SIMPLE ELECTROMAGNETIC DEVICES

NAME _____ SCHOOL _____

DATE STARTED_____ DATE COMPLETED_____

PREREQUISITE: Light Bulbs, Switches and Batteries course or a basic understanding of how a simple electrical circuit works.

HOW TO DO THIS COURSE: Do the steps one at a time, in order. When you finish a step, put your initials and the date on the sign-off line on the right. A split line means to get a pass (and an initial) from another student (or your Academic Supervisor if it says that). A * means get a checkout.

PURPOSE: Gain some practical experience with devices which use electromagnetic effects and become familiar with some of their applications.

ESTIMATED TIME: 10 hours.

MATERIALS NEEDED TO DO THIS COURSE

Data Sheet (DS) #8907 Materials List for Simple Electromagnetic Devices (stapled separately)
Study booklet, *Simple Electromagnetic Devices*, with these data sheets (DS):
3620 3621
Exam: 3622, 8906 (answers)
Simple Electromagnetic Devices Lab Supervisor Manual, with these data sheets:
7335 8907
Other materials:
No unusual materials are needed in the classroom, but laboratory materials need to be prepared for demonstrations and practical applications. See *Simple Electromagnetic Devices Lab Supervisor Manual* for a full list of materials (this list is also provided separately from the manual so it can be more easily used for shopping).

A. MAGNETS

*1. READ: Data Sheet (DS) #3620 Simple Electromagnetic Devices. ____ ____

2. DEMONSTRATE: Static electricity. Blow up a balloon and rub it on a wool sweater or a soft rug until you feel it try to stick when you pull it away. Then see if it will stick to a wall. Try to notice how the amount of pull changes when you move it closer to or farther from the wall. (This will work better on some days than on others, depending on how dry the air is.) _____

3. DEMONSTRATE: Permanent magnets. Experiment with two bar magnets and some paper clips.
   a) See how the magnets attract or push apart from each other depending upon which ends you bring together. ___

b) See from how far away a bar magnet will pull a paper clip. Measure this distance. Is it the same for both ends of the magnet? ___

c) See how many paper clips you can pick up with one magnet. What happens if you try it with both magnets stuck together end to end? What happens if you try it with both magnets stuck together side by side? How well does a horseshoe magnet pick up clips? (If you don't have a horseshoe magnet, you can simulate one by holding two bar magnets in a V shape with two ends stuck together.) ___

d) See how many paper clips can stick together end to end hanging in a chain from one magnet. Why do you think they stick together? ___

e) Check to see if any of the paper clips you have been using have become magnetized (that is, see if they will now stick to each other at all when the magnet isn't there). ___ _____

4. DEMONSTRATE: Magnetic poles.

a) Near the North Pole of the Earth is a point called the Magnetic North Pole. It is called this because the whole Earth acts like it has a big bar magnet running through it, with one end near the North Pole and the other end near the South Pole. The north-seeking needle of a magnetic compass points to the Magnetic North Pole of the Earth. Use a magnetic compass to find out what direction the Magnetic North Pole is from where you are. ___

b) Hang one of your bar magnets from a string tied around the middle of it, so it will hang level and can turn freely. See which way it points. Decide which end of your bar magnet points to the Magnetic North Pole and mark it "N." Mark the other end S. Do the same thing with your other bar magnet, so you have N and S marked on both. (Notice that N means "north-seeking" and S means "south-seeking.") ___

c) Which ends of the two bar magnets attract each other? Which ends push apart? ___

d) Thought experiment: If the earth really did have a big bar magnet through the middle, carefully consider what you have learned so far and what your experiment shows and answer this question: which label (N or S) would you need to put on the end sticking out at the North Pole? Explain why in writing, so that you could explain this to someone. **Supervisor pass** on this part. ___ ____ ____

B. ELECTROMAGNETS

1. PRACTICAL APPLICATION: DS #3621 Activities for Simple Electromagnetic Devices, Activity #1. Electromagnet action in a speaker ____ ____

2. PRACTICAL APPLICATION: DS #3621, Activity #2. Make an electromagnet. (Note: if your school lab has suitable electromagnets already made and available, you don't have to make another one. You can sign off this step when you have read the instructions and know how the electromagnets are made.) ____ ____

3. PRACTICAL APPLICATION: DS #3621, Activity #3. Test the electromagnet coil. ____ ____

4. PRACTICAL APPLICATION: DS #3621, Activity #4. Test the electromagnet with a bolt in it. ____ ____

5. PRACTICAL APPLICATION: DS #3621, Activity #5. Test the electromagnet using two batteries. ____ ____

6. DEMONSTRATE: Examine a doorbell or buzzer and find the electromagnetic coil. _____

7. DEMONSTRATE: Examine a clock motor or other small motor and find the electromagnetic coil (or coils). (Hint: in a very simple clock motor the coil may have only one loop.) _____

C. ELECTROMAGNET APPLICATIONS

1. PRACTICAL APPLICATION: DS #3621, Activity #6. Make a buzzer. ____ ____

2. (Optional) PRACTICAL APPLICATION: DS #3621, Activity #7. Make and use a telegraph set. ____ ____

3. PRACTICAL APPLICATION: DS #3621, Activity #8. Make electricity. ____ ____

4. PRACTICAL APPLICATION: DS #3621, Activity #9. Transform electricity. ____ ____

5. PRACTICAL APPLICATION: DS #3621, Activity #10. Generate electricity. ____ ____

6. DEMONSTRATE: Take the bolt out of your electromagnet coil and test the bolt to see how much permanent magnetism it has. (If it won't pick up a paper clip, see if it will pick up a common pin or a staple.) Based on the experiments you have done, what do you think you could do to make the bolt a stronger permanent magnet? ____ ____

7. READ: Reread DS #3620 Simple Electromagnetic Devices. _____

8. PRACTICAL APPLICATION: DS #3621, Activity #11. Assemble a simple motor. Save your electromagnet (with a battery and any other parts you need) so you can demonstrate it to the Examiner. ____ ____

9. PRACTICAL APPLICATION: DS #3621, Activity #12. Use your motor as a generator. ____ ____

10. (Optional) PRACTICAL APPLICATION: DS #3621, Activity #13. Make your motor stronger. ____ ____

11. ESSAY: In your own words explain in writing how and why your set-up for Activities #11−13 works, as a motor and as a generator. **Supervisor pass.** ____ ____

I have completed the steps of this course. I understand what I studied and can use it.

Student_____ Date _____

The student has completed the steps of this course and knows and can apply what was studied.

Academic Supervisor_____ Date _____

The student has passed the exam for this course.

Examiner _____ Date _____