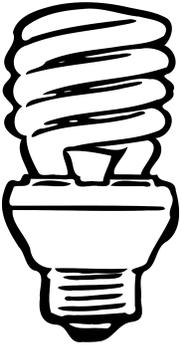# Light Bulb Comparison Worksheet

Purpose: Let's explore energy use and energy efficiency by comparing the electricity consumption of different light bulbs.

THE FACTS:			
Acronym	LED	CFL	
Definition	Light-Emitting Diode	Compact Fluorescent Lamp	Incandescent
Picture			
Energy used	9 watts = 0.009 kWh	23 watts = 0.023 kWh	60 watts = 0.06 kWh
Lifespan of bulb	25,000 hours	12,000 hours	1,000 hours
Average use per day	5 hours		
Estimated light bulbs per house	20 light bulbs		
Price of electricity in NS	$0.15/kWh		

Light Bulb Comparison Calculations

1. **a) How much energy is consumed by 20 incandescent light bulbs used for five hours per day for a year?**

   _____W ÷ 1000 W/kWh = _____ kWh

   _____kWh x 5h/day = _____kWh/day

   _____kWh/day x 365 days = _____kWh/yr

   _____kWh/yr x 20 incandescent bulbs per house = _____kWh/yr per house

   b) What is the annual cost?

   _____kWh/yr per house x $0.15/kWh = $_____/yr

2. **a) How much energy is consumed by 20 CFL light bulbs used for five hours per day for a year?**

   _____W ÷ 1000 W/kWh = _____ kWh

   _____kWh x 5h/day = _____kWh/day

   _____kWh/day x 365 days/yr = _____kWh/yr

   _____kWh/yr x 20 incandescent bulbs per house = _____kWh/yr per house

   b) What is the annual cost?

   _____kWh/yr per house x $0.15/kWh = $_____/yr

3. a) How much energy is consumed by 20 LED light bulbs used for five hours per day for a year?

_____W ÷ 1000 W/kWh = _____ kWh

_____kWh x 5h/day = _____kWh/day

_____kWh/day x 365 days/yr = _____kWh/yr

_____kWh/yr x 20 incandescent bulbs per house = _____kWh/yr per house

b) What is the annual cost?

_____kWh/yr per house x $0.15/kWh = $_____/yr

Conclusion:

	Light-Emitting Diode (LED) light bulb	Compact Fluorescent Light (CFL) light bulb	Incandescent light bulb
Annual energy cost (5hrs/day)			

Light Bulb Comparison Discussion

1. Which type of light bulb has the **highest** electricity cost for a year?

_____

2. Which type of light bulb has the **lowest** electricity cost for a year?

_____

3. How much money would you **save** in electricity costs in a year if you switched all 20 incandescent light bulbs to LEDs? How much would you save if you switched 40 bulbs?

_____

4. How much money would you **save** in electricity costs for a year if you switched all 20 CFL light bulbs to LEDs? How much would you save if you switched 40 bulbs?

_____

5. How much money would you **save** in electricity costs for a year if you used 20 incandescent bulbs for half the amount of time, so 2.5 hours per day rather than 5 hours per day?

_____

6. Which strategy would you **save** more in electricity costs for a year, by reducing your light bulb use by half the amount of time as in Question 5 or by switching from incandescent to LED light bulbs as in Question 3?

_____

Light Bulb Comparison - Answer Key

Calculations:

1. a) How much does energy is used by 20 **incandescent** light bulbs for five hours per day for a year? b) What is the **annual cost**?	60 W ÷ 1000 W/kWh = 0.06 kWh 0.06 kWh x 5h/day = 0.3 kWh/day 0.3 kWh/day x 365 days = 109.5 kWh/yr 109.5 kWh/yr x 20 incandescent bulbs per house = 2190 kWh/yr 2190 kWh/yr x $0.15/kWh = $ 328.50/yr
2. a) How much energy is used by 20 **CFL** light bulbs for five hours per day for a year? b) What is the **annual cost**?	23 W ÷ 1000 W/kWh = 0.023 kWh 0.023 kWh x 5h/day = 0.115 kWh/day 0.115 kWh/day x 365 days/yr = 41.975 kWh/yr 41.975 kWh/yr x 20 CFL light bulbs per house = 839.5 kWh/yr 839.5 kWh/yr x $0.15/kWh = $ 125.93/yr
3. a) How much energy is used by 20 **LED** light bulbs for five hours per day for a year? b) What is the **annual cost**?	9 W ÷ 1000 W/kWh = 0.009 kWh 0.009 kWh x 5h/day = 0.045 kWh/day 0.045kWh/day x 365 days/yr = 16.425 kWh/yr 16.425 kWh/yr x 20 LED light bulbs per house = 328.5 kWh/yr 328.5 kWh/yr x $0.15/kWh = $ 49.28/yr

Discussion:

1. Which type of light bulb has the **highest** electricity cost for a year?	INCANDESCENT
2. Which type of light bulb has the **lowest** electricity cost for a year?	LED
3. a) How much money would you **save** in electricity costs in a year if you switched all 20 incandescent light bulbs to LEDs? b) How much would you save if you made this switch for a home with 40 bulbs?	a) $328.50 - $49.28 = $ 279.22 saved b) (2 x $328.50) - (2 x $49.28) = $ 558.44 saved
4. a) How much money would you **save** in electricity costs for a year if you switched all 20 CFL light bulbs to LEDs? b) How much would you save if you switched 40 bulbs?	a) $ 125.93/yr - $ 49.28/yr = $ 76.65 saved b) (2 x $ 125.93) - (2 x $ 49.28) = $ 153.30 saved
5. How much money would you **save** in electricity costs for a year if you used 20 incandescent bulbs for half the amount of time, so the usage would be 2.5 hours per day rather than 5 hours per day?	60 W ÷ 1000 W/kWh = 0.06 kWh 0.06 kWh x 2.5h/day = 0.15 kWh/day 0.15 kWh/day x 365 days = 54.75 kWh/yr 54.75 kWh/yr x 20 incandescent bulbs per house = 1095 kWh/yr 1095 kWh/yr x $0.15/kWh = $ 164.25/yr $ 328.50/yr (5 hr/day) - $ 164.25/yr (2.5 hr/day) = $ 164.25 saved
6. Which strategy would you **save** more in electricity costs for a year: reducing your light bulb use by half the amount of time as in Question 5, or switching from incandescent to LED light bulbs as in Question 3?	The situation in Question 3 would save more money than the situation in Question 5 because it saves more if you replace 20 incandescent light bulbs with 20 LED light bulbs rather than using incandescent bulbs for half the amount of time.

CURRICULUM LINKS

Grade 6 Mathematics
N02: Students will be expected to solve problems involving whole numbers and decimal numbers

Grade 6 Science
Consumption and Conservation: Describe how our actions could lead to reducing electrical energy consumption in your environment (108-5, 108-8, 303-30, 106-3)

Grade 7 Mathematics
SCO N02: Students will be expected to demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals to solve problems (for more than one-digit divisors or more than two-digit multipliers, the use of technology is expected).
- **B14** solve and pose problems that utilize addition, subtraction, multiplication, and division of integers
- **D3** develop and use rate as a tool for solving indirect measurement problems in a variety of contexts

Grade 7 Science
GCO 1: Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

Grade 8 Mathematics
N04 Students will be expected to demonstrate an understanding of ratio and rate
N07 Students will be expected to demonstrate an understanding of multiplication and division of integers, concretely, pictorially, and symbolically.

Grade 9 Mathematics
Students are expected to communicate in order to learn and express their understanding of mathematics (Communication [C])
- Connect mathematical ideas to other concepts in mathematics, to everyday experiences, and to other disciplines (Connections [CN])
GCO: Students will demonstrate operation sense and apply operation principles and procedures in both numeric and algebraic situations.
- **B1** model, solve, and create problems involving real numbers
- **B2** add, subtract, multiply, and divide rational numbers in fractional and decimal forms using the most appropriate methods

Grade 9 Science
Use of Electrical Energy
- Relate electrical energy to domestic power consumption costs: Watt as a unit of power (1W = 1J/s) (308-18)
- Make informed decisions and propose a course of action on science, technology, and social issues, including human and environmental needs for electricity and energy (113-9, 113-13)

Grade 10 Mathematics
Performance Indicators
- **N01.01** Compare the unit price of two or more given items.
- **N01.02** Solve problems that involve determining the best buy, and explain the choice in terms of the cost as well as other factors, such as quality and quantity.

Grade 11 Mathematics
Performance Indicators
- **A03** Students will be expected to solve problems by applying proportional reasoning and unit analysis.
- **A03.01** Explain the process of unit analysis used to solve a problem (e.g., given kmh and time in hours, determine how many kilometers; given revolutions per minute, determine the number of seconds per revolution).
- **A03.02** Solve a problem, using unit analysis.
- **A03.03** Explain, using an example, how unit analysis and proportional reasoning are related (e.g., to change kmh to km/min., multiply by 1 h/60 min. because hours and minutes are proportional [constant relationship]).
- **A03.04** Solve a problem within and between systems using proportions or tables (e.g., km to m or kmh to ft./sec.).

Grade 12 Mathematics
- **N03.03** Generate options that might improve the profitability of a small business