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?

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1. When is work done?

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1. What unit is energy measured in?

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

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1. What is an energy transfer?

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1. Give TWO examples of an energy transfer

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1. What is an energy transformation?

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1. Give TWO examples of an energy transformation

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1. What is ‘useful’ energy?

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1. What is ‘waste’ energy?

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1. A fan transforms electrical energy into both heat and kinetic energy.
2. Which is the useful energy?

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1. Which is the waste energy?

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1. What is efficiency?

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1. a) An efficient lightbulb would make lots of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy
2. 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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. **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

x 100

x 100

Efficiency =

1. A fan makes 800 J of thermal energy and 250 J of kinetic energy from 1050 J of electrical energy
2. A microwave makes 50 J of sound energy and 680 J of thermal energy from 730 J of electrical energy
3. 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?
4. 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?
5. Fred’s petrol engine takes in 2000 J of chemical energy and makes 400 J of kinetic energy. How efficient is the engine?
6. Fred’s diesel engine takes in 3000 J of chemical energy and makes 800 J of kinetic energy. How efficient is the engine?
7. 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?
8. 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?
9. 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?
10. 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

1. A torch makes 400 J of thermal energy and 30 J of light energy

HINT: Calculate what the energy input must be first

1. 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
2. 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.