

Energy Efficiency Worksheet

Multiple Choice

1. A motor with an energy efficiency of 80% consumed 360 000 J of electrical energy. While it was in operation, 72 000 J of energy were dissipated in the form of heat and sound. How much useful energy is provided by this motor?
 A) 57 600 J B) 216 000 J C) 230 400 J **D) 288 000 J**

$$\frac{80}{100} = \frac{x}{360000} =$$

2. 75 Joules of energy enter a light bulb. 30 joules of energy are transformed into light, how much energy is dissipated as heat?
 A) 16 J **B) 45 J** C) 80 J D) 105 J

$$75 - 30 = 45$$

3. A technician examines different electrical devices to determine the one that is the most energy efficient. While conducting a test, he notes that one of these devices consumes 550 000 J of energy and loses 315 000 J at the same time. What is the energy efficiency of this device?
 A) **42.7%** B) 57.2% C) 68.1% D) 174.6%

$$\% = \frac{U}{C} = \frac{235000}{550000} \leftarrow (550000 - 315000)$$

4. 30 Joules of energy enter a light bulb. 20 joules of energy are transformed into light, how much energy is dissipated as heat?
 A) 6.7 joules **B) 10 joules** C) 13 joules D) 100 joules

$$30 - 20 = 10$$

Short Answer

5. A microwave oven with a power of 1 500 W heated the water in a bowl for 30 seconds. The water absorbed 27 kJ of energy during that time. What is the energy efficiency of this microwave oven?

convert to kJ ↑

$$\% = \frac{U}{C} = \frac{27}{45} = \frac{27}{50000} \quad E = P t = 1500 \times 30 = 45000$$

60% 45 kJ

6. A fridge that is 77% efficient consumes 3 500 J of energy. How much useful energy does it provide? /2

$$\frac{77}{100} = \frac{x}{3500} = \text{2695J}$$

7. An electric motor consumed 900 000 J of energy over a certain amount of time. Given that it dissipated 80 000 J in the form of heat and 10 000 J in the form of sound energy over a certain amount of time.

a) how much useful energy did the motor provide?

$$900\,000 - 80\,000 - 10\,000 \text{ lost}$$

$$\underline{810\,000 \text{ J}}$$

b) What is the energy efficiency of this motor?

$$\% = \frac{U}{C} \quad \frac{810\,000 \times 100}{900\,000} = \underline{90\%}$$

8. A microwave oven is used to heat up the water in a bowl. The following table provides information on the energy involved is in operation.

Energy consumed by the microwave oven	Useful energy required to heat up the water	Energy dissipated while the water is heated up
24 000 J	?	6 000

What is the energy efficiency of the microwave oven?

$$\% = \frac{U}{C} \quad \frac{18000}{24000} = \underline{75\%} \rightarrow (24000 - 6000)$$

9. A television that is 88% efficient provides 220 kWh of useful energy. How much energy does it consume?

$$\frac{88}{100} = \frac{220}{x} = \underline{250 \text{ kWh}}$$

10. A technician examines different electrical devices to determine the one that is the most energy efficient. While conducting a test, he notes that one of these devices consumes 5 000 J of energy and loses 1 200 J at the same time. What is the energy efficiency of this device?

$$\% = \frac{U}{C} \quad \frac{3800}{5000} = \underline{76\%} \rightarrow (5000 - 1200)$$

11. A computer that is 87% efficient consumes 375 kWh of energy. How much useful energy does it provide?

$$\frac{87}{100} = \frac{x}{375} = \underline{326.3 \text{ kWh}}$$

12. A television that is 83% efficient provides 4 600 J of useful energy. How much energy does it consume?

$$\frac{83}{100} = \frac{4600}{x} = 5542 \text{ J}$$

13. The table below has three different hairdryer models. Which is most energy efficient?

	Model A	Model B	Model C
Useful energy	450 kWh	700 kWh	600 kWh
Energy consumed	520 kWh	770 kWh	630 kWh

(A)

$$\frac{450 \times 100}{520} = 87\%$$

(B)

$$\frac{700 \times 100}{770} = 91\%$$

(C) model C

$$\frac{600 \times 100}{630} = 95\%$$

14. The following table provides information on the energy used by the motors of two pencil sharpeners.

Fan	Useful energy (Blades turning)	Energy dispersed (not useful)	Total amount of energy consumed
Sharpener A	17 786 000 J	+ 356 000 J	18 142 000 J
Sharpener B	167 kWh	89 kWh	256 kWh

Which of these two sharpeners is more energy efficient?

A best

A

$$\frac{17\,786\,000}{18\,142\,000} \times 100 = 98\%$$

B

$$\frac{167 \times 100}{256} = 65\%$$

15. A technician examines different electrical devices to determine the one that is the most energy efficient. While conducting a test, he notes that one of these devices consumes 72 000 J of energy and loses 30 000 J at the same time. What is the energy efficiency of this device?

$$\frac{(72000 - 30000)}{72000} \times 100 = 58\%$$

16. Your heating system is 45 percent energy efficient.

- a) What amount of energy would it consume to transform 9000 kWh into useful thermal energy for heating the house during the winter?

$$\frac{45}{100} = \frac{9000}{x} = 20000 \text{ kWh}$$

New System

- b) Changing the insulation would increase your house to 85 percent energy efficient. The cost to change the insulation is 3000\$. The cost of heating is 7 cents/kWh. How many years will it take to recover your investment?

$$\frac{85}{100} = \frac{9000}{x}$$

10588 kWh.

$$20000 \times 0.07 = \$1400$$

$$10588 \times 0.07 = \$741$$

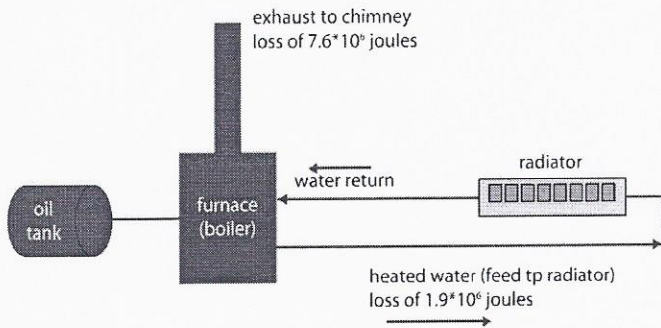
$$1400 - 741 = 659 \text{ saved/year}$$

$$3000 / 659 = 4.5 \text{ years}$$

17. Some homes are still heated by hot water boiler furnaces. The components of the system are an oil tank, a furnace, water pipes and radiators.

The furnace burns the oil from the storage tank. The heat released is used to heat water which is then pumped to radiators throughout the house. A diagram is shown below.

Furnace System



If all the heat from the combustion was used to heat the water, the system would be 100% efficient. However, some heat is lost in the furnace exhaust and some is lost from the pipes delivering the water to the radiators.

One litre of oil delivers 38 000 kJ of energy. 7 600 kJ are lost to the exhaust, and 900 kJ are lost in transporting the hot water to the radiators.

Determine the efficiency of this heating system.

$$\frac{38000 - 7600 - 900}{38000} \times 100 = 75\%$$