Y7 Energy Knowledge Organiser

Energy Units

Energy changes are measured in joules (J) or kilojoules (kJ).

1000 J = 1kJ

To convert from J to kJ, divide by 1000.

Example: Convert 3000J into kilojoules.

3000J ÷ 1000 = 3kJ

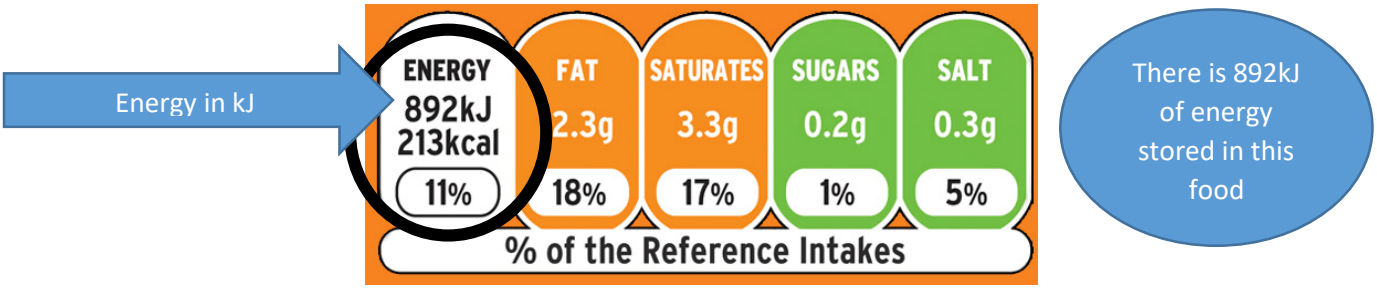
To convert from kJ to J, times by 1000.

Example: Convert 2kJ into joules.

2kJ x 1000 = 2000J

Energy in food – Food Labels

Energy stored in food can be released by combustion (burning) or by respiration in our cells. The labels on packets of food show how much energy is available from the food.

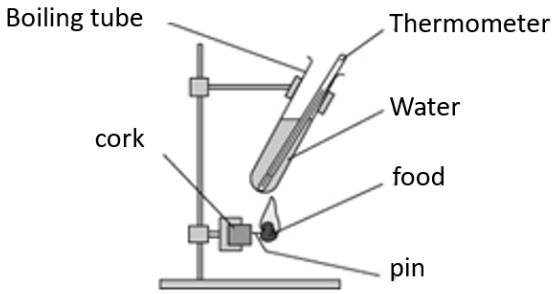


The amount of energy stored in food may be shown in a unit called the calorie (kcal), as in the photograph. However, the scientific unit for energy is the joule, which has the symbol J.

A lot of energy is stored in most foods, so food labels usually show kJ (kilojoules) instead of J.

Energy in food experiment

Equipment



Method

1. Choose three different types of food and draw a results table
2. Put one piece of food on the pin and find the mass of the cork, pin and food together. Write the name of your food in your table.
3. Use the measuring cylinder to measure 10cm^3 of water, and put it into the boiling tube. Record the temperature of the water.
4. Light the food using the Bunsen burner, and hold the burning food under the boiling tube. Make sure the flame is touching the boiling tube.
5. When the food has finished burning record the temperature of the water again. Let the food cool down and find the total mass of the cork, pin and food remaining on it.
6. Repeat for the other foods.

Example Results

Food	**Temperature at the beginning (°C)**	**Temperature at the end (°C)**	**Temperature difference (°C)**
salted peanuts	19	31	12
cashew nuts	20	33	13
raisins	21	27	6

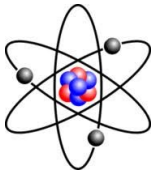
Temperature change = temperature at the end – temperature at the beginning

Conclusion

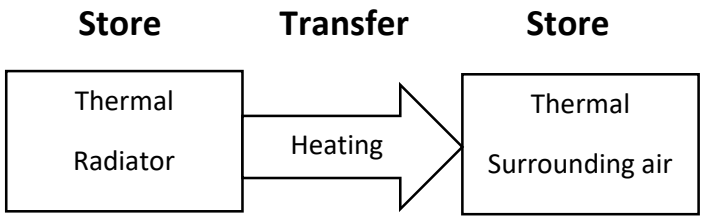
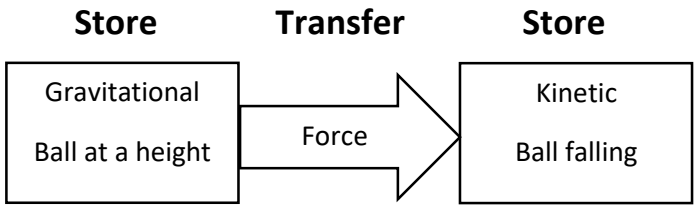
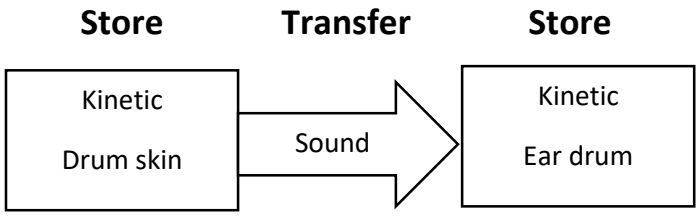
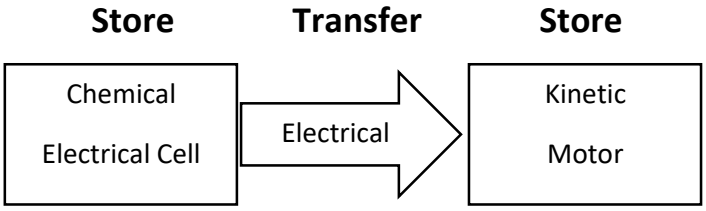
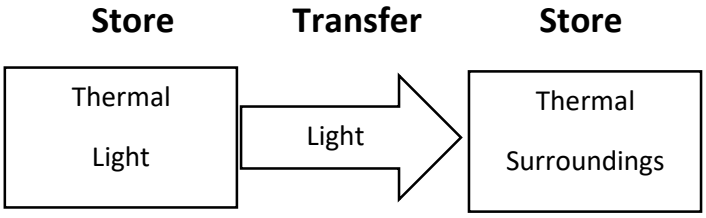
When the food is burned, the energy stored in it is transferred to the water and made it hotter.

The food that gave the highest temperature change was cashew nuts, this means it stored the most chemical energy.

Energy Stores

Key word	Description	Examples	Picture
Magnetic	The energy stored in two separated magnets that are attracting, or repelling	Fridge magnets, compasses.	
Thermal	The energy stored in a warm object.	Human bodies, hot coffees, stoves or hobs.	
Chemical	The energy stored in chemical bonds, such as those between molecules.	Food, muscles, electrical cells.	
Kinetic	The energy stored in a moving object	Runners, moving buses, moving cars.	
Electrostatic	The energy stored in two separated electric charges that are attracting, or repelling.	Thunderclouds, Van De Graaff generators.	
Elastic	The energy stored when an object is stretched or compressed.	Stretched elastic, compressed springs, inflated balloons.	
Gravitational	The energy stored when an object is moved higher.	Aeroplanes, kites, mugs on a table.	
Nuclear	The energy stored in atoms.	Nuclear fuel, radioactive material	

Energy Transfers

	Definition	Examples
Heating	Energy is transferred from a hotter object to a cooler one.	A radiator heating the air in a room. 
Force	Energy is transferred when a force moves through a distance.	A ball falling from a height. 
Sound	Energy transferred by the vibration of particles.	Hearing the sound of a drum being hit. 
Electrical	Energy is transferred when moving charges in a wire.	An electrical cell turning a motor. 
Light	Energy is transferred by light waves.	A bulb lighting up a room. 

Energy Conservation

Energy cannot be created or destroyed, just transferred from one store to another.

The total energy of a system stays the same. The idea that the total energy has the same value before and after a change is called conservation of energy.

Energy Dissipation

Any energy that is not transferred to useful energy stores is said to be dissipated (or wasted) because it is lost to the surroundings.

Once dissipated, energy can no longer be stored usefully as the energy has spread out.

Energy is usually lost by heating up the surroundings.

<u>Examples</u>

- Friction in mechanical systems, such as motors.
- Tumble dryers heating the surrounding air.
- Filament bulbs wasting energy as heat.

Filament bulb

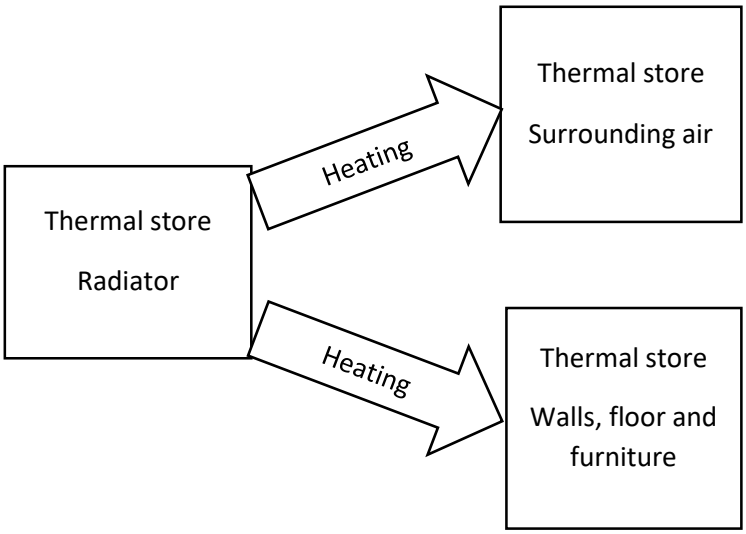
Energy saving bulb

Energy transfer diagrams

Energy transfer diagrams may be used to show the locations of energy stores and energy transfers.

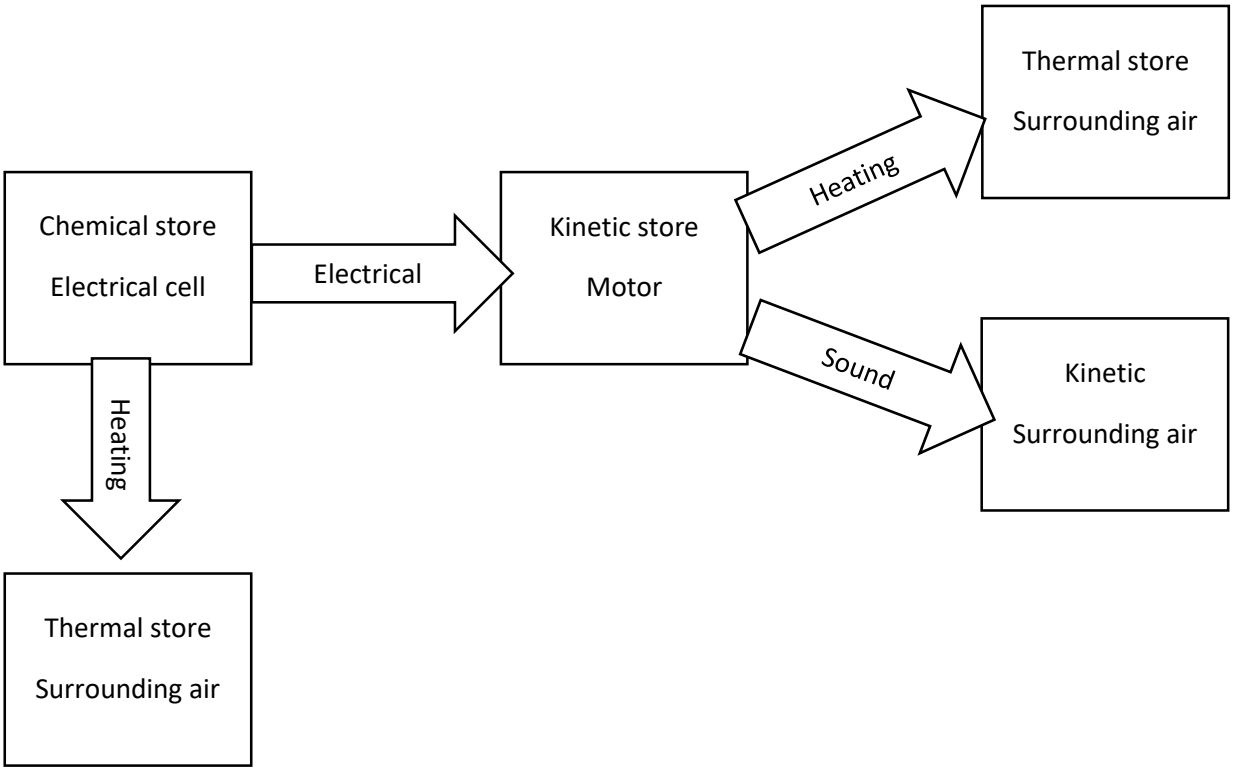
Example 1

When a radiator heats up the air in a room, some energy is used to heat the air in the room. However, some of the energy is also transferred to the walls, floor and furniture. This can be shown by adding more transfers to our earlier example.



Example 2

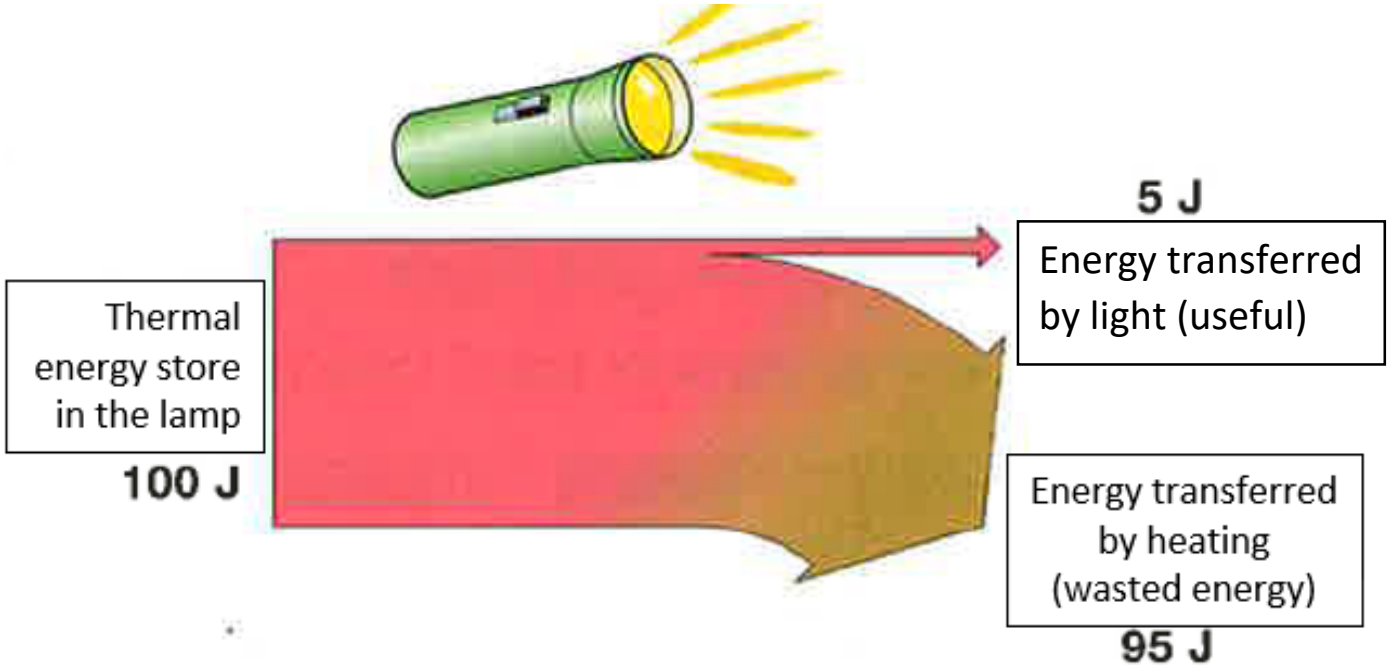
When an electrical cell turns a motor, some energy is used to turn the motor, but some energy is transferred by heating to the surroundings. As the motor turns some energy is transferred to the surroundings by heating and sound.



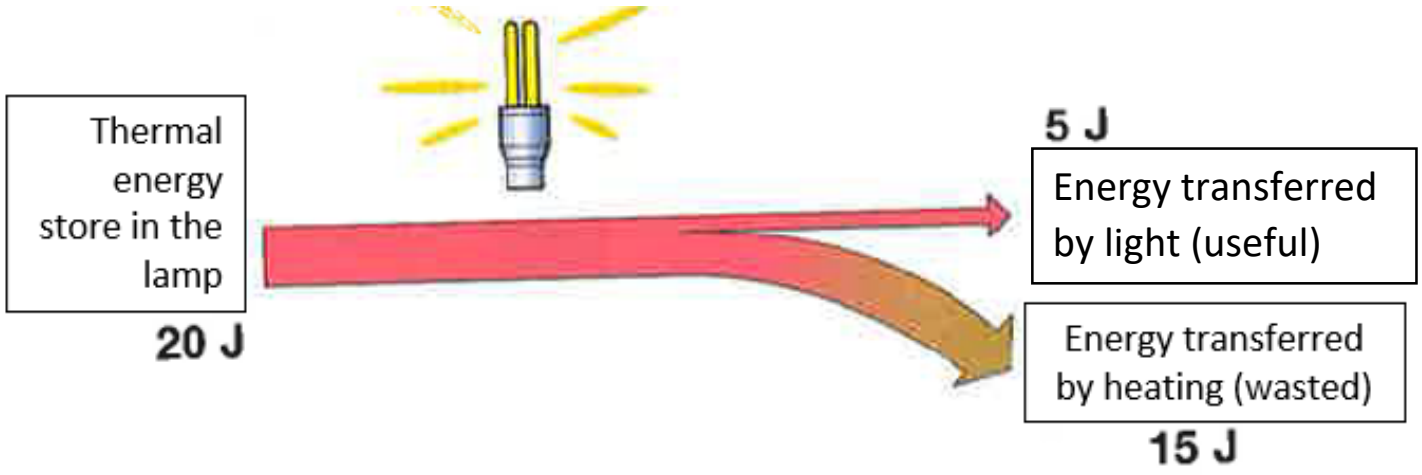
Sankey diagrams

You can show energy transfers in a Sankey diagram. Sankey diagrams start off as one arrow that splits into two or more points. This shows how all of the energy in a system is transferred into different stores.

Old filament bulbs transfer most of their energy by heating to the surroundings, but only a small amount is transferred as light.



New energy saving bulbs transfer most of their energy as light, and only a small amount is transferred by heating to the surroundings.



Energy Efficiency

Devices are designed to waste as little energy as possible. This means that as much of the input energy as possible should be transferred into useful energy stores.

How good a device is at transferring energy input to useful energy output is called efficiency.

A very efficient device will waste very little of its input energy.

A very inefficient device will waste most of its input energy.

$$\textit{Efficiency} = \frac{useful\ output\ energy}{total\ input\ energy}$$

$$\textit{Percentage Efficiency} = \frac{useful\ output\ energy}{total\ input\ energy}\ x100\%$$

Energy changes are measured in joules (J) or kilojoules (kJ).

There are no units for efficiency.

Example: The energy supplied to a light bulb is 200J. A total of 40J of this is usefully transferred as light. How efficient is the light bulb?

Efficiency = $\frac{useful\ output\ energy}{total\ input\ energy}$ = $\frac{40J}{200J}$ = 0.2

Percentage Efficiency = $\frac{useful\ output\ energy}{total\ input\ energy}$ x100 = $\frac{40J}{200J}$ x100 = 0.2 x 100 = 20%