Physics 112

Mirrors Problems

Part I.   Mirrors and Reflection Problems.

1. A converging mirror has a focal length of 15.0 cm.
a) Where is the image if the object is 58.0 cm
from the vertex? b) What is the height of the
image if the original object was 75.0 cm high?

2. A 2.5 m tall person stands 1.5 m in front of
a large diverging mirror. a) What is the
focal length of the mirror if the mirror has a
magnification of $M = +0.65$? b) What is the
height of the image?

3. An image of a person's face is located a distance
of $d_i = -25.0$ cm from the vertex of a converging
mirror. The person is 11.0 cm from the vertex.
a) What is the focal length of the mirror? b)
What is the magnification of the mirror? c)
What is the height of the image if the face is
26.0 cm high?

4. How far from the vertex is an image in a
diverging mirror if it has a focal length of
$f = -49.0$ cm and the object is 33.0 cm from the
vertex?

5. Determine the image distance for a converging
mirror with a focal length of $f = 44$ cm if the
object is placed 62 cm from the screen. What are
the four characteristics of the image?

6. A 15 cm pencil is placed 35 cm from a diverging
mirror. If the focal length is $f = -25$ cm, find
the image distance and height. What are the
four characteristics of the image?

7. Determine the image distance in in a converging
mirror that has a focal length of 15.0 cm when
the object is placed a) 40.0 cm from the mirror;
and b) 10.0 cm from the mirror.

8. Determine the image distance in a diverging
mirror that has a focal length of -20.0 cm when
the object is placed a) 10.0 cm from the mirror;
and b) 30.0 cm from the mirror.

9. A candle 3.0 cm high is placed 30.0 cm from a
converging mirror with a focal length of 20.0 cm.
Find the location and height of the image. What
are the images characteristics?

10. A woman looks at herself in a magnifying
converging mirror whose focal length is 20.0 cm.
If her face is 10.0 cm from the mirror, at what
distance from the mirror is her image? what is
the magnification of her face?

11. A 2.0 cm high candle is placed 15 cm in from
of a converging mirror with a focal length of
30.0 cm. How far behind the mirror does the
candle appear, and how large is it?

12. A dentist holds a converging mirror with a focal
length of 20.0 mm a distance of 15 mm from a
tooth. What is the magnification of a filling in
the tooth?

13. A trucker sees the image of a car passing her
truck in her diverging rear-view mirror whose
focal length is -60.0 cm. If the car is 1.5 m high
and 6.0 m away, what is the size and location of
the image?

14. Where is an image formed with a converging
mirror of focal length 25 cm if the object is
placed a) 45 cm from the vertex? b) 15 cm from
the vertex?

15. A converging mirror has a focal length of 42 cm.
Where should an object be placed to produce a
real image one third the size of the object?

16. A converging mirror has a focal length of 42 cm.
Where should an object be placed to produce a
virtual image three times the size of the object?

17. Where is the centre of curvature of a diverging
mirror that produces an image three quarters as
high as the original object? The original object
is 24.0 cm from the vertex of the mirror.

18. A converging mirror has a focal length of 30.0 cm.
Where must an object be placed to produce a
real image five times the size of the object?

19. A child looks at his reflection in a spherical Christmas tree ornament 8.0 cm in diameter, and sees that the image of his face is reduced by a factor of half. How far is his face from the ornament?

20. A converging mirror has a focal length of 15 cm. Where would you place an object in order to produce a virtual image two times as tall as the object?

21. A converging mirror has a focal length of 24 cm. Where would you place an object: a) to produce a real image one-third the size of the object? b) to produce a real image 3.00 times the size of the object? c) to produce a virtual image 3.00 times the size of the object?

22. A converging mirror has a focal length of $f = 15.0$ cm. The distance between the object and its real, enlarged image is 40.0 cm. Determine the magnification.

23. A converging mirror has a focal length of $f = 12.0$ cm. The distance between the object and its real, reduced image is 55.0 cm. Determine the magnification.

24. You are given either a converging or diverging mirror with a known focal length f. Using the mirror and magnification equations, show that to obtain a desired magnification M, the object should be placed a distance of, $d_o = \dfrac{f(M-1)}{M}$.

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Answer List

1.   a) $d_i = 20.2\,\text{cm}$

     b) $h_i = -26.1\,\text{cm}$

2.   a) $f = -2.8\,\text{m}$

     b) $h_i = 1.6\,\text{m}$

3.   a) $f = 19.6\,\text{cm}$

     b) $M = 2.27$

     c) $h_i = 59.1\,\text{cm}$

4. $d_i = -19.7\,\text{cm}$

5. $d_i = 1.5 \times 10^2\,\text{cm}$. Image is real, inverted, beyond C, and larger than the object.

6. $d_i = -15\,\text{cm}$; $h_i = 6.3\,\text{cm}$. Image is virtual, between V and F, smaller than the object, and erect.

7.   a) $d_i = 24.0\,\text{cm}$

     b) $d_i = -30.0\,\text{cm}$

8.   a) $d_i = -6.70\,\text{cm}$

     b) $d_i = -12.0\,\text{cm}$

9. $d_i = 60.0\,\text{cm}$; $h_i = -6.0\,\text{cm}$. The image is real, inverted, beyond C, and larger than the object.

10. $d_i = -20.0\,\text{cm}$; $M = +2.0$

11. $d_i = -30.0\,\text{cm}$; $h_i = 4.0\,\text{cm}$

12. $M = +4.0$

13. $h_i = 14\,\text{cm}$; $d_i = -0.55\,\text{m}$

14.   a) $d_i = 56\,\text{cm}$

      b) $d_i = -38\,\text{cm}$

15. $d_o = 1.7 \times 10^2\,\text{cm}$

16. $d_o = 28\,\text{cm}$

17. $C = -144$

18. $d_o = 36\,\text{cm}$

19. $d_o = 2.0\,\text{cm}$

20. $d_o = 7.5\,\text{cm}$

21.   a) $d_o = 96\,\text{cm}$

      b) $d_o = 32\,\text{cm}$

      c) $d_o = 16\,\text{cm}$

22. $d_o = 20.0\,\text{cm}$, $d_i = 60.0\,\text{cm}$, $M = -3.00$

23. $d_o = 69.5\,\text{cm}$, $d_i = 14.5\,\text{cm}$, $M = -0.209$

24. *proof*

Catalog List

1.	20P CB 1	2.	20P CB 2	3.	20P CB 3	4.	20P CB 4
5.	20P CB 5	6.	20P CB 6	7.	20P CB 8	8.	20P CB 9
9.	20P CB 11	10.	20P CB 12	11.	20P CB 13	12.	20P CB 14
13.	20P CB 15	14.	20P CB 17	15.	20P CB 19	16.	20P CB 20
17.	20P CB 21	18.	20P CB 24	19.	20P CB 26	20.	20P CB 27
21.	20P CB 28	22.	20P CB 31	23.	20P CB 32	24.	20P CB 40