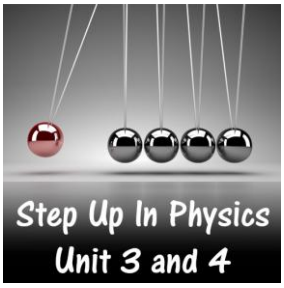
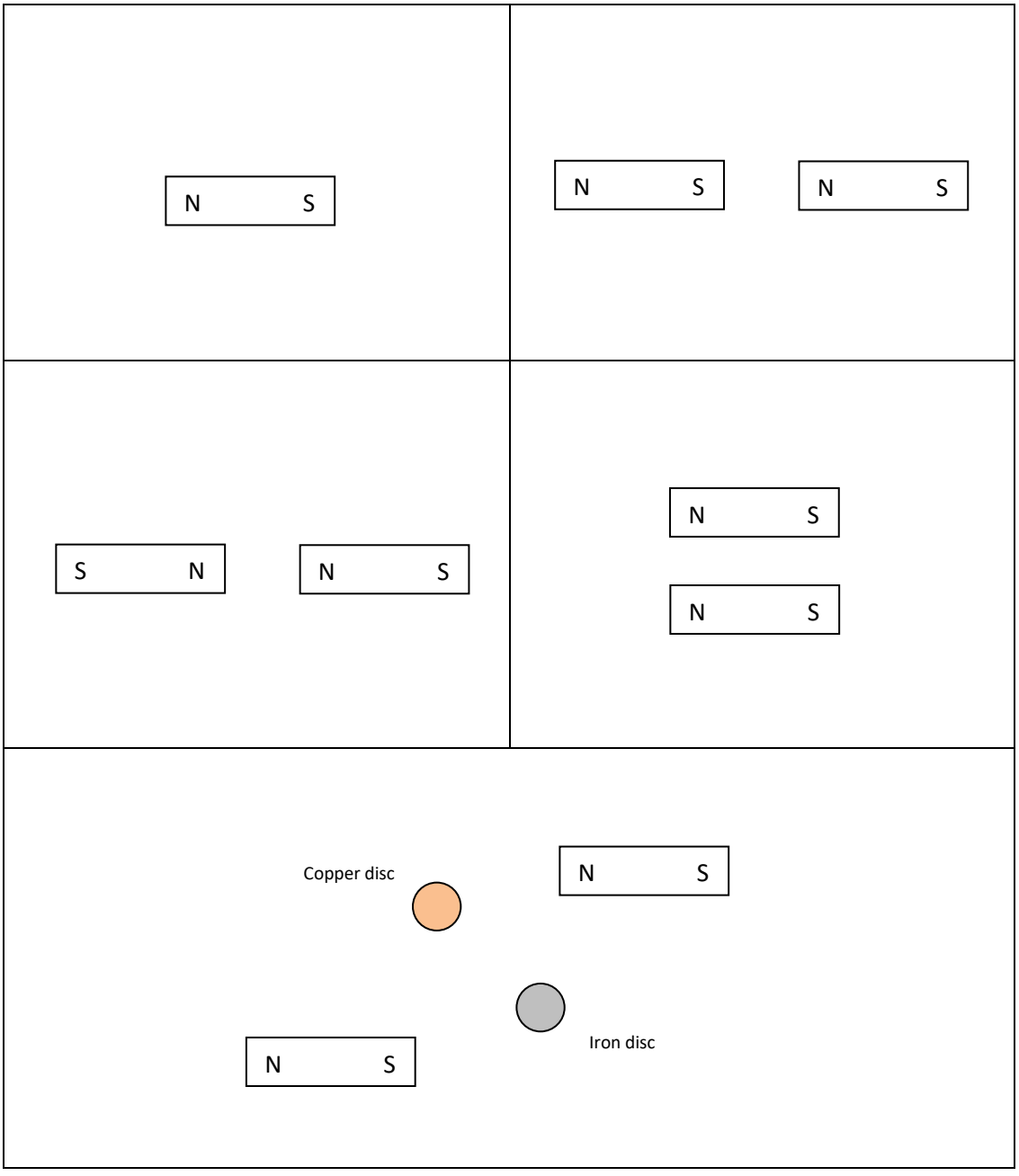
Magnetic Fields

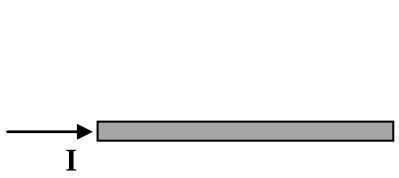
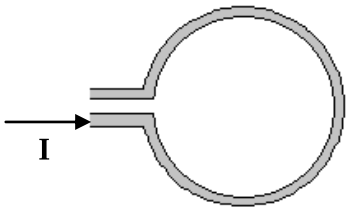
Problems Worksheet



1. Draw the magnetic field in the space surrounding the permanent magnets in each scenario below.



2. Draw the magnetic field produced by the current flowing through the shaded wire(s) in each scenario below.

<table>
<tr><td> 
</td><td> 
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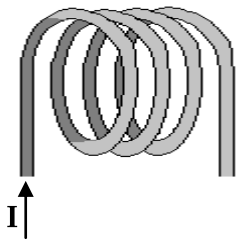
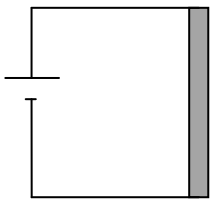
<tr><td> 
</td><td>  </td></tr>
<tr><td> 

(parallel wires with current in same direction)</td><td> 

(parallel wires with current in opposite direction)</td></tr>
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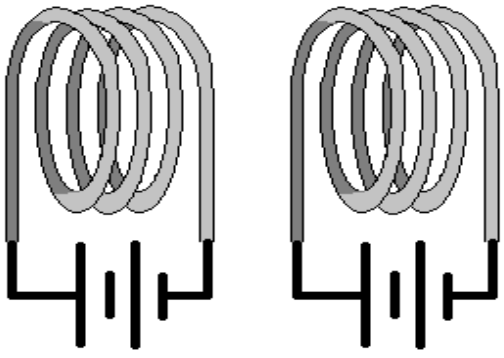
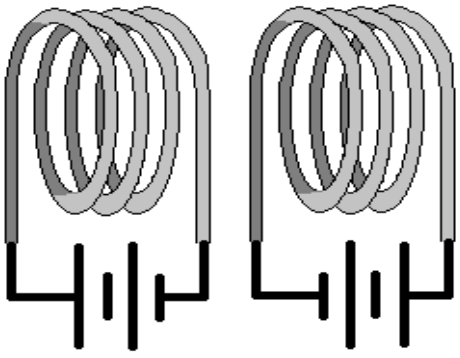
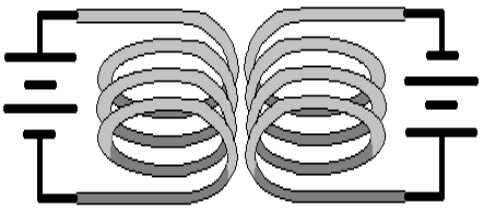
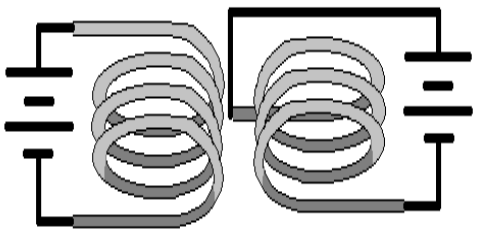
3. A long, straight wire carries a current.

    a. Calculate the current in the wire if it produces a 76.0 mT magnetic flux density 12.0 cm from the wire.

b. How far away from the wire would the magnetic flux density have dropped to 18.5 mT?

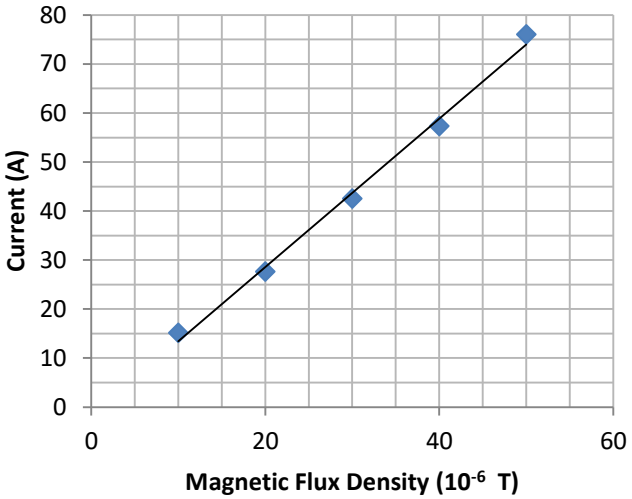
4. A long, straight wire has a current I_0 flowing through it. At a distance r_0 the magnetic flux density was measured to be B_o. In terms of B_0, determine the magnetic flux density when the current is tripled and the field is measured at half the original distance from the wire.

5. Indicate whether the pair of solenoids in each scenario will experience repulsive or attractive forces.

 Repulsion/ Attraction	 Repulsion/ Attraction
 Repulsion/ Attraction	 Repulsion/ Attraction

6. For a science fair project, a student decided to build an electromagnet. He took an insulated wire, wrapped it around an empty glue stick a dozen times and connected the two bare ends of the wire to a 9V battery. The electromagnet was only just able to pick up a single paperclip. List three design changes the student could try to make the electromagnet more effective. Describe why each change would make the electromagnet more effective.

7. The graph shows the values recorded for an experiment testing the relationship between current and magnetic flux density surrounding a straight wire in a school classroom.



a. Using the gradient, determine the distance the magnetic sensor was placed from the wire.

b. Even when maintaining the sensor a constant distance from the wire, the values of the magnetic flux recorded by the sensor varied depending on the orientation of the wire and placement of the sensor. Suggest a reason for this.

c. Describe a method to eliminate this variable flux measurement from effecting the experiment.

8. The magnetic behaviour of a material is determined by its electrons surrounding the nucleus. Explain how an electron could be responsible for the magnetic behaviour of a material.

9. At which location on the Earth would the south pole of a freely suspended bar magnet point straight up in to the air? Explain your answer.

10. The two wires shown below each have a 10.0 A current flowing into the page and are 40.0 cm apart. Point P and Q are used as reference points in the following questions.

a. Draw the magnetic field in the space surrounding the two wires.

b. Calculate the magnitude of the magnetic flux density at location P, half way between the two wires.

c. Calculate the magnitude of the magnetic flux density at location Q, located 20.0 cm to the left of the left most wire.