

*Light and Optics*

<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	20	20		Local stores	Students can supply. Ruler should be clear plastic, with both inch and centimeter scales.	
Clear plastic protractor Semicircular with 0.5 degrees divisions	20	20		Local stores	Students can supply.	
Construction paper: black and assorted colors	1 pk black, 1 pk colors	1 pk black, 1 pk colors		Local supplier	Black is used to make masks. A large variety of paper of different colors and textures is required for experiment 1.3. If available, origami paper is also useful for that experiment.	1.1
Plane mirrors Use one of the following: (A) glass, about 10 cm <sup>2</sup> , back surface mirror (B) plexiglass, silver-backed, 2.5" x 3.5"	2 pk 12 3 pk 8	1 pk 12 1.5 pk 8	\$12.65/ pk 12 \$9.95/pk 8	NASCO SB16721M Frey 15563297		1.1
Wooden blocks to hold small mirrors upright	20	10		Local supplier		1.1
Scissors	10	5		Local supplier		1.1
Metersticks 1. 100 cm 2. 50 cm	24 24	12 12	\$2.25; \$1.88/12+ \$1.70 ea; \$1.47/12+	NASCO S00938M NASCO SB12163M	See also POM and EC. In Experiment 1.1, half metersticks will be less cumbersome. In Experiment 7.6, metersticks will be easier to work with.	1.1
Butcher paper, white (20" x 1300' roll)	1 roll	1 roll	approx. \$30.00/roll	Local supplier	Use white paper where specifically noted. Smaller rolls of paper can be used (e.g., shelf paper with no glossy sheen).	1.1
Light box: Materials needed: 1. Light bulb, 200 W (General Electric 6" clear glass) 2. Keyless porcelain lampholder, medium base (#9875 Leviton, 660 W, 250 V) 3. Cord and plug (approx. 6' cord with molded two prong plug) 4. Sturdy cardboard box, approx. 12" cube, or empty 5 gal. ice cream container	10 10 10 10	10 10 10 10		Local supplier Local hardware store Local hardware store Local supplier	See <i>Light &amp; Color</i> Instructor's Guide for instructions on making a light box.	1.1
Flashlight plastic, requires 2 D cells	10	5		Local stores		1.3
White paper	1 pk	1 pk		Local supplier		1.3

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Various materials of different types of surfaces				Local supplier	Include sandpaper, foil, shiny paper, black velvet, etc.	1.3
Translucent tape or masking tape	1 roll	1 roll		Local supplier		1.3
Index cards	5 pks	2 pks		Local supplier		1.5
Nails 3" and 4" length that stand on their heads	20	10		Local stock/hardware store	See also POM.	1.5
Single bulb electric circuit	10	5			See EC and L&C.	1.5
Equipment for demonstration Plane mirror (8" x 10") on a support. Wooden dowel on a support.	1/class	1/class		Local supplier		1.7
Piece of heavy corrugated cardboard approximately 9" x 12"	10	5		Local supplier		2.5
Straight pins or T-pins	1-2 small boxes	1-2 small boxes		Local supplier		2.5
Half-silvered mirror Use one of the following: (A) One-way transparent mirror glass with hard chromium coating (50% reflection, 4 to 8% transmission) (B) First surface flat mirror aluminized on outer surface	2 - 3" x 4"  4 - 51mm x 51mm x 16mm	1 - 3" x 4"  2 - 51 mm x 51mm x 1.6mm	\$6.00  \$3.95	Edmund Industrial Optics NT40-045  Edmund Scientific CR3052323		2.10
Cylinders	1 pair for each half- silvered mirror	1 pair for each half-silvered mirror			Batteries or cans would work well. Cylinders should be tall enough that the "second" cylinder can be seen over the top of the mirror.	2.10
Full-length mirror	1/class	1/class		Local supplier		OPT 2.11
Polar graph paper	40 sheets	40 sheets		Local supplier		3.2
To mark mirrors: Use one of the following: (A) masking tape and colored markers (B) Post-it notes in different colors	1 roll 1 set/class 2 pkg	1 roll 1 set/class 2 pkg		Local supplier  Local supplier	Masking tape is difficult to remove if left on the mirrors.	3.2

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Beakers, assorted sizes	30-40	20-30			See POM. It is useful to have some beakers devoted to holding the various liquids to save on washing beakers. The number of beakers depends on the number of various liquids provided.	4.1
Various liquids: vegetable oil, corn syrup, sugar water, salt water	samples for 10 groups	samples for 5 groups		Local supplier	If salt water is cloudy, try using sodium chloride rather than table salt. See also POM.	4.1
Food coloring	1 bottle	1 bottle		Local supplier		OPT 4.1
Containers with straight sides 1. 2-5/16" x 2-5/16" x 6-1/4" 2. 4" x 4" x 4"	20 10	15 5	\$0.58 \$1.04	AMAC Plastic Products Corp. or Local supply/stores	Exact dimensions not important. Smaller container should be 2"-3" on a side. Larger container is required for 4.8.	4.2
Microscope slides 27mm x 75mm with 0.95-1.05mm thickness	10	5	\$7.15/ pk 72	Frey 15571694	Exact dimensions not important.	4.4
Thick piece of glass with (roughly) parallel sides	10	5		Local hardware store	Window glass would work; if possible, thicker glass would be better.	4.4
Prisms Use one of the following: (A) Equilateral prism (glass) face (25 mm), height (75 mm) (B) Equilateral prism (glass) 75 mm sides, 9 mm thick (C) Equilateral prism (acrylic) side 2.5" (D) Equilateral refraction prism 75 mm sides, acrylic	5 5 5 5	3 3 3 3	\$9.10 \$19.30 \$7.15 \$8.65	Sargent-Welch WL3462-20 Sargent-Welch WL3480 NASCO SB18048M Sargent-Welch CP32866-00		4.9
Blue & red acetates (1.5" x 2")	10 pairs	5 pairs		Local art store/theatrical supply house	See also L&C. Here, the exact shade of blue and red is not important.	4.9
Refraction tanks, semi-cylindrical plastic (12 cm diameter x 3.2 cm deep)	1 pk 12	1 pk 12	\$22.15	Sargent-Welch WL 3502	See also POM.	5.1
Graph paper (5 squares/inch)	1-2 pk	1-2 pk		Local supplier	Or students can supply.	5.7
Modeling clay	2 lb	1 lb	\$3.10/lb	Delta ESS 16-030-8615	See also POM.	6.2
Drawing compass	20	20		Local supplier	Or students can supply.	6.3

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Double convex lens: 1. $f = 50$ mm, diameter = 38 mm 2. $f = 100$ mm, diameter = 50 mm	10 pairs	10 pairs	1. \$2.45 ea 2. \$4.50 ea	Frey 15584664 Frey 15584679	Want two lenses of different focal lengths and different diameters. The lens with the larger diameter should have a focal length of approximately 100 mm.	7.2
Additional convex lenses: 1. $f = 150$ mm, diameter = 38 mm 2. $f = 200$ mm, diameter = 50 mm 3. $f = 300$ mm, diameter = 38 mm	5 sets	5 sets	1. \$3.25 ea 2. \$4.95 ea 3. \$3.25 ea	Frey 15584655 Frey 15584685 Frey 15584667	Want additional lenses with a wide range of focal lengths.	7.4
Long filament bulb and socket: Medium screw base porcelain socket Cord about 6' long, with molded two prong plug Long filament incandescent bulb medium screw base, 40 W	20 20 20	10 10 10	\$2.40  \$3.85/pk 2	Frey 15594681 or local hardware store Local hardware store Frey 15598389 or local hardware store (e.g., Philips Tubular Bulb, 40 Watt, BC40T10)	Same size socket as for household bulbs. Note: On some, the screws are exposed and "live" sockets in which the screws are safely hidden.	8.10
Multiple-outlet power strip (with surge suppressor)	5	5		Local hardware store	See also L&C, Kin. These can be purchased from local hardware stores at lower prices. They are used to plug in multiple long filament bulbs from one outlet and to turn the bulbs on and off.	OPT 8.10
Double concave lenses: 1. $f = 100$ mm, diameter = 38 mm 2. $f = 200$ mm, diameter = 50 mm	10 pairs	10 pairs	1. \$3.10 ea 2. \$3.05 ea	Frey 15584670 Frey 15584697	Want two lenses of different focal lengths and different diameters. The lens with the larger diameter should have a focal length of approximately 100 mm.	10.1
Additional double concave lens: $f = 50$ mm, diameter = 38 mm	10 sets	5 sets	\$3.10	Frey 15584670		10.4
Concave mirrors: 1. $f = 150$ mm, diameter = 50 mm 2. $f = 70$ mm, diameter = 75 mm	10 pairs	10 pairs	1. \$2.90 ea 2. \$4.50 ea	Sargent-Welch WL3520-12 Sargent-Welch WL3520-15	Want two mirrors of different focal lengths and different diameters. The mirror with the larger diameter should have a focal length of approximately 100 mm.	11.1
Additional concave mirrors: 1. $f = 200$ mm, diameter = 50 mm 2. $f = 300$ mm, diameter = 50 mm	10 sets	5 sets	1. \$2.90 ea 2. \$2.90 ea	Sargent-Welch WL3520-13 Sargent-Welch WL3520-14	Want additional mirrors to provide a wide range of focal lengths.	11.4
Convex mirrors: 1. $f = 200$ mm, diameter = 50 mm 2. $f = 50$ mm, diameter = 38 mm	10 pairs	10 pairs	1. \$2.90 ea 2. \$2.90 ea	Sargent-Welch WL3520-20 Sargent-Welch WL3520-22	Want two mirrors of different focal lengths and different diameters. The mirror with the larger diameter should have a focal length of approximately 100 mm.	11.8

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Additional convex mirrors: 1. $f = 100$ mm, diameter = 50 mm 2. $f = 150$ mm, diameter = 50 mm	10 sets	5 sets	1. \$2.90 ea 2. \$2.90 ea	Sargent-Welch WL3520-16 Sargent-Welch WL3520-18	Want additional mirrors to provide a wide range of focal lengths.	11.8
Cardboard tubing	10	10		Local supplier	Obtain from wrapping paper or paper towels. These should be long enough to make periscopes.	12.1
Plane mirrors, approx. 10 cm square	10	10	\$12.65/pk 12	NASCO SB16721M		12.1
Glass spheres 1"	2 pk 8	1 pk 8	\$0.95	Delta ESS 16-190-4253	See also POM.	12.9
Optical fiber	10 pieces	5 pieces	\$0.50 / foot	Edmund Scientific, EO2-531	Purchase minimum is 25 feet.	12.11
Large plastic funnel	10	5		Local supplier		12.11
Bucket or sink	10	5		Local supplier	A sink in a dark room, if possible, is preferable.	12.11