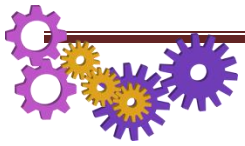


Name _____

Where appropriate – ALWAYS show your formulas and your work!
Use the back of your paper if you need to.

Additive Primary Colors (Light)

Using flashlights covered with various colors of cellophane, mix the following light patterns and record what you see. It works best if you shine the lights on a white surface.

Light color combination	Color you see
Red + Green	
Green + Blue	
Blue + Red	
Red + Green + Blue	

Subtractive Primary Colors (Pigments)

This time, you'll be mixing paints (pigments) and the tricky part is getting equal amounts of pigment mixed. Place **one dot each** on your paper plate, then mix them together with a paintbrush until they are completely blended.

Pigment color combination	Color you see
Cyan + yellow	
Yellow + magenta	
Cyan + magenta	
Cyan + magenta + yellow	

Tell what colors are reflected and absorbed when a different color light is shone on a **red apple**.

	Absorbed	Reflected
White light		
Red light		
Blue light		

Angles of Reflection

Using a mirror and protractor, shine the Laser light beam at the mirror using the following angles – at what angle does the light reflect off the mirror?

Angle of Incidence	Angle of Reflection
60°	
45°	
15°	

Now, set two mirrors at 90° to each other and shine the light at a 45° angle into the middle of the first mirror. Sketch what happens to the light beam – include the angle measurements below. *If you poof a little baby powder into the air, it makes it easier to see the light beams.*

Refraction

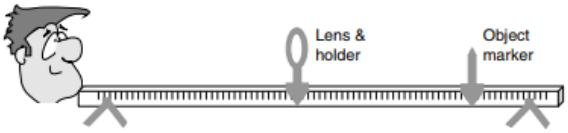
Using a full glass of water, place the bottom of this sheet of paper behind the glass and look through the water. What happens to the arrow?

What kind of lens did the glass of water act like?

Sketch what happened with the light rays traveling through the glass – include the actual image, the light rays and the virtual image in your sketch.

Optics Bench - Measuring Focal Lengths

- Place the convex lens in its holder and set it at the 50cm mark of the optic bench.
- Put the object marker on the bench a few centimeters away from the lens.
- From the opposite end, look at the marker, it should appear right side up. It it's not – move the object marker closer until it appears right side up.
- NOW, ask a partner to slowly move the object marker away from the lens. Make a note of the distance of the object marker from the lens just as the image begins to invert – this is the focal length (f) of the lens. Repeat this process three times – then take the average result for a more accurate measurement.

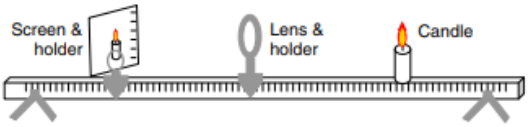


	Focal Length (cm)
Trial 1	
Trial 2	
Trial 3	
Average Focal Length	

Optics Bench - Forming Images

Now remove the marker and place the screen in its holder so that the millimeter markings run vertically up the card. Leave the convex lens at the 50 cm mark.

- Light the candle and without letting go of it – hold it approximately two focal lengths (see your calcs above) from the lens
- Now move the screen until the image cast on it is focused
- Sketch that **virtual image** below – noting its height and orientation



Ray Diagrams

Using the information from the candle/optics bench lab on the previous page, sketch and completely label its ray diagram, including focal distances.

Index of Refraction

Material	Index of Refraction (*n*)
Helium	1.00004
Water	1.33
Emerald	1.58
Cubic Zirconia	2.17

The diagrams below show light traveling from water (A) into another material (B). Using the chart above, label material B for each diagram as helium, water, emerald or cubic zirconia.