Sri Chaitanya IIT Academy, India

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr. IPLCO **Date: 12-12-15**

Time: 9:00 AM to 12:00 Noon **RPTM-14** **Max.Marks: 360**

KEY SHEET

PHYSICS			CHEMISTRY			MATHS	
Q.NO	ANSWER		Q.NO	ANSWER		Q.NO	ANSWER
1	4		31	2		61	3
2	1		32	1		62	2
3	3		33	1		63	4
4	3		34	2		64	2
5	4		35	3		65	3
6	3		36	2		66	4
7	1		37	1		67	3
8	4		38	2		68	2
9	1		39	2		69	4
10	4		40	1		70	1
11	4		41	1		71	3
12	1		42	1		72	4
13	2		43	1		73	3
14	3		44	1		74	4
15	2		45	4		75	2
16	3		46	1		76	1
17	2		47	3		77	3
18	1		48	4		78	2
19	2		49	3		79	4
20	1		50	3		80	2
21	1		51	3		81	2
22	2		52	1		82	3
23	1		53	3		83	1
24	3		54	1		84	3
25	4		55	2		85	4
26	2		56	2		86	1
27	1		57	3		87	4
28	2		58	4		88	2
29	3		59	4		89	4
30	3		60	3		90	1

PHYSICS

1. conceptual
2. Deviation produced by one is cancelled by the other.
   use $\delta = A(\mu - 1)$
3. $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = 3$

   $\therefore 3 = (1.25 - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ......(1)

   and $-2 = \left(\frac{1.25}{\mu} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ....(2)

   $-\frac{3}{2} = \frac{0.25\mu}{1.25 - \mu} \Rightarrow -0.5\mu = 3.75 - 3\mu$

   $\Rightarrow \mu = 3.75/2.5 = 1.5$
4. Case I : When tank is filled with water given the apparent depth = 9.4 cm
   Height of water t=12.5 cm
   Refractive index of water

   $$\mu_w = \frac{\text{Real depth}}{\text{Apparent depth}} = \frac{12.5}{9.4} = 1.33$$

   Case II : When tank is filled with the liquid refractive index of liquid $\mu = 1.63$

   Again $\mu = \frac{\text{Real depth}}{\text{Apparent depth}}$

   Apparent depth= $\frac{12.5}{1.63} = 7.67\,\text{cm}$

   $\therefore$ The microscope is shifted by $= 9.4 - 7.67 = 1.73\,\text{cm}$
5. The glass plate produces a shift of $1\left[1 - \frac{2}{3}\right] = \frac{1}{3}\text{cm}$. So when plate is placed required image distance $= 12 - \frac{1}{3}\text{cm}$

   $\therefore \frac{1}{240} + \frac{1}{12} = \frac{1}{7} = \frac{1}{f}$ and $\frac{1}{v} = \frac{1}{12 - \frac{1}{3}}$

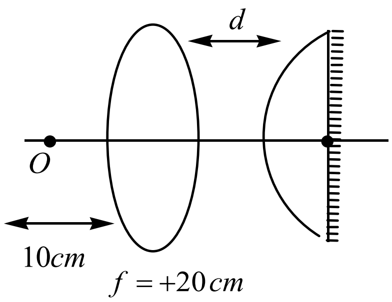
   $\frac{1}{u} = \frac{1}{240} + \frac{1}{12} - \frac{3}{35} = \frac{1}{240} - \frac{1}{12 \times 35}$

   $\therefore u = 560\,\text{cm}$
6. The silvered lens can be replaced by a mirror of focal length given as (DIAGRAM)

   $\frac{1}{F_M} = \frac{1}{f_m} - \frac{2}{f_1}$

   for lens $\upsilon = \frac{uf}{u + f}$

   $\upsilon = \frac{-10 \times 20}{-10 + 20} = -20$



So this position has to be centre of curvature of mirror in order for the ray to retrace its path so d=40-20=20cm.

7. $\frac{1}{V}-\frac{1}{u}=\frac{1}{f}$

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

$m=\frac{\upsilon}{u}=\frac{f}{u+f}$

$\frac{f}{-12+f}=-\left(\frac{f}{-16+f}\right)$

m is same in both the cases

f=14cm

8. Using lens makers formula

9. Given distance between screen and object a=90 cm

Distance between screen and object the lens d=20 cm

Using the displacement formula

$$\mathrm{f}=\frac{\mathrm{a}^2-\mathrm{d}^2}{4\mathrm{a}}=\frac{(90)^2-(20)^2}{4\times 90}=\frac{7700}{360}=21.4\mathrm{cm}$$

10. Focal length for upper half is

$$f_1=\left(\frac{\mu-1}{\mu/\mu_1-1}\right)f_{air}=\left(\frac{1.5-1}{\frac{1.5}{2.5}-1}\right)20=40cm$$

Focal length for lower half is,

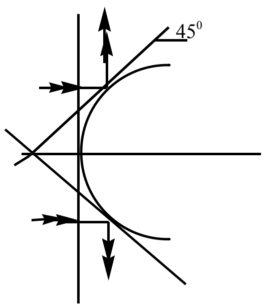
$$f_2=\left(\frac{\mu-1}{\mu/\mu_2-1}\right)f_{air}=\left(\frac{1.5-1}{\frac{1.5}{2.5}-1}\right)\times 20=-25cm$$

If the object is at infinity two images will form at corresponding focuses.

So, the required separation is

$x=|f_1|+|f_2|=40+25=65cm$

11. At the point of incidence slope should be ± 1



$y^2 = 2x$

$y = \sqrt{2x}$

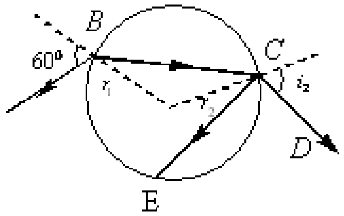
$\frac{dy}{dx} = \sqrt{2}.\frac{1}{2\sqrt{x}} = \frac{1}{\sqrt{2x}} = 1$

$\sqrt{2x} = 1$

$2x = 1$

$x = \frac{1}{2} \Rightarrow y = \pm 1$

12. Dimension parallel to surface does not change
13. The path of ray AB after refraction at opposite face and reflection at opposite face as shown in the figure. We have to find <DCE



By snell's law $(\sin 60^0 / \sin r_1) = \sqrt{3}$

Or $\sin r_1 = \sin 60^0 / \sqrt{3} = 1/2$

$\therefore r_1 = 30^0$ and hence $\therefore r_2 = 30^0$

Considering refraction at $C\left(\sin r_2 / \sin i_2\right) = 1/\sqrt{3}$

Or $\sin i_2 = \sqrt{3}/2$

$\therefore i_2 = 60^0$

$\angle ECD = 180^0 - (i_2 + r_2)$

$= 180^0 - 90^0 = 90^0$

14. $r = \frac{4}{\sqrt{\mu^2 - 1}} = \frac{12}{\sqrt{\frac{16}{9} - 1}} = \frac{12 \times 3}{\sqrt{7}} cm$
15. Conceptual
16. 3

$I_{\max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2 = \left(\sqrt{4I} + \sqrt{I}\right)^2 = 9I$

$I_{\min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2 = \left(\sqrt{4I} - \sqrt{I}\right)^2 = I \ \Delta x = (\mu - 1)t = n\lambda$

17. 2
18. 1

$$I = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$$

$$I_0 = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$$

$$\therefore \cos\left(\frac{\phi}{2}\right) = \frac{1}{2}$$

or $\frac{\phi}{2} = \frac{\pi}{3}$ or $\phi = \frac{2\pi}{3} = \left(\frac{2\pi}{\lambda}\right).\Delta x$ or $\frac{1}{3} = \left(\frac{1}{\lambda}\right)y.\frac{d}{D}$ $\left(\Delta x = \frac{yd}{D}\right)$

$$\therefore y = \frac{\lambda}{3\times\frac{d}{D}} = \frac{6\times10^{-7}}{3\times10^{-4}} \qquad = 2\times10^{-3} \text{ m=2 mm}$$

19. 2

$S_1P - S_2P = \frac{\lambda}{4} \Rightarrow \triangle\phi = 90^0$

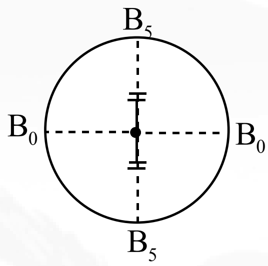
Initial $\triangle\phi = \frac{\pi}{6} = 30^0$

$\therefore$Final phase diff $= 90^0 + 30^0 = 120^0 (or) 90^0 - 30^0 = 60^0$

$\therefore \; I^1 = 4I_0 \cos^2\frac{\phi}{2} = 4I_0 \times \frac{1}{4} = I_0 = I/4$

(or) $I^1 = 4I_0 \cos^2\frac{\phi}{2} = 4I_0.\cos^2\frac{60^0}{2} = 4I_0 \times \frac{3}{4} \qquad = 3I_0 = 3I/4$

20. $\therefore$ no of maximas formed = 20



21. 1

In interference we know that

$I_{\max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$ and $I_{\min} = \left(\sqrt{I_1} \sim \sqrt{I_2}\right)^2$

Under normal conditions (when the widths of both the slits are equal)

$I_1 = I_2 = I$ (say)

$\therefore \quad I_{\max} = 4I$ and $I_{\min} = 0$

When the width of one of the slits is increased. Intensity due to that slit would increase, while that of the other will remain same. So let:

$I_1 = I$ and $I_2 = \eta I \qquad (\eta > I)$

Then, $\quad I_{\max} = I\left(1 + \sqrt{\eta}\right)^2 > 4I$

and $I_{\min} = I\left(\sqrt{\eta} - 1\right)^2 > 0$

$\therefore$ Intensity of both maxima and minima is increased.

22. 2

$I(\phi) = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$

Here, $\quad I_1 = I$

And $I_2 = 4I$

At point A, $\qquad (\phi) = \frac{\pi}{2}$

$\therefore \quad I_A = I + 4I = 5I$

At point B, $\phi = \pi$

$\therefore \quad I_B = 1 + 4I - 4I = I$

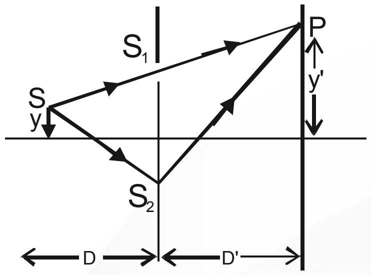
$\therefore \quad I_A - I_B = 4I$

23.

$y' = \frac{d}{2}$ at point P exactly infront of S_1

$\therefore \Delta x = \frac{yd}{D} + \frac{d^2}{2D'}$

For minimum intensity $\therefore \Delta x = (2n-1)\frac{\lambda}{2}$ $(n = 1)$

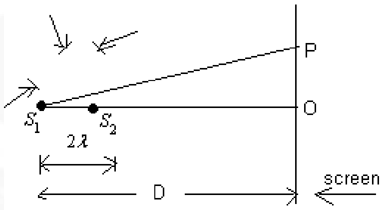


Putting the value we get

$(0.5\sin\pi t)\times 10^{-6} + 0.25\times 10^{-6} = \frac{500}{2}\times 10^{-9}$ $\quad 0.5\sin\pi t + 0.25 = \frac{0.5}{2}$

$\sin\pi t = 0 \Rightarrow \pi t = 0, \pi, 2\pi, ... \Rightarrow t = 1s$

24.



Referring to the figure,the path difference between the two waves starting from S_1 *and* S_2 turns out to be $(2\lambda\cos\theta) = n\lambda$ where n is taken as 1 to get the point of maximum intensity which is the same as a point O. Therefore, the above relation gives $\cos\theta = 1/2$ *so that* $\theta = 60^o$

and $\tan\theta = PO/D = \sqrt{3}$, giving $PO = D\sqrt{3}$

25. Let *l* be the distance between the two slits, at any instant, then

It is given that $v = \frac{d\ell}{dt}$ …(i)

The path difference reaching the point P from the slits is evidently $\Delta = y\frac{\ell}{D}$

Differentiating both sides with respect to time t, we get

$$\frac{d\Delta}{dt} = \frac{y}{D}.\frac{d\ell}{dt} = \frac{yv}{D} \quad \text{…(ii)}$$

[From eqn. (i)]

Since, a change in optical path difference of λ, corresponds to one fringe, so the number of fringe crossing point P, per unit time is

$$\left(\frac{d\Delta}{dt}\right)\frac{1}{\lambda} = \frac{yv}{\lambda D}$$

26. $\mu = \frac{\sin 60}{\sin\theta} = \frac{\sin 2\theta}{\sin\theta}$

27. $\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$

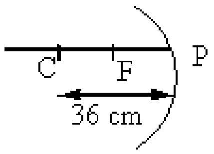
28. Given radius of curvature of concave mirror, R=-36 m

(For concave mirror radius of curvature of concavature is taken a negative)

$\therefore$ For length $f=\frac{R}{2}=\frac{36}{2}=-18cm$

Distance of object $u=-27cm$ (object distance is always taken as negative)

Height of object $O=2.5cm$



Use the mirror formula

$$\frac{1}{f}=\frac{1}{v}+\frac{1}{u}\Rightarrow-\frac{1}{18}=\frac{1}{v}-\frac{1}{27}$$

$$\frac{1}{v}=-\frac{1}{18}+\frac{1}{27}=\frac{-3+2}{54}=-\frac{1}{54}$$

Distance of screen from mirror $v=-54cm$

Let the size of image be I. By using the formula of magnification for mirror.

$$m=\frac{v}{u}=\frac{I}{O}\Rightarrow\frac{-(-54)}{-27}=\frac{I}{2.5}$$
$$I=-5cm$$

The negative sign shown that the images is formed in front of the mirror and it is inverted. Thus, the screen should be placed at a distance 54c m and the size of images is 5 cm, real, inverted and magnified in nature.

29. Angular dispersion is zero if $(\mu_v-\mu_R)A+(\mu_V^{'}-\mu_R^{'})A^{'}=0$

Dispersive power: $\omega=\frac{(\mu_V-\mu_R)A}{d}$

30. C

$\overline{v_{i/l}}=m^2\overline{v_{o/l}}$

$\overline{v_o}=\overline{v_l}(1-\frac{1}{m^2})$