

Concepts of Physics: Homework 7

Due: 21 October 2024

1 Power ranking

Various bulbs consume the indicated energy over the indicated periods of time. Rank the bulbs in order of increasing power consumption. Explain your answer.

Instant	Energy	Time
Bulb A	6000 J	10 min
Bulb B	9000 J	10 min
Bulb C	6000 J	20 min
Bulb C	9000 J	20 min

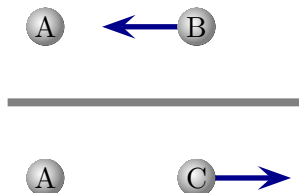
2 Power

An electric kettle has power rating of 1500 W. A cell phone charger has power rating of 5.0 W. Suppose that you use the kettle and charger regularly. in each of the following *explain your answer*.

- Which do you think typically uses more energy in your daily life?
- Suppose that you use the kettle twice per day for about 6.0 min each time. Determine the total energy used by the kettle per day, assuming that, when it is on, the kettle uses its maximum power.
- Suppose that you use your charger for an average of 4.0 hr per day. Determine the total energy used by the charger per day, assuming that, when it is on, it operates at maximum power.
- Determine how long you would have to use the charger so that it matched one day of energy consumption of the kettle energy consumption in part b). Does this change your answer to part a)?

3 Pairs of charged balls

Various pairs of balls that may or may not be charged are placed near each other and the observed interactions are as illustrated. What interaction would occur if C were placed near to B? Explain your answer.



4 Combined electric forces

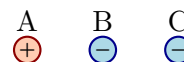
Three charged particles are held at fixed locations. The distances between adjacent charges are the same and the sizes of their charges are the same. The particle on the left is positively charged.



- Suppose there is no net force on the middle charge. What type of charge could the particle on the right have? Explain your answer.
- Suppose the net force on the middle charge points right. What type of charge could the particle on the right have? Explain your answer.

5 Electric forces and charge particle motion

Three charged particles are held at fixed locations. The distances between adjacent charges are the same and the sizes of their charges are the same. The charge in the middle (B) is initially held at rest and is then released. After it is released, which way will it begin to move? Explain your answer.



6 Magnesium ions

Magnesium is a light metal that is very reactive (it burns easily). It is found in magnesium chloride (a salt used to coat roads). There are several types of magnesium atom but each has 12 protons. The most common type (called magnesium-24) also has 12 neutrons. A single magnesium-24 atom has mass 4.0×10^{-26} kg.

- Suppose that you have a chunk of magnesium with mass 0.12 kg (about 4.2 oz). Determine the total number of magnesium atoms in the chunk.
- Determine the total number of protons, neutrons and electrons in the chunk.
- Suppose that each of the magnesium atoms in the chunk is ionized by losing one electron. Determine the total charge of the remaining magnesium ions.

7 Electric current in an LED

The current through a typical LED bulb is $20 \text{ mA} = 0.020 \text{ A}$.

- Determine the total charge that flows through the bulb per minute.
- Determine the number of electrons that flow through the bulb per minute.

8 Physics videos

Find a physics video, that uses the concept of energy or power, from one of the following YouTube channels:

[MinutePhysics](#)

[Physics Girl](#)

[Steve Mould](#)

[Veritasium](#)

You can choose any video provided that it: a) is about physics or related to physics, b) you find it interesting and c) **the video uses or discusses electricity or magnetism.**

- a) Provide the video location and title.
- b) Briefly describe as best as you can how the video used ideas from **electricity or magnetism.**
- c) Describe a main question that the video seemed to answer.
- d) Describe a question that you would ask the person presenting the video about the subject that they described.
- e) Go to D2L. In the Physics Videos discussion forum, find the Physics Videos: Homework 4 topic. Provide a link to your video there and a one sentence description of the video content (everyone in the class will eventually see this).