Draft!

INS Physics Lab 3: Magnetism, Electromagnetism, and Review

As before, in this lab you will compare claims made about how *physics* works with experiences of how *the world* works. Hopefully the two fit together well.

Magnetic Fields Forever What does a magnetic field look like?

Cover the bar magnet with a sheet of blank, white paper and lightly sprinkle iron filings on the paper. The seed will also work!

- Sketch the field lines.
- Can you tell N from S based on your sketch?

Carefully put the iron filings back in the bag.

Tape two magnets in a line so that the same poles are together. Possibilities are N-S S-N or, the ever popular, S-N N-S. Cover the magnets with the paper and lightly sprinkle iron filings again.

- What do you predict the field lines will look like?
- What do you observe? Sketch and explain. Can you tell N from S?

Iron-snowglobe time! Thoroughly shake up the "snowglobe" and put the cow magnet into it. Describe the 3-d field lines. Say, "ooh" or "cool."

Oersted's experiment Arrange the wire in a N-S direction; do not yet attach the battery! Bring the compass directly under the wire.

- Connect the battery so that the current flows south. What do you predict will happen? Quickly disconnect the battery.
- What did happen? Explain.
- Connect the battery so that the current flows north. What do you predict will happen? Quickly disconnect the battery.
- What did happen? Explain.

Arrange the wire in an E-W direction; do not yet attach the battery! Bring the compass directly under the wire.

- Connect the battery. What do you predict will happen? Quickly disconnect the battery.
- What did happen? Explain.

Use the magnetic field detector to sketch the magnetic field around the wire.

Disconnect the battery, connect a generator to the wire and orient the wire in a N-S direction. Bring the compass under the wire and turn the generator. Based on the compass deflection, which way is the current flowing? Does this match the indicator on the generator?

Electromagnetic Induction Find the E & M Demo H53.

- Move a cylindrical magnet into each coil. What do you observe?
- What quantity does the needle (meter) read?
- Why do the different coils give rise to different reactions in the meter?
- Predict what happens when the magnet is pushed in/pulled out. In what direction is the magnetic flux changing? How does the induced EMF "react" to this?
- Pick one of the coils and put the magnet in slowly. Pull it out slowly. Put the same magnet in the same coil quickly. Pull it out quickly. Put the same magnet in the same coil and leave it there. What happens in each of these cases? Explain in terms of changing magnetic flux.

Electromagnet/Solenoid Wrap one of the nails with 50 loops of the wire. Use the scissors to cut the wire as needed. Attach the ends of the wire to the battery. How many paper clips can you lift?

Repeat for 100 loops.

Unwind the wire and store it reasonably. Thank you, and have a nice day.

And now for the fun stuff - Rotational Dynamics Which is faster: the ball rolled down the ramp or the ball dropped from the same height?

Weigh and measure the ball.

Predict how fast the dropped will hit the ground. Predict how fast the ball rolling down the ramp will be at the bottom.

Use the motion sensor to measure the velocity of the dropped ball as it hits the ground. Do this three times and average.

Use the motion sensor to measure the velocity of the rolling ball at the floor.

Compare.