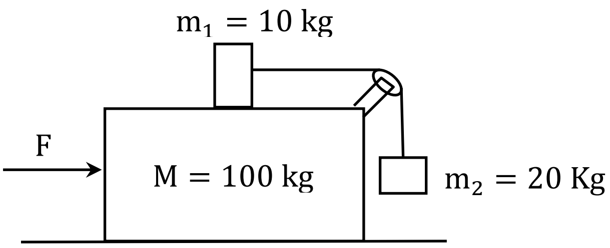
PHYSICS
JEE-MAIN (July-Attempt)
26 July (Shift-1) Paper Solution

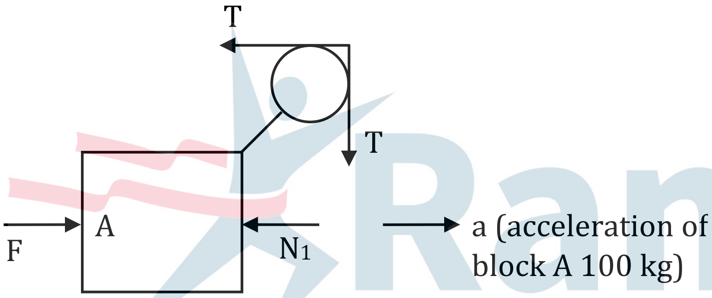
SECTION - A

1. Three masses $M = 100$ kg, $m_1 = 10$ kg and $m_2 = 20$ kg are arranged in system as shown in figure. All the surfaces are frictionless and strings are inextensible and weightless. The pulleys are also weightless and frictionless. A force F is applied on the system so that the mass m_2 moves upward with an acceleration $2\ ms^{-2}$. The value of F is : (Take $g = 10\ ms^{-2}$)



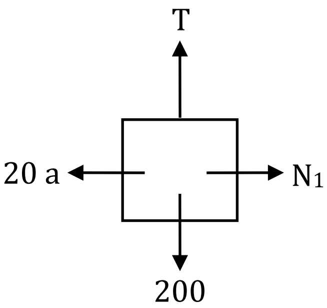
(A) 3360 N (B) 3380 N (C) 3120 N (D) 3240 N

Sol. **(C) by NTA but (A) by Motion**



$F - T - N_1 = 100\ a$ ... (1)

FBD of 20 kg Block wrt (100 kg)

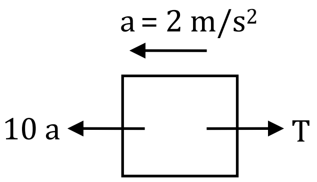


$\uparrow a_2 = 2\ m/s^2$, $N_1 = 20\ a$ ... (2)

$T - 200 = 20 \times 2$

$\boxed{T = 240\ N}$

FBD for 10 kg wrt (100 kg)



$10a - 240 = 10 \times 2$

$\boxed{a = 26\ m/s^2}$

$F - 240 - 20 \times 26 = 100 \times 26$

* $\boxed{F = 3360\ N}$

2. A radio can tune to any station in 6 MHz to 10 MHz band. The value of corresponding wavelength bandwidth will be:

(A) 4 m (B) 20 m (C) 30 m (D) 50 m

Sol. **(B)**

$\lambda_1 = \frac{C}{f_1} = \frac{3\times10^8}{6\times10^6} = 50\ cm$

$\lambda_2 = \frac{C}{f_2} = \frac{3\times10^8}{10\times10^6} = 30\ cm$

$\lambda_1 - \lambda_2 = 50 - 30 = 20\ m$

3. The disintegration rate of a certain radioactive sample at any instant is 4250 disintegrations per minute. 10 minutes later, the rate becomes 2250 disintegrations per minute. The approximate decay constant is :

(Take $\log_{10} 1.88 = 0.274$)

(A) $0.02\ min^{-1}$ (B) $2.7\ min^{-1}$ (C) $0.063\ min^{-1}$ (D) $6.3\ min^{-1}$

Sol. **(C)**

$R_1 = \frac{dN_0}{dt} = -\lambda N_0 = 4250$

$R_2 = -\lambda N = 2250$

$\frac{N}{N_0} = \frac{2250}{4250}$

$\frac{N_0}{N} = 1.88$ ... (1)

$N = N_0 e^{-\lambda(10)}$

$\frac{N}{N_0} = e^{-\lambda(10)}$

$1.88 = e^{10\lambda}$

$Log_{10}(1.88) = 10\lambda \log_{10} e$

$0.274 = 10 \times .4343\ \lambda$

$\lambda = \frac{0.274}{4.343}$

$\lambda = 0.063$

4. A parallel beam of light of wavelength 900 nm and intensity 100 Wm^{-2} is incident on a surface perpendicular to the beam. The number of photons crossing 1 Cm^2 area perpendicular to the beam in one second is :

(A) 3×10^{16} (B) 4.5×10^{16} (C) 4.5×10^{17} (D) 4.5×10^{20}

Sol. **(B)**

$n = \frac{IA\lambda t}{hc}$

$\frac{n}{t} = \frac{IA\lambda}{hc}$

↓

No. of e^-/sec = $\frac{100\times10^{-4}\times900\times10^{-9}}{6.6\times10^{-34}\times3\times10^{8}}$

= $\frac{9\times10^{-9+34-8}}{6.6\times3}$

= $\frac{30\times10^{16}}{6.6}$

= 4.5×10^{16}

5. In young's double slit experiment, the fringe width is 12 mm. If the entire arrangement is placed in water of refractive index $\frac{4}{3}$, then the fringe width becomes (in mm) :

(A) 16 (B) 9 (C) 48 (D) 12

Sol. **(B)**

$\underset{(air)}{B} = \frac{D\lambda}{d} = 12 \text{ mm}$

In water

$B_{water} = \frac{D\lambda_{water}}{d} = \frac{D\lambda_{air}}{d\mu_{water}}$

$\frac{\lambda_{air}}{\lambda_{water}} = \frac{\mu_{water}}{\mu_{air}}$

$\frac{\lambda_{air}}{\lambda_{water}} = \frac{\mu_{water}}{1}$

$\lambda_{water} = \frac{\lambda_{air}}{\mu_{water}}$

$\frac{12}{\frac{4}{3}} = 9 \text{ mm}$

6. The magnetic filed of a plane electromagnetic wave is given by :

$\bar{B} = 2 \times 10^{-8} \sin(0.5 \times 10^3 x + 1.5 \times 10^{11} t)\hat{j}$ T.

The amplitude of the electric filed would be:

(A) 6 Vm^{-1} along x − axis (B) 3 Vm^{-1} along z − axis

(C) 6 Vm^{-1} along z − axis (D) 2×10^{-8} Vm^{-1} along z − axis

Sol. **(C)**

$K = 0.5 \times 10^3$, $w = 1.5 \times 10^{11}$

$B_{max} = 2 \times 10^{-8}$, $v = \frac{w}{K} = \frac{1.5\times10^{11}}{0.5\times10^3}$

$C = \frac{E_{max}}{B_{max}}$ $v = 3 \times 10^8 = C$

$E_{max} = C\, B_{max}$

$= 3 \times 10^8 \times 2 \times 10^{-8} = 6$ volt/m

Direction of propagation → (–x)

Direction of B propagation → (+x)

Direction of E propagation → (along z axis)

As E, B and C are perpendicular

So answer (C).

7. In a series LR circuit $X_L = R$ and power factor of the circuit is P_1 when capacitor with capacitance C such that $X_L = X_C$ in put in series, the power factor becomes P_2 The ratio $\frac{P_1}{P_2}$ is :

(A) $\frac{1}{2}$ (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{\sqrt{3}}{\sqrt{2}}$ (D) 2 : 1

Sol. **(B)**

$P_1 = \cos\phi_1 = \frac{R}{z} = \frac{R}{\sqrt{R^2+R^2}} = \frac{R}{R\sqrt{2}} = \frac{1}{\sqrt{2}}$

$P_2 = \cos\phi_2 = \frac{R}{z} = \frac{R}{\sqrt{R^2+(R-R^2)}} = \frac{R}{R} = 1$

$\frac{P_1}{P_2} = \frac{\frac{1}{\sqrt{2}}}{1} = \frac{1}{\sqrt{2}}$

8. A charge particle is moving in a uniform magnetic filed $(2\hat{i} + 3\hat{j})$ T. If it has an acceleration of $(\alpha\hat{i} - 4\hat{j})\ m/s^2$, then the value of α will be :

(A) 3 (B) 6 (C) 12 (D) 2

Sol. **(B)**

$\vec{B}.\vec{a} = 0, [\bar{B} \perp \vec{a}]$

$2\alpha - 12 = 0$

$\alpha = 6$

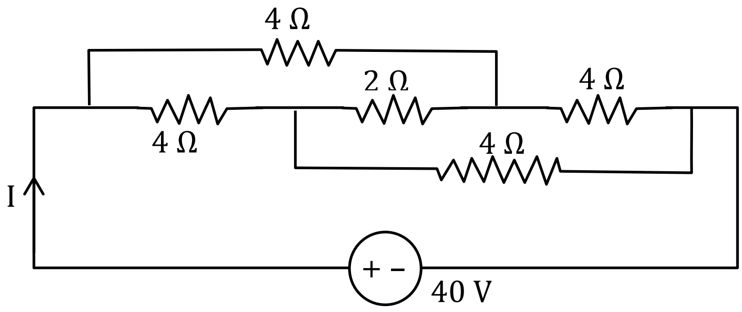
9. B_X and B_Y are the magnetic fields at the center of two coils X and Y respectively, each carrying equal current. If coil X has 200 turns and 2 0cm radius and coil Y has 400 turns and 20 cm radius, the ratio of B_X and B_Y is :

(A) 1:1 (B) 1:2 (C) 2 :1 (D) 4:1

Sol. **(B)**

$\frac{B_x}{B_y} = \frac{\frac{\mu_0 N_1 I}{2r}}{\frac{\mu_0 N_2 I}{2r}} = \frac{N_1}{N_2} = \frac{200}{400} = \frac{1}{2}$

10. The current I in the given circuit will be:



(A) 10 A (B) 20 A (C) 4 A (D) 40 A

Sol. **(A)**

By WSB, Req = $\frac{8\times8}{8+8} = 4\Omega$

$I = \frac{V}{Req} = \frac{40}{4} = 10$ A

11. The total charge on the system of capacitors $C_1 = 1\,\mu F, C_2 = 2\mu F, C_3 = 4\mu F$ and $C_4 = 3\,\mu F$ Connected in parallel is :

(Assume a battery of 20 V is connected to the combination)

(A) 200 μC (B) 200 C (C) 10 μC (D) 10 C

Sol. **(A)**

$C_{eq} = C_1 + C_2 + C_3 + C_4 = 1 + 2 + 3 + 4 = 10\ \mu F$

$q = C_{eq} V = 10\ \mu F \times 20 = 200\ \mu C$

12. When a particle executes Simple Hormonic Motion, the nature of graph of velocity as a function of displacement will be :

(A) Circular (B) Elliptical (C) Sinusoidal (D) Straight line

Sol. **(B)**

$v = \omega\sqrt{A^2 - x^2}$

$v^2 = \omega^2A^2 - \omega^2x^2$

$v^2 + \omega^2x^2 = \omega^2A^2$

$\frac{v^2}{(\omega A)^2} + \frac{x^2}{A^2} = 1 \rightarrow$ Elliptical

13. 7 mol of a certain monotomic ideal gas undergoes a temperature increase of 40K at constant pressure. The increase in the internal energy of the gas in this process is :

(Given $R = 83\ JK^{-1}\ mol^{-1}$)

(A) 5810 J (B) 3486 J (C) 11620 J (D) 6972 J

Sol. **(B)**

n = 7

ΔT = 40 K

$\Delta U = \frac{nfR\Delta T}{2}$

$= \frac{7\times3\times8.3\times40}{2} = 21 \times 166 = 3486$ J

14. A monatomic gas at pressure P and volume V is suddenly compressed to one eighth of its original volume. The final pressure at constant entropy will be :

(A) P (B) 8P (C) 32 P (D) 64 P

Sol. **(C)**

Constant entropy means process is adiabatic

$V_1 = V$ $\Delta S = \frac{\Delta Q}{T}$

So

$V_2 = \frac{V}{8}$ $\because \Delta S = 0$ .... [as S = constant]

$P_1 V_1^r = P_2 V_2^r$ $\therefore \Delta Q = 0 \Rightarrow$ Adiabatic

$P_1 V^{5/3} = P_2 (\frac{V}{8})^{5/3}$

$\boxed{P_2 = 32 P_1}$

15. A Water drop of radius 1 cm is broken into 729 equal droplets. If surface tension of water is 75 dyne/ cm then the gain in surface energy upto first decimal place will be :

(Given $\pi = 3.14$)

(A) 8.5×10^{-4} J (B) 8.2×10^{-4} J (C) 7.5×10^{-4} J (D) 5.3×10^{-4} J

Sol. **(C)**

Initial surface energy = T.A

$U_i = \frac{75 \times 10^{-5}}{10^{-2}} \frac{N}{m} \times [(4\pi(1 \times 10^{-2})^2)]$

$= 75 \times 10^{-3} \times 4\pi \times 10^{-4} = 942 \times 10^{-7}$

But

$(\text{Volume})_i = (\text{Volume})_f$

$\frac{4}{3}\pi R^3 = 729(\frac{4}{3}\pi r^3)$ (r= final, R = initial)

$r = \frac{R}{(729)^{\frac{1}{3}}} = \frac{R}{9} = \frac{1}{9}$ cm

$U_f = 729[TA] = 729\left[\frac{75 \times 10^{-5}}{10^{-2}} \frac{N}{m}\right]\left[4\pi\left(\frac{1}{9} \times 10^{-2}\right)^2\right]$

$= 729[75 \times 10^{-3} \times \frac{4\pi \times 10^{-4}}{81}]$

$= 9 \times 942 \times 10^{-7}$ J

Gain in surface energy $= (9 \times 942 - 942) \times 10^{-7}$

$= 8 \times 942 \times 10^{-7}$

$= 7536 \times 10^{-7}$ J

$= 7.5 \times 10^{-4}$ J

16. The percentage decrease in the weight of a rocket, when taken to a height of 32 km above the surface of earth will be :

(Radius of earth = 6400 km)

(A) 1% (B) 3% (C) 4% (D) 0.5%

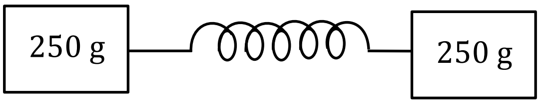
Sol. **(A)**

$g' = g(1-\frac{2h}{R})$

$g' = g(1-\frac{2\times 32}{6400}) = \frac{g(99)}{100}$

$\frac{mg-mg'}{mg}\times 100 = \frac{g-g'}{g}\times 100 = \frac{g-\frac{99g}{100}}{g}\times 100 = \frac{1}{100}\times 100 = 1\%$

17. As per the given figure, two blocks each of mass 250 g are connected to a spring of spring constant 2 Nm^{-1} If both are given velocity v in opposite directions, then maximum elongation of the spring is:



(A) $\frac{v}{2\sqrt{2}}$ (B) $\frac{v}{2}$ (C) $\frac{v}{4}$ (D) $\frac{v}{\sqrt{2}}$

Sol. **(B)**

$K_i + U_i = K_f + U_f$

$2(\frac{1}{2}mv^2) + 0 = 0 + \frac{1}{2}(2)(x_{max})^2$

$x_{max}^2 = mv^2 = 0.25v^2 = \frac{v^2}{4}$

$\boxed{x_{max} = \frac{v}{2}}$

18. A monkey of mass 50 kg climbs on a rope which can withstand the tension (T) of 350 N. If monkey initially climbs down with an acceleration of 4 m/s^2 and then climbs up with an acceleration of 5 m/s^2. Choose the correct option ($g = 10\ m/s^2$).

(A) T = 700 N while climbing upward

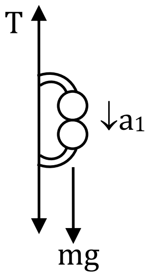
(B) T= 350 N while going downward

(C) Rope will break while climbing upward

(D) Rope will break while going downward

Sol. **(C)**

FBD of monkey while moving downward

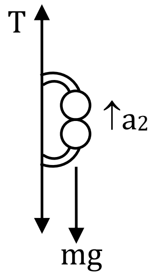


$mg - T = ma_1$

$500 - T = 50 \times 4$

$\boxed{T = 300\ N}$

FBD of monkey while moving upward



$T - mg = ma_2$

$T - 500 = 50 \times 5$

$\boxed{T = 750\,N}$

But breaking strength of string = 350 N.

So, string will break while monkey moving upward.

19. Two projectiles thrown at 30° and 45° with the horizontal respectively, reach the maximum height in same time. The ratio of their initial velocities is :

(A) $1:\sqrt{2}$ (B) $2:1$ (C) $\sqrt{2}:1$ (D) $1:2$

Sol. **(C)**

$h_{1max} = h_{2max}$

$\frac{u_{1y}^2}{2g} = \frac{u_{2y}^2}{2g}$

$\boxed{u_{1y} = u_{2y}}$

$u_1 \sin 30 = u_2 \sin 45$

$\frac{u_1}{2} = \frac{u_2}{\sqrt{2}}$

$\frac{u_1}{u_2} = \frac{2}{\sqrt{2}} = \sqrt{2}:1$

20. A screw gauge of pitch 0.5 mm is used to measure the diameter of uniform wire of length 6.8 cm the main scale reading is 1.5 mm and circular scale reading is 7. The calculated curved surface area of wire to appropriate significant figures is :

[Screw gauge has 50 divuisons on its circular scale]

(A) 6.8 cm^2 (B) 3.4 cm^2 (C) 3.9 cm^2 (D) 2.4 cm^2

Sol. **(B)**

$S = 2\pi rl$

L.C. = $\frac{Pitch}{\text{No. of division on circular scale}}$

L.C. = $\frac{0.5}{50} = 0.01\,mm$

d = 1.5 mm + 7 × 0.01

d = 1.57 = 0.157 cm, r = $\frac{0.157}{2}$

$S = 2 \times \frac{22}{7} \times \frac{0.157}{2} \times 6.8$

S = $\frac{6.7106}{2}$ = 3.4 cm^2

21. If the initial velocity in horizontal direction of a projectile is unit vector $\hat{i}$ and the equation of trajectory is $y = 5x(1-x)$. The y component vector of the initial velocity is________$\hat{j}$
(Take g = 10 m/s^2)

Sol. **(5)**

y = 5x – 5x^2

y = $x tan\theta - \frac{gx^2}{2u^2 cos^2\theta}$ .... $tan\theta = 5$

$\vec{u}_x = \hat{i} \rightarrow u_x = 1$

u cosθ = 1

$tan\theta = \frac{u_y}{u_x} = \frac{u_y}{1}$

$5 = \frac{u_y}{1}$

$\boxed{u_y = 5} \rightarrow \vec{u}_y = 5\hat{j}$

22. A disc of mass 1 kg and radius R is free to rotate about a horizontal axis passing through its centre and perpendicular to the plane of disc. A body of same mass as that of disc is fixed at the highest point of the disc. Now the system is released, when the body comes to the lowest position, its angular speed will be $4\sqrt{\frac{x}{3R}}$ rad S^{-1} where $x =$ _______ ($g = 10\ ms^{-2}$)

Sol. **(5)**

By MEC →

$mg(2R) = \frac{1}{2} I_{disc}\omega^2 + \frac{1}{2} I_{particle}\omega^2$

$mg(2R) = \frac{1}{2}\omega^2[\frac{mR^2}{2} + mR^2]$

$mg2R = \frac{1}{2}\omega^2[\frac{3mR^2}{2}] = \frac{3}{4}m\omega^2R^2$

$\omega^2 = \frac{8g}{3R} = \boxed{\omega = \sqrt{\frac{80}{3R}}}$

Given

$\omega = 4\sqrt{\frac{x}{3R}} = \sqrt{\frac{80}{3R}}$

$\frac{16x}{3R} = \sqrt{\frac{80}{3R}}$

$\boxed{x = 5}$

23. In an experiment to determine the young's modulus of wire of length exactly 1 m, the extension in the length of the wire is measured as 0.4 mm with an uncertainty of $\pm 0.02\ mm$ when a load of 1 kg is applied. The diameter of the wire is measured as 0.4 mm with an uncertainty of $\pm 0.01\ mm$. The error in the measurement of Young's modulus (ΔY) is found to be $x \times 10^{10} NM^{-2}$. The value of x is ______.
(take g = 10 ms^{-2})

Sol. **(2)**

L = 1 m

$\Delta L = 0.4 \times 10^{-3}$ m

$d = 0.4 \times 10^{-3}$ m

$Y = \frac{FL}{A\Delta L} = \frac{mg(1)}{\frac{\pi d^2}{4}(0.4\times10^{-3})}$

$Y = \frac{40}{\pi(0.4\times10^{-3})^3}$

$Y = \frac{40\times7}{22\times64\times10^{-3}\times10^{-9}}$

$Y = 0.199 \times 10^{-12}$ N/m^2

$\frac{\Delta Y}{Y} = \frac{\Delta F}{F} + \frac{\Delta L}{L} + \frac{\Delta A}{A} + \frac{\Delta(\Delta L}{\Delta L}$

$= \frac{\Delta L}{L} + 2\frac{\Delta d}{d}$

$= \frac{0.02}{0.4} + 2 \times \frac{0.01}{0.4}$

$\frac{\Delta Y}{Y} = \frac{0.1}{2} + \frac{0.1}{2} = 0.1$

$\Delta Y = 0.1 \times Y = 0.1 \times 0.199 \times 10^{11}$

$\boxed{\Delta Y = 1.99 \times 10^{10}}$ $\therefore$ $\boxed{x = 2}$

$\simeq 2 \times 10^{10}$

24. When a car is approaching the observer, the frequency of horn is 100 Hz. After passing the observe, it is 50 Hz. If the observer moves with the car, the frequency will be $\frac{x}{3}\ Hz$ where $x =$ ____________.

Sol. **(200)**

$f = f_0(\frac{V}{V-V_s})$

U = speed of second

$100 = f_0(\frac{V}{V-V_s})$ ... (1)

V_s = speed of car (source)

$50 = f_0(\frac{V}{V+V_s})$ ... (2)

(1) ÷ (2)

$2 = \frac{U+U_s}{V+V_s}$

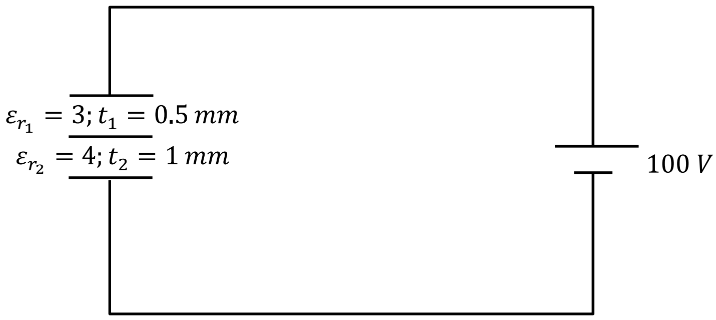
$2V - 2V_s = V + V_s$

$V = 3V_s$

$100 = f_0\left(\frac{V}{V+\frac{V}{3}}\right) = f_0\left(\frac{3}{2}\right)$

$f_0 = \frac{200}{3} = \frac{x}{3}$ $\therefore$ $\boxed{x = 200}$

25. A composite parallel plate capacitor is made up of two different dielectric materials with different thickness $(t_1 \ and \ t_2)$ as shown in figure. The two different dielectric materials are separated by a conducting foil F. The voltage of the conducting foil is __________V.



Sol. **(60)**

$C_1 = \frac{\epsilon_0 kA}{t_1}$

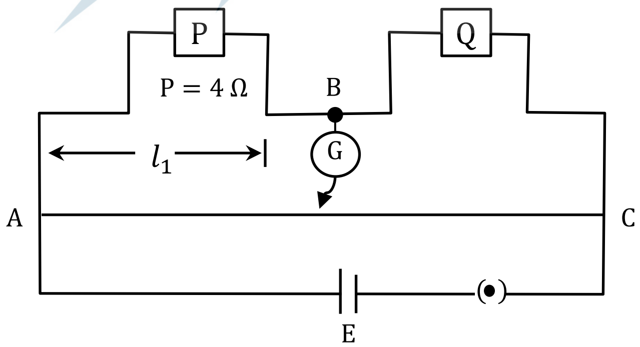
$C_2 = \frac{\epsilon_0 kA}{t_2}$

$V_2 = \frac{C_1 \times 100}{C_1 + C_2} = \frac{\frac{\epsilon_0 k_1 A}{t_1} \times 100}{\frac{\epsilon_0 k_1 A}{t_1} + \frac{\epsilon_0 k_2 A}{t_2}}$

$= \frac{\frac{k_1}{t_1} \times 100}{\frac{k_1}{t_1} + \frac{k_2}{t_2}} = \frac{\frac{3}{0.5} \times 100}{\frac{3}{0.5} + \frac{4}{1}} = \frac{300}{5} = 60$

$\boxed{V_2 = 60 \text{ volt}}$

26. Resistances are connected in a meter bridge circuit as shown in the figure. The balancing length l_1 is 40 cm. Now an unknown resistance x is connected in series with P and new balancing length is found to be 80 cm measured from the same end. Then the value of x will be _______Ω.



Sol. **(20)**

At null point

4 × 60 = Q × 40

$\boxed{Q = 6\Omega}$

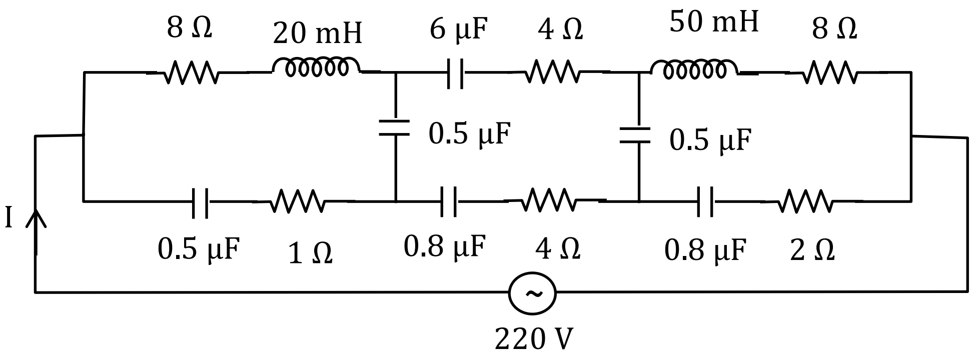
Now P = (4 + x)

(4 + x) × 20 = 6 × 80

4 + x = 24

$\boxed{x = 20\Omega}$

27. The effective current I in the given circuit at very high frequencies will be __________A.



Sol. **(44)**

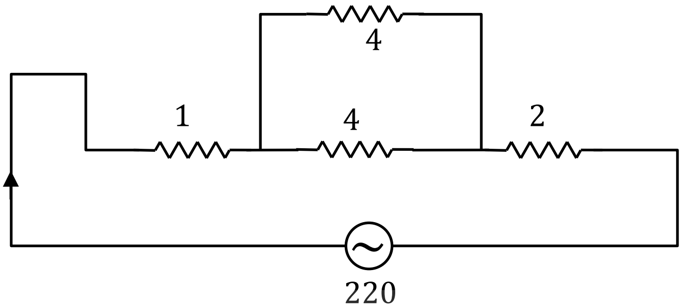
At high frequency ($X_C = \simeq 0, X_L = \simeq \infty$)

Z = 1 + 4||4 + 2

$\boxed{z = 5}$

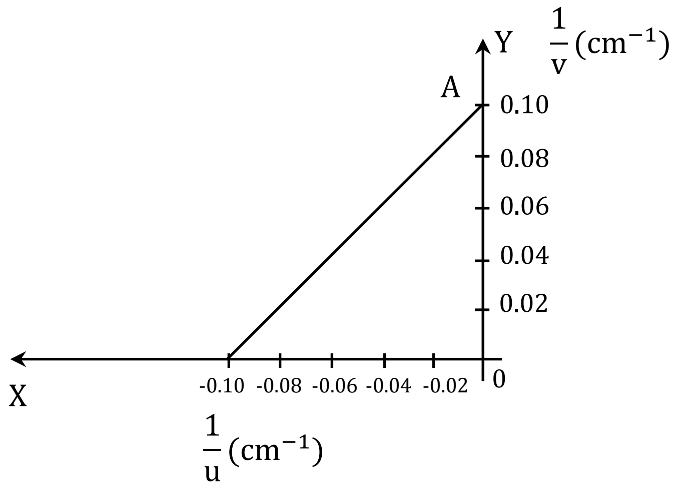
$I = \frac{V}{z} = \frac{220}{5}$

$\boxed{I = 44A}$



28. The graph between $\frac{1}{u}$ and $\frac{1}{v}$ for a thin convex lens in order to determine its focal length is plotted as shown in the figure. The refractive index of lens is 1.5 and its both the surfaces have same radius of curvature R. The value of R will be ________cm.

(where u = object distance, v = image distance)



Sol. **(10)**

$\frac{1}{f} = (\mu - 1)(\frac{1}{R} - \frac{1}{-R}) = \frac{(\mu-1)2}{R}$

R = 2(μ – 1)f

R = 2(1.5 – 1) × f

$\boxed{R = f}$ ... (1)

From given graph

$\frac{1}{u} - \frac{1}{v} = \frac{1}{f}$

$y - x = \frac{1}{f}$

$y = x + (\frac{1}{f})$ ⇒ Intercept on y axis

$\frac{1}{f} = 0.1$ From graph

$f = \frac{1}{0.1} = 10$

$\boxed{R = f = 10\, cm}$

29. In the hydrogen spectrum λ be the wavelength of first transition line of Lyman series. The wavelength difference will be "$a\lambda$" between the wavelength of 3^{rd} transition line of Paschen series and that of 2^{nd} transition line of Balmer series where a= ________.

Sol. **(5)**

For Lyman seres I line

$\frac{1}{\lambda} = R(\frac{1}{1^2} - \frac{1}{2^2}) = \frac{3R}{4}$

$\boxed{\lambda = \frac{4}{3R}} \to R = \frac{4}{3\lambda}$

For Paschen 3^{rd} transition

$\frac{1}{\lambda_3} = R(\frac{1}{3^2} - \frac{1}{(6)^2}) = R(\frac{1}{9} - \frac{1}{36}) = R(\frac{4-1}{36})$

$\boxed{\lambda_3 = \frac{12}{R}} = \frac{12\lambda}{\frac{4}{3\lambda}} = 9\lambda$

For Balmer 2^{nd} line

$\frac{1}{\lambda_2} = R(\frac{1}{(2)^2} - \frac{1}{(4)^2}) = R(\frac{1}{4} - \frac{1}{16}) = R(\frac{4-1}{16})$

$\lambda_2 = \frac{16}{3R} = \frac{16}{\frac{3\times 4}{3\lambda}} = 4\lambda$

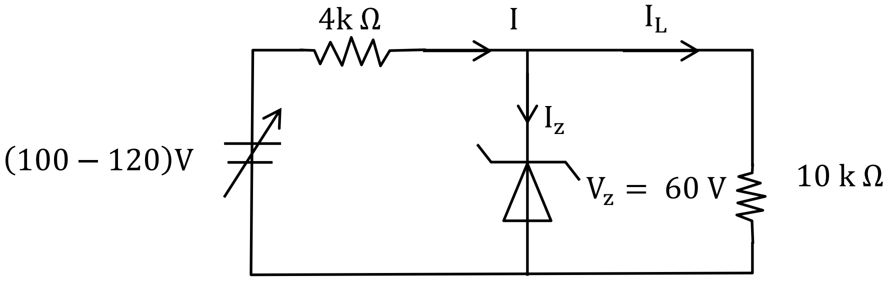
$|\lambda_3 - \lambda_2| = a\lambda$

$9\lambda - 4\lambda = a\lambda$

$5\lambda = a\lambda$

$\boxed{a = 5}$

30. In the circuit shown below, maximum zener diode current will be ________m.A.



Sol. **(9)**

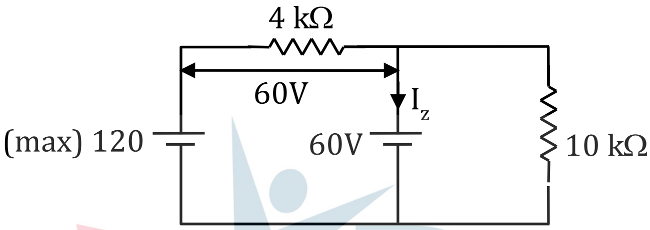
At 100 volt

$V_{across}10\ k\Omega = \frac{100\times10}{10+4} = \frac{1000}{14} = 71.42$

$71.42 > V_z\ (60)$

So diode will be ON

If V = 120 then diode also ON



$$I_z = \frac{60}{10k\Omega} = 6mA$$

$I = \frac{60}{4} = 15\ mA$

$I_{z\,(max)} = I - I_L = 15\ mA - 6\ mA = 9\ mA$