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10TH CLASS-PHYSICAL SCIENCE

IMPORTANT PROBLEMS (1/2 MARK TO 4 MARKS)

1.Convert 20^0C into Kelvin Scale?(1 Mark)

Ans: C=20^0C, K=?

K=C+273=20+273=**293K**

2.Convert 546 K into Celsius Scale(1 Mark)

Ans: We know that C=K-273

=546-273

=**273K**

3. 1g of ice at 0^0C and 1g of water at 40^0C are mixed. What is resultant temperature? (½ Mark)

Ans: 0^0C

Explanation: 1g of ice at 0^0C→ 1g of water at 0^0C (Q)=mL=1x80=80 cal

1g of water at 40^0C→ 1g of water at 0^0C (Q)=msΔT=1x1x40=40cal

Heats are not equal,So some ice present in the mixer. Resultant temperature is 0^0C

4. 4 kg of water is 100^0C temperature how much heat energy is required for whole water to evaporate?(2 Mark)

Ans: m=4 kg=4000 g

L=540 cal

Q=mL=4000x540=**$216x10^4$ cal**

5.What would be the final temperature of a mixture of 50g of water at 20^0C temperature and 50g of water at 40^0C temperature?(2 Marks)

Ans: m_1=50g m_2=50g

T_1=20^0C T_2=40^0C

Final temperature (T)=$m1T1 + m2T2/m1 + m2 = (50X20 + 50X40)/100 = (1000 + 2000)/100$ =**30^0C**

6.How much heat energy is required when 10g of water at 25^0C convert to 75^0C of water? (2 Marks)

Ans: m=10g , S=1 cal/g-^{0}C, T_1 =25^0 C ,T_2=75^0C

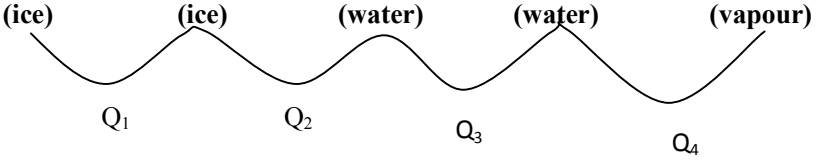
Q=mS(T_2 -T_1)=10x1x(75-25)=10x50=**500 cal**

7. Calculate required heat energy to change 12 g of ice at -10^0 C into water vapour at 100^0 C (4 Marks)

Ans: m =10g , S_{ice}=0.5 cal/g-^{0} c , S= 1 cal/g-^{0} c, L_F=80 cal/g, L_E=540 cal/g

-10^0 C--------> 0^0 C---------> 0^0 C----------> 100^0 C----------> 100^0 C

(ice) (ice) (water) (water) (vapour)



Q_1= ms(T_2-T_1)=12x0.5(0+10)=6x10=60 cal

Q_2= mL=12x80=960 cal

Q_3= ms(T_2-T_1)=12x1(100-0)=12x100=1200 cal

Q_4= mL=12x540=6480 cal

Heat energy required (Q)= Q_1 + Q_2 + Q_3 + Q_4 =60+ 960+ 1200 + 6480=**8700 cal**

8.Answer these. (4 Marks)

a) How much energy is transferred when 1 gm of boiling water at 100^0C condenses to water at 100^0C ?

b) How much energy is transferred when 1 gm of water at 100^0C cools to water at 0^0C ?

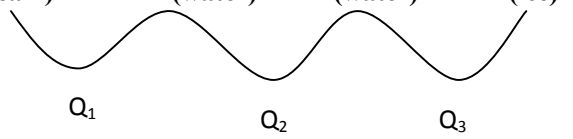
c) How much energy is released or absorbed when 1 gm of water at 0^0C freezes to ice at 0^0C ?

d) How much energy is released or absorbed when 1 gm of steam at 100^0C turns to ice at 0^0C ?(4 Marks)

Ans: m = 1g, S_{ice}=0.5 cal/g-^{0}C, S_{water}=0.5 cal/g-^{0}C , L_F=80 cal/g, L_E=540 cal/g

100^0 C--------> 100^0 C---------> 0^0 C----------> 0^0 C

(steam) (water) (water) (ice)



a) Q_1 = mL =1x540=540 cal

b) Q_2 = mL+ ms(T_2-T_1)=1x540+1x1(100-0)=540+100=640cal

c) Q_3 = mL =1x80=80cal

d) Q= 640+80=**720 cal** (or) 540+100+80=**720 cal**

9.The concentration of H^+ of the solution is 10^{-14} . What is the p^H value of the solution?(1/2 Mark)

Ans: [H^+]=10^{-14}

p^H= -$\log_{10}$ [H^+]= -$\log_{10}$ [10^{-14}]= 14 $\log_{10}$ 10=14x1=**14**

10.The refractive index of glass is 3/2.Find the speed of light in glass?(1 Mark)

Ans: n=3/2 C=$3x10^8$ m/s

v=?

n=C/v

v=C/n= $3x10^8x2/3$=**$2x10^8$ m/s**

11.Refractive index of glass relative to water is 9/8. What is the refractive index of water relative to glass?(1 Mark)

Ans: n_{gw}=9/8

$n_{wg}=1/n_{gw}$=**8/9**

12.Determine the refractive index of benzene if the critical angle is 42^0 (2 Marks)

Ans: c=42^0

n=?

$n=1/\sin c$ =1/sin42^0=1/0.6691=**1.49**

13.A light ray is incident on air-liquid interface at 45^0 and is refracted at 30^0. What is the refractive index of the liquid? For what angle of incidence will the angle between reflected ray and refracted ray be 90^0 ?(4 Marks)

Ans: i= 45^0 r=30^0 n=?

$n = \sin i/\sin c$=sin 45^0/ sin 30^0= $\frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}}$= $\sqrt{2}$=**1.414**

The angle between reflected and refracted rays is 90^0

i+ r =90^0

r =90-i

n= tan i

1.414 = tan i

i= $\tan^{-1}(1.414)$= **54.7^0**

From Snell's law n=sin i/sin r= sin i/sin (90-i)=sin i/cos i= tan i

14.Refractive index and thickness of the glass slab are 1.5, 3 cm respectively. Find the vertical shift of the glass slab? (2 Marks)

Ans: n=1.5

Thickness =3 cm

Vertical shift= ?

$n = thickness\ of\ slab\ /(\ thickness\ of\ slab\ -\ vertical\ shift)$

$1.5 = 3/3 - verical\ shift$

Vertical shift= 4.5-3/1.5=1.5/1.5=**1 cm**

15.The focal length of a converging lens is 20cm. An object is 60cm from the lens. Where will the image be formed and what kind of image is it ? (4 Marks)

Ans: f= 20cm u= - 60cm v= ?

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

$\frac{1}{20}=\frac{1}{v}+\frac{1}{60}$

$\frac{1}{v}=\frac{1}{20}-\frac{1}{60}$=$3-1/60$ =2/60=1/30

v=**30 cm**

Real ,diminished and inverted image

Image forms between F_1 and $2F_1$

v<u ---> Diminished image

F=20 cm and C ($2F_2$)=40 cm---> Between F_1 and $2F_1$

m= v/u= 30/-60= -1/2 - sign means Real image

16.An electric lamp and a screen are placed on the table, in a line at a distance of 1m. In what positions of convex lens of focal length of f=21cm will the image of lamp be sharp? (4 Marks)

Ans: Distance between lamp and screen=1 m=100 cm

Let distance between lamp and lens (u) = - x cm

Distance lens and screen(v) = (100-x) cm

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

$\frac{1}{21}=\frac{1}{100-x}+\frac{1}{x}=\frac{100}{x(100-x)}==\frac{100}{100x-x^2}$

x^2-100x+2100=0

x^2-70x-30x+2100=0

x(x-70)-30(x-70)=0

x-70=0 or x-30=0

x=70 cm or x=30 cm

17.What is the focal length of double concave lens kept in air with two spherical surfaces of radii R_1=30cm and R_2=60cm. Take refractive index of lens as n=1.5 (2 Marks)

Ans: n=1.5, R_1=30cm, R_2=60cm

Lens maker's formula for double concave lens $\frac{1}{f}=-(n-1)[\frac{1}{R1}+\frac{1}{R2}]$

$\frac{1}{f}=-(1.5-1)\left[\frac{1}{30}+\frac{1}{60}\right]=-(0.5)\left[\frac{3}{60}\right]=-\frac{1}{2}X\frac{1}{20}=-\frac{1}{40}$

f= -40 cm

18.Find the radii of curvature of a convexo-concave convergent lens made of glass with refractive index n=1.5 having focal length of 24cm. One of the radii of curvature is double the other. (4 Marks)

Ans: n=1.5 f=24 cm

Let $R_1 = R$ and $R_2 = 2R$

Lens maker's formula of convexo- concave lens $\frac{1}{f} = (n-1)[\frac{1}{R1} - \frac{1}{R2}]$

$$\frac{1}{24} = (1.5-1)\left[\frac{1}{R} - \frac{1}{2R}\right] = (0.5)\left[\frac{1}{2R}\right] = \frac{1}{2}X\frac{1}{2R} = \frac{1}{4R}$$

R= 6 cm

R_1= R=6 cm and R_2= 2R=2x6=12cm

19.Doctor advised to use 2D lens. What is its focal length? (1 Mark)

Ans: P= 2D , f=?

f=100/P=100/2=**50 cm**

20.A prism with an angle A= 60^0 produces an angle of minimum deviation of 30^0. Find the refractive index of material of the prism (2 Marks)

Ans: A= 60^0 , D=30^0

Refractive index of the prism $n = \frac{Sin(\frac{A+D}{2})}{Sin(\frac{A}{2})} = \frac{Sin(\frac{60^0+30^0}{2})}{Sin(\frac{60^0}{2})} = \frac{\text{Sin}45^0}{\text{Sin }30^0} = \frac{\frac{1}{\sqrt{2}}}{1/2} = \sqrt{2} = \mathbf{1.414}$

21.A light ray falls on one of the faces of a prism at an angle 40^0 so that it suffers angle of minimum deviation of 30^0. Find the angle of prism and angle of refraction at the given surface. (2 Marks)

Ans: i=40^0 D=30^0

We know that $i = \frac{(A+D)}{2}$

A=2i-D= 2x40^0 -30^0=80^0-30^0= **50^0**

Also r=A/2= 50^0/2= **25^0**

22.The focal length of a lens suggested to a person with Hypermetropia is 100cm.Find the distance of near point and power of the lens? (4 marks)

Ans: f= 100 cm d= ? P= ?

Focal length of lens in hyperrmetropia $f = \frac{25d}{d-25}$

$$100 = \frac{25d}{d-25}$$

100d-2500=25d

75d= 2500

d= 2500/75=**33.33 cm**

Power of the lens P=100/f= 100/100=**1D**

23.The wave length of a radio wave is 1.0 m. Find its frequency (1 Mark)

Ans: λ= 1 m C=3x10^8 m/s υ=?

We know that C= υ λ

υ= C/λ=3x10^8/1=**3x10^8 Hz**

24.If the resistance of your body is 100000Ω what would be the current that flows in your body when you touch the terminals of a 12V battery? (2 Marks)

Ans: R=100000Ω, V=12 V, I= ?

From Ohm's law V=IR

I=V/R=12/100000=**0.00012A**

25.A uniform wire of resistance 100Ω is melted and recast into wire of length double that of the original. What would be the resistance of the new wire formed? (4 Marks)

Ans:

Before recast

R_1 =100Ω $l_1 = l$ A_1 =A

After recast

R_2 =100Ω $l_2 = 2l$ A_2 =A/2

Use formula $\frac{R2}{R1} = \frac{l2XA1}{l1XA2}$

$$\frac{R2}{100} = \frac{2lXA}{lXA}X2 = 4$$

R_2= **400Ω**

26.Three resistors of values 2Ω, 4Ω, 6Ω,are connected in series. Find the equivalent resistance of combination of resistors? (1 Mark)

Ans: R_1= 2Ω R_2= 4Ω R_3=6Ω

Equivalent resistance in series R= R_1+ R_2+ R_3

=2+4+6=**12Ω**

27. Three resistors of values 2Ω, 4Ω, 6Ω,are connected in parallel. Find the equivalent resistance of combination of resistors? (2 Marks)

Ans: R_1= 2Ω R_2= 4Ω R_3=6Ω

Equivalent resistance in series $\frac{1}{R} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} = \frac{R1R2+R2R3+R3R1}{R1R2R3} = \frac{2X4+4X6+6X2}{2X4X6} = \frac{8+24+12}{2X4X6} = \frac{44}{48} = \mathbf{\frac{11}{12}}\Omega$

28.Two bulbs have ratings 100W, 220V and 60W,220V. Which one has the greatest resistance? (2 Marks)

Ans:

1st bulb	**2nd bulb**
P=100W V=220V	P=60W V=220V
$R=V^2/P$	$R=V^2/P$
R=220X220/100	R=220X220/60
R=484Ω	R=806.6Ω

2nd bulb has the greatest resistance

29.A wire of length 1m and radius 0.1 mm has a resistance of 100Ω. Find the resistivity of the material? (2 Marks)

Ans: l=1m r=0.1 mm=$0.1X10^{-3}$m=10^{-4} m R=100Ω

$A = \pi r^2$ =3.14 X $(10^{-4})^2$= $3.14x10^{-8}$ m^2

Resistivity(ρ)= RA/l= 100x$3.14x10^{-8}$/1= **$3.14x10^{-6}$ Ω-m**

30.A house has 3 tube lights, two fans and a Television. Each tube light draws 40W. The fan draws 80W and the Television draws 60W. On the average, all the tube lights are kept on for five hours, two fans for 12 hours and the television for five hours every day. Find the cost of electric energy used in 30days at the rate of Rs.3.00 per KWH (4 Marks)

Ans: i) No. of tube lights= 3

Wattage= 40W

Used hours= 5

No.of units consumed for tube lights=$\frac{No.of\ light X\ WattageXUsed\ hoursX30}{1000}=\frac{3X40X5X30}{1000}=18\ KWH$

ii) No. of Fans= 2

Wattage= 80 W

Used hours= 12

No.of units consumed for Fans =$\frac{No.of\ fansX\ WattageXUsed\ hoursX30}{1000}=\frac{2X80X12X30}{1000}=57.6\ KWH$

iii) No. of Television= 1

Wattage= 60 W

Used hours= 5

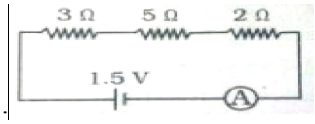
No.of units consumed for Fans =$\frac{No.of\ fansX\ WattageXUsed\ hoursX30}{1000}=\frac{1X60X5X30}{1000}=9\ KWH$

Total units consumed for 30days= 18+ 57.6 + 9= 84.6 KWH

Cost of 1 KWH= 3/-

Cost of 84.6 KWH= 84.6 X 3=**253.8/-**

31. Find the quantity of current in the above circuit(2 Marks)



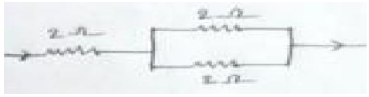
Ans: R= R_1+ R_2+ R_3

R=3+5+2=10Ω

V=1.5 V

I=V/R=1.5/10= **0.15 A**

32. Find the equivalent resistance (1 Mark)



Ans: $R = 2 + \frac{2X2}{2+2}$=2+1=**3Ω**

33.The value of magnetic field induction which is uniform is 2T. What is the flux passing through a surface of area 1.5 m^2 perpendicular to the field? (2 Marks)

Ans: B=2T, A=1.5 m^2

Φ=BA

Magnetic flux(Φ)=2X1.5=**3 weber**

34.A force of 8N acts on a rectangular conductor 20cm long placed perpendicular to a magnetic field. Determine the magnetic field induction if the current in the conductor is 40A (2 Marks)

Ans: F=8N, l=20cm=0.2 m, I=40A

Required formula F=BIL

$$B = \frac{F}{IL} = \frac{8}{40X0.2} = \frac{8}{8} = 1\ Tesla$$

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