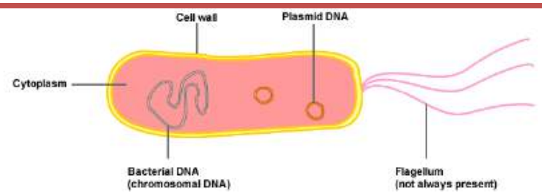
Y9 AP3 Learnsheet Foundation

Y9 Biology (F) Infectious Diseases

Where do we get drugs from?
- Most drugs today are made in the lab.
- Some are found naturally is plants and fungi.
- New drugs need to be tested to make sure they are safe, the right dose, and that they work effectively.

START

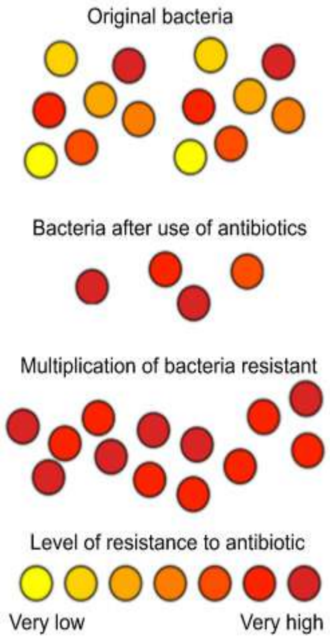


How is disease caused?
- Microbes like bacteria, fungi, protists and viruses can cause disease.
- They can be spread and infect others.
- The infection can cause symptoms like sneezing.

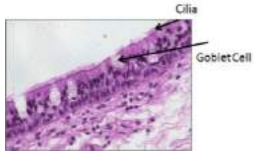
How are diseases spread?
- Microbes can be passed from person to person through physical contact.
- Some can move through the air or water.
- Some, like Malaria, can be transferred by insects.

Key words:
1. **Pathogen:** A microorganism that can cause disease.
2. **Microorganism:** A living thing too small to see with only your eyes.
3. **Symptom:** Effects on your body from a pathogen.
4. **Communicable:** Diseases can be passed on to other people
5. **Antibiotic:** A type of drug that can kill bacteria.
6. **White Blood Cell:** A type of cell in the immune system.
7. **Vaccine**: An inactive or dead version of a pathogen used to prevent disease.
8. **Painkiller:** A type of drug used to reduce symptoms of disease.

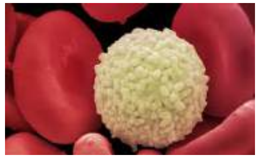
How do viruses and bacteria damage us?
- Viruses enter our cells and reproduce quickly, damaging our cells.
- Bacteria also reproduce quickly and make toxins that damage tissues and make us feel ill.



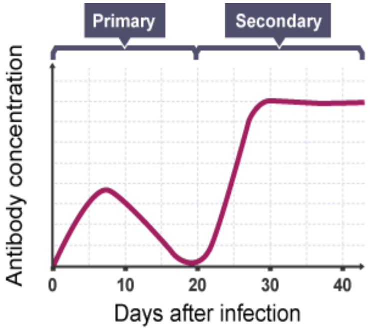
How do vaccines work?
- Vaccines prevent illness, but can't cure it.
- A dead or inactive version of a pathogen is injected into a person.
- This makes white blood cells make antibodies to fight the infection.
- If the real pathogen enters the body, white blood cells remember how to fight it and do so quickly.



How does the body prevent disease?
- Your skin, nose, trachea, bronchi and stomach can all help prevent disease.
- Mucus and ciliated cells can trap pathogens.



How do white blood cells stop pathogens?
1. They can engulf and ingest pathogens in phagocytosis.
2. They can produce antibodies.
3. They can produce antitoxins.



How do antibiotics work?
1. They can kill bacteria in our bodies.
2. They can't kill viruses as they live inside our cells where antibiotics can't reach.
3. Some bacteria are becoming resistant to some antibiotics- they don't kill them any more!

Types of Disease

1) Give one way that pathogens can be spread. ☐
2) How can bacteria make us feel ill? ☐
3) What are the symptoms of gonorrhoea? ☐
4) What type of disease is measles? ☐
5) Why does tobacco mosaic virus affect photosynthesis? ☐
6) What are the vectors for malaria? ☐

Fighting Disease

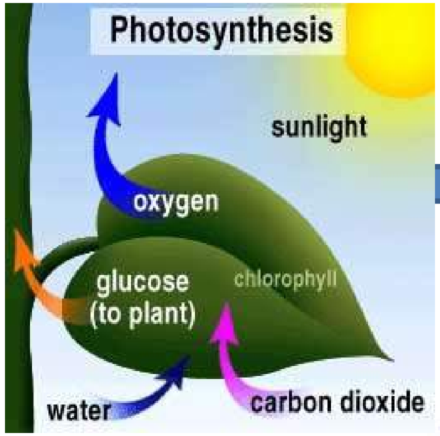
7) What does the stomach produce that can kill pathogens? ☐
8) Give three ways that white blood cells can defend against pathogens. ☐
9) Give one pro and one con of vaccination. ☐
10) Why is it difficult to develop drugs that kill viruses? ☐
11) Which plant does the painkiller aspirin come from? ☐
12) Give two things that drugs are tested on in preclinical testing. ☐

Y9 Biology (F) Bioenergetics

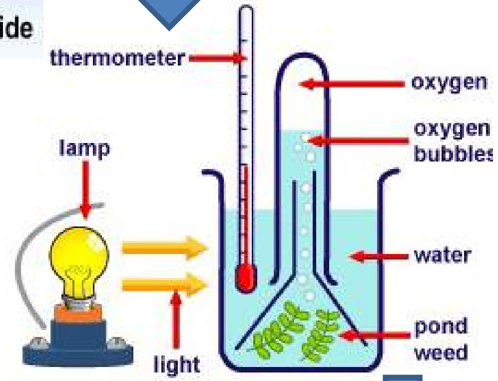
START

carbon dioxide + water → (light energy, chlorophyll) → glucose + oxygen

Photosynthesis



Investigating Photosynthesis: Count the number of oxygen bubbles in a set amount of time.
More oxygen = more photosynthesis



Exercise:

- Uses both aerobic and anaerobic respiration in order to supply enough energy, quick enough to our cells.
- After we exercise we must get rid of lactic acid by reacting it with oxygen = oxygen debt.
- This is why we are out of breath after exercise

Anaerobic Respiration in yeast

glucose → Ethanol + Carbon dioxide + energy

Key words:

1. **Photosynthesis:** Light energy is used to react carbon dioxide and water to make glucose and oxygen
2. **Limiting factor:** A factor that affects the rate of reaction. When the factor is increased the rate of reaction goes up
3. **Aerobic respiration:** Respiration using oxygen
4. **Anaerobic respiration:** Respiration with <u>no</u> oxygen

<u>Anaerobic respiration takes place when there is no oxygen available.</u>

GOOD: Can produce some energy when there is no oxygen
GOOD: Can produce energy very quickly
BAD: Produces very small amount of energy
BAD: produces lactic acid which is poisonous for our cells

Respiration: Chemical reaction that gives our cells energy

Breathing: A mechanical process that gets oxygen into our lungs for respiration and carbon dioxide out

<u>Factors that can affect how quickly photosynthesis works:</u>

1) Carbon dioxide concentration
2) Light intensity
3) Temperature

glucose → lactic acid + energy

Anaerobic Respiration in animals

glucose + oxygen → carbon dioxide + water

Aerobic Respiration

<u>How the Plant uses glucose</u>

1. The plant uses glucose in respiration
2. The plant stores glucose as starch
3. To make cellulose to build plant tissue

QUESTIONS

Photosynthesis

1. Write out the word equation for photosynthesis from memory (repeat until you can!)
2. Write out the symbol equation for photosynthesis from memory (repeat until you can)
3. What is the role of stomata in relation to photosynthesis?
4. Why stomata close at night?
5. What role does osmosis play in photosynthesis?
6. Explain why photosynthesis is endothermic.
7. Describe & explain why the effect of temperature as a limiting factor for photosynthesis is different to the effects of CO_2 and light intensity.
8. Why does increasing light intensity have no effect on photosynthesis above a certain level?
9. If there was already the optimum levels of CO_2, temperature and light intensity, what is the only other way the rate of photosynthesis could be increased in a plant?
10. Why is counting the bubbles from pondweed an indicator of the rate of photosynthesis?
11. Use the inverse square law to compare the light intensity hitting a plant from a lamp that is 20cm, 40cm, and 80cm away. What do you notice? (HINT: do the calculation in m instead of cm)
12. List 3 uses of glucose produced by respiration
13. What is the link between nitrate ions and photosynthesis?

Respiration

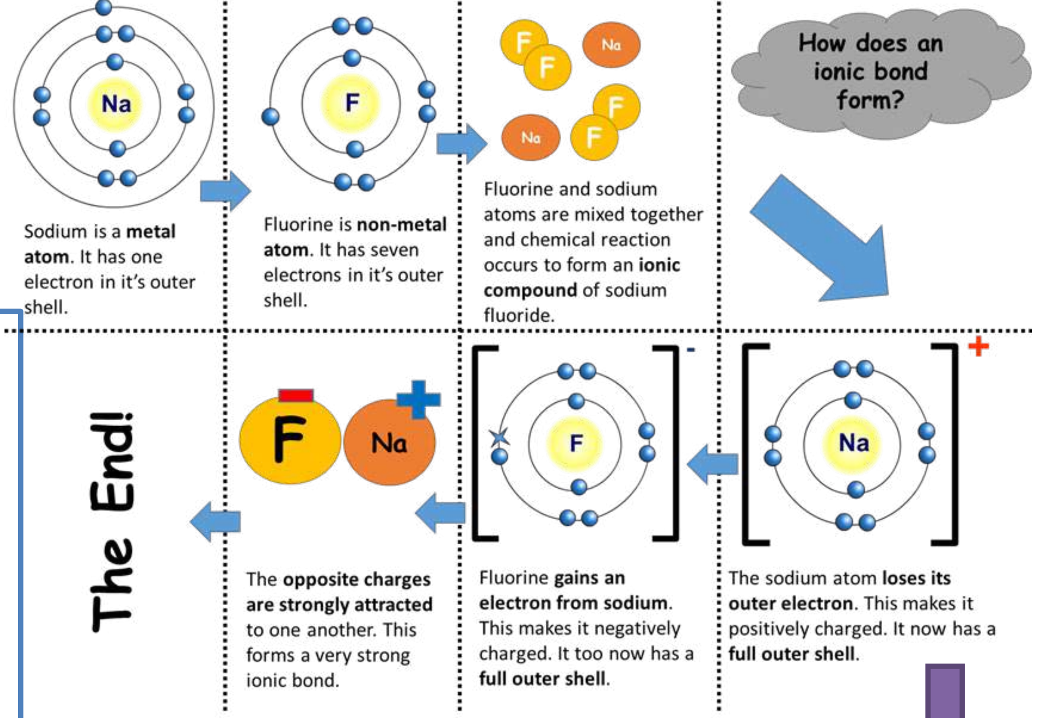
1. Write out the word equation for respiration from memory (repeat until you can!)
2. Write out the symbol equation for respiration from memory (repeat until you can)
3. Explain what happens during respiration on terms of energy transfer.
4. Explain why respiration is exothermic.
5. Give examples of what the energy transferred during respiration is used for
6. Outline the similarities and differences between anaerobic respiration in yeast and in animals.
7. Compare aerobic respiration to anaerobic respiration in terms of the need for oxygen, the different products formed, and the different amounts of energy transferred.
8. Describe how the raw materials for respiration enter the body and travel to target cells.
9. How are the waste products excreted from the body?
10. Explain the changes to heart rate and breathing that happen during exercise.
11. Why is it important to eventually remove the lactic acid built up from anaerobic respiration
12. Why do you keep breathing heavily for several minutes *after* you have stopped vigorous exercise?

Y9 Biology (F) Bonding, Structure and States of Matter

START

Why do atoms bond together?
All atoms want **full** outer shells of **electrons.** This makes them more **stable.** If they have space in their outer shell they can fill this by either giving away electrons, accepting electrons or **sharing** electrons.

Ionic and Covalent Bonding



Bonding, Structure and Properties Keywords

Ionic Bond – when a metal atom transfers and electron to a non-metal atom. The opposite charges attract.
Covalent Bond – when a pair of electrons are shared between two non-metal atoms.
Metallic Bond – the attraction between positive metal ion s and negatively charged electrons in a metal.
Electrostatic Force of Attraction – the force of attraction between opposite charges.
Free Electrons – electrons that are able to move freely through a structure to conduct electricity.
Ion – an atom that has lost electrons to become positively charged, or gained electrons to become negatively charged.
Atom – a neutrally charged particle, there are over 100 different types, one for each element.
Melting Point – the temperature a substance turns from a solid to a liquid.
Malleable – a substance that changes shape easily rather than shattering
Intermolecular Force - a weak force that exists between molecules or polymer chains.
Alloy - formed when a metal is mixed with another element to improve its properties
Polymer – a very long molecule made from joining small monomers together. E.g. plastics
Lattice - a regular organised 3D structure on atoms

What is covalent bonding?
When **non-metal** atoms bond they **share** pairs of electrons – this type of bonding is called **covalent** bonding.

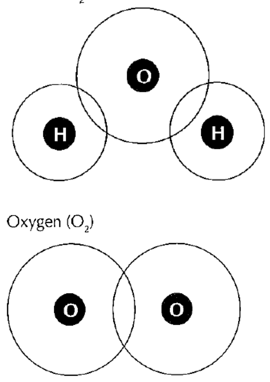
Comparing Ionic and Covalent Bonding

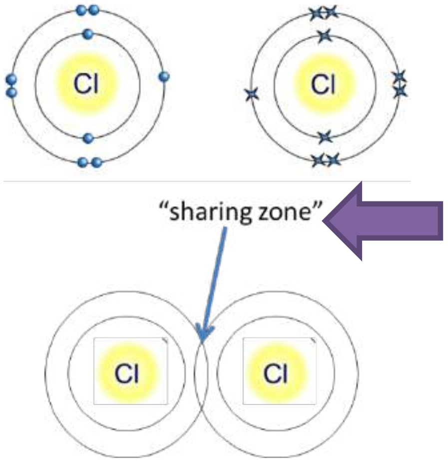
Covalent	Ionic
Pair(s) of electrons are shared Does not involve ions Bonding between non-metals Forms molecules (groups of atoms bonded together)	Involves ions of opposite charges Bonding between a metal and a non metal Does not form molecules Electrons are transferred from the metal atom to the non metal atom.

Try these…

c) Water (H_2O)

b) Oxygen (O_2)





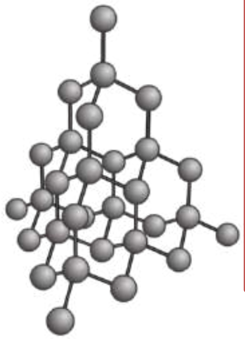
How does it work?
Each chlorine atom has **seven** electrons in its outer most shell. Each chlorine needs **one** more electron to gain a full outer shell and be stable.

The chlorine on the left needs to share **one** electron to the chlorine on the right and the chlorine on the right needs to share **one** electron to the chlorine on the left.

That means **two** electrons (a pair) need to go in the sharing zone. Each chlorine has six other electrons in it's outer shell, these can be added on outside the sharing zone.

Structure and Properties

Diamond

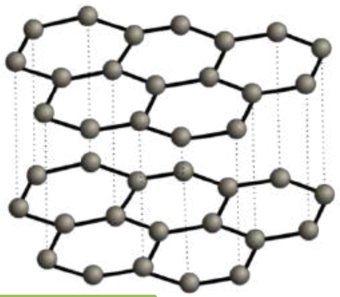


Very hard strong high melting point each carbon has four strong covalent bonds to other carbon atoms.
To break these a large amount of energy is needed. Does not conduct electricity because all the electrons are used to form covalent bonds with other carbon atoms. Without free electrons diamond cannot conduct electricity.

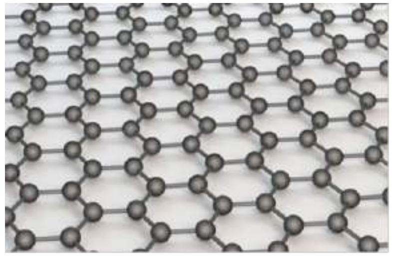
Graphite	Graphene
Layers	No Layers
Weak forces between layers	No layers
Each carbon atom covalently bonded to 3 others	
Free electrons	
Slippery	Not Slippery
Conducts electricity	
High melting point	
Used in pencils	Used in foldable screens

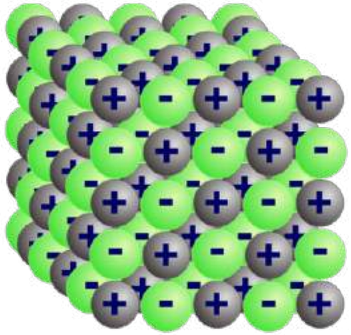
It is much softer than diamond because the carb on atoms are only bonded to 3 others by strong covalent bonds in layers. The layers are held together by weak forces which are easily broken. This allows the layers to slide over one another. Because each carbon atom only forms 3 covalent bonds with others there are free electrons. These electrons can flow through the structure allowing graphite to conduct electricity.

Graphite



Graphene



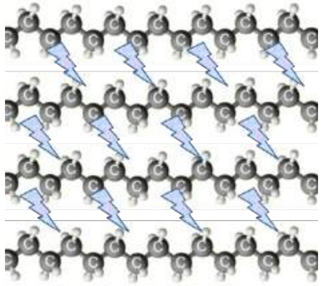


This is what the structure of a ionic substance could look like. Many oppositely charged ions attracting to each other in a giant 3D lattice.

Tips – when describing substances you should

- Name the type of bonding (ionic/covalent/metallic/ weak forces)
- Describe the number of bonds each atom forms
- Describe the strength of the bond
- Give any charges of any ions (positive or negative)

Polymers



Intermolecular forces exist **between** polymer chains

Because polymer chains are so large these forces are much stronger

This makes polymers **very strong** and gives them **higher melting** and boiling points than simple molecules.

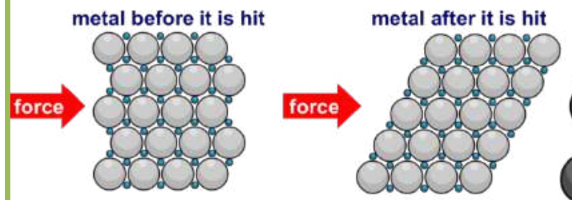
Simple Molecules

- **low boiling/melting point**
- Small groups of atoms
- Covalent bonds between atoms within molecules
- Intermolecular forces between molecules are weak
- Little energy needed to melt/boil

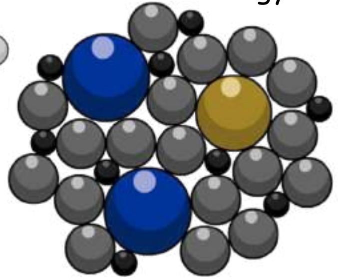
Polymers

- **Higher boiling/melting point**
- Many monomers joined in long chains
- Covalent bonds between atoms within polymer chains
- Intermolecular forces between polymer chains are strong
- More energy needed to melt/boil

Alloys are harder than pure metals



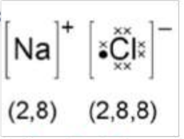
- In pure metals the atoms are all the same size.
- They form organised layers.
- These layers can easily slide so the metal changes shape more easily.



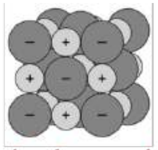
- In alloys, metals are mixed with other elements.
- The atoms are different sizes so there are no longer nice neat layers.
- The layers cannot easily slide making the alloy harder.

Models of Ionic Bonding and Ionic Lattices

Dot and cross

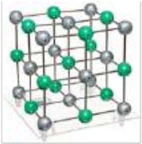


- Shows clearly what happens in terms of electrons
- Does not show what the arrangement in the structure might be like.



- Shows clearly the regular structure of a giant ionic lattice.
- You can only see the outside of the structure and not what's going on inside.

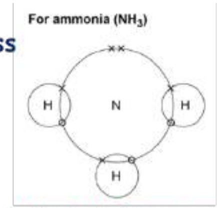
Ball and Stick



- Shows clearly the regular structure of a giant ionic lattice.
- You can only see external and internal structure.
- Ions are all the same size.
- Shows gaps between the ions.

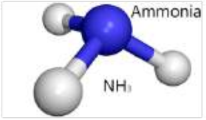
Models of Covalent Bonding

Dot and cross



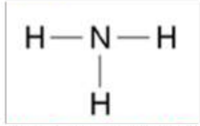
- Shows clearly that electrons are shared when outer shells overlap.
- Shows which atoms the electrons come from.
- Relative size of atoms not always correct.
- Arrangement of atoms (e.g. angle) not always correct.

Displayed Formula



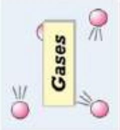
- Shows how atoms are connected but in large molecules it would be too complex.
- Does not shows which atoms the electrons flows come from.
- Shows what the molecule would look like in 3D.

Displayed Formula

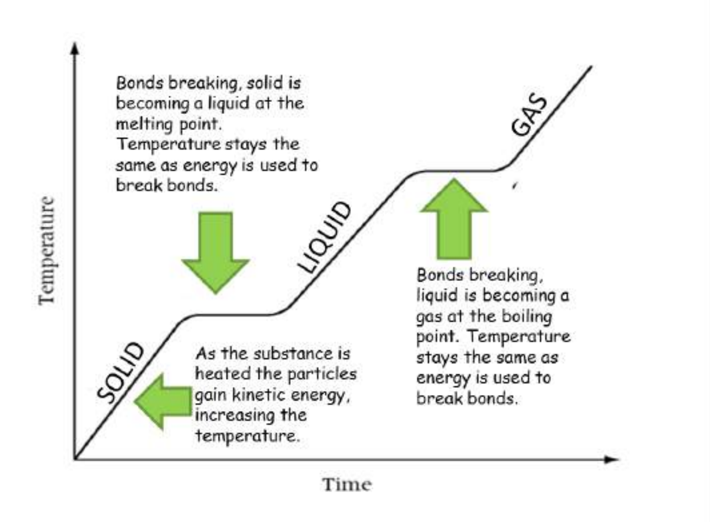


- Shows how atoms are connected in large molecules where dot and cross would be too complex.
- Does not shows which atoms the electrons come from.
- Doesn't show what the molecule would look like in 3D.

Particle Theory

	Solid (s)	Liquid (l)	Gas (g)
Properties	Fixed shape, fixed volume, high density, doesn't flow	No fixed shape, fixed volume, lower density, flows	No fixed shape, no fixed volume, very low density, flows
Particle Arrangement	Tightly packed, lattice structure (rows)	Loosely packed, but close together	Far apart
Particle Motion (amount of kinetic energy)	Vibrate only, very low kinetic energy	Constant random motion, high kinetic energy, slow movement	Constant random motion, very high kinetic energy, very fast
Bonding	Strong forces	Weak forces	Very weak forces
Diagram			

Changes in State



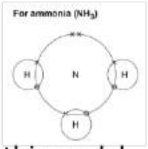
	Type of Bonding	Description of Structure	Properties of Structure	Examples of Substances
Simple Covalent Molecules	Covalent Bonding	Small groups of atoms bonded together with strong covalent bonds. Weak intermolecular forces between molecules. Always made up of two non-metal atoms.	Often liquids or gases, but sometimes solids. Very low melting and boiling points. Cannot conduct electricity.	Oxygen Carbon Dioxide Ammonia
Giant Covalent Structure	Covalent Bonding	Many non metal atoms held together by strong covalent bonds. It is a giant structure so many atoms joined together in a large 3D lattice.	Solids at room temperature. Very high melting and boiling points. Do not conduct electricity (except graphite) Very hard/strong materials	Diamond Graphite Silicon Dioxide
Giant Ionic Structures	Ionic Bonding	Made up of both metal and non-metal atoms held together by the attraction between oppositely charged ions. It is a giant structure so many atoms joined together in a large 3D lattice.	Solids at room temperature. Very high melting and boiling points. Do not conduct electricity when solid but do when melted (molten) or dissolved in water. Brittle if hit.	Sodium Chloride Magnesium Chloride
Metallic Structure	Metallic Bonding	Made up of metal and atoms held together by the attraction between metal ions and delocalised electrons. It is a giant structure so many atoms joined together in a large 3D lattice.	Solids at room temperature. Very high melting and boiling points. Do conduct electricity when solid and melted (molten). Malleable	Iron Steel (alloy) Copper Bronze (alloy)

1. What type of bonding occurs between two metal atoms?
2. What type of bonding occurs between two non metal atoms?
3. What type of bonding occurs between a metal and a non-metal atom?
4. What is a covalent bond?
5. What is an ionic bond?
6. What is a metallic bond?
7. Describe how an ionic bond forms between an atom of Lithium and an atom of fluorine. Use diagrams to help you.
8. Try the examples of covalent bonding on the first page of the learn sheet.
9. What is a molecule?
10. What is a giant structure?
11. Describe the structure and bonding in metals.

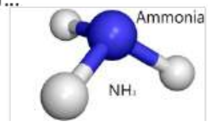
16. Explain why alloys are harder than pure metals.
17. Describe the structure and bonding in ionic substances e.g. sodium chloride.
18. Describe the structure and bonding in diamond.
19. Describe the structure and bonding in graphite.
20. Use particle theory to explain why:
    a) Solids are not fluid but liquids and gases are.
    b) Liquids are able to take the shape of the container whereas solids do not.
    c) Gases expand to fill the space whereas liquids do not.
    d) Solids and liquids have a definite volume whereas gases do not.
    e) Diffusion in gases is faster than in liquids.
    f) Diffusion cannot happen in solids.

substance	melting point (°C)	boiling point (°C)	state at -100°C	state at 20°C	state at 200°C
A	56	120			
B	32	87			
C	-35	16			
D	375	508			
E	-210	-196			
F	-78	-45			
G	-27	34			
H	203	365			
I	57	187			
J	-133	-84			
K	-27	12			
L	354	489			

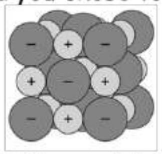
Why would you chose to use this model?



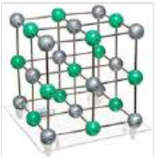
Instead of this model...



Why would you chose to use this model?



Instead of this model...



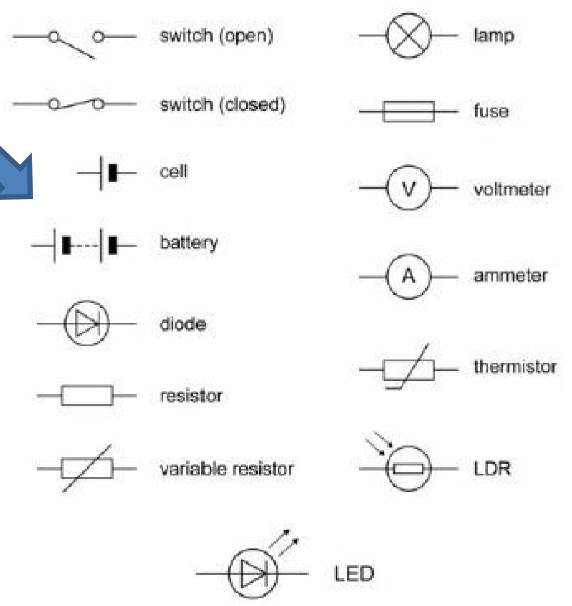
Y9 Physics (F) Electricity

Electricity Page 1

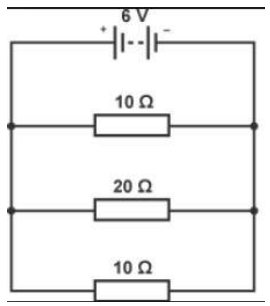
START

Key Words:

Conductor A material or object that allows electricity to flow through it.
Insulator A material or object that does not allow electricity to flow through it.
Ohmic conductor a conductor that obeys Ohm's Law.
Current The rate of flow of electrical charge around a circuit.
Potential Difference (P.d) A measure of work done. Makes the current flow.
Resistance Opposes the electric current.
Thermistor A temperature dependent resistor
LDR A light dependent resistor.
Diode A component that allows current to flow in only one direction.
Power The rate that energy is transferred.
Alternating P.d Voltage that changes from positive to negative.
Direct P.d Voltage that pushes the current in one direction .
National Grid A system of cables & transformers that connect power stations to consumers.
Transformer A device that increases or decreases P.d.



The **total resistance** in a **parallel** circuit is the reciprocals of all of the resistances.



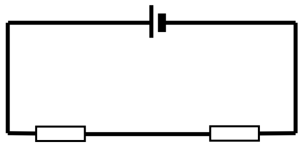
e.g. $$\frac{1}{R_{Total}} = \frac{1}{10} + \frac{1}{20} + \frac{1}{10} = 0.25$$

This answer is 1 divided by the total resistance so we need to do 1 divided by our answer:

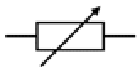
$$1 \div 0.25 = 4\Omega$$

4Ω is the total resistance for this circuit.
Use your scientific calculator to add the fractions!

The **total resistance** in a **series** circuit is the sum of the resistors in the circuit

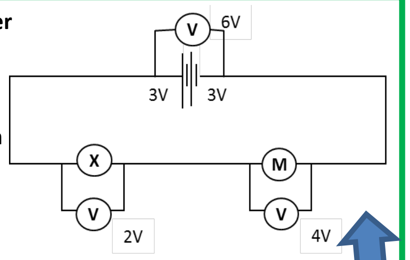


e.g. 6 + 10 = 16 Ω

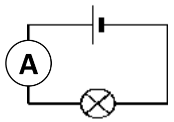


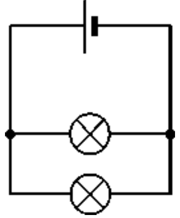
A **variable resistor** can alter the resistance in a circuit and is useful for things like controlling volume or light dimmer switches . LDRs **decrease** resistance when there is bright light. Thermistors **decrease** resistance when it gets warmer.

- P.d. is measured using a **voltmeter** connected in parallel across a component.
- In a series circuit the P.d of the cells or battery is shared between the components.
- In a parallel circuit the P.d. across each branch is equal to the P.d. across the cell.



- Current is measured using an Ammeter in series with the circuit.
- In a series circuit the current is the same everywhere.
- In a parallel circuit the current is split when it reaches a branch.
- The circuit needs to be complete for the current to flow.





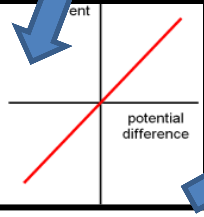
$Charge = Current \times time$	$Q = I\,t$
$P.d. = Current \times Resistance$	$V = I\,R$
$Power = P.d. \times Current$	$P = V\,I$
$Power = (Current)^2 \times Resistance$	$P = I^2 R$
$Energy = Power \times time$	$E = Pt$
$Energy = Charge \times P.d$	$E = QV$

LEARN & USE THE UNITS:

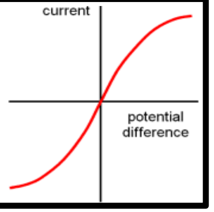
Charge	**Coulombs (C)**
Current	**Amps (A)**
P.d.	**Volts (V)**
Resistance	**Ohms (Ω)**
Power	**Watts (W)**
Energy	**Joules (J)**
Time	**Seconds (s)**

Electricity
Page 2

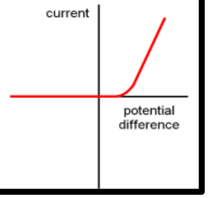
The current through a **resistor** (at a constant temperature) is directly proportional to the P.d across it.



The resistance of a **bulb** increases as the temperature of the filament increases

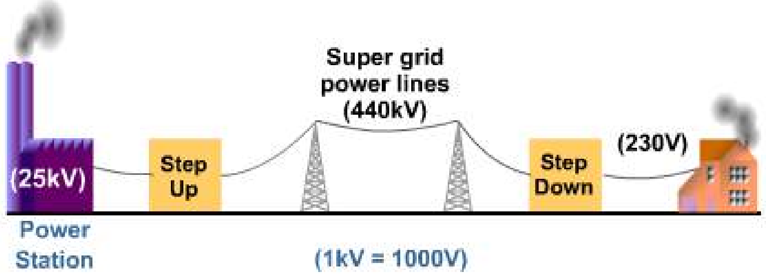


The current through a **diode** flows in one direction. It has a very high resistance in the opposite direction.



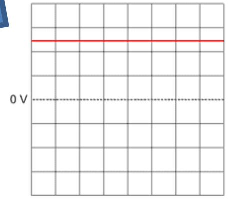
The National Grid

- Electricity is transferred from power stations to consumers along cables of the National Grid.
- When a current flows through a wire some energy is lost as heat. The higher the current, the more heat is lost.
- To reduce these losses, the National Grid transmits electricity at a low current. This needs a high voltage.
- Power stations produce electricity at 25,000V. Electricity is sent through the National Grid cables at 400,000V, 275,000V and 132,000V.
- Step-up transformers are used at power stations to produce the very high voltages needed to transmit electricity through the National Grid power lines.
- These high voltages are too dangerous to use in the home, so step-down transformers are used locally to reduce the voltage to safe levels.

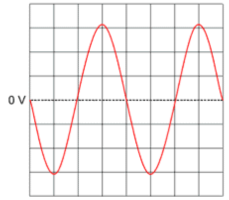


Household electricity has a potential difference of around **230V** and a frequency of **50 Hz (Hertz),** so changes direction 50 times in a second.

Direct current(DC) only flows in one direction, whereas current from the mains supply is **alternating current (AC)** because it alters direction.

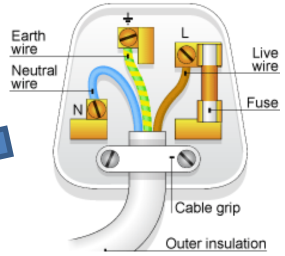


DC- one direction



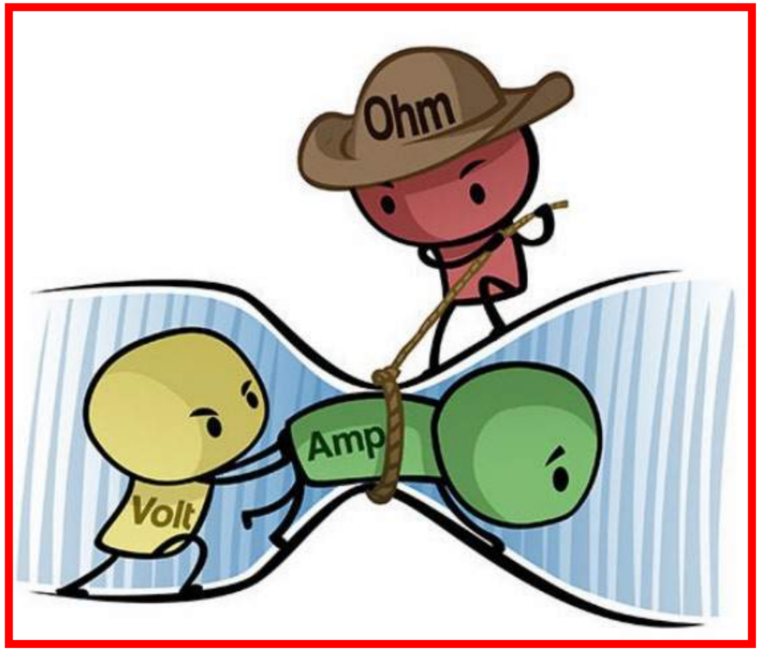
AC- alternating direction

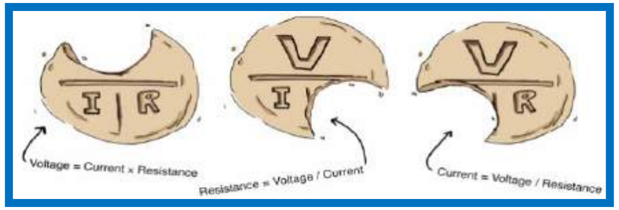
- Blue is neutral and goes on the left
- Green/yellow is Earth and goes to the top
- Brown is live and goes to the right
- A fuse will melt & break the circuit when the current is too high.



The circuits in your house are earthed outside. Appliances with metal cases need to be earthed inside the case.
This is just in case a live wire comes loose- the current will then pass through the earth wire and not you when you touch it.

FINISH





ELECTRICITY

1. Draw a circuit diagram to show how the P.d and current of a bulb can be investigated.
2. Draw the V-I characteristic graphs for: (a) an Ohmic conductor (b) a diode (c) a filament bulb.
3. Explain why the V-I graph for the bulb is the shape that it is.
4. What is the unit of charge?
5. If a current of 4A flow for 30s how much charge will flow?
6. If 60Ω resistor has a P.d of 12V put across it, how much current will flow?
7. Calculate the missing voltages in the circuits below:

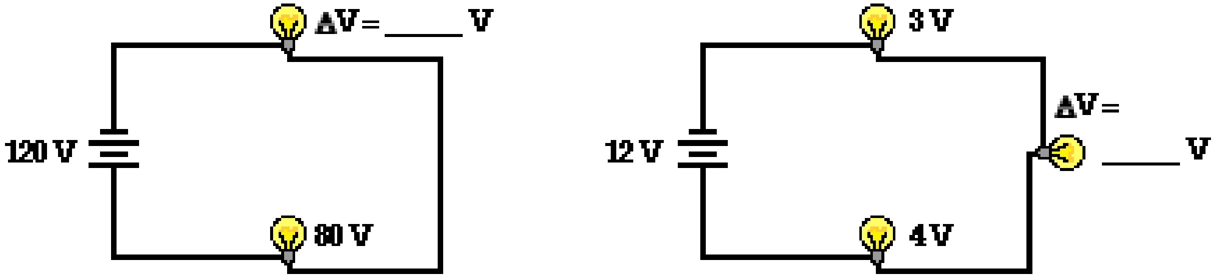
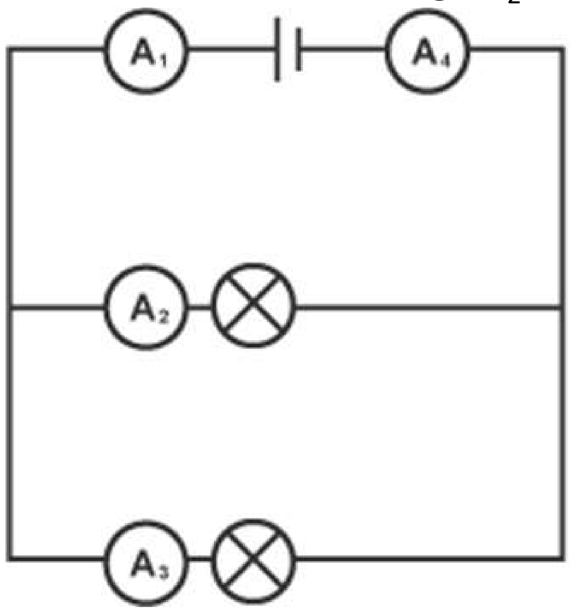


Diagram A Diagram B

8. How mucl hen it is plugged into the 230V mains supply?

ELECTRICITY

8. The current through A_1 = 6A and the current through A_2 = 4A What is the current through A_3 and A_4 ?



9. What is the power of a bulb that has a resistance of 200Ω when a current of 0.2A flow through it?
10. Draw a labelled diagram of a 3-pin plug.
11. What is the function of the Earth wire?
12. Draw a labelled diagram of the National Grid.
13. Why is the P.d. increased to over 400kV for transmitting electricity across the national grid?
14. Explain what potential difference, current and resistance are in words.