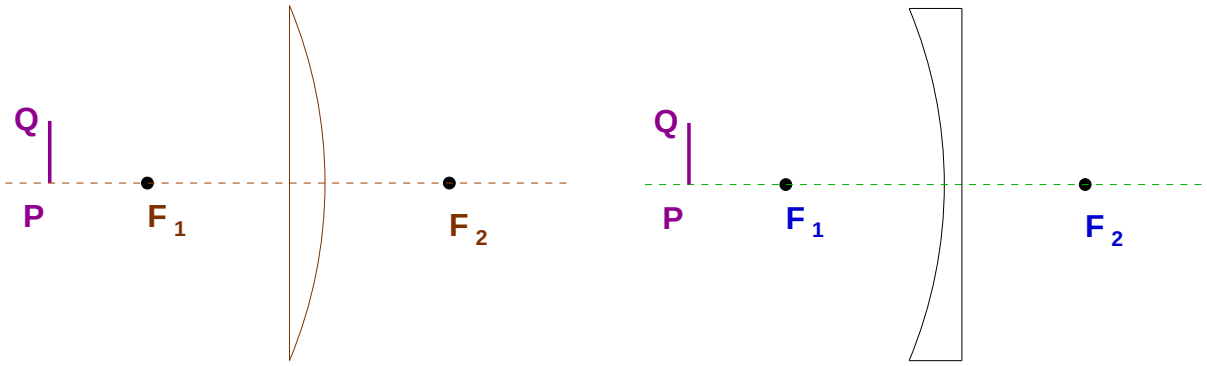
PHYSICS 232 – SAMPLE TEST # 2

Problem 1

(a) We can see the light that comes from the sun, but we can never hear any of the explosions that take place on the sun. Why can light reach us but sound from the sun cannot? State at least one difference between sound and light to support your answer.

(b) Are radio waves and light made of the same "stuff"? If so, what makes them different? If not, what is each made of?

(c) In these two diagrams, F_1 and F_2 are the focal points. In each case, state the type of the lens (converging or diverging). Then draw the image of the object PQ and state its type (real, erect, etc). Ignore the thickness of the lenses (thin lenses).



(d) As you move away from an object, do you have to increase or decrease the focal length of the lens in your eye to focus on the object? Explain.

Problem 2

A space-walking astronaut has run out of fuel for her jet-pack and is floating in space with zero velocity. The astronaut and all her equipment have a total mass $M = 250$ kg. She decides to use her 100 W flashlight as a light rocket to get back to the Space Shuttle.

(a) Assuming that the beam of light from the flashlight is in one direction, what force will it exert on the astronaut?

(b) What will be her acceleration due to this force?

(c) How long will it take her to reach the Shuttle if she is 6 m away from it when she turns on the flashlight?

Problem 3

Light of frequency $f = 5 \times 10^{14}$ Hz is incident normally on a glass plate of index of refraction $n = 1.5$ and thickness $d = 3$ mm.

(a) What is the wavelength of this light inside the glass plate?

(b) How long will it take a wavefront of this light to go through the glass plate?

Problem 4

The diameter of the moon is 3,420 km and its distance from the earth is 380,000 km. Find the diameter of the image of the moon formed by a spherical concave mirror on the earth of radius of curvature $R = 2$ m, when the axis of the mirror points straight at the moon.

Problem 5

What is the thinnest film of a coating with $n = 1.42$ on glass ($n = 1.60$) for which destructive interference of the green component (500 nm) of an incident white light beam in air can take place by reflection?