Chapter - 10
Light - Reflection and Refraction

Q: 1 **Two convex lenses P and Q have focal length 0.50 m and 0.40 m respectively.**

Which of the following is TRUE about the combined power of the two lenses?

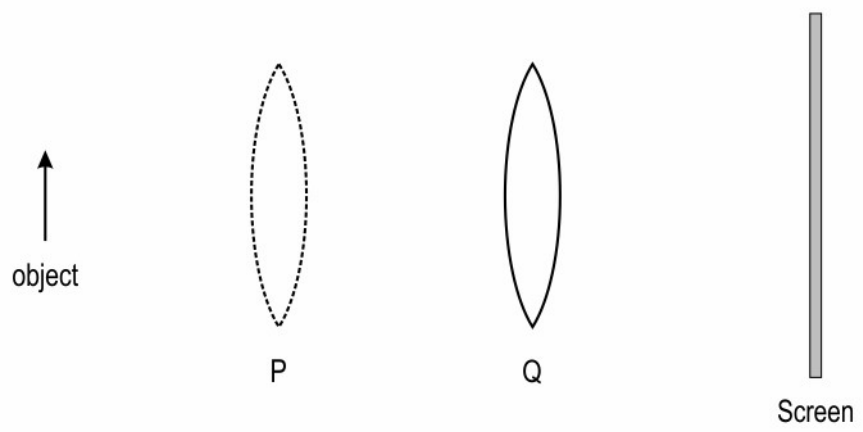
1 P is equal to 4.5 D.
2 P is less than 4.5 D.
3 P is more than 4.5 D.
4 P cannot be determined from the information given.

Q: 2 **When an incident ray of light enters a medium from air, it bends towards the normal.**

Which of the following is TRUE about the refractive index of the medium (n_m) as compared to the refractive index of air (n_a)?

1 n_m is equal to n_a.
2 n_m is less than n_a.
3 n_m is more than n_a.
4 (The refractive indices cannot be compared based on the given information.)

Q: 3 **When a lens in placed at Q, a sharp image is formed on the screen. The image formed is real, inverted and diminished. When the lens is moved to P, another sharp image is formed on the screen.**



What is the nature of the image formed when the lens is at P?

1 magnified and inverted
2 magnified and upright
3 diminished and upright
4 diminished and inverted

The image below shows a student demonstrating that sunrays concentrated to a point using a spherical mirror can burn a paper as a science project.

Answer the following questions.

Q: 4 **What is the term used for the distance between the mirror and the paper?**

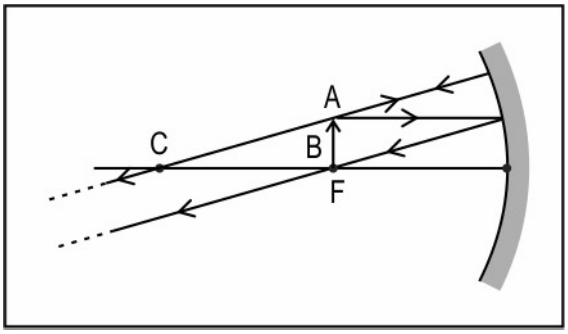
1 radius of curvature
2 principal focus
3 principal axis
4 focal length

Q: 5 **What kind of image would be formed on the paper?**

1 real and diminished
2 real and enlarged
3 virtual and diminished
4 virtual and enlarged

Q: 6 **The student wants to depict the above experiment as a ray diagram. Which of the following diagram should he draw?**

1



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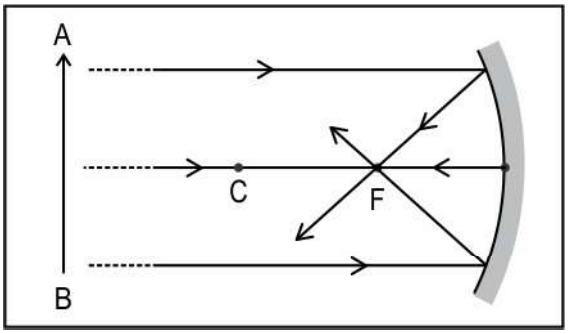
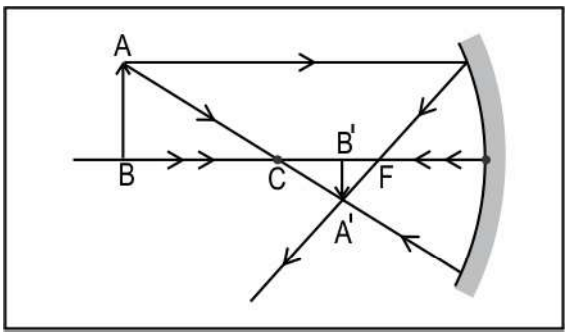
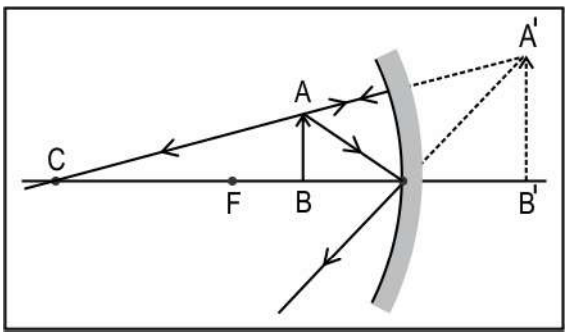


3



4



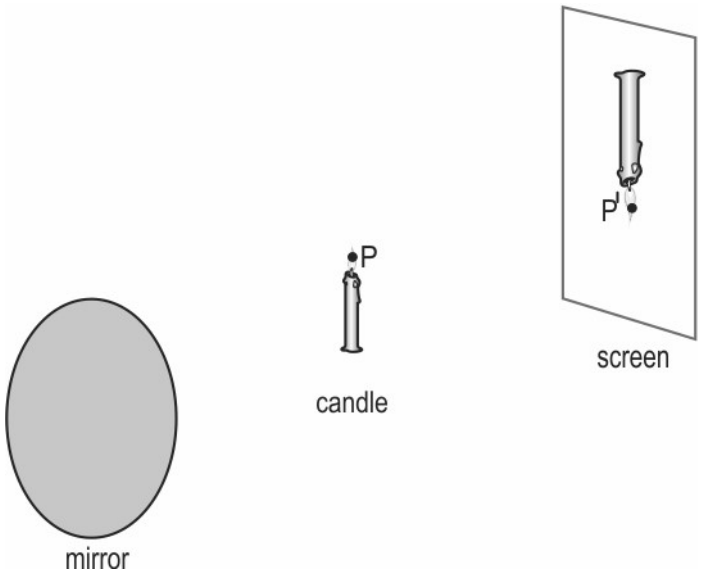
Q: 7 **If the student wishes to point the mirror to another object so as to obtain a virtual enlarged image, where should be the position of the object with respect to the mirror?**

1. at principal focus
2. at centre of curvature
3. between pole and principal focus
4. between centre of curvature and principal focus

Q: 8 **Which of the following is NOT a common use for the type of spherical mirror used by the student for the experiment above?**

1. car headlights
2. solar cooker
3. rear-view mirror
4. shaving mirrors

Q: 9 **The diagram below shows the image of a candle, as formed through reflection from a concave mirror, obtained on a screen.** **[1]**



How many light rays from the point P on the candle flame can be drawn to the corresponding point on the image P'?

Q: 10 **The eyeball of a person has become slightly larger. Which kind of lens should the person wear to correct the defect in the vision caused by this change in the size of the eyeball?** **[1]**

Q: 11 **The images formed by an ordinary convex lens suffer from a defect, called chromatic defect, which leads to false coloured edges in the images. This happens because light rays of different colours bend differently as they enter and leave the lens.** **[2]**

If a parallel white light beam passes through a convex lens, the light of which colour (among violet to red in the spectrum) will converge at a point closest to the lens? Justify your answer.

Q: 12 **Smriti is looking at herself in a convex mirror in a science museum, standing 2 m away from the mirror. Her image appears to be around half her actual height. Estimate the focal length of the mirror.** **[3]**

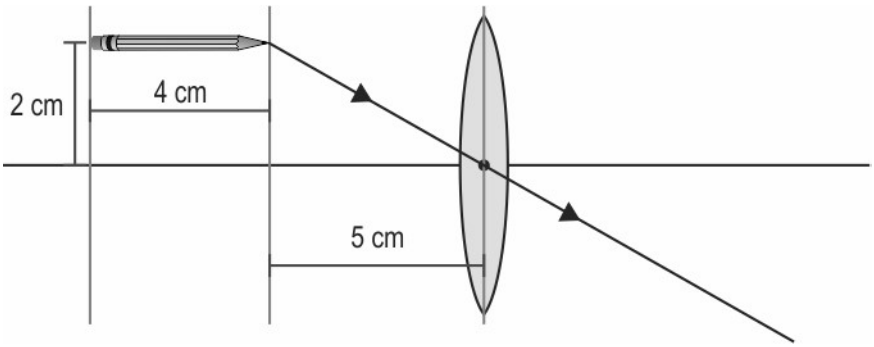
Q: 13 **In a human eye, the distance between the lens and the retina is 17 mm. The light entering the eye gets refracted at the cornea and then at the lens. Ciliary muscles in the eye can control the focal length of the lens by changing its shape.** **[3]**

(a) Diana is looking at the Moon. What is the focal length of the combination of cornea and the lens in Diana's eyes at this time?

(b) Diana is reading a book kept at a distance of 20 cm from her eyes. What is the focal length of the combination of the cornea and the lens in Diana's eyes at this time?

(c) When Diana brings the book closer to her eyes, the letters appear blurry to her and she cannot read the book. Explain why the letters appear blurry to her.

Q: 14 **(a) Copy the scaled ray diagram given below. Draw more required incident rays from the pencil to illustrate the formation of the image of the pencil by the convex lens of focal length 3 cm.** **[5]**

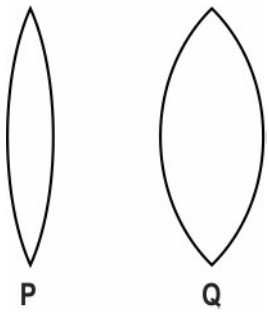


Your completed diagram should show the image of the whole pencil.
(Note: Assume that the lens in the diagram is a thin lens.)

(b) What is the distance of the image of the pointed end of the pencil from the lens?

(c) What is the length of the image of the pencil?

Q: 15 **Manju has two convex lenses P and Q made of the same material as shown in the figure.** **[3]**



She is looking at printed text on a page using lens P. She notices that when she slowly takes the lens away from the page, the text turns upside down when the lens crosses a distance of 10 cm from the page.

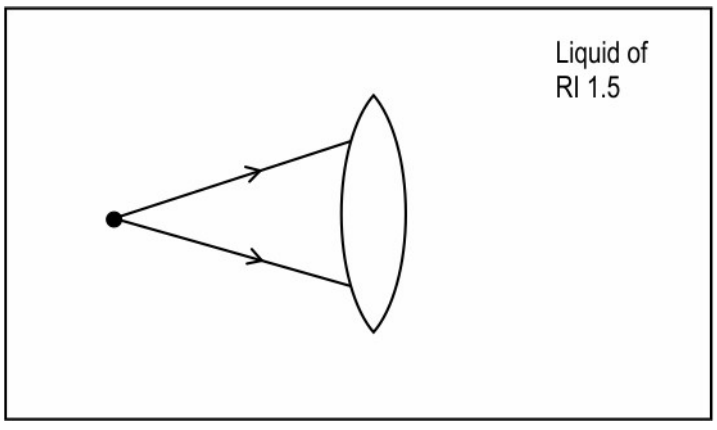
(a) Which characteristic of lens P does the distance 10 cm signify?
(b) If Manju does the same with lens Q, at what distance will the inversion of the image happen - less than, equal to, or more than 10 cm? Justify your answer.

Q: 16 **A person needs a lens of power -5.0 D for correction of his vision.** **[2]**

(a) What is the possible vision defect of the person?
(b) What is the focal length of the corrective lens?

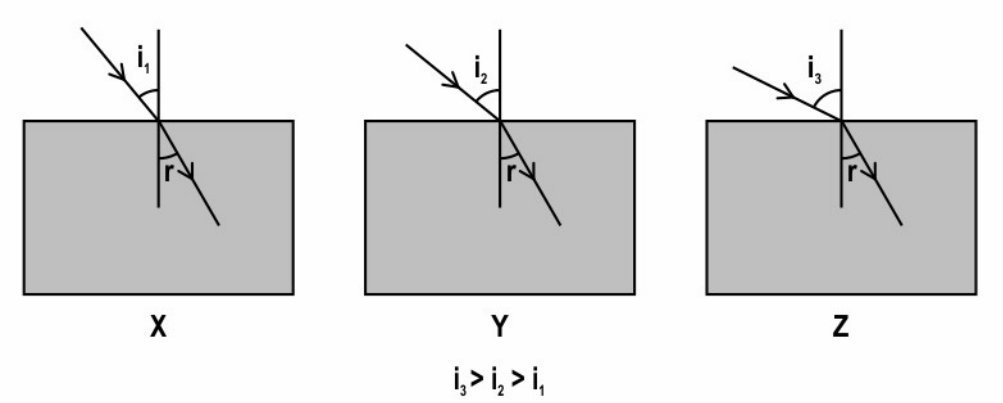
Q: 17 **A lens made of material with refractive index 1.5 is immersed in a liquid with refractive index 1.5.** **[2]**

The diagram below shows two rays incident on the lens when it is immersed in the liquid.



Copy the diagram and draw the light rays after they pass through the lens. Justify your diagram.

Q: 18 **The image below shows the refraction of light in three transparent rectangular blocks, X, Y and Z, made of different materials when they are placed in air. The angle of incidence is different in each case but the angle of refraction is the same in all three blocks.** **[2]**

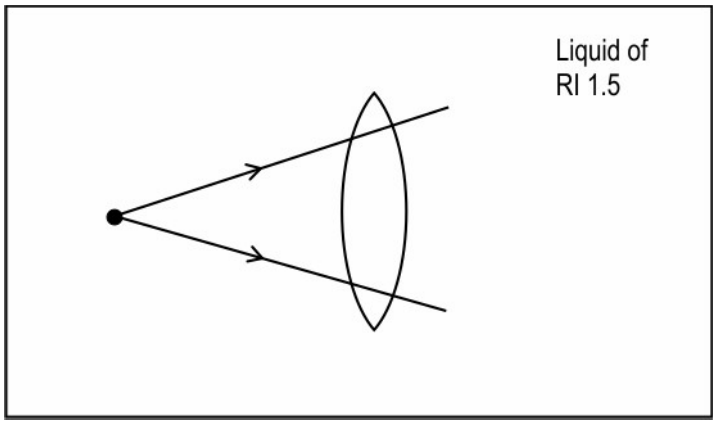


Compare the speed of light in the three blocks. Justify your answer.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	1
2	3
3	1
4	4
5	1
6	2
7	3
8	3

Q.No	Teacher should award marks if students have done the following:	Marks
9	infinitely many	1
10	concave lens	1
11	violet	1
	because it will bend the most after refraction OR because glass has the highest refractive index for violet coloured light	1
12	Identifying object distance as -2 m	0.5
	Finding out image distance as +1 m using magnification formula	1
	Using the correct formula (1/u + 1/v = 1/f) [0.5 marks] Calculating focal length as +2 m, using the formula [1 marks]	1.5
13	(a) 17 mm	0.5
	(b) - Substituting correct values into lens formula [0.5 marks] - Calculating focal length as 18.6 mm using lens formula [1 mark]	1.5
	(c) because the location of the image moves behind the retina	1
14	(a) Correct completed ray diagram should include the following: - another correctly drawn incident ray from the pointed end of the pencil [1 mark] - two correctly drawn incident rays from the blunt/rear end of the pencil [2 marks] - correctly drawn image of the pencil using the point images of the front and rear ends of the pencil [1 mark]	4
	(b) 7.5 cm (with an error margin of 0.5 cm)	0.5
	(c) 3.6 cm (with an error margin of 0.4 cm)	0.5
15	(a) focal length OR half the radius of curvature	1

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) 1 mark for each point: **- The inversion will happen at a distance less than 10 cm.** **- A thicker lens has a smaller focal length.**	**2**
16	**(a) myopia**	**1**
	(b) 0.5 marks each for correct value and unit: **-0.2 m**	**1**
17	 **(Students should draw the rays through the lens and further in the liquid in the same direction as the incident ray without showing any bending at the interface of the liquid and the lens.)**	**1**
	Since the refractive index of the liquid is equal to that of the material of the lens, the light rays do not undergo refraction as they pass from the liquid to the lens and back into the liquid.	**1**
18	**speed in X > speed in Y > speed in Z**	**1**
	As per Snell's law, $\frac{\sin}{}$ i/sinr)} = n **Since the angle of incidence is minimum in block X, the refractive index of material of block X is minimum.** **(Award full marks even if Snell's law is not mentioned.)**	**0.5**
	The refractive index of a material is given by n = vc . **Since refractive index of block X is minimum, speed of light is maximum in block X.** **OR** **Since material of block X is the least dense, the speed of light is maximum in block X.**	

Q.No	Teacher should award marks if students have done the following:	Marks
	The refractive index of a material is given by $n = \frac{c}{v}$. Since refractive index of block X is minimum, speed of light is maximum in block X. OR Since material of block X is the least dense, the speed of light is maximum in block X.	0.5