Activity #10

Title: Infrared (IR) at Work in the Home- Teacher's Answer Sheet

PREDICTIONS below will vary. The actual OBSERVATIONS were made with a Sony model SLV-440 VCR with the remote controller held at a fixed distance of 30 cm. (The maximum operable distance for this remote exceeded 8 meters—which was the longest straight-line distance I could achieve in MY home.)

MATERIAL	(PREDICTION)OBSERVATION	MAX. DISTANCE
HAND	NO	
NOTEBOOK PAPER (SINGLE SHEET)	YES	5 METERS
NOTEBOOK PAPER (DOUBLE SHEET)	YES	3.5 METERS
CARDBOARD (SINGLE LAYER)	YES	1 METER
CARDBOARD (DOUBLE LAYER)	NO	
ALUMINUM FOIL (SINGLE LAYER)	NO	
ALUMINUM FOIL (DOUBLE LAYER)	NO	
CLEAR PLASTIC BAG (SINGLE LAYER)	YES	
CLEAR PLASTIC BAG (DOUBLE LAYER)	YES	
TISSUE (SINGLE SHEET)	YES	
TISSUE (DOUBLE SHEET)	YES	
OPAQUE PLASTIC BAG (SINGLE LAYER)	YES	
OPAQUE PLASTIC BAG (DOUBLE LAYER)	YES	
BROWN PAPER BAG (SINGLE LAYER)	YES	
BROWN PAPER BAG (DOUBLE LAYER)	YES	4 METERS

Analysis questions:

1. Describe the method you used to determine the location of the internal IR receiver in your appliance. Most students will use a small square of material that is opaque to IR energy (i.e., aluminum foil, mirror, etc.) and place the sample over various regions of the face of the appliance while pressing

the POWER button until the remote controller is no longer functional. At this point, the student has located the IR receiver that must be "targeted" during the testing procedure for this activity. Alternately, the student could make a large shield of IR-opaque material with a small cutout. This "hole" could be moved to various locations over the face of the appliance (while pressing the POWER button of the remote controller) until the controller became operable.

2. What experimental controls (parts of each trial that remained the same) did you use when testing the various materials in this activity to guarantee valid results? The test samples should be the same size, held over the same area of the appliance face, at the same distance from the face…. with the remote controller held at a constant distance from the material to be tested. All trials should be conducted on the same appliance/remote controller.

3. What additional equipment/materials, if any, would be required to rank the materials from best to poorest with respect to their ability to transmit IR energy in this activity? No additional equipment would be required to perform this task. For those materials that are transparent to IR energy, additional thickness could be progressively built up (and measured) in front of the IR receiver until the appliance no longer functioned. A comparison of the measured thicknesses could then be used to rank the samples. Students may also suggest that an "IR meter" could be used to measure the strength of the IR signal after passing through test materials…and subsequently ranking the materials as a result on these findings.

4. Which materials tested that were opaque to visible light allowed the IR signal to pass through? The IR energy passed through notebook paper, cardboard, tissue paper, opaque plastic bags, and brown paper bags—all of which are opaque to visible light.

5. From your observations (required to answer question #4), why do you suppose astronomers often photograph celestial objects using IR cameras? IR energy can pass through dust, haze, smog, fog, clouds, and other similar atmospheric impediments as well as interstellar "dust" to allow for maximum photographic clarity.