Energy and Efficiency Comprehension Worksheet

Name:

Energy is the ability to do work. Work is done when a force moves an object. Both energy and work are measured in joules (J). The law of conservation states that energy cannot be created or destroyed, only transferred and transformed. An energy transfer is when energy is moved from one object to another e.g. when kicking a ball, the kinetic energy from your leg is transferred into the ball. An energy transformation is when energy changes from one type to another e.g. a lightbulb transforms electrical energy into thermal (heat) and radiant (light) energy.

Whenever energy is transformed, it will into at least 2 types of energy. The energy we wanted to make in an energy transformation is termed ‘useful’ energy. The energy we did not want to make in an energy transformation is called ‘waste’ energy. For example; a lightbulb produces both light and thermal energy. The light is the energy we want to create, so light is the useful energy. We did not want to create thermal energy, so that is the waste energy.

Efficiency is a measure (as a percentage) of how much useful energy is made in a transformation, compared to how much waste energy is made. In an efficient energy transformation, very little waste energy is made.

1. What is energy?

_____

_____

2. When is work done?

_____

_____

3. What unit is energy measured in?

_____

4. What does the law of conservation of energy state?

_____

_____

5. What is an energy transfer?

_____

_____

6. Give TWO examples of an energy transfer

_____

_____

_____

7. What is an energy transformation?

_____

_____

8. Give TWO examples of an energy transformation

_____

_____

_____

_____

9. What is ‘useful’ energy?

_____

_____

10. What is ‘waste’ energy?

_____

_____

11. A fan transforms electrical energy into both heat and kinetic energy.

a) Which is the useful energy?

_____

b) Which is the waste energy?

_____

12. What is efficiency?

_____

_____

13. a) An efficient lightbulb would make lots of _____ energy

b) An efficient lightbulb would make small amounts of _____ energy

ENERGY EFFICIENCY CALCULATIONS

1. A fan uses 1000 J of electrical energy to produce 150 J of kinetic energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad}{\qquad} \times 100$$

Efficiency =

2. A torch uses 500 J of chemical energy to make 5 J of light energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad}{\qquad} \times 100$$

Efficiency =

3. A toaster uses 2000 J of electrical energy to produce 1000 J of thermal energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad}{\qquad} \times 100$$

Efficiency =

4. A lightbulb transforms 125 J of electrical energy into 25 J of light energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad}{\qquad} \times 100$$

Efficiency =

5. An iron transforms 1160 J of electrical energy into 830 J of thermal energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad}{\qquad} \times 100$$

Efficiency =

6. A wind turbine transforms 3590 J of kinetic energy into 1000 J of electrical energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad\qquad}{\qquad\qquad} \times 100$$

Efficiency =

7. A car uses 7500 J of chemical energy to make 6000 J of kinetic energy and 1500 J of sound energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad\qquad}{\qquad\qquad} \times 100$$

Efficiency =

8. A wind up toy stores 845 J of elastic energy and transforms it into 45 J of sound energy and 800 J of kinetic energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad\qquad}{\qquad\qquad} \times 100$$

Efficiency =

9. A phone screen makes 90 J of light energy and 110 J of thermal energy from 200 J of chemical energy in its battery

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad}{\qquad} \times 100$$

Efficiency =

10. A fan makes 800 J of thermal energy and 250 J of kinetic energy from 1050 J of electrical energy

Amount of useful energy output = _____

Amount of energy input = _____

Substitute the numbers into the equation

$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\text{Efficiency} = \frac{\qquad}{\qquad} \times 100$$

Efficiency =

11. A fan makes 800 J of thermal energy and 250 J of kinetic energy from 1050 J of electrical energy

12. A microwave makes 50 J of sound energy and 680 J of thermal energy from 730 J of electrical energy

13. An engine has an energy input of 100 J and gives out 27 J of useful kinetic energy. What is the efficiency of the engine?

14. A hair dryer has an energy input of 1500 J and gives out 1300 J of useful energy. What is the efficiency of the hair dryer?

15. Fred's petrol engine takes in 2000 J of chemical energy and makes 400 J of kinetic energy. How efficient is the engine?

16. Fred's diesel engine takes in 3000 J of chemical energy and makes 800 J of kinetic energy. How efficient is the engine?

17. Fred's hairdryer takes in 1200 J of electrical energy and gives out 1000 J as thermal energy and energy and 200 J as sound energy. How efficient is it?

18. Fred's light bulb takes in 60 J of electrical energy and gives out 54 J as thermal energy and 6 J as light energy. How efficient is it?

19. Jane’s lawnmower takes in 1500 J of energy and gives out 500 J of kinetic energy. 400 J is also given out as sound energy and 600 J as thermal energy. How efficient is it?

20. A battery powered fan makes 500 J of kinetic energy and 3500 J of thermal energy
    HINT: Calculate what the energy input must be first

21. A torch makes 400 J of thermal energy and 30 J of light energy
    HINT: Calculate what the energy input must be first

22. A crane uses petrol to lift a piano up in the air giving it 2400 J of gravitational potential energy, but producing 800 J of thermal energy and 200 J of sound energy

23. Mr Montgomery’s computer uses 4500 J of electrical energy to make 500 J of light energy from the screen and 200 J of sound energy from the speakers. The rest of the energy is transformed into thermal energy.