Learning and Evaluation Situation

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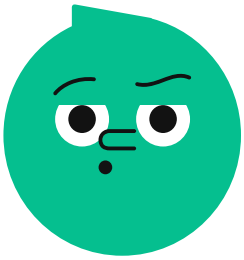

Apply Your New Knowledge!

The following questions will help you check your understanding of electrical power, electrical energy, and energy efficiency.

1. In a toaster, the heating elements are responsible for transforming energy. What form(s) does the energy take?

- Energy consumed: _____

- Useful energy: _____

Teacher's Comments	The student does not identify the forms of energy.	0
	The student correctly identifies one form of energy.	1
	The student correctly identifies both forms of energy.	2

2. The toaster has a power of 1 ,600 W and operates for 4 min. 30 sec.
Calculate the electrical energy consumed.

Teacher's Comments	The student does not use an appropriate calculation method.	0
	The student uses an appropriate calculation method, but their work includes one or more major errors.	1
	The student uses an appropriate calculation method, but their work includes several minor errors.	2
	The student uses an appropriate calculation method, but their work includes one minor error.	3
	The student uses an appropriate calculation method.	4

3. Assuming the toaster has an energy efficiency of 30 %, calculate the amount of useful energy.

Teacher's Comments		
	The student does not use an appropriate calculation method.	0
	The student uses an appropriate calculation method, but their work includes one or more major errors.	1
	The student uses an appropriate calculation method, but their work includes several minor errors.	2
	The student uses an appropriate calculation method, but their work includes one minor error.	3
	The student uses an appropriate calculation method.	4

4. Now, calculate the dissipated energy.

Teacher's Comments		
	The student does not use an appropriate calculation method.	0
	The student uses an appropriate calculation method, but their work includes one or more errors.	1
	The student uses an appropriate calculation method.	2

Challenge

Hydro-Québec measures electrical energy consumed in kilowatt-hours (kWh) rather than in joules (J). The formula used to calculate electrical energy consumed is shown below.

$$E = P\Delta t$$

E : Energy consumed in kilowatt hour (kWh)
P : Electrical power in kilowatts (kW)
Δt : time difference in hours (h)

Conversions

1 kW = 1 000 W
1 h = 60 min = 3 600 s
1 kWh = 3 600 000 J

Given that Hydro-Québec charges approximately $0.09 per kWh, complete the following table.

Appliance	Water Heater	Dishwasher	Stove	Dryer
Power	3 800 W		2,70 kW	5 000 W
Usage Time (variable units)	30 min	1 h 45 min		
Energy Consumed (kWh)			1,80	
Cost ($)		0,22		0,38
Useful Energy (kWh)	1,48		1,30	
Energy Efficiency (%)		60		45