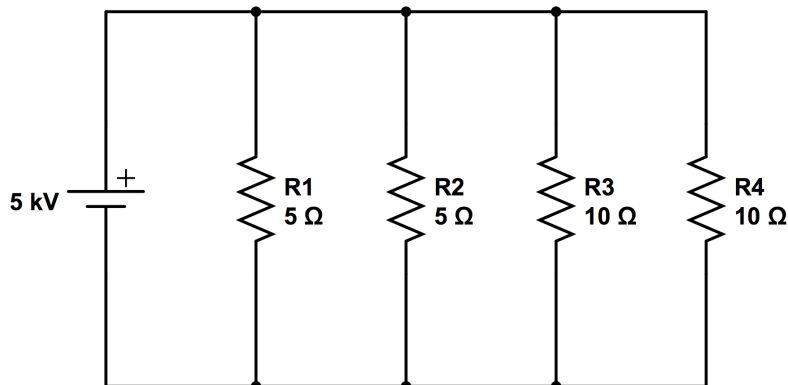


Quantitative Problems
(Given, Find, Solution REQUIRED)

1. The MagicLewShip has been retrofitted with 4 new Lewlectric engines powered by a 5 [kV] (5000 [V]) battery. The engines are connected in parallel as shown in the schematic diagram below:



Calculate the following:

- What is the total power consumption of the four motors in [W]?
 - How much energy is required to run the motors for 1 year (365 days)?
 - How much energy is present in a 1 [kg] piece of Lewtonium using Einstein's equation $E=mc^2$?
 - If all the energy of the 1 [kg] of Lewtonium mass is converted to energy, how many years could it power the MagicLewShip?
2. The frequency of red light is 400 [THz]. What is the amount of energy associated with a single photon of red light using Planck's model of light quanta? How many photons of red light would be required to equal the amount the energy stored in the 1 [kg] piece of Lewtonium in the problem above?
3. Waves can be described as particles, and particles as waves. Suppose a person of mass 70 [kg] (~150 lbs) is running at 10 [m/s]. What is the runner's wavelength using deBroglie's relationship between momentum and wavelength?

Qualitative Problems

**Short answer (in a complete sentence) or a fully labeled graph
(Given, Find, Solution NOT required)**

4. **What is the wave-particle duality and why is it important?**

5. **What is wave diffraction? Sketch a diagram from the wave tank demo that depicts wave diffraction.**

6. **What is the significance of Young's Double Slit Experiment? Draw a diagram illustrating the experiment and include a discussion of constructive and destructive wave interference in your explanation of the experiment.**

7. **What are the two basic ideas behind Einstein's Special Theory of Relativity?**

8. **What is the basic idea behind Einstein's General Theory of Relativity?**

HW Set 7 Answers

- 1a. 1.5×10^7 [W]
1b. 4.73×10^{14} [J]
1c. 9.00×10^{16} [J]
1d. 190.27 years
- 2a. 2.65×10^{-19} [J]
2b. 3.4×10^{35} photons
3. 9.46×10^{-37} [m]
- 4-8. Will discuss in class