{[\text{P}_{\text{AB}_2}]^2}$$

$$K_p = \frac{\left[\frac{2x}{2+x} \times P\right]^2 \times \left[\frac{x}{2+x} \times P\right]}{\left[\frac{2(1-x)}{2+x} \times P\right]^2}$$

$$K_p = \frac{4x^3}{2+x} \times P \times \frac{1}{4(1-x)^2}$$

$$K_p = \frac{4x^3 \times P}{2} \times \frac{1}{4} \quad (\text{As } 1-x \approx 1 \text{ and } 2+x \approx 2)$$

$$x = (8K_p/4P)^{1/3} = (2K_p/P)^{1/3}$$

54. According to the given data, when concentration of  $\text{Br}_2$  is doubled, the initial rate of disappearance of  $\text{Br}_2$  remains unaffected. So order of reaction with respect to  $\text{Br}_2$  is zero. The rate law for the reaction will be :

$$k [\text{CH}_3\text{COCH}_3] [\text{H}^+]$$

55.  $\text{Fe}(\text{OH})_3(\text{s}) \rightleftharpoons \text{Fe}^{3+}(\text{aq.}) + 3\text{OH}^-(\text{aq.})$

$$K = \frac{[\text{Fe}^{3+}] [\text{OH}^-]^3}{[\text{Fe}(\text{OH})_3]}$$

$$K = [\text{Fe}^{3+}] [\text{OH}^-]^3$$

(as activity of solid is taken unity)

Concentration of  $\text{OH}^-$  ion in the reaction is decreased by  $1/4$  times then equilibrium concentration of  $\text{Fe}^{3+}$  will be increased by 64 times in order to keep the value of  $K$  constant.

56.  $\text{C}_3\text{H}_8 + 5\text{O}_2 \longrightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$
- |   |   |   |   |          |
|---|---|---|---|----------|
| 1 | 5 | 3 | 4 | (Volume) |
|---|---|---|---|----------|

So 1 volume or 1 litre of propane requires 5 volume or 5 litre of  $\text{O}_2$  to burn completely.

57.  $\text{pH} = -\log_{10} [\text{H}^+]$   
 $[\text{H}^+] = 10^{-\text{pH}}$   
 $[\text{H}^+] \text{ of solution 1} = 10^{-3}$   
 $[\text{H}^+] \text{ of solution 2} = 10^{-4}$   
 $[\text{H}^+] \text{ of solution 3} = 10^{-5}$

Total concentration of  $[\text{H}^+]$

The volume taken in each case is 1 L

$$= 10^{-3} (1 + 1 \times 10^{-1} + 1 \times 10^{-2})$$

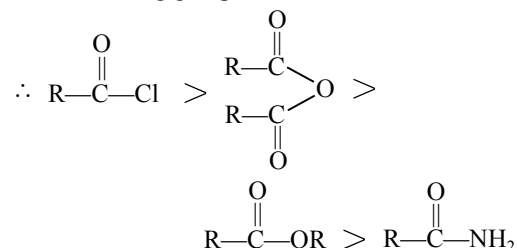
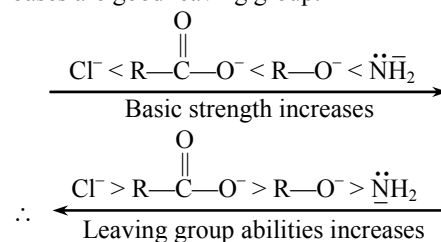
$$= 10^{-3} \left( \frac{1}{1} + \frac{1}{10} + \frac{1}{100} \right)$$

$$= 10^{-3} \left( \frac{111}{100} \right) = 1.11 \times 10^{-3}$$

Therefore,  $\text{H}^+$  ion concentration in mixture of equal volume of these acid solutions

$$= \frac{1.11 \times 10^{-3}}{3} = 3.7 \times 10^{-4} \text{ M}$$

58. The relative reactivities of acyl compound towards nucleophilic substitution will depend upon the nature of leaving group ability. Weak bases are good leaving group.



59. DNA contains two types of nitrogenous bases, i.e.,

Purine  $\rightarrow$  Adenine (A), Guanine (G)

Pyrimidine  $\rightarrow$  Cytosine (C), Thymine (T)

Adenine pairs with thymine (A : T) by two hydrogen bonds and Guanine with Cytosine (G : C) by three hydrogen bonds.

60.  $\text{H}-\text{C}\equiv\text{C}-\text{H} > \text{CH}_2=\text{CH}_2 > \text{CH}_3-\text{CH}_3$
- |             |             |               |               |               |                    |
|-------------|-------------|---------------|---------------|---------------|--------------------|
| $\text{sp}$ | $\text{sp}$ | $\text{sp}^2$ | $\text{sp}^2$ | $\text{sp}^3$ | $\text{sp}^3$      |
|             |             |               |               |               | (Acidic character) |

Conjugate base of the given acid is as follows :



(Basic character)

So conjugate base of stronger acid is weaker and vice-versa.

61. Equimolar solutions of the given chlorides when prepared in water forms their respective hydroxides.  $\text{Be}(\text{OH})_2$  is amphoteric, but the hydroxides of other alkaline earth metals are basic. The basic strength increases down the group. Therefore higher the basic character higher will be the pH.

62. As smaller the size of cation, higher will be hydration and its effective size will increase so mobility in aqueous solution will decrease.

63. According to Heisenberg uncertainty principle

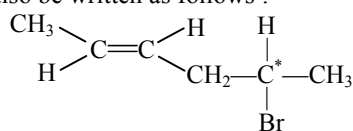
$$\Delta p \cdot \Delta x \geq \frac{h}{4\pi}$$

$$m\Delta v \cdot \Delta x \geq \frac{h}{4\pi}$$

$$(m \cdot \Delta v)^2 \geq \frac{h^2}{4\pi^2}$$

$$\Delta v \geq \frac{1}{2m} \sqrt{\frac{h^2}{\pi^2}}$$

64. Given compound,  
 $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CHBrCH}_3$   
 may also be written as follows :



Both geometrical isomerism (cis-trans form) and optical isomerism is possible in this compound.

Number of optical isomer =  $2^n = 2^1 = 2$   
 (Here n = number of asymmetric carbon)  
 Therefore, total number of stereoisomers  
 =  $2 + 2 = 4$

65.  $[\text{Fe}(\text{CN})_6]^{3-} \longrightarrow [\text{Fe}(\text{CN})_6]^{4-}$ ,  $E^\circ = +0.35 \text{ V}$   
 $\text{Fe}^{3+} \longrightarrow \text{Fe}^{2+}$ ,  $E^\circ = +0.77 \text{ V}$   
 Higher the positive reduction potential, stronger is the oxidizing agent. Oxidizing agent oxidizes other compounds and gets itself reduced easily.

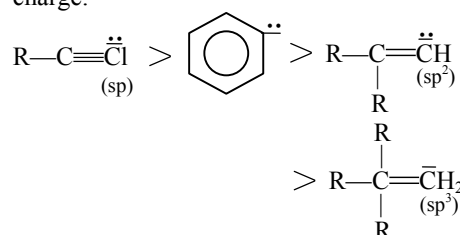
66. As ionization enthalpy (both first and second) increases from left to right across the period. Only chromium is exceptional due to the stable configuration ( $3d^5$ ) so the correct order is :  
 $\text{Cr} > \text{Mn} > \text{V} > \text{Ti}$

66. The electron density of 'phenol ring' is most among chloro benzene, benzyl alcohol and nitrobenzene.  
 In phenol, due to 'OH' group there will be both +M and "-I". But +M-effect of 'OH' dominates over its "-I".

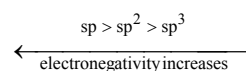
68.  $\text{He}_2^+ < \text{O}_2^- < \text{NO} < \text{C}_2^{2-}$   
 Bond order 0.5 1.5 2.5 3.0

69.  $\text{PbO} + 2\text{HCl} \longrightarrow \text{PbCl}_2 + \text{H}_2\text{O}$   
 x mole 2x moles x mole  
 $\frac{6.5}{224} \text{ mole} \quad \frac{3.2}{36.5} \text{ mole}$   
 $= 0.029 \text{ mole} = 0.087 \text{ mole}$   
 Thus, 0.029 mole of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl.

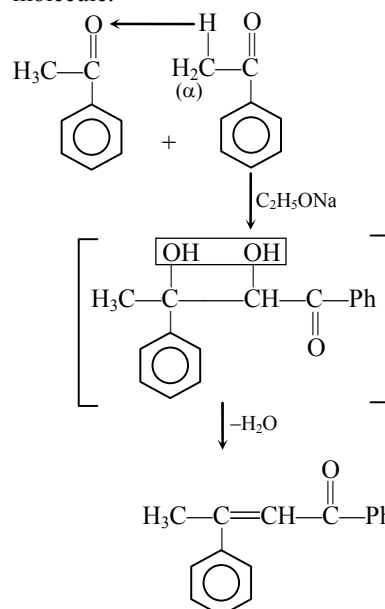
70. More is the electronegativity of hybrid atom, more will be its tendency to retain the (-)ve charge.



The electronegativity of hybrid orbitals, depends on their 's' character. It follows given order,



71. Acetophenone when reacted with base like  $\text{C}_2\text{H}_5\text{ONa}$ , will undergo aldol condensation reaction with simultaneous loss of  $\text{H}_2\text{O}$  molecule.



72. Weight of  $6.023 \times 10^{23}$  molecules of water = 18 g  
 As volume occupied by  $6.023 \times 10^{23}$  molecules of water (density =  $1 \text{ g cm}^{-3}$ ) will be

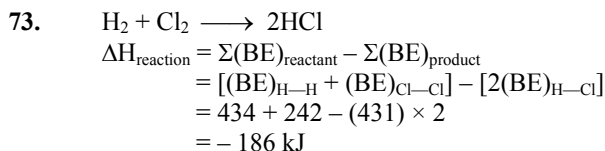


$$= \frac{18\text{g}}{1\text{g cm}^{-3}} = 18 \text{ cm}^3 \text{ or mL}$$

So volume occupied by one molecule of water

$$= \frac{18}{6.023 \times 10^{23}} = 2.988 \times 10^{-23}$$

$$= 3.0 \times 10^{-23} \text{ cm}^3$$



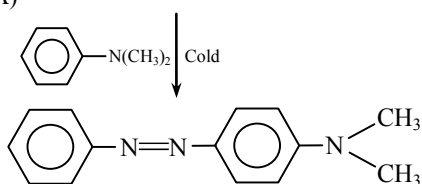
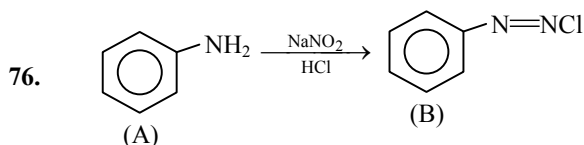
As  $\Delta H_{\text{reaction}} = -186 \text{ kJ}$   
 So enthalpy of formation of HCl

$$= \frac{-186 \text{ kJ}}{2}$$

$$= -93 \text{ kJ mol}^{-1}$$

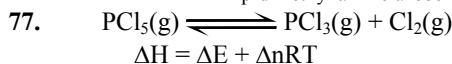
74. The oxidation state of Co in  $[\text{Co}(\text{OX})_2(\text{OH})_2]^-$  is +5. This is not possible. The oxidation state of Ti in  $[\text{Ti}(\text{NH}_3)_6]^{3+}$  is +3.  $\text{Ti}^{3+}$  has just one unpaired electron. O.S. of 'V' in  $[\text{V}(\text{gly})_2(\text{OH})_2(\text{NH}_3)_2]^+$  is again +3 and it means the number of unpaired electrons is 2. Oxidation state of Fe in  $[\text{Fe}(\text{en})(\text{bpy})(\text{NH}_3)_2]^{2+}$  is +2. So it contains 4 unpaired electron. More is the oxidation number of unpaired electron more will be the paramagnetic character.

75. Natural rubber is cis-1,3-polyisoprene and has only cis-configuration at energy double bond.



(C), Butter yellow

p-dimethyl amino azobenzene



Here,  $\Delta n$  = Change in number of moles of product and reactant

As  $\Delta n = +\text{ve}$ , so  $\Delta H = +\text{ve}$

$$\Delta S = S_{\text{product}} - S_{\text{reactant}}$$

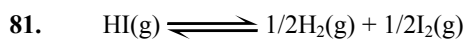
$$\Delta S = +\text{ve}$$

78. Uncertainty in momentum  
 $(m\Delta v) = 1 \times 10^{-18} \text{ g cm s}^{-1}$   
 Uncertainty in velocity

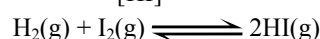
$$(\Delta v) = \frac{1 \times 10^{-18}}{9 \times 10^{-28}} = 1.1 \times 10^9 \text{ cm s}^{-1}$$

79. The angular shape of ozone molecule consists of 2 sigma and 1 pi-bond.

80. For body centered cubic structure, packing fraction = 0.68, i.e., 68% of the unit cell is occupied by atoms and 32% is empty.

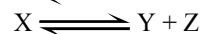
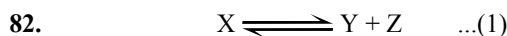


$$K = \frac{[\text{H}_2]^{1/2} [\text{I}_2]^{1/2}}{[\text{HI}]} = 8$$



$$K' = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = (1/8)^2$$

$$K' = 1/64$$



Initially 1 0 0

At eq.  $1-\alpha$   $\alpha$   $\alpha$

Total no. of moles at equilibrium

$$= 1 - \alpha + 2\alpha = 1 + \alpha$$



Initially, when  $t = 0$  1 0

At eq.  $1 - \alpha$   $2\alpha$

Total no. of moles at equilibrium

$$= 1 - \alpha + 2\alpha = 1 + \alpha$$

$$K_{p1} = \frac{P_Y \times P_Z}{P_X} = \frac{[(\alpha/1 + \alpha)P_1][\alpha/1 + \alpha] \times P_1}{[1 - \alpha/1 + \alpha] \times P_1}$$

$$K_{p2} = \frac{(P_B)^2}{P_A} = \frac{[(2\alpha/1 + \alpha) \times P_2]^2}{[1 - \alpha/1 + \alpha] \times P_2}$$

$$\frac{K_{p1}}{K_{p2}} = \frac{P_1}{4P_2}$$

$$\frac{P_1}{P_2} = \frac{36}{1} = 36 : 1$$

83. Thyroxine and adrenaline are amine hormone. These are water soluble hormones having amino groups.

84. According to Kohlrausch's law "At infinite dilution, each ion makes definite contribution to molar conductance of an electrolyte whatever be the nature of the other ion of the electrolyte"

$$\Lambda_m^\infty = \lambda_+^\infty + \lambda_-^\infty$$

$\lambda_+^\infty$  and  $\lambda_-^\infty$  are molar ionic conductance at infinite dilution for cations and anions, respectively.

Element	% composition	Mole ratio	Simple ratio
C	38.71	38.71/12 = 3.22	3.22/3.22 = 1
H	9.67	9.67/1 = 9.67	9.67/3.22 = 3
O	51.62	51.62/16 = 3.22	3.22/3.22 = 1

85. Green chemistry means such reaction which reduce the use and production of hazardous chemicals.

86. Packing fraction for a cubic unit cell is

$$f = \frac{z \times 4/3\pi r^3}{d^3}$$

Here a = edge length, r = radius of cation and anion  
Efficiency of packing in simple cubic or primitive cell =  $\pi/6 = 0.52$

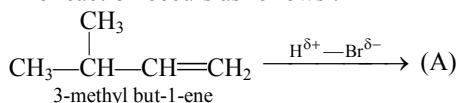
i.e., 52% of unit cell is occupied by atoms and 48% is empty.

87. As primary is more reactive than secondary and tertiary alkyl halides so  $\text{CH}_3\text{CH}_2\text{Br}$  has the highest relative rate.

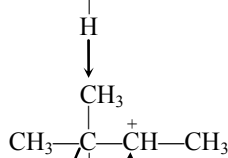
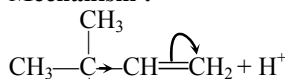
88.  $\text{NO}_2 > \text{NO}_2^+ > \text{NO}_2^-$   
132°    130°    115° (Bond angles)

89. If silicon is doped with any of the element of group III (B, Al, Ga etc.) of the periodic table, p-type of semiconductor will be obtained.

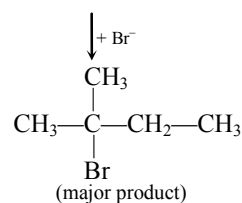
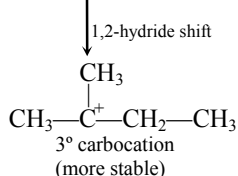
90. The reaction occurs as follows :



**Mechanism :**



2° carbocation  
(less stable)



91. Atomic mass of C = 12, H = 1 and O = 16

Thus empirical formula of the compound is  $\text{CH}_3\text{O}$ .

92. CFSE in octahedral field depends upon the nature of ligands. Stronger the ligands larger will be the value of  $\Delta_{\text{oct}}$ .

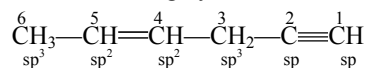
93. The ionic character of the bonds in hydrides increase from LiH to CsH so thermal stability of these hydrides decreases as follows :



94. State functions or state variables depend only on the state of the system.

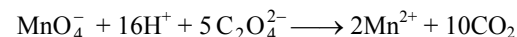
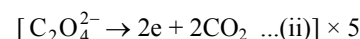
Here 'w' represents work done and 'q' represents amount of heat so both of these are not state functions.

95. In the following hydrocarbon



The state of hybridization of carbons 1, 3 and 5 are sp,  $\text{sp}^3$  and  $\text{sp}^2$  respectively.

96.  $[5e + \text{MnO}_4^- + 8\text{H}^+ \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} \dots(\text{i})] \times 2$



As 2 moles of  $\text{MnO}_4^-$  required to oxidize 5 moles of oxalate.

So number of moles of  $\text{MnO}_4^-$  required to oxidize 1 mole of oxalate =  $2/5 = 0.4$ .

97.  $k_1 = 10^{16} e^{-2000/T}$   
 $k_2 = 10^{15} e^{-1000/T}$

The temperature at which  $k_1 = k_2$  will be  
 $10^{16} e^{-2000/T} = 10^{15} e^{-1000/T}$

$$\frac{e^{-2000/T}}{e^{-1000/T}} = \frac{10^{15}}{10^{16}}$$

$$e^{-1000/T} = 10^{-1}$$

$$\log_e e^{-1000/T} = \log_e 10^{-1}$$

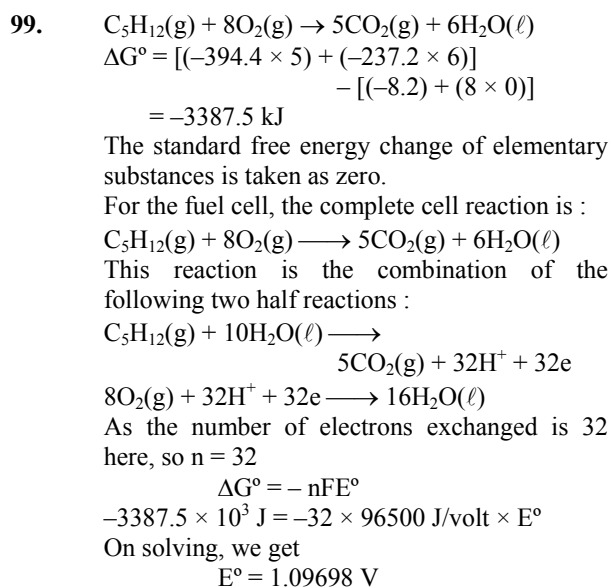
$$2.303 \times \log_{10} e^{-1000/T} = 2.303 \times \log_{10} 10^{-1}$$

$$\frac{-1000}{T} \times \log_{10} e = -1$$

On solving, we get

$$T = 1000/2.303 \text{ K}$$

98. A strong base can abstract an  $\alpha$ -hydrogen from aldehyde and ketones to form a carbanion or the enolate ion.



100. For simple cubic :

$$r^+/r^- = \frac{a}{2}$$

Here  $a$  = edge length and  
 $r^+/r^-$  = interatomic distance

For body centered :

$$r^+/r^- = \frac{a\sqrt{3}}{4}$$

For face centered :

$$r^+/r^- = \frac{a}{2\sqrt{2}}$$

Therefore ratio of radii of the three will be

$$\frac{a}{2} : \frac{a\sqrt{3}}{4} : \frac{a}{2\sqrt{2}}$$