

*Electromagnets*

<i>Equipment</i>	<i>Quantity required for 20 students working:</i>		<i>Unit cost</i>	<i>Supplier and catalog number</i>	<i>Comments</i>	<i>First use</i>
	<i>together as a class</i>	<i>semi-self paced</i>				
Clear plastic ruler (1 ft. length) subdivided into 1/10" and centimeter scales	1/student	1/student		Local stores/supply	Students can supply.	
Clear plastic protractor Semicircular with 0.5 degree divisions	1/student	1/student		Local stores/supply	Students can supply.	
Magnetizer to remagnetize magnets: Use one of the following: (A) High strength, 115VAC ETP. (Uses electric current pulses; includes 3 keepers and instructions)	1	1	\$128.50	Frey 15583539	We recommend using one or the other of these magnetizers. See also L&C.	
(B) Remagnetizer™ (Uses permanent neodymium magnets; requires no electricity)	1	1	\$38.15	NASCO SB22516M		
Rechargeable batteries and charger: Batteries, D-cell NiCad rechargeable, 1.25 V, 1.600 A•h	20	10	\$6.49/pk 2	Radio Shack 23-123 or local stores	See also EC. For best results, completely discharge NiCad rechargeable before recharging.	
Battery charger Holds 10 NiCad batteries: 9V, D, C, AA, AAA, or N	2	2	\$29.99	Radio Shack 23-134*		
Magnetic compasses Use some of the following: (A) Compasses, 23 mm diameter (with clear plastic case and top)	90	30	\$12.85/pk 30	NASCO SB16729M	A large assortment of compasses of various sizes is suggested. About 10 for each pair of students.	1.1
(B) Compasses, 35 mm diameter	100	50	\$2.25/ea	Frey 15568397		
(C) Magnetic detection compasses, 1/2" diameter	100	50	\$4.95/pk 10	Delta WW-032-2410		
(D) Magnetic detection compasses, 1 3/8" diameter	100	50	\$18.95/pk 12	Delta WW-030-5887		
Ring stands	10	5	\$10.95	Frey 15574176	See also POM. The ring stands hold a tray of magnetic compasses surrounding a current- carrying wire. Other supports may be used.	1.1
Support rings, 5" diameter	10	5	\$6.00	Frey 15574104		

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Buret clamp (single), (A) with plain jaws or (B) with plastic-coated jaws	10	5	(A) \$6.95 (B) \$6.95	(A) Frey 15574110 (B) Frey 15574266	See also POM, L&C.	1.1
Knife switches 1. plastic SPST, 1.5"L x 1"W	3 pk 10	3 pk 10	\$14.50/pk 10	NASCO SB09736M	See also EC.	1.1
Copper bus bar wire 16 gauge, 125 ft, 1 lb. spool	1 spool	1 spool	\$6.75	NASCO SB10509M	See also EC.	1.1
PVC covered copper connecting wire, white pvc, 22 gauge, 100 ft. roll	1 roll	1 roll	\$4.10	NASCO SB10520M	See also EC.	1.1
Alligator connector cords 12", covered wire, clips at both ends	15 pks 6	15 pks 6	\$7.50/pk 6 (3 red, 3 black)	NASCO SB13984M	See also EC.	1.1
Cardboard or a light tray	10	5		Local stores/supply		1.1
Magnaprobe A small bar magnet in a gimbal mounting.	10	5	\$15.25	Frey 15593235 (Instructions included.)	Optional: Demonstrates three-dimensional nature of magnetic fields. Can be used to show direction of fields around wire and coils.	OPT 1.2
Paper clips, small and large				Local stores/supply		2.2
Collection of nonmagnetic materials	10 sets	5 sets		Delta ESS (see Comments) or general lab supplies	These are described in the <i>Properties of Matter</i> equipment list under Delta ESS Sink or Float Kits. Other objects made of similar materials (aluminum, wooden, and plastic) can be used.	2.2
Small pieces of various types of metal:	10 of each	10 of each	\$10.80/kit	NASCO SB14273M	Electrodes can be used. This equipment can also be used in <i>Properties of Matter</i> and <i>Electric Circuits</i> . Kit contains electrodes: copper, lead, zinc, aluminum, iron, carbon, nickel; all measure 4" x 3/4"	2.2
Miniature bulbs: 1. miniature drycell, threaded base, #14 bright blue ceramic, 2.5 V	10 pk 10	10 pk 10	\$4.65/pk 10	Frey 15563636	See also EC. Also listed in catalog as "miniature lamps."	2.2

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2. miniature drycell, threaded base #13 green ceramic, 3.8 V	2 pk10	2 pk10	\$4.65/pk10	Frey 15563594		
Miniature bulb sockets: Use one of the following: (A) plastic screw base (B) white plastic w/mounting holes (C) masonite base with Fahnestock clips	20 20 20	20 20 20	\$15.15/pk 12 \$22.99/pk 12 \$0.75/ea	Sargent-Welch CP33008K Sargent-Welch CP84165-70A NASCO SB17079M	See also EC. Also listed in catalog as "miniature lamp receptacles."	2.2
Small wooden dowel	10	5		Local hardware store	See also POM.	2.4
Metal brads	20	10		Local stores/supply		2.4
Bar Magnets Use one of the following: (A) steel, with marked poles (150 x 19 x 7 mm, boxed with separator and keeper) (B) zinc-plated chrome alloy, with marked poles (6" x 3/4" x 1/4", boxed with keepers) (C) Alnico alloy bar magnet (150 mm x 19 mm x 7 mm) (D) Alnico (1") (E) 2" marked N/S (F) Magnet, 3" L x 1/2" diameter (G) ceramic (2" length) (H) Bar magnet unmarked, 1.375" length	20 20 10 40 20 12 20 20	10 10 5 20 10 6 10 10	\$7.50/pk 2 \$9.50/pk 2 \$7.65/ea \$6.95/pk 10 \$6.95/pk 2 \$3.25 \$4.95/pk 2 \$11.95/pk 10	Frey 15501488 NASCO SB15358M Frey 15569831 Delta WW-130-0320 Delta WW-130-7569 NASCO CO9784M Delta WW-130-0419 Delta WW-130-0090	Each group of students need at least one set of strong magnets for Experiment 3.1. See also Mag.	3.1
Rubber bands	20	10		Local stores/supply		3.1
Block of wood, 1/2" to 1" thick	10	5		Local hardware store		3.1
Stiff conducting supports	20	10		Local stores/supply	Bending metal coat hangers works well.	3.1
Enamel coated wire	1 spool	1 spool	\$10.95	Frey 15581130	Price for 24 gauge	3.3
Sandpaper	1 sheet	1 sheet		Local hardware store	Needed to scrape enamel off wire.	3.3