MATERIALS LIST FOR
SIMPLE ELECTROMAGNETIC DEVICES

The materials needed are listed here in the sequence used, by experiment. A "shopping list" at the end gives them all together without duplicates.

The more exotic items (such as a bell or buzzer, small motors, etc.) may be obtained from a science supplies distributor such as Frey Scientific, Edmund Scientific or Cenco (now Sargent-Welch). Radio Shack is also a handy source for many of these items.

A.2. Demonstration: Static electricity.
a rubber balloon
piece of wool or soft rug

A.3. Demonstration: Permanent magnets.
bar magnets (fairly long and thin, not stubby, and not so strong that they are very difficult to hold apart or separate. Try to get two that are *not* labeled with N and S on the ends. If unlabeled bar magnets are not available, cover up the N and S labels for these steps)
(recommended) a small horseshoe magnet
paper clips
ruler

A.4. Demonstration: Magnetic poles.
magnetic compass
bar magnets
thin string (2 or 3 feet will do)
tape (to put on bar magnet for labeling)
marker

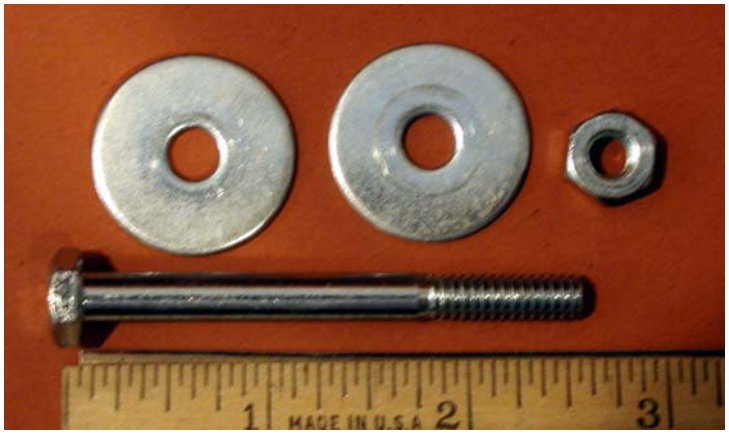
For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #1:

B.1. Practical Application:
small speaker
2 1.5-volt D-cell batteries (rechargeable batteries recommended to help keep freshly charged batteries available and reduce the expense of buying new ones)
battery holders (to make it easier to attach wires to the batteries)
insulated hook-up wires (three here, several will be needed later on; they should be about 8 inches long with small alligator clips on the ends)

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #2:

B.2. Practical Application: Make an electromagnet.

plastic soda straw or ball point pen tube
2 large bolts (to fit through straw 2½" long ¼" × 20 size works well) with nuts and 2 washers for each
60 feet of #24 gauge insulated copper wire (magnet wire or bell wire)
tape (masking tape is fine) or glue



For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #3:

B.3. Practical Application: Test the electromagnet coil

1.5v D-cell battery (in a holder)
compass
paper clips
6-volt lantern batteries. (At least 2 will be needed—more if they wear out. If using rechargeable batteries, 4 D cells connected in series in a 4-battery holder are equivalent to one 6-volt lantern battery.)
a big steel nail or bolt (unmagnetized) (to fit freely inside the straw used for the electromagnet coil)

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #4:

B.4. Practical Application: Test the electromagnet with a bolt in it.

bolt, washers and nut for your coil
bar magnet
some paper clips
6-volt battery

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #5:

B.5. Practical Application: Test the electromagnet using two batteries.

electromagnet
bar magnet
some paper clips
2 6-volt batteries

B.6. Demonstration: Examine a doorbell or buzzer.

doorbell or buzzer (to take apart and find the coil). Try to get a doorbell or buzzer mechanism where the coil is easy to see (most have a cover that can be removed).

B.7. Demonstration: Examine a clock motor or other small motor.

clock motor or other small motor (to take apart and find the coil)—several if possible.

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #6:

C.1. Practical Application: Make a buzzer.
thin sheet metal strips (steel, can be cut from a tin can), about ½ inch wide and 2 to 3 inches long (longer strips may be used for mounting electromagnets)
balsa or plywood (or Styrofoam) base for mounting, about 4" × 6"
small block of wood or Styrofoam for a support block
several small sheet metal screws (for attaching strips to base)
hook up wires
6-volt battery

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #7:

(Optional) C.2. Practical Application: Make and use a telegraph set.
materials from C.1
materials to make a second buzzer are needed unless one is already available
additional hookup wires (including a pair of longer wires for telegraph set-up)

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #8:

C.3. Practical Application: Make electricity.
electromagnet coil
galvanometer (or other meter with needle dial). A galvanometer can be obtained from a science supplies distributor. If a galvanometer is not available, any sensitive voltage or current meter with a needle dial will do. (In some demonstrations, if a meter reads the wrong way the leads can be reversed so the needle motion will go up the dial.)
strong bar magnet

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #9:

C.4. Practical Application: Transform electricity.
2 electromagnets
6-volt battery
galvanometer
a small knife switch

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #10:

C.5. Practical Application: Generate electricity.
2 small DC motors
1.5-volt light bulb
1.5-volt battery
galvanometer

C.6. Demonstration: Residual magnetism.
electromagnet
paper clips
common pins or staples

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #11:

C.8. Practical Application: Assemble a simple motor.

2 electromagnets
2 small flat permanent magnets (like the ceramic magnets available from Radio Shack)
2 large safety pins (with the catches removed). Size 3 quilting pins are 2" long and work well.
a long (4") nail (that fits through the end of the safety pins)
2 washers to go on the nail (look for 1" fender washers)[1]
a Popsicle stick
insulating tape (masking tape from above is fine, but electrical tape is more durable)
insulated hook-up wires (as above)
Styrofoam or wood for base, about 4" by 6"
Styrofoam for support blocks (two small pieces)
2 fresh batteries (6-volt size)
glue or tape
2 electromagnets
2 small flat permanent magnets. (These are different from the usual bar magnets, because the magnetism goes in the short direction from one flat side to the other, with one flat side N and the other S. They still act just like bar magnets if you remember where the poles are.)
2 large safety pins (with the catches removed)
a nail about 4 inches long (that fits through the ends of the safety pins)
2 one-inch washers with small holes (to go on the nail, if needed)
a Popsicle stick
insulated wire
insulating tape
Styrofoam or wood (to cut for the base and support blocks)
2 fresh 6-volt lantern batteries (or other low voltage power supply)

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #12:

C.9. Practical Application: Use your motor as a generator.

meter

For Data Sheet #3621 Activities for Simple Electromagnetic Devices, Activity #13:

(Optional) C.10. Practical Application: Make your motor stronger.

2nd 6-volt battery
metal strips for brushes

[1] Hardware stores usually have bins labeled “fender washers.” They are large diameter washers with relatively small holes, ideal for this purpose.

SHOPPING LIST

1 long (4") nail (that fits through the ends of the safety pins)
2 1.5-volt D-cell batteries (rechargeable recommended)
1.5-volt light bulb
2 electromagnets
2 large bolts (2½" long ¼" × 20 size works well) with nuts and 2 washers for each
2 large safety pins (with the catches removed). Size 3 quilting pins are 2" long and work well.
2 small DC motors
2 small flat permanent magnets (like the ceramic magnets available from Radio Shack)
2 washers to go on the nail (look for 1" fender washers)
60 feet of #24 gauge insulated copper wire (magnet wire or bell wire)
2 6-volt lantern batteries—if using rechargeable batteries, 4 D-cells connected in a 4-battery holder
balsa or plywood (or Styrofoam) base for mounting, about 4" × 6"
bar magnets—fairly long and thin; unmarked with N and S
battery holders
big steel nail or bolt (to fit freely inside the straw used for the electromagnet coil), unmagnetized
bolt, washers and nut
clock motor or other small motor—several if possible.
common pins or staples
doorbell or buzzer (to take apart and find the coil)
2 electromagnets
electromagnetic coil
galvanometer (or other meter with needle dial)
glue
hook-up wires
insulated hook-up wires with small alligator clips
insulating tape
magnetic compass
marker
metal strips (for buzzer and motor brushes)
paper clips
plastic soda straw or ball point pen tube
Popsicle stick
rubber balloon
ruler
several small sheet metal screws (for attaching strips to base)
small blocks of wood or Styrofoam for support blocks
small horseshoe magnet
small knife switch
small speaker
Styrofoam for support blocks (two small pieces)
Styrofoam or wood for base, about 4" by 6"
tape (masking tape is fine)

thin sheet metal strips (steel, can be cut from a tin can), about ½ inch wide and 2 to 3 inches long (Acco binder strips can also be used); longer strips for mounting electromagnets
thin string (2 or 3 feet will do)
wool piece or soft rug