EDQUEST.CA
MIDDLE SCHOOL SCIENCE RESOURCES

Grade 9 Lab Notebook

Science in Action 9

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Electrical Principles and Technologies

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QUICKLAB CHARGE IT! (p. 273)

To experience the nature of electrical forces

Observations: Trial 1

Observations: Trial 2

Observations: Trial 3

Question 8

Question 9

Trial 1

Trial 2

Trial 3

QUICKLAB STATIC CHARGE (p. 275)

Purpose: To observe the characteristics of static electricity

Observations: Procedure 1

_____

_____

_____

Observations: Procedure 2

_____

_____

_____

Van de Graff Generator

1 _____

2 _____

3 _____

4 _____

Question 4

_____

_____

_____

Question 5

_____

_____

_____

Activity D-1 Inquiry **Investigating Static Electricity**

PROBLEM: What is the effect of charged objects on each other and on natural objects?

HYPOTHESIS: _____

_____

PROCEDURE: Follow the procedure in the textbook p. 277

DATA COLLECTION:

Hanging Object	Approaching Object	Observations

ANALYSIS / INTERPRETATION OF DATA

7. _____

_____

8. _____

_____

CONCLUSION

_____

_____

_____

APPLICATION

_____

QUICKLAB ELECTRICAL CURRENT (p. 279)

To observe the characteristics of electrical current

Question 6 (Illustrate) / Question 7 (Explain)

Challenge 1

Caption _____

Challenge 2

Caption _____

Challenge 3

Caption _____

Challenge 4

Caption _____

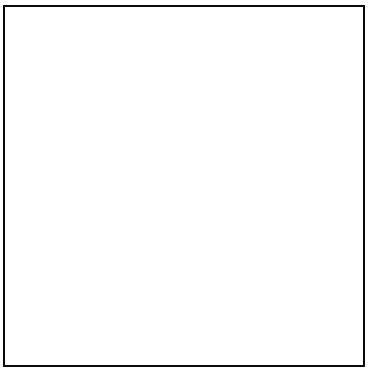
Challenge 5

Caption _____

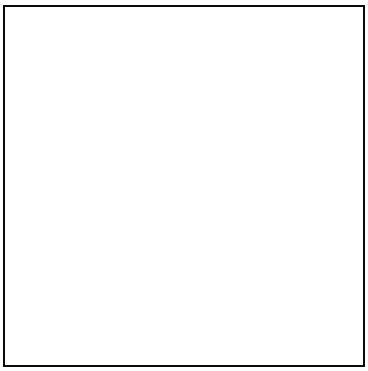
SKILL PRACTICE **(p. 282)**

USING VOLTMETERS

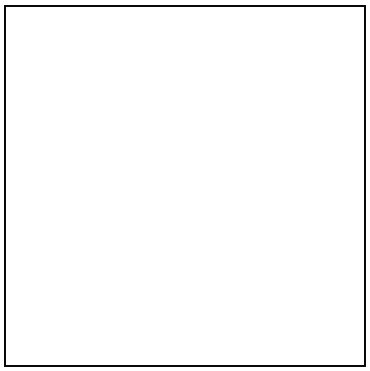
Cell 1



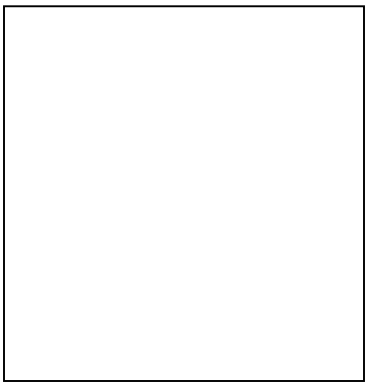
Cell 2



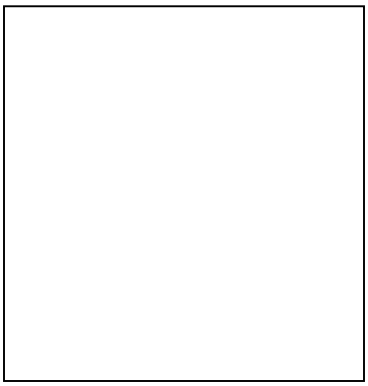
Cell 3



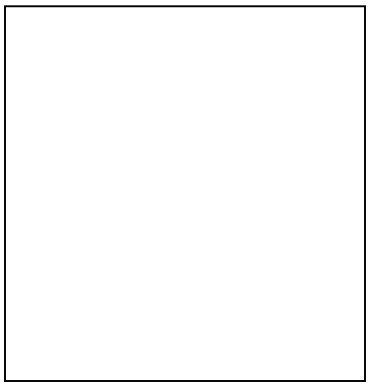
Cell 4



Cell 5



Cell 6



VOLTMETER READINGS

Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6

PREDICTION (when two cells are connected): _____

_____

EXPLANATION OF RESULTS _____

_____

_____

_____

QUICKLAB BLOW A FUSE! (p. 286)

Purpose: To observe the function of a fuse

Illustration of bulb and steel wool

Observations:

_____

_____

_____

_____

_____

Question 5

_____

_____

_____

QUICKLAB FRUIT CELLS (p. 290)

Purpose: To test the ability of fruits and vegetables to act as electrolytes

OBSERVATIONS:

Voltmeter Reading:

Voltage obtained from different Fruits and Vegetables

Type of Fruit / Vegetable	Prediction (voltage)	Actual (voltage)

Question 4

_____

_____

_____

Question 5 (connecting two fruits/vegetables)

Activity D-2 Inquiry **Choosing Electrolytes**

PROBLEM: What type of solution is the best electrolyte for a wet cell?

HYPOTHESIS: _____

_____

PROCEDURE: Follow the procedure in the textbook p. 291

DATA COLLECTION:

Solution	Voltage
Distilled water	
Tap water	
Sugar solution	
Salt solution	
Lemon juice	
Vinegar	
Dilute hydrochloric acid	
Dilute potassium hydroxide	

ANALYSIS / INTERPRETATION OF DATA

9. _____

_____

10. _____

_____

CONCLUSION

11. _____

_____

_____

APPLICATION (ELECTROLYTES IN THE BODY)

_____

EXTENSION (BEST ELECTRODES)

_____

Activity D-3 Inquiry **Investigating Conductivity**

PROBLEM: How does the conductivity of different solutions compare?

HYPOTHESIS: _____

_____

PROCEDURE: Follow the procedure in the textbook p. 299

DATA COLLECTION:

Solution	Conductivity Reading
Distilled water	
Tap water	
Salt solution	
Copper II Sulfate	
Vinegar	
Dilute hydrochloric acid	
Dilute potassium hydroxide	

ANALYSIS / INTERPRETATION OF DATA

7. _____

_____

8. _____

_____

CONCLUSION

9. _____

_____

_____

APPLICATION (ENVIRONMENTAL MONITORING)

_____

EXTENSION (AMOUNT OF SOLUTE IN SOLVENT)

_____

QUICKLAB MAKE YOUR OWN DIMMER SWITCH (p. 301)

Purpose: To control the amount of current flowing through an electrical device

ILLUSTRATION:

Question 5

QUICKLAB FUNNEL POWER (p. 304)

Purpose: To build a model that represents different amounts of current and resistance in a circuit

ILLUSTRATION:

Question 4

SKILL PRACTICE **(p. 282)**

USING OHM'S LAW

1. Calculations

The amount of **current** created is _____

2. Calculations

The **voltage** is _____

3. Calculations

The **resistance** is _____

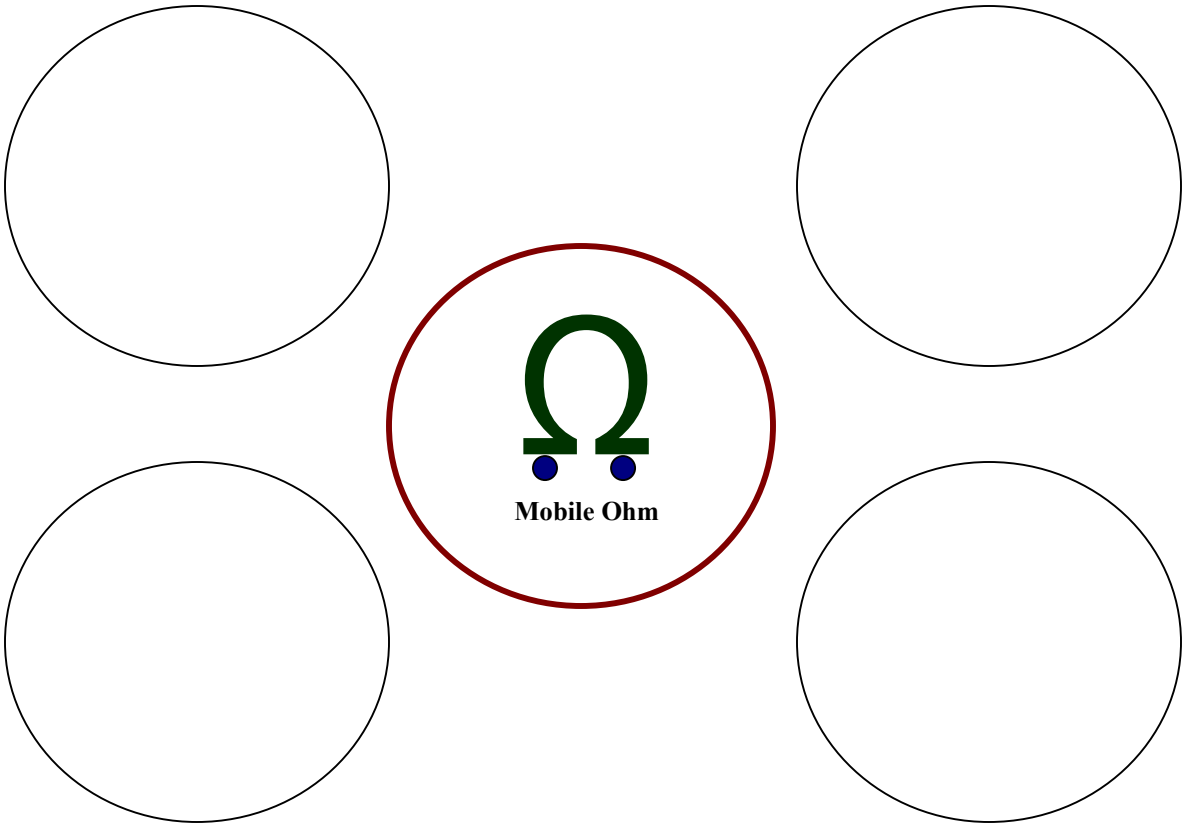
SKILL PRACTICE (p. 308)

USING AMMETERS

Observations

1 bulb	2 bulbs
Reading 1 _____	Reading 2 _____

OHM'S TO REMEMBER (HOW DO YOU REMEMBER AN OHM ?)



Activity D-4 Inquiry **What's The Resistance?**

PROBLEM: Do different materials have different values of electrical resistance?

HYPOTHESIS: _____

_____

PROCEDURE: Follow the procedure in the textbook p. 309

DATA COLLECTION:

Substance	Length connected		Voltage	Current	Resistance
	(1 cm)	(10 cm)			
Copper wire	1 cm				
		10 cm			
Nichrome wire	1 cm				
		10 cm			
Solid graphite	1 cm				
		10 cm			
Rubber tubing	1 cm				
		10 cm			
	1 cm				
		10 cm			
	1 cm				
		10 cm			

ANALYSIS / INTERPRETATION OF DATA

Using Ohm's Law **(R = V / I)**

7. Calculations for **resistance** should be in the table above

8. _____

_____

9. _____

10. _____

CONCLUSION

11. _____

APPLICATION (SURGE PROTECTORS)

EXTENSION (WARMING PIPES IN WINTER)

QUICKLAB FLASHLIGHT DESIGN (p. 311)

Purpose: To explore circuits by designing a simple flashlight

ILLUSTRATION:

Question 3

QUICKLAB HOW DOES THAT TOY WORK ? (p. 313)

Purpose: To determine the circuit design of an electronic device

ILLUSTRATION OF THE PARTS OF A SIMPLE TOY

SCHEMATIC DIAGRAM

Question 3 – Design your own unique toy vehicle (maybe a 'mobile Ohm')

Illustration	Schematic

Activity D-5 Problem Solving **Wiring A Secure & Safe Home**

NEED Lights that come on automatically to announce a visitor makes a home safer and deters burglars

PROBLEM: Can you design a basic circuit for the interior and exterior of a small home?

SPECIFICATIONS in the textbook p. 314

- outdoor light must comes on when someone approaches
- a photoconductor device should be included
- schematic should provide lighting for three rooms and the outdoor light
- an electrical control device should also be included (for emergency shut down)

PROCEDURE:

- Brainstorm and sketch different designs
- Consider the materials you will require
- Choose the best design and begin to build your model

SCHEMATIC

BUILD A PROTOTYPE

TEST / EVALUATE

COMMUNICATE (Feedback from Peers)

GIVE IT A TRY GOING SHOPPING (p. 320)

Purpose: Examine the photo on p. 320 and answer the questions

Energy transformations _____

_____

_____

_____

_____

Cooler transformations _____

_____

_____

_____

Wheelchair transformations _____

_____

_____

_____

Pushing by hand _____

_____

_____

_____

_____

Activity D-6 Problem Solving ***Transforming Heat into Electricity***

NEED There are some places where it is impossible to measure temperature with a thermometer

PROBLEM: How can you monitor the temperature inside a kiln, using a thermocouple?

SPECIFICATIONS in the textbook p. 322

- Sketch how a thermocouple could be used in a kiln
- Proof is needed to show that the thermocouple converts heat into electricity

PROCEDURE:

- How can the electricity produced by a thermocouple be translated into temperature

ILLUSTRATIVE PROCEDURE

TEST / EVALUATE follow **Steps 2 - 7** on p. 322

COMMUNICATE

8. _____

_____

_____

9. _____

_____

10. _____

_____

_____

Activity D-7 Problem Solving **GET YOUR MOTOR RUNNING**

NEED Can some motor-building kits be suitable for beginners and more advanced hobbyists

PROBLEM: How can you build a simple motor and then have it operate at different speeds and in different directions?

SPECIFICATIONS in the textbook p. 326

- Level 1 - A functioning motor that shows movement
- Level 2 - A functioning motor that turns a half-turn to a full-turn
- Level 3 - A functioning motor that spins continuously
- Level 4 - A functioning motor that can be adjusted to spin at different speeds
- Level 5 - A functioning motor that can spin in different directions

PROCEDURE:

- Read TOOLBOX 3 p. 482

ILLUSTRATIVE SKETCH OF COMPLETED MOTOR

BUILD A PROTOTYPE
(follow the procedure on p. 327)

TEST / EVALUATE

9. Modifications made: _____

_____

COMMUNICATE

10. _____

_____

11. _____

_____

12. _____

_____

13. _____

_____

14. INSTRUCTIONS FOR BUILDING A SIMPLE MOTOR

Materials Needed:

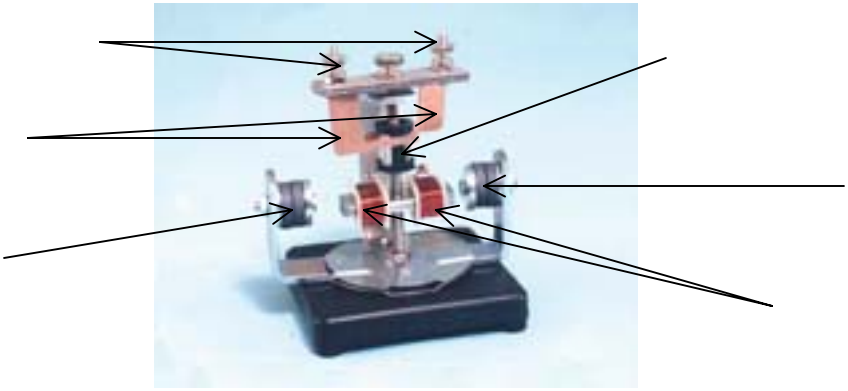
Procedure		**Illustration**
Step 1		
Step 2		
Step 3		
Step 4		
Step 5		
Step 6		
Step 7		
Step 8		
Step 9		
Step 10		

QUICKLAB ST. LOUIS MOTOR (p. 328)

A St. Louis motor is designed to show how an electric motor works

Purpose: To identify the parts of a St. Louis Motor and examine its operation

LABEL THE PARTS OF A ST. LOUIS MOTOR



Question 4 – Observations in Step 2

Question 5 – Observations in Step 3

Activity D-8 *EXPERIMENT* on your own **Generating Electricity**

BEFORE YOU START Energy transformation using a generator (p. 330)

PROBLEM: How can mechanical energy be converted into electrical energy?

PROCEDURE: (How will you build a generator?)

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

ILLUSTRATIVE PROCEDURE

MODIFICATIONS NEEDED FOR THE GENERATOR TO WORK

_____

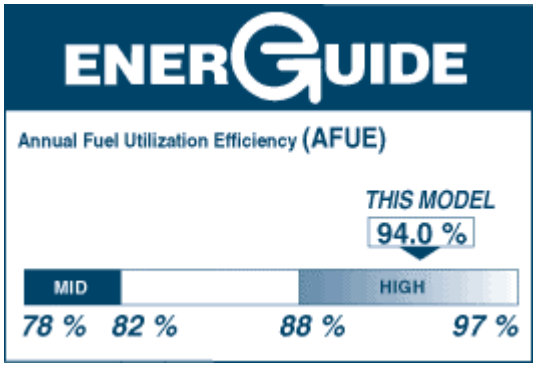
_____

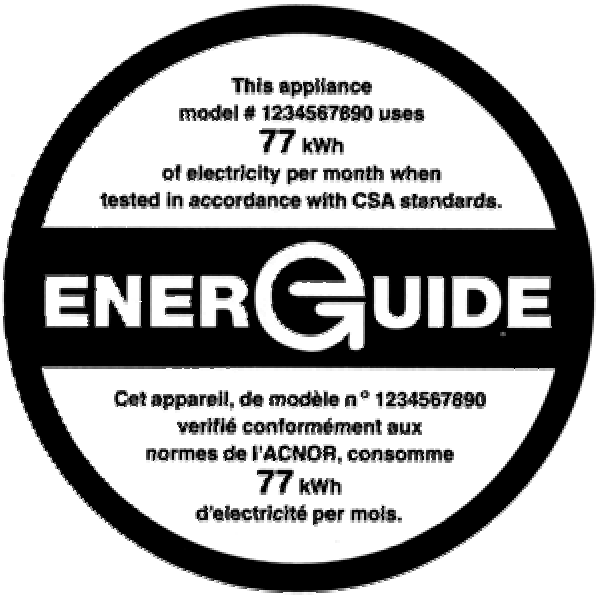
_____

SKILL PRACTICE (p. 333)

POWER PRACTICE

Sample EnerGuides





Electrical device	Voltage	Current	Power rating	Consumption (Time Running – Est.)	Cost @ $0.07/kW.h
Light bulb					
Curling iron					
Coffee maker					
Radio					
Alarm clock					
Stereo					
Television					

Activity D-9 Problem Solving **CIRCUIT ASSESSMENT**

NEED Testing circuits often requires information regarding type of circuit in use

PROBLEM: Can you build model series and parallel circuits?

SPECIFICATIONS in the textbook p. 334 **Criteria for Success** Read **TOOLBOX 3** p. 482

Each model circuit should have three components in addition to a voltage source

- voltage across each item in a circuit
- current in each branch of a circuit
- power usage of each component

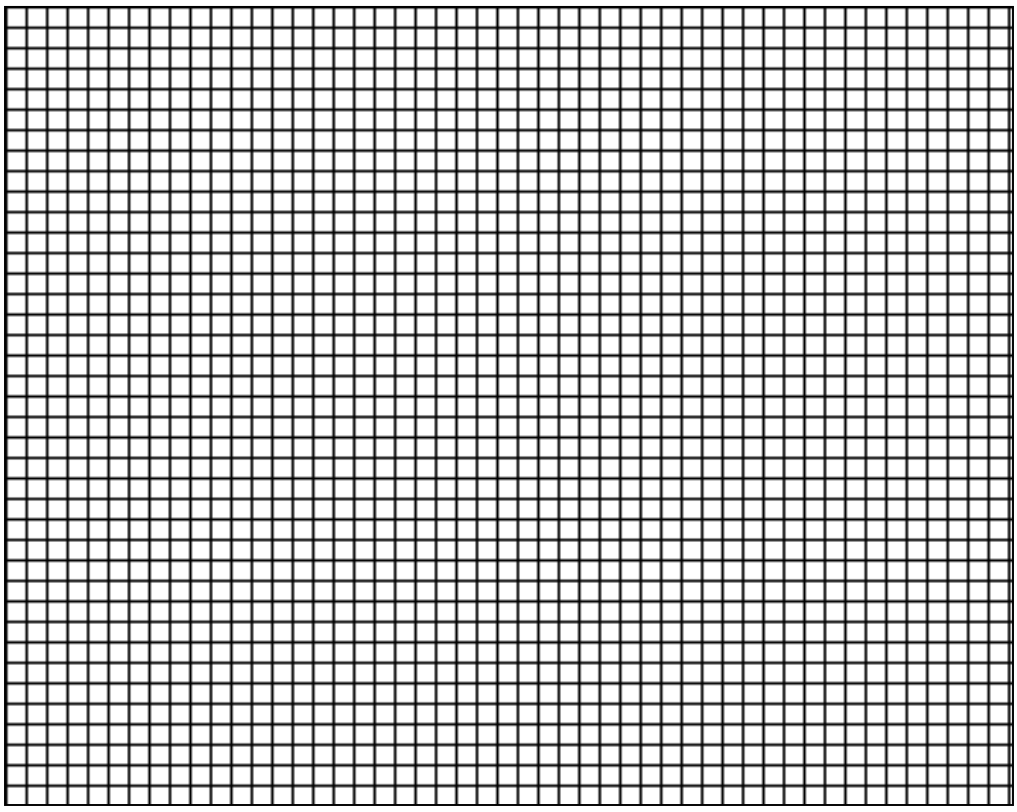
BUILD A PROTOTYPE CIRCUIT

(Series) **(Parallel)**

TEST / EVALUATE

Series Circuit				Parallel Circuit			
Component	Voltage	Current	Power	Component	Voltage	Current	Power

Comparison of Series and Parallel Circuits



COMMUNICATE

5. _____

_____

_____

6. _____

_____

_____

7. _____

_____

_____

SKILL PRACTICE **(p. 336)**

COMPARING INPUT AND OUTPUT ENERGIES

Device	Input Energy	Output Energy	Efficiency
Gas-powered SUV	675 kJ	81 kJ	
Gas-Electric Hybrid	675 kJ	195 kJ	
Mid-efficiency Nat. Gas Furnace	110 MJ	85 MJ	
Electric Baseboard Heater	9.5 kJ	9.5 kJ	
Alkaline Dry Cell	84.52 kJ	74.38 kJ	
Florescent Light	12.5 kJ	2.75 kJ	
Incandescent Light	780 J	31 J	

Most efficient Device is _____

Least efficient Device is _____

Differences between the most and least efficient devices are:

_____

_____

_____

_____

_____

_____

Activity D-10 Problem Solving **Kettle Efficiency**

NEED Product efficiencies must be true to their claim

PROBLEM: Can you test the efficiency of an electric kettle?

SPECIFICATIONS in the textbook p. 337 **Criteria for Success**

- Design a procedure to measure the amount of electrical energy is consumed by a kettle while heating (**energy input**)
- Design a procedure to measure the amount of energy gained by the water (**energy output**)

E = mass of water in grams x 4.19 x change in temperature in C° = energy in joules

Efficiency of Kettle = $\frac{\text{Output Energy}}{\text{Input Energy}}$ **x 100%**

PROCEDURAL STEPS

Step 1	
Step 2	
Step 3	
Step 4	
Step 5	
Step 6	
Step 7	
Step 8	

TEST / EVALUATE

Other Devices and Their Efficiencies

Device	Input Energy	Output Energy	Efficiency

Possible Sources of Error

6. _____

_____

_____

_____

Communicate

7. _____

_____

_____

8. _____

_____

_____

_____

9. _____

_____

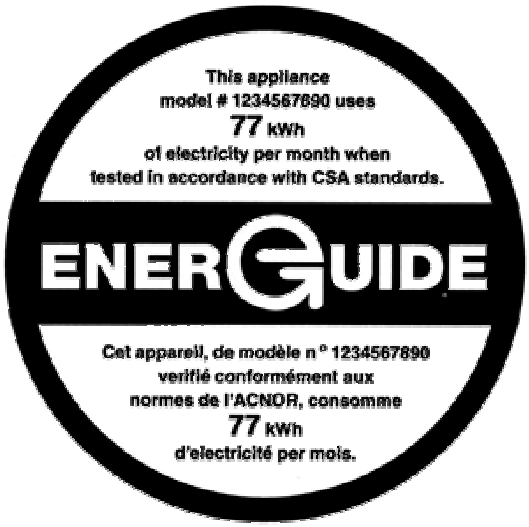
_____

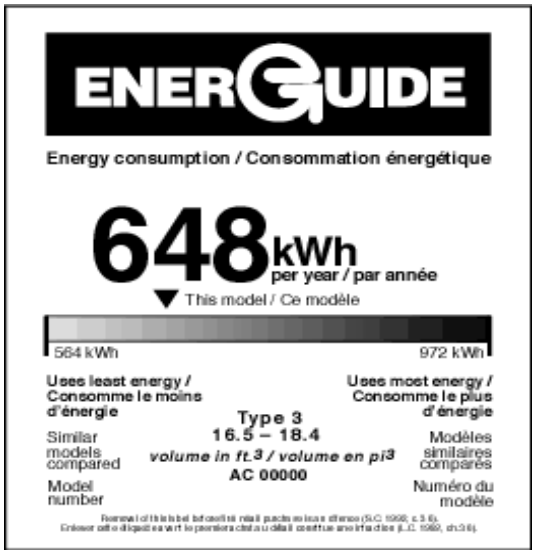
_____

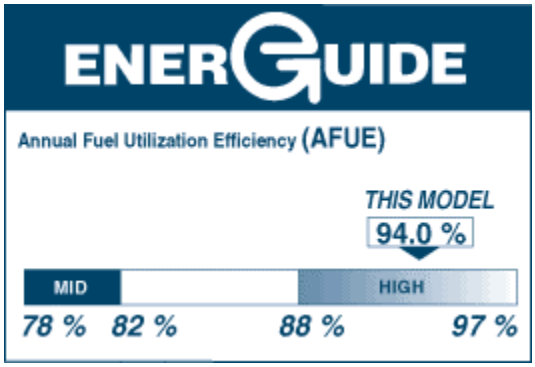
GIVE IT A TRY SHOPPING FOR APPLIANCES (p. 339)

Purpose:

Check out various ENERGUIDE stickers, like the ones below, for large and small appliances and report your findings to the class







GIVE IT A TRY ENERGY NEWS (p. 348)

Purpose: To find out about different energy sources and compare them

Choose any two of the energy sources provided and make comparisons as listed in the table and then present your findings to the class in a creative way.

WIND
NUCLEAR
GEOTHERMAL
WAVES
NATURAL GAS
FUEL CELLS
COAL
SOLAR
TIDAL
BIOMASS

Comparative Factor		
availability		
cost		
sustainability		
environmental impact		
applications		
safety		

Activity D-12 Problem Solving **Harness The Wind**

NEED Various degrees of winds can be harnesses to generate electricity

PROBLEM: Can you design a windmill that operates well in low and high winds?

SPECIFICATIONS in the textbook p. 349 **Criteria for Success**

- Free-standing (but it can be anchored to the foundation it rests on)
- Turning shaft must be connected to the armature of a small electric motor, so the motor runs
- It must produce a detectable current
- Must function in a stable manner when tested with a fan at different distances.

LIST OF MATERIALS

_____

_____

_____

_____

_____

_____

_____

_____

BLUEPRINT

TEST / EVALUATE

COMMUNICATE 5. _____

_____

_____

6. a) reliability _____

b) safety _____

c) current generating efficiency _____

_____

GIVE IT A TRY NUMBER RACE (p. 355)

Purpose: To compare the time it takes to do a calculation with a calculator and without one

W/ Calculator	Problem	W/O Calculator
	345 + 582 + 681 + 984 + 557 + 618 + 343 + 783 + 295 + 235	
	345 - 582 + 681 - 984 + 557 + 618 - 343 + 783 - 295 + 235	
	345 - 582 - 681 + 984 - 557 + 618 - 343 + 783 + 295 - 235	
	345 + 582 - 681 - 984 - 557 + 618 - 343 + 783 - 295 + 235	
	345 - 582 + 681 + 984 - 557 + 618 + 343 + 783 - 295 + 235	
	345 + 582 - 681 - 984 + 557 - 618 + 343 + 783 + 295 + 235	
	345 - 582 + 681 + 984 - 557 - 618 + 343 - 783 + 295 - 235	
	345 + 582 - 681 - 984 + 557 - 618 + 343 + 783 - 295 - 235	
	345 - 582 - 681 - 984 - 557 - 618 - 343 - 783 - 295 - 235	

In what way is an electronic device **better** for doing calculations?

_____

On what way is an electronic device **worse**?

_____

How you do a similar test with **words**?

_____

_____

_____

_____

_____