## PW6. Explain energy conservation and analyse processes in terms of energy changes and dissipation

Energy is the ability to do work or move something. It is measured in Joules (J).

The law of conservation of energy states that energy cannot be created or destroyed but can be converted from one form to another.

Q1: Use the forms of energy in the list below to complete the following sentences. Each word can be used once.

***POTENTIAL*** ***CHEMICAL*** ***KINETIC*** ***SOUND*** ***ELECTRICAL***

(i) Vibrations cause _____ energy.

(ii) Energy stored in a battery or food is called _____ energy.

(iii) Energy just waiting to do work is called _____ energy.

(iv) We mainly use _____ energy in our homes.

(v) Any moving object has _____ energy.

Q2: Use the forms of energy in the list below to complete the following sentences about energy conversions (changing one form of energy into another). Each word can be used once.

***POTENTIAL*** ***CHEMICAL*** ***KINETIC*** ***SOUND*** ***ELECTRICAL*** ***LIGHT***

(i) A lightbulb converts _____ energy into _____ and heat energy.

(ii) A moving car converts the chemical energy in fuel into _____ energy.

(iii) A radio converts electrical energy into _____ energy.

(iv) An object about to fall converts _____ energy into kinetic energy as it falls.

(v) The _____ energy in fuel is converted into heat energy by burning

Q3: The diagram shows a common light bulb. Complete the table below by writing a tick √ beside the **TWO** main energy changes that take place when the bulb is in use.

| | |
|---|---|
| | Electrical to light |
| | Electrical to sound |
| | Electrical to heat |
| | Chemical to heat |
| | Heat to light |

Q4: When you turn a light on, all of the electrical energy is not converted into light energy because some of it is wasted as heat energy. In fact, most of the energy produced on earth ends up as wasted heat.

(a) Give another example of where energy is wasted as heat.

_____

_____

(b) How can we prevent some of this energy from being wasted?

_____

_____

Dissipation: Energy lost to less useful forms. Usually heat and sound energy.

Q5: Fill in the blank and circle the correct answer:

***DISSIPATION*** ***KINETIC*** ***SOUND*** ***ENERGY*** ***FRICTION*** ***HEAT***

After a ball hits the ground, its _____ energy is converted to other forms of _____. When the ball hits the ground it makes a sound therefore we can say that some of the Kinetic energy is converted to _____ energy. After continuous bouncing the ball begins to heat up. This is caused by _____ between the ball and the ground. Therefore, we can say that some of the kinetic energy is converted to _____ energy. When energy is lost to less useful forms it is called _____.

Efficiency of a device can be calculated using the following formula:

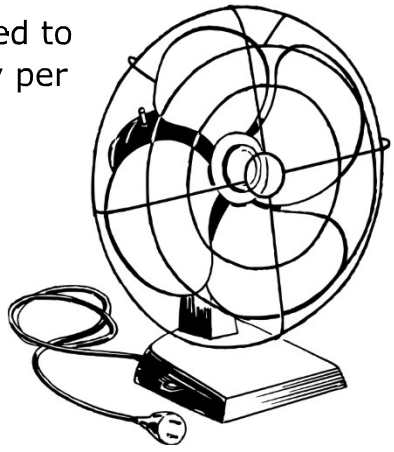
$$Efficiency\ (\%) = \frac{Useful\ Output}{Input}\ x\ \frac{100}{1}$$

Q6: Find the efficiency of a lightbulb if when supplied with 100J of electrical energy, it produces 90 J of heat energy and 10 J of light energy.

Q7: Find the efficiency of a lightbulb if when supplied with 100J of electrical energy, it produces 70 J of heat energy and 30 J of light energy.

Q8: Find the efficiency of a kettle which produces 50,000J of heat energy, and 10,000J of sound energy when 60,000 J of energy is supplied. Calculate the efficiency of the kettle?

Q9: The blades of this fan are turned by a motor when connected to the electric mains. The mains supplies 200 J of electrical energy per second. It takes 170 J of energy to turn the fan. The remaining energy is dissipated.



a) How much energy in Joules was dissipated?

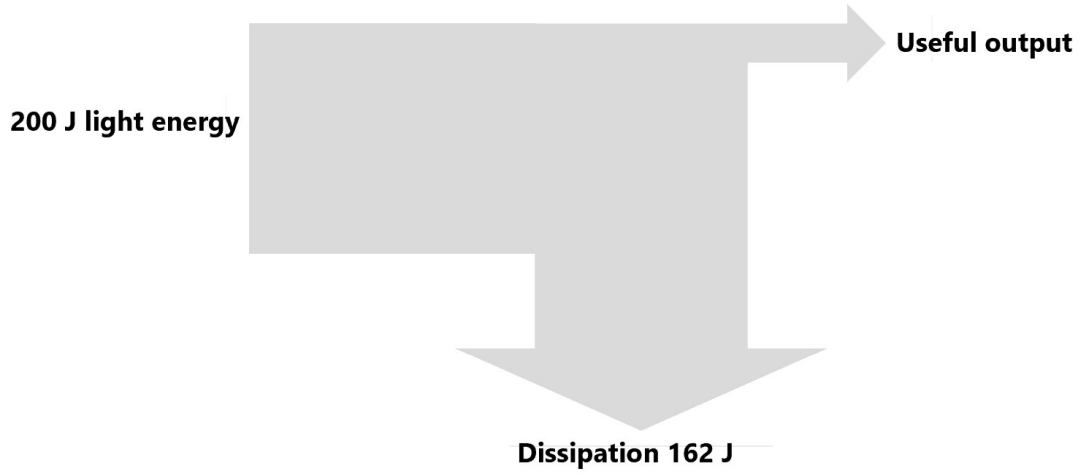
b) What form of energy could this energy be dissipated as?

c) Calculate the efficiency of the fan

Answer: _____ %

Q10: Sankey Diagrams give a visual of input and output energy.

Study the Sankey diagram of a solar panel which receives 200 J of energy and answer the questions that follow.




a) How much useful energy is generated? _____

b) What type of energy would the "Useful Output" be for a solar panel? _____

c) What type of energy would the "dissipation" be for a solar panel? _____

d) Calculate the efficiency of the solar panel:

Answer: _____ %

Cost of electricity

Electricity companies sell units of electricity. These units are called kilowatt-hours.
1 unit = 1 kilowatt-hour (kWh).
A kilowatt-hour is the amount of energy provided when 1 kilowatt of power is used for one hour.

| Number of kilowatt-hours used = Power of appliance (in kilowatts) x time (in hours) |
|---|

Remember that 1 kilowatt (kW) = 1000 watts (W)

Multiply the number of kilowatt-hours used by the price per kilowatt-hour to get the total price of using the appliance.

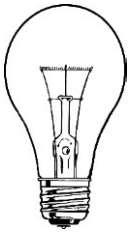
Q11: The ESB charges for electricity at a rate of 11 cent per kWh. A hair-drier of power rating 1.5 kW is used for 1 hour each day.

(i) How many units of electricity are used?

(ii) What is the cost, in cent, of using the hair- drier for six days?

Q12: A normal 100 W light bulb costs about €1.60 to buy. An 'energy-saving' bulb only uses about 18 W to produce the same amount of light. It costs €6.50. (100 W = 0.1 kW, and 18 W = 0.018 kW) The cost of 1 kWh is 6 cent. Calculate the cost of running each bulb for 6 hours. (Show all workings)

Normal Bulb:

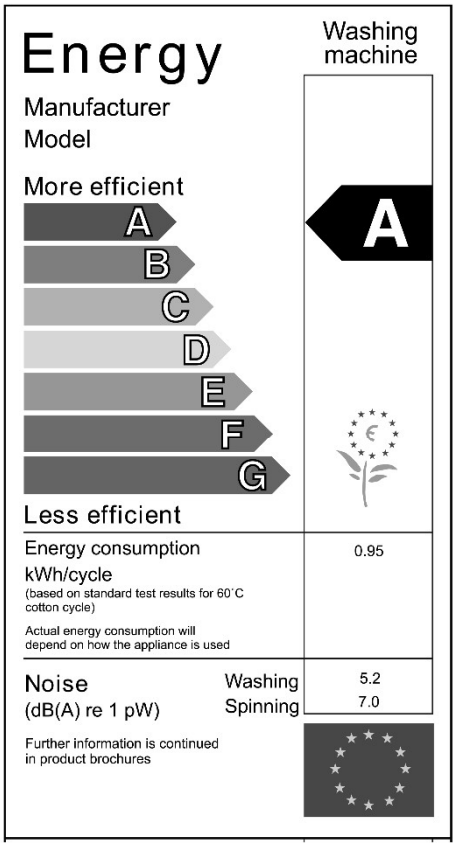


Energy saving Bulb:

Calculate the cost of running each bulb for 6 hours a day for a year

The energy saving light bulb is more expensive but is has a lifespan of 6000hours. The normal light bulb has a lifespan of 1000 hours. Using this information and the calculations above, write a paragraph encouraging people to use energy saving light bulbs with reasons.

Q13: Electrical Equipment




This EU energy label is found on many appliances used in the home. The labels rate each appliance for its energy efficiency.

It also tells us how many units (kWh) of electrical energy the washing machine uses in a standard wash cycle. You multiply this number by the cost per Unit of electricity to find out how much it costs per wash.

Cost per wash = Units per cycle X Cost per Unit

Martin bought a washing machine with the label shown. He runs it twice a week.

How much does it cost him to run the machine for one week if electricity costs 6 cent per kWh?

How much would it cost Martin per year?

His previous washing machine used 2.5kwh per wash cycle. How much money has he saved over one year by using a more efficient machine?

What other things might someone think about when choosing a washing machine?