



PHYSICS

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PHYSICS (HINGLISH)

LIGHT-REFLECTION AND REFRACTION

Ncert Intext Questions

1. Define the principal focus of a concave mirror.



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2. The radius of curvature of a spherical mirror is 20 cm. What is its focal length?



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3. Name a mirror that can give an erect and enlarged image of an object.



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4. Why do we prefer a convex mirror as a rear-view mirror in vehicles?



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5. Find the focal length of a convex mirror whose radius of curvature is 32 cm.



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6. A concave mirror produces three times (enlarged) magnified real image of an object placed at 10 cm in front of it. Where is the image located?



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7. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal?

Why?





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8. Light enters from air into glass having refractive index 1.50. What is the speed of light in glass?

The speed of light in vacuum is $3 \times 10^8 \text{ m s}^{-1}$.



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9. Find out, from table 10.3 (NCERT Page No. 175), the medium having highest optical

density. Also find the medium with lowest optical density.



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10. You are given kerosene, turpentine oil and water. In which of these does the light ray travel fastest? Given refractive index of kerosene = 1.44, Refractive index of turpentine 1.47, refractive index of water = 1.33.



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11. The refractive index of diamond is 2.42.

What is the meaning of this statement?



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12. Define 1 diopetre of power of a lens.



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13. A convex lens forms a real and inverted image of a needle at a distance of 50 cm from

the lens. Where is the needle placed in front of the convex lens, so that this image is of the same size as the object?



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14. Find the power of a concave lens of focal length 2 m .



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1. The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object?

A. Between the principal focus and the centre of curvature.

B. At the centre of curvature.

C. Beyond the centre of curvature.

D. Between the pole of the mirror and its principal focus.

Answer:



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2. No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be

A. plane

B. concave

C. convex

D. either plane or convex

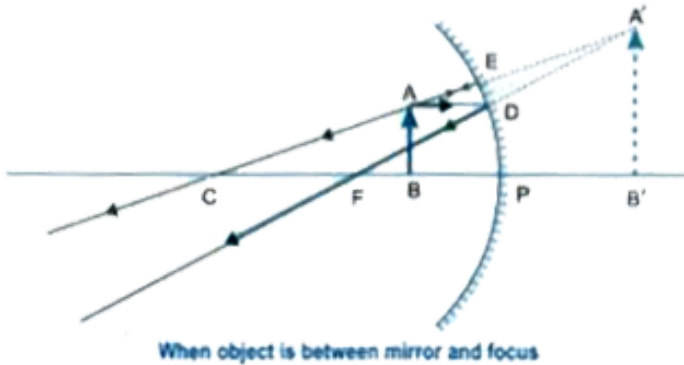
Answer:



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3. We wish to obtain an erect image of an object, using a concave mirror of focal length 15 cm. What should be the range of the distance of the object from the mirror? What is the nature of the image Is the image larger or smaller than the object? Draw a ray diagram to show the image formation in this

case.



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4. Name the type of mirror used in following situations:

(a) Headlights of a car

(b) Side/Rear-view mirror of a vehicle

(c) Solar furnace

Support your answer with reason.



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5. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm.

Find the position and nature of the image.



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6. The magnification produced by a plane mirror is + 1. What does this mean?



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7. An object 5 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm . Find the position of the image , its nature of size.



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8. An object of size 7 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm . At what distance from the mirror should a screen be placed so that a sharp focused image can be obtained ? Find the size of the nature of the image.



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9. Which one of the following materials cannot be used to make a lens ?

A. water

B. glass

C. plastic

D. clay

Answer:



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10. Where should an object be placed in front of a convex lens to get a real image of the size of the object ?

A. At the principal focus of the lens

B. At Twice the focal length

C. At infinity

D. Between the optical centre of the lens
and its principal lens.

Answer:



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11. A spherical mirror and a thin spherical lens have each a focal length of -15 cm . The mirror and lens are likely to be

A. both concave

B. both convex

C. the mirror is concave and the lens is convex

D. the mirror is convex and the lens is concave.

Answer:



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12. Which of the following lens would you prefer to use while reading small letters found in a dictionary ?

- A. A convex lens of focal length 50 cm
- B. A concave lens of focal length 50 cm
- C. A convex lens of focal length 5 cm
- D. A concave lens of focal length 5 cm

Answer:



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13. One half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object ? Verify your answer experimentally . Explain your observations.



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14. An object 5 cm in length is held 25 cm away from a converging lens of focal length 10 cm . Draw a ray diagram and find the position, size and the nature of the image formed.



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15. A concave (diverging) lens of focal length 15 cm , forms an image 10 cm forms and image 10 cm from the lens . How far is the object placed from the lens ? Draw the ray diagram.





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16. Find the focal length - 2.0 D. What type of lens is this ?



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17. A doctor has prescribed a corrective lens of power + 1.5 D . Find the focal length of the lens. Is the prescribed lens diverging or converging ?



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Very Short Answer Questions

1. What is light ?



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2. What is a ray of light ?



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3. What is a beam of light ?



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4. Name a communication device which uses light for its working.



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5. What is the angle of reflection when a ray of light falls normally on a plane mirror?



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6. What kind of image can be obtained on the screen?



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7. What type of image is formed:

(i) in a plane mirror, and (ii) on a cinema screen?



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8. Name the type of mirror which always forms a virtual and diminished image.



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9. Which mirror-convex or concave has larger field of view?



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10. If an object is placed at the focus of a concave mirror, where is the image formed?



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11. What should be the position of the object when a concave mirror is to be used:

(i) as a shaving mirror?, and (ii) as a doctor's mirror?



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12. What sign (+ve or -ve) is given to the focal length of:

(a) a concave mirror?, and (b) a convex mirror?



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13. Give the cartesian sign convention for:

(a) height of a real image, and

(b) height of a virtual image.



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14. What is the significance of +ve sign of magnification?



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15. Can a plane mirror be called spherical mirror?



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16. A man standing in front of a spherical mirror, finds his image having a very small

head, a fat body and legs of normal size. What type of mirrors are used in these three parts?



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17. Differentiate between virtual image formed by a concave mirror and of a convex mirror.



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18. What is the magnification produced by a plane mirror?



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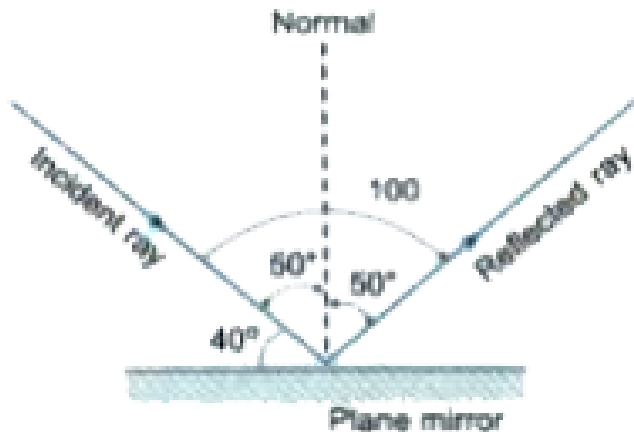
19. The angle between an incident ray and the mirror is 40° .

(i) What is the angle of incidence?

(ii) What is the angle of reflection?

(iii) What is the total angle through which the

ray of light turns?

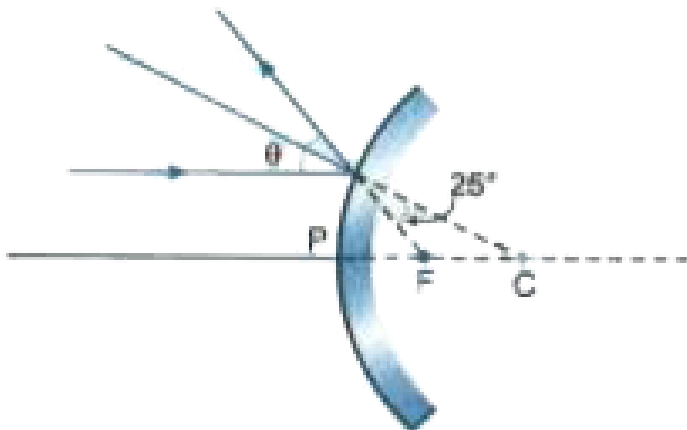


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20. Why does a convex mirror is said to have a virtual principal focus?

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21. What is the value of θ in the following ray diagram?



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22. Explain why a ray of light passing through the centre of curvature of a concave mirror

gets reflected along the same path after reflection.



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23. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror and show the angle of incidence and angle of reflection on it.



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24. What is the nature of the image formed by a concave mirror if the magnification produced by the mirror is $+3$?



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25. Between which two points of a concave mirror should an object be placed to obtain a magnification of -3 ?



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26. The outer surface of a hollow sphere of aluminium of radius 50 cm is to be used as a mirror. What will be the focal length of this mirror? Which type of spherical mirror will it provide?



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27. Which property of concave mirror is utilised for using them as shaving mirrors?



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28. What is an optically rarer medium?



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29. What is an optically denser medium?



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30. Define the term refraction of light.



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31. Define the term angle of incidence.



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32. Define the term angle of refraction.



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33. Define the term refractive index of a medium in terms of speed of light.



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34. What is absolute refractive index?



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35. What is relative refractive index?



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36. What is the unit of refractive index?



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37. Refractive index of two material mediums X and Y are 1.3 and 1.5 respectively. In which of the two, the light would travel faster?



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38. What is the cause of refraction of light?



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39. What is the relationship between the refractive index of two media?



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40. In which direction a ray of light bends when it goes from water to glass?



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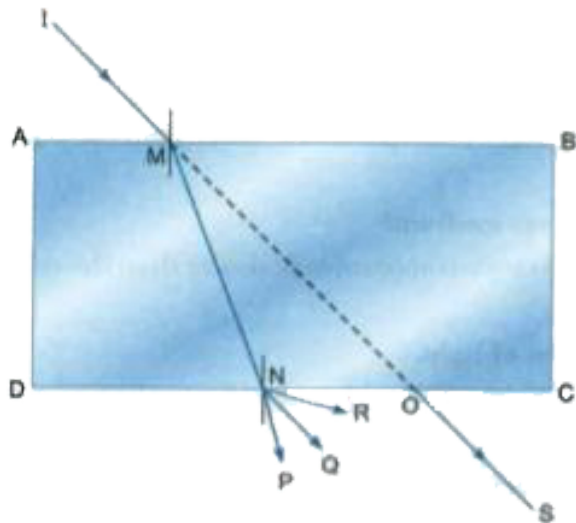
41. If refractive indices of water and alcohol are 1.33 and 1.36 respectively, which of the two is optically denser medium?



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42. If a light ray IM is incident on the surface AB as shown, identify the correct emergent

ray.



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43. Why does a ray of light bend when it travels from one medium into another?

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44. What is a lens?



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45. Name a point inside a lens such that a ray of light passing through it goes undeviated.



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46. Name the phenomena on which the working of a lens is based.

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47. State two examples of phenomenon of refraction of light in everyday life situations.

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48. What is meant by power of a lens?



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49. Give the SI unit of power of lens. State whether the power of a converging lens is positive or negative.



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50. Aspherical mirror and a lens have same focal length of -20 cm. What type of mirror and lens are these?





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51. A small electric lamp is placed at the focus of a convex lens. What is the nature of beam of light produced by the lens?



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52. An object is placed 80 cm from a converging lens of focal length 25 cm. What is the nature of the image?



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53. What is the power of a combination of lenses?



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54. State one advantage of using combination of lenses in optical instruments instead of a single lens.



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55. What is monochromatic light?



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56. How does phenomenon of lateral inversion occurs?



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57. Under what condition a lens becomes invisible when placed in a transparent liquid?





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58. Define the term magnification.



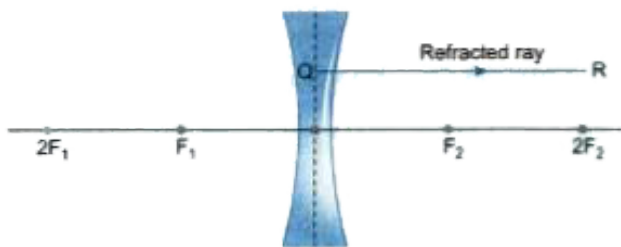
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59. Show diagrammatically, how should two converging lenses be arranged so that a parallel beam becomes parallel after passing through two lenses.



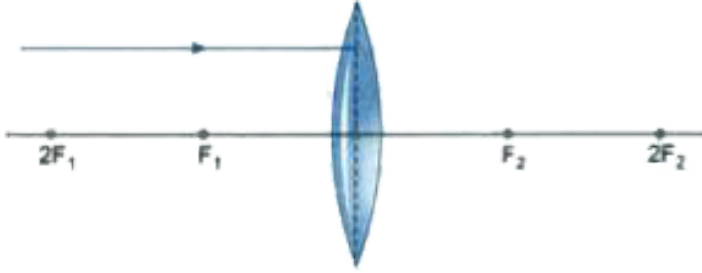
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60. The diagram below shows the refracted ray QR through a concave lens. Complete the diagram by drawing the corresponding incident ray.



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61. Redraw the given diagram and show the path of the refracted ray.



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Short Answer Questions I

1. What possible phenomenon can happen when light falls on a surface?

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2. List four characteristics of the images formed by plane mirrors?



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3. List four specific characteristics of the images of the objects formed by convex mirrors.



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4. Explain the term lateral inversion.



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5. In what way is the word AMBULANCE printed in front of the hospital vans? Why is it printed this way?



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6. How can you distinguish between a plane mirror, a concave mirror and a convex mirror without touching them?



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7. State the laws of refraction of light. If the speed of light in vacuum is 3×10^8 m/s, find the absolute refractive index of a medium in which light travels with a speed of 1.4×10^8 m/s.





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8. State two positions in which a concave mirror produces a magnified image of a given object. List two differences between the two images.



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9. The linear magnification produced by a spherical mirror is $+3$. Analyse this value and state the (i) type of mirror and (ii) position of

the object with respect to the pole of the mirror. Draw ray diagram to show the formation of image in this case.



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10. What will happen to a ray of light when it falls normally on a surface? Show it diagrammatically.



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11. Identify the device used (a spherical mirror or lens) in following cases, when the image formed is virtual and erect in each case.

(a) Object is placed between device and its focus, image formed is enlarged and behind it.

(b) Object is placed between the focus and device, image formed is enlarged and on the same side as that of the object.

(c) Object is placed between infinity and device, image formed is diminished and between focus and optical centre on the same side as that of the object.

(d) Object is placed between infinity and device, image formed is diminished and between pole and focus, behind it.



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12. A convex lens of focal length 20 cm can produce a magnified virtual as well as real image. Is this a correct statement? If yes, where shall the object be placed in each case for obtaining these images?



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13. How are power and focal length of a lens related? You are provided with two lenses of focal length 20 cm and 40 cm respectively. Which lens will you use to obtain more convergent light?



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14. Under what condition in an arrangement of two plane mirrors, incident ray and reflected ray will always be parallel to each other,

whatever may be angle of incidence. Show the same with the help of a ray diagram.



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15. Draw a ray diagram showing the path of rays of light when it enters with oblique incidence (i) from air into water, (ii) from water into air.



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16. List two properties of the images formed by convex mirrors. Draw ray diagram in support of your answer.



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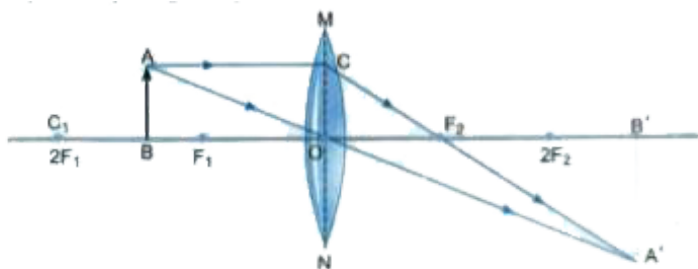
Short Answer Questions II

1. Distinguish between real image and virtual image.



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2. Study the ray diagram given below and answer the following questions:



- (i) State the type of lens used in the figure.
- (ii) List two properties of the image formed .
- (iii) In which position of the object will be magnification be -1 ?



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3. To construct a ray diagram we use two rays of light which are so chosen that it is easy to determine their directions after reflection from the mirror. Choose these two rays and state the path of these rays after reflection from a concave mirror. Use these two rays to find the nature and position of the image of an object placed at a distance of 15 cm from a concave mirror of focal length 10 cm.



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4. Explain with the help of a ray diagram, why a pencil partly immersed in water appears to be bent at the water surface.



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5. Draw a ray diagram to show the path of the reflected ray in each of the following cases. A ray of light incident on a convex mirror

(a) strikes at its pole making an angle from θ the principal axis.

(b) is directed towards its principal focus.

(c) is parallel to its principal axis.



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6. A student wants to project the image of a candle flame on a screen 80 cm in front of a mirror by keeping the candle flame at a distance of 20 cm from its pole.

(i) Which type of mirror should the student use?

(ii) Find the magnification of the image

produced.

(iii) Find the distance between the object and its image.

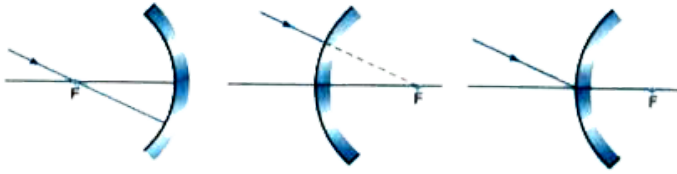
(iv) Draw a ray diagram to show the image formation in this case and mark the distance between the object and its image.



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7. Draw the following diagram, in which a ray of light is incident on a concave/convex mirror, on your answer sheet. Show the path of this

ray, after reflection, in each case.



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8. Distinguish between a convex lens and a concave lens.

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9. If the image formed by a mirror for all positions of the object placed in front of it is always erect and diminished, what type of mirror is it? Draw a ray diagram to justify your answer. Where and why do we generally use this type of mirror?



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10. A pencil when dipped in water in a glass tumbler, appears to be bent at the interface of

air and water. Will the pencil appear to be bent to the same extent, if instead of water we use liquids like, kerosene or turpentine. Support your answer with reason.



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11. How is the refractive index of a medium related to the speed of light? Obtain an expression for refractive index of a medium with respect to another in terms of speed of light in these two media?



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12. Sudha finds out that the sharp image of the window pane of her science laboratory is formed at a distance of 15 cm from the lens. She now tries to focus the building visible to her outside the window instead of the window pane without disturbing the lens. In which direction will she move the screen to obtain a sharp image of the building? What is the approximate focal length of this lens?



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Long Answer Questions

1. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

(i) What should be the range of distance of an object placed in front of the mirror?

(ii) Will the image be smaller or larger than the object. Draw ray diagram to show the formation of image in this case.

(iii) Where will the image of this object be, if it

is placed 24 cm in front of the mirror? Draw ray diagram for this situation also to justify your answer. Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams.



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2. Suppose you have three concave mirrors A, B and C of focal lengths 10 cm, 15 cm and 20 cm. For each concave mirror you perform the experiment of image formation for three

values of object distance of 10 cm, 20 cm and 30 cm. Giving reason answer the following:

(a) For the three object distances, identify the mirror/mirrors which will form an image of magnification - 1.

(b) Out of the three mirrors identify the mirror which would be preferred to be used for shaving purposes/makeup.

(c) For the mirror B draw ray diagram for image formation for object distances 10 cm and 20 cm.



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3. (i) Rohit claims to have obtained an image twice the size of object with a concave lens. Is he correct? Give reason for your answer.

(ii) Where should an object be placed in case of a convex lens to form an image of same size as of the object? Show with the help of ray diagram the position and the nature of the image formed.

(iii) With the help of ray diagram, illustrate the change in position, nature and size of the image formed if the convex lens in case of (ii)

is replaced by concave lens of same focal length.



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Some Important Numericals

1. Find the size, nature and position of image formed when an object of size 1 cm is placed at a distance of 15 cm from a concave mirror of focal length 10 cm.



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2. The image of an object formed by a mirror is real, inverted and is of magnification - 1. If the image is at a distance of 40 cm from the mirror, where is the object placed? Where would the image be if the object is moved 20 cm towards the mirror? State reason and also draw ray diagram for the new position of the object to justify your answer.



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3. An object 2 cm high is placed at a distance of 16 cm from a concave mirror which produces a real image 3 cm high.

(i) Find the position of the image.

(ii) What is the focal length of mirror?



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4. A concave mirror of focal length 10 cm is placed at a distance of 35 cm from a wall. How far from the wall an object be placed so that

its image formed by the mirror falls on the wall?



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5. A 2.0 cm tall object is placed perpendicular to the principal axis of a concave mirror of focal length 10 cm. The distance of the object from the mirror is 15 cm. Find the nature, position and size of the image formed. Represent the situation with the help of a ray diagram.



6. A student has focused the image of a candle flame on a white screen using a concave mirror. The situation is as given below:

Length of the flame = 1.5 cm

Focal length of the mirror = 12 cm

Distance of flame from the mirror = 18 cm

If the flame is perpendicular to the principal axis of the mirror, then calculate the following:

(a) Distance of the image from the mirror

(b) Length of the image

If the distance between the mirror and the flame is reduced to 10 cm, then what would be observed on the screen? Draw ray diagram to justify your answer for this situation.



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7. A 2 cm high object is placed at a distance of 32 cm from a concave mirror. The image is real, inverted and 3 cm in size. Find the focal length of the mirror and the position where the image is formed?



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8. A convex mirror used for rear-view on an automobile has a radius of curvature of 3.00 m. If a bus is located at 5.00 m from this mirror, find the position, nature and size of the image.



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9. Size of image of an object formed by a mirror having a focal length of 20 cm, is observed to

be reduced to $\frac{1}{3}$ rd of its size. At what distance the object has been placed from the mirror ?
What is the nature of the image and the mirror ?



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10. A truck uses a convex mirror as view finder whose radius of curvature is 2.0 m. A maruti car is coming behind the truck at a distance of 10 m. What will be the position of the image of the car and size of the image of the car when

observed by the driver of the truck through the convex mirror?



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11. If the angle of incidence(i)for a light ray in air be 45° and the angle of refraction (r)in glass be 30° , find refractive index of glass with respect to air.



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12. Refractive index of water with respect to air is 1.33. What is the value of refractive index of air with respect to water?



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13. The absolute refractive indices of glass and water are $\frac{4}{3}$ and $\frac{3}{2}$ respectively . If the speed of light in glass is 2×10^8 m/s , calculate the speed of light in (i) vaccum , (ii) water.





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14. Refractive index of water with respect to air is $\frac{4}{3}$ and glass is $\frac{3}{2}$. What is the refractive index of glass with respect to water ?



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15. The refractive indices of glass and water with respect to air are $\frac{3}{2}$ and $\frac{4}{3}$ respectively . If speed of light in glass is $2 \times 10^8 \text{ m/s}$, find the speed of light in water.



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16. Refractive indices of water and benzene with respect to air are 1.33 and 1.50 respectively. Calculate the refractive index of benzene with respect to water.



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17. Refractive index of diamond with respect to glass is 1.6 and absolute refractive index of

glass is 1.5. Find out the absolute refractive index of diamond.



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18. The absolute refractive indices of two media 'A' and 'B' are 2.0 and 1.5 respectively. If the speed of light in medium 'B' is 2×10^8 m/s, calculate the speed of light in:

(i) vacuum (ii) medium 'A'.



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19. The image of a candle flame formed by a lens is obtained on a screen placed on the other side of the lens. If the image is three times the size of the flame and the distance between lens and image is 80 cm, at what distance should the candle be placed from the lens? What is the nature of the image at a distance of 80 cm from the lens?



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20. An object 3 cm high is placed 20 cm from convex lens of focal length 12 cm. Find the nature, position and height of the image.



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21. An object 1 m tall is placed on the principal axis of a convex lens and its 40 cm tall image is formed on the screen placed at a distance of 70 cm from the object. What is the focal length of the lens ?





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22. An 5 cm tall object is placed on the principal axis of a convex lens of focal length 50 cm at a distance of 40 cm from it. Find the nature, position and size of image.



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23. A student focussed the image of a candle flame on a white screen using a convex lens. He noted down the positive of the candle,

screen and the lens as under.

Position of candle = 12.0 cm

Position of the screen = 50.0 cm

Position of the screen = 88.0 cm

(i) What is the focal length of the convex lens ?

(ii) Where will the image be formed if he shifts the candle towards the lens at a position of 31.0 cm ?

(iii) What will be the nature of the image formed if the further shifts the candle towards the lens ?

(iv) Draw a ray diagram to show the formation of the image in case (iii) as said above .



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24. An object 2 cm high is placed at a distance of 64 cm from a white screen. On placing a convex lens at a distance of 32 cm from the object it is found that a distinct image of the object is formed on the screen. What is the focal length of the convex lens and size of the image formed on the screen ?



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25. A real, $\frac{4}{5}$ size of the object is formed 18 cm from a lens. Calculate the focal length of the lens.



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26. An object kept at a distance of 60 cm from a lens gives a virtual image at a distance of 20 cm over the same side of the lens. What is the focal length of the lens ? Is the lens converging or diverging >



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27. "A convex lens can form a magnified erect as well as magnified inverted image of an object placed in front of it". Draw ray diagram to justify this statement stating the position of the object with respect to the lens in each case.

An object of height 4 cm is placed at a distance of 20 cm from a concave lens of focal length 10 cm . Use lens formula to determine the position of the image formed.



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28. At what distance from a concave lens of focal length 20 cm a 6 cm tall object be placed so as to obtain its image at 15 cm from the lens ? Also calculate the size of the image formed.

Draw a ray diagram to justify your answer for the above situation and label it.



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29. A convex lens has a focal length of 10 cm .

What is its power ?



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30. A student uses a lens of focal length 50 cm and another of - 50 cm . What is the nature of the lens and its power used by each of them ?



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31. Two thin lenses of focal lengths $+ 10$ cm and $- 5$ cm are kept in contact. What is the focal length and power of the combination.



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Hots Higher Order Thinking Skills

1. Which one of the two-glass and water is optically denser and why?



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2. Why does white light split up into different colours while passing through a glass prism?

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3. Can a convergent lens in one medium become divergent in another medium?

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4. A man is going away from the plane mirror with a velocity of 3 m/s. With what velocity is he going away from his own image in the mirror?



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5. Under what condition a convex lens when placed in a medium behaves as an ordinary glass plate?



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6. Why does a concave mirror has a real principal focus ?



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7. A concave mirror and convex lens are immersed in water. What change, if any, do you expect in the focal length of the two?



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8. Which is a better reflector-a plane mirror or a right-angled prism?



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9. A man is holding a lighted candle in front of a thick glass mirror and on viewing it obliquely he noticed a number of images of the candle why ?



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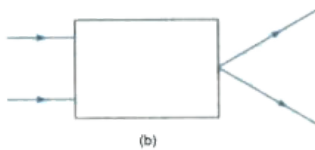
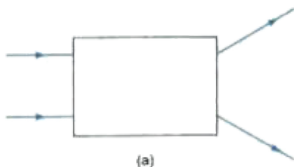
10. A concave mirror of focal length f produces an image n times the size of the object. What would be the object distance for which the image is real?



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11. In the following figures, one lens is placed inside each box. State the nature of the lens.

Complete the ray diagrams.





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12. A convex lens forms a blurred image of an object on a screen.

Suggest a suitable way to get a sharp image on a screen without disturbing the object , lens or the screen.

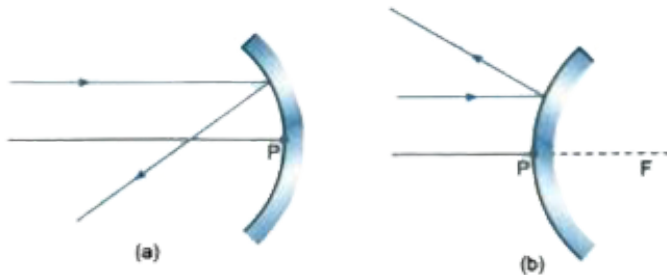


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13. Why does a ray of light parallel to the principal axis

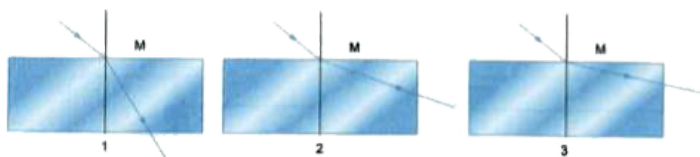
(i) bend towards the principal axis in the case of a concave mirror and

(ii) goes away from the principal axis in the case of convex mirror as shown here ?



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14. The ray diagrams given below show the paths of a ray of light travelling from a medium M into different media 1, 2 and 3.



(a) In which of three media 1, 2 or 3 does light travel: (i) faster, (ii) slower than in medium M?

(b) Arrange the media 1, 2 and 3 in descending order of (i) speed of light through them, (ii) their refractive index.



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15. If x , y and z denote the object distance, image distance and the radius of curvature respectively of a spherical mirror, which one of the following is the correct relation between them ?

A. $Z = 2 \frac{xy}{x - y}$

B. $Z = 2 \frac{x + y}{xy}$

C. $Z = 2 \frac{xy}{x - y}$

D. $Z = 2 \frac{x - y}{xy}$

Answer:



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16. You are given lenses with powers $+10\text{ D}$, $+5\text{ D}$, -5 D , -20 D , and -10 D . Taking a pair of lenses at a time, which two lenses will you select to have a combination of total focal length when the two lenses are kept in contact in each case.

A. 20 cm

B. -10 cm

C. -20 cm

D. $\frac{20}{3}$ cm

Answer:



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17. A student recorded the following data for the values of object distance and corresponding image distance while performing an experiment on real image formation lens of power + 4 D. Two of these observations are incorrect. Without making

any calculations, identify these observations and give reason for your choice.

Observation	A	B	C	D	E
Object Distance u (cm)	30	40	50	60	70
Image Distance v (cm)	20	60	50	70	30

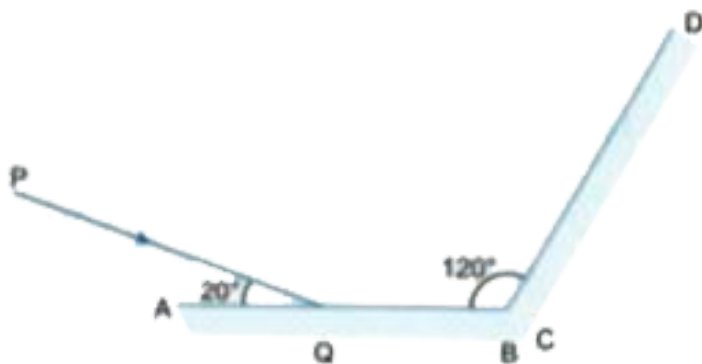
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18. The given ray diagram shows a ray of light PQ striking a mirror AB. The mirror AB and CD are at an angle of 120° with each other. The ray PQ strikes the surface of the mirror AB at point Q.

(i) Draw the complete path of reflection of the

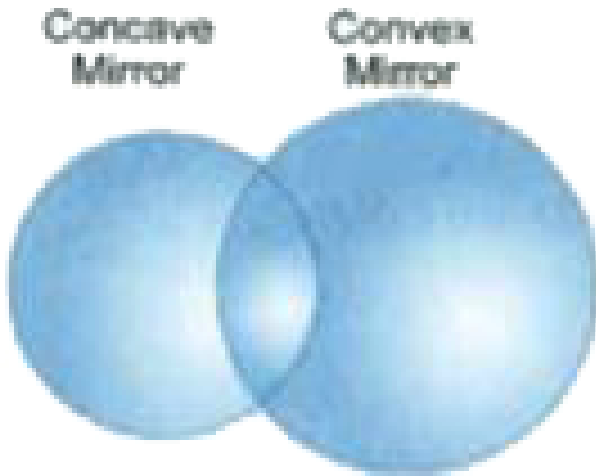
ray at mirrors AB and CD.

(ii) Calculate the sum of angles which the reflected rays make with the surfaces of mirrors AB and CD.



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19. Compare and contrast between the image formation by a concave and convex mirror. Write the similarities in the common space and the dissimilarities in the left side or the right side.



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20. Playing with an old lens one morning, Ravi discovers that if he holds the lens 10 cm away from a wall opposite to a window, he can see a sharp but upside-down picture of outside world on the wall. That evening, he covers a lighted lamp with a piece of opaque paper on which he has pierced, a small hole 1 mm in diameter. By placing the lens between the illuminated card and the wall, he manages to produce a sharp image of diameter 5 mm on the wall.

What is the power of the lens ?



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21. Playing with an old lens one morning, Ravi discovers that if he holds the lens 10 cm away from a wall opposite to a window, he can see a sharp but upside-down picture of outside world on the wall. That evening, he covers a lighted lamp with a piece of opaque paper on which he has pierced, a small hole 1 mm in diameter. By placing the lens between the illuminated card and the wall, he manages to produce a sharp image of diameter 5 mm on

the wall.

In the evening experiment , how far away from the opaque paper did he place the lens ?



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22. Playing with an old lens one morning, Ravi discovers that if he holds the lens 10 cm away from a wall opposite to a window, he can see a sharp but upside-down picture of outside world on the wall. That evening, he covers a lighted lamp with a piece of opaque paper on

which he has pierced, a small hole 1 mm in diameter. By placing the lens between the illuminated card and the wall, he manages to produce a sharp image of diameter 5 mm on the wall.

How far apart were the card and the wall ?



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23. If the image formed by a lens for all positions of the object placed in front of it is always virtual, erect and diminished, state the

type of the lens. Draw a ray diagram in support of your answer. If the numerical value of focal length of such a lens is 20 cm, find its power in new cartesian sign conventions.



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Some Important Numericals For Practice

1. An object is placed at a distance of 10 cm from a convex mirror of focal length 5 cm .

(i) Draw a ray diagram showing the formation

of image.

(ii) State two characteristics of the image formed.

(iii) Calculate the distance of the image from mirror.



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2. An object placed 20 cm in front of a mirror is found to form an image of 15 cm (i) in front of it, (ii) behind the mirror. Find the focal

length of the mirror and the kind of mirror in each case.



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3. An object is placed at a distance of 10 cm from a concave mirror of focal length 20 cm .

(i) Draw a ray diagram for the formation of image.

(ii) Calculate the image distance.

(iii) State two characteristics of the image formed.



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4. If an object 10 cm high is placed at a distance of 36 cm from a concave mirror of focal length 12 cm , find the position , nature and height of the image.



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5. An arrow 2.5 cm high is placed at a distance of 25 cm from a diverging mirror of focal

length 20 cm. Find the nature, position and size of the image formed.



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6. A converging mirror forms a real image of height 4 cm of an object of height 1 cm placed 20 cm away from the mirror.

Calculate (i) image distance, (ii) focal length of the mirror.



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7. In an experiment with a rectangular glass slab, a student observed that a ray of light incident at an angle of 60° with the normal on one face of the slab, after refraction, strikes the opposite face of the slab before emerging out in air making an angle of 42° with the normal. Draw a labelled ray diagram to show the path of this ray. What value would you assign to the angle of refraction and angle of emergence?



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8. Three beams of light 1, 2 and 3 of the same wavelength are sent through three different materials of refractive indices 1.60, 1.50 and 1.55. Arrange the velocity of these beams in different materials in ascending order.



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9. A convex lens has a focal length of 10 cm. At what distance from the lens should the object be placed so that it forms a real and inverted image 20 cm away from the lens? What could

be the size of the image formed if the object is 2 cm high? With the help of a ray diagram, show the formation of the image by the lens in this case.



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10. The image of a candle flame placed at a distance of 30 cm from a spherical lens is formed on a screen placed on the other side of the lens at a distance of 60 cm from the optical centre of the lens. Identify the type of

lens and calculate its focal length. If the height of the flame is 3 cm, find the height of its image.



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11. An object of height 5 cm is placed perpendicular to the principal axis of a concave lens of focal length 10 cm. If the distance of the object from the optical centre of the lens is 20 cm, determine the position,

nature and size of the image formed using the lens formula.



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12. A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image at 10 cm from the lens? Also, find the magnification of the lens.



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13. At what distance should an object be placed from a convex lens of focal length 18 cm to obtain an image at 24 cm from it on the other side. What will be the magnification produced in this case?



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14. A 2 cm high candle flame is placed at a distance of 80 cm from a white screen. On placing a convex lens exactly at the mid point of the candle and the screen, a distant image

of the flame is seen on the screen. What is the focal length of the lens and the size of the candle flame image formed? Draw a ray diagram to show the formation of the image in this case.



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15. One half of a convex lens of focal length 10 cm is covered with a black paper. Can such a lens produce an image of a complete object placed at a distance of 30 cm from the lens?

Draw a ray diagram to justify your answer.

A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 15 cm. Find the nature, position and size of the image.



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16. The power of a lens is +4D. What kind of lens is it and what is its focal length?



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17. A lens has focal length of 10 cm. What is the power of the lens and what is its nature?



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18. The power of a lens is - 2 D. What is its focal length?



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19. Two lenses of power 3D and -5D are placed in contact to form a composite lens. An object is placed at a distance 50 cm from this composite lens, find the position of the image.



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Proficiency Exercise Short Answer Questions I

1. The image of an object formed by a lens is real, inverted and of the same size as the

object. If the image is at a distance of 40 cm from the lens, what is the nature and power of the lens? Draw ray diagram to justify your answer.



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Proficiency Exercise Long Answer Questions

1. Find the position of an object which when placed in front of a concave mirror of focal

length 20 cm produces a virtual image twice the size of the object.



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2. An object 2 cm in size is placed 20 cm in front of a concave mirror of focal length 10 cm. Find the distance from the mirror at which a screen should be placed in order to obtain sharp image. What will be the size and nature of the image formed?



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3. When an object is placed at a distance of 60 cm from a convex mirror the magnification produced is $\frac{1}{2}$. Where should the object be placed to get a magnification of $\frac{1}{3}$



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4. A concave lens has focal length of 20 cm. At what distance from the lens a 5 cm tall object be placed so that it forms an image at a

distance of 15 cm from the lens? Also calculate the size of the image formed.



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5. At what distance should an object be placed from a convex lens of focal length 18 cm to obtain an image at 36 cm from it? What will be the magnification produced in this case?



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