Observatory: The Environment, Second Year of Secondary Cycle Two
Teacher's Guide B

INFO BRIEF ACTIVITIES

Overview chart

The first two columns in this chart show the activity number and title. The concept or concepts that are central to the activity appear in the third column. The fourth column indicates the source program or programs for the activity content: ST for Science and Technology, EST for Environmental Science and Technology, AST for Applied Science and Technology and SE for Science and the Environment. Each activity is structured according to a particular method, which is identified in the fifth column. Finally, the last column contains a list of the materials for each activity.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 1	From the biggest to the smallest	Rutherford's atomic model	ST EST SE	Empirical	• Student book, Chapter 1, pp. 6, 7, 11–13 and Appendix 1 • The *Toolbox*, p. 13

NOTE TO TEACHERS

– Adaptable versions of the reproducibles in Guides A and B are available on the Companion Website at the following address: www.erpi.com/observatory.cw

– Rather than providing students with the appendix to this activity, you could ask them to do their own research on the Internet or in reference works to answer the activity questions.

Activity number	Title	Concept	Program	Method	Materials
INFO BRIEF 2	Air or nitrogen?	Periodicity of properties	EST	Formation of an opinion	• Student book, Chapter 1, pp. 23–24

NOTE TO TEACHERS

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– Rather than providing students with the appendixes to this activity, you could ask them to do their own research on the Internet or in reference works to answer the activity questions.

– You could ask students to record their sources for each piece of information gathered. They could also highlight the relevant facts in the appendixes. They would then be prepared to cite their sources in their opinion texts.

Activity number	Title	Concepts	Programs	Method	Materials
INFO BRIEF 3	Electric fruit	Electrolytes Electrolytic dissociation	ST EST	Observation	• Student book, Chapter 2, pp. 55, 56 and 58–60 • The *Toolbox*, p. 51 • ammeter *or* multimeter • electrical conductivity meter • apple • pear • banana • orange • lemon • wash bottle of distilled water

NOTE TO TEACHERS OR LAB TECHNICIANS

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– Make sure the electrodes are not oxide-coated. They can be sanded if necessary.

– It is important to use an ammeter that can detect current in the order of 10^{-6} A. Multimeters usually work for this purpose.

– Each team should use the same ammeter or multimeter, the same electrodes and the same electrical conductivity meter.

– The protocol should be completed fairly quickly to obtain an accurate comparison of the concentrations of electrolytes in the various fruit and to minimize the risk of error.

Activity number	Title	Concepts	Programs	Method	Materials
INFO BRIEF 4	Boiling water efficiently	Law of conservation of energy Energy efficiency Distinction between heat and temperature Relationship between heat energy, specific heat capacity, mass and temperature variations EST	ST EST AST	Experimental	• Student book, Chapter 3, pp. 70–75 • various electrical appliances for heating water (e.g. hot plate, kettle, fondue set, raclette grill, stove element) • 100-mL graduated cylinder • 500-mL beaker • thermometer • stopwatch *or* watch

NOTE TO TEACHERS OR LAB TECHNICIANS

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– Use a thermometer to ensure that the initial water temperature is the same for all appliances.

– To reduce the cost of this activity, you could give each team only one appliance to test, and the teams could share their results.

– You could send students to the cafeteria to measure the time it takes to boil water on an electric range or in a microwave oven.

– If you wish, you can adapt the handout by removing the mathematical formula in question 15 (a concept covered in Chapter 5) or by deleting the protocol.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 5	Hot or cold?	Endothermic and exothermic reactions	EST SE	Empirical	• Student book, Chapter 4, pp. 114–117

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– At the end of this activity, you could take students to the lab to see whether the masses they calculated for the various substances really do cause a temperature variation of 10°C.

– Prerequisite concepts: To carry out this activity, students must have studied the following concepts: the mole (Chapter 1, p. 30) and the relationship between heat, mass, specific heat capacity and temperature variations (Chapter 3, pp. 74 and 75). To simplify the activity, you can focus on the target concept (endothermic and exothermic reactions) by providing the answers to questions 3 and 4 and telling students how to calculate molar mass in question 6 b).

Activity number	Title	Concepts	Programs	Method	Materials
INFO BRIEF 6	Electricity in the air	Static electricity Electrical charge Coulomb's law EST	ST EST AST	Technological design process	• Student book, Chapter 5, pp. 141–149 • clear plastic jar • sheet of cardboard • sheet of aluminum foil • 4-cm (or longer) nail • adhesive tape • pencil • ruler • scissors

NOTE TO TEACHERS

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– You can use a glass jar instead of a plastic one.

– If the lid of the jar is plastic, you can use it instead of the circular piece of cardboard.

INFO BRIEF ACTIVITIES – Overview chart (*continued*)

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 7	A question of values	Minerals	ST EST	Formation of an opinion	• Student book, Chapter 6, pp. 184–189

NOTE TO TEACHERS

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– Rather than providing students with the appendixes to this activity, you could ask them to do their own research on the Internet or in reference works to answer the activity questions.

– You could ask students to record their sources for each piece of information gathered. They could also highlight the relevant facts in the appendixes. They would then be prepared to cite their sources in their opinion texts.

Activity number	Title	Concepts	Programs	Method	Materials
INFO BRIEF 8	The warming Arctic	Permafrost Glacier and pack ice	ST EST	Empirical	• Student book, Chapter 6, pp. 194, 195 and 207–209

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– Rather than providing students with the appendixes to this activity, you could ask them to do their own research on the Internet or in reference works to answer the activity questions.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 9	Blowing in the wind	Atmospheric circulation	ST EST SE	Technological design process	• Student book, Chapter 7, pp. 224 and 226–228 • The *Toolbox*, p. 75 • cardboard box such as a shoebox (at least 11 cm deep), without the lid • sheet of corrugated cardboard • wooden skewer • straw • toothpick • adhesive tape • ruler • pencil • compass • retractable utility knife • scissors

NOTE TO TEACHERS OR LAB TECHNICIANS

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– To see whether the anemometers work in the classroom, you can test them with fans. By varying the fan speed, students can observe how their anemometers work.

– Students will have to adjust the size of the cardboard rectangle and the arc to fit the box.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 10	Countdown to clean air	Contamination (atmosphere)	EST SE	Formation of an opinion	• Student book, Chapter 7, pp. 235–237

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– Rather than providing students with the appendixes to this activity, you could ask them to do their own research on the Internet or in reference works to answer the activity questions.

– You could ask students to record their sources for each piece of information gathered. They could also highlight the relevant facts in the appendixes. They would then be prepared to cite their sources in their opinion texts.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 11	Germs we can't live without	Nitrogen cycle	ST EST	Empirical	• Student book, Chapter 8, pp. 258–259

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– Rather than providing students with Appendix 1 to this activity, you could ask them to do their own research on the Internet or in reference works to answer question 10.

Activity number	Title	Concepts	Programs	Method	Materials
INFO BRIEF 12	Subject to variation	Terrestrial biomes Aquatic biomes	ST EST	Experimental	• Student book, Chapter 8, pp. 262–279 • 200 mL sand • 200 mL wet soil • 200 mL water • 3 250-mL beakers • ring stand • 3 thermometer clamps • 3 thermometers • lamp with 250-W bulb • ruler • stopwatch *or* watch

NOTE TO TEACHERS OR LAB TECHNICIANS

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– To obtain results similar to those in this answer key, make sure the soil is moist, but not saturated. Its preparation will depend on how much moisture it already contained at the time of purchase.

– If you wish, you can adapt the reproducible by adding questions on the concept of specific heat capacity, discussed in Chapter 3 of the student book (pp. 74–75). The following are examples of questions that could be added:

Why does the temperature of one substance rise more quickly than that of another substance, even when the two receive the same amount of energy?
The temperature variation depends on the specific heat capacity of each substance—the amount of heat the substance must absorb for its temperature to rise by one degree. Specific heat capacity is a characteristic property of every substance.

Based on your results, which environment has the highest specific heat capacity?
The water.

Based on your results, which environment has the lowest specific heat capacity?
The sand.

– You can also modify the reproducible by deleting the protocol.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 13	What about the human population?	Study of populations (density)	ST EST	Empirical	• Student book, Chapter 9, pp. 292–298

NOTE TO TEACHERS

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– Rather than providing students with the appendix to this activity, you could ask them to do their own research on the Internet or in reference works to answer questions 8 to 18. You would then have to bear in mind that the larger the number of information sources consulted, the higher the chances are that the data will not agree.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 14	A planet in turmoil	Disturbances	ST EST AST	Empirical	• Student book, Chapter 10, pp. 327–329

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– Rather than providing students with the appendix to this activity, you could ask them to do their own research on the Internet or in reference works to answer question 7.

Activity number	Title	Concept	Program	Method	Materials
INFO BRIEF 15	Three steps to clean water	Wastewater treatment	EST	Modelling	• Student book, Chapter 10, pp. 339–341 • The *Toolbox*, pp. 32, 33 and 43 • about 250 mL wastewater containing glucose (organic matter) • 500-mL wash bottle • 3 65-mm funnels • fine-mesh sieve • 3 sheets of 12.5-cm filter paper • 2 250-mL Erlenmeyer flasks • 40 mL of 8 g/L suspension of active baker's yeast • hot plate • thermometer • stir bar • magnetic stirrer • dropper bottle of bleach • 200 mL tap water • 600-mL beaker • test tube (15 mm × 125 mm) • test-tube rack • plastic dropper • dropper bottle of Fehling's solution A • dropper bottle of Fehling's solution B

NOTE TO TEACHERS OR LAB TECHNICIANS

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– Remind students that all models have their limitations—particularly this one.

– The treated water is not safe to drink. Be sure to warn students not to drink it.

Activity number	Title	Concept	Program	Method	Materials
INFO BRIEF 15 *(continued)*					

NOTE TO TEACHERS OR LAB TECHNICIANS (*continued*)

– Prepare the wastewater for each class as follows:
In a 600-mL beaker, mix 150 mL of 7.5 g/L glucose solution with about 40 mL of vegetable oil. Add a small handful of sand and another of gravel along with a few bits of wood or plastic. Stir the mixture just before distributing it to students.

– To prepare the active yeast suspension, heat 800 mL of water to 38°C and add a packet (8 g) of baker's yeast, found in most grocery stores. To make sure the yeast is active, add about 5 mL of glucose to approximately 15 mL of the suspension. If the yeast is active, the mixture will begin to bubble within 15 minutes. It is best to prepare the yeast suspension only a short time before the modelling activity and to keep its temperature at about 38°C.

– If a single period is too short to complete the modelling, you can let the yeast suspension act on the wastewater (steps 9 to 13) overnight.

– To prepare Fehling's solution A:
Dissolve 34.6 g of copper sulphate ($CuSO_4 \bullet 5H_2O$) in 500 mL of distilled water. Filter the solution prior to use.
A commercial preparation of this product is also available.

– To prepare Fehling's solution B:
Dissolve 125 g of potassium sodium tartrate and 173 g of potassium hydroxide (KOH) in 500 mL of distilled water.
This mixture does not keep.
A commercial preparation of this product is also available.

– Students can test the Fehling's solution with a sample of wastewater and compare the results of this test with those obtained in step 24.

Activity number	Title	Concepts	Program	Method	Materials
INFO BRIEF 16	An information chain	Gene Protein synthesis	EST	Modelling	• Student book, Chapter 11, pp. 353–359

NOTE TO TEACHERS OR LAB TECHNICIANS

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– For this activity, students may work in teams of two to help each other design and build the model.

– Each team will need the following materials:
- 5 pieces of about 15 g (50 mL) of plasticine of different colours (e.g. blue, red, yellow, green and purple)
- 12 160-mm pipe cleaners of one colour (e.g. pink)
- 6 160-mm pipe cleaners of another colour (e.g. beige)

– To create the spiral forms shown in the diagrams, students can wrap the pipe cleaners around a pencil.

– To check students' models of the transcription process in questions 11 and 12, you can ask them to demonstrate how they would change their models rather than have them draw the results.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 17	It's in the bag	Types and properties (plastics)	ST EST	Formation of an opinion	• Student book, Chapter 12, pp. 396–398 and Appendix 5

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– Rather than providing students with the appendixes to this activity, you could ask them to do their own research on the Internet or in reference works to answer the activity questions.

– You could ask students to record their sources for each piece of information gathered. They could also highlight the relevant facts in the appendixes. They would then be prepared to cite their sources in their opinion texts.

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 18	Changing gears	Speed changes	ST EST AST	Observation	• Student book, Chapter 13, pp. 435–438 and 442–443 • 4 gear templates (See the appendix to this activity.) • scissors • 2 sheets of foam core (400 mm × 200 mm) • pencil • cutting mat • retractable utility knife • nail • 4 25-mm paper fasteners

NOTE TO TEACHERS

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– You can offer students an additional challenge by asking them to draw the gears themselves rather than providing them with the templates.

INFO BRIEF ACTIVITIES – Overview chart (*continued*)

Activity number	Title	Concept	Programs	Method	Materials
INFO BRIEF 19	An electric shoebox?	Conduction	ST EST AST	Technological analysis	• Student book, Chapter 14, pp. 459–469 • The *Toolbox*, pp. 89–90 • shoebox (with lid) • 14-gauge electrical wire (at least 1200 mm) • 24-gauge electrical wire (at least 700 mm) • light bulb with base and wires • 9-V battery • duct tape • insulating connector • 2 short electrical wires with alligator clips • markers • tape measure • combination pliers • wire strippers • retractable utility knife • cutting mat • ruler

NOTE TO TEACHERS

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– If you wish, you could add a question about parallel and series circuits, which are covered in Chapter 5 of the student book (pp. 157–158). For example, you could add the following question:

Does your technical object contain a parallel circuit or a series circuit? Explain your answer.
A series circuit, because the components are connected end to end and the circuit does not branch out at any point.