Energy

Threshold Concept

Energy can't be created or destroyed, it can only be transferred from one store to another in a closed system

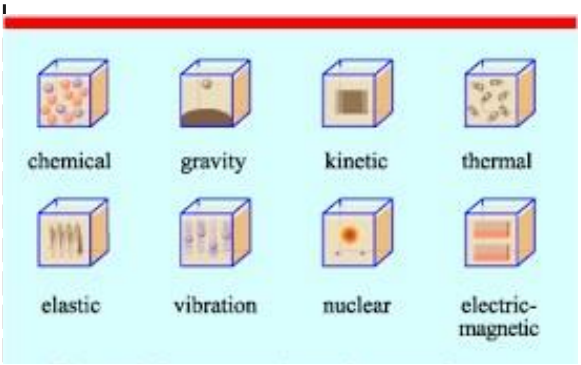
Keywords

Energy – moved between stores during transfers
Store – A temporary housing for energy
Transfer – The movement of energy between stores
Useful – The energy store that you wish for the energy to flow into
Dissipated – The store that energy flows into that is not useful or wasted

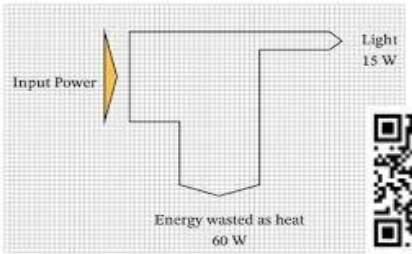
Movement between stores

Energy Transfer	Description
Mechanical	When a force acts on a body e.g. a collision
Electrical	Electricity can transfer energy from a power source, such as a cell, delivering it to components within a circuit
Heating	Thermal energy can be transferred by conduction, convection or radiation
Radiation	Light and sound carry energy and can transfer this between two points

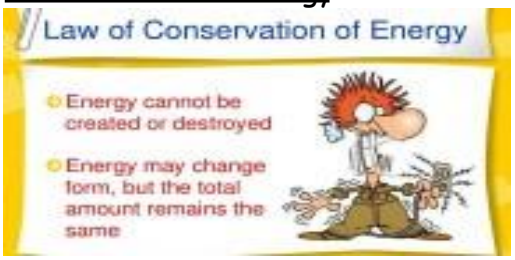
Energy Stores



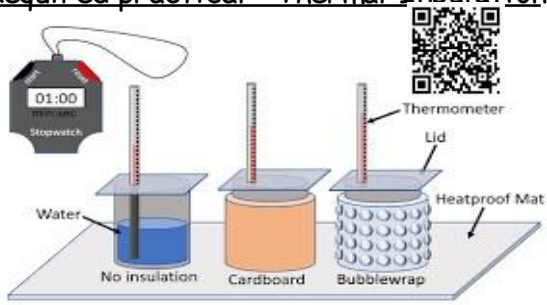
Sankey Diagrams



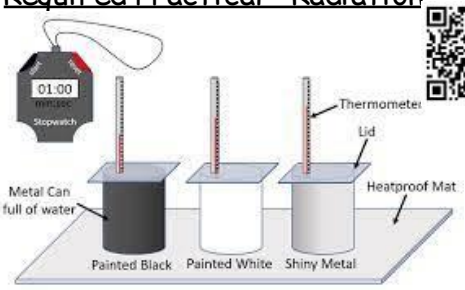
Conservation of energy



Required practical – Thermal Insulation



Required Practical -Radiation



Equations for this topic

Work = Force x Distance

Power = Work done/ time

Efficiency = useful energy output/total energy input

Foundations of chemistry

Threshold Concept

All matter is made of particles

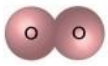
States of matter:

State	Solid	Liquid	Gas
Closeness of particles	Very close	Close	Far apart
Arrangement of particles	Regular pattern	Randomly arranged	Randomly arranged
Movement of particles	Vibrate around a fixed position	Move around each other	Move quickly in all directions
Energy of particles	Low energy	Greater energy	Highest energy
2D diagram			

Atoms and compounds:

Elements contain just **one type** of atom.

Oxygen (O_2)



Compounds contain **different types** of atom bonded together.

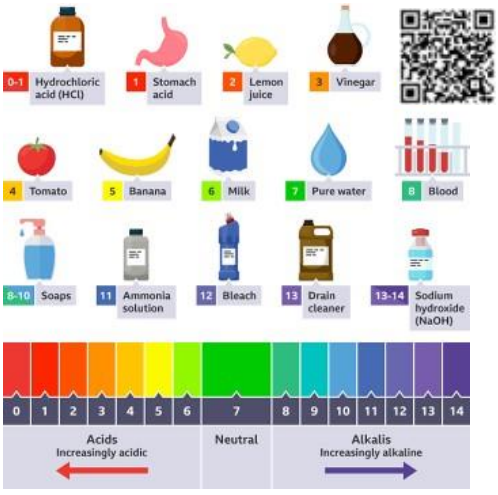
Carbon dioxide (CO_2)

Pure substances:

Pure substances are made from only one chemical element or one compound.

For example, salt is a pure substance made only of sodium chloride.

The pH scale:

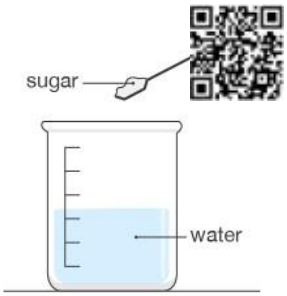


Keywords

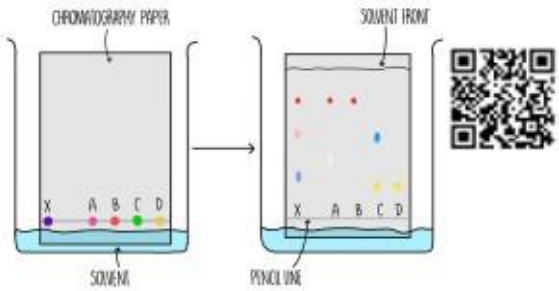
- **Particles:** The tiny things that all materials are made from. The smallest unit of matter.
- **Atom:** Atoms are the building blocks of all matter. Everything is made of atoms even yourself. They are the smallest particle of an element, which are far too small to see.
- **Solid:** Have a fixed shape and cannot flow, because their particles cannot move from place to place, cannot be compressed (squashed), because their particles are close together and have no space to move into.
- **Liquid:** Flow and take the shape of their container because their particles can move around each other, cannot be compressed, because their particles are close together and have no space to move into
- **Gas:** Flow and completely fill their container, because their particles can move quickly in all directions, can be compressed, because their particles are far apart and have space to move into

Solubility:

- Some solids dissolve in water to make a solution.
- These solids are soluble.
- A solution is made from a solute (usually a solid) and a solvent (liquid).
- Some gases, such as oxygen and carbon dioxide, can also dissolve in water.



Required practical: Chromatography



Equations for this topic:

$$R_f \text{ value} = \frac{\text{distance travelled by substance } (B)}{\text{distance travelled by solvent } (A)}$$

Forces

Threshold Concept

Every action has an equal and opposing action.

Keywords

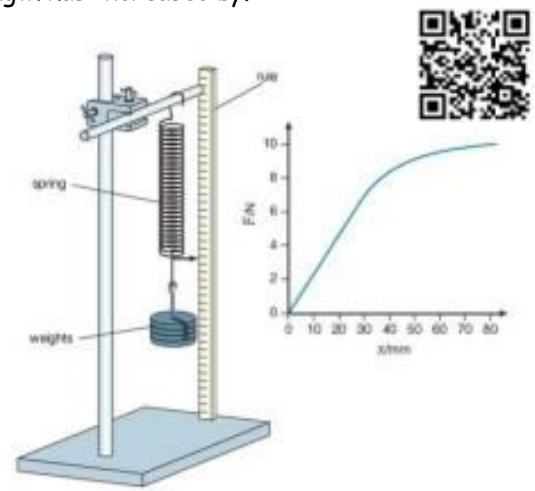
- **Contact:** Contact forces are forces that act between two objects that are physically touching each other.
- **Non contact:** Non-contact forces are forces that act between two objects that are not physically touching each other.
- **Balanced:** When the total force in opposite directions are equal in magnitude.
- **Unbalanced:** When the total force in opposite directions aren't equal in magnitude.
- **Force:** A push or a pull. The unit of force is the newton (N).

Contact and non contact forces

Contact Force	Non-Contact Force
A **contact force** involves a force between two objects in contact.	A **non-contact force** involves a force between objects not touching. You can't 'see' anything physically touching, but there is still an attraction or repulsion.
For example, **friction** between your feet and the ground can be present.	For example, **magnetic** forces between two magnets can happen when the magnets are near but not touching.

Required practical

When you apply a force to a material it can extend. The extension is the amount the length has increased by.



Scalar and vector quantities

A scalar quantity has only magnitude.
A vector quantity has both magnitude and direction.

Scalar Quantities

length, area, volume
speed
mass, density
pressure
temperature
energy, entropy
work, power

Vector Quantities

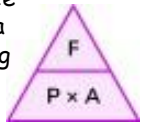
displacement
velocity
acceleration
momentum
force
lift, drag, thrust
weight

Free body diagrams

A free body diagram models the forces acting on an object
The object or 'body' is usually shown as a box or a dot. The forces are shown as thin arrows pointing away from the centre of the box or dot

Pressure:

Pressure is the amount of force applied to a specific area. It is caused when objects exert a force on another object. It can be on a visible level (pushing a door, rolling out cake icing) or at a molecular level (gas particles in a can)



Equations for this topic

weight = mass × gravitational field strength	$W = m\,g$
work done = force × distance (moved along the line of action of the force)	$W = Fs$
force = spring constant × extension	$F = ke$
moment of a force = force × distance (perpendicular to the direction of the force)	$M = Fd$
pressure = force normal to a surface / area of that surface	$p = \frac{F}{A}$
distance travelled = speed × time	$s = vt$
resultant force = mass × acceleration	$F = ma$

Periodic Table

Threshold Concept

All elements fit within the Periodic Table

Link to information on most of the topic, consisting of slides, videos, and quizzes

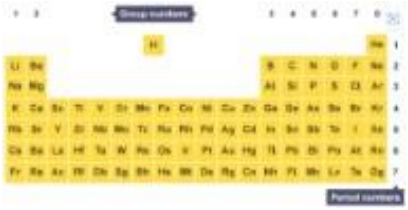
Keywords

Elements - a substance that cannot be broken down into any other substance.
Periodic Table – a table showing every element that is known to exist.
Symbol – a sign/letter/character that is used to represent something

Periodic Table & Developing the Periodic Table

Task 1 & 2

Mendeleev redesigned Newlands periodic table by organising the periodic table by atomic weights and the properties of the elements.
Some gaps were left based on his predictions of other elements that hadn't been discovered yet.
As more elements were found, the modern periodic table took from organised by atomic number.



RAM & Isotopes

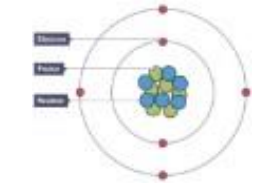
Task 10

RAM

Isotopes

Atomic Structure

Task 8



Electronic Configuration

Task 9

Example, using an atom of sodium

No. of electrons per shell
1st shell: up to 2
2nd shell: up to 8
3rd shell: up to 8
etc

Group 1 – Alkali Metals

Task 4

1

Li
Na
K
Rb
Cs
Fr

All share similar properties:
- Are soft (can be cut)
- Have relatively low MP
- Have low densities

The further down the group you go, the more reactive the elements become.
- They will react will air and tarnish quite quickly.
- They will react with water to produce an alkaline solution (hence the name) and turn universal indicator blue/purple

Group 7 - Halogens

Task 5

7

F
Cl
Br
I
At
Ts

All have 7 electrons in outer shell.
All diatomic (made up of two atoms bonded together.

The further down the group you go, the less reactive the elements become.
The further down the group you go, the higher its MP and BP, because:
- Molecules become larger
- Intermolecular forces become stronger
- More energy is needed to overcome these forces

Group 0 – Noble Gases

Task 3

0

He
Ne
Ar
Kr
Xe
Rn
Og

All have full outer shells.
All unreactive (inert).

All have low boiling points.
Lower down the group, the higher it gets.
This is because, going down the group:
- Atoms become larger
- Intermolecular forces between atoms become stronger
- More energy is needed to overcome these forces

Reproduction

Threshold Concept

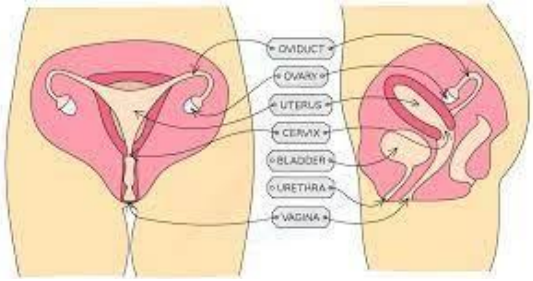
Reproduction can happen sexually and asexually

Keywords

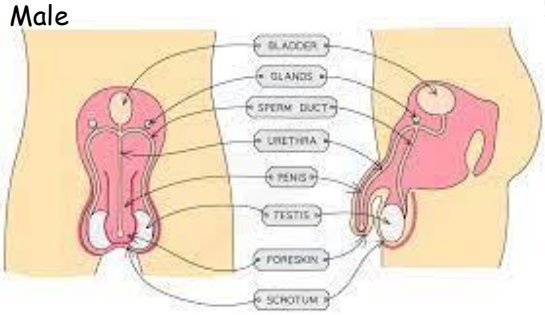
- **Sperm:** male reproductive cell that contains genetic material
- **Egg**: female reproductive cell that contains genetic material
- **Reproduction**: the joining of sex cells (a sperm and egg) to produce offspring
- **Fertilisation:** the joining of a male and female sex cell/genetic material
- **Develop**: build upon given information

Reproductive organs

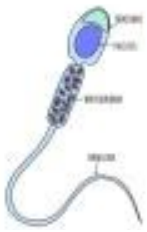
Female



Male



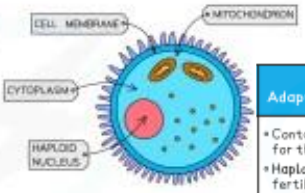
Sperm cell



Adaptations

- The head contains the genetic material for fertilisation in a **haploid nucleus** (containing half the normal number of chromosomes)
- The **acrosome** in the head contains digestive **enzymes** so that a sperm can penetrate an egg
- The mid-piece is packed with **mitochondria** to release **energy** needed to swim and fertilise the egg
- The **tail** enables the sperm to **swim**

Egg cell

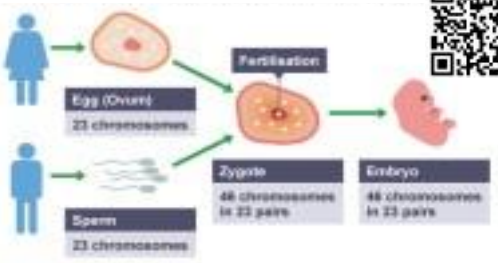


Adaptations

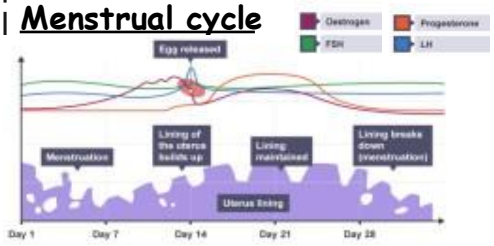
- Contains a lot of **cytoplasm** which has nutrients for the growth of the early embryo
- **Haploid nucleus** contains the genetic material for fertilisation
- **Cell membrane changes after fertilisation** by a single sperm so that no more sperm can enter

Fertilisation

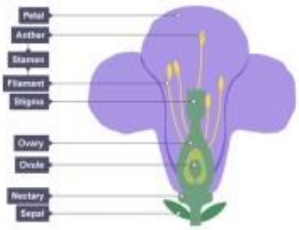
When the sperm and egg nuclei join, they form a ZYGOTE



Menstrual cycle



Plant structures



IVF

In Vitro Fertilisation is used to help people with fertility issues conceive

Equations for this topic