JEE-ADVANCED-2012-P1-Model

Time: 3:00 Hrs. **IMPORTANT INSTRUCTIONS** **Max Marks: 210**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 10)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N : 11 – 15)	Questions with Multiple Correct Choice	4	0	5	20
Sec – III(Q.N : 16 – 20)	Questions with Integer Answer Type	4	0	5	20
Total				**20**	**70**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N : 31 – 35)	Questions with Multiple Correct Choice	4	0	5	20
Sec – III(Q.N : 36 – 40)	Questions with Integer Answer Type	4	0	5	20
Total				**20**	**70**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N : 51 – 55)	Questions with Multiple Correct Choice	4	0	5	20
Sec – III(Q.N : 56 – 60)	Questions with Integer Answer Type	4	0	5	20
Total				**20**	**70**

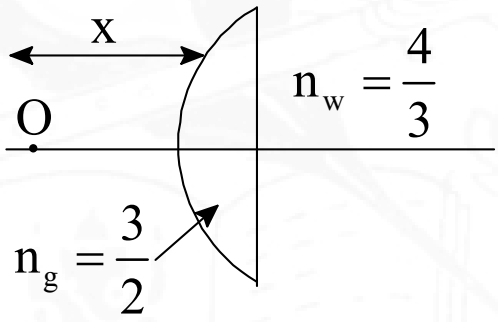
PHYSICS **Max.Marks:70**

SECTION – I

(SINGLE CORRECT CHOICE TYPE)

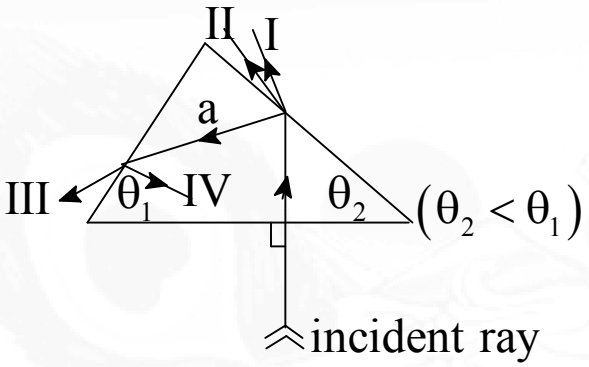
This section contains 10 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct

1. An object 'O' is kept in air in front of a thin plano convex lens of radius of curvature 10cm. It's refractive index is 3/2 and the medium towards right of plane surface is water of refractive index 4/3. What should be the distance 'x' of the object so that the rays become parallel finally.



A) 5cm B) 10cm C) 20cm D) 30cm

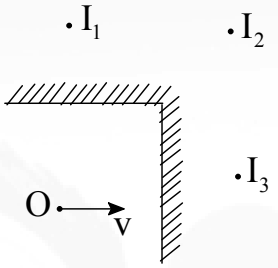
2. A white light ray is incident on a glass prism, and it create four refracted rays I, II, III and IV. The correct match of the following refracted rays with the colours given (a & IV are rays due to total internal reflection).



Ray	Colours
I	P) Red
II	Q) Green
III	R) Yellow
IV	S) Blue

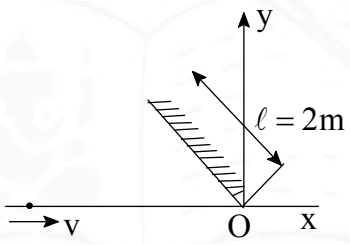
A) P, Q, R, S B) P, R, Q, S C) P, R, S, Q D) P, S, Q, R

3. Object O is placed front of two perpendicular mirror as shown I_1, I_2, I_3 are the three images of O. If O moves with velocity v as shown speed of I_2 will be



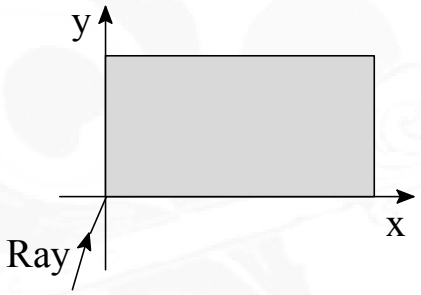
A) v B) $\sqrt{2}v$ C) $\sqrt{3}v$ D) $\sqrt{5}v$

4. A plane mirror of length 2m is kept along the line y = - x as shown in the figure. An insect having velocity of $4\hat{i}\,cm/s$ is moving along the x-axis from far away. The time span for which the insect can see its image will be



A) 50 sec B) 25 sec C) $25\sqrt{2}$ sec D) $50\sqrt{2}$ sec

5. A ray of light travelling in air is incident almost along y-axis on a medium of variable refractive index at the origin. The refractive index of the medium changes according to the relation $\mu = 1 + x^2$. What is the light ray vector at the point where the x coordinate becomes equal to 1 ?



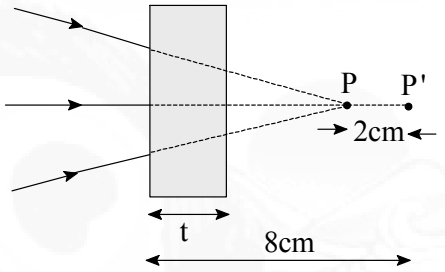
A) $\left(\sqrt{3}/2\right)\hat{i} + \left(1/2\right)\hat{j}$

B) $\left(1/2\right)\hat{i} + \left(\sqrt{3}/2\right)\hat{j}$

C) $\left(1/\sqrt{2}\right)\hat{i} + \left(1/\sqrt{2}\right)\hat{j}$

D) $\left(\sqrt{3}/2\right)\hat{i} + \left(1/\sqrt{2}\right)\hat{j}$

6. Rays from a lens are converging towards a point image P as shown in figure. A glass plate of thickness t cm and refractive index 1.5 is placed in the path of the rays, as a result, the image forms at 'P'_____. The value of t is

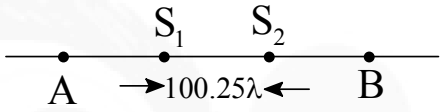


A) 2 cm B) 3 cm C) 6 cm D) 5.8 cm

7. Converging rays are incident on a convex spherical mirror so that their extensions intersect 30cm behind the mirror on the optical axis. The reflected rays form a diverging beam so that their extensions intersect the optical axis 1.2m from the mirror. Determine the focal length of the mirror.

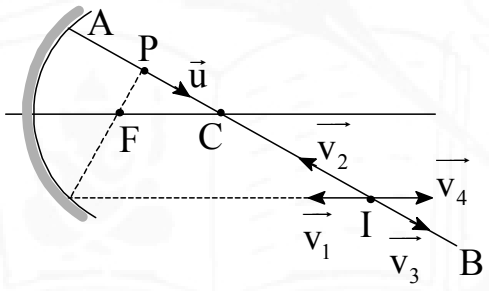
A) 40 cm B) 60 cm C) 30 cm D) 24 cm

8. S_1 and S_2 are two coherent sources of radiations separated by distance 100.25λ, where λ is the wavelength of radiation. S_1 leads S_2 in phase by $\frac{\pi}{2}$. A and B are two points on the line joining S_1 and S_2 as shown in figure. The ratio of amplitudes of sources S_1 and S_2 are in ratio 1 : 2. The ratio of intensities at A to that of B is



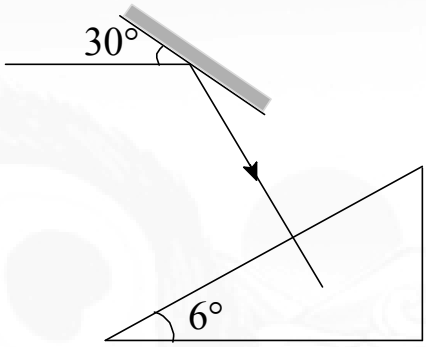
A) ∞ B) $\frac{1}{9}$ C) zero D) 9

9. A point object P moves along line AB passing through centre of curvature of concave mirror as shown in figure. The object velocity is constant and is approaching the centre of curvature of mirror. For the instant shown in figure the image is formed at I. At this instant, the image is having velocity along



A) $\vec{v}_1$ B) $\vec{v}_2$ C) $\vec{v}_3$ D) $\vec{v}_4$

10. Find the net deviation produced in the incident ray for the optical instrument shown in figure below. (Take refractive index of the prism material as 2).



A) 66° clockwise B) 66° anti-clockwise

C) 54° anticlockwise D) 54° clockwise

SECTION – II

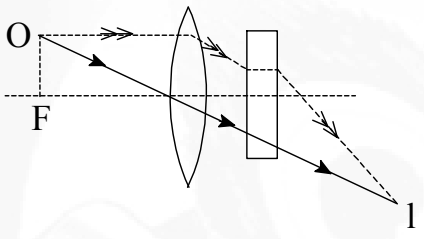
(MULTIPLE CORRECT CHOICE TYPE)

This section contains 5 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE** is/ are correct

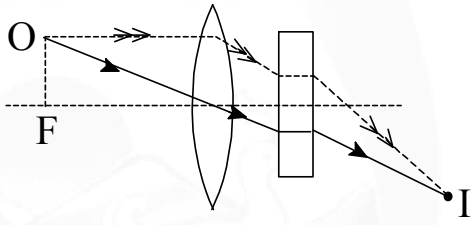
11. Choose correct ray diagram

All symbols have their usual meaning and all the rays shown are paraxial. (Focal length of each lens is F) (Diagrams are not to the scale)

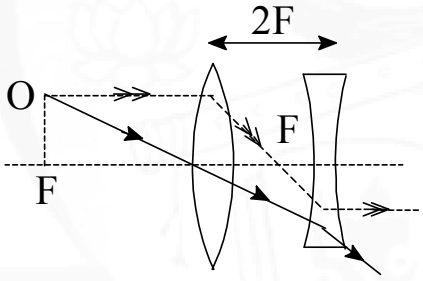
A)



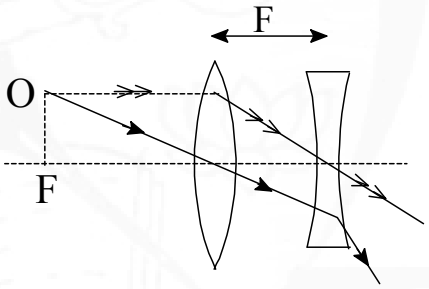
B)



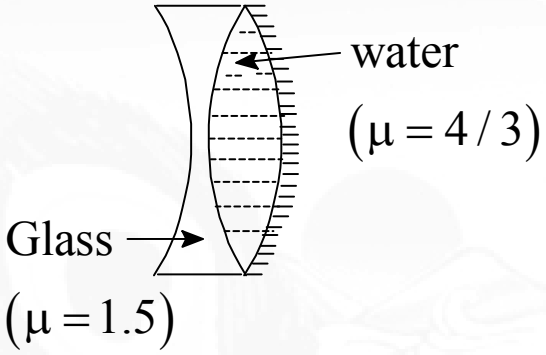
C)



D)



12. The radius of curvature of the left and right surface of the concave lens are 10cm and 15cm respectively. The radius of curvature of the mirror is 15cm.



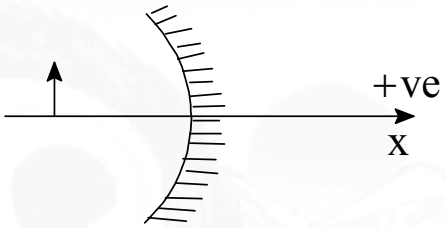
A) equivalent focal length of the combination is –18cm.

B) equivalent focal length of the combination is +36cm

C) the system behaves like a concave mirror.

D) the system behaves like a convex mirror.

13. An extended object is moving along x-axis in front of concave mirror as shown in figure. The correct alternate of the following statements about property of image is



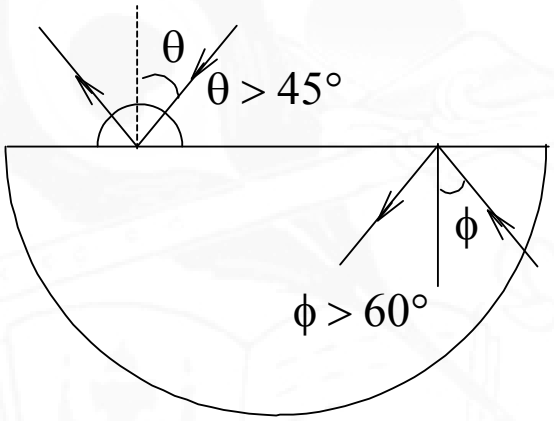
A) If the object velocity is +ve and moving between focus and centre of curvature then image velocity is –ve and its size increases

B) If the object velocity is -ve and moving between focus and pole then image velocity is +ve and its size increases

C) If the object velocity is -ve and is moving beyond centre of curvature then image velocity is +ve and its size increases

D) When object is just on left of focus the image is at $-\infty$ and when object is on right side of focus the image is at $+\infty$

14. A hemispherical drop of liquid rests on the flat side of a hemispherical glass plate as shown. If a ray is incident on the drop of liquid normally, it gets reflected totally at the liquid glass interface if the angle of incidence is greater than 45°. On the other hand, if a ray is incident on the glass hemisphere normally, it gets totally reflected from the flat boundary between air and glass if angle of incidence is greater than or equal to 60°.



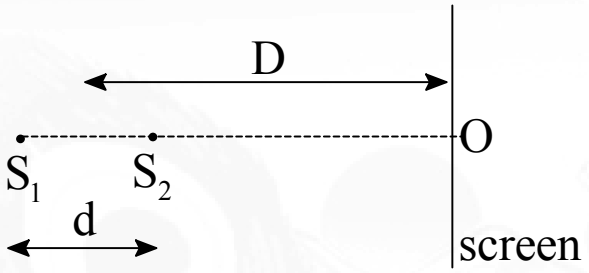
A) liquid is denser medium w.r.t glass

B) Glass is denser medium w.r.t liquid

C) The critical angle for liquid air interface may be 30°

D) The refractive index for glass may be 1.5

15. Two point monochromatic and coherent sources of light of wavelength λ are each placed as shown in the figure below, screen is infinitely large. The initial phase difference between the sources is zero O. (D>>d). Mark the correct Statement(s).



A) If $d = \frac{7\lambda}{2}$, O will be a minima.

B) If $d = \lambda$, only one maxima can be observed on screen

C) If $d = 4.8\lambda$, then a total 10 minimas would be there on screen

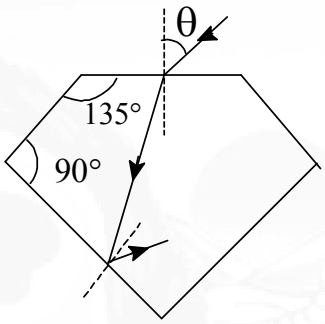
D) If $d = \frac{5}{2}\lambda$, the intensity at O would be minimum.

SECTION –III

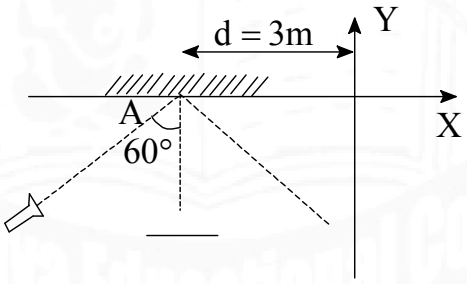
(INTEGER ANSWER TYPE)

This section contains 5 questions . The answer to each of the questions is a single digit integer, ranging from **0 to 9.** The appropriate bubbles below the respective question numbers in the ORS have to be darkened.

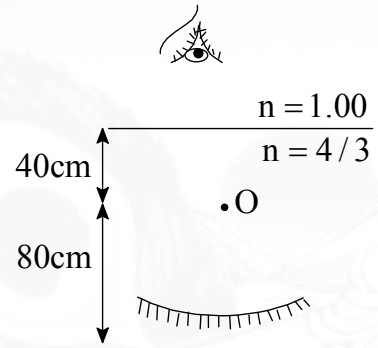
16. A ray of light enters a diamond (n=2) from air and is being internally reflected near the bottom as shown in the figure. The maximum value of angle θ is $\sin^{-1}\left(\frac{\sqrt{x}-1}{\sqrt{y}}\right)$ then product of xy is



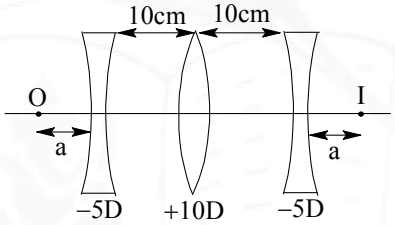
17. Figure shows a torch producing a straight light beam falling on a plane mirror at an angle 60°. The reflected beam make a spot P on the screen along Y-axis. If at t = 0, mirror starts rotating about the hinge A with an angular velocity $\Omega = 1°$ per second clockwise. Then the speed of the spot on screen after time t = 15s is $\frac{N\pi}{3}$ m/s then N is



18. Consider the situation sketched. An illuminated object lies 40cm under the surface of water (n = 4/3), 80cm above a concave spherical mirror whose focal length is 40cm. An observer looking down from above in the air (n = 1.00) sees two images. Find distance (in meters) between these two images is $N \times 0.1$ then the value of N is



19. For what value of "a", image of the object O will be formed at I, at the same distance a from the third lens is 4N meters then the value of N is



20. A double slit of separation 1.5mm is illuminated by white light (between 4000-8000A°). One a screen 120cm away colored interference is formed. If a pinhole is made on this screen at a distance 3.0 mm from the central white fringe, some wavelengths will be absent in the transmitted light. How many number of wavelengths will be absent at pin hole.