15. Consider the visible light spectrum (ROYGBIV)...
    a) Which color has the greatest frequency? violet
    b) Which color has the greatest wavelength? red

Unit 7 – Optics

Physics Classroom: Reflection…+ Refraction…

Key Vocab Words:

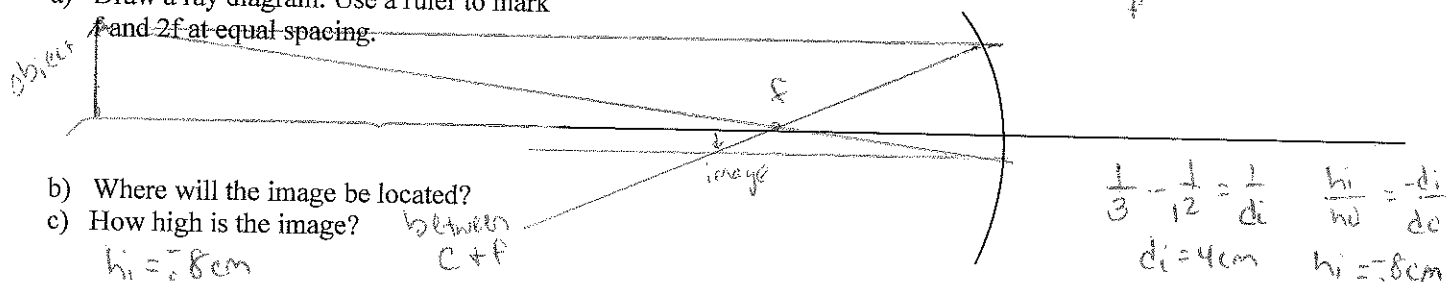
reflection, refraction, angle of refraction, angle of incidence, plane (flat) mirrors, concave converging mirrors, convex diverging mirrors, convex converging lens, concave diverging lens, real, virtual, inverted, upright.

Problems:

1. Answer the following questions as they pertain to mirrors:
    a) Describe the physical properties of the image seen in a plane mirror. virtual, upright $d_i = d_o$, $h_i = h_o$
    b) Describe the physical properties of a virtual image. upright, where light appears to converge.
    c) An object produces a virtual image in a concave mirror. Where is the object located? behind the mirror
    d) An object is located beyond the center of curvature (2f) of a concave converging mirror. Locate and describe the physical properties of the image. smaller, infront of f, real, inverted
    e) Describe the image seen in a convex diverging mirror.

2. Answer the following questions as they pertain to lens:
    a) Describe the physical properties of an image seen in a convex converging lens. inverted if real, upright if virtual.
    b) Describe the physical properties of an image seen in a concave diverging lens. magnified or smaller, depending on location

3. An object 2.4-cm high (h_o) is placed 12.0 (d_o) cm from a concave converging mirror with a focal point of 3.0 cm.
    a) Draw a ray diagram. Use a ruler to mark f and 2f at equal spacing.

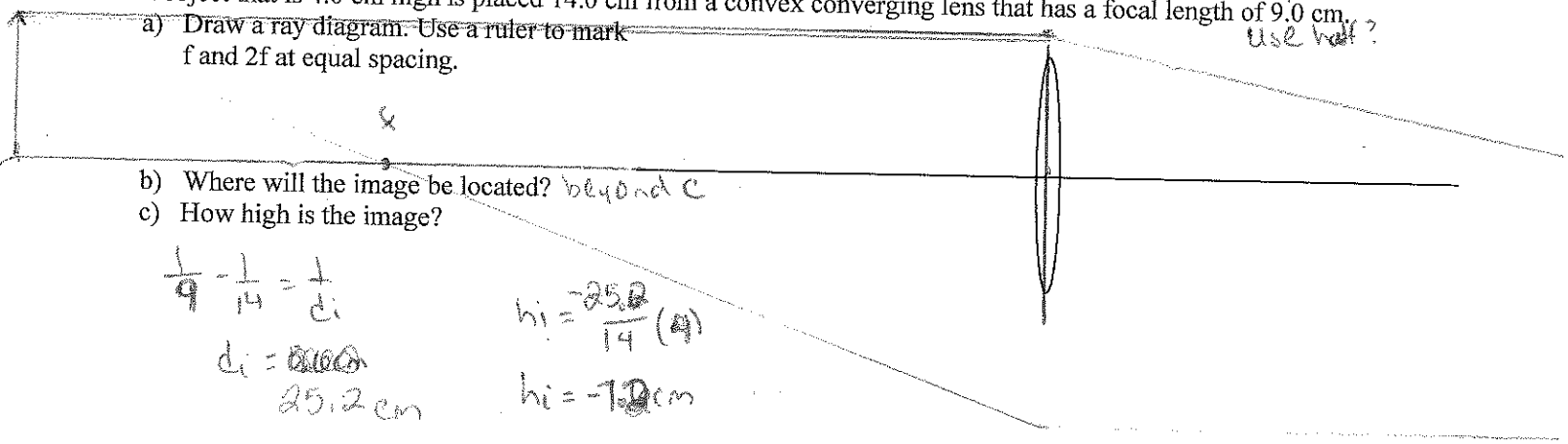


    b) Where will the image be located? between C + F
    c) How high is the image? $h_i = -7.8$ cm

$\frac{1}{3} - \frac{1}{12} = \frac{1}{d_i}$ $\quad d_i = 4$ cm

$\frac{h_i}{h_o} = \frac{-d_i}{d_o}$ $\quad h_i = -7.8$ cm

4. An object that is 4.0 (h_o) cm high is placed 14.0 (d_o) cm from a convex converging lens that has a focal length of 9.0 cm.
    a) Draw a ray diagram. Use a ruler to mark f and 2f at equal spacing.



    b) Where will the image be located? beyond C
    c) How high is the image?

$\frac{1}{9} - \frac{1}{14} = \frac{1}{d_i}$ $\quad d_i = 25.2$ cm

$h_i = \frac{-25.2}{14}(4)$ $\quad h_i = -7.2$ cm

Unit 8 – Electrostatics

Physics Classroom: Static Electricity

Key Vocab Words:

electrostatics, neutral, insulator, conductor, electroscope, charging by friction, charging by conduction, charging by induction, grounding, electric field, electric field lines

Problems:

1. Describe the steps one would take to charge an object by each of the following ways: friction, conduction, and induction. → approach an object w/ a charged object + ground it
    ← rub 2 different objects together
    ← touch an object w/ a charged object

2. **TRUE or FALSE** – An object that is positively charged contains all protons and no electrons.
    only hydrogen may

3. **TRUE or FALSE** – An object that is negatively charged could contain only electrons with no accompanying protons.
impossible

4. **TRUE or FALSE** – An object that is electrically neutral contains only neutrons.
Impossible

5. A physics student is investigating the charge on several objects and makes findings below. The student knows that object **A is negatively charged and object B is electrically neutral.** What can be concluded about the charge on objects C, D, E and F?

Object C −	**Object D** −	**Object E** +	**Object F** +
attracts B N	repels C −	attracts D −	attracts A −
		repels F +	

6. A rubber balloon possesses a positive charge. If brought near and touched to the door of a wooden cabinet it sticks to the door. This does not occur with an uncharged balloon. Explain what happens to allow the balloon to stick.
Electrons in the wall are attracted to the balloon

Unit 9 – Electric Circuits

Physics Classroom: Current Electricity

Key Vocab Words:

electric current, conventional current, electric circuit, resistance, voltage, series circuit, equivalent resistance, parallel circuit, ammeter, voltmeter, kilo-watt hour

Problems:

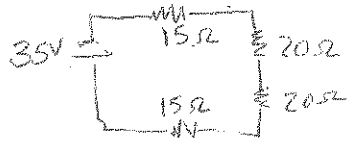
$V = IR$

1. Which of the following will cause the current through an electrical circuit to decrease?
   a. decrease the voltage b. decrease the resistance c. increase the voltage (d.) increase the resistance

2. A circuit is wired with a power supply, a resistor and an ammeter (for measuring current). The ammeter reads a current of 24 mA (milliAmps). Determine the new current if the voltage of the power supply was…
   a) Increased by a factor of 2 and the resistance was held constant. 48 mA
   b) Increased by a factor of 2 and the resistance was increased by a factor of 2. 24 mA
   c) Increased by a factor of 3 and the resistance was decreased by a factor of 2. 144 mA

$V = 24\ (R)$

3. Two 15.0-Ω resistors and two 20.0-Ω resistors (for a total of 4 resistors) are connected in series and placed across a 35.0-V battery.



   a) What is the equivalent resistance of the circuit? 70Ω
   b) What is the value of the current in the circuit? .5 Amps
   c) What is the potential drop (**voltage**) across each resistor? $V_{15} = 7.5V$, $V_{20} = 10V$
   d) Calculate the power of each resistor. $P_{15} = 3.75W$ $P_{30} = 5W$
   e) Calculate the total power in the circuit. $P = 17.5W$
   f) Assuming that the above resistors are light bulbs of given resistance, what will happen if one is unscrewed?
they all go dark

4. A 15.0-Ω resistors and a 30.0-Ω resistor are connected in parallel and placed across a 40.0-V battery.
   a) What is the equivalent resistance of the circuit? 10Ω
   b) What is the value of the current in each branch of the circuit? $I_{15} = 2.7A$, $I_{30} = 1.3A$ 40V 15Ω 30Ω
   c) What is the value of the total current through the circuit? I = 4Amps
   d) Calculate the power of each resistor. $P_{15} = 108W$ $P_{30} = 39W$
   e) Calculate the total power in the circuit. $P = 147W$
   f) Assuming that each of the above resistors are light bulbs of given resistance, what will happen if one is unscrewed? the other lights a little brighter.

5. A coffee pot, rated at 950 W, is plugged into a 120-V source and left on for 4 hours
   a) How much energy (in kWh) does the coffee pot use? (1000 W = 1 kW). 3.8kwh
   b) If it costs $0.14 for every kilowatt-hour, how much does it cost to run the coffee pot?
$0.53