

Name: _____

Rec. Instr.: _____

Rec. Time: _____

For full credit, make your work clear to the grader. Show the formulas you use, all the essential steps, and results with correct units and correct number of significant figures. Point values are given in parenthesis. For TF or MC questions, choose the best answer.

1. (2) A concave mirror has a radius of curvature of 1.0 m. Its focal length is
 a. 1.0 m. b. 2.0 m. c. 0.50 m. d. -1.0 m. e. -2.0 m. f. -0.50 m.
2. (4) A mirror with focal length $f = +0.75$ m is pointed at the sun.
 a) (2) The image of the sun is
 a. 0.75 m in front of the mirror. c. 0.75 m behind the mirror.
 b. 1.50 m in front of the mirror. d. 1.50 m behind the mirror.
- b) (2) The type of image formed is
 a. real and inverted. c. real and upright.
 b. virtual and inverted. d. virtual and upright.

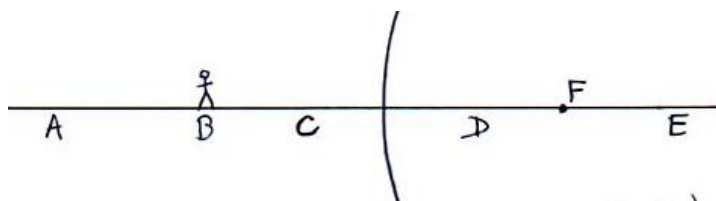
3. (16) Standing 1.25 m in front of a mirror in an amusement park, your image is upright and $2.2\times$ as taller as you are.
 a) (6) How far is your image from the mirror?



- b) (2) **T F** Your image is virtual.
 c) (2) **T F** Your image is located in front of the mirror.
 d) (4) Find the focal length of the mirror (with correct sign).

- e) (2) The mirror is a. planar. b. concave. c. convex.

4. (6) The sketch shows a person standing in front of a convex mirror, with focal point F.
 a) (3) Which of the labeled points (ABCDEF) is closest to the location of the image: _____



- b) (3) The type of image is
 a. real & magnified. c. virtual & magnified.
 b. real & diminished d. virtual & diminished.

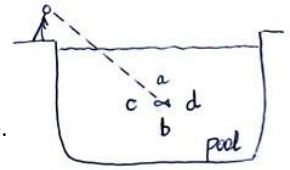
5. (2) Which type of mirror is appropriate to use for shaving or applying makeup, because it can give an upright magnified image?
 a. planar. b. concave. c. convex.

6. (2) Which type of mirror *always* makes an image smaller than the object?

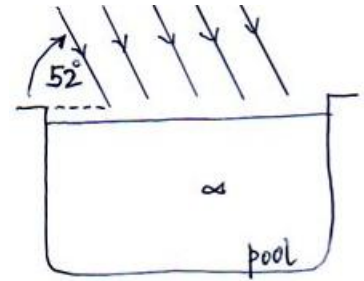
- a. planar. b. concave. c. convex.
-

7. (2) Ralph is cleaning the pool and notices a fish in the water—the diagram shows its apparent location (position of the image of the fish, seen by Ralph). The actual location of the fish is

- a. above the image. b. below the image. c. left of the image. d. right of the image.



8. (6) If the sun is actually 52° above the horizon, how high above the horizon does it appear to the fish in the pool? (Hint: Draw a ray to the fish' eye.)



9. (8) A person's right eye has a far point distance of 4.0 m. Vision for this eye is to be corrected using a contact lens on the eye.

- a) (2) This eye is a. nearsighted. b. farsighted. c. astigmatic. d. achromatic.
b) (6) What is the power of the corrective lens that is needed?
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10. (10) A person's eyes need reading glasses with power of +1.25 Diopters to read a book held 25 cm from the eye. The lens are held 2.5 cm in front of the eyes. Suppose the right and left eyes behave the same.

- a) (2) These eyes are a. nearsighted. b. farsighted. c. astigmatic. d. achromatic.
b) (2) The required corrective lens is a. converging. b. diverging.
c) (6) What is the person's near point if reading glasses are not being used?
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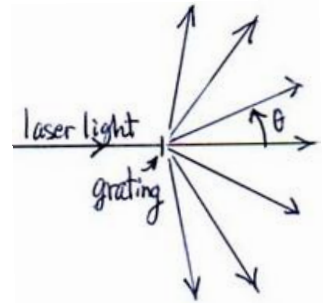
11. (2) In Young's double slit experiment, the light passing through two slits interferes on a distant screen

- a. because the light through one slit moves slower than the light through the other slit.
b. because the light through one slit changes its wavelength by a tiny amount.
c. because the light through one slit travels a greater distance than the light through the other slit.

12. (4) Typical window glass has an index of refraction near 1.52 . Light in air (use $n = 1$) outside the glass has wavelength of 480 nm, and then enters the glass. Find its **wavelength** *inside* the glass.

13. (12) Light from a blue laser (wavelength 440. nm) passes through a diffraction grating and then produces 7 bright spots on a screen (a central spot and three spots on each side.) The two bright spots farthest from the center occur at $\theta = \pm 72^\circ$.

a) (6) How far apart are the lines in the diffraction grating?



b) (6) Light from a red laser (wavelength 680. nm) is passed through the same grating. How many bright spots will be formed now?

14. (10) Unpolarized light of intensity 0.40 kW/m^2 is incident on “crossed polarizers” A and B (ones with their axes at 90° to each other).

a) (4) What is the intensity of the light after passing through the second polarizer (polarizer B in the diagram)?



b) (6) Now a third polarizer (C, not shown) is placed between the first two, with its axis at 30° to A’s axis and 60° to B’s axis. What is the final intensity of light emerging from polarizer B?

15. (12) A camera has an $f/2.8$ telephoto lens of focal length $+250.0$ mm. It is used to snap a photo of a 2.00 -m high basketball player standing 16.0 m from the lens.

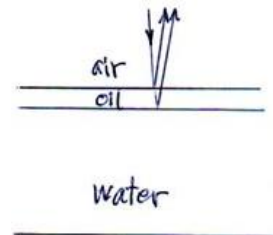
a) (4) What is the maximum usable diameter over which the lens can collect light?

b) (4) How far from the film must the lens be for proper focussing?

c) (4) How large is the image of the player on the film?

16. (12) A thin layer of oil ($n_{\text{oil}} = 1.25$) of uniform thickness $d = 250$ nm is floating on water ($n = 1.33$). Imagine that white visible light (between 400 nm and 700 nm) is being reflected off of the oil layer.

a) (6) Find the longest wavelength of visible light that undergoes **constructive interference** on reflection from the oil layer.



b) (6) Find the longest wavelength of visible light that will undergo **destructive interference** on reflection from the oil layer.