PHYS-1150 (7)(Kaldon-**11994**) Name _____ **1150**

WMU - Spring 2009

Topic 2 / Worksheet 1 – 25,000 points Section: 7a 7b 7c 7d

See website for additional comments. A to G H to M N to S T to Z Rev. 04/07/09

Electrical Power

(Assigned: 7 April 2009 • Due: Thursday 16 April 2009)

I. It is the Year 2009, and what is your Electrical Footprint? Suppose you are rushing around in the morning and trying to get dressed, make breakfast, print out that paper that's due and check the weather for any Michigan snowstorms. Make a list of all the electrical devices you use during that morning (up to a maximum of 12 items – if you have more than 12 items, we prefer the ones that use more power or more time). *On the back of this sheet is a handy fill-in-the-blanks table to make this easy to calculate.* Then separately count up "large", "medium" and "small" lamps that you are likely to use around the house. Specify your criteria. Example: Large might be a halogen floor lamp or big fixture of 300 W to 500 W. Medium might be a 3-way light bulb or a fixture with multiple bulbs totally 100 W to 200W. Small might be 25 W to 60 W single light bulbs. Ignore little 7W nightlights.

II. Estimate how many Joules of energy that your use of the items in (I) entailed. Let's assume that you are using some of these items (hair dryer, toaster oven, microwave, clock radio, computer, printer, TV, stereo) for one hour (3600 sec) and some for more specific times (you probably aren't using a hair dryer for an hour).

III. Gasoline has an energy content of 1.32×10^8 J/gallon. How many gallons of fuel did you use in part II?

Worksheet 1 Worksheet

	Item	Watts	Minutes	Seconds	Joules
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

Total Watts: _____ Total Joules: _____

Lamps:

Small
Medium
Large

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Topic 2 / Worksheet 2 – 25,000 points Section: 7a A to G 7b H to M 7c N to S 7d T to Z Rev. 04/07/09

See website for additional comments.

Frequency and Wavelength

(Assigned: 7 April 2009 • Due: Thursday 16 April 2009)

I. For your hometown, what channel is your local PBS station? (If your hometown is not in the United States, use the channel for Kalamazoo/Grand Rapids.) We need the broadcast channel number, not the channel number that it might be located on your cable TV. For example, in Allendale, PBS is on cable channel 12, but that is not the answer we want here. Next, find out what frequency, *f*, the visual and audio signals for that channel number are broadcast at. Finally, turn those frequencies into wavelengths, λ in meters, and tell us what kind of EM waves these are. How can you know what frequencies go with what channel numbers? I dunno – they're standardized for the U.S. Try *Ask.com*, *Google* or use some other search engine on the Web, for one. This will be the last time I ask this question for the UHF/VHF channels before the DTV conversion.

II. Visible light falls between about 400 nm and 750 nm. A pure bright yellow or red-orange color might be $\lambda = 670nm$ or $\lambda = 555\ nm$. Which is which? And what is the frequency of these two pure colors?

III. In the thrilling bound volume, An *Ab Initio* Study of the K-α Spectra of Lithium Ions in Lithium Halides (LiX), *A Thesis for the Degree of Masters of Science in Physics, Michigan Technological University, Philip Edward Kaldon, 1988*, the not-yet-Dr. Phil writes about photons which have an energy of 60.9 eV. Given that 1 eV = 1.602×10^{-19} J and for photons, $E = h f$, where *h* is Planck's constant (it's probably inside of the front or back book cover of your text) – find the frequency *f* and wavelength λ of a 60.9 eV photon, and show that it falls somewhere near the border between X-rays and UV.

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Topic 2 / Worksheet 3 – 25,000 points Section: 7a A to G 7b H to M 7c N to S 7d T to Z Rev. 04/07/09

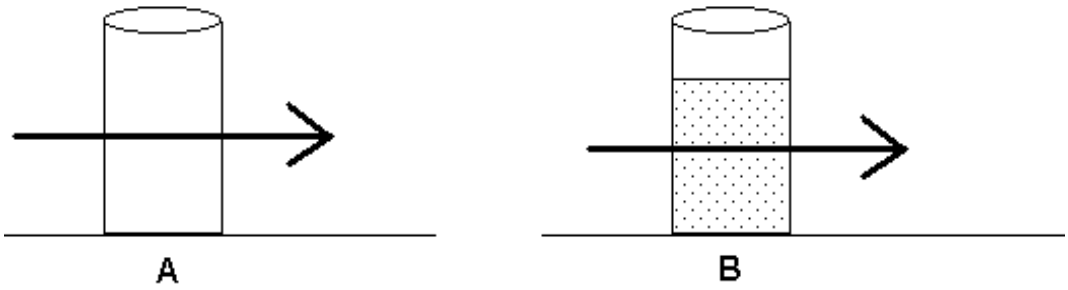
See website for additional comments.

Optics Observations

(Assigned: 7 April 2009 • Due: Thursday 16 April 2009)

I. Mirrors • Try as you might, you cannot see behind your head with a *single* plane mirror. Position yourself in front of a mirror at any angle θ other than θ = 0°, which would be normal to the surface. Now turn you head until you can see your eyes. If you want to stare at the space in between your eyes, while your eyes face straight ahead, what angle θ is this? Does this make sense? Is there any other angle you can do this with a single plane mirror?

II. Find a drinking glass that is (a) made of clear glass, (b) has relatively straight sides so that it is nearly a cylinder. Look through the glass under the conditions A=empty and B=filled with water. Describe the images that you see. Repeat with a spoon in the glass, resting at an angle. Raise your head so you are looking down at the top surface. Describe what you see.



III. The Blind Spot • The human eye is a remarkable instrument. But it does have flaws. For some people, these show up in being nearsighted or farsighted, or other vision problems up to and including no vision at all. There is speculation that some of the Impressionist painters had vision problems, which explains the blurry swirls of all the colors and no discernible detail. In this part we want you to locate your "blind spot". This is where your optic nerve attaches to the retina and there are no rods or cones. You don't normally notice this because your brain "fills in the blanks" by putting a similar adjacent pattern over the "hole". You will need someone to help you. Close your left eye and center the dot " • " below directly ahead of your right eye. Move the paper slowly forward and back, all the time staring at the dot. At some distance, the cross "×" will seem to disappear. Have your assistant measure the distance roughly from the tip of your nose to the page. Turn this sheet around 180° and repeat for the left eye. Are the distances the same?

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Topic 2 / Worksheet 4 – 25,000 points Section: 7a A to G 7b H to M 7c N to S 7d T to Z Rev. 04/07/09

See website for additional comments.

Ranium - The Only Thing Missing is "U"

(Assigned: 7 April 2009 • Due: Thursday 16 April 2009)

I. **"Half-ing" A Good Time (25,000 points)**

9.) A radioactive substance will decay at a rate according to its *half-life*. For example, if you have a *trillion* atoms of the same isotope, then after the time of one half-life, we typically expect half of the trillion will decay, leaving half a trillion atoms of the original isotope. Fill in this table for the 2nd through the 75th half-lives. *PTPBIP – Round off any fractions of an atom. Stop if number < 1. We want whole atoms only.*

0 1,000,000,000,000

1	500,000,000,000	26		51	
2		27		52	
3		28		53	
4		29		54	
5		30		55	
6		31		56	
7		32		57	
8		33		58	
9		34		59	
10		35		60	
11		36		61	
12		37		62	
13		38		63	
14		39		64	
15		40		65	
16		41		66	
17		42		67	
18		43		68	
19		44		69	
20		45		70	
21		46		71	
22		47		72	
23		48		73	
24		49		74	
25		50		75	