Please complete the following problems on separate paper. Make sure your name, T.A.’s name, and tutorial day (Mon or Wed) is written at the top of your problem set. Show all your reasoning and work legibly, and draw a box around the final numerical or single-word answer where applicable. You may turn your problem set either directly to Professor Harlow or your T.A., or you may drop it in your T.A.’s designated drop box at the base of the stairs outside the lecture hall, in the basement of MP. Any work received after 7:00 PM on the due date will be considered late, and a late penalty will be applied.

1. (2 points) Pulses on a violin string take 2.27 milliseconds to reflect back and forth from the fixed ends of the string. This causes a vibration with a period of 2.27 milliseconds. What is the frequency, and what is this note called?

2. (2 points) In industrial settings, neutral metal objects are often coated by spraying them with electrically charged paint droplets.
   1.1 How does placing charge on the droplets help them stick to a neutral metal object’s surface?
   1.2 The paint droplets are all the same size and are all given the same electric charge. Why does this type of charging ensure that the coating will be highly uniform?

3. (3 points) If you were to remove all the electrons from a single drop of water, you would have 12,000 Coulombs of negative electric charge. The remaining drop of water would still contain protons which would have 12,000 Coulombs of positive electric charge. If you placed all the removed electrons a distance of 1 metre from the now positive drop of water, how strong would the attractive force between the electrons and water be?

4. (2 points) During a particular power surge, the voltage across an incandescent light bulb increases by 10% (ie, to 1.1 times what it was before the surge).
   4.1 If the bulb’s electric resistance doesn’t change, by what percentage will the current passing through the bulb’s filament change due to the surge?
   4.2 If the bulb’s electric resistance doesn’t change, by what percentage will the power consumed by the bulb change due to the surge?

5. (2 points) Ontario Hydro sells electric power by the kilowatt-hour (kWh). A house that uses an average of 1000 Watts for an hour has consumed 1 kWh. How many Joules of energy are equivalent to 1 kWh?
Some suggested problems (not to be turned in):

Practice 1. To modify the pitch of a guitar string you could change its mass, tension, or length. To raise its pitch, how should you change each of these three characteristics?

Practice 2. A fuse limits the current that can flow through an electric circuit to the value printed on its label. Why can putting a 50-A fuse in a circuit rated to carry only 30 A lead to a fire?

Practice 3. A steel paper clip is normally not magnetic. However, when you touch one end of the paper clip to the north end of a permanent magnet, the paper clip becomes magnetic. Which end of the paper clip becomes a south pole?

Practice 4. Each of the two wires in a particular extension cord has an electric resistance of 0.04 Ohms. You're using this extension cord to operate a toaster oven, so a current of 15 Ampers is flowing through it.
   Practice 4.1 What is the voltage drop across each wire in this extension cord?
   Practice 4.2 How much power is wasted in each wire of this extension cord?