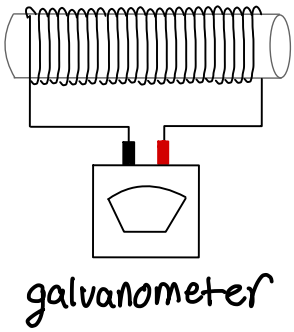
Name: Juan Rios, Melvin Evans, Matthew Mendoza

Group: _____



Lab 07 – Electromagnetic Induction

Lab Worksheet

Complete this lab worksheet and turn it in for credit. Show all your work including the calculations you performed (attach additional sheets if necessary).

7.4.1 Testing the Equipment

1. In what direction (towards or away) does your compass point when you put it near:

   a. The north pole of the bar magnet?

It points to the south needle.

   b. The south pole of the bar magnet?

It points to the North needles.

2. What can you conclude about the direction of the magnetic field at the north pole and south pole of a bar magnet (what does this mean about the North and south pole of the Earth)?

The north pole is earths south end of the magnet and the south pole is the earth north end of the magnet.

3. With the setup shown in figure 7.2, what direction does the needle deflect when the switch is closed? Which side of the galvanometer is the current going into (draw a diagram)?

It goes to the right on the Galvanometer. Therefore, it enters from the positive terminal.

   Reverse the polarity of the battery. What direction does the needed deflect? What side of the galvanometer is the current going into this time?

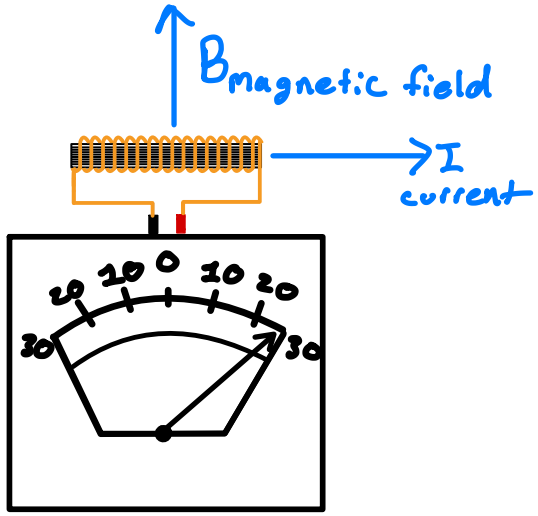
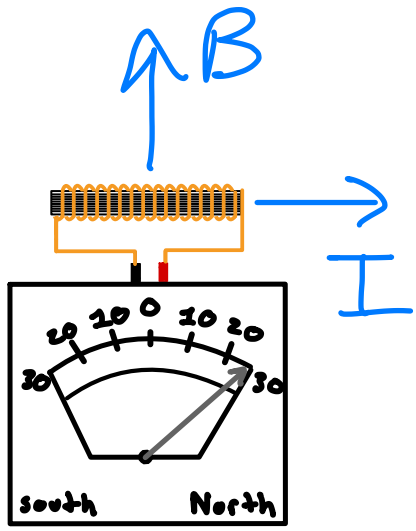
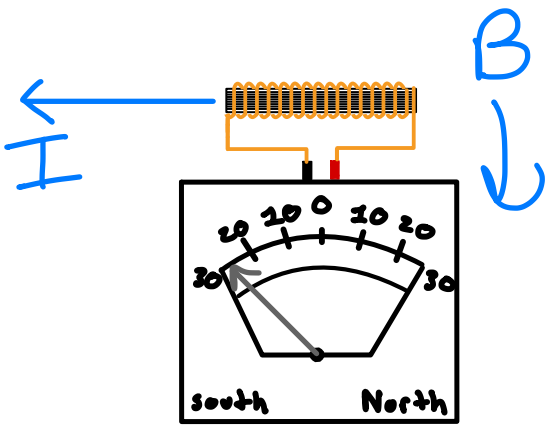
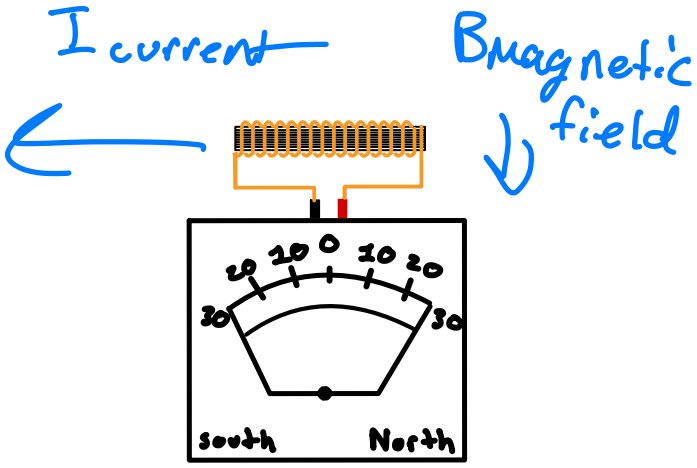
It goes to the left of the galvanometer. Therefore, it exits out of the negative terminal of the galvanometer to the negative terminal of the battery.

   What conclusions can you draw about how the galvanometer works?

It is a tool to measure current going into and expelling out of the meter. If the needle moves to the right current is coming into the meter and if it is going to the left then current is being expelled out of the galvanometer.

7.4.2 Magnetic Field of a Coil

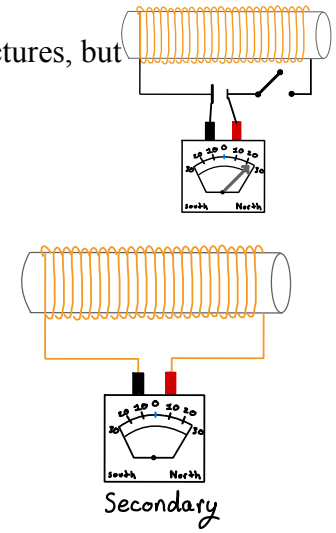
1. On the left, draw the direction of the current, and predict the magnetic field pattern. Then measure the magnetic field direction using the compass. Draw the magnetic field lines.

Prediction	Measurement
Battery Polarity 1 	Battery Polarity 1 
Battery Polarity 2 	Battery Polarity 2 

2. About how far away do you need to be before the coil's magnetic field no longer affects the compass?

At 4.5 cm the compas is no longer affected by the coil's magnetic field

7.4.3 Induced Current by a Coil

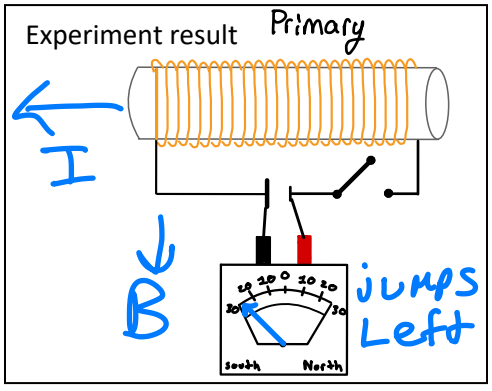


For each of the actions described, answer the following questions (you may draw pictures, but make sure they are labeled):

a) What is the direction of the current in the primary?
b) What is the direction of the magnetic field at the location of the secondary?
c) Is the flux through the secondary increasing, decreasing or staying the same?
d) In what direction will the induced magnetic field from the secondary point?
e) Which direction will the current flow in the secondary?
f) What direction will the galvanometer point?

Do not do the experiments until you have made all of the predictions

1. The switch is already open, then it is closed.



a) What is the direction of the current in the primary?
The direction towards the left. Meaning it the energy flows from the positive terminal through the circuit.

b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the left, from the positive to the negative terminal, then that means that the magnetic field is pointing downwards.

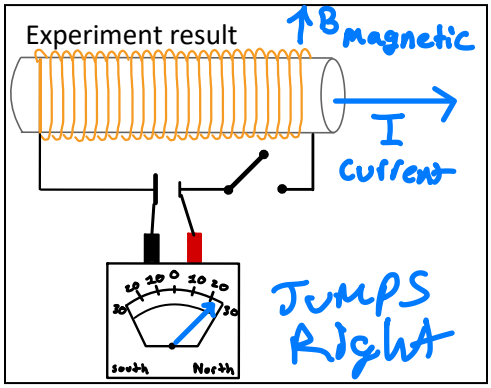
c) Is the flux through the secondary increasing, decreasing or staying the same?
The magnetic flux is increasing due to the increase in current.

d) In what direction will the induced magnetic field from the secondary point?
Upward due to the normal magnetic field pointing downward.

e) Which direction will the current flow in the secondary?
It is increasing as well.

f) What direction will the galvanometer point?
We assume it will be pointing to the left.

2. The switch is already closed, then opened



a) What is the direction of the current in the primary?

Current is flowing to the right meaning it is flowing back to the negative terminal.

b) What is the direction of the magnetic field at the location of the secondary?

Pointing upward due to the current flowing to the right.

c) Is the flux through the secondary increasing, decreasing or staying the same?

Decreasing because the current is decreasing.

d) In what direction will the induced magnetic field from the secondary point?
It should be going downward as the induced field will be the opposite of the normal field.

e) Which direction will the current flow in the secondary?

The current will flow the same direction as the primary.

f) What direction will the galvanometer point?

The galvanometer will point to the right.

3. The switch is closed, and the secondary is moved away from the primary

a) What is the direction of the current in the primary?
The current will be going to the right.

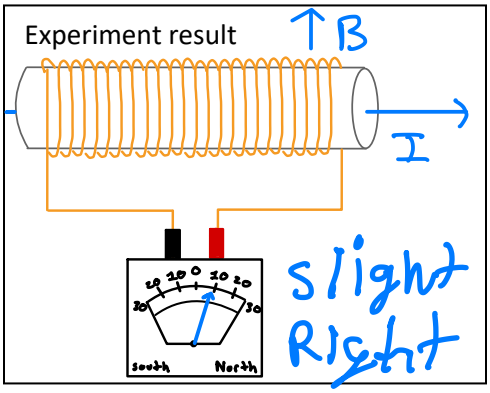
b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to downward.

c) Is the flux through the secondary increasing, decreasing or staying the same?
There is no change in Magnetic flux. As the current is not changing nor the angle.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be going downward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current will not flow in the secondary due to it being moved away from the primary which is the charged one.

f) What direction will the galvanometer point?
We assume that the needle will go to the right.



4. The switch is closed and secondary is moved towards the primary

a) What is the direction of the current in the primary?
The current will be going to the right.

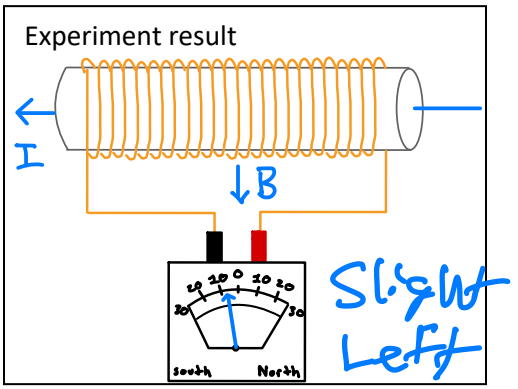
b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to upward.

c) Is the flux through the secondary increasing, decreasing or staying the same?
There is no change in Magnetic flux. As the current is not changing nor the angle.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be going downward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current will flow from the primary to the secondary.

f) What direction will the galvanometer point?
We assume that the needle will go to the right.



5. The switch is closed and the primary is move away from the secondary

a) What is the direction of the current in the primary?
The current will be going to the right.

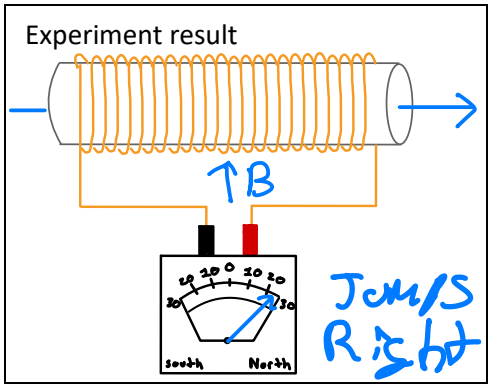
b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to upward.

c) Is the flux through the secondary increasing, decreasing or staying the same?
There is no change in Magnetic flux. As the current is not changing nor the angle.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be going downward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current will not flow in the secondary due to it being moved away from the primary which is the charged one.

f) What direction will the galvanometer point?
We assume that the needle will go to the right.



6. The switch is closed, and the secondary is rotated.

a) What is the direction of the current in the primary?
The current will be going to the right.

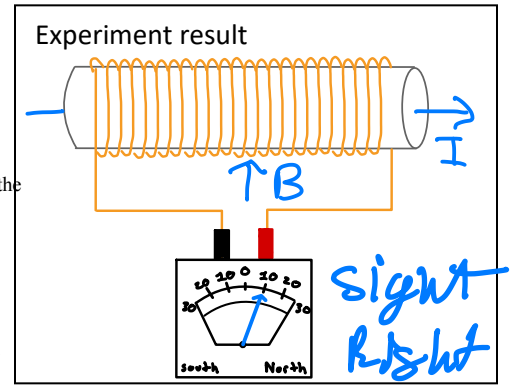
b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to upward

c) Is the flux through the secondary increasing, decreasing or staying the same?
There is no change in Magnetic flux. As the current is not changing nor the angle. We are only rotating the object.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be going downward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current will not flow in the secondary due to it being moved away from the primary which is the charged.

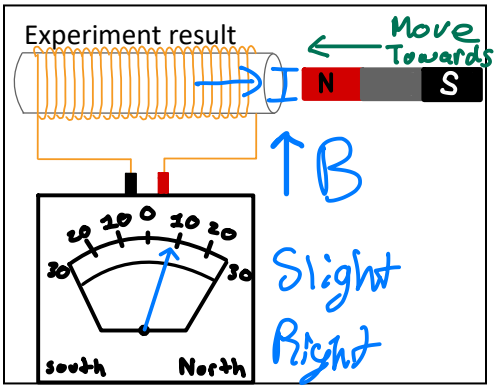
f) What direction will the galvanometer point?
We assume that the needle will go to the right.



7.4.3 Induced Current by a Magnet

Make the same predictions from 7.4.2 for the following actions:

1. The north end of the magnet is moved towards the coil.



a) What is the direction of the current in the primary?
The current will be going to the right.

b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to downward.

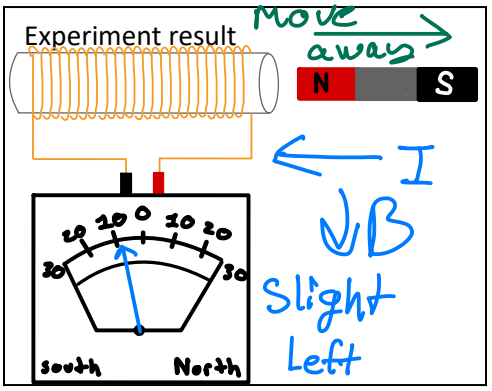
c) Is the flux through the secondary increasing, decreasing or staying the same?
There Magnetic flux increasing due to the increase current.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be going upward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current flows into the north end and out the south.

f) What direction will the galvanometer point?
We assume that the needle will go to the right.

2. The north end of the magnet is moved away from the coil



a) What is the direction of the current in the primary?
The current will be going to the left.

b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to upward.

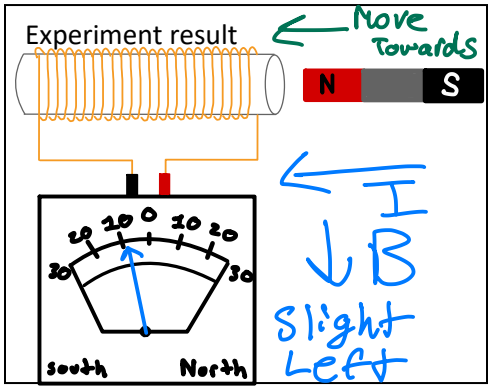
c) Is the flux through the secondary increasing, decreasing or staying the same?
The flux is increasing due to the increasing current.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be going downward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current will flow into the north end and out the south.

f) What direction will the galvanometer point?
We assume that the needle will go to the Left.

3. The south end of the magnet is moved towards the coil



a) What is the direction of the current in the primary?
The current will be going to the left.

b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to downward.

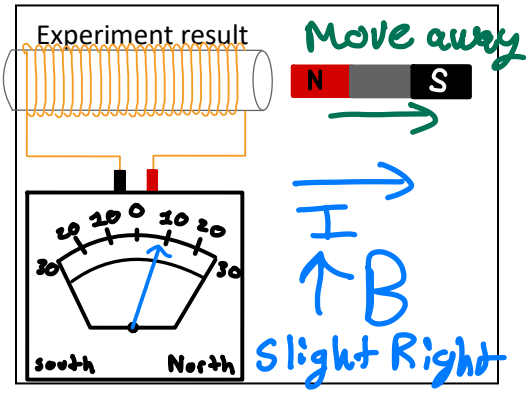
c) Is the flux through the secondary increasing, decreasing or staying the same?
There is no change in Magnetic flux. As the current is not changing nor the angle.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be goingupward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current will flow from the north end and then out of the south end.

f) What direction will the galvanometer point?
We assume that the needle will go to the Left.

4. The south end of the magnet is moved away from the coil



a) What is the direction of the current in the primary?
The current will be going to the right.

b) What is the direction of the magnetic field at the location of the secondary?
Since the current is going to the right then the magnetic field will be going to upward.

c) Is the flux through the secondary increasing, decreasing or staying the same?
There is no change in Magnetic flux. As the current is not changing nor the angle.

d) In what direction will the induced magnetic field from the secondary point?
The induced field will be going downward to counter act the field that is already there.

e) Which direction will the current flow in the secondary?
Current will not flow in this system.

f) What direction will the galvanometer point?
We assume that the needle will go to the right.