Infection and response

Threshold Concept

Pathogens are microorganisms that cause disease

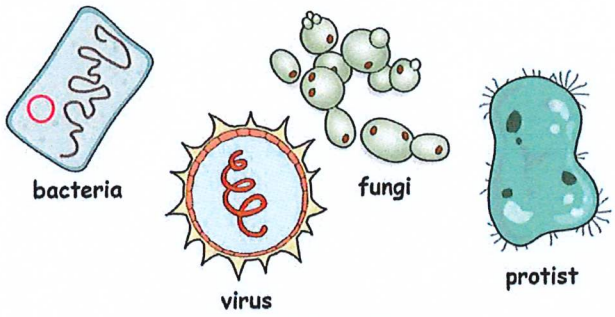
Keywords

- **Pathogens:** A microorganism that causes disease e.g. bacteria, virus, protist, fungus.
- **Microorganism:** Are so small they can only be seen using a microscope.
- **Virus:** A disease causing agent about 1/100th of the size of a bacterial cell. Can only replicate within host body cell/
- **Bacteria:** A single celled microorganism without a true nucleus, some cause disease.
- **Fungi:** A microorganism that can cause disease, and that produces spores that can spread to other organisms.

Communicable and non-communicable disease:

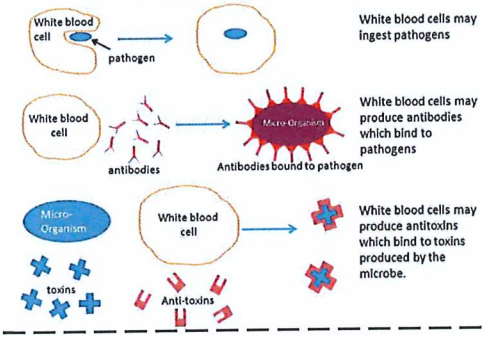
- Communicable, which can be transferred from one person to another, or from one organism to another, eg in humans, these include measles, food poisoning and malaria
- Non-communicable, which are not transferred between people or other organisms

Pathogens

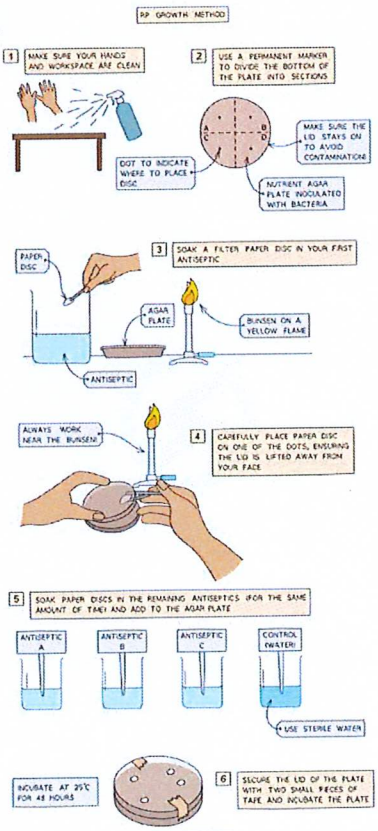


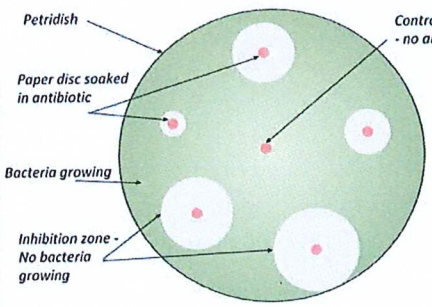
Fighting against disease

How white blood cells protect us from disease



Required practical



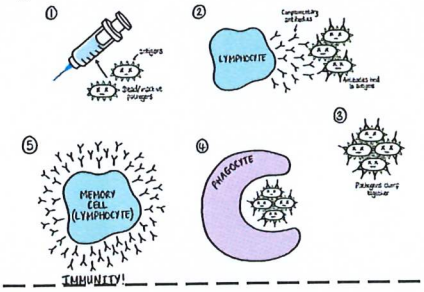


Antibiotics vs painkillers

- Antibiotics are substances that slow down or stop the growth of bacteria.
- Painkillers are chemicals that relieve the symptoms but do not kill the pathogens.

Vaccinations

Vaccines allow a dead or altered form of the disease causing pathogen to be introduced into the body, which contain a specific antigen.



Equations for this topic

Electricity (Part 1)

Threshold Concept

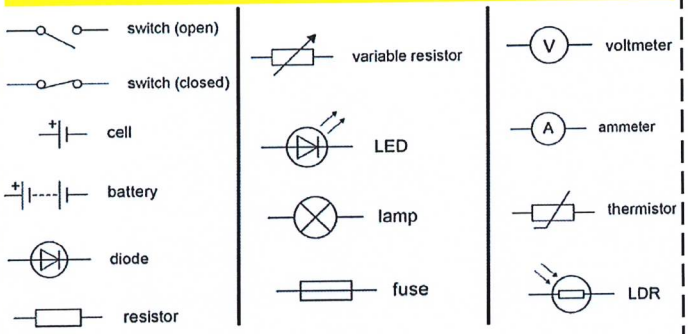
Electricity is the flow of electrons.

Keywords

- **Electron:** a stable subatomic particle with a charge of negative electricity, found in all atoms and acting as the primary carrier of electricity in solids.
- **Electricity:** is the presence or flow of charged particles.
- **Charge:** is a property of a body which experiences a force in an electric field. Charge is measured in coulombs (C).
- **Current:** Current is the rate of flow of electric charge around a circuit.

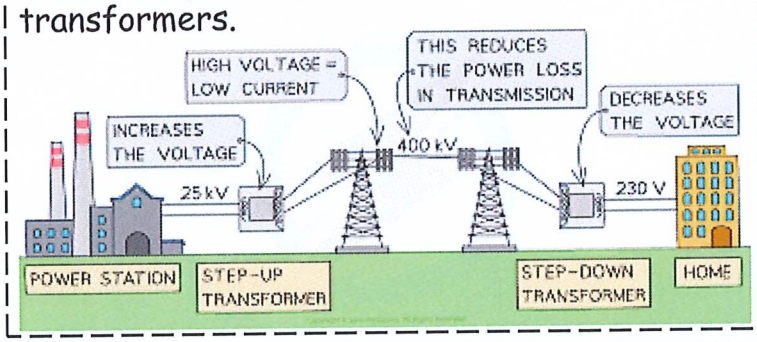
Circuit Symbols

An electronic circuit can include lots of different components. All of which can be represented with a symbol:

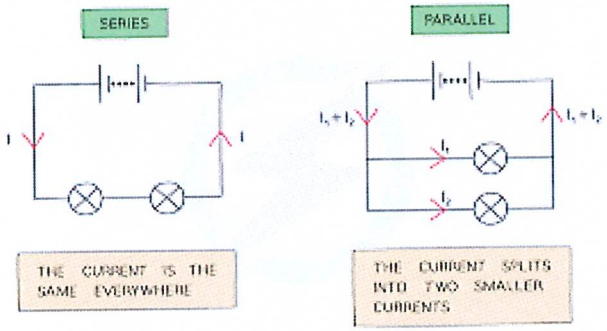


National Grid

The **National Grid** distributes electricity across the country. The National Grid connects power stations to homes, workplaces and public buildings all around the country through a system of cables and transformers.

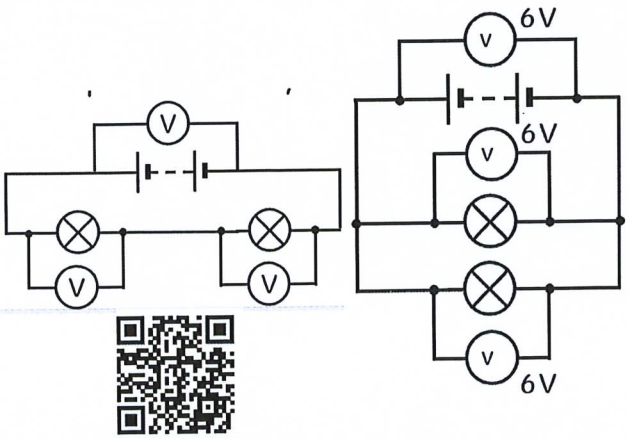


Series and Parallel circuits



In a series circuit, the potential difference/voltage supplied by the battery is **shared** by the components.

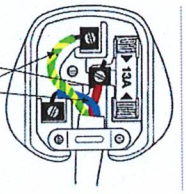
In a parallel circuit, the potential difference across each bulb is the **same** as the potential difference across the battery.



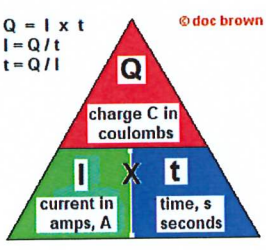
Practical

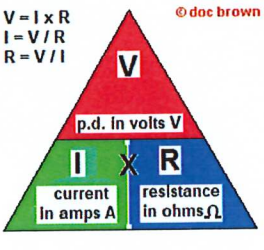
Wiring a plug

- The live wire.
- The neutral wire.
- The earth wire.



Equations for this topic





Electricity Part 2

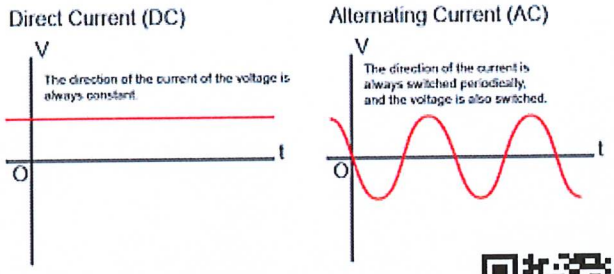
Threshold Concept

Potential Difference is the push that causes current to flow.

Keywords

- **Energy transfer:** the change of energy from one form to another.
- **Current:** Current is the rate of flow of electric charge around a circuit.
- **Resistance:** is a measure of the opposition to current flow in an electrical circuit.
- **Potential difference (voltage):** is the difference in the amount of energy that charge carriers have between two points in a circuit.

Alternating and Direct current (ACDC)

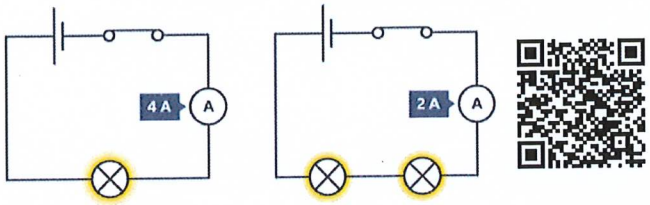


Electricity can flow either as direct or alternating current, and is used in homes to power electrical appliances.

Resistance

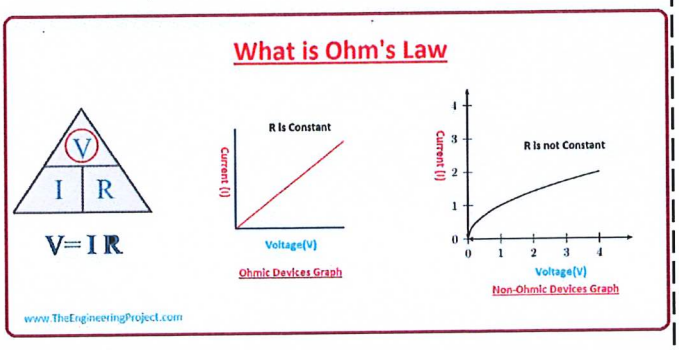
Resistance (R) is a measure of how difficult it is for current to flow. Resistance is measured in units called ohms (Ω).

The more resistance there is in a circuit, the less current will flow.



Ohm's Law

Ohm's law states that current is directly proportional to potential difference (providing the temperature remains constant).

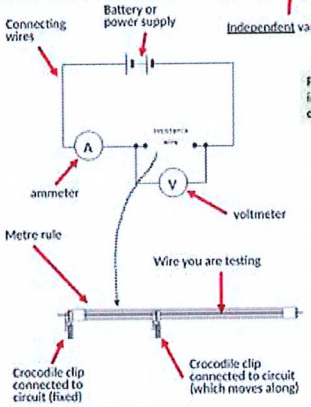


Required Practical's

Resistance

Required practical	Physics 3
Resistance in circuits	Combined Science 15

Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits. This should include:
A - the length of a wire at constant temperature
B - combinations of resistors in series and parallel



Possible sources of significant error (which you can attempt to control): inaccurate attachment of crocodile clips; heating effect of electric current; misreading metre rule; misreading ammeter or voltmeter.

Method A steps:

- Connect the circuit as shown
- Record in a table:
  - length of the wire between the crocodile clips
  - the readings on the ammeter
  - the readings on the voltmeter
- Move the crocodile clip and record the new ammeter and voltmeter readings. Note that the voltmeter reading may not change.
- Repeat this to obtain several pairs of meter readings for different lengths of wire
- Calculate and record the resistance for each length of wire using the equation $R = V/I$

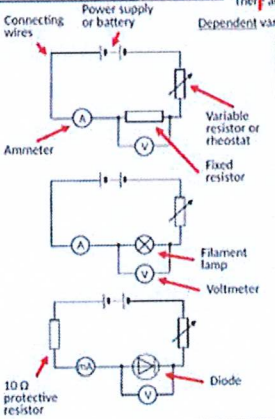
I-V characteristics

Required practical	Physics 4
I-V characteristics	Combined Science 16

Use circuit diagrams to construct appropriate circuits to investigate the current-potential difference characteristics of a variety of circuit elements including a filament lamp, a diode and a resistor at constant temperature.

There are three investigations in this required practical.

Dependent variable Independent variable

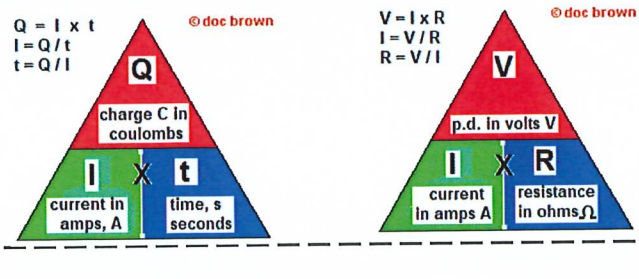


Possible sources of significant error (which you can attempt to control): misreading ammeter or voltmeter; inaccurate graphing

Method steps:

- Connect the circuit
- Record the readings on the ammeter and voltmeter in a suitable table.
- Adjust the variable resistor and record the new ammeter and voltmeter readings. Repeat this to obtain several pairs of readings
- Swap the connections on the battery. (the readings on the ammeter and voltmeter should now be negative)
- Continue to record pairs of readings of current and potential difference with the battery reversed
- Swap the leads on the battery back to their original positions
- Replace the resistor with the lamp.
- Repeat the steps above with the lamp in place of the resistor
- Swap the leads on the battery back to their original positions.
- If you can, reduce the battery potential difference to less than 5 V
- Replace the ammeter with a milliammeter (or change the setting on the multimeter)
- Replace the lamp with the diode. Connect the positive side of the diode to the milliameter.
- Repeat steps above to obtain pairs of readings of potential difference and current for the diode.

Equations for this topic



Bonding Part 1

Threshold Concept

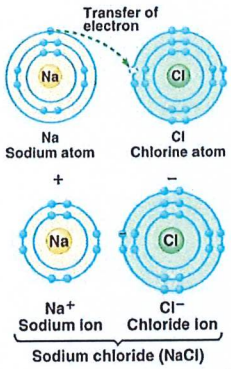
How do 100 elements make up everything in the universe?

Keywords

Electron - a subatomic particle with a negative charge
Electrostatic attraction - strong attraction between oppositely charged ions
Weak intermolecular forces - force of attraction between atoms, elements and molecules
Delocalised electron - free moving electron that isn't a part of any atom
Ion – a charged particle

Forming ions

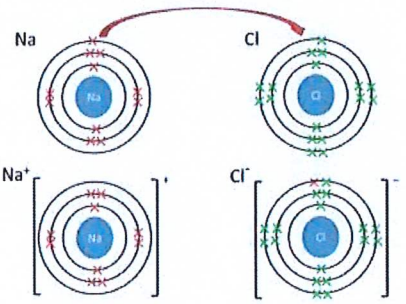
An ion is an charged particle.
Atoms will lose or gain electrons to get a full outer shell.
The **metal** atom **loses electrons** to become a **positive** ion
The **non-metal** atom **gains electrons** to become a **negative** ion.



Use task 3-5

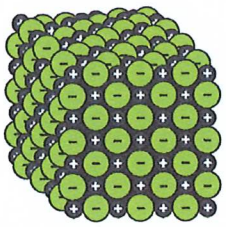
Ionic bonds

Ionic bonds are formed between metals and non-metals. Metals **lose** electrons and **non-metals** gain electrons. The oppositely charged ions attract one another forming an ionic bond.



Ionic compounds and properties

Positive and negative ions join together to form a giant ionic lattice



electrostatic attraction is strong

↓

Ionic compounds have a high M.P

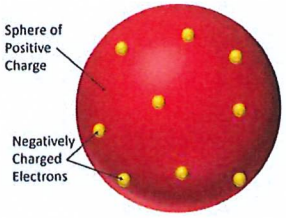
↓

Lots of energy needed to overcome attraction

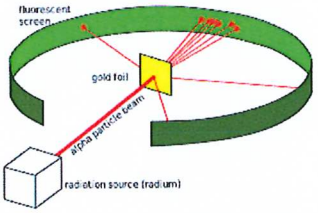
Ionic compounds <u>don't</u> conduct when <u>solid</u> because the ions are locked in position. When molten or dissolved the ions are free to move and can conduct

History of the atom

JJ Thomson – Suggested the <u>plum pudding model</u>. Atoms were a ball of positive charge with negative particles scattered within.



Ernest Rutherford – Alpha scattering experiment. Found that atoms has a very small, positive nucleus and the majority of atoms are empty space.



Bonding Part 2

Threshold Concept

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Keywords

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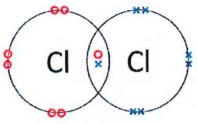
Weak intermolecular forces - force of attraction between atoms, elements and molecules
Delocalised electron - free moving electron that isn't a part of any atom
Ion – a charged particle

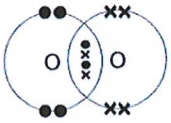
Covalent bonds

Two non-metals will form a covalent bond. The atoms share electrons to make themselves stable.

Cl — Cl



- 1 shared pair = a single bond
- 2 shared pairs = a double bond
- 3 shared pairs = a triple bond

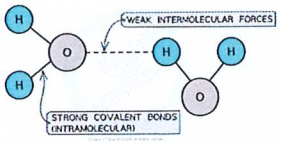


O═O

Simple Covalent compounds

Simple covalent compounds have strong covalent bonds between atoms and weak intermolecular forces between molecules.

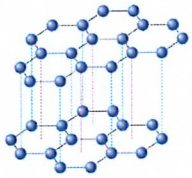
Properties – low m.p and b.p
- cannot conduct electricity



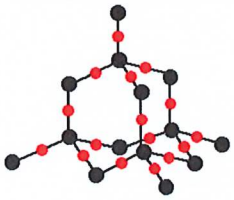
Giant Covalent Structures

Diamond

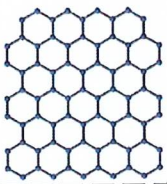
Graphite



Silicon dioxide



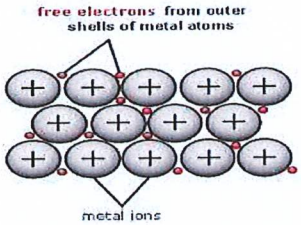
Graphene



Fullerenes

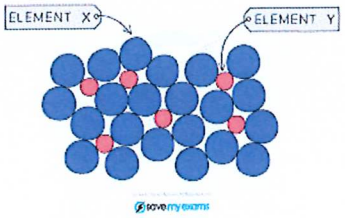
Metallic bonding

Metals consist of a giant metallic structure. They are positive metal ions surrounded by a sea of delocalised electrons



Alloys

Alloys are a mixture of metals and another element.
Alloys are stronger than metals as the different sized atoms distort the layers



States of matter