

WEEKLY TEST OYM TEST - 24 BALLIWALA
 SOLUTION Date 06-10-2019

[PHYSICS]

1.

According to lens maker's formula,

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

For given concave lens,

$$R_1 = -3 \text{ cm} \quad \text{and} \quad R_2 = -4 \text{ cm}$$

$$\therefore \frac{1}{v} - \frac{1}{u} = (\mu - 1) \left(\frac{1}{-3} + \frac{1}{4} \right)$$

$$\text{or} \quad \frac{1}{v} - \frac{1}{(-12)} = (1.5 - 1) \left(\frac{-4 + 3}{12} \right)$$

$$\text{or} \quad \frac{1}{v} + \frac{1}{12} = 0.5 \times \frac{-1}{12} = \frac{-1}{24}$$

$$\text{or} \quad \frac{1}{v} = -\frac{1}{24} - \frac{1}{12} = \frac{-1-2}{24} = -\frac{1}{8}$$

$$\text{or} \quad v = -8 \text{ cm.}$$

2.

As shown in the figure, the system is equivalent to combination of three thin lens in contact.

$$\therefore \frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$$

By lens maker's formula,

$$\frac{1}{f_1} = \left(\frac{3}{2} - 1 \right) \left(\frac{1}{\infty} - \frac{1}{25} \right) = \frac{-1}{50}$$

$$\frac{1}{f_2} = \left(\frac{4}{3} - 1 \right) \left(\frac{1}{25} + \frac{1}{20} \right) = \frac{3}{100}$$

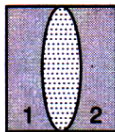
$$\frac{1}{f_3} = \left(\frac{3}{2} - 1 \right) \left(\frac{1}{-20} - \frac{1}{\infty} \right) = -\frac{1}{40}$$

$$\frac{1}{f} = \frac{1}{5} \left[-\frac{1}{10} + \frac{3}{20} - \frac{1}{8} \right]$$

$$= \frac{1}{5} \left[\frac{-8 + 12 - 10}{80} \right] = \frac{1}{5} \left[\frac{-6}{80} \right]$$

$$\text{or} \quad f = -\frac{400}{6} \text{ cm} = -66.6 \text{ cm}$$

Hence, the system behaves as a concave lens of focal length 66.6 cm.



3.

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \quad \dots(i)$$

Given, $f = 10$ cm (as lens is converging)

$u = -8$ cm (as object is placed on left side of the lens)

Substituting these values in eqn. (i), we get;

$$\frac{1}{10} = \frac{1}{v} - \frac{1}{-8} \quad \text{or} \quad \frac{1}{v} = \frac{1}{10} - \frac{1}{8}$$

$$\text{or} \quad \frac{1}{v} = \frac{8-10}{80}$$

$$\text{or} \quad v = \frac{80}{-2} = -40 \text{ cm}$$

Hence, magnification produced by the lens,

$$m = \frac{v}{u} = \frac{-40}{-8} = 5.$$

4.

Here, $f_1 = 20$ cm, $f_2 = 25$ cm.

The effective power of the combination is,

$$\begin{aligned} P &= P_1 + P_2 = \frac{1}{f_1} + \frac{1}{f_2} \\ &= \frac{100}{20} + \frac{100}{25} \quad \left(\because P \text{ (in dioptre)} = \frac{100}{f \text{ (in cm)}} \right) \\ &= 5D + 4D = 9D. \end{aligned}$$

5.

Focal length of convex lens, $f_1 = 25$ cm

Focal length of concave lens, $f_2 = -25$ cm

Power of combination in dioptres,

$$P = P_1 + P_2 = \frac{100}{f_1} + \frac{100}{f_2} = \frac{100}{25} - \frac{100}{25} = 0.$$

6.

7.

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$$

$$\text{or} \quad \frac{1}{f} = \frac{1}{0.2} + \frac{1}{0.2} - \frac{0.5}{(0.2)(0.2)}$$

$$\text{or} \quad 1/f = 5 + 5 - 0.5 \times 5 \times 5$$

$$\text{or} \quad 1/f = 10 - 12.5 = -2.5$$

$$\text{or} \quad f = -(1/2.5) = -0.4 \text{ m.}$$

8.

$R = -24$ cm, $f = -12$ cm, $m = 1.5$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}; \quad \frac{1}{1.5u} + \frac{1}{u} = -\frac{1}{12}$$

$$\frac{2.5}{1.5u} = -\frac{1}{12} \quad \text{or} \quad u = -20 \text{ cm}$$

-ve sign shows that object is placed in front of a convex mirror.

9.

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f} \quad \text{or} \quad \frac{1}{-20} + \frac{1}{v} = \frac{1}{20}$$

$$\therefore v = 10 \text{ cm}$$

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

$$\text{or} \quad \frac{10}{20} = \frac{h_2}{2 \text{ mm}} \quad \text{or} \quad h_2 = 1 \text{ mm.}$$

10.

$$\begin{aligned} \frac{1}{f} &= (\mu - 1) \left(\frac{1}{R_1} + \frac{1}{R_2} \right) \\ &= (1.5 - 1) \left(\frac{1}{10} + \frac{1}{10} \right) = 0.1 \end{aligned}$$

$$f = 10 \text{ cm}$$

$$\therefore R = 2f = 2 \times 10 = 20 \text{ cm.}$$

11.

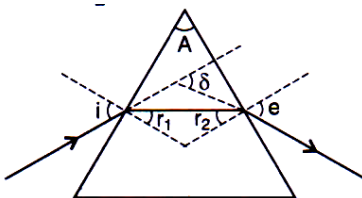
$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$v = 3u$, $u = 20 \text{ cm}$ and both v and u are $-ve$.

12.

We know that when convex lens is made of three different materials, then it has three refractive indices and therefore three focal lengths. Hence, number of images formed by the lens will be three.

13.



Here, $i = 60^\circ$, $A = 30^\circ$, $\delta = 30^\circ$

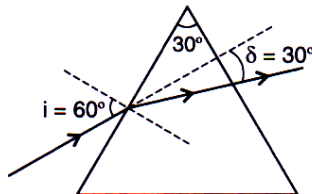
As $i + e = A + \delta$

$$e = A + \delta - i = 30^\circ + 30^\circ - 60^\circ = 0^\circ$$

Hence emergent ray is normal to the surface.

$$e = 0^\circ \text{ or } r_2 = 0^\circ$$

As $r_1 + r_2 = A$



$$\therefore r_1 = A - r_2 = 30^\circ - 0^\circ = 30^\circ$$

$$\mu = \frac{\sin i}{\sin r_1} = \frac{\sin 60^\circ}{\sin 30^\circ} = \frac{\sqrt{3}}{2} \times \frac{2}{1} = \sqrt{3} = 1.732$$

14.

For dispersion without deviation

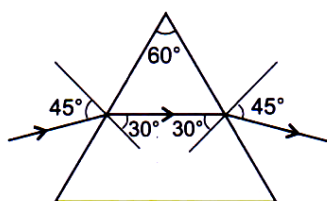
$$\begin{aligned}\delta_1 + \delta_2 &= 0 \\ (\mu_1 - 1)A_1 + (\mu_2 - 1)A_2 &= 0 \\ A_2 &= -\frac{(\mu_1 - 1)A_1}{(\mu_2 - 1)}\end{aligned}$$

Substituting the given values, we get

$$A_2 = -\frac{(1.5 - 1)15^\circ}{(1.75 - 1)} = -10^\circ$$

-ve sign shows that prism must be joined in opposition.

15.



As ray pass symmetrically through prism, hence

$$\begin{aligned}\delta_{\min} &= (i + e) - A = 30^\circ \\ \mu &= \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\frac{A}{2}} = \sqrt{2}\end{aligned}$$

[CHEMISTRY]

16.

The given formula $\text{CoCl}_3 \cdot 6\text{NH}_3$ confirms the (b) answer only. Moreover,

$$\begin{aligned}\text{Moles of complex} &= \frac{2.675}{267.5} = 0.01 \\ \text{Moles of AgCl} &= \frac{4.78}{143.5} = 0.033\end{aligned}$$

This shows 3Cl^- ions in ionic sphere.

17.

$[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ has weak ligand H_2O and absorbs red light of visible spectrum. The colour that appears is blue. $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ is labile complex and changes to $[\text{Cu}(\text{NH}_3)_4]^{2+}$ by the addition of strong ligand NH_3 . It has strong ligand NH_3 and absorbs yellow light of visible spectrum. The colour that appears is deep blue (indigo).

18.

Both show *cis* and *trans*-geometrical isomerism. *Cis*-isomer appears in *d* and *l* optical isomers. Hence, both have total 3 isomers each.

19.

Neutral cases of carbonyls slightly increase the bond length of $\text{C} - \text{O}$ bond by donation in antibonding molecular orbitals of CO molecule.

20.

21.

22.

This compound is *cis*-platin anticancer compound.

In $[\text{Co}(\text{en})_3]^{3+}$ has all (en) in *cis*- positions and hence, shows optical isomerism.

23.

The structure shows absence of any ion in ionic sphere.

24.

It is a chelate of five members.

25.

'Low spin' means pairing of electrons takes place. d^4

↑	↑	↑	↑	
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 changes to d^4

↑↓	↑	↑		
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 with two vacant orbitals. This will give d^2sp^3 octahedral system.

26.

$[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ gives four ions in water.

27.

28.

Because $\frac{1}{3}$ of 3Cl^- are precipitated as AgCl , only one Cl^- is present in ionic sphere.

29.

30.

$[\text{CrCl}_2(\text{H}_2\text{O})_4]\text{Cl}$

$$\text{Moles of } \text{Cl}^- = \text{Moles of } \text{AgCl} = MV = 0.01 \times \frac{100}{1000} = \mathbf{0.001}$$