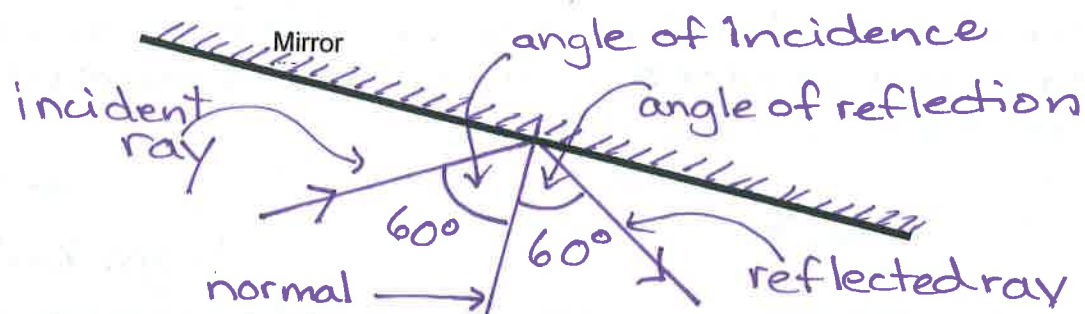


6. What is the Law of Reflection?

The angle of an incident ray equals the angle of the reflected ray.

7. For the plane mirror below, draw a normal to the mirror, a light ray that reflects at an angle of reflection of 60 degrees, and its incident ray. Clearly label the incident ray, normal, reflected ray and angle of incidence and angle of reflection.



8. Draw a sketch of a light ray traveling from glass (index of refraction, $n = 1.52$) into water ($n = 1.33$). Make sure you draw a normal and show whether the ray bends towards the normal or away from the normal.

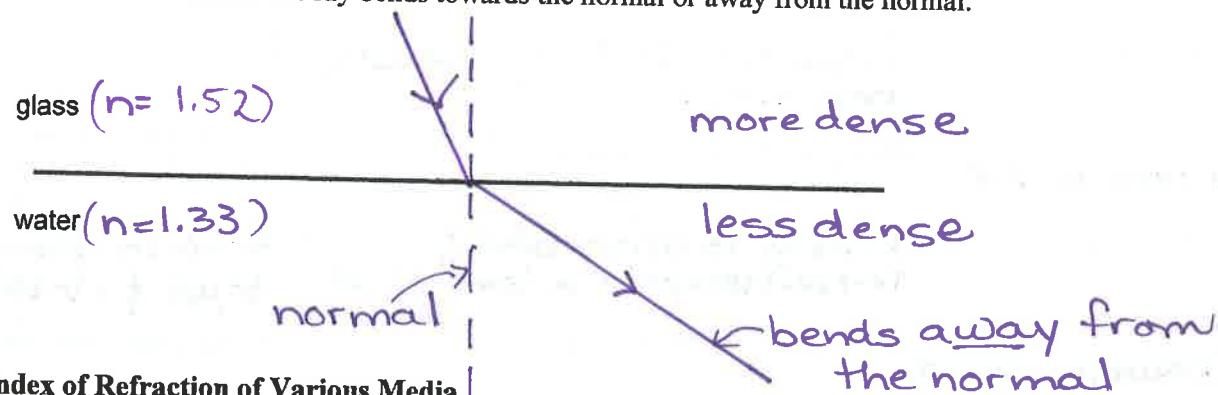


Table #1: The Index of Refraction of Various Media

Medium	Index of Refraction (n)
Air/vacuum	1.00
Water	1.33
Ethyl alcohol	1.36
Quartz	1.46
Vegetable oil	1.47
Acrylic	1.49
Glass	1.52
Zircon	1.92
Diamond	2.42

9. Would you expect light passing through glass to travel faster or slower than through ethyl alcohol?

glass ($n = 1.52$)
alcohol ($n = 1.36$)
Slower in glass

10. When light travels from water to glass, would it bend towards the normal or away from the normal?

glass ($n = 1.52$)
water ($n = 1.33$)
Slower in glass, therefore bends toward the normal

11. Explain why an acrylic stirring rod is almost transparent when submerged in vegetable oil compared to when it is placed in water.

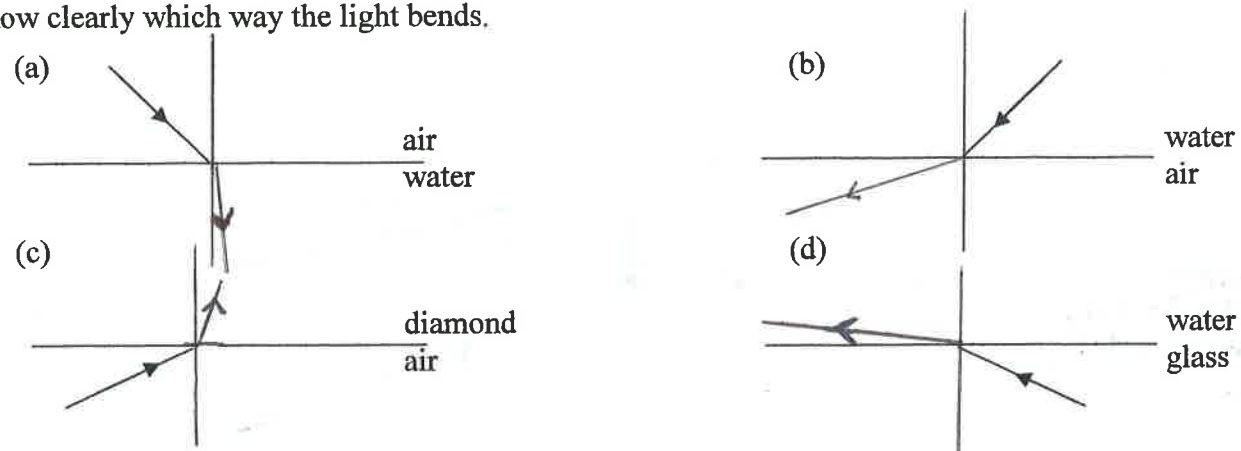
Acrylic & vegetable oil have almost the same index of refraction, so light passes through them both the same.

12. Define refraction. Be sure to include the two conditions necessary for refraction.
Refraction is when a light ray changes speed and also direction. It occurs when light passes through 2 substances of different densities and at an angle to the boundary

Water is different thus it will cause refraction (bending of light)

more dense \rightarrow towards normal
less dense \rightarrow away from normal

13. Draw the continuation of the light ray in the second medium. Show clearly which way the light bends.



14. The speed of light in a mysterious substance is 2.04×10^8 m/s. Calculate the index of refraction and check values in Table #1 above to determine what the substance is. Write down all givens, show all steps.

Given: $v = 2.04 \times 10^8$ m/s
 $c = 3.00 \times 10^8$ m/s
Required: $n = ?$

$$n = \frac{c}{v} = \frac{3.00 \times 10^8}{2.04 \times 10^8} = 1.47$$

The substance is probably vegetable oil.

15. A futuristic science fiction novel writes about a very special material with an index of refraction of 0.90. What is the speed of light in this material? Write down all givens; show your steps (algebra or formula triangle). Why would this material be so special?

Given: $n = 0.90$
 $c = 3.00 \times 10^8$ m/s
Required: $v = ?$

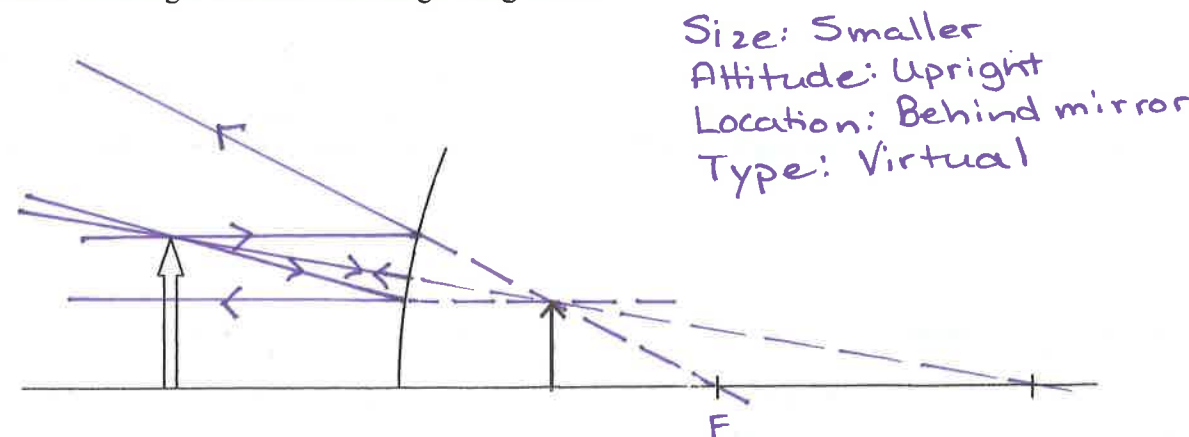
$$n = \frac{c}{v} \text{ so } v = \frac{c}{n} = \frac{3.00 \times 10^8}{0.90} = 3.33 \times 10^8 \text{ m/s}$$

This material is special because v is greater than c which is the speed of light in a vacuum.

16. What are the properties (SALT) of images in:

- A plane mirror?
- A concave mirror at the different object locations?
- A convex mirror?
- A converging lens at the different object locations?
- A diverging lens?

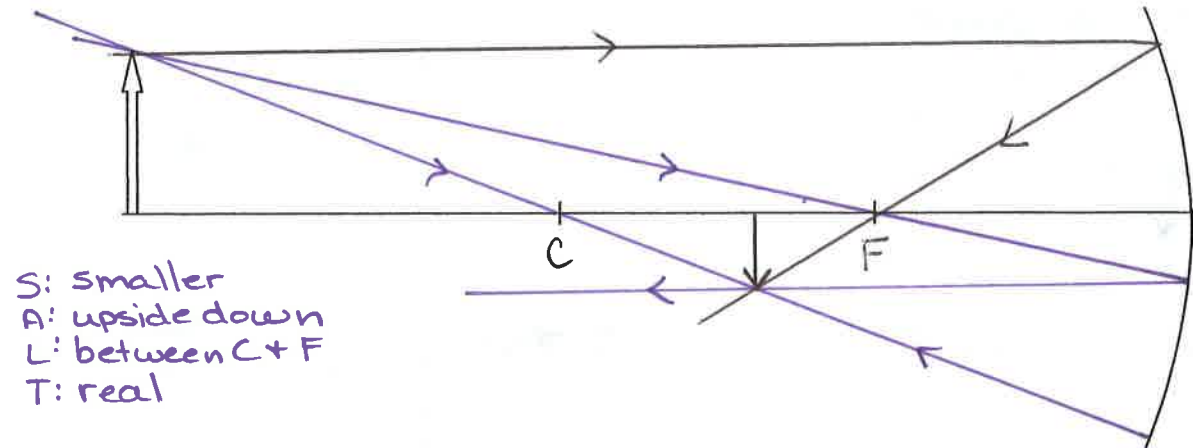
17. Draw three light rays and their reflected rays. Be sure to draw the three arrowheads of the reflected rays. Draw the image. Describe the image using SALT.



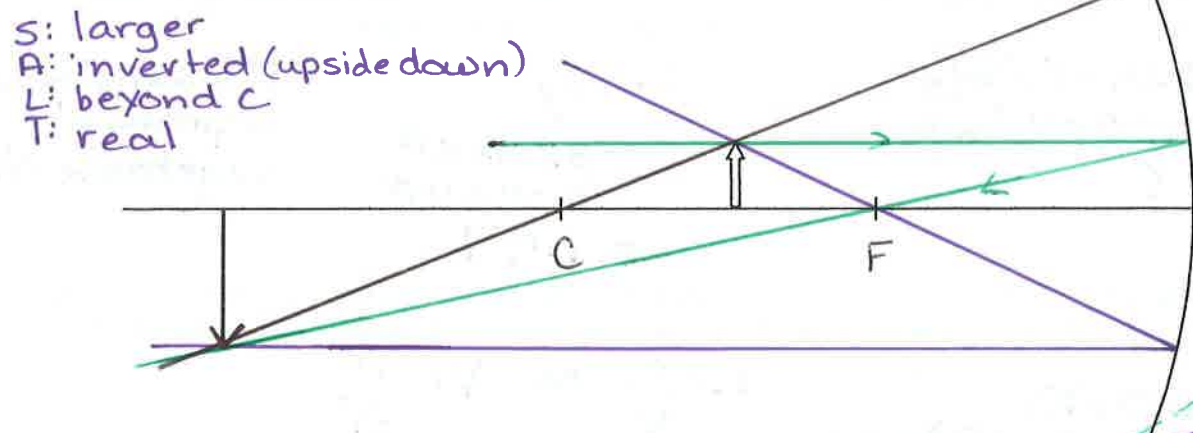
Grade 10 Optics Unit Test Review

$$n = \frac{c}{v} \qquad c = 3.00 \times 10^8 \text{ m/s}$$

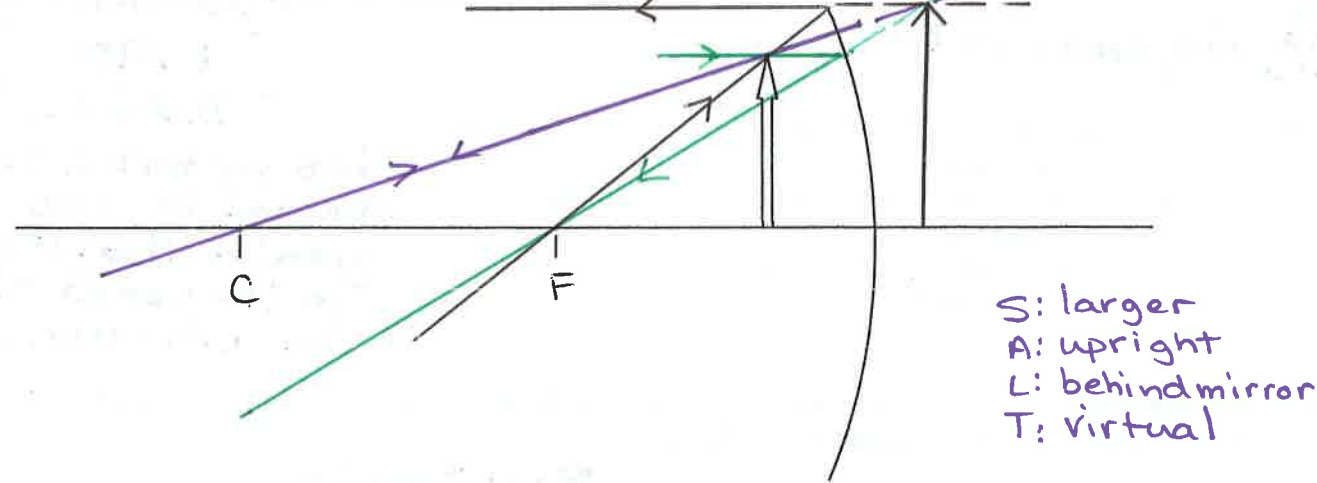
18. (a) Draw three light rays. Draw and describe the image.



(b) Draw three light rays. Draw and describe the image.



(c) Draw three light rays. Draw and describe the image.



19. In the novel Lord of the Flies, a band of marooned boys use the eyeglasses of a nearsighted boy to focus light and start fires for warmth and cooking. However, diverging lenses are required to correct nearsightedness, and cannot be used to start fires. Sketch a converging and a diverging lens and then sketch what happens to parallel rays when they pass through the lenses to show why diverging lenses cannot be used.



1. Name 3 uses of optics in any of the following fields: medical, scientific, environmental, everyday applications.

Glasses, contact lenses, telescopes, microscopes, binoculars, medical imaging, store scanners, mirrors, car mirrors, cameras, security cameras

2. Fill in the following table on different sources of light:

Type	Definition	Example
Incandescence	Light created from heating	light bulb
Bioluminescence	Light created by living organisms	Firefly, angler fish
Chemiluminescence	Light created by chemical reaction	Glow stick
Fluorescence	Energy is absorbed and immediately re-emitted as a different wavelength	CFL bulbs
Phosphorescence	Energy is absorbed & re-emitted over a long time	Glow-in-the-dark toys & clothing
Triboluminescence	Light created by friction or crushing	Duct tape, lifesaver mints
Electric Discharge	Light created from high voltage electricity	Lightning
Light-emitting diode	Light created by electricity flowing through semiconductors	New LED Christmas lights

3. What is the difference between fluorescence and phosphorescence?

fluorescence: absorbs energy and immediately re-emits energy as light
phosphorescence: absorbs energy but re-emits light slowly over a period of time

4. What would be the advantages and disadvantages of using fluorescent lighting in your home instead of incandescent?

advantages - more energy efficient, less electricity given off as heat
disadvantages - more expensive, waste disposal more difficult

5. Place the following types of electromagnetic waves in order from smallest wavelength to largest wavelength: x-rays, visible light, radio waves

smallest wavelength → longest wavelength
x-rays, visible light, radio waves
greatest frequency → smallest frequency