Name: _____
Date: _____

Electric Field Demonstration

Materials:

- Lawn seeds (~1 handful)
- Vegetable oil (enough to make a ~1cm deep layer in the plastic tray)
- Plastic tray (roughly A4 size or larger)
- At least 4 connection wires (dependent on your power source)
- 2x Aluminium foil sheets scrunched into various shapes of your choosing*
- 2x Rubber gloves (recommended)
- Insulation mat (optional, depends on the surface of your bench)
- High tension power source
    - We are using rating of ~400kV transformer (1mm sparking distance is ~3kV)
    - Alternatives:
        - Traditional 12V DC power pack and Ruhmkorff coil
        - Any high voltage power supply for a gas discharge tube
        - Or build your own voltage Cockraft Walton voltage multiplier (remember to use high rating ceramic capacitors and high voltage diode (3kV)

Method:

1. Put on a pair of plastic gloves
2. Put a plastic tub on styrofoam mat if you have a conductive bench
3. Use aluminum foil to make the shape of the conductors you want to investigate
4. The foils will later connect to the anode and cathode from the high tension power supply. Put the conductors on the tub and make sure the two conductors are not touching each other; otherwise, you will short the circuit.
5. Use Blu-tek to secure the conductors to the tub when necessary
6. Connect the wires from the conductors. (Do not connect the other end to the power supply yet) and let other ends of the wires hanging out of the tub.
7. Pour oil slowly into the tub. The foil may move a bit. Adjust the foil position if necessary
8. Connect the the wires to a high tension power supply. Do not turn on the power supply yet.
9. Sprinkle lawn seeds to the tub. Remember do not put too many seeds in. Otherwise, you may not see the electric field clearly. You may also sprinkle more after but quite messy to take them out. Note some seeds sink and some seeds float.
10. Check the circuit again
11. Turn on the power supply and keep your hands off. You may sprinkle more seeds from the top at this stage.
12. Record what you observation.
13. If you want to change the configurations, turn off and disconnect the power supply.

Suggested Configurations

A. Two parallel plates
B. One foil ball and one parallel plate
C. Two foil balls
D. One foil ball and a segment of circle
E. One foil circle and a segment of a circle

F. ** Two concentric circles (Faraday's cage)

Electric Field Student Questions

1. List three important safety precautions to be taken before/during this demonstration.

2. Sketch and label the experimental setup. Use configuration A in your sketch.

3. Describe what the lawn seeds do when the power is initially switched on.

4. Sketch the aluminium foil shape and the lawn seeds for each configuration.

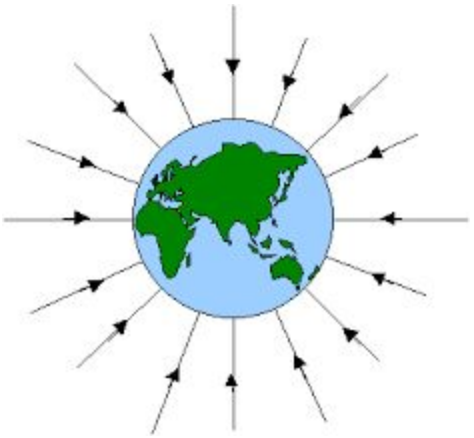
A	B	C
D	E	F

5. At roughly what angle do the lawn seeds appear to meet the aluminium foil surfaces at?

6. From observing the lawn seeds' arrangements in your answer to question 4, state in general, where the the lawn seeds are the most concentrated and where they are the least concentrated. How does the concentration of the lawn seeds relate to the electric field strength?

7. In configuration A, all field lines (except the end ones) should have roughly the same spacing between them. What does this mean about the electric field between the two parallel plates?

8. Configurations B, C, and D all involve a foil ball. Compare the arrangement of the lawn seeds near the foil balls with the gravitational field lines around a spherical mass.



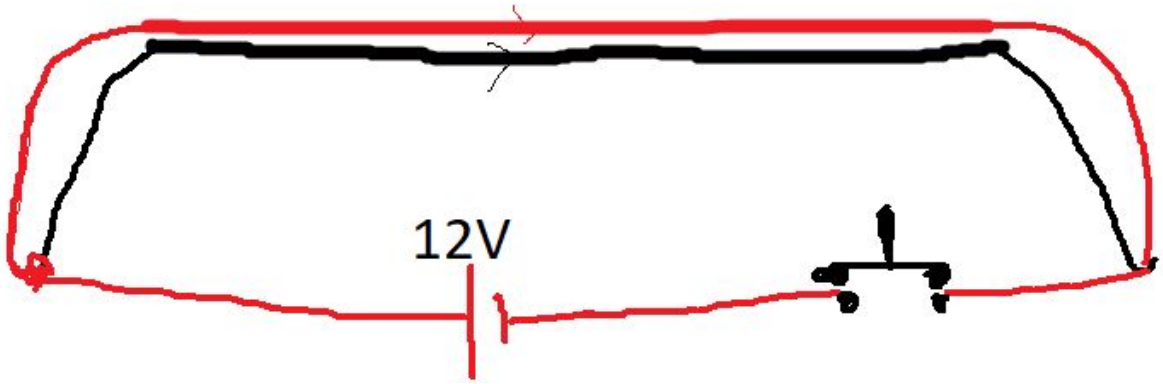
Ampere's Force Law Demonstration

Materials:

- 2 strands of flexible ~32 gauge (awg)insulated wire (each about 30-50cm long)
- 2 retort stands and boss head clamps
- Sticky tape
- 12V DC Powerpack/dry cell pack/car battery/car battery charger
- 4x alligator clips

Method:

1. Ensure the power on the power supply is switched OFF before continuing.
2. Strip about 1-2cm of insulation from the end of each wire.
3. Sticky tape the ends of the two wires together; sticky tape the other two ends.
4. Use the alligator clips to attach each end of the now double wire to the voltage generator.
5. Use the other alligator clips to connect the voltage generator to the power supply.



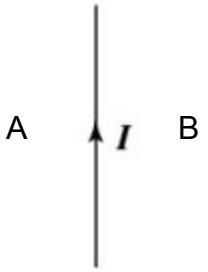
Ampere's Force Law Student Questions

In the diagrams below, a constant current of I is running through all wires, in the direction of the arrow.

1. During the parallel wires demonstration, write down three observations you make about the wires (i.e. how much they move, the direction they move, the nature of their movement).

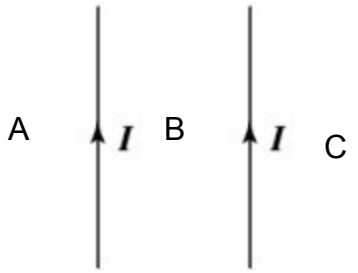
2. Draw the circuit diagram for the parallel wires demonstration. Indicate the direction of the current in each wire with an arrow.

3. In the space below, use dots and Xs to show the direction of the magnetic field at locations A and B.



4. LW = left wire and RW = right hand wire. First use the right hand screw rule to determine the directions of the fields created by each wires as in question 3. Because we have a magnetic field and wire carrying current, the interaction of the magnetic field and current will create a force to move the wires. Determine the following:

a) The force on RW caused by LW's magnetic field. _____
b) The force on LW caused by RW's magnetic field. _____
c) According to my answers for a) and b), these two wires would (*circle one*) **repel/attract** each other.



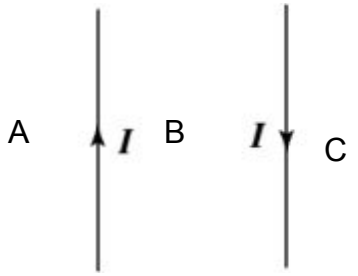
5. LW = left wire and RW = right wire. Use the right hand rule to determine the following:

a) What is different about the wire configuration in this question compared to the previous question?

b) The force on RW caused by LW's magnetic field. _____

c) The force on LW caused by RW's magnetic field. _____

d) According to my answers for a) and b), these two wires would (*circle one*) **repel/attract** each other.



6. From the information you learned today, if enough current passes through a mobile phone charger cable, do you expect the cable will explode or implode? Explain with a reason.