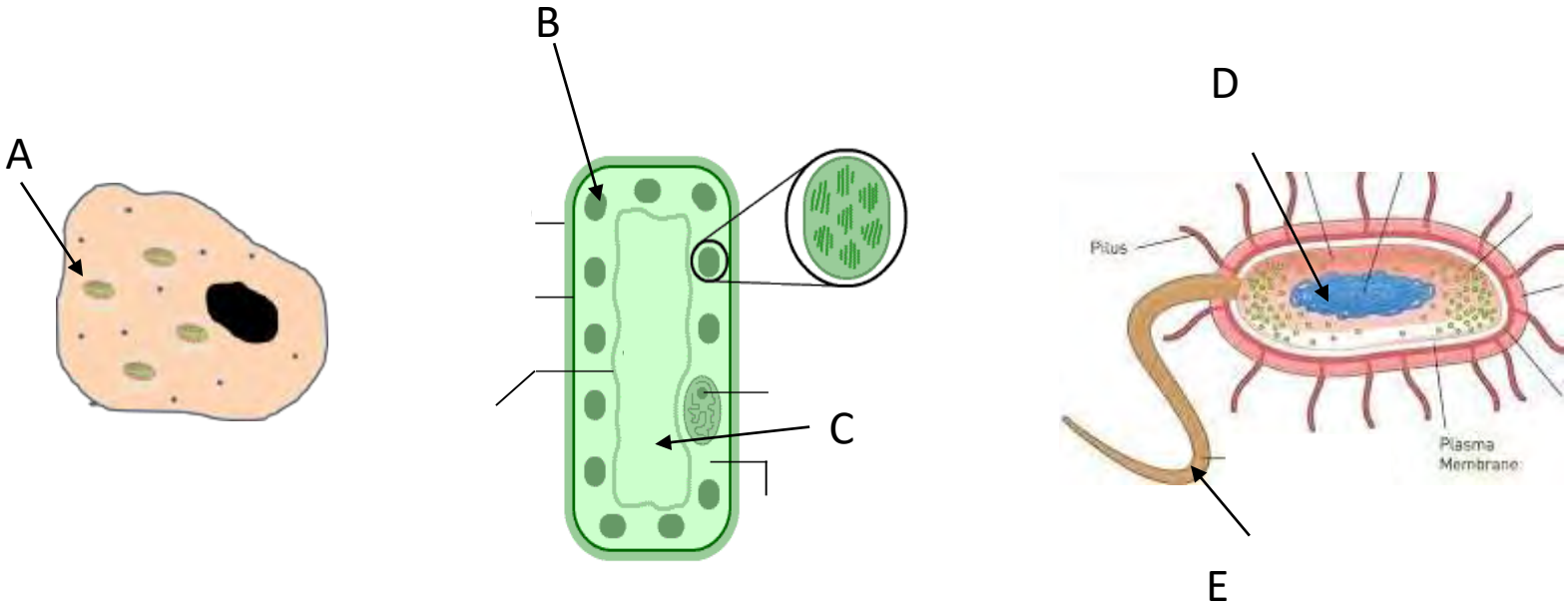
Biology 1 Revision

<u>Paper 1 topics:</u>

- Cells
- Systems
- Plants
- Disease

Cell structure

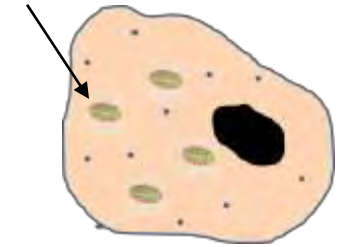
- Plant, animal or bacterial? Prokaryote or Eukaryote?
- What are the names of structures A-E?



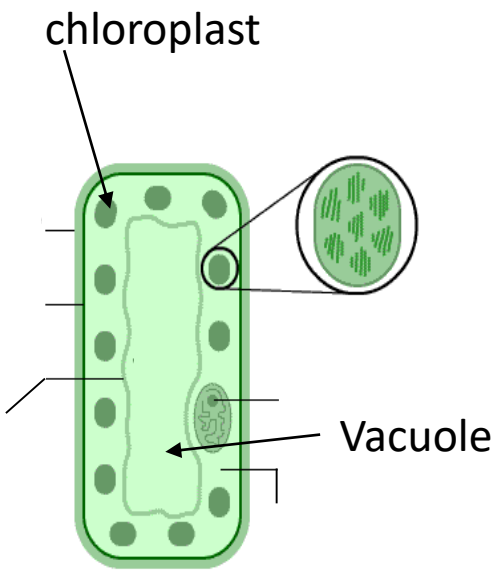
Cell structure

- Plant, animal or bacterial?
- What are the names of structures A-E?

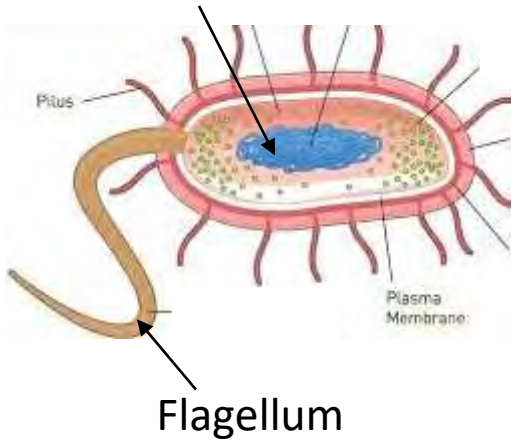
Animal - eukaryote



Plant - eukaryote

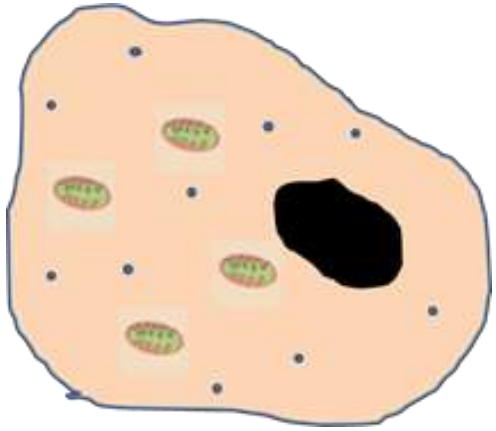


Bacteria - Prokaryote

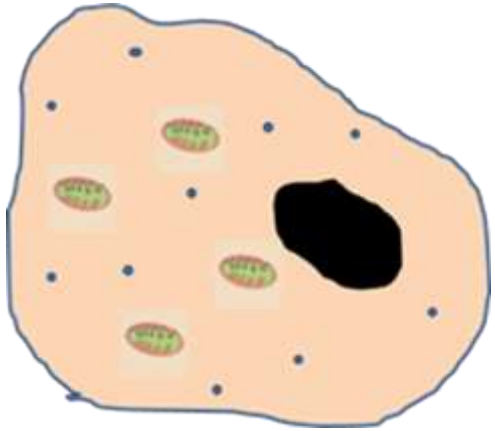


Part	Function	Animal	Plant
Nucleus		✓	✓
	most of the chemical reactions take place here.		
Mitochondria			
	where protein synthesis occurs		
	controls the passage of substances into and out of the cell		
	made of cellulose, which strengthens the cell		
Chloroplasts			
	filled with cell sap.		

What should the blank spaces say?



Part	Function	Animal	Plant
Nucleus	Contains DNA, controls the activities of the cell	✓	✓
Cytoplasm	most of the chemical reactions take place here.	✓	✓
Mitochondria	Site of respiration	✓	✓
Ribosome	where protein synthesis occurs	✓	✓
Cell Membrane	controls the passage of substances into and out of the cell	✓	✓
Cell Wall	made of cellulose, which strengthens the cell	X	✓
Chloroplasts	absorb light energy to make food	X	✓
Vacuole	filled with cell sap.	X	✓



Specialised cells

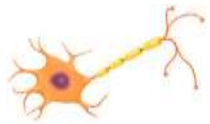
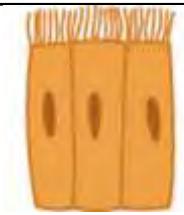
Diagram	Name	Function	Adaptation
		Transmit electrical impulse	
		Transport oxygen	
		Sweep mucus & pathogens away from the lungs	
		Fertilise an egg cell	

Diagram	Name	Function	Adaptation
	Nerve cell	Transmit electrical impulse	Long axon to carry impulse over long distances Many dendrites to make many connections with other cells
	Red blood cell	Transport oxygen	Biconcave shape → large surface area No nucleus so it can contain more haemoglobin
	Ciliated epithelial cell	Sweep mucus & pathogens away from the lungs	Sticky mucus traps dust. Hairs move dirt away from lungs.
	Sperm cell	Fertilise an egg cell	Streamlined shape & tail – can swim to the egg Chemicals in the tip to enter the egg cell.

Microscopes

Which microscope allows us to see mitochondria?

electron

How many micrometres are there in a millimetre?

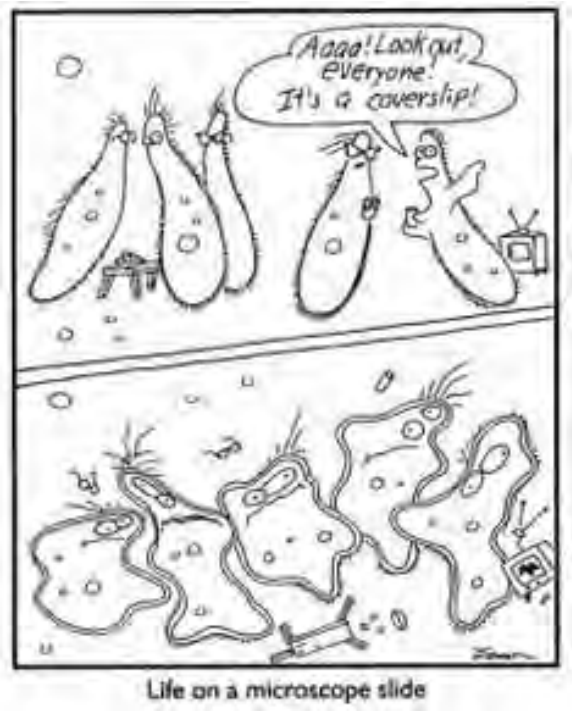
1000

A scientist viewed a picture of a cell, that had been magnified 100,000 times.

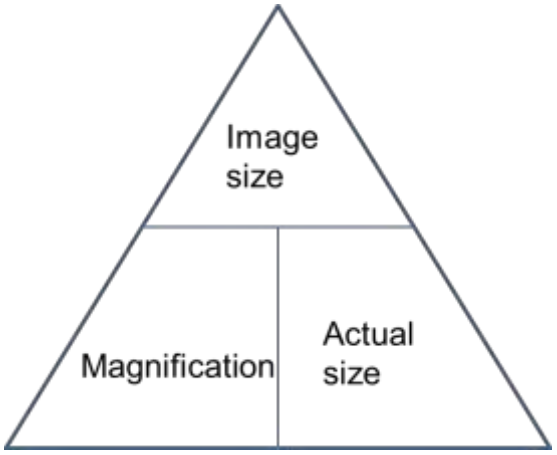
The size of the cell in the image was 25mm.

How large was the actual cell?

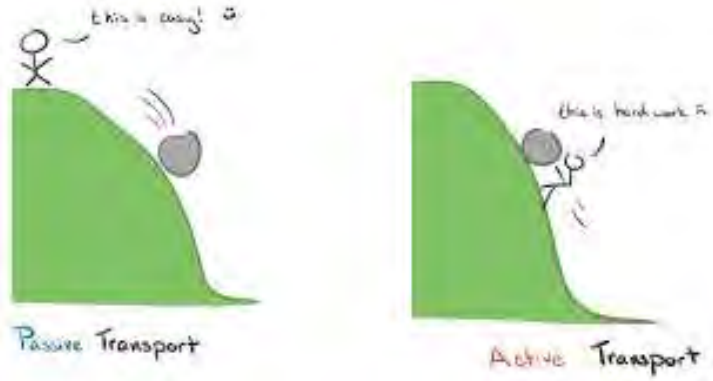
0.25µm



Life on a microscope slide



Exchange of substances



Diffusion, osmosis or active transport?

- Uptake of mineral ions in the soil into root hair cells, against the concentration gradient.

ACTIVE TRANSPORT – requires energy from respiration

- Uptake of water in root hair cells.

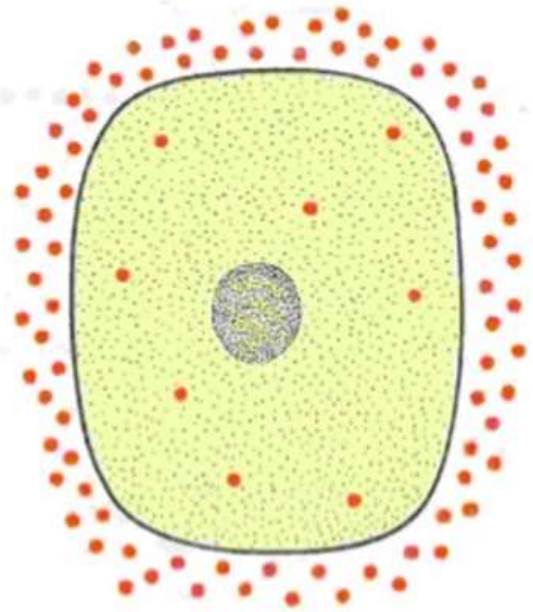
OSMOSIS

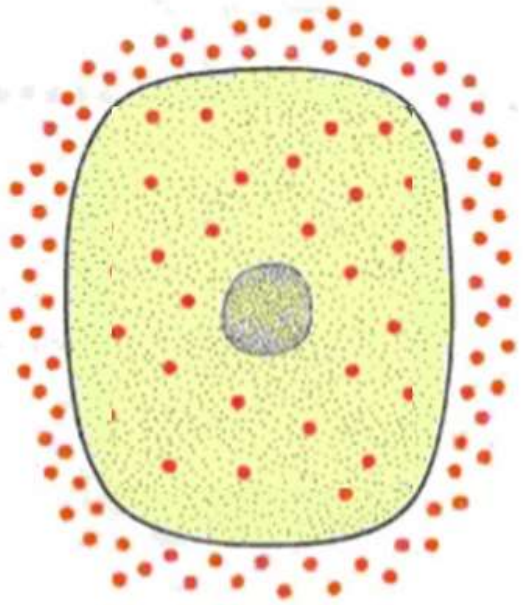
- Movement of oxygen and carbon dioxide between alveoli and capillaries.

DIFFUSION – passive, no energy required as it is moving from an area of high concentration to an area of low concentration.

Exchange of substances

- How can we speed up diffusion?
- How is this achieved in the lungs and small intestine?



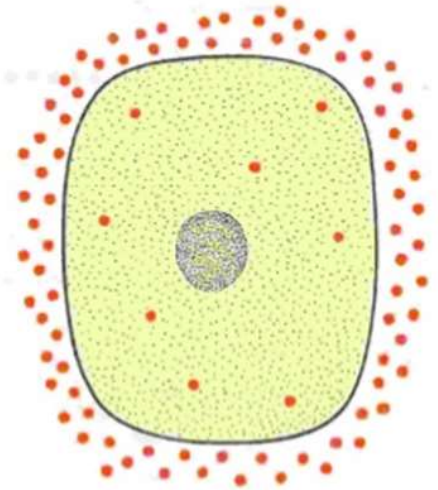


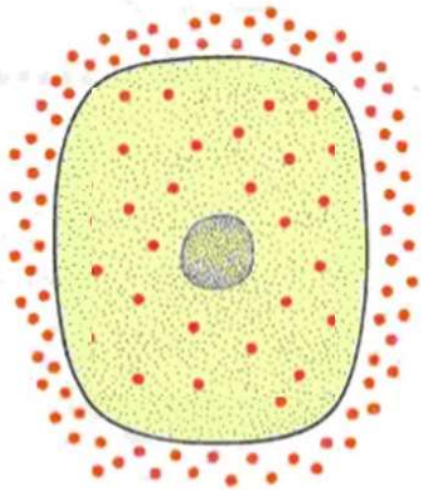
Which cell will have more rapid diffusion of oxygen?

Why?

Exchange of substances

- Many alveoli and villi → Large surface area
- Many capillaries so an excellent blood supply → Steep concentration gradient
- Alveoli and villi both have thin walls → Short diffusion distance



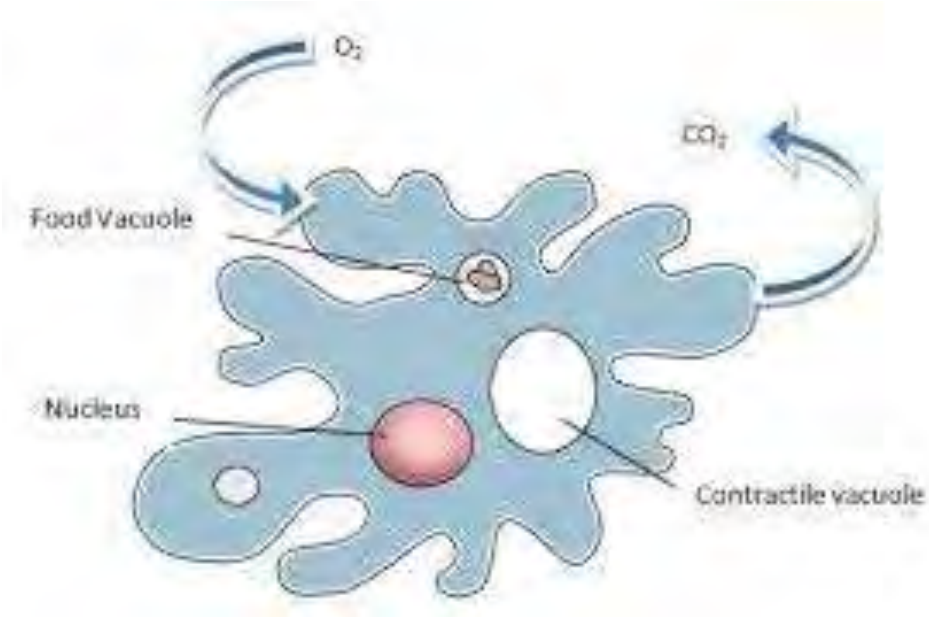


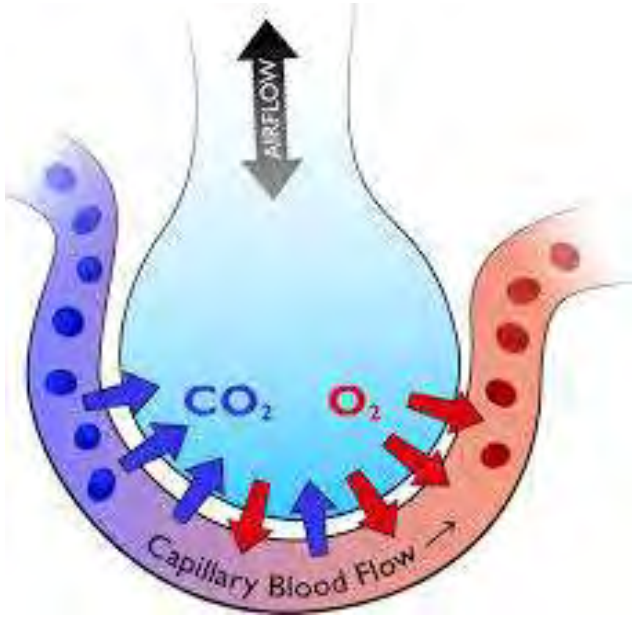
The cell on the left:

There is a steeper concentration gradient so diffusion is faster. This cell is respiring rapidly, so the oxygen concentration inside the cell remains low.

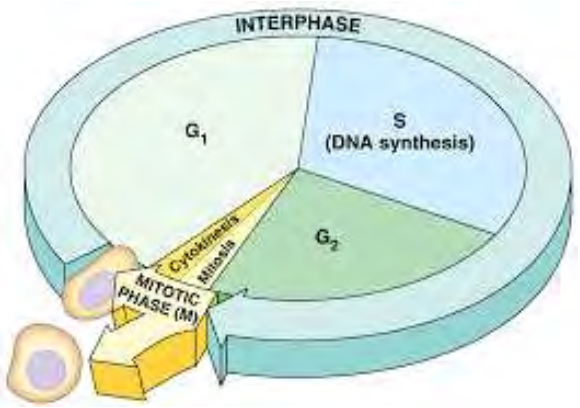
Why do we have lungs?

Multicellular organisms need specialised exchange surfaces – diffusion across the surface would not be sufficient to supply the organism's needs.





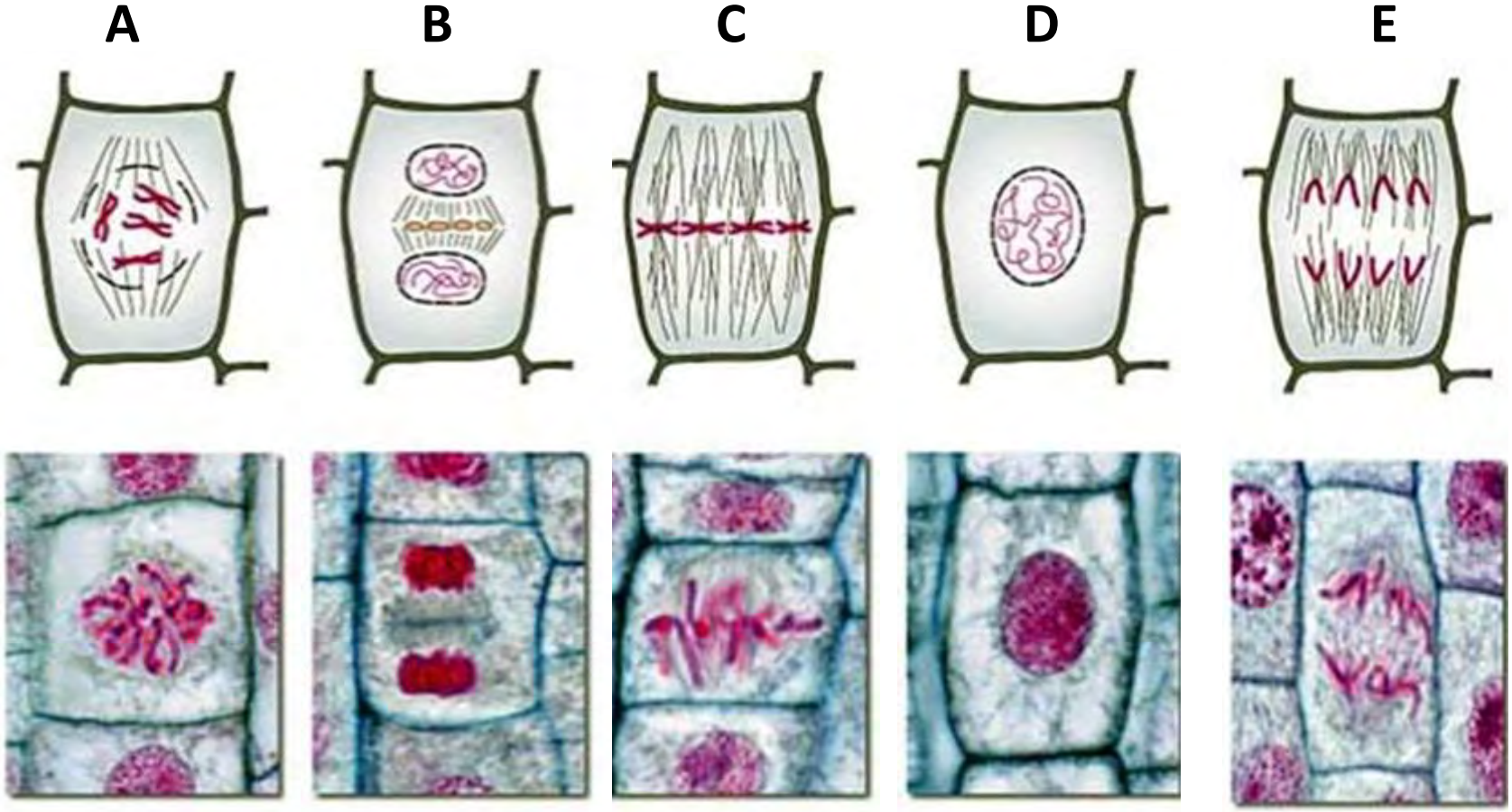
Cell cycle



- Main stages
- G1 – growth – new ribosomes, mitochondria
- S – DNA replication
- G2 – more growth, checking for errors
- M – Mitosis – nucleus divides

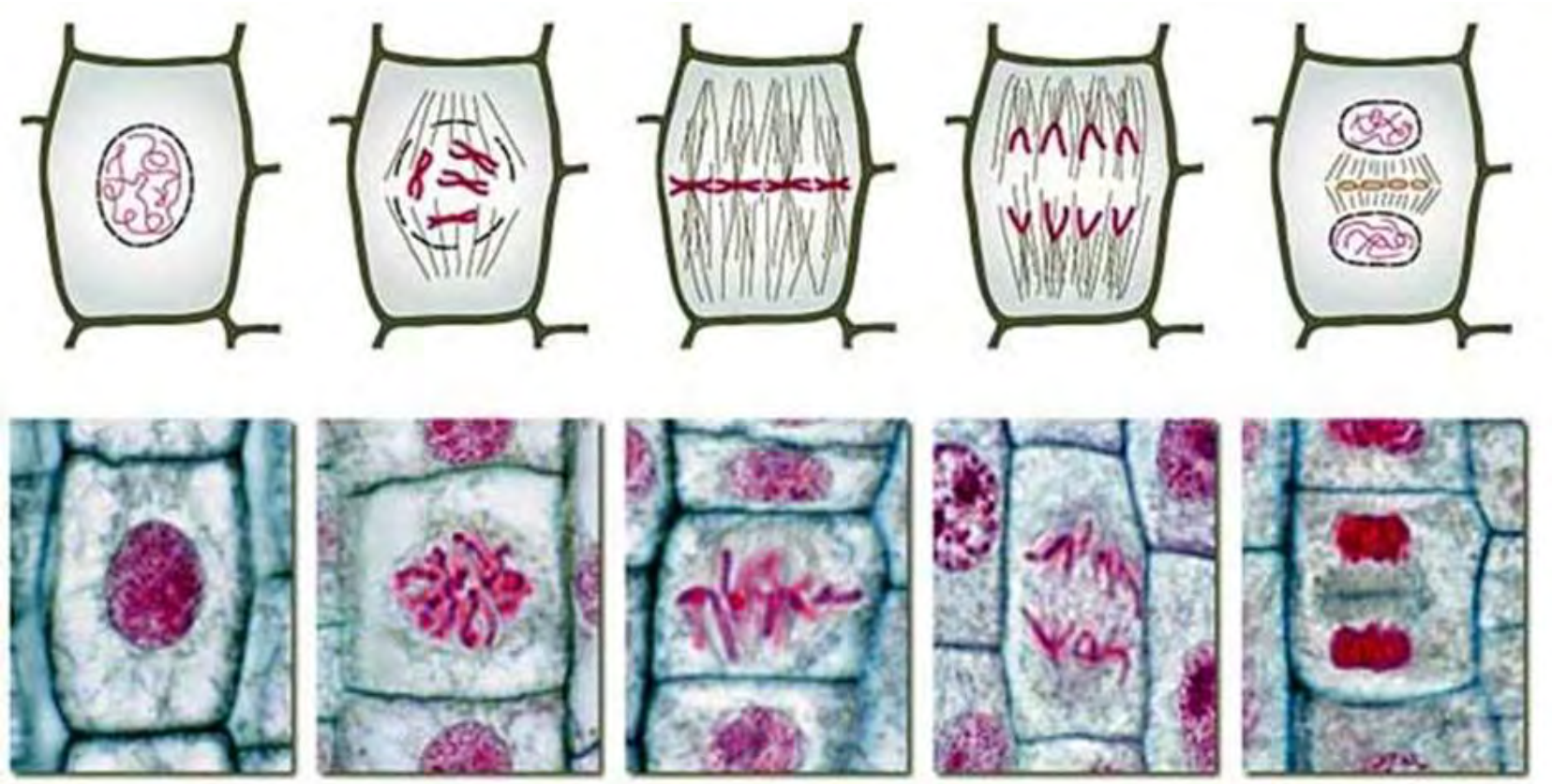
- What happens at each stage?

Mitosis – put the stages in order

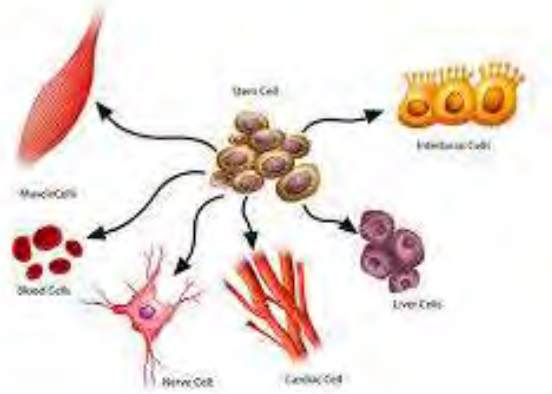


Mitosis

D A C E B



Stem cells



- What are they?

Undifferentiated cells, capable of dividing many times and developing into different types of specialised cells

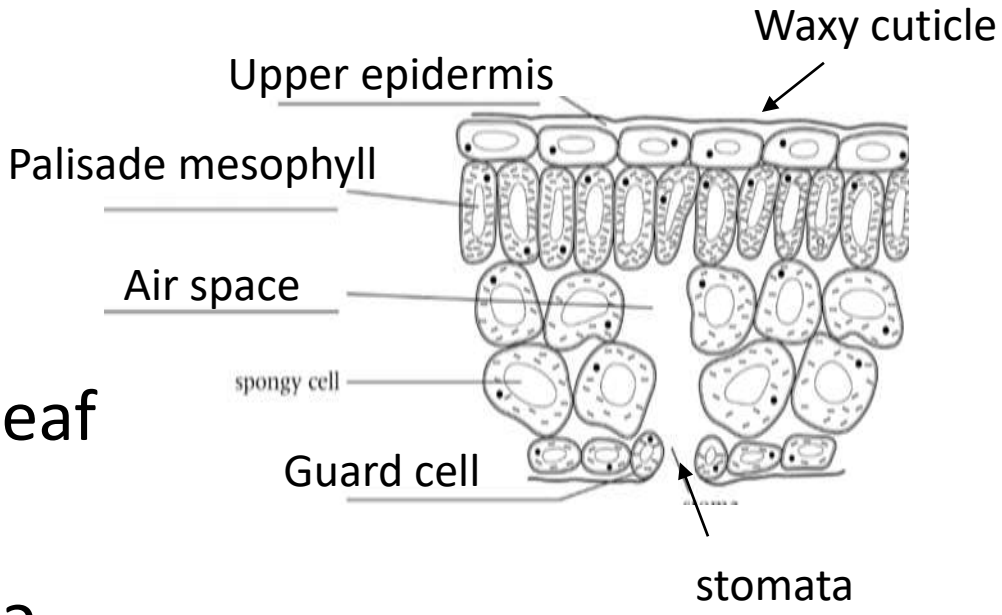
- Adult vs Embryo
  - Range of cell types –

  embryo can develop into many more cell types, so can treat more diseases
  - Rejection

  if the stem cell is taken from a patient's own bone marrow there will not be issues with rejection
  - Ethical issues

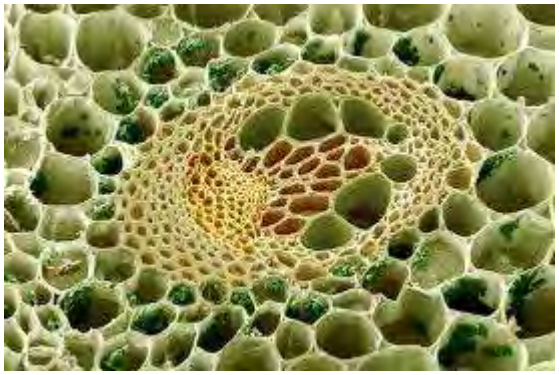
  some people object to using embryonic stem cells as it involves destroying embryos.

Plant tissues

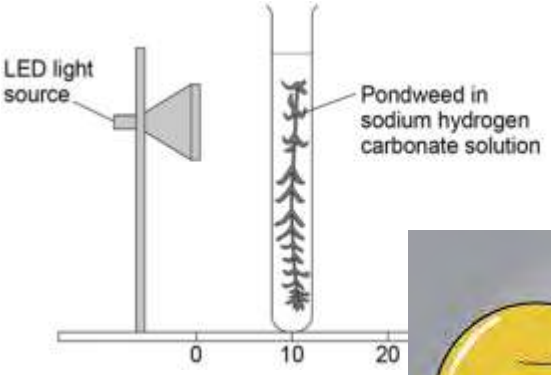


- Label the parts of the leaf
- Which plant tissue is it?

Plant tissue	Role
Mesophyll	Carry out photosynthesis
Epidermis	Cover the plant
Xylem and Phloem	Transport substances
Meristem	Growing tips of shoots and roots



Photosynthesis



- Equation:

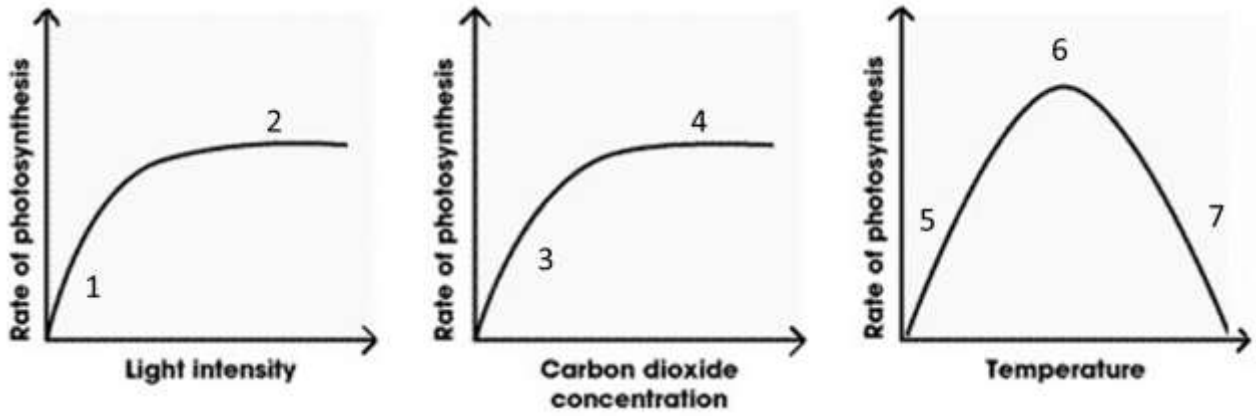
Carbon dioxide + water → glucose + oxygen

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

- Why do plants do photosynthesis?
- To produce glucose – stored as starch, stored as fats and oils, used to make amino acids, used to make cellulose for cell walls, used in respiration
- Measuring photosynthesis?
- Counting bubbles under water in a minute, measuring volume of oxygen produced per minute, testing leaves for the presence of starch

Limiting factors

- What are the limiting factors for photosynthesis?
- Light intensity, temperature, carbon dioxide levels (chloroplasts)



What is the limiting factor(s) at:

1 light intensity

2 carbon dioxide levels/temperature

3 carbon dioxide levels

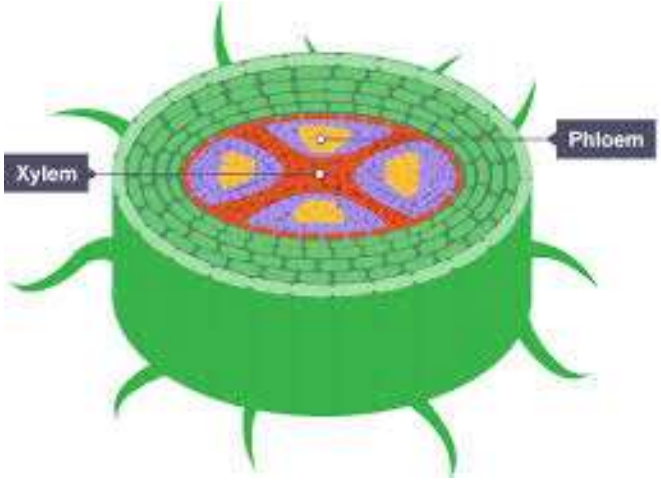
4 light intensity/temperature

5 temperature

6 light intensity/carbon dioxide levels

7 temperature

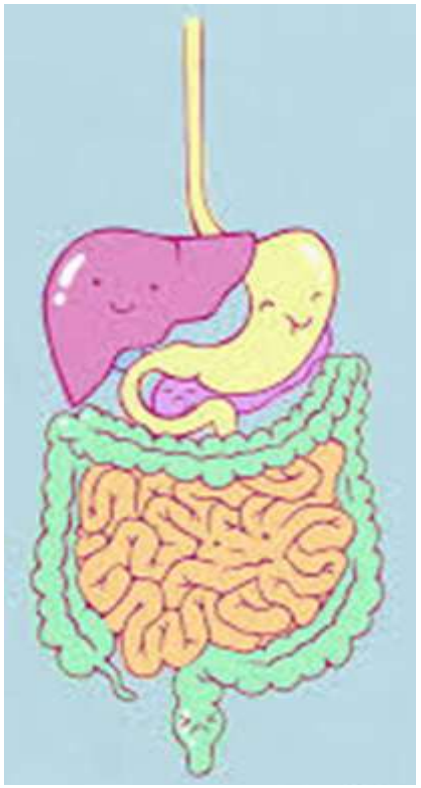
Transport in plants



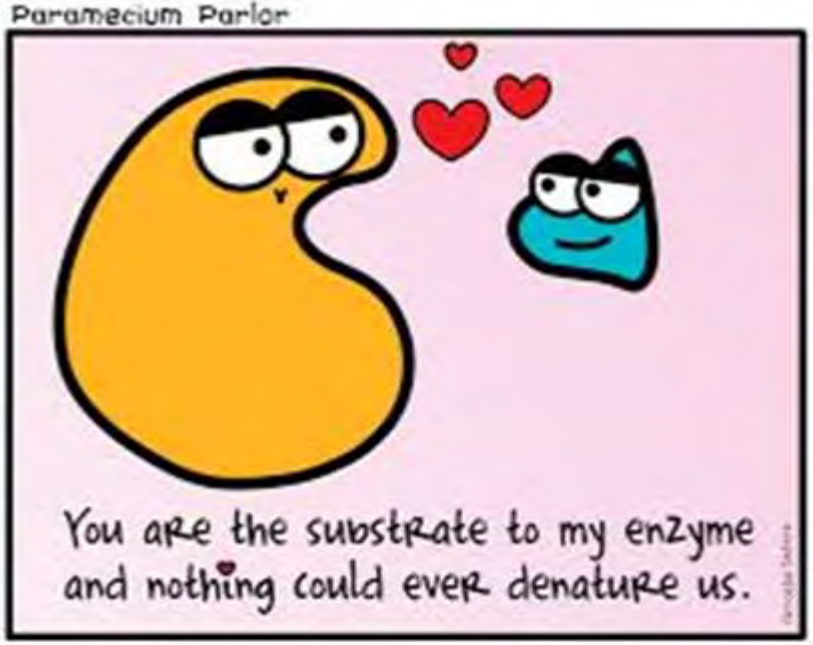
- What does the xylem transport?
- Water and mineral ions
- What does the phloem transport?
- sugar
- What is transpiration?
- Evaporation of water from stomata in the leaves
- What factors speed up transpiration?
- High temperature, low humidity, wind, high light intensity (opens stomata)

Systems – digestive system

- What do amylase, protease and lipase break down? What is the product in each case?
  - Amylase: Starch → sugar
  - Protease: Protein → amino acids
  - Lipase: Fat → fatty acids and glycerol
- What is the food test for:
- Starch
- Iodine – turns blue black
- Protein
- Biuret – turns purple
- Fat
- Sudan III – top layer is red
- Glucose
- Heat with benedict's – turns orange



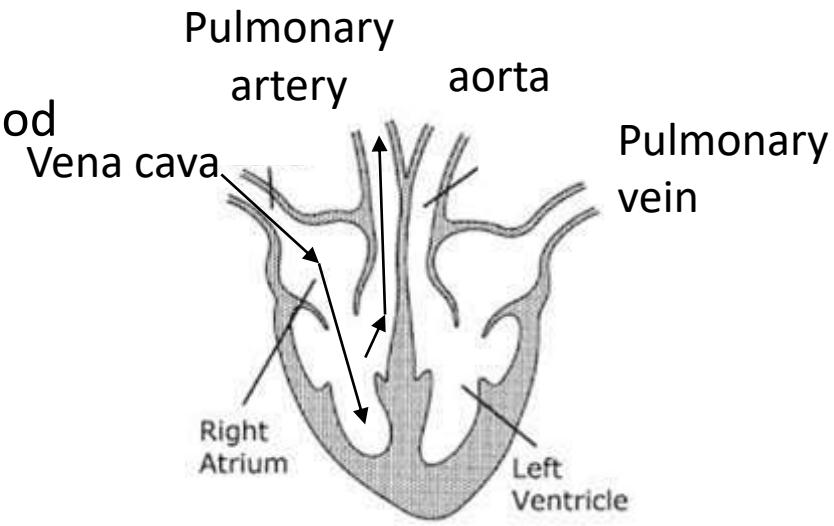
Digestive system

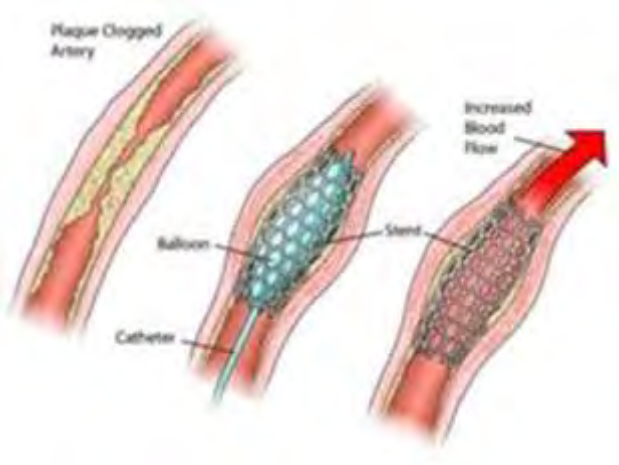


- Where are villi found?
- Small intestine
- What happens to enzymes at high temperatures or the wrong pH?
- Enzymes denature (active site changes shape so substrate cannot fit)

Systems – Circulatory system

- Label the blood vessels
- Add arrows to show the direction of blood flow.
- How is heart rate controlled?
- Pacemaker on the right atrium.
- How can an irregular heart beat be treated?
- Artificial pacemaker





What is this? What is it used for?

Stent

Widens coronary arteries if there is a fatty deposit

Advantages – increases blood flow to heart muscle

Disadvantages – surgery/ anaesthetic risk, blood clotting, damage to blood vessels

Systems – Circulatory system

Why do arteries have a thick muscle layer?

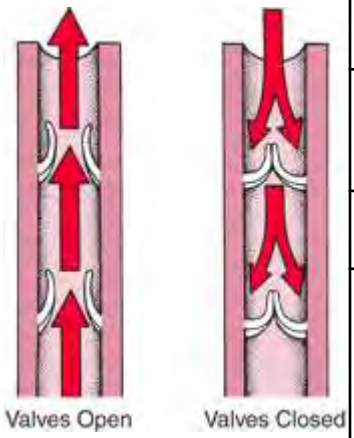
To cope with high blood pressure.

Why do veins have valves?

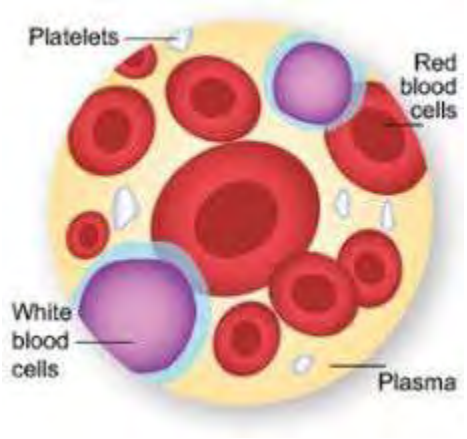
To prevent backflow

Why do capillaries have thin walls?

To allow rapid exchange of substances by diffusion.



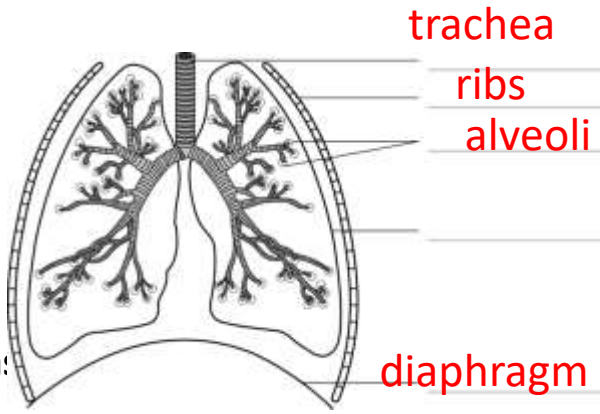
Component	Function
Red blood cells	Transports oxygen
White blood cells	Destroys pathogens
Platelets	Clots blood
Plasma	Transports dissolved substances, e.g. urea, water, glucose, amino acids, mineral ions, hormones



Systems – Respiratory system

- **What is the equation for aerobic respiration?**
- Glucose + oxygen → carbon dioxide + water
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
- **What is the equation for anaerobic respiration in animals?**
- Glucose → lactic acid
- **What is the equation for anaerobic respiration in plants and yea**
- Glucose → ethanol + carbon dioxide
- **Why is lactic acid produced when we exercise?**
- We don't have enough oxygen reaching our muscles, so they do anaerobic respiration instead of aerobic respiration.
- **Why does our heart rate increase when we exercise?**
- More oxygen and glucose are delivered to our cells.
- Our cells do more respiration. This releases more energy.

Label the diagram

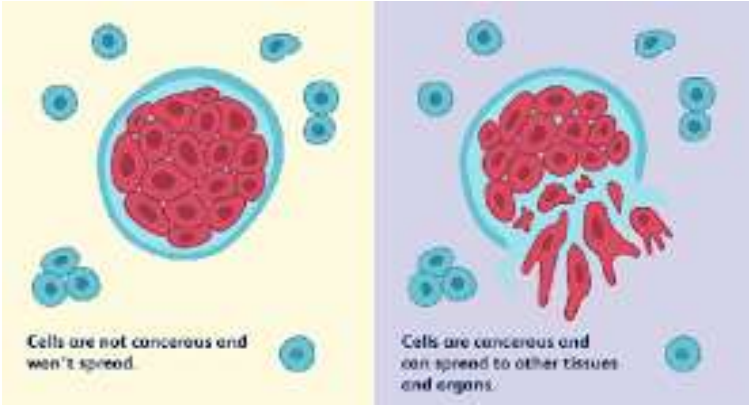


Non-communicable diseases

- Match the risk factors to the disease:

Disease	**Risk Factor**
Lung disease and lung cancer	Diet, smoking and lack of exercise
Cancer	Obesity
Cardiovascular disease	Alcohol
Liver and brain function	Smoking
Type 2 Diabetes	Smoking and alcohol
Unborn babies	Carcinogens and ionising radiation

Cancer



- What is cancer?
- Changes in cells that lead to uncontrolled growth and division.
- What are benign tumours?
- Abnormal growths of cells contained in one area.
- What are malignant tumours?
- Cancers that spread to other tissues through the blood where they form secondary tumours.

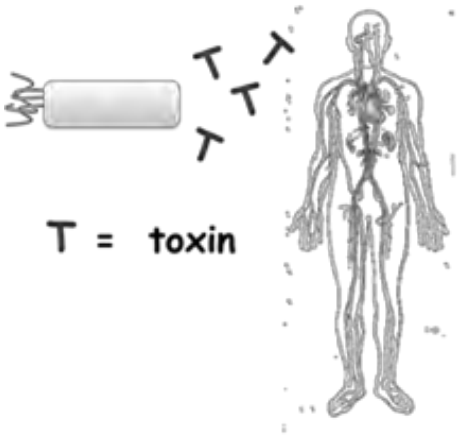
Disease

Type of pathogen	Name of disease	How it is spread	Reducing the spread	Symptoms	Treatment
Virus	Measles	droplets from sneezes, coughs	vaccination	Rash, fever	
	HIV	Sexual contact, dirty needles	condoms	More likely to get other infections (white blood cells are affected)	antiretroviral drugs
	Tobacco mosaic virus			Mosaic pattern on leaves → less photosynthesis	
Fungus	Rose black spot	Wind, water	Remove and destroy affected leaves	Black spots on leaves → less photosynthesis	fungicide
Bacteria	Salmonella	Poor food hygiene	Wash hands before handling food, vaccinate chickens		
	Gonorrhoea	sexual contact	condoms	Yellow/green discharge, pain when urinating	antibiotics
Protist	Malaria	mosquitos	Mosquito nets, destroy breeding sites	Fever, can be fatal	

What do plants need minerals for?

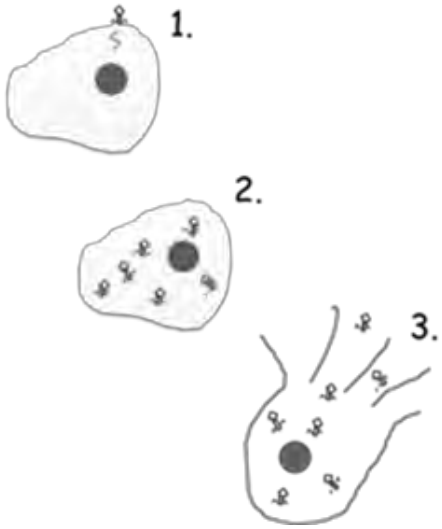
- Nitrates – TO MAKE PROTEIN
- Not enough nitrates → stunted growth
- Magnesium – TO MAKE CHLOROPHYLL
- Not enough magnesium → yellow leaves

For each picture, name the type of pathogen it represents and say why it makes us feel ill.



Bacteria

Reproduces rapidly and makes toxins



Virus

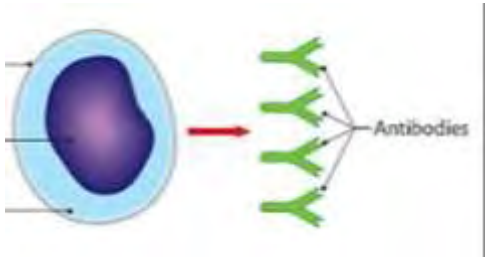
Damages tissues

Body's defences

- What do they do?
- Mucus
- Traps pathogens and dirt in the airways
- Cilia
- Sweeps mucus, pathogens and dirt away from the lungs
- Skin
- Forms a barrier
- Platelets
- Clots the blood at the site of a wound
- Stomach acid
- Destroys pathogens in food and drink

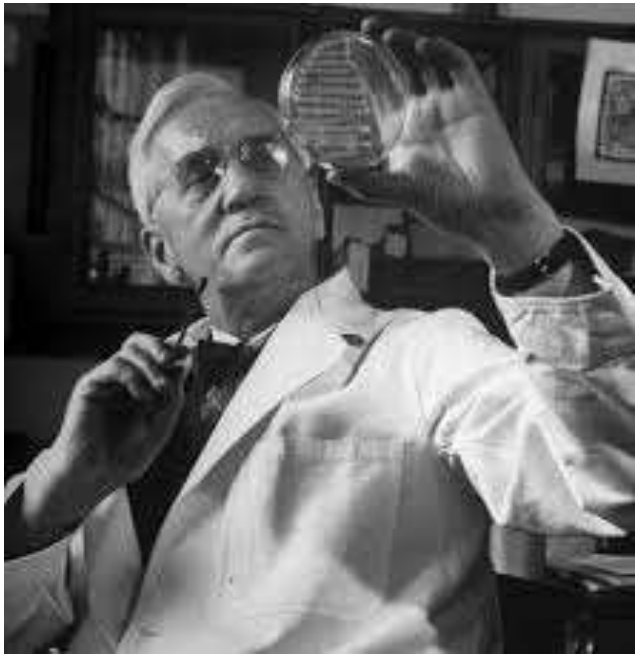
Which type of white blood cell does each picture show? How do they each protect us?

Phagocyte - Engulfs and ingests pathogens (phagocytosis)



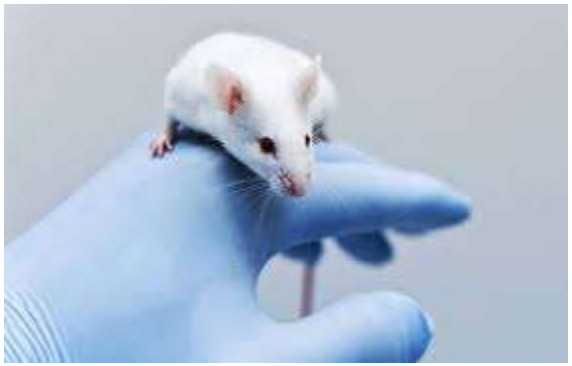
Lymphocyte - Produces antibodies and antitoxins

Drugs



- What is an antibiotic?
- Drug that kills bacteria.
- What is a painkiller?
- Drug that relieves symptoms only.
- Why can't antibiotics cure a common cold?
- Antibiotics only kill bacteria not viruses.
- Why should doctors only give out specific antibiotics for specific infections?
- Reduces risk of getting resistant strains of bacteria
- Where do aspirin, digitalis and penicillin originate from?
- Willow tree, foxglove and a mould.

Drug testing



- Why do drugs need to be tested
- For toxicity, efficacy, dosage and side effects.
- What steps are involved in pre-clinical testing?
- Cells and tissue testing, testing live animals.
- What steps are involved in clinical testing?
- Testing healthy volunteers, testing patients with the disease.
- What is a placebo?
- Fake drug
- What is a double blind trial?
- Neither the doctors nor the patients know who has been given the real drug and who has been given the placebo.

Biology 2 Trilogy Foundation Revision

<u>Paper 2 topics:</u>

- Homeostasis
- Inheritance
- Variation & Evolution
- Ecology
- Human Impact

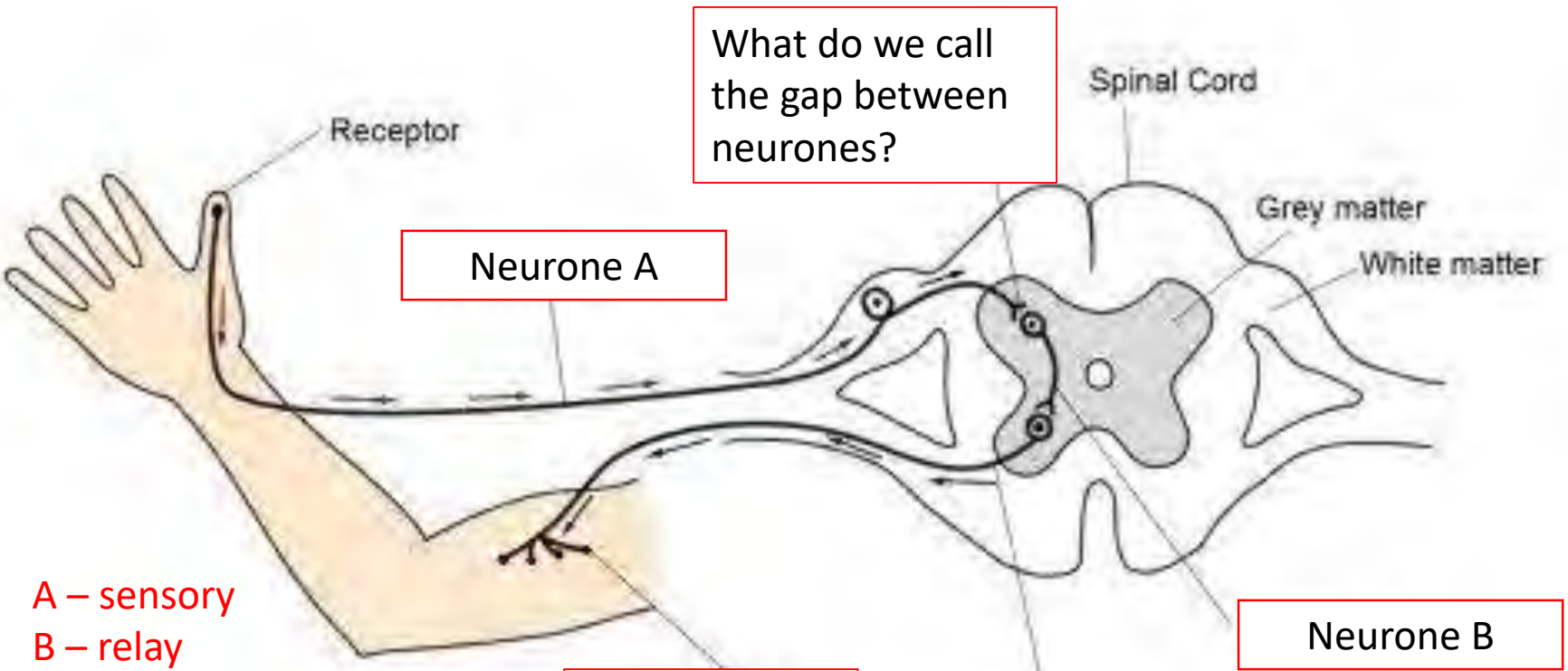
What are receptors?

Groups of _specialised_ cells that can detect _stimuli_ from the environment.

What types of stimuli can they detect?

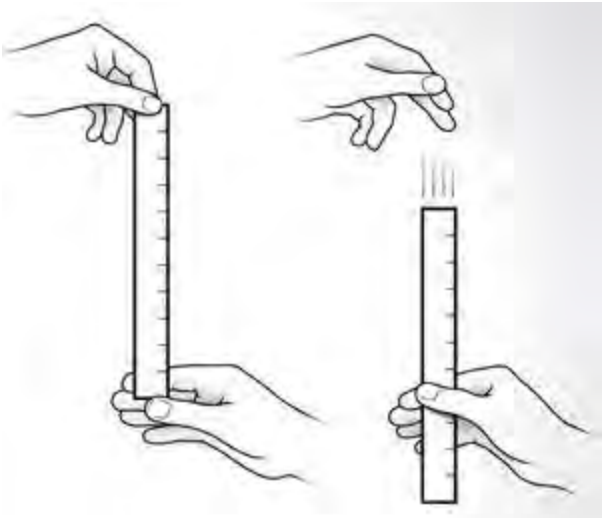
Pain - skin
Temperature - skin
Pressure - skin
Chemicals – tongue and nose
Light – eye
Sound - ear

Reflex actions



- A – sensory
- B – relay
- C – motor
- Gap – synapse
- Response is carried out by the effector (muscle or gland)

Required Practical: Reaction Time



What were the problems with this method?

- Not very accurate – human error – e.g. don't always drop in exactly the same way, difficult to keep finger and thumb exactly the same distance apart
- Can guess when your partner is about to drop, so can cheat

Why would be a computer program be better? (e.g. pushing a button when you see a word appear)

- More accurate – removes human error
- More repeatable

Causes of Extinction?

- New diseases
- New predators
- New, more successful competitors
- Changes to the environment over geological time - such as Climate change – increase in global temperatures
- A single catastrophic event - such as volcanic eruption, meteor

Fossils

What are fossils?

'Remains' of organisms from many years ago, found in rocks.

Why do we study fossils?

Can study them to learn how different organisms have changed as life developed on Earth.

Gives evidence for evolution by natural selection.

Fossils

How are fossils formed?

1. Mummification

Conditions keep the individual preserved – with no oxygen, microbes can't decompose tissue. E.g. peat bogs or in ice.

2. Mineral replacement

Sediment layers form above organism. Minerals replace parts as they decay, and turn to stone.

3. Trace fossils

Moulds and casts made from e.g. footprints.

Fossils

What are fossils?

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Why do we study fossils?

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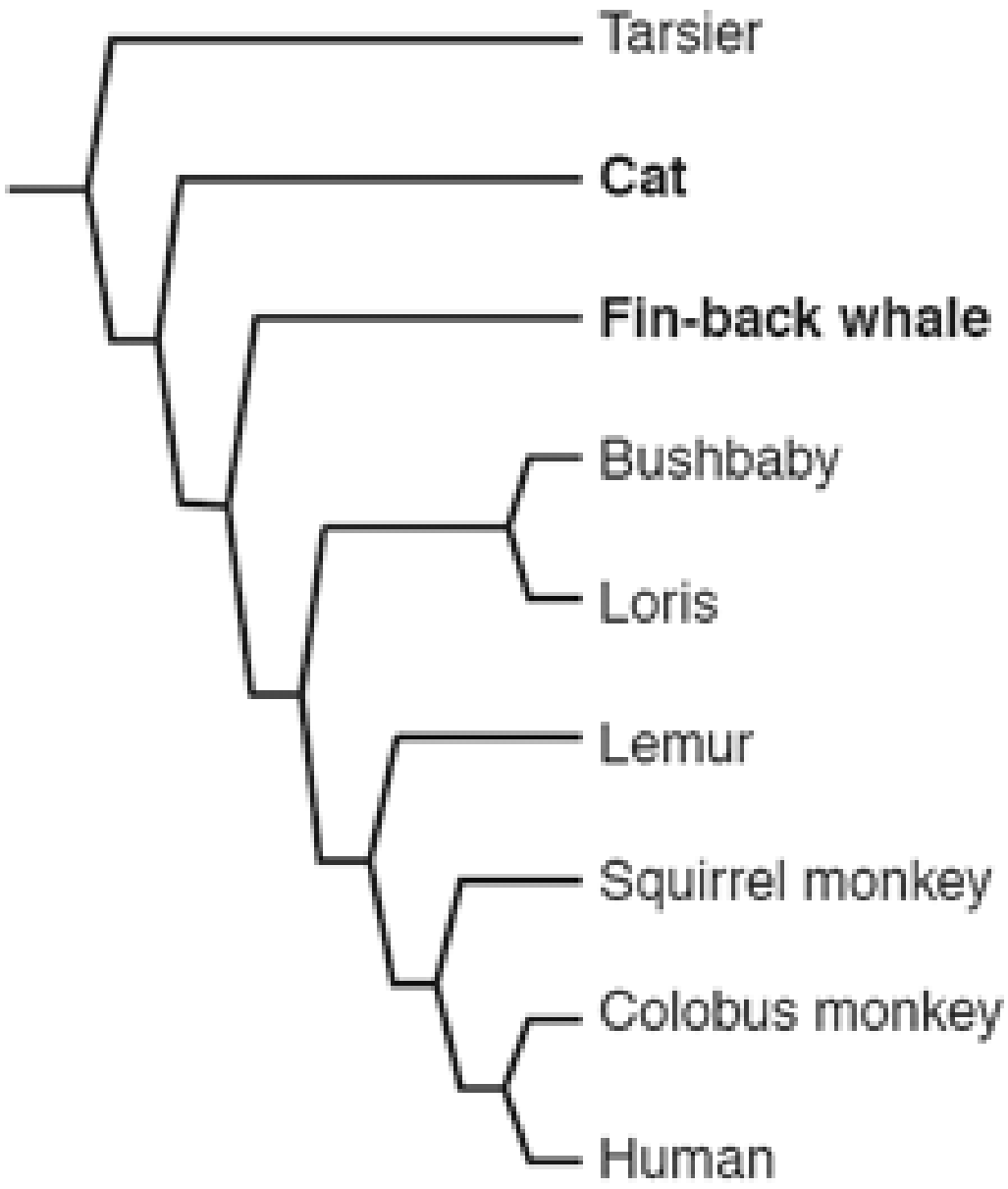
Gives evidence for evolution by natural selection.

Classification – 5 Kingdoms

You need to remember the hierarchy (order of subgroups) from kingdom to species. Carl Linnaeus came up with this system.

Kingdom	**K_____**	**Keeping**
Phylum	**P_____**	**Pesky**
Class	**C_____**	**Creatures**
Order	**O_____**	**Organised**
Family	**F_____**	**For**
Genus	**G_____**	**Grumpy**
Species	**S_____**	**Scientists**



1. What is the closest relative of the human? Colobus monkey
2. What is our most distant relative on this tree? Tarsier
3. What is the Loris most closely related to?

Bush baby

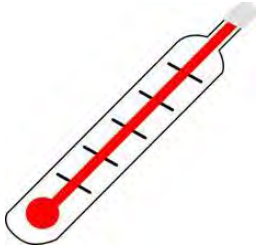
Abiotic Factors

Abiotic Factors = Non living factors

- Water levels
- Oxygen levels
- Carbon dioxide levels
- Temperature
- Light intensity
- Nutrient levels
- Wind intensity

What abiotic factors affect where organisms live?

Use the pictures to help you



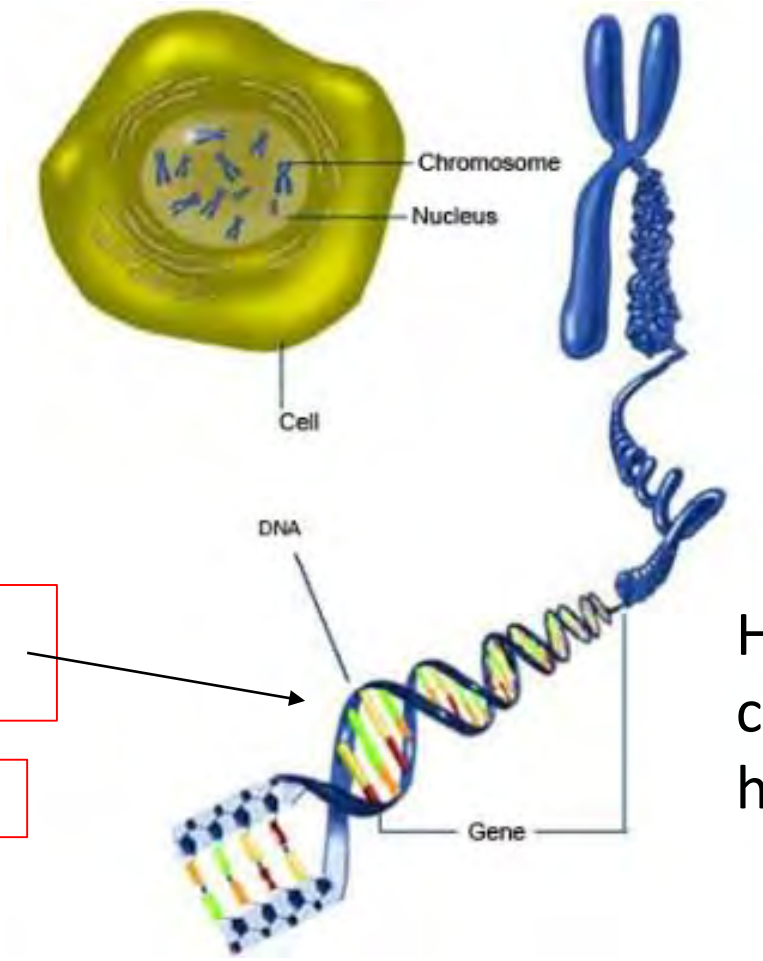
Biotic factors

Biotic factors = Living factors:

- availability of _____
- new _____ arriving
- new _____
- one species _____ another

- availability of food
- new predator arriving
- new pathogen
- one species out-competing another

DNA



Chromosomes contain genetic information

What do we call this structure?

Double helix

How many chromosomes do we have in our cells?

46

Types of reproduction

Sexual

- How many parents are needed?
  Two
- Do gametes fuse? (what are gametes?)
  Yes (sperm and egg)
- Does it lead to variation?
  yes

Types of reproduction

<u>Asexual</u>

- How many parents are needed?

  One

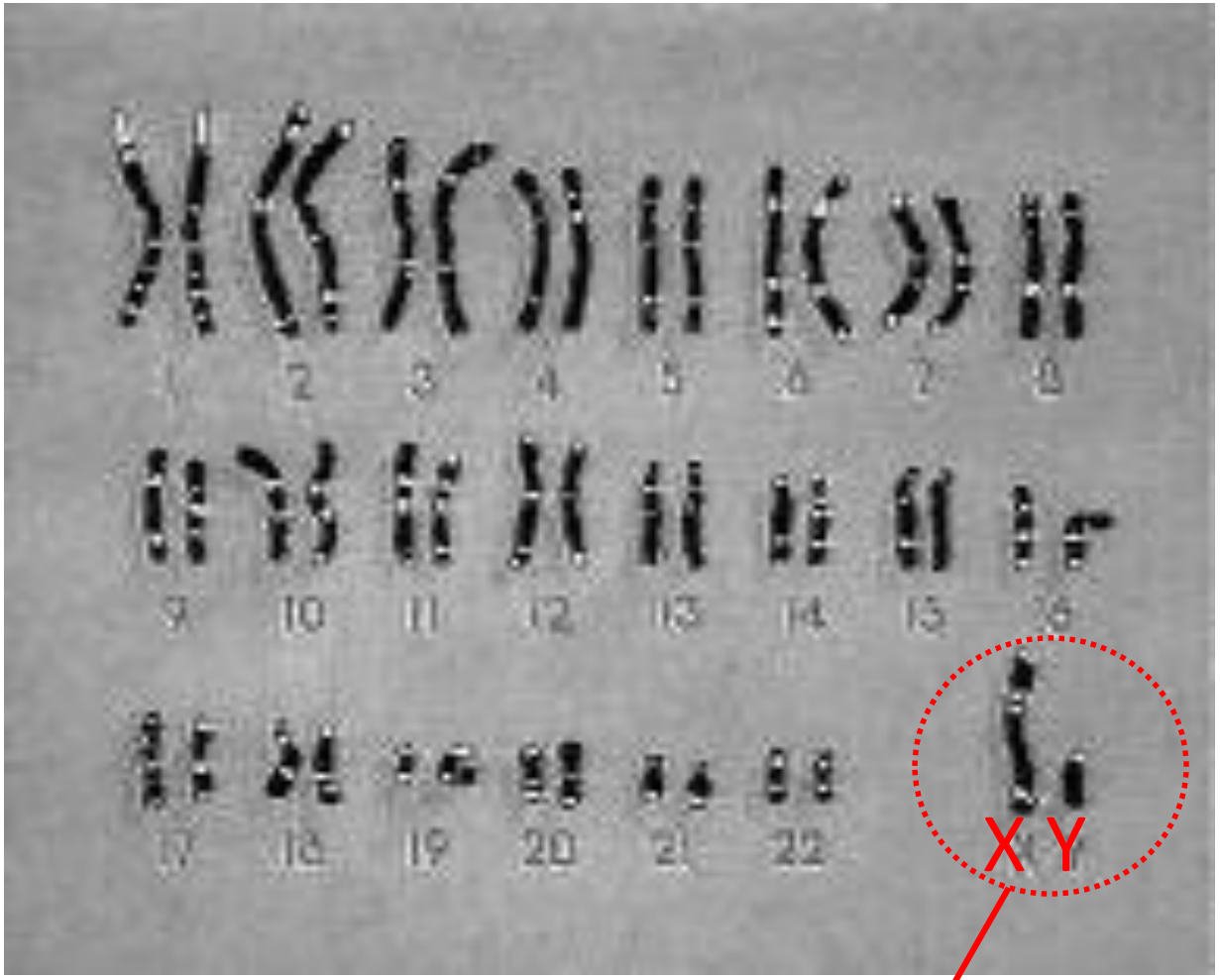
- Do gametes fuse?

  No

- Does it lead to variation?

  No – it produces clones

What do these chromosomes tell you?



Cystic fibrosis

- Both parents must have the faulty allele for a child to get the disease
- A parent who has only one faulty allele is a “carrier”

	C	**c**
C	**CC**	**Cc**
c	**Cc**	**cc**

What proportion have cystic fibrosis?

25%

Adaptations?

- Camouflage – colour of fur
- Animals in cold regions have a small surface area:volume ratio to conserve heat
- Fat layer for insulation in arctic fox
- Fur is shorter in desert fox
- Eyes on the front of the head to see prey
- Sharp teeth for ripping flesh
- Etc, etc

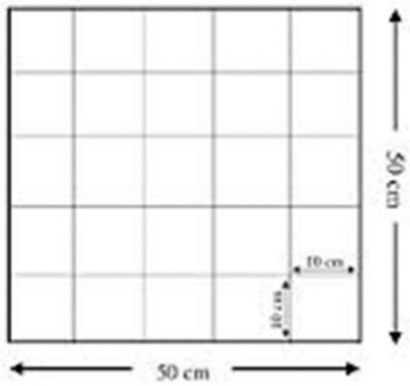
Random sampling

- Why do we need to place the quadrat at several different random sites in the field? So it is representative of the whole field

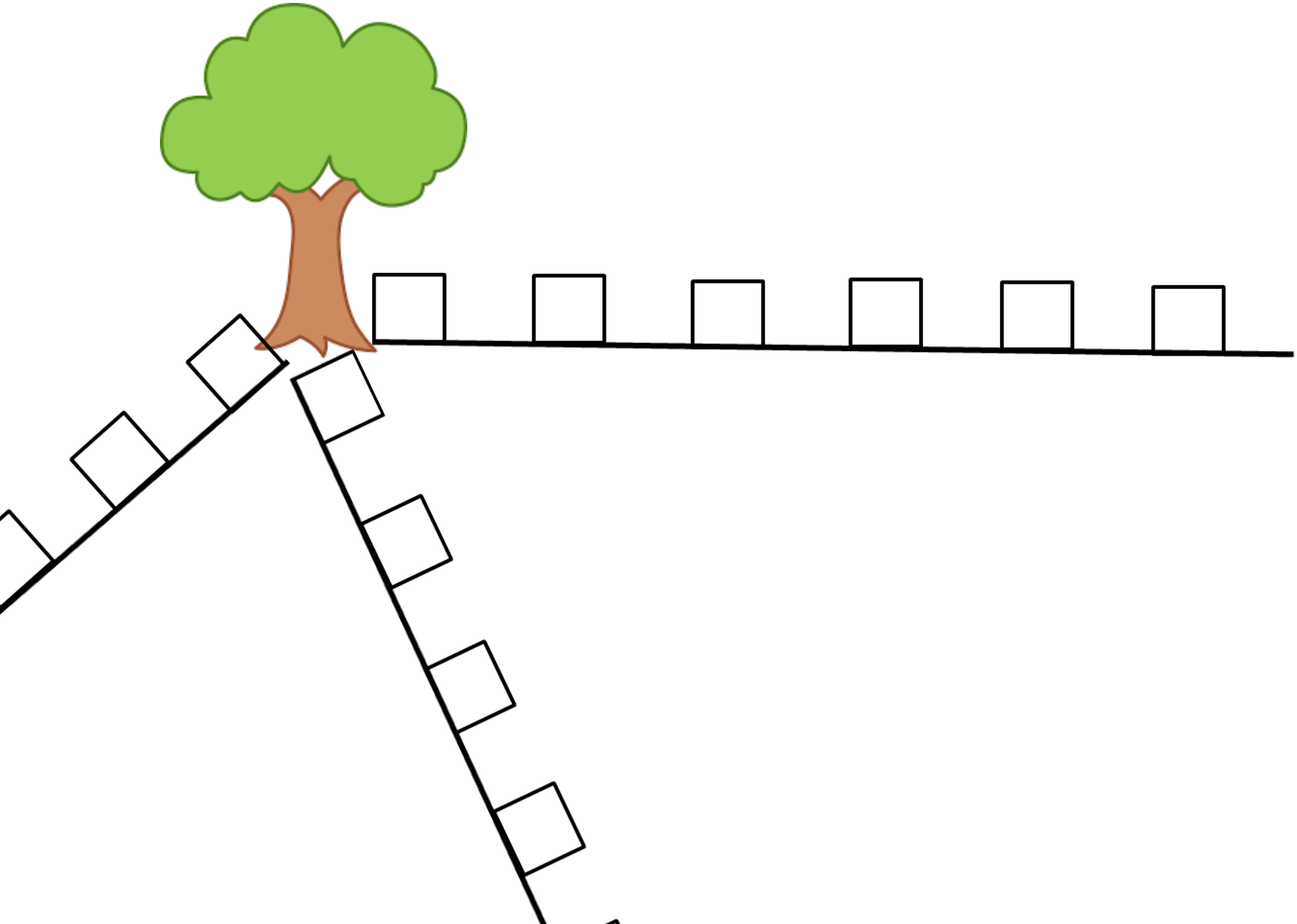
Mean number of daisies per quadrat = 14

- The quadrats were 0.5m by 0.5m. How many of these quadrats could we fit into $1m^2$? 4
- If the field is $334m^2$, use the mean to estimate the abundance of daisies. Give your answer to 3sf.

18,700



Transect sampling



Contraceptive Methods

Why might someone choose to use an implant rather than the pill?

Why might someone choose to use condoms rather than the coil?

Contraceptive Methods

Why might someone choose to use an implant rather than the pill?

Don't have to remember to take it.

Longer lasting

Why might someone choose to use condoms rather than the coil?

Doesn't require a medical procedure for condoms.

Coil has increased risk of ectopic pregnancy.

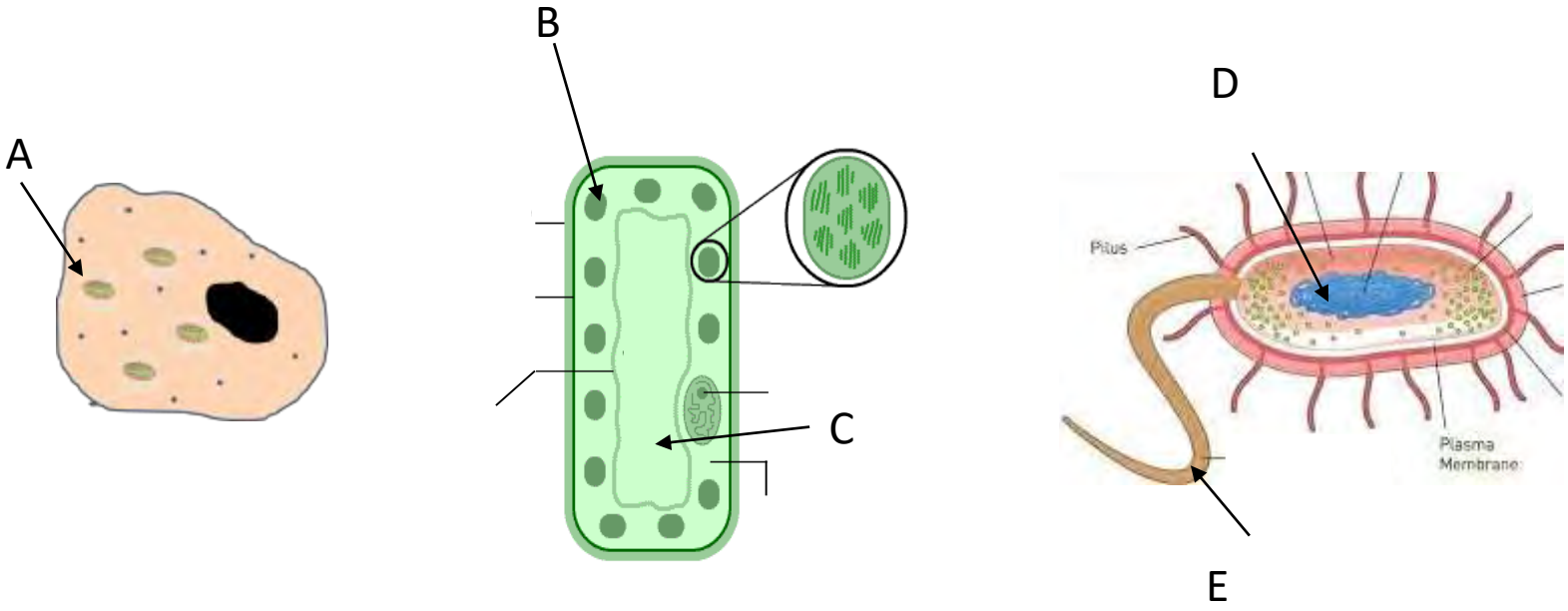
Biology 1 Revision

<u>Paper 1 topics:</u>

- Cells
- Systems
- Plants
- Disease

Cell structure

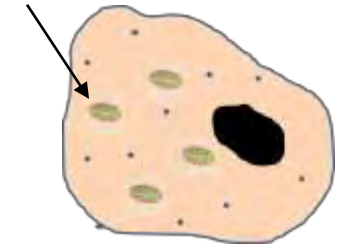
- Plant, animal or bacterial? Prokaryote or Eukaryote?
- What are the names of structures A-E?



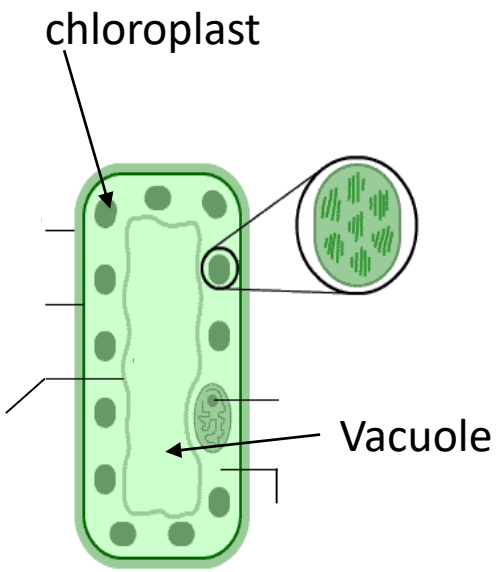
Cell structure

- Plant, animal or bacterial?
- What are the names of structures A-E?

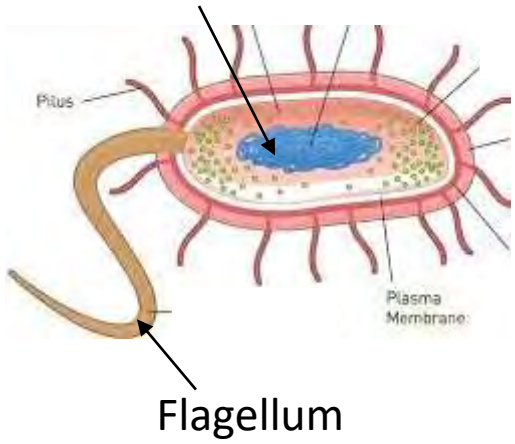
Animal - eukaryote



Plant - eukaryote

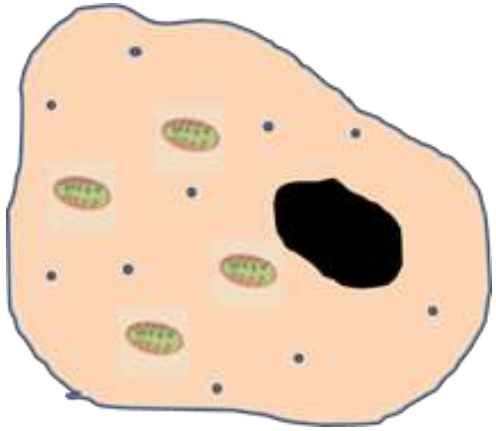


Bacteria - Prokaryote

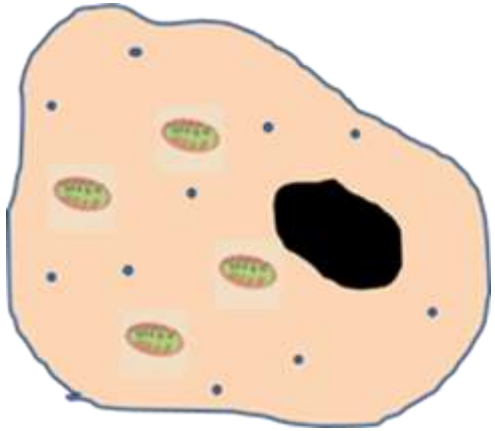


Part	Function	Animal	Plant
Nucleus		✓	✓
	most of the chemical reactions take place here.		
Mitochondria			
	where protein synthesis occurs		
	controls the passage of substances into and out of the cell		
	made of cellulose, which strengthens the cell		
Chloroplasts			
	filled with cell sap.		

What should the blank spaces say?



Part	Function	Animal	Plant
Nucleus	Contains DNA, controls the activities of the cell	✓	✓
Cytoplasm	most of the chemical reactions take place here.	✓	✓
Mitochondria	Site of respiration	✓	✓
Ribosome	where protein synthesis occurs	✓	✓
Cell Membrane	controls the passage of substances into and out of the cell	✓	✓
Cell Wall	made of cellulose, which strengthens the cell	X	✓
Chloroplasts	absorb light energy to make food	X	✓
Vacuole	filled with cell sap.	X	✓



Specialised cells

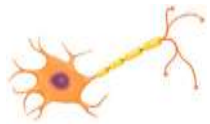
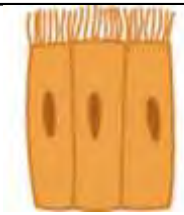
Diagram	Name	Function	Adaptation
		Transmit electrical impulse	
		Transport oxygen	
		Sweep mucus & pathogens away from the lungs	
		Fertilise an egg cell	

Diagram	Name	Function	Adaptation
	Nerve cell	Transmit electrical impulse	Long axon to carry impulse over long distances Many dendrites to make many connections with other cells
	Red blood cell	Transport oxygen	Biconcave shape → large surface area No nucleus so it can contain more haemoglobin
	Ciliated epithelial cell	Sweep mucus & pathogens away from the lungs	Sticky mucus traps dust. Hairs move dirt away from lungs.
	Sperm cell	Fertilise an egg cell	Streamlined shape & tail – can swim to the egg Chemicals in the tip to enter the egg cell.

Microscopes

Which microscope allows us to see mitochondria?

electron

How many micrometres are there in a millimetre?

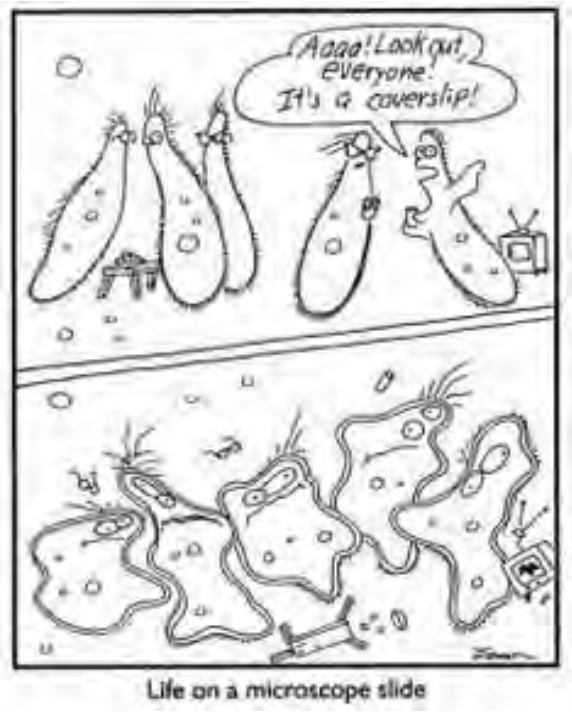
1000

A scientist viewed a picture of a cell, that had been magnified 100,000 times.

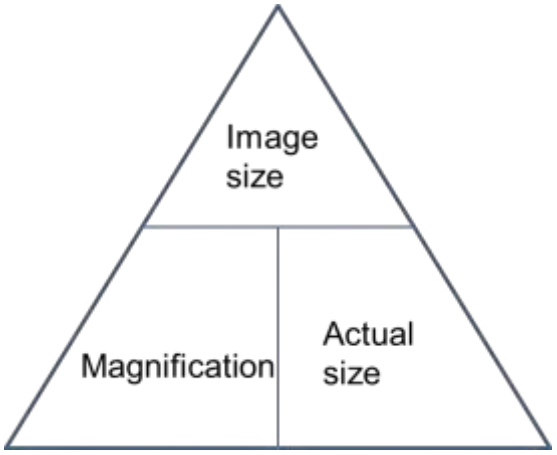
The size of the cell in the image was 25mm.

How large was the actual cell?

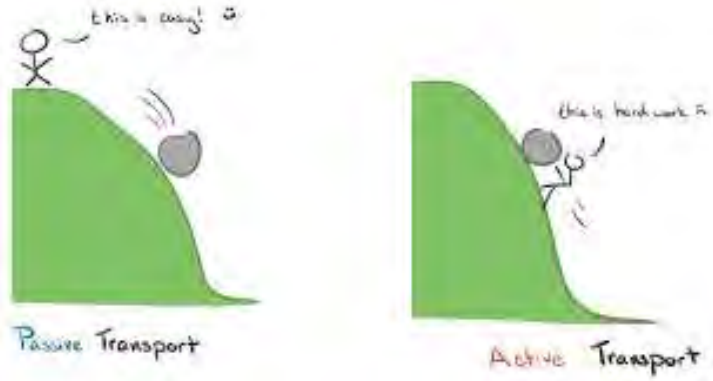
0.25µm



Life on a microscope slide



Exchange of substances



Diffusion, osmosis or active transport?

- Uptake of mineral ions in the soil into root hair cells, against the concentration gradient.

ACTIVE TRANSPORT – requires energy from respiration

- Uptake of water in root hair cells.

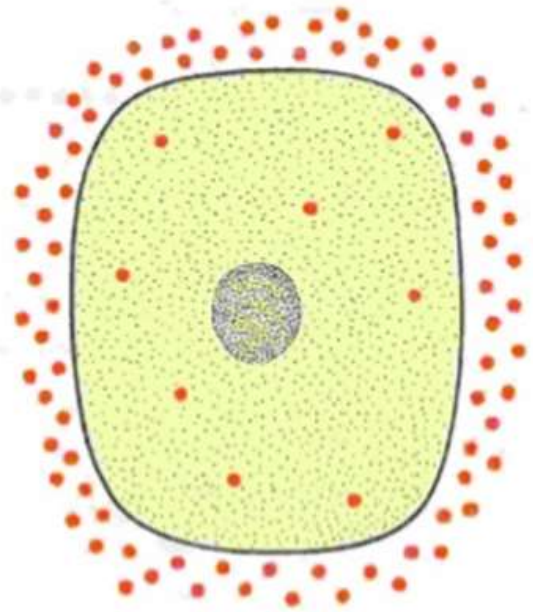
OSMOSIS

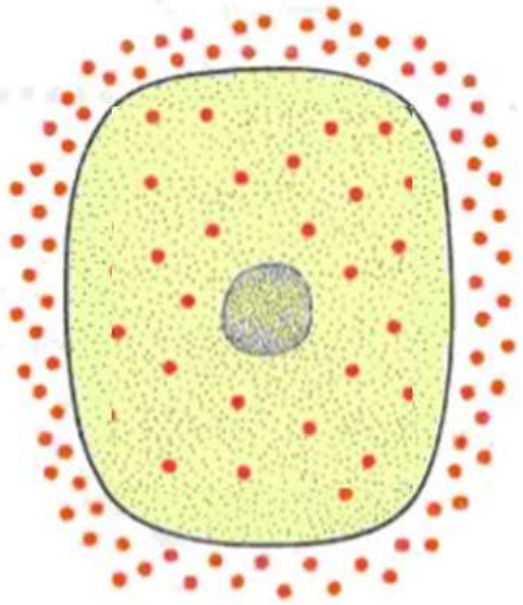
- Movement of oxygen and carbon dioxide between alveoli and capillaries.

DIFFUSION – passive, no energy required as it is moving from an area of high concentration to an area of low concentration.

Exchange of substances

- How can we speed up diffusion?
- How is this achieved in the lungs and small intestine?



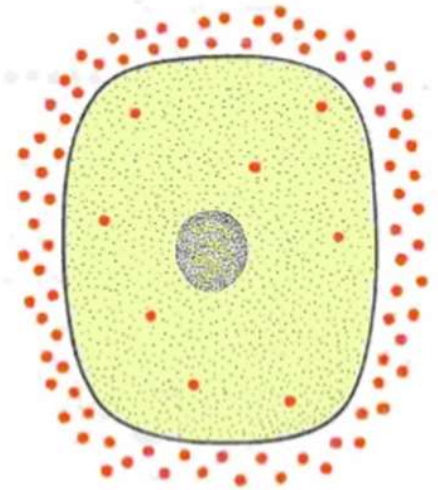


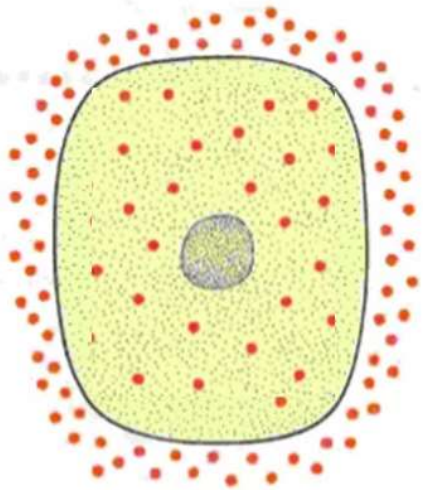
Which cell will have more rapid diffusion of oxygen?

Why?

Exchange of substances

- Many alveoli and villi → Large surface area
- Many capillaries so an excellent blood supply → Steep concentration gradient
- Alveoli and villi both have thin walls → Short diffusion distance



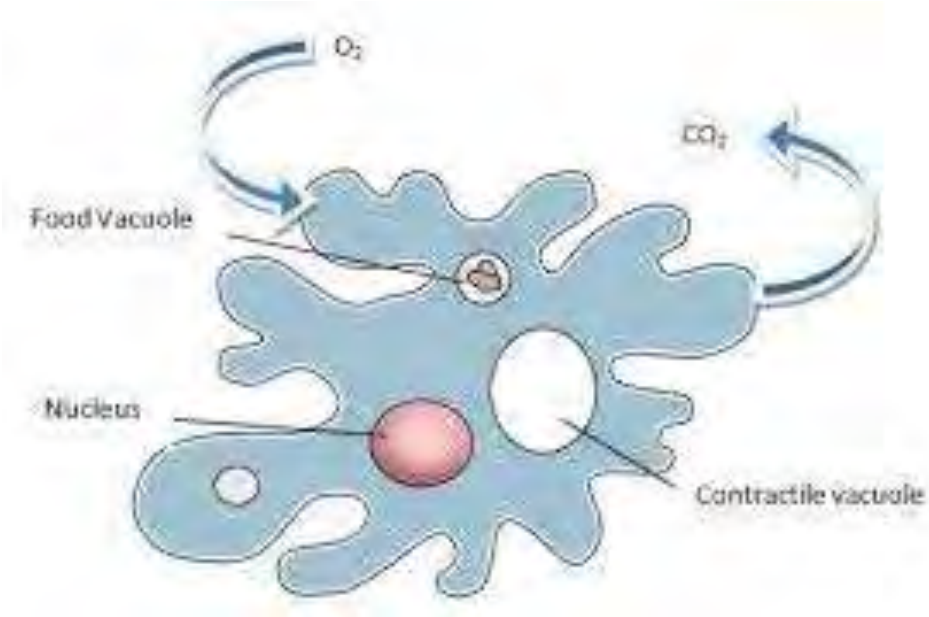


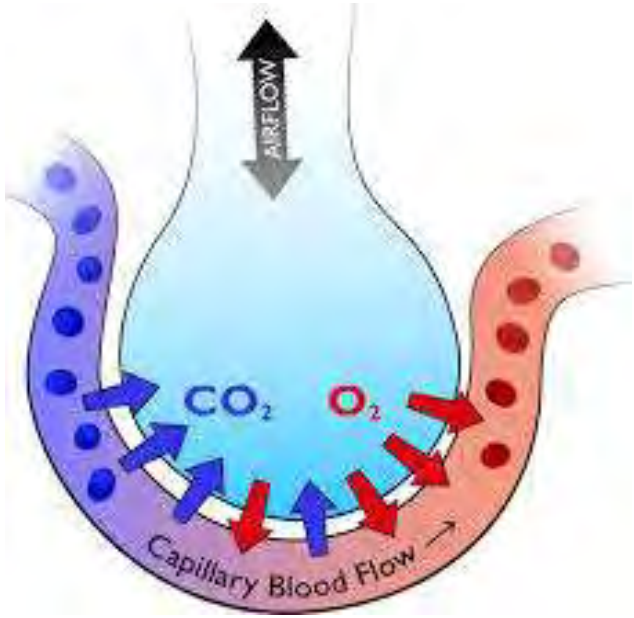
The cell on the left:

There is a steeper concentration gradient so diffusion is faster. This cell is respiring rapidly, so the oxygen concentration inside the cell remains low.

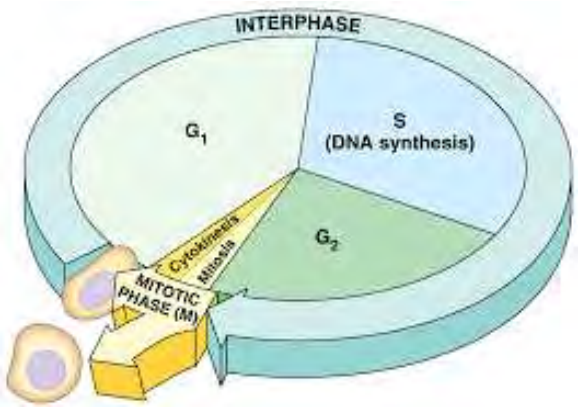
Why do we have lungs?

Multicellular organisms need specialised exchange surfaces – diffusion across the surface would not be sufficient to supply the organism's needs.





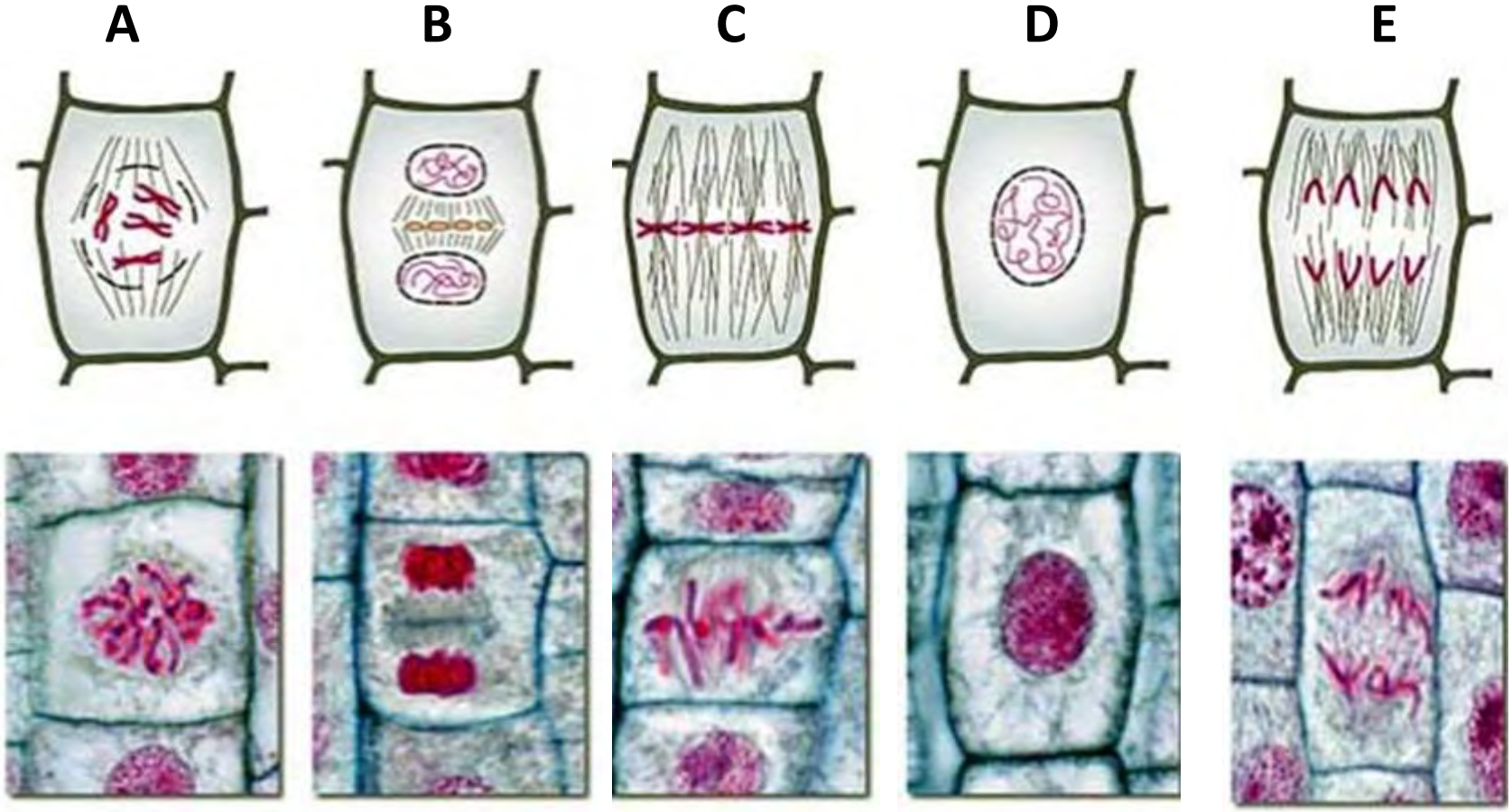
Cell cycle



- Main stages
- G1 – growth – new ribosomes, mitochondria
- S – DNA replication
- G2 – more growth, checking for errors
- M – Mitosis – nucleus divides

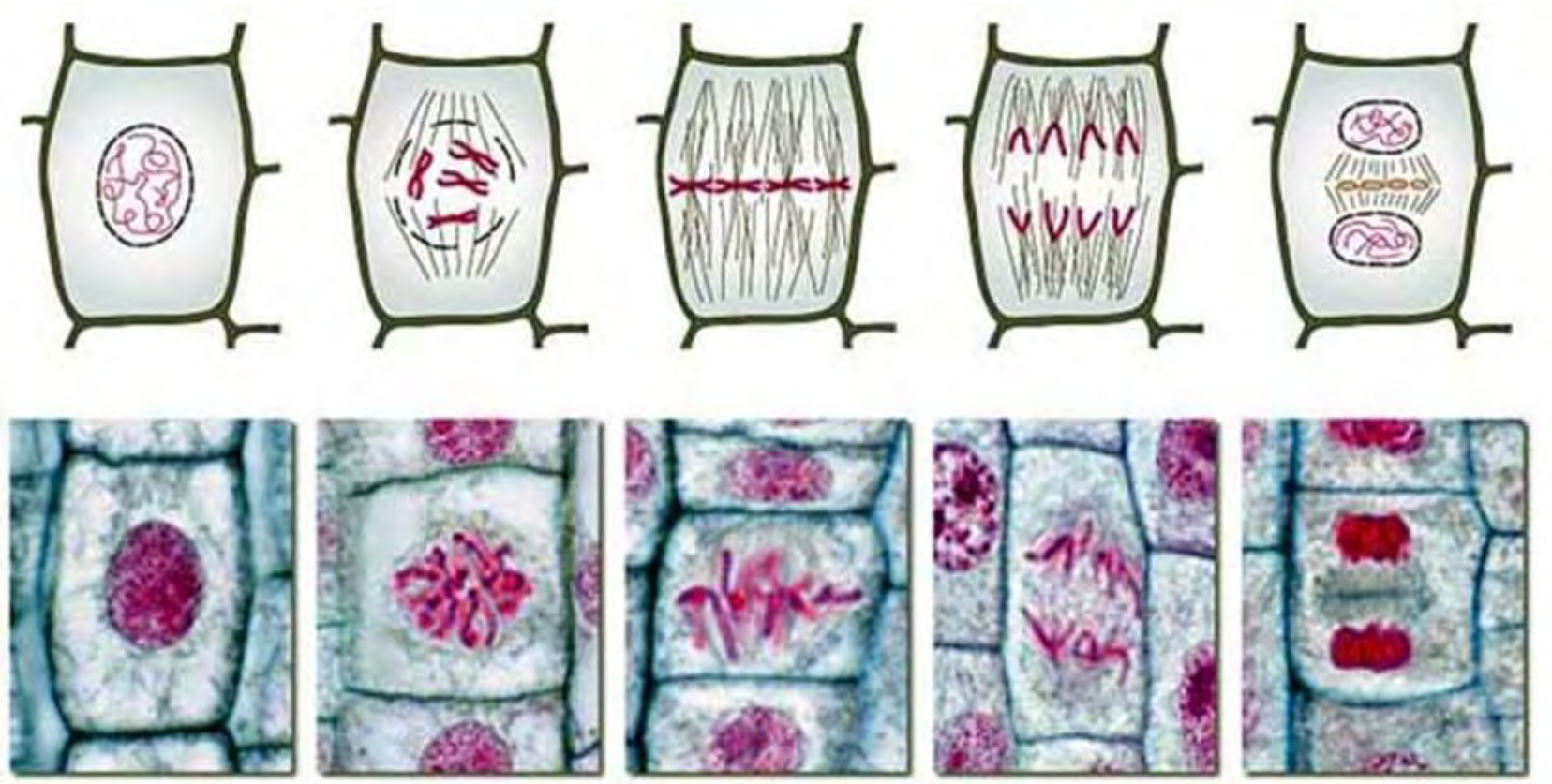
- What happens at each stage?

Mitosis – put the stages in order

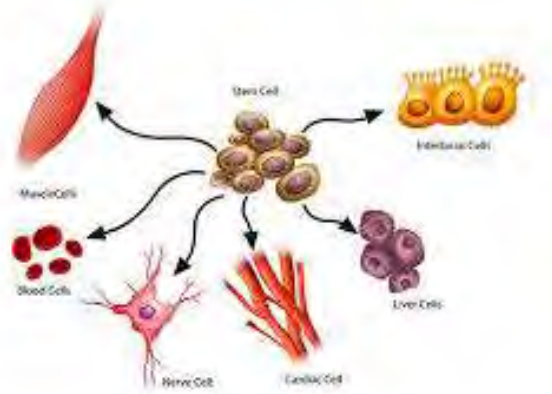


Mitosis

D A C E B



Stem cells



- What are they?

Undifferentiated cells, capable of dividing many times and developing into different types of specialised cells

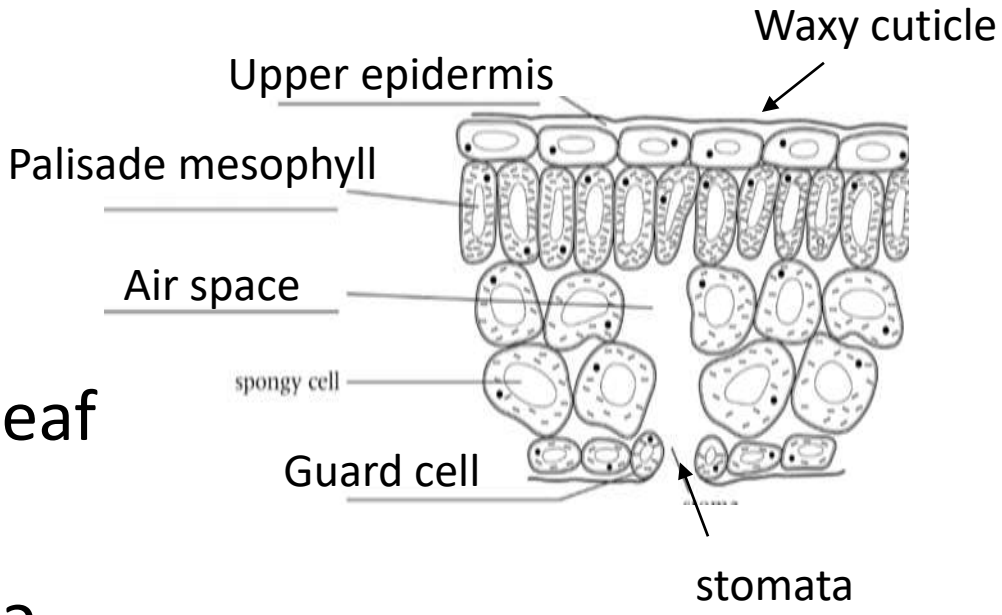
- Adult vs Embryo
  - Range of cell types –

  embryo can develop into many more cell types, so can treat more diseases
  - Rejection

  if the stem cell is taken from a patient's own bone marrow there will not be issues with rejection
  - Ethical issues

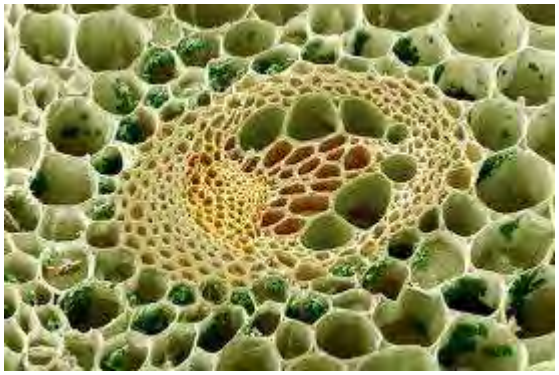
  some people object to using embryonic stem cells as it involves destroying embryos.

Plant tissues

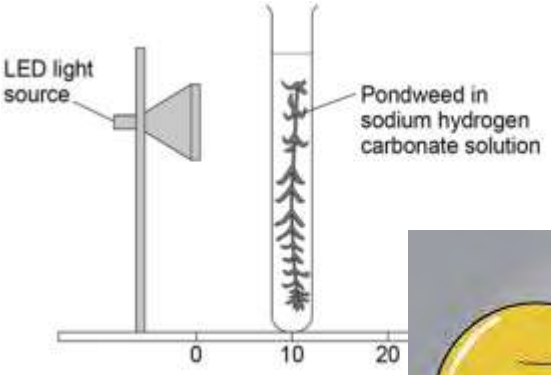


- Label the parts of the leaf
- Which plant tissue is it?

Plant tissue	Role
Mesophyll	Carry out photosynthesis
Epidermis	Cover the plant
Xylem and Phloem	Transport substances
Meristem	Growing tips of shoots and roots



Photosynthesis



- Equation:

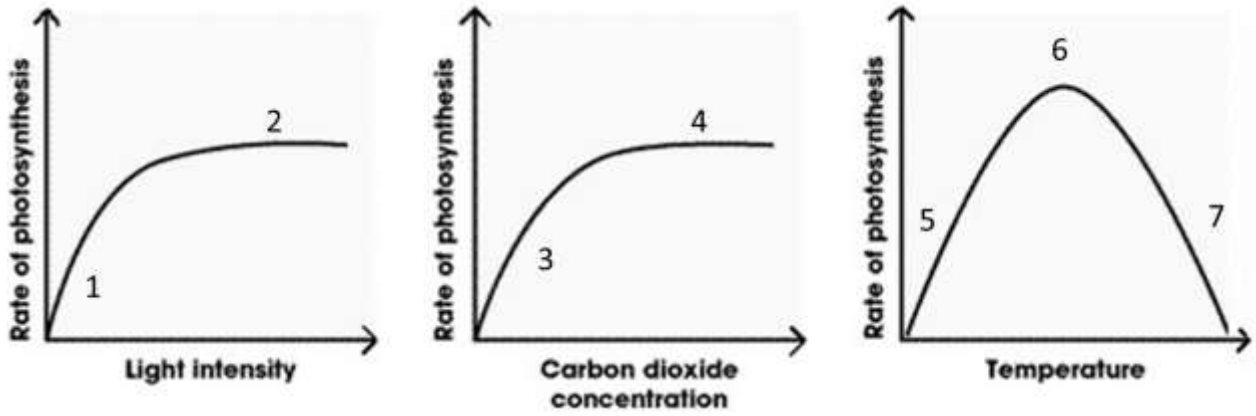
Carbon dioxide + water → glucose + oxygen

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

- Why do plants do photosynthesis?
- To produce glucose – stored as starch, stored as fats and oils, used to make amino acids, used to make cellulose for cell walls, used in respiration
- Measuring photosynthesis?
- Counting bubbles under water in a minute, measuring volume of oxygen produced per minute, testing leaves for the presence of starch

Limiting factors

- What are the limiting factors for photosynthesis?
- Light intensity, temperature, carbon dioxide levels (chloroplasts)



What is the limiting factor(s) at:

1 light intensity

2 carbon dioxide levels/temperature

3 carbon dioxide levels

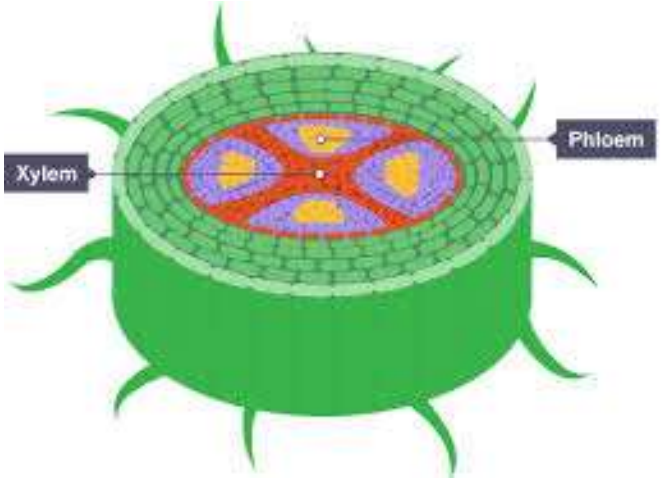
4 light intensity/temperature

5 temperature

6 light intensity/carbon dioxide levels

7 temperature

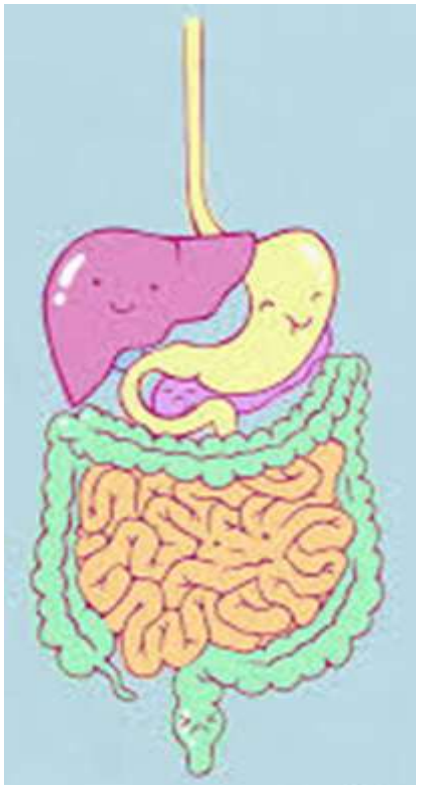
Transport in plants



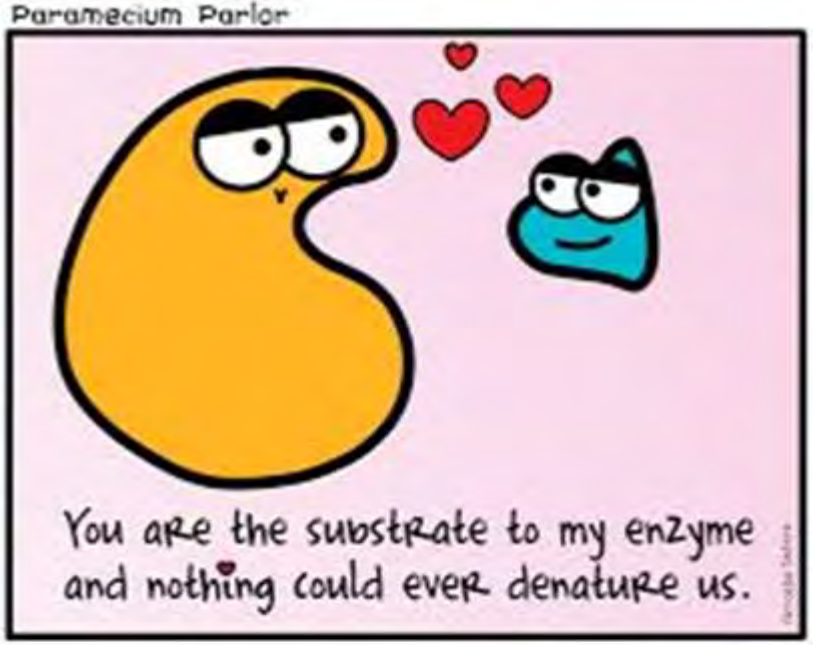
- What does the xylem transport?
- Water and mineral ions
- What does the phloem transport?
- sugar
- What is transpiration?
- Evaporation of water from stomata in the leaves
- What factors speed up transpiration?
- High temperature, low humidity, wind, high light intensity (opens stomata)

Systems – digestive system

- What do amylase, protease and lipase break down? What is the product in each case?
  - Amylase: Starch → sugar
  - Protease: Protein → amino acids
  - Lipase: Fat → fatty acids and glycerol
- What is the food test for:
- Starch
- Iodine – turns blue black
- Protein
- Biuret – turns purple
- Fat
- Sudan III – top layer is red
- Glucose
- Heat with benedict's – turns orange



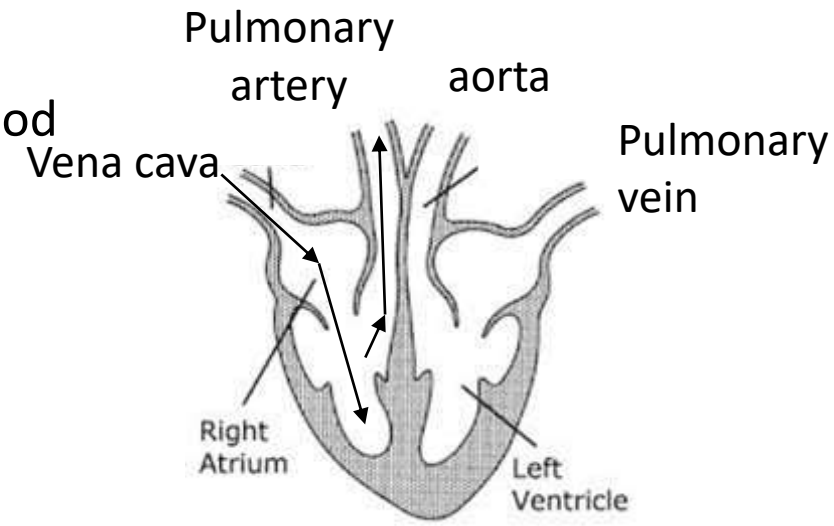
Digestive system

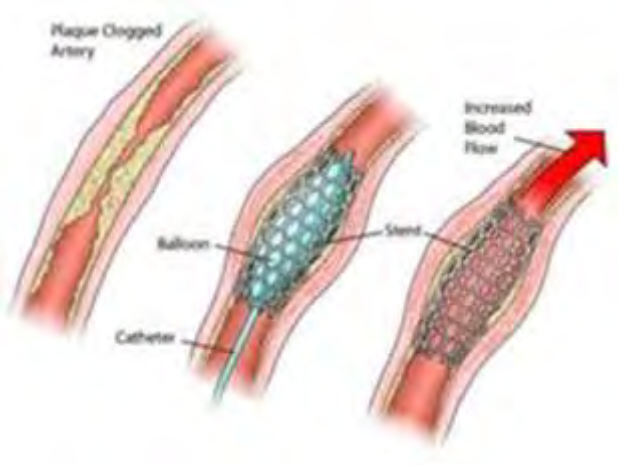


- Which organ makes bile?
- Liver (stored in the gall bladder)
- What does bile do?
- Emulsifies fat droplets to increase the surface area, neutralises stomach acid, so the small intestine is the correct pH.
- Where are villi found?
- Small intestine
- What happens to enzymes at high temperatures or the wrong pH?
- Enzymes denature (active site changes shape so substrate cannot fit)

Systems – Circulatory system

- Label the blood vessels
- Add arrows to show the direction of blood flow.
- How is heart rate controlled?
- Pacemaker on the right atrium.
- How can an irregular heart beat be treated?
- Artificial pacemaker





What is this? What is it used for?

Stent

Widens coronary arteries if there is a fatty deposit

Advantages – increases blood flow to heart muscle

Disadvantages – surgery/ anaesthetic risk, blood clotting, damage to blood vessels

Systems – Circulatory system

Why do arteries have a thick muscle layer?

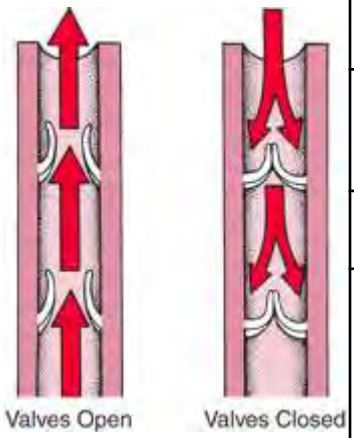
To cope with high blood pressure.

Why do veins have valves?

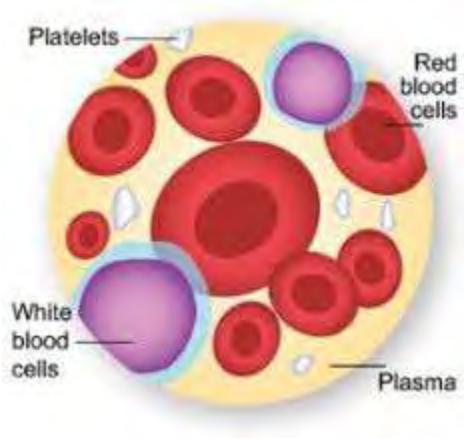
To prevent backflow

Why do capillaries have thin walls?

To allow rapid exchange of substances by diffusion.



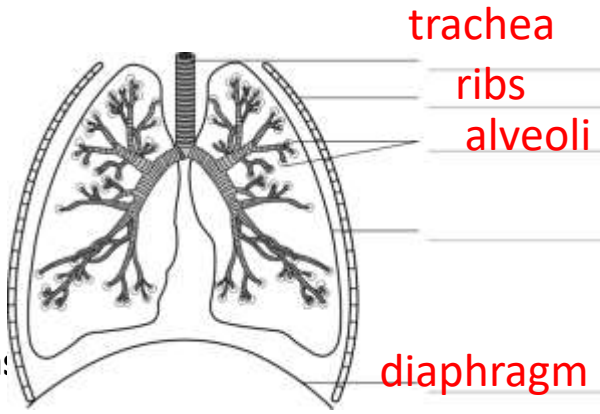
Component	Function
Red blood cells	Transports oxygen
White blood cells	Destroys pathogens
Platelets	Clots blood
Plasma	Transports dissolved substances, e.g. urea, water, glucose, amino acids, mineral ions, hormones



Systems – Respiratory system

- **What is the equation for aerobic respiration?**
- Glucose + oxygen → carbon dioxide + water
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
- **What is the equation for anaerobic respiration in animals?**
- Glucose → lactic acid
- **What is the equation for anaerobic respiration in plants and yea**
- Glucose → ethanol + carbon dioxide
- **Why is lactic acid produced when we exercise?**
- We don't have enough oxygen reaching our muscles, so they do anaerobic respiration instead of aerobic respiration.
- **Why does our heart rate increase when we exercise?**
- More oxygen and glucose are delivered to our cells.
- Our cells do more respiration. This releases more energy.

Label the diagram

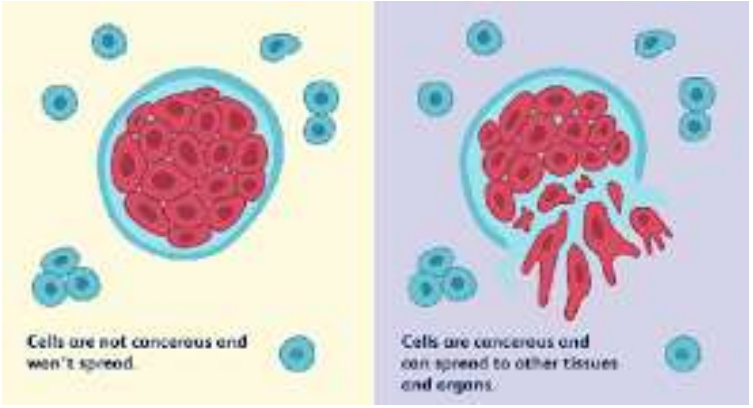


Non-communicable diseases

- Match the risk factors to the disease:

Disease	**Risk Factor**
Lung disease and lung cancer	Diet, smoking and lack of exercise
Cancer	Obesity
Cardiovascular disease	Alcohol
Liver and brain function	Smoking
Type 2 Diabetes	Smoking and alcohol
Unborn babies	Carcinogens and ionising radiation

Cancer



- What is cancer?
- Changes in cells that lead to uncontrolled growth and division.
- What are benign tumours?
- Abnormal growths of cells contained in one area.
- What are malignant tumours?
- Cancers that spread to other tissues through the blood where they form secondary tumours.

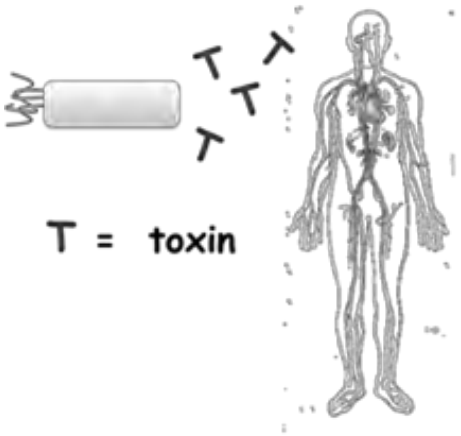
Disease

Type of pathogen	Name of disease	How it is spread	Reducing the spread	Symptoms	Treatment
Virus	Measles	droplets from sneezes, coughs	vaccination	Rash, fever	
	HIV	Sexual contact, dirty needles	condoms	More likely to get other infections (white blood cells are affected)	antiretroviral drugs
	Tobacco mosaic virus			Mosaic pattern on leaves → less photosynthesis	
Fungus	Rose black spot	Wind, water	Remove and destroy affected leaves	Black spots on leaves → less photosynthesis	fungicide
Bacteria	Salmonella	Poor food hygiene	Wash hands before handling food, vaccinate chickens		
	Gonorrhoea	sexual contact	condoms	Yellow/green discharge, pain when urinating	antibiotics
Protist	Malaria	mosquitos	Mosquito nets, destroy breeding sites	Fever, can be fatal	

What do plants need minerals for?

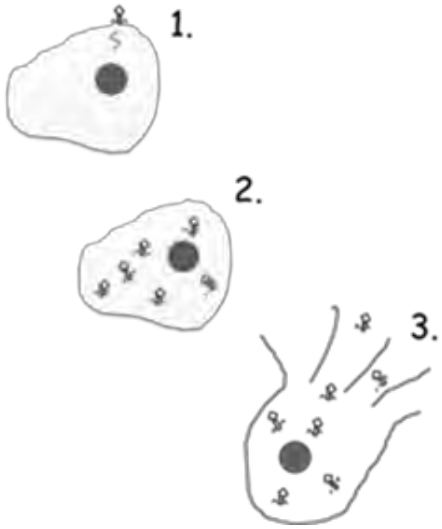
- Nitrates – TO MAKE PROTEIN
- Not enough nitrates → stunted growth
- Magnesium – TO MAKE CHLOROPHYLL
- Not enough magnesium → yellow leaves

For each picture, name the type of pathogen it represents and say why it makes us feel ill.



Bacteria

Reproduces rapidly and makes toxins



Virus

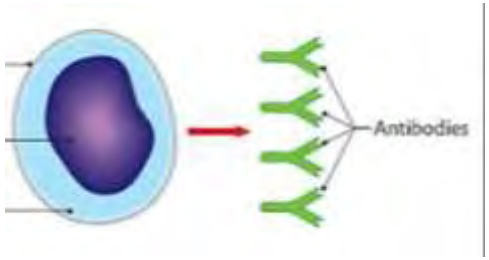
Damages tissues

Body's defences

- What do they do?
- Mucus
- Traps pathogens and dirt in the airways
- Cilia
- Sweeps mucus, pathogens and dirt away from the lungs
- Skin
- Forms a barrier
- Platelets
- Clots the blood at the site of a wound
- Stomach acid
- Destroys pathogens in food and drink

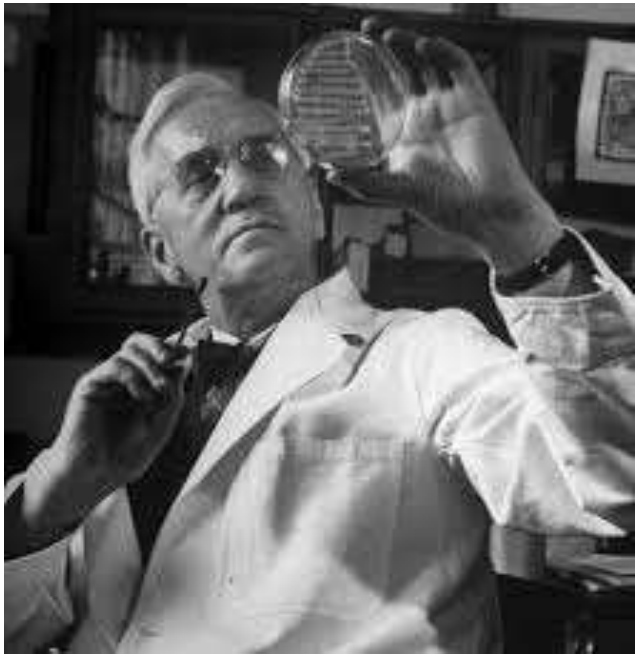
Which type of white blood cell does each picture show? How do they each protect us?

Phagocyte - Engulfs and ingests pathogens (phagocytosis)



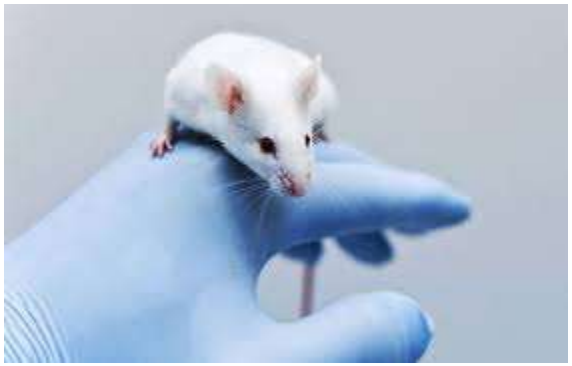
Lymphocyte - Produces antibodies and antitoxins

Drugs



- What is an antibiotic?
- Drug that kills bacteria.
- What is a painkiller?
- Drug that relieves symptoms only.
- Why can't antibiotics cure a common cold?
- Antibiotics only kill bacteria not viruses.
- Why should doctors only give out specific antibiotics for specific infections?
- Reduces risk of getting resistant strains of bacteria
- Where do aspirin, digitalis and penicillin originate from?
- Willow tree, foxglove and a mould.

Drug testing



- Why do drugs need to be tested
- For toxicity, efficacy, dosage and side effects.
- What steps are involved in pre-clinical testing?
- Cells and tissue testing, testing live animals.
- What steps are involved in clinical testing?
- Testing healthy volunteers, testing patients with the disease.
- What is a placebo?
- Fake drug
- What is a double blind trial?
- Neither the doctors nor the patients know who has been given the real drug and who has been given the placebo.

Trilogy Biology Higher Revision

<u>Paper 2 topics:</u>

- Homeostasis
- Inheritance
- Variation & Evolution
- Ecology
- Human Impact

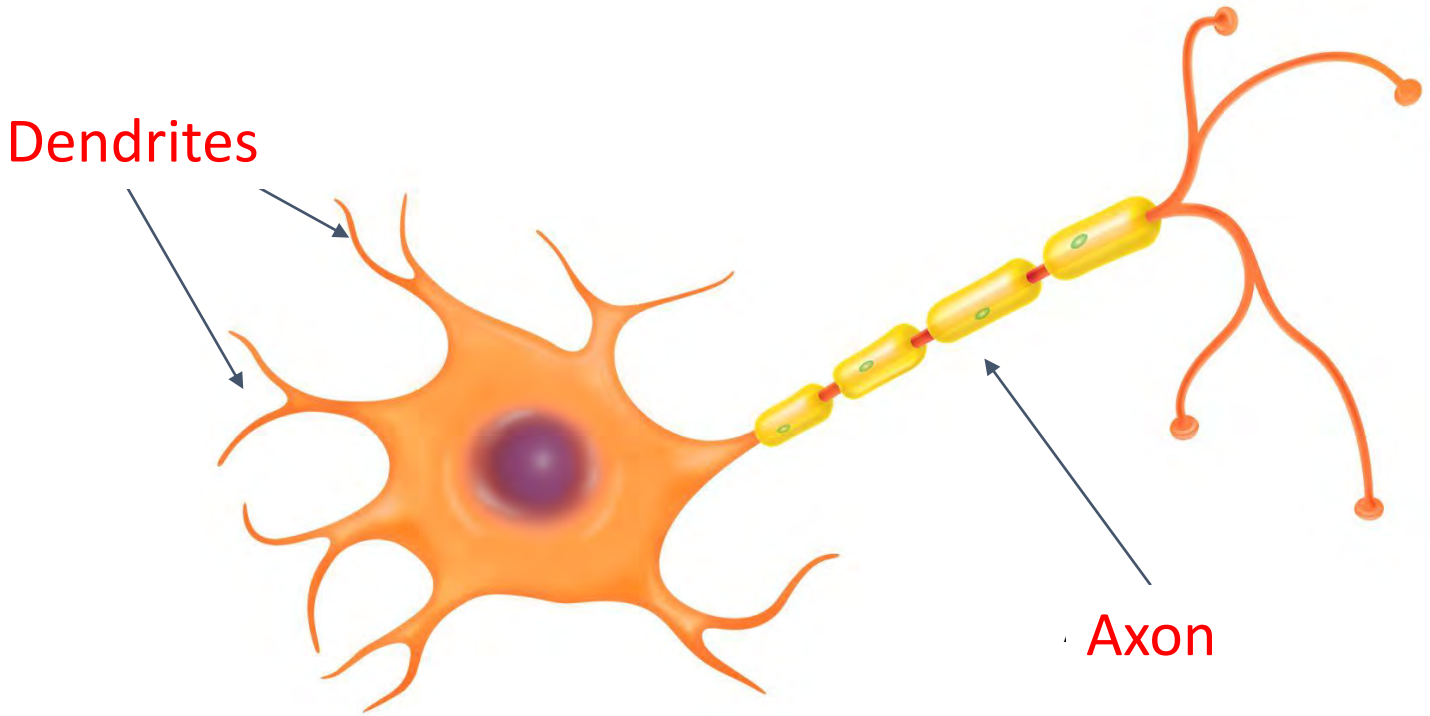
What are receptors?

Groups of specialised cells that can detect stimuli from the environment.

What types of stimuli can they detect?

Pain - skin
Temperature - skin
Pressure - skin
Chemicals – tongue and nose
Light – eye
Sound - ear

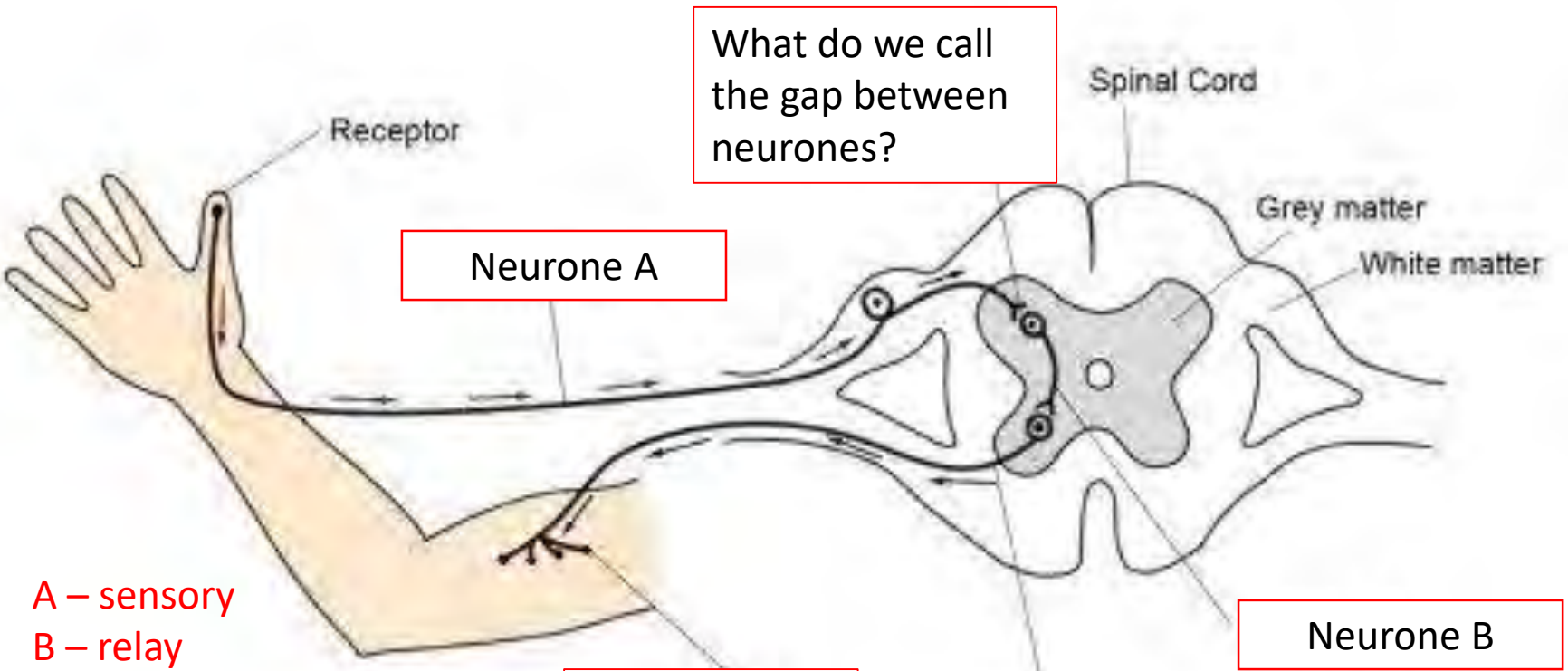
Neurone



Coordinator - CNS

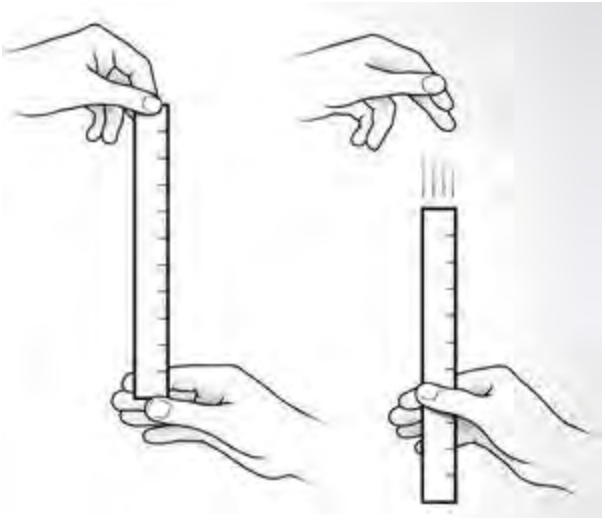
Receive and process information from receptors.

Reflex actions



- A – sensory
- B – relay
- C – motor
- Gap – synapse
- Response is carried out by the effector (muscle or gland)

Required Practical: Reaction Time



What were the problems with this method?

- Not very accurate – human error – e.g. don't always drop in exactly the same way, difficult to keep finger and thumb exactly the same distance apart
- Can guess when your partner is about to drop, so can cheat

Why would be a computer program be better? (e.g. pushing a button when you see a word appear)

- More accurate – removes human error
- More repeatable

Controlling blood sugar levels

Blood glucose concentration

Monitored and controlled by which gland? pancreas

Produces 2 hormones:

1) _____: after a meal

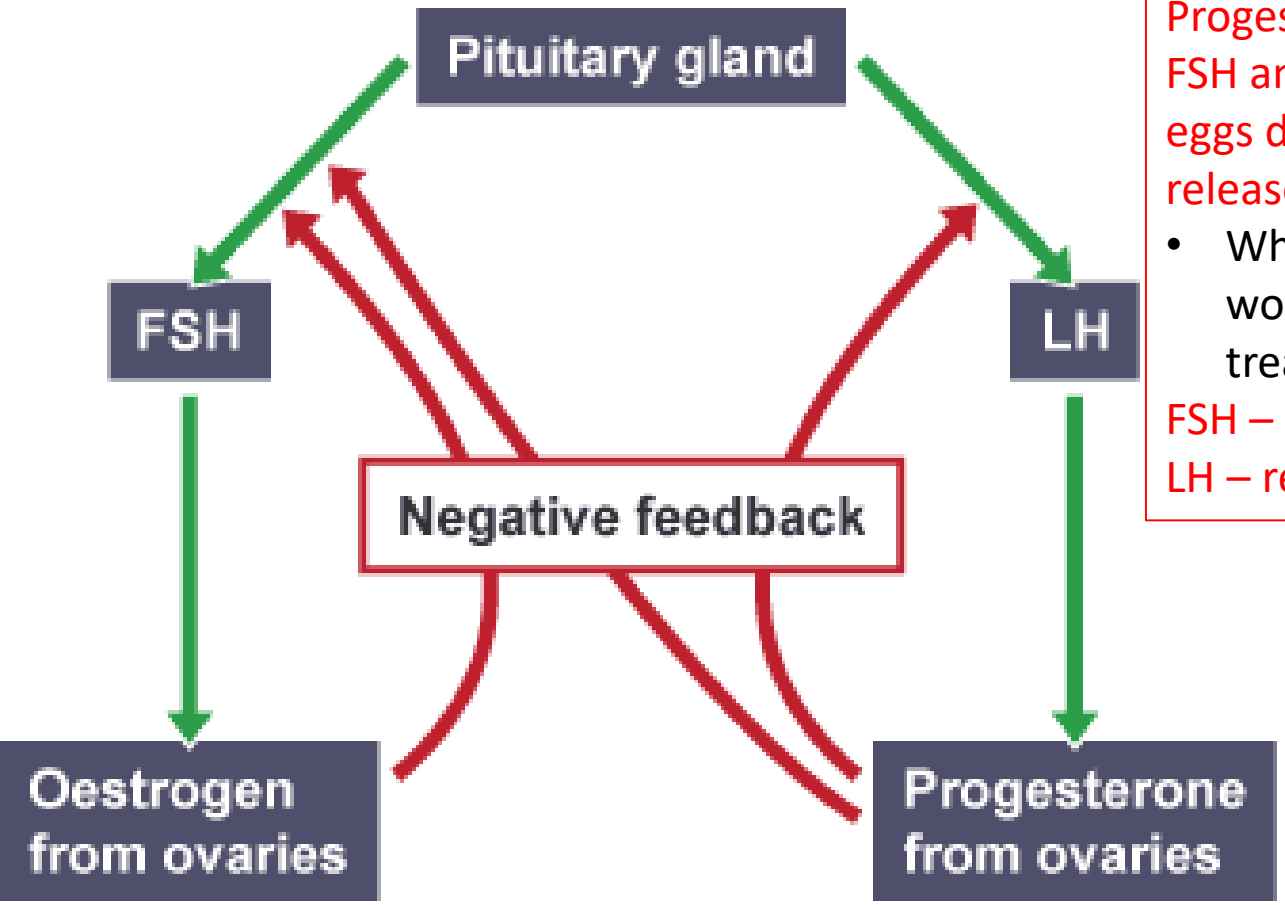
insulin

Glucose to glycogen

2) _____: when blood glucose levels are low

glucagon

Glycogen to glucose



- Which hormones are found in contraceptive pills? Why?

Progesterone and oestrogen – stop FSH and LH being produced so eggs do not mature and are not released.

- Which hormones are given to women having fertility treatment? Why?

FSH – matures eggs

LH – releases eggs

Causes of Extinction?

- New diseases
- New predators
- New, more successful competitors
- Changes to the environment over geological time - such as Climate change – increase in global temperatures
- A single catastrophic event - such as volcanic eruption, meteor

Fossils

What are fossils?

'Remains' of organisms from many years ago, found in rocks.

Why do we study fossils?

Can study them to learn how different organisms have changed as life developed on Earth.

Gives evidence for evolution by natural selection.

Fossils

How are fossils formed?

1. Mummification

Conditions keep the individual preserved – with no oxygen, microbes can't decompose tissue. E.g. peat bogs or in ice.

2. Mineral replacement

Sediment layers form above organism. Minerals replace parts as they decay, and turn to stone.

3. Trace fossils

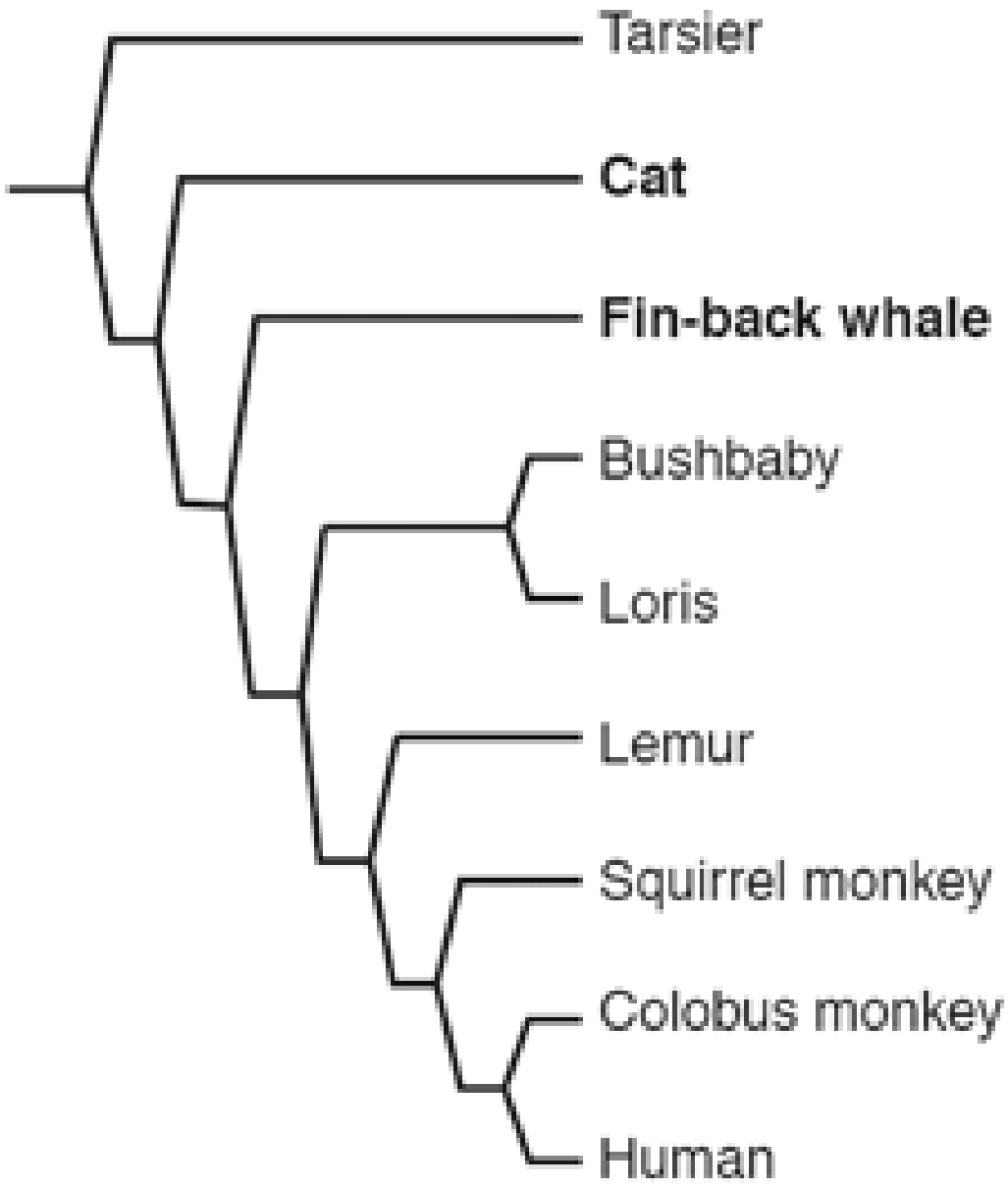
Moulds and casts made from e.g. footprints.

Classification – 5 Kingdoms

You need to remember the hierarchy (order of subgroups) from kingdom to species. Which scientist came up with this system?

Carl Linnaeus

Kingdom	**K_____**	**Keeping**
Phylum	**P_____**	**Pesky**
Class	**C_____**	**Creatures**
Order	**O_____**	**Organised**
Family	**F_____**	**For**
Genus	**G_____**	**Grumpy**
Species	**S_____**	**Scientists**



1. What is the closest relative of the human? Colobus monkey
2. What is our most distant relative on this tree? Tarsier
3. What is the Loris most closely related to?

Bush baby

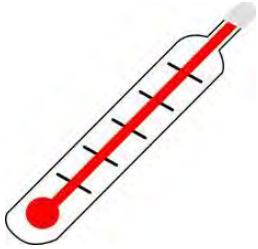
Abiotic Factors

Abiotic Factors = Non living factors

- Water levels
- Oxygen levels
- Carbon dioxide levels
- Temperature
- Light intensity
- Nutrient levels
- Wind intensity

What abiotic factors affect where organisms live?

Use the pictures to help you



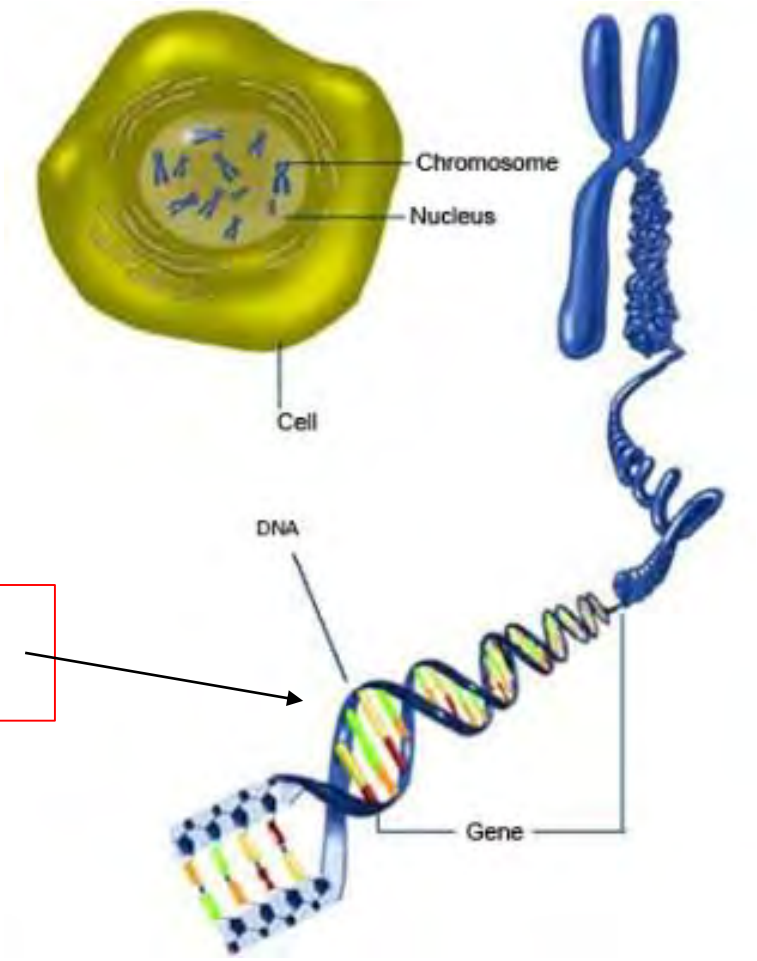
Biotic factors

Biotic factors = Living factors:

- availability of _____
- new _____ arriving
- new _____
- one species _____ another

- availability of food
- new predator arriving
- new pathogen
- one species out-competing another

DNA

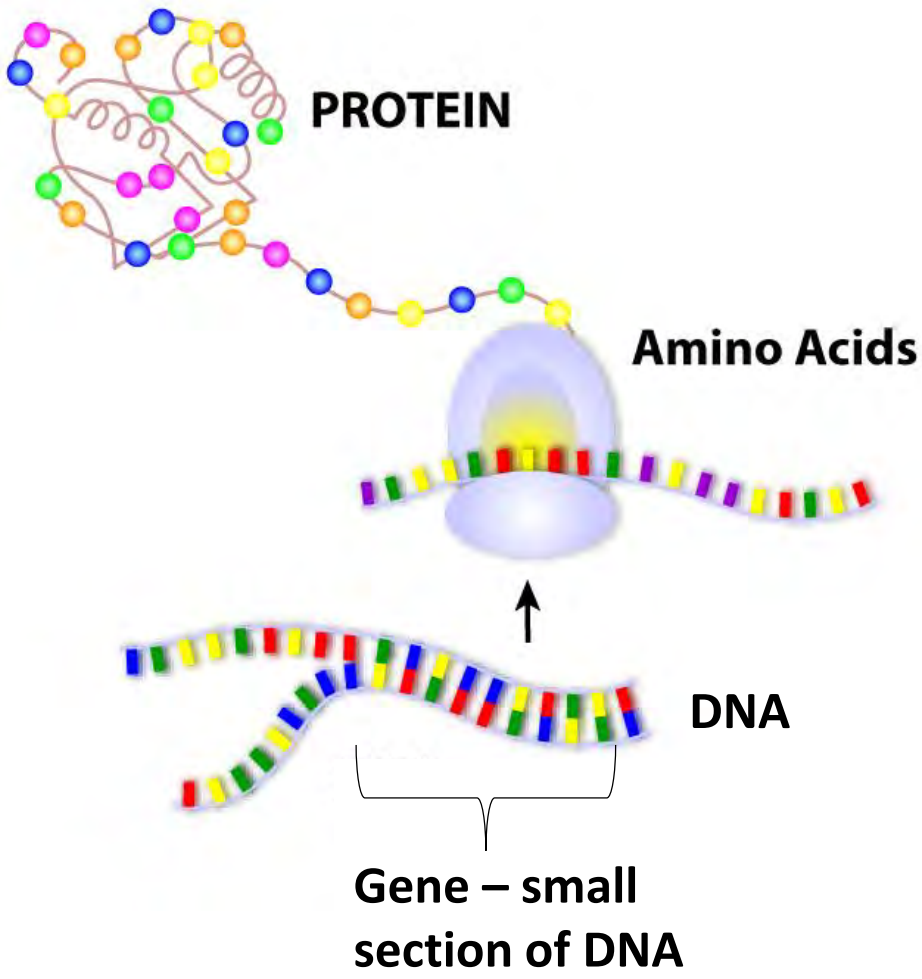


What do we call this structure?

Double helix

Chromosomes contain genetic information

So what are genes?



Each gene codes for a particular sequence of **amino acids**, to make a specific **protein**.

Types of reproduction

Sexual

- How many parents are needed?
  Two
- Do gametes fuse? (what are gametes?)
  Yes (sperm and egg)
- Does it lead to variation?
  yes

Types of reproduction

<u>Asexual</u>

- How many parents are needed?

  One

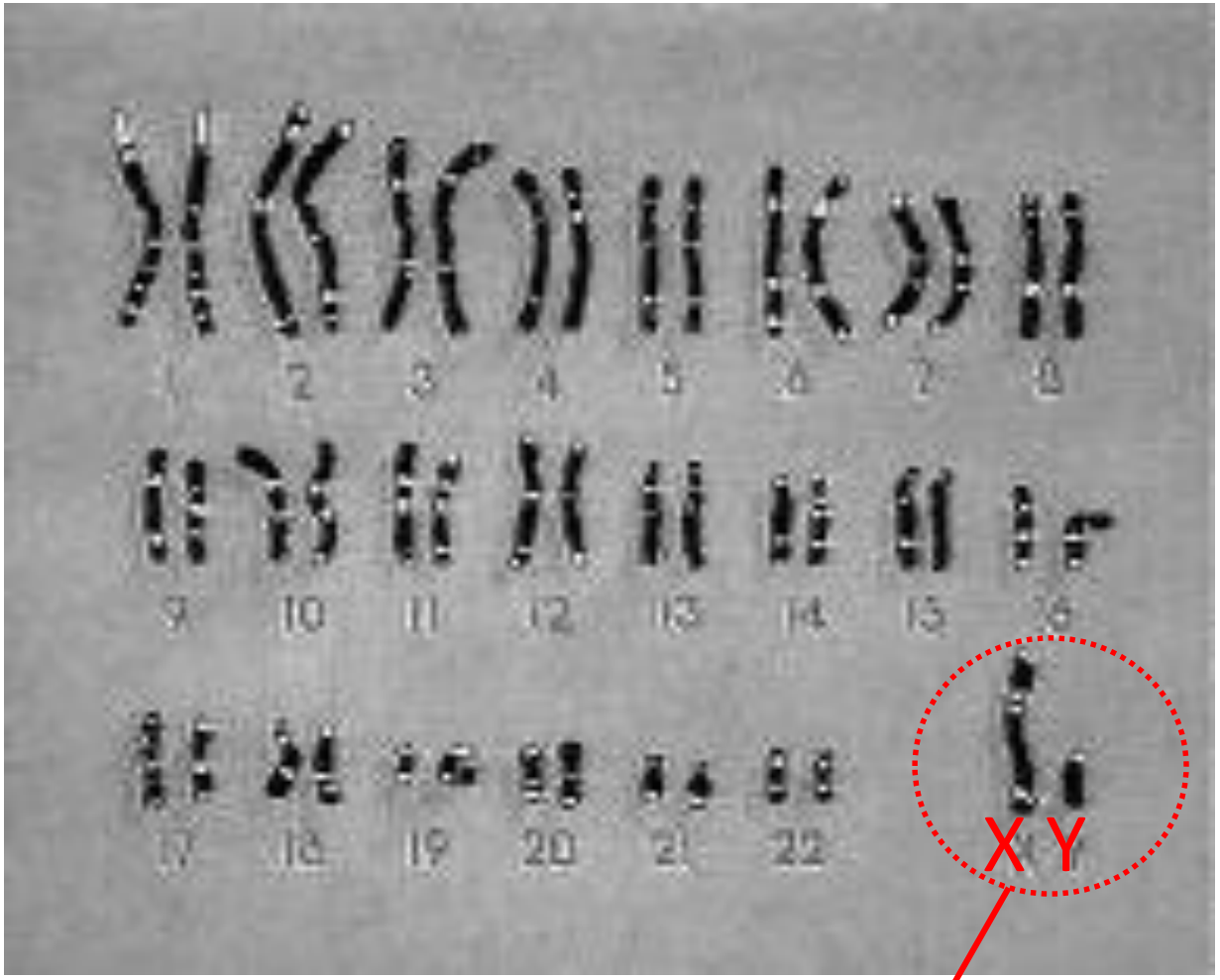
- Do gametes fuse?

  No

- Does it lead to variation?

  No – it produces clones

What do these chromosomes tell you?



Cystic fibrosis

- Both parents must have the faulty allele for a child to get the disease
- A parent who has only one faulty allele (heterozygous) is a “carrier”

	C	**c**
C	**CC**	**Cc**
c	**Cc**	**cc**

What proportion have cystic fibrosis?

25%

Adaptations?

- Camouflage – colour of fur
- Animals in cold regions have a small surface area:volume ratio to conserve heat
- Fat layer for insulation in arctic fox
- Fur is shorter in desert fox
- Eyes on the front of the head to see prey
- Sharp teeth for ripping flesh
- Etc, etc

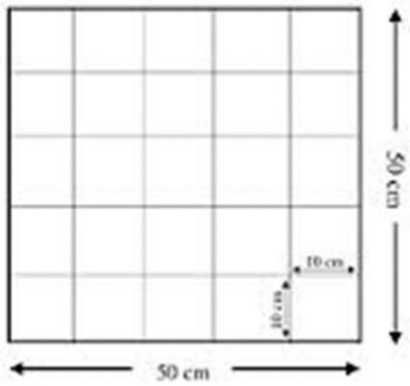
Random sampling

- Why do we need to place the quadrat at several different random sites in the field? So it is representative of the whole field

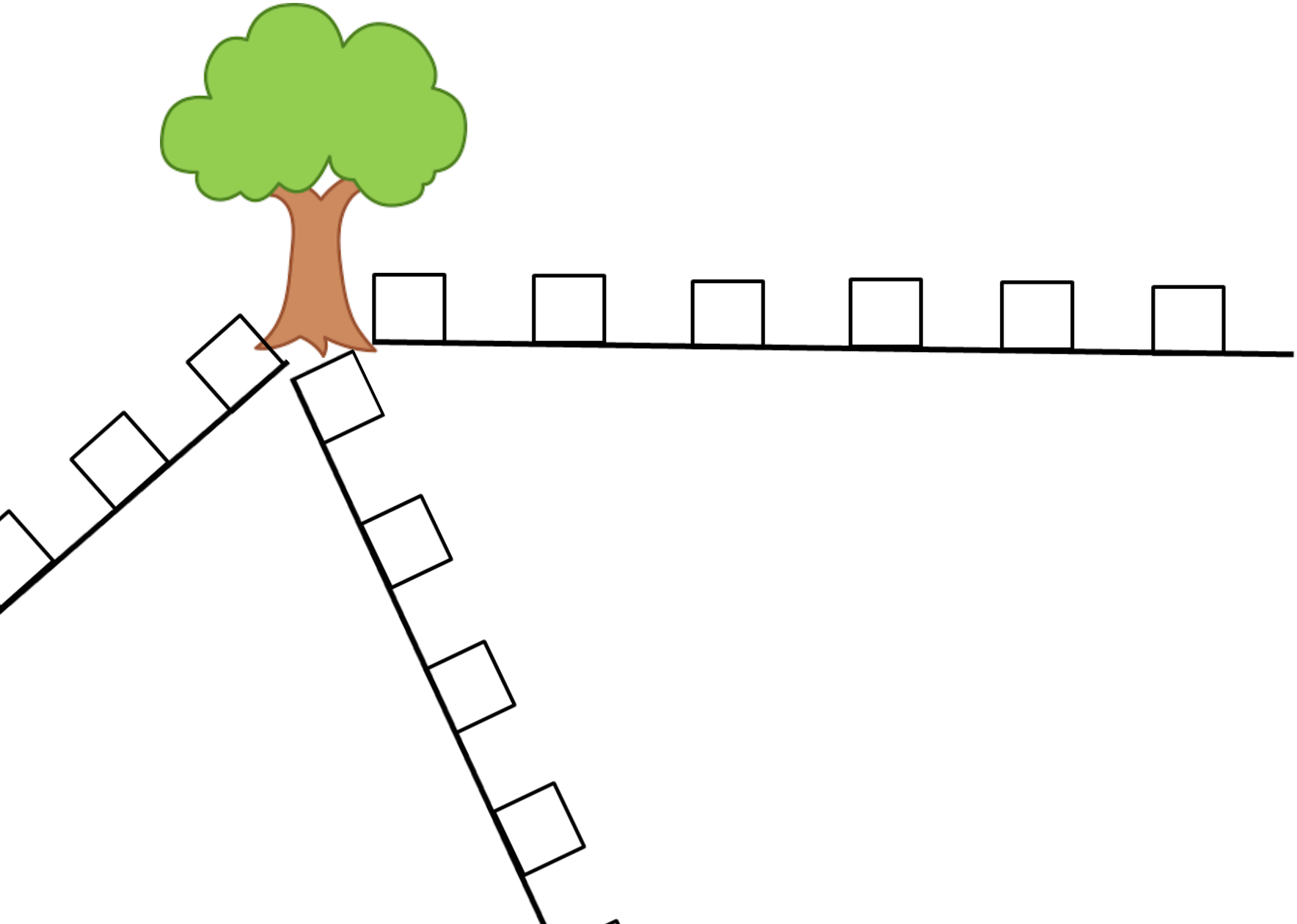
Mean number of daisies per quadrat = 14

- The quadrats were 0.5m by 0.5m. How many of these quadrats could we fit into $1m^2$? 4
- If the field is $334m^2$, use the mean to estimate the abundance of daisies. Give your answer to 3sf.

18,700



Transect sampling



Contraceptive Methods

Why might someone choose to use an implant rather than the pill?

Why might someone choose to use condoms rather than the coil?

Contraceptive Methods

Why might someone choose to use an implant rather than the pill?

Don't have to remember to take it.

Longer lasting

Why might someone choose to use condoms rather than the coil?

Doesn't require a medical procedure for condoms.

Coil has increased risk of ectopic pregnancy.

Round 1 – Structure of the atom

1. Compare the plum pudding and nuclear models of the atom.
2. Complete the table:

Name of particle	Relative charge	Relative mass
Proton		
	0	1
	-1	Very small

3. Define the term isotope.

Round 1 – Structure of the atom

1. Compare the plum pudding and nuclear models of the atom.

Plum pudding has a ball of positive charge with electrons embedded in it. There are no neutrons.

Nuclear model has a nucleus containing protons and neutrons and electrons in shells orbiting the nucleus.

2. Complete the table:

Name of particle	Relative charge	Relative mass
Proton	**+1**	**1**
Neutron	0	1
Electron	-1	Very small

Isotopes: have the same numbers of protons and electrons but different numbers of neutrons.

Round 2 - Bonding

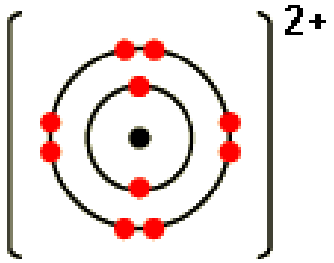
1. Draw the electron arrangement in a fluorine atom and a fluoride ion.
   $^{19}_{9}F$
2. Draw the bonding in magnesium oxide.
3. Draw the bonding in sodium.
4. Explain why metals can conduct electricity.

$^{24}_{12}Mg$ $^{16}_{8}O$

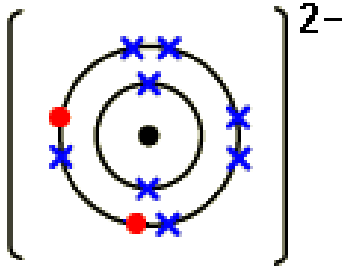
Round 2 - Bonding

fluorine atom,
F 2,7

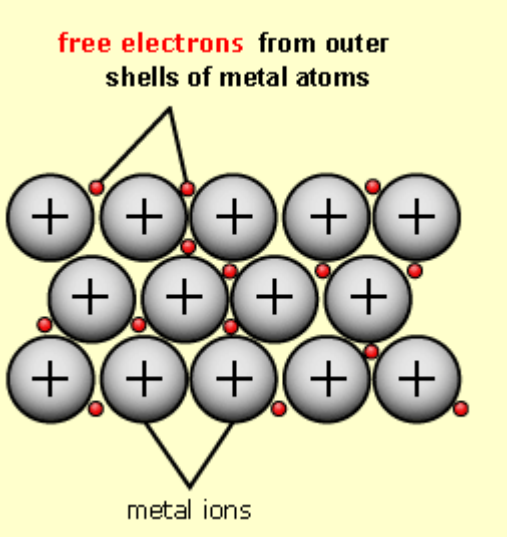
fluoride ion
F^- $[2,8]^-$



magnesium ion,
Mg^{2+} $[2,8]^{2+}$



oxide ion,
O^{2-} $[2,8]^{2-}$



3. Electrons in outer shell of metals are delocalised so are free to move throughout the structure.

N.B. Metallic bond is attraction between the positive metal ions and the delocalised electrons.

Round 3 - Bonding

1. Explain why ionic solids have high melting points.
2. Explain why ionic compounds can conduct electricity when molten or dissolved but not as a solid.
3. Why is graphite soft but diamond extremely hard?

Round 3 - Bonding

1. The ions are joined in a giant lattice with strong electrostatic attraction between oppositely charged ions. Each ion forms many strong bonds so lots of energy is needed to break these bonds.

2. Ions need to be free to move and carry the charge. In a solid they are in a fixed position.

3. Graphite has weak intermolecular forces between the layers that are easily broken. In diamond every atom is covalently bonded to 4 others. These bonds take a lot of energy to break.

Round 4 - Bonding

1. Identify the bonding in the following structures:

	Mp/bp (°C)	Conductivity	Solubility in water
A	3500	Yes when dissolved/molten	Yes
B	50	No	No
C	3000	Yes	No
D	2500	No	No

Round 4 - Bonding

1. Identify the bonding in the following structures:

	Mp/bp (°C)	Conductivity	Solubility in water
A	3500	Yes when dissolved/molten	Yes
B	50	No	No
C	3000	Yes	No
D	2500	No	No

A= ionic **B = Covalent (simple)** **C = Metallic** **D = Giant covalent**

Round 5 – Acids, bases and salts

1. Name the ions found in acids and alkalis.
2. Draw an ionic equation for neutralisation.
3. Why would we not make sodium chloride by putting sodium metal in hydrochloric acid?
4. Write a general equation for the reaction of an acid and a base.
5. Give the name of the acid and the base used to make zinc chloride.

Round 5 – Acids, bases and salts

1. Acid = hydrogen ions (H^+); alkalis = hydroxide ions (OH^-).
2. $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$.
3. Would be explosively reactive.
4. Acid + base → salt + water.
5. Zinc oxide (a base is a metal oxide) + hydrochloric acid

Round 6 – Electrolysis

1. Explain what happens to the ions during the electrolysis of NaCl (l).
2. When NaCl(aq) is electrolysed H_2 gas is formed at the negative electrode NOT Na metal. Why is this?
3. When Al is made the positive electrode has to be frequently replaced. Why?
4. Why is cryolite used in the electrolysis of Aluminium oxide?
5. Complete the half equations (HT):

   a) Mg^{2+} + ….e^- → Mg

   b) ….Cl- → Cl_2 + ….e^-

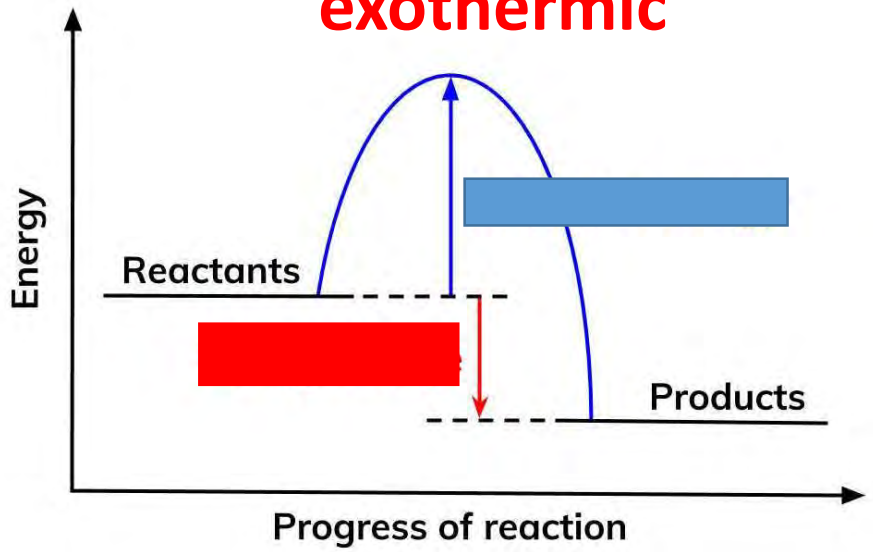
Round 6 – Electrolysis

1. Na^+ ions are attracted to the negative electrode. They gain 1 electron to form Na atoms. Cl^- ions are attracted to the positive electrode. They lose 1 electron, forming Cl_2 gas.
2. Some water is dissociated releasing H^+ ions. The least reactive ion is discharged.
3. O_2 formed there reacts with the graphite electrode, forming CO_2 gas.
4. Lowers melting temperature of aluminium oxide, so saves energy.
5. a) $Mg^{2+} + \mathbf{2}e^- \rightarrow Mg$ b) $\mathbf{2}Cl^- \rightarrow Cl_2 + \mathbf{2}e^-$

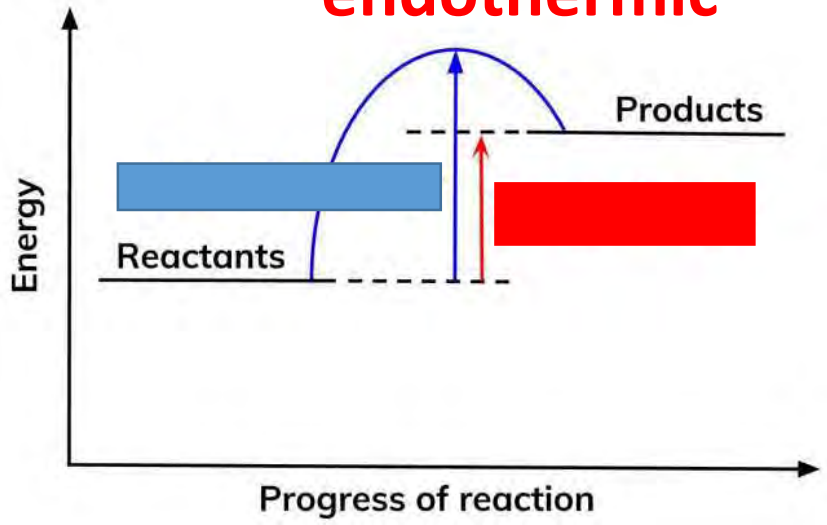
Round 7 - Energy in chemical reactions

- In an **exothermic** reaction the temperature **increases**.
- In an **endothermic** reaction the temperature **decreases**.

exothermic



endothermic



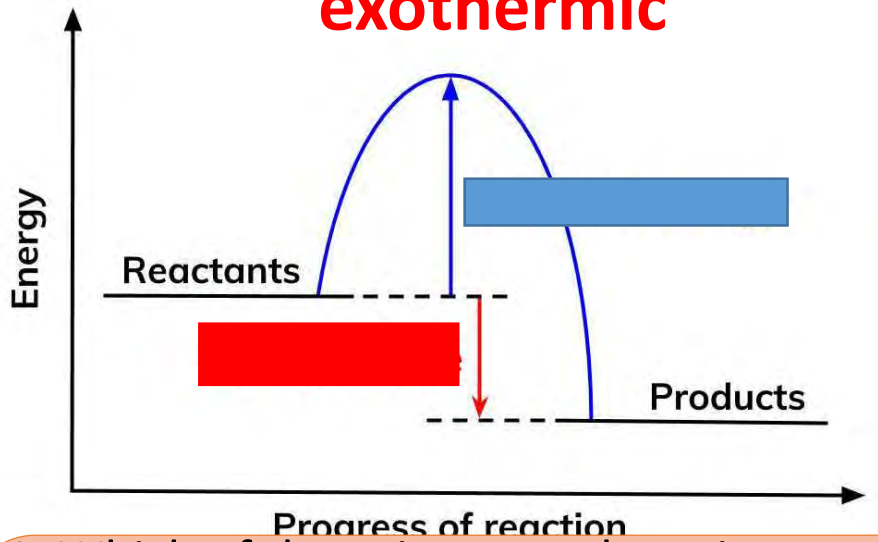
1. Which of these is an exothermic reaction and which is an endothermic reaction?
2. What are the blue and red arrows showing?
3. (HT) Is bond breaking exothermic or endothermic? Explain your answer.

Define the term: catalyst

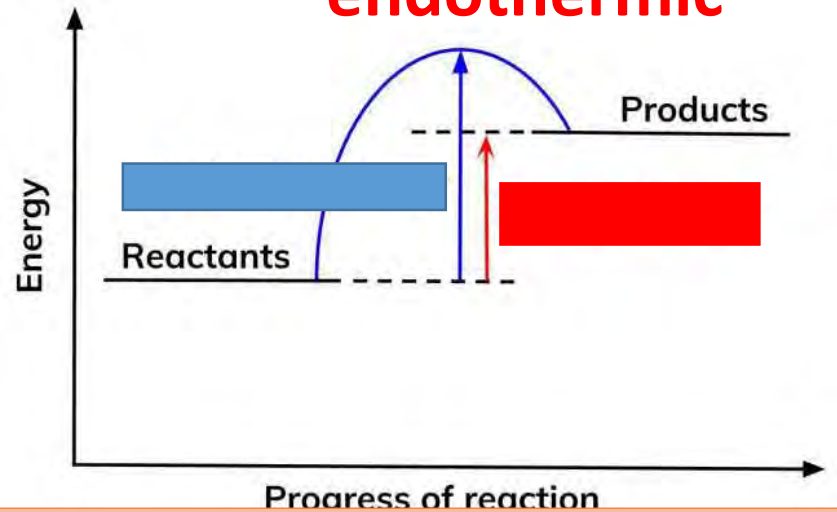
Round 7 - Energy in chemical reactions

- In an **exothermic** reaction the temperature **increases**.
- In an **endothermic** reaction the temperature **decreases**.

exothermic



endothermic

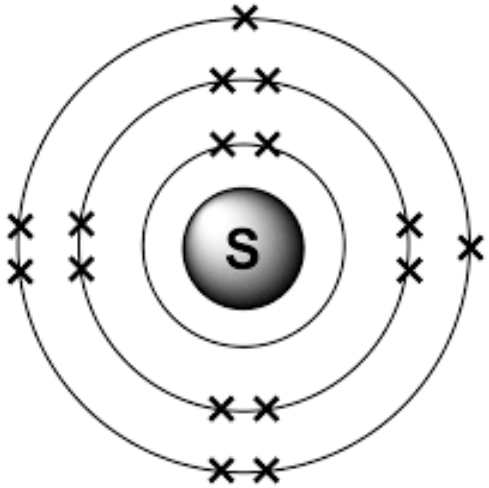


1. Which of these is an exothermic reaction and which is an endothermic reaction?
2. What are the blue and red arrows showing?
3. (HT) Is bond breaking exothermic or endothermic? Explain your answer. **Endothermic. Energy is needed to break bonds**

Define the term: catalyst. **Catalysts speed up a reaction by providing an alternative pathway with a lower activation energy. They are not used up.**

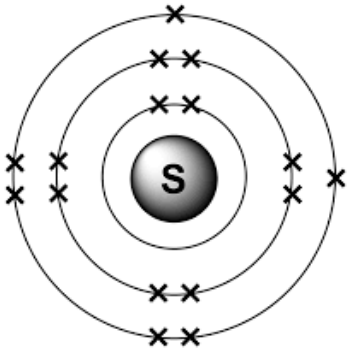
Round 8 – Periodic table

1. Newlands and Mendeleev both put the elements in order of _____.
2. Mendeleev produced a table that was more respected because……
3. The modern periodic table has elements in order of _____
4. This element would be found in period ____ and group ____.



Round 8 – Periodic table

1. Newlands and Mendeleev both put the elements in order of ___**atomic mass**_____.
2. Mendeleev produced a table that was more respected because…**he left gaps for undiscovered elements where the elements did not match the properties of the rest of the group. He predicted the properties of these element**s…
3. The modern periodic table has elements in order of __**atomic number**__
4. This element would be found in period _**3**_ and group _ **6** _.



Round 9 – Group 1 – Alkali Metals

1. Complete the equations:

Sodium + oxygen →

Lithium + water →

Potassium + chlorine →

2. State and explain the trend in reactivity down group 1.

Round 9 – Group 1 – Alkali Metals

1. Complete the equations:

Sodium + oxygen → **sodium oxide**

Lithium + water → **lithium hydroxide + hydrogen**

Potassium + chlorine → **potassium chloride**

2. State and explain the trend in reactivity down group 1.

Reactivity increases. Outer shell electron is further from nucleus; and there is more shielding; meaning less electrostatic attraction between electron and positive nucleus; so electron is more easily lost.

Round 10 – Group 7 – Halogens

1. Complete the equations:

chlorine + sodium bromide →

Bromine + sodium iodide →

2. State and explain the trend in reactivity down group 7.

3. Explain why the boiling temperature increases down group 7 (also applies to group 0).

Round 10 – Group 7 – Halogens

1. Complete the equations:

chlorine + sodium bromide → **sodium chloride + bromine**

Bromine + sodium iodide → **sodium bromide + iodine**

2. State and explain the trend in reactivity down group 7.

Reactivity decreases. Outer electron shell is further from nucleus; meaning less electrostatic attraction between electron and positive nucleus; so electron is less easily gained.

3. Explain why the boiling temperature increases down group 7 (also applies to group 0).

Relative molecular mass increases down the group so strength of intermolecular forces increases.

Required practical – Measuring Energy Changes

In the experiment acid (hydrochloric acid) is put into the cup. Alkali (sodium hydroxide) is added 1ml at a time and the temperature recorded.

1. Identify

a) The independent variable **Volume of sodium hydroxide**

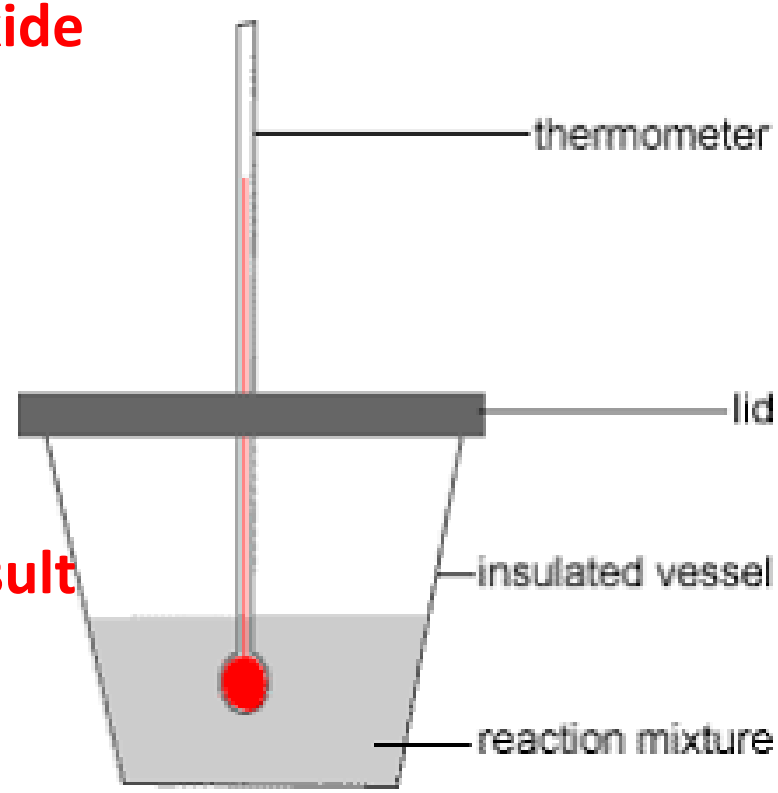
b) The dependent variable **Temperature**

c) The control variables. **Volume of acid, concentration of acid + alkali**

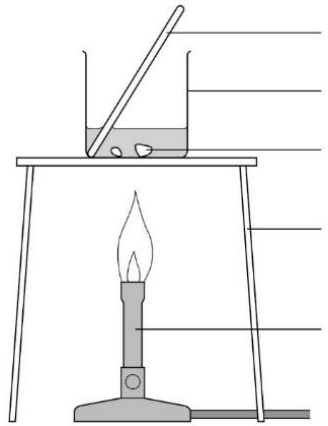
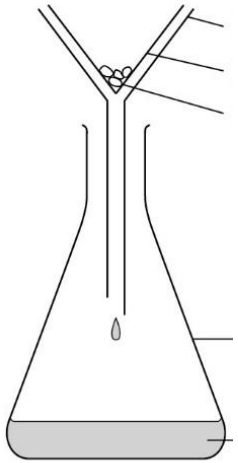
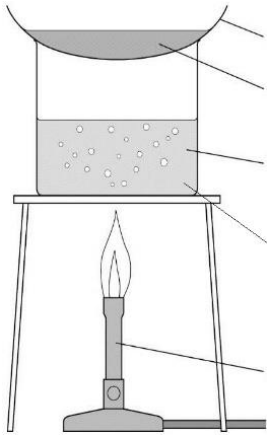
2. Is the temperature a continuous or categoric variable? **Continuous – it has number values**

3. Why do we use a polystyrene cup and not a beaker? **Prevents heat loss so we get a more accurate result**

4. What other steps do we take to ensure we get accurate results? **Use a lid. Stir solution before taking temperature reading.**

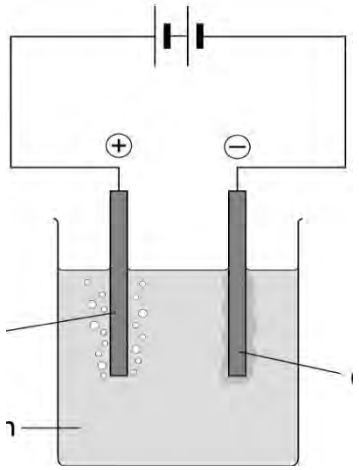


Required practical – Making Salts

Step 1	Step 2	Step 3
		

1. Why do we heat the acid?
   Speeds up reaction – ensures all acid will react.
2. Why do we add excess base?
   Ensures all acid will react. (SAFETY)
3. Why do we use a waterbath?
   It is safer, crystals can spit if evaporating basin is heated directly
4. Name the chemicals needed to make copper sulfate.
   Copper oxide + sulfuric acid

Required practical – electrolysis of solutions



1. How can you test for the gases:

a) Oxygen b) Chlorine c) Hydrogen

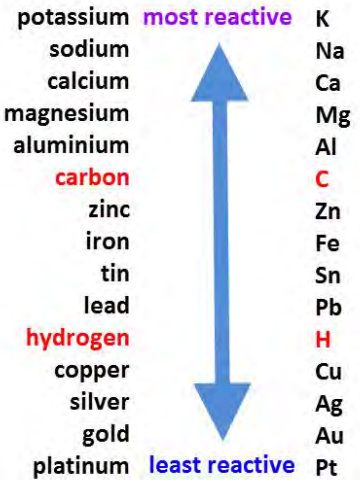
2. Explain why hydrogen is formed when electrolysing sodium sulfate.

3. Explain why the pH increases during the electrolysis of sodium chloride solution.

4. Predict what will be formed during the electrolysis of:

a) potassium bromide b) Silver nitrate

Solution	Observation at cathode	Substance formed at cathode	Observation at anode	Substance formed at anode
Copper chloride	Metal forms	Copper	bubbles	Chlorine
Copper sulfate	Metal forms	Copper	bubbles	oxygen
Sodium chloride	bubbles	hydrogen	bubbles	Chlorine
Sodium sulfate	bubbles	hydrogen	bubbles	oxygen



Round 1 – Structure of the atom

1. Compare the plum pudding and nuclear models of the atom.
2. Complete the table:

Name of particle	Relative charge	Relative mass
Proton		
	0	1
	-1	Very small

3. Define the term isotope.

Round 1 – Structure of the atom

1. Compare the plum pudding and nuclear models of the atom.

Plum pudding has a ball of positive charge with electrons embedded in it. There are no neutrons.

Nuclear model has a nucleus containing protons and neutrons and electrons in shells orbiting the nucleus.

2. Complete the table:

Name of particle	Relative charge	Relative mass
Proton	**+1**	**1**
Neutron	0	1
Electron	-1	Very small

Isotopes: have the same numbers of protons and electrons but different numbers of neutrons.

Round 2 - Bonding

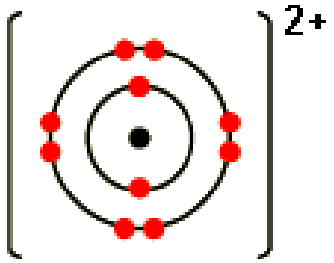
1. Draw the electron arrangement in a fluorine atom and a fluoride ion.
   $^{19}_{9}F$
2. Draw the bonding in magnesium oxide.
3. Draw the bonding in sodium.
4. Explain why metals can conduct electricity.

$^{24}_{12}Mg$ $^{16}_{8}O$

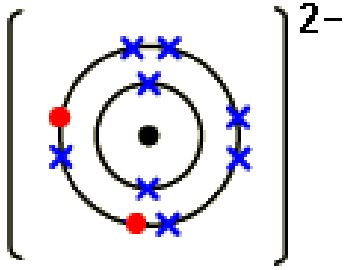
Round 2 - Bonding

fluorine atom,
F 2,7

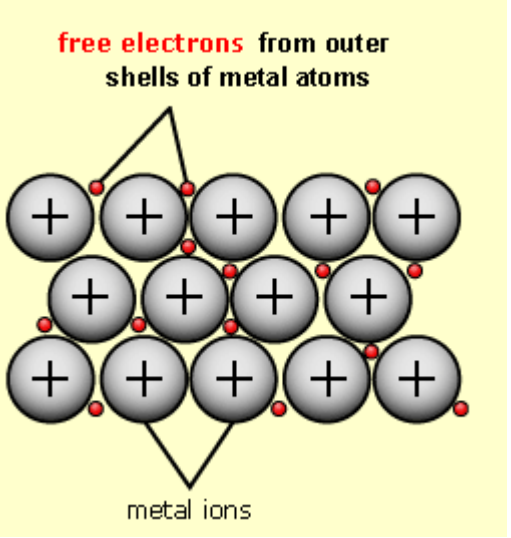
fluoride ion
F^- $[2,8]^-$



magnesium ion,
Mg^{2+} $[2,8]^{2+}$



oxide ion,
O^{2-} $[2,8]^{2-}$



3. Electrons in outer shell of metals are delocalised so are free to move throughout the structure.

N.B. Metallic bond is attraction between the positive metal ions and the delocalised electrons.

Round 3 - Bonding

1. Explain why ionic solids have high melting points.
2. Explain why ionic compounds can conduct electricity when molten or dissolved but not as a solid.
3. Why is graphite soft but diamond extremely hard?

Round 3 - Bonding

1. The ions are joined in a giant lattice with strong electrostatic attraction between oppositely charged ions. Each ion forms many strong bonds so lots of energy is needed to break these bonds.

2. Ions need to be free to move and carry the charge. In a solid they are in a fixed position.

3. Graphite has weak intermolecular forces between the layers that are easily broken. In diamond every atom is covalently bonded to 4 others. These bonds take a lot of energy to break.

Round 4 - Bonding

1. Identify the bonding in the following structures:

	Mp/bp (°C)	Conductivity	Solubility in water
A	3500	Yes when dissolved/molten	Yes
B	50	No	No
C	3000	Yes	No
D	2500	No	No

Round 4 - Bonding

1. Identify the bonding in the following structures:

	Mp/bp (°C)	Conductivity	Solubility in water
A	3500	Yes when dissolved/molten	Yes
B	50	No	No
C	3000	Yes	No
D	2500	No	No

A= ionic **B = Covalent (simple)** **C = Metallic** **D = Giant covalent**

Round 5 – Acids, bases and salts

1. Name the ions found in acids and alkalis.
2. Draw an ionic equation for neutralisation.
3. Why would we not make sodium chloride by putting sodium metal in hydrochloric acid?
4. Write a general equation for the reaction of an acid and a base.
5. Give the name of the acid and the base used to make zinc chloride.

Round 5 – Acids, bases and salts

1. Acid = hydrogen ions (H^+); alkalis = hydroxide ions (OH^-).
2. $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$.
3. Would be explosively reactive.
4. Acid + base → salt + water.
5. Zinc oxide (a base is a metal oxide) + hydrochloric acid

Round 6 – Electrolysis

1. Explain what happens to the ions during the electrolysis of NaCl (l).
2. When NaCl(aq) is electrolysed H_2 gas is formed at the negative electrode NOT Na metal. Why is this?
3. When Al is made the positive electrode has to be frequently replaced. Why?
4. Why is cryolite used in the electrolysis of Aluminium oxide?
5. Complete the half equations (HT):

   a) Mg^{2+} + ….e^- → Mg

   b) ….Cl- → Cl_2 + ….e^-

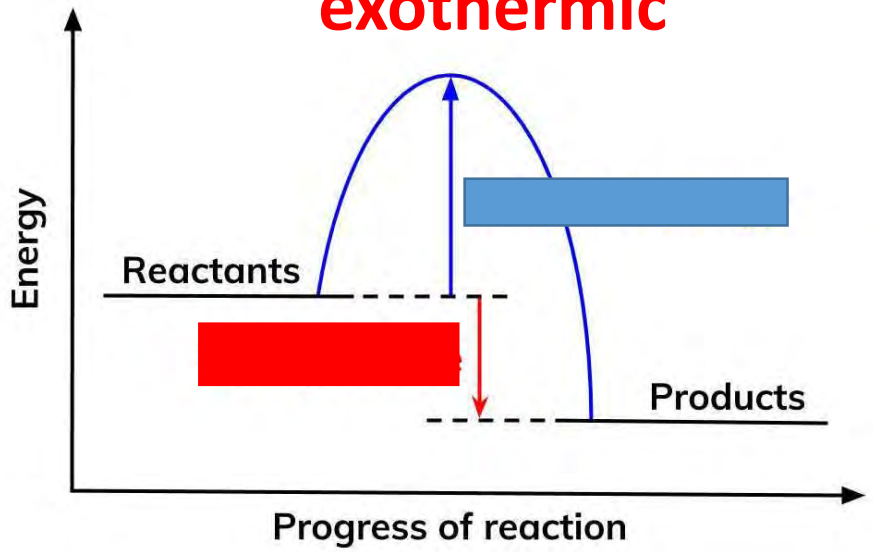
Round 6 – Electrolysis

1. Na^+ ions are attracted to the negative electrode. They gain 1 electron to form Na atoms. Cl^- ions are attracted to the positive electrode. They lose 1 electron, forming Cl_2 gas.
2. Some water is dissociated releasing H^+ ions. The least reactive ion is discharged.
3. O_2 formed there reacts with the graphite electrode, forming CO_2 gas.
4. Lowers melting temperature of aluminium oxide, so saves energy.
5. a) $Mg^{2+} + \mathbf{2}e^- \rightarrow Mg$ b) $\mathbf{2}Cl^- \rightarrow Cl_2 + \mathbf{2}e^-$

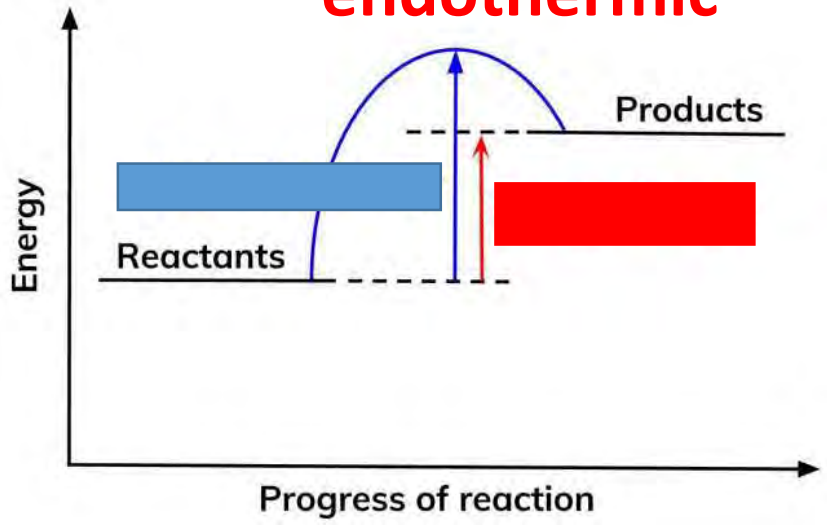
Round 7 - Energy in chemical reactions

- In an **exothermic** reaction the temperature **increases**.
- In an **endothermic** reaction the temperature **decreases**.

exothermic



endothermic



1. Which of these is an exothermic reaction and which is an endothermic reaction?
2. What are the blue and red arrows showing?
3. (HT) Is bond breaking exothermic or endothermic? Explain your answer.

Define the term: catalyst

Round 7 - Energy in chemical reactions

- In an **exothermic** reaction the temperature **increases**.
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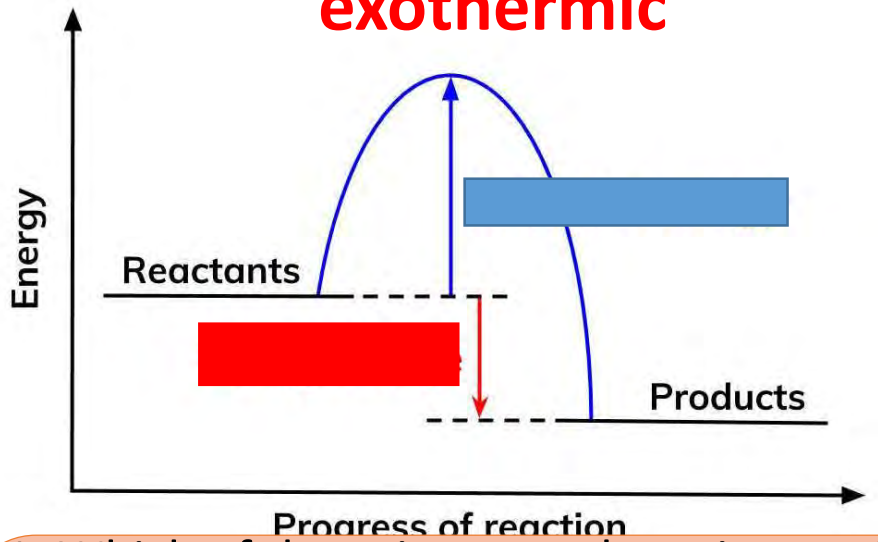
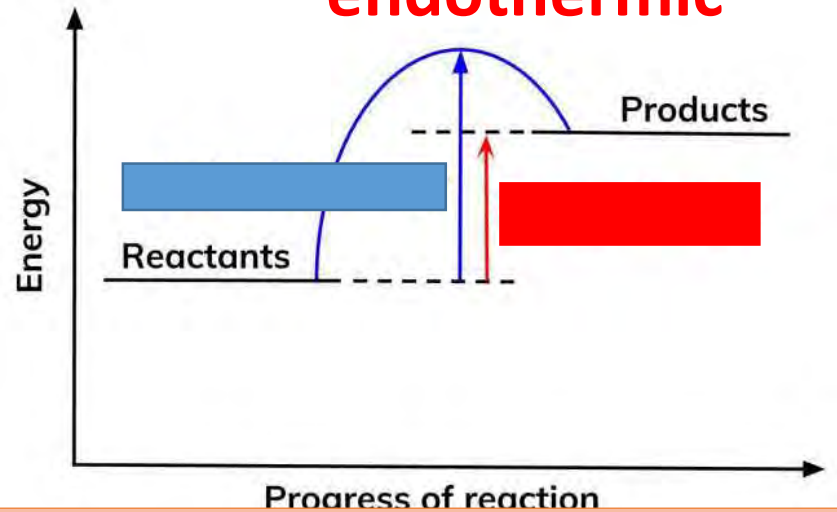
exothermic



endothermic



1. Which of these is an exothermic reaction and which is an endothermic reaction?
2. What are the blue and red arrows showing?
3. (HT) Is bond breaking exothermic or endothermic? Explain your answer. **Endothermic. Energy is needed to break bonds**

Define the term: catalyst. **Catalysts speed up a reaction by providing an alternative pathway with a lower activation energy. They are not used up.**

Bond energy calculation (HT)

hydrogen + chlorine → hydrogen chloride

$$H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$$

H – H + Cl – Cl → H – Cl + H – Cl

Bond type	Energy (KJ/mol)
H-H	436
Cl-Cl	243
H-Cl	432

Negative energy change means the reaction is exothermic

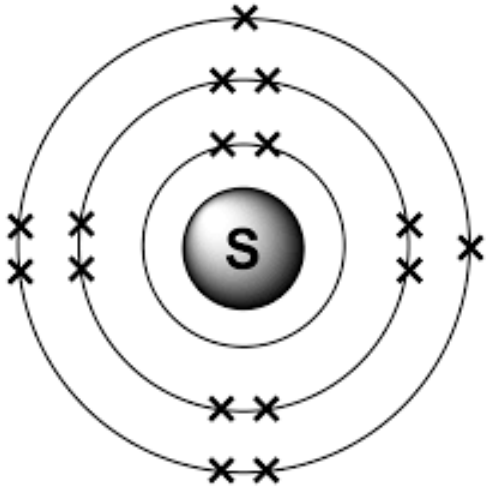
Energy needed to break reactant bonds
= 436 + 243 = 679 KJ/mol

Energy released when new bonds form
= 2 x 432 = 864 KJ/mol

Energy change = reactants – products
= 679 – 864
= -185 KJ/mol

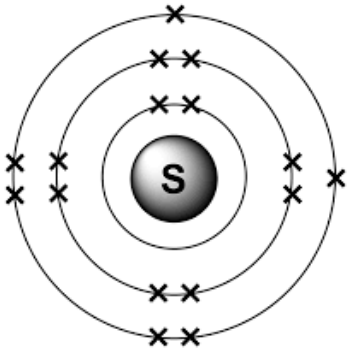
Round 8 – Periodic table

1. Newlands and Mendeleev both put the elements in order of _____.
2. Mendeleev produced a table that was more respected because……
3. The modern periodic table has elements in order of _____
4. This element would be found in period ____ and group ____.



Round 8 – Periodic table

1. Newlands and Mendeleev both put the elements in order of ___**atomic mass**_____.
2. Mendeleev produced a table that was more respected because…**he left gaps for undiscovered elements where the elements did not match the properties of the rest of the group. He predicted the properties of these element**s…
3. The modern periodic table has elements in order of __**atomic number**__
4. This element would be found in period _**3**_ and group _ **6** _.



Round 9 – Group 1 – Alkali Metals

1. Complete the equations:

Sodium + oxygen →

Lithium + water →

Potassium + chlorine →

2. State and explain the trend in reactivity down group 1.

Round 9 – Group 1 – Alkali Metals

1. Complete the equations:

Sodium + oxygen → **sodium oxide**

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2. State and explain the trend in reactivity down group 1.

Reactivity increases. Outer shell electron is further from nucleus; and there is more shielding; meaning less electrostatic attraction between electron and positive nucleus; so electron is more easily lost.

Round 10 – Group 7 – Halogens

1. Complete the equations:

chlorine + sodium bromide →

Bromine + sodium iodide →

2. State and explain the trend in reactivity down group 7.

3. Explain why the boiling temperature increases down group 7 (also applies to group 0).

Round 10 – Group 7 – Halogens

1. Complete the equations:

chlorine + sodium bromide → **sodium chloride + bromine**

Bromine + sodium iodide → **sodium bromide + iodine**

2. State and explain the trend in reactivity down group 7.

Reactivity decreases. Outer electron shell is further from nucleus; meaning less electrostatic attraction between electron and positive nucleus; so electron is less easily gained.

3. Explain why the boiling temperature increases down group 7 (also applies to group 0).

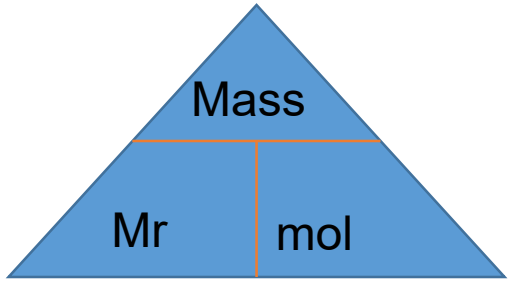
Relative molecular mass increases down the group so strength of intermolecular forces increases.

Round 11 – The Mole (HT)

1. Write down the triangle that links mass, Mr and moles.
2. What mass of CO_2 will be formed when 4g of methane (CH_4) is combusted? $CH_4 + 2O_2 \rightarrow CO_2 + H_2O$

Round 11 – The Mole (HT)

1. Write down the 3 mole triangles.



2. What mass of CO_2 will be formed when 4g of methane (CH_4) is combusted? $CH_4 + 2O_2 \rightarrow CO_2 + H_2O$

	CH_4	CO_2
Mass	4	
Mr	**16**	**44**
Mol		
Ratio	1	1

Required practical – Measuring Energy Changes

In the experiment acid (hydrochloric acid) is put into the cup. Alkali (sodium hydroxide) is added 1ml at a time and the temperature recorded.

1. Identify

a) The independent variable **Volume of sodium hydroxide**

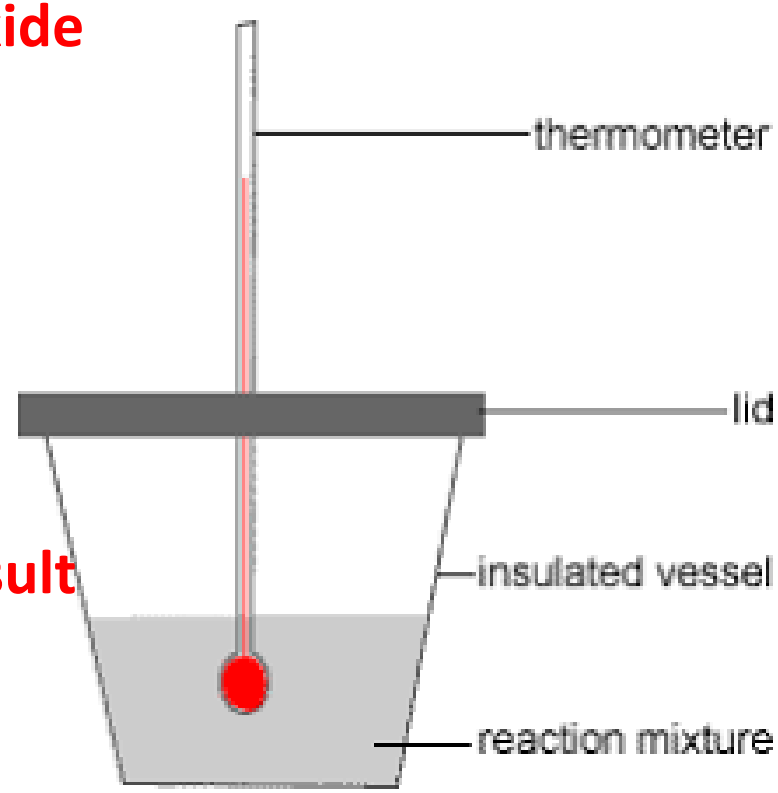
b) The dependent variable **Temperature**

c) The control variables. **Volume of acid, concentration of acid + alkali**

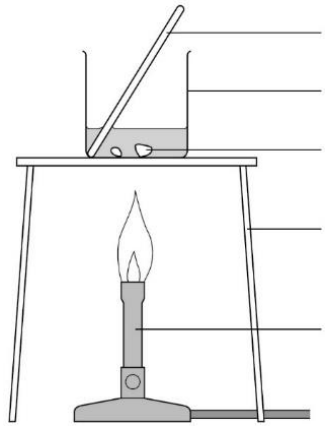
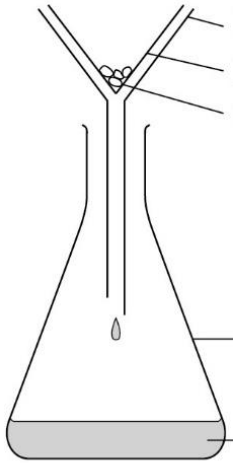
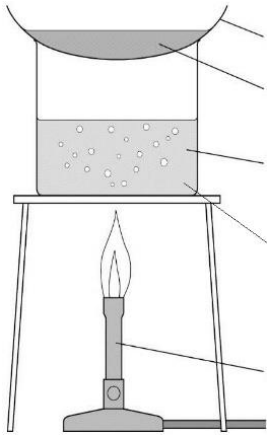
2. Is the temperature a continuous or categoric variable? **Continuous – it has number values**

3. Why do we use a polystyrene cup and not a beaker? **Prevents heat loss so we get a more accurate result**

4. What other steps do we take to ensure we get accurate results? **Use a lid. Stir solution before taking temperature reading.**

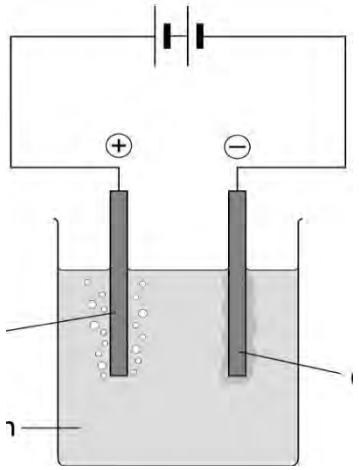


Required practical – Making Salts

Step 1	Step 2	Step 3
		

1. Why do we heat the acid?
   Speeds up reaction – ensures all acid will react.
2. Why do we add excess base?
   Ensures all acid will react. (SAFETY)
3. Why do we use a waterbath?
   It is safer, crystals can spit if evaporating basin is heated directly
4. Name the chemicals needed to make copper sulfate.
   Copper oxide + sulfuric acid

Required practical – electrolysis of solutions



1. How can you test for the gases:

a) Oxygen b) Chlorine c) Hydrogen

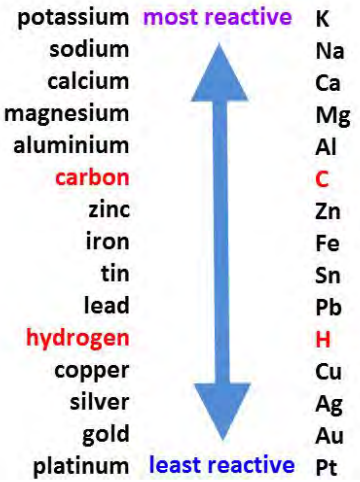
2. Explain why hydrogen is formed when electrolysing sodium sulfate.

3. Explain why the pH increases during the electrolysis of sodium chloride solution.

4. Predict what will be formed during the electrolysis of:

a) potassium bromide b) Silver nitrate

Solution	Observation at cathode	Substance formed at cathode	Observation at anode	Substance formed at anode
Copper chloride	Metal forms	Copper	bubbles	Chlorine
Copper sulfate	Metal forms	Copper	bubbles	oxygen
Sodium chloride	bubbles	hydrogen	bubbles	Chlorine
Sodium sulfate	bubbles	hydrogen	bubbles	oxygen



Round 1 – Rates of reaction

1. List the factors that affect the rate of a chemical reaction.
2. Predict what will happen to the rate of a chemical reaction if the concentration of a reactant is doubled.
3. Explain why a 10°C increase in the temperature can double the rate of a reaction.
4. Draw an energy profile for a catalysed reaction.
5. Identify the catalyst:

$$N_2 + 3H_2 \overset{Fe}{\rightleftharpoons} 2NH_3$$

Round 1 – Rates of reaction

1. List the factors that affect the rate of a chemical reaction.

Temperature, surface area, concentration, pressure, catalysts

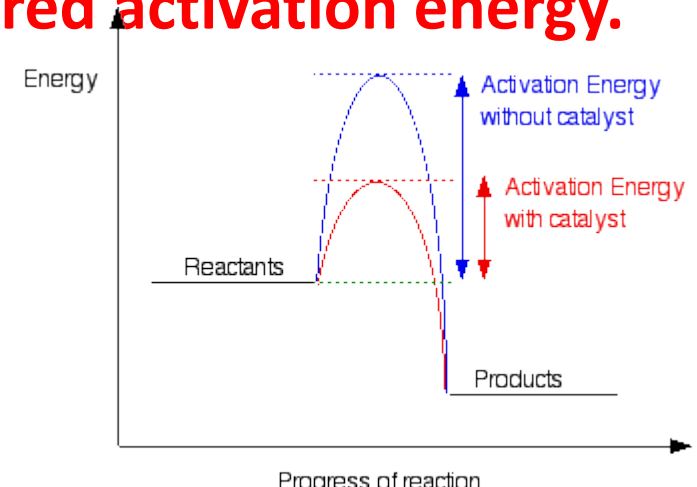
2. Predict what will happen to the rate of a chemical reaction if the concentration of a reactant is doubled.

The rate will double as there are double the number of particles in the same volume, so the frequency of collisions will double.

3. Explain why a 10°C increase in the temperature can double the rate of a reaction.

Particles have more kinetic energy so collide more frequently. These collision are also more energetic meaning more particles have the required activation energy.

3. Draw an energy profile for a catalysed reaction.



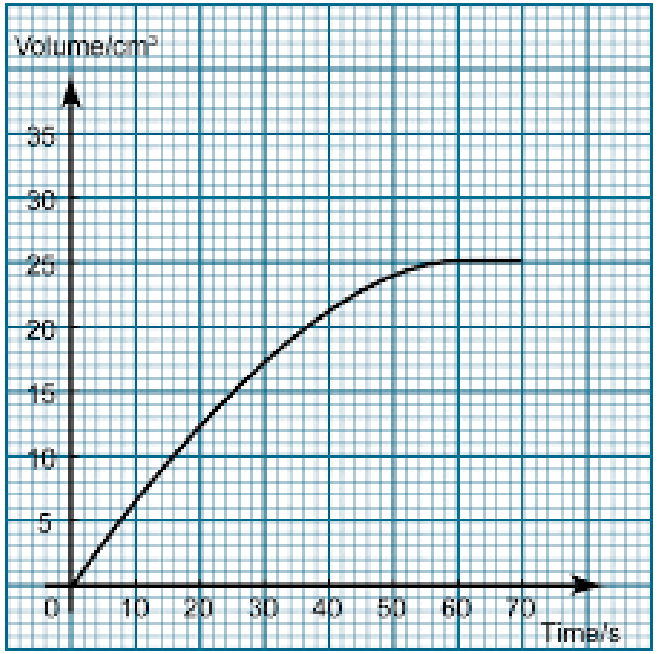
4. Identify the catalyst:

Fe – catalysts are written above the arrow

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Round 2 – Rates of reaction

1. Define the term mean rate of reaction.
2. Use the graph to calculate the mean rate of reaction:



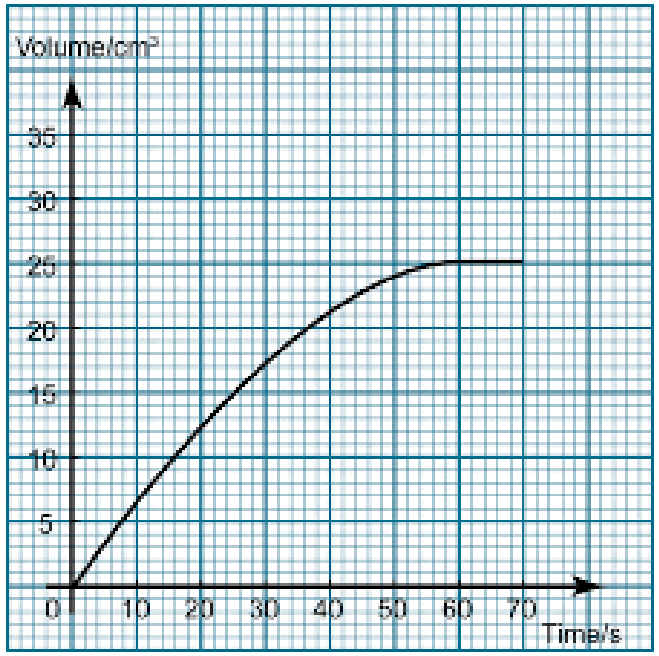
Round 2 – Rates of reaction

1. Define the term mean rate of reaction.

Mean rate = quantity of product made / reactant used up

time

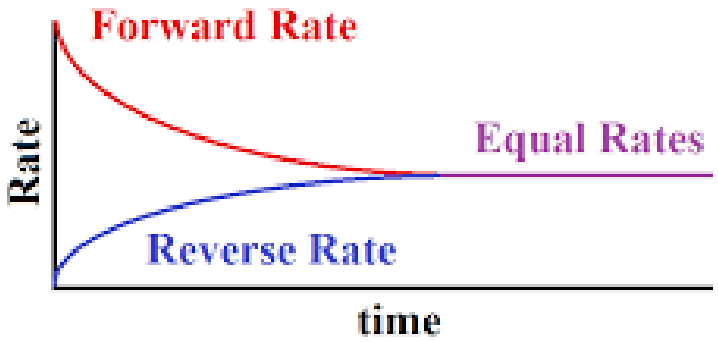
2. Use the graph to calculate the mean rate of reaction:

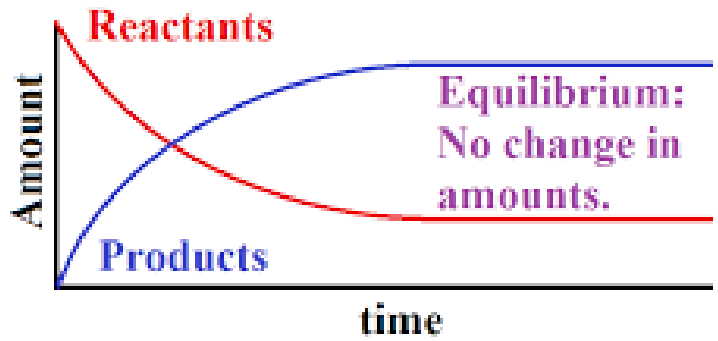


Mean rate
= 25 / 56
= 0.446 cm^3/s

Round 3 – Equilibrium

1. Draw the symbol for a reversible reaction.
2. Define equilibrium.
3. Draw a line on each graph to show where equilibrium is established.



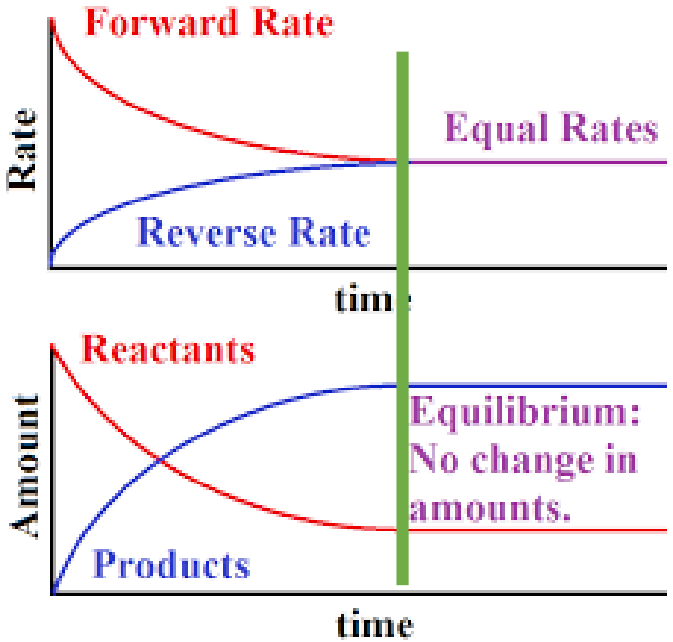


Round 3 – Equilibrium

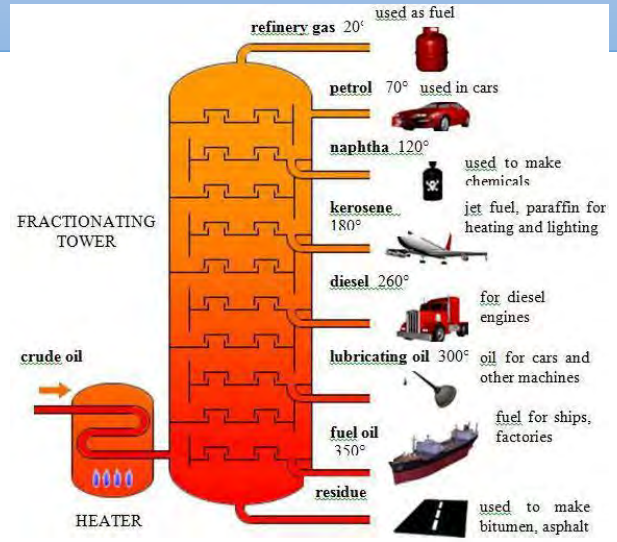
1. Draw the symbol for a reversible reaction. ⇌

2. Define equilibrium. **Occurs in a closed system, where the rate of the forward reaction is equal to the rate of the reverse reaction**

3. Draw a line on each graph to show where equilibrium is established. **Point where conc stops changing**



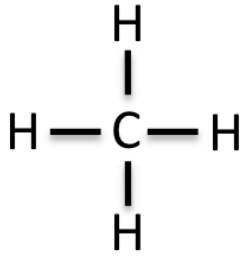
Round 4 – Fractional distillation and hydrocarbons

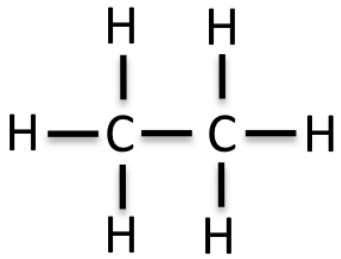


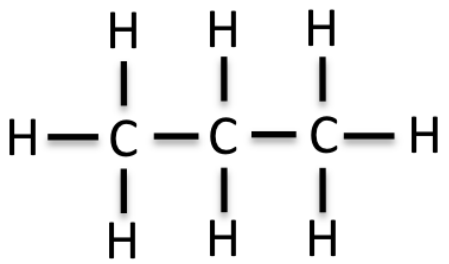
1. Explain how crude oil is separated into fractions.
2. Define the term hydrocarbon.
3. Complete and balance the equation:

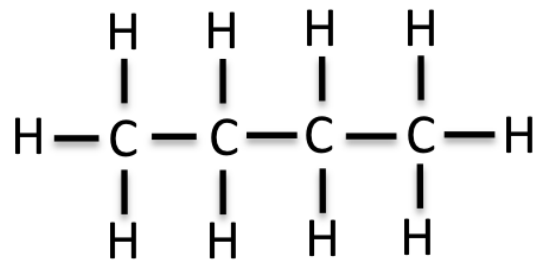
$$C_3H_8 + O_2 \rightarrow \_\_\_\_\_ + \_\_\_\_\_$$

4. Describe how boiling point, viscosity and flammability change with molecular size.
5. Give the general formula for the alkanes.
6. Name the first 4 alkanes.









Round 4 – Fractional distillation and hydrocarbons

1. Explain how crude oil is separated into fractions.

Crude oil is heated to vaporise it. Vapours rise up column and cool. Vapours condense at the boiling temperature of the molecule.

2. Define the term hydrocarbon. **A molecule made of carbon and hydrogen only**

3. Complete and balance the equation:

$$C_3H_8 + 5O_2 \rightarrow \_3CO_2\_\_ + \_\_4H_2O\_\_$$

4. Describe how boiling point, viscosity and flammability change with molecular size. **Boiling point and viscosity increase with Mr, flammability decreases.**

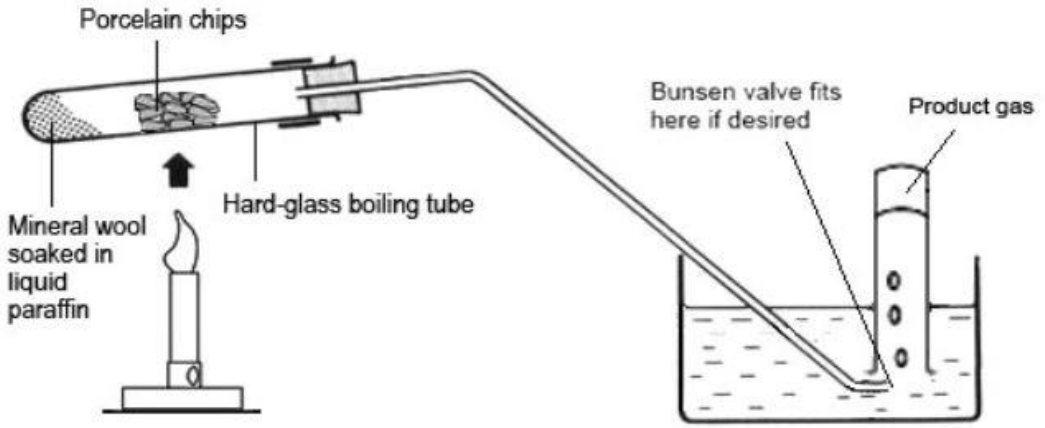
5. Give the general formula for the alkanes. C_nH_{2n+2}

6. Name the first 4 alkanes. **Methane (C1), ethane (C2), propane (C3), butane (C4)**

Round 5 – Cracking and alkenes

1. Give the conditions for catalytic cracking and steam cracking.
2. Why do we do cracking?
3. Describe how to test for alkenes.
4. Balance the equation:

$$C_{12}H_{26} \rightarrow C_6H_{14} + \_\_\_\_\_ + \_\_\_\_\_$$



Round 5 – Cracking and alkenes

1. Give the conditions for catalytic cracking **(heat to vapourise and pass vapours over a hot catalyst)** and steam cracking **(mix with steam, heat to a very high temperature).**
2. Why do we do cracking? **To make smaller alkanes that are useful as fuels and alkenes that can be used to make plastics**
3. Describe how to test for alkenes. **Add bromine water. Stays orange with alkanes and goes colourless with alkenes**
4. Balance the equation:

$$C_{12}H_{26} \rightarrow C_6H_{14} + \_C_2H_4\_\_ + \_\_ C_4H_8 \_\_$$

OR

$$C_{12}H_{26} \rightarrow C_6H_{14} + \_C_3H_6\_\_ + \_\_ C_3H_6 \_\_$$

Round 6 – Formulations and testing for gases

1. A pure substance is made of a single _____ or _____.
2. Pure substances melt or _____ at a specific temperature.
3. Compared to pure substances, mixtures have _____ melting points and melt over a range of temperatures.
4. A formulation is a _____ that has been designed as a useful product.
5. Components are mixed in precise quantities to give desired _____.
6. Complete the table:

Gas	Test with…..	Result
Hydrogen		
Oxygen		
	Limewater	
	Damp blue litmus paper	

Round 6 – Formulations and testing for gases

1. A pure substance is made of a single ___element___ or ___compound___.
2. Pure substances melt or ___boil___ at a specific temperature.
3. Compared to pure substances, mixtures have ___lower___ melting points and melt over a range of temperatures.
4. A formulation is a ___mixture___ that has been designed as a useful product.
5. Components are mixed in precise quantities to give desired ___properties___.
6. Complete the table:

Gas	Test with…..	Result
Hydrogen	**Lit splint**	**Squeaky pop**
Oxygen	**Glowing splint**	**Splint relights**
Carbon dioxide	Limewater	**Limewater goes cloudy**
Chlorine	Damp blue litmus paper	**Litmus paper bleaches**

Round 7 – Evolution of the atmosphere

Intense volcanic activity

Earth cools and oceans form

Plants evolve and photosynthesise

1. State what gases are present at each stage in the evolution o f the atmosphere flow diagram.
2. List 3 ways that carbon dioxide was removed from the atmosphere.
3. How do human activities produce carbon dioxide and methane?

Round 7 – Evolution of the atmosphere

Intense volcanic activity

Atmosphere consists of:

- Mainly CO_2.
- Volcanoes released N_2 and maybe CH_4 and NH_3.
- Little or no O_2.

Earth cools and oceans form

Changes to atmosphere:

- CO_2 levels drop
- As CO_2 is dissolved forming carbonates

Plants evolve and photosynthesise

Changes to atmosphere:

- O_2 levels increase as photosynthesis occurs

Round 7 – Evolution of the atmosphere

2. List 3 ways that carbon dioxide was removed from the atmosphere.

- **Dissolved in oceans forming carbonates**
- **Locked up in fossil fuels**
- **photosynthesis**

3. How do human activities produce carbon dioxide and methane?

Carbon dioxide – combustion and deforestation

Methane – landfill and intensive animal farming

Round 8 – Global climate change and pollutants

1. Define the term carbon footprint.
2. Can the carbon footprint be reduced for

a) A person

b) A company

c) A country

3. Why might these actions be limited?

4. Give 2 products from incomplete combustion. Why are they an issue?

5. How is sulfur dioxide formed from combustion? What problems does it cause?

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1. Define the term carbon footprint. – **total amount of carbon dioxide and methane emitted over the lifetime of a product, service or event.**
2. Can the carbon footprint be reduced for

a) A person – **turn off lights, walk, get public transport**

b) A company – **carbon offsetting, use carbon neutral fuels**

c) A country – **carbon capture, use taxation, invest in public transport systems**

3. Why might these actions be limited? **Cost and lack of political resolve**

4. Give 2 products from incomplete combustion. **Carbon (soot) and carbon monoxide** Why are they an issue? **Soot – causes global dimming and can cause asthma. Carbon monoxide - toxic**

5. How is sulfur dioxide formed from combustion? What problems does it cause?

Sulfur impurities in fuel react with oxygen. Acid rain.

Round 9 – Earths resources (potable water and LCAs)

1. Define the terms: pure water and potable water
2. State how potable water can be made from

a) Freshwater

b) Sea water

3. Which method would France use? Why?

4. Define the terms: sustainable development, finite resource and renewable resource.
5. Lifecycle assessments assess the environmental impact of a product. Explain why they are open to bias.

Round 15 – Earths resources (potable water and LCAs)

1. Define the terms: pure water **(contains only water molecules)** and potable water **(water that is safe to drink)**
2. State how potable water can be made from

a) Freshwater **(1. Filtered to remove solids. 2. Sterilised using chlorine / UV light / ozone)**

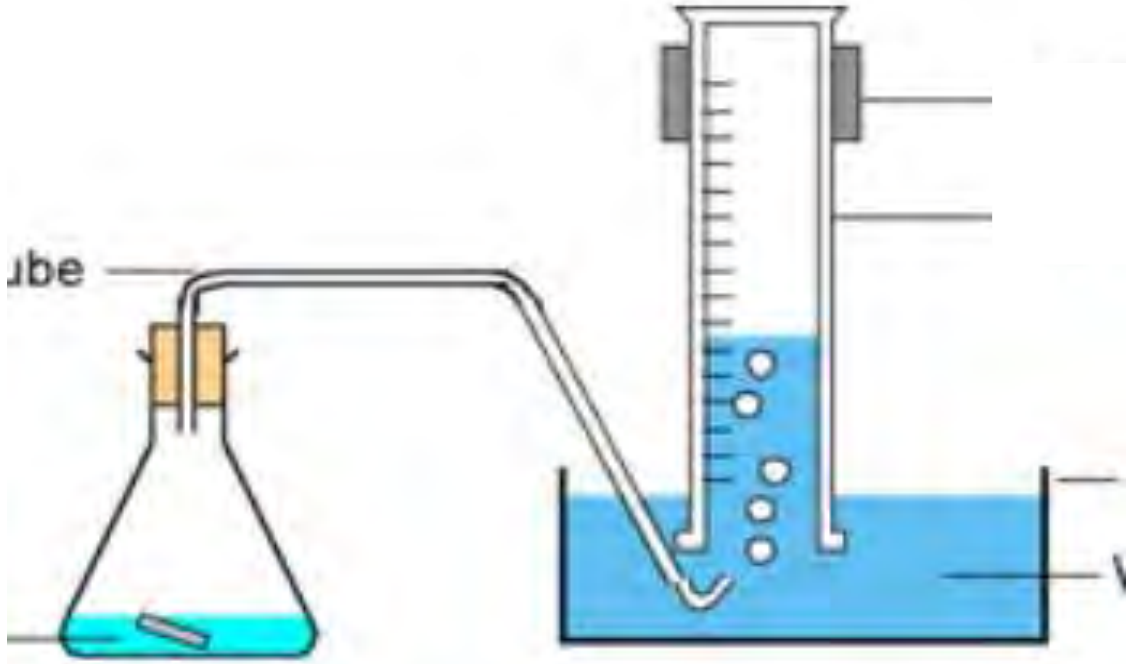
b) Sea water **(Distillation or reverse osmosis)**

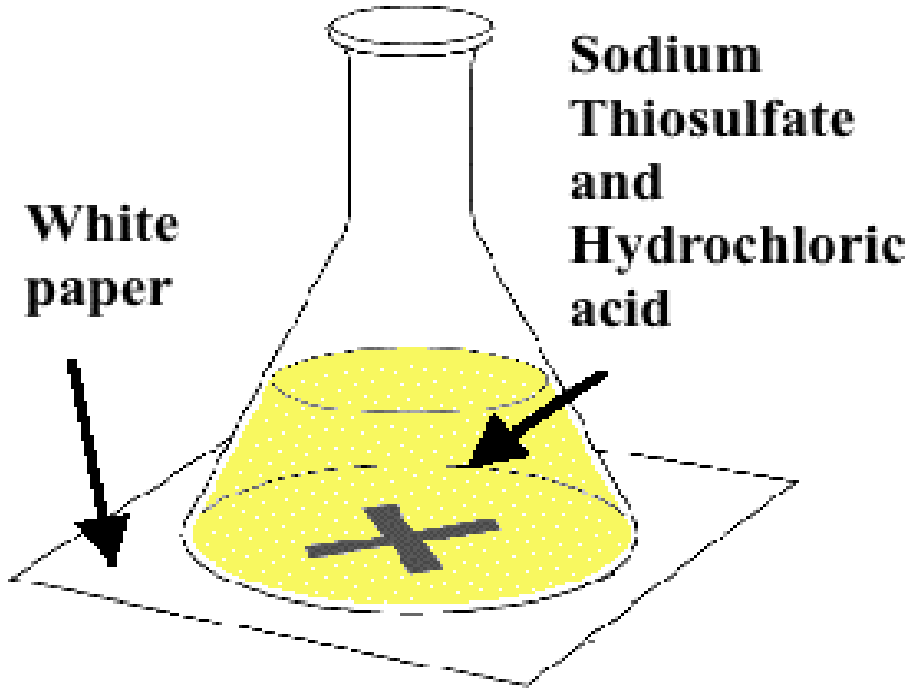
3. Freshwater. France has a cool climate so has access to sufficient freshwater. It is cheaper / requires less energy to use freshwater.

4. Define the terms: sustainable development **(meeting the needs of our generation without compromising the ability of future generations to meet their needs)**, finite resource **(a resource that can not be replaced once it has been used)** and renewable resource **(a resource that can be replaced once it has been used)**.

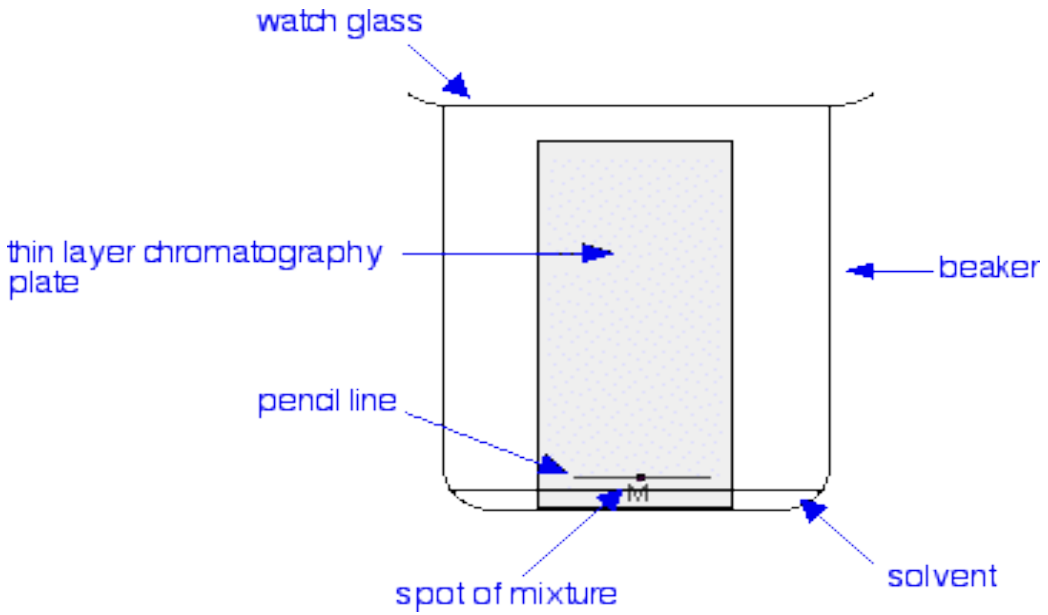
5. Lifecycle assessments assess the environmental impact of a product. Explain why they are open to bias. **(LCAs assess use of water, resources, energy and waste production. Not all of these can be easily quantified leading to misrepresentation)**

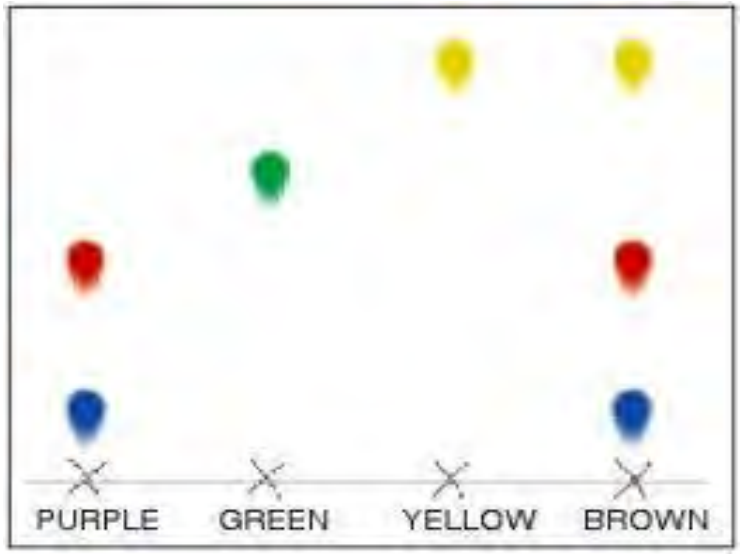
Required practical – rates of reaction





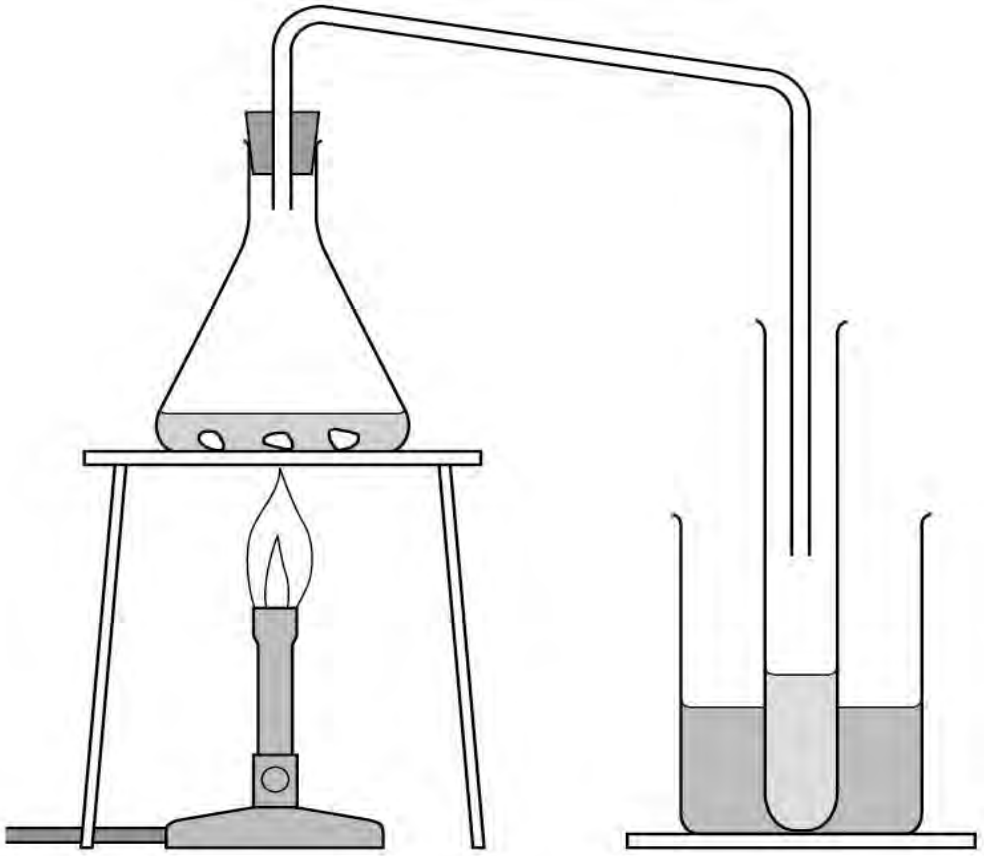
Required practical – chromatography

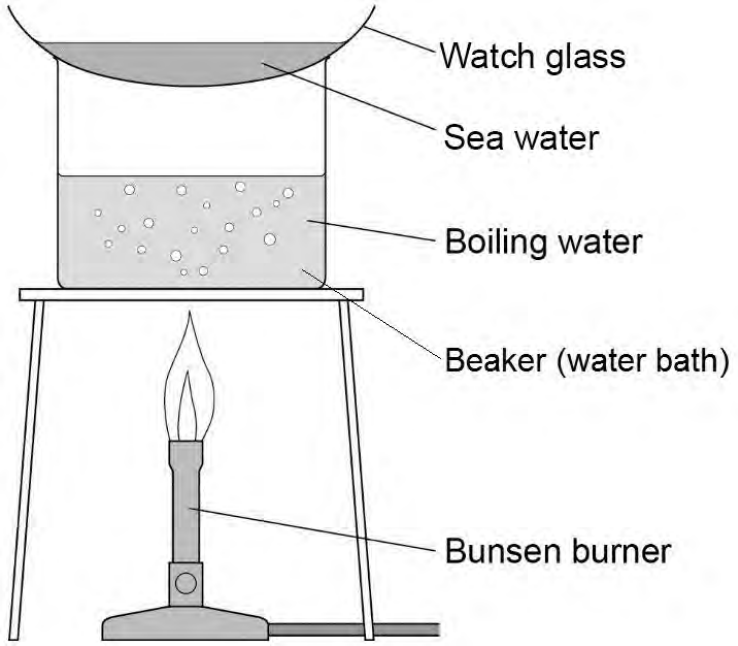




$$Rf = \frac{\text{distance travelled by spot}}{\text{distance travelled by solvent}}$$

Required practical – potable water





Round 1 – Rates of reaction

1. List the factors that affect the rate of a chemical reaction.
2. Predict what will happen to the rate of a chemical reaction if the concentration of a reactant is doubled.
3. Explain why a 10°C increase in the temperature can double the rate of a reaction.
4. Draw an energy profile for a catalysed reaction.
5. Identify the catalyst:

$$N_2 + 3H_2 \overset{Fe}{\rightleftharpoons} 2NH_3$$

Round 1 – Rates of reaction

1. List the factors that affect the rate of a chemical reaction.

Temperature, surface area, concentration, pressure, catalysts

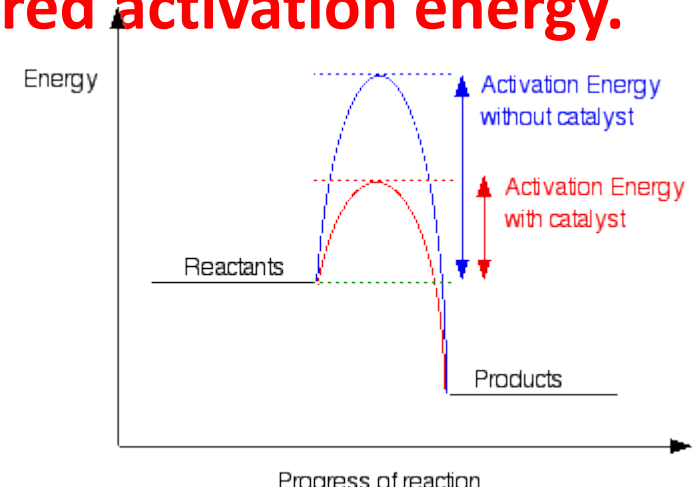
2. Predict what will happen to the rate of a chemical reaction if the concentration of a reactant is doubled.

The rate will double as there are double the number of particles in the same volume, so the frequency of collisions will double.

3. Explain why a 10°C increase in the temperature can double the rate of a reaction.

Particles have more kinetic energy so collide more frequently. These collision are also more energetic meaning more particles have the required activation energy.

3. Draw an energy profile for a catalysed reaction.



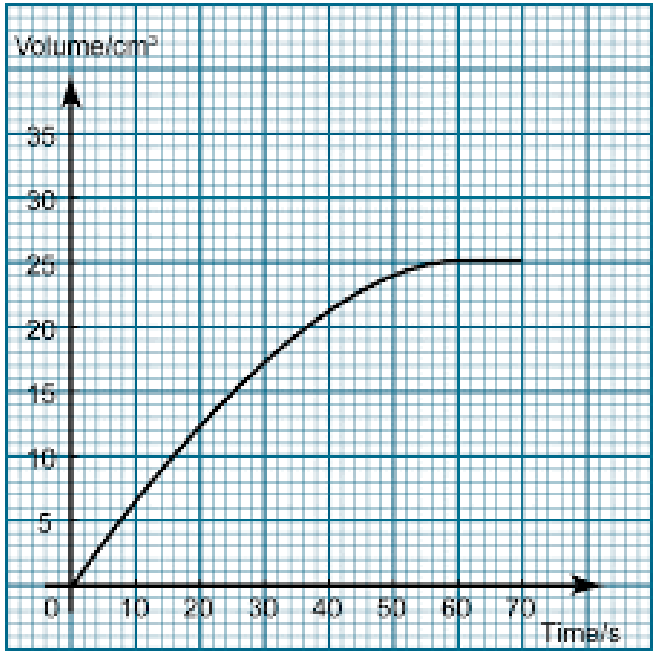
4. Identify the catalyst:

Fe – catalysts are written above the arrow

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Round 2 – Rates of reaction

1. Define the term mean rate of reaction.
2. Use the graph to calculate the mean rate of reaction:



3. How would you calculate the rate of reaction at 30 second (HT)?

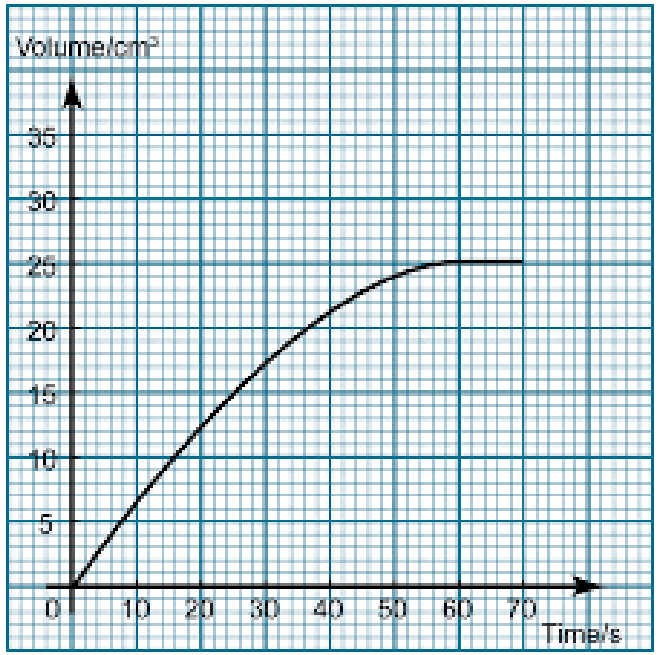
Round 2 – Rates of reaction

1. Define the term mean rate of reaction.

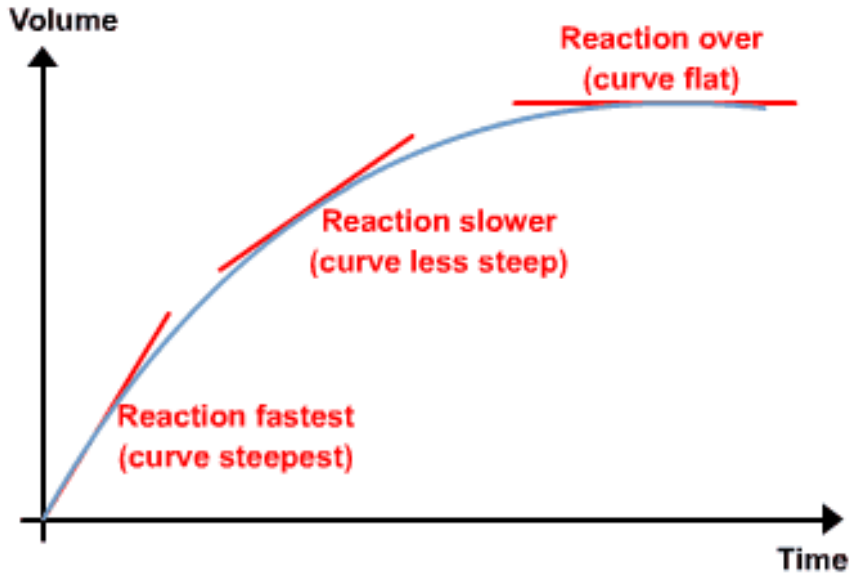
Mean rate = quantity of product made / reactant used up

time

2. Use the graph to calculate the mean rate of reaction:



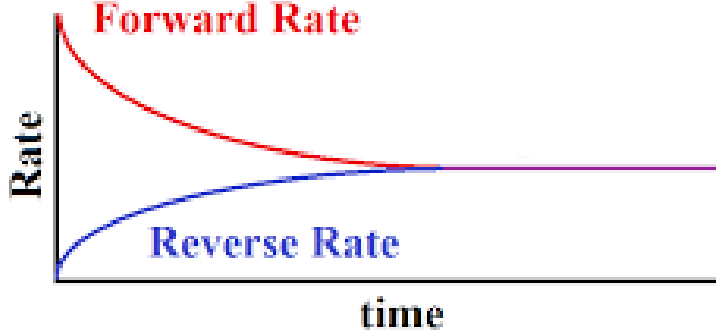
Mean rate
= 25 / 56
= 0.446 cm^3/s

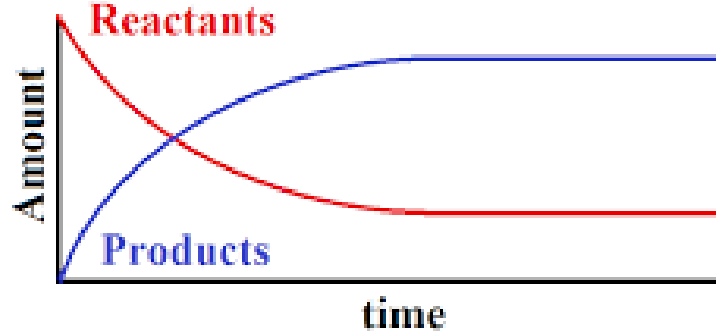


3. How would you calculate the rate of reaction at 30 second (HT)? **Draw a tangent line and calculate its gradient.**

Round 3 – Equilibrium

1. Draw the symbol for a reversible reaction.
2. Define equilibrium.
3. Draw a line on each graph to show where equilibrium is established.





4. (HT) Describe what happens to the equilibrium

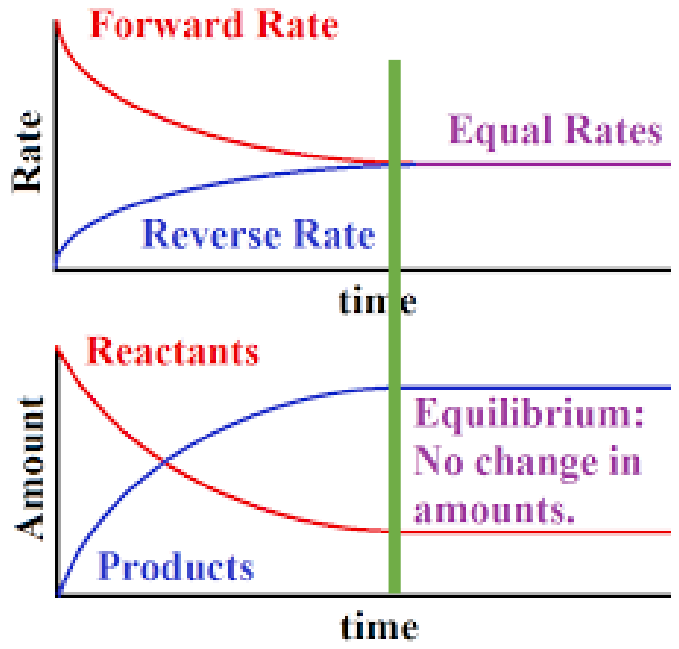
$$N_{2(g)} + O_{2(g)} \overset{\text{endothermic}}{\rightleftharpoons} 2NO_{(g)}$$

when

a) the concentration of a reactant is increased.
b) The pressure is increased
c) The temperature is increased

Round 3 – Equilibrium

1. Draw the symbol for a reversible reaction. ⇌
2. Define equilibrium. **Occurs in a closed system, where the rate of the forward reaction is equal to the rate of the reverse reaction**
3. Draw a line on each graph to show where equilibrium is established. **Point where conc stops changing**



4. (HT) Describe what happens to the equilibrium

$$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$$

endothermic

when

a) the concentration of a reactant is increased.

Eqm moves to right to oppose the change so amount of product increases

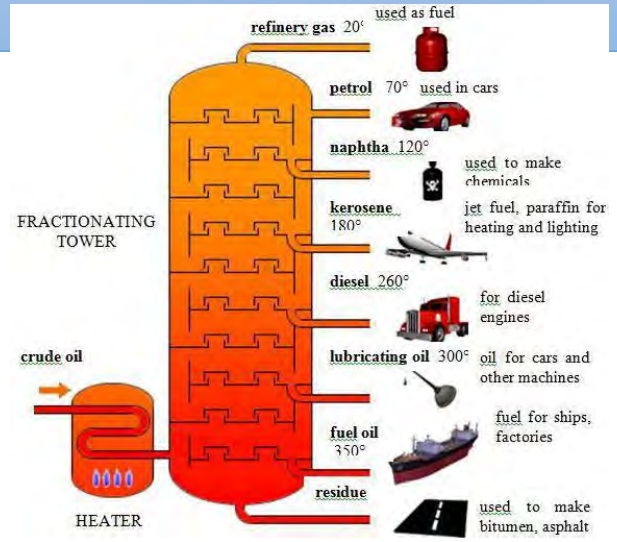
a) The pressure is increased

No change. There are equal number of gas particles on both sides.

a) The temperature is increased

Eqm moves in endothermic direction so amount of product increases

Round 4 – Fractional distillation and hydrocarbons



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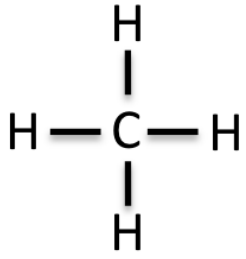

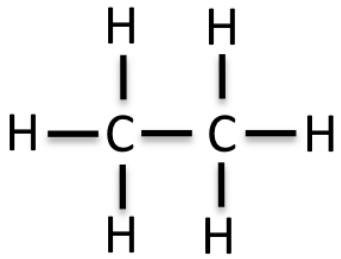

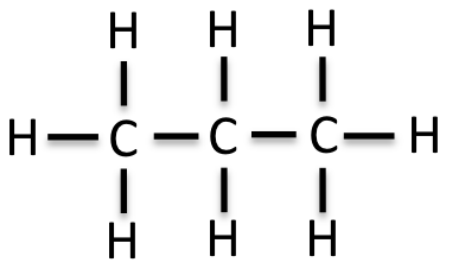

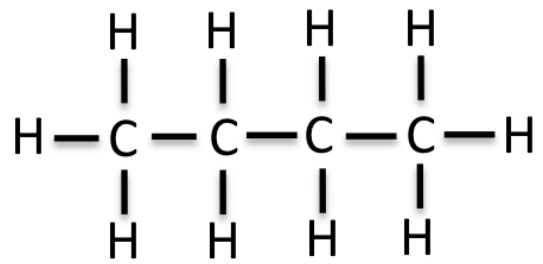

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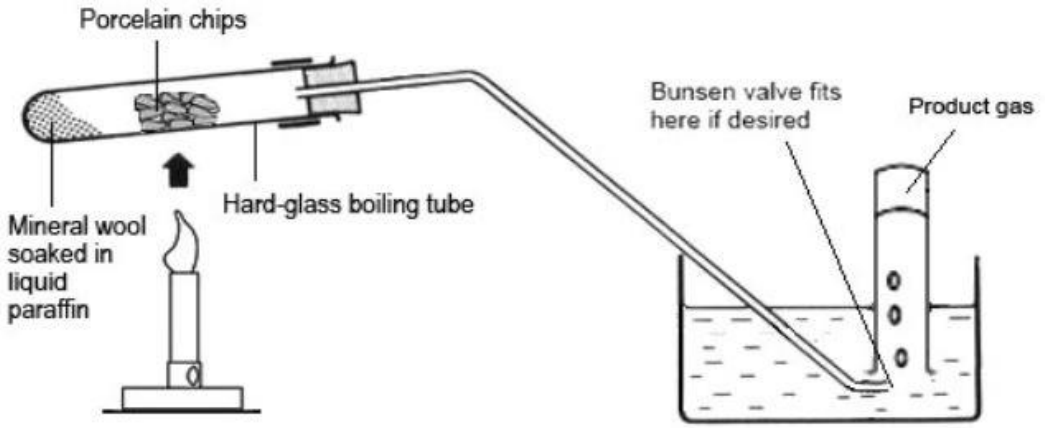

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Round 7 – Evolution of the atmosphere

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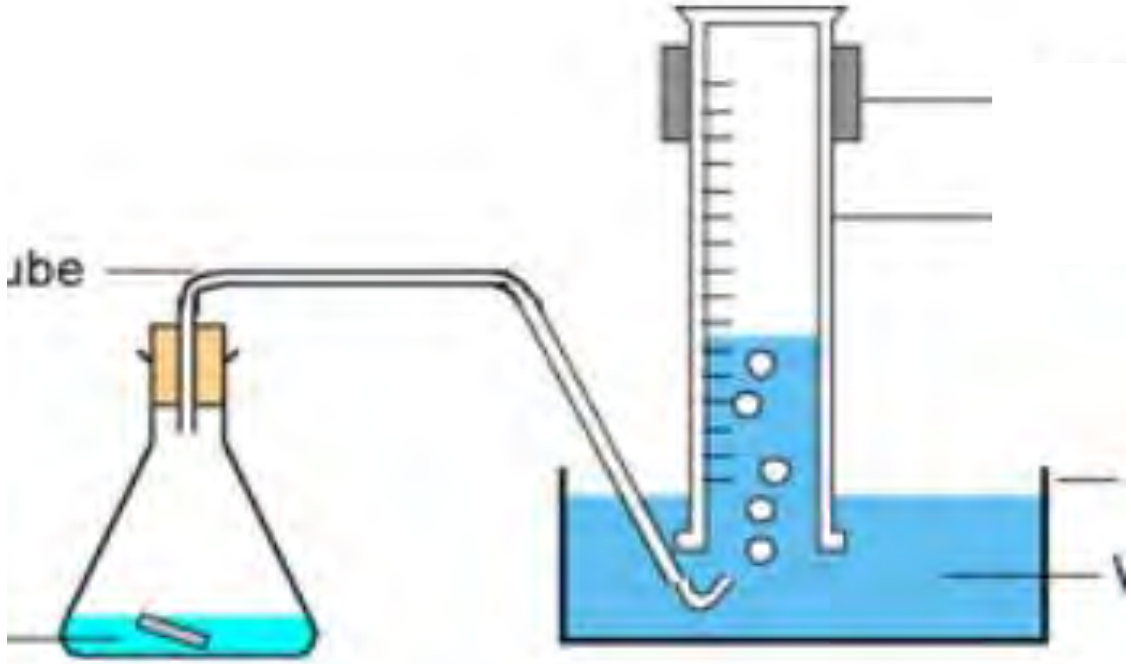
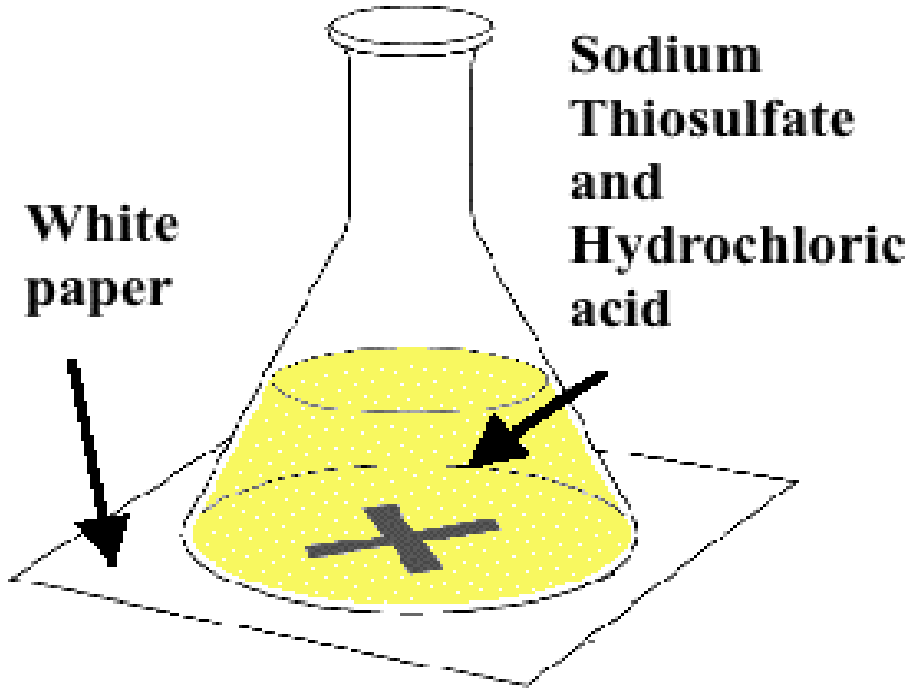
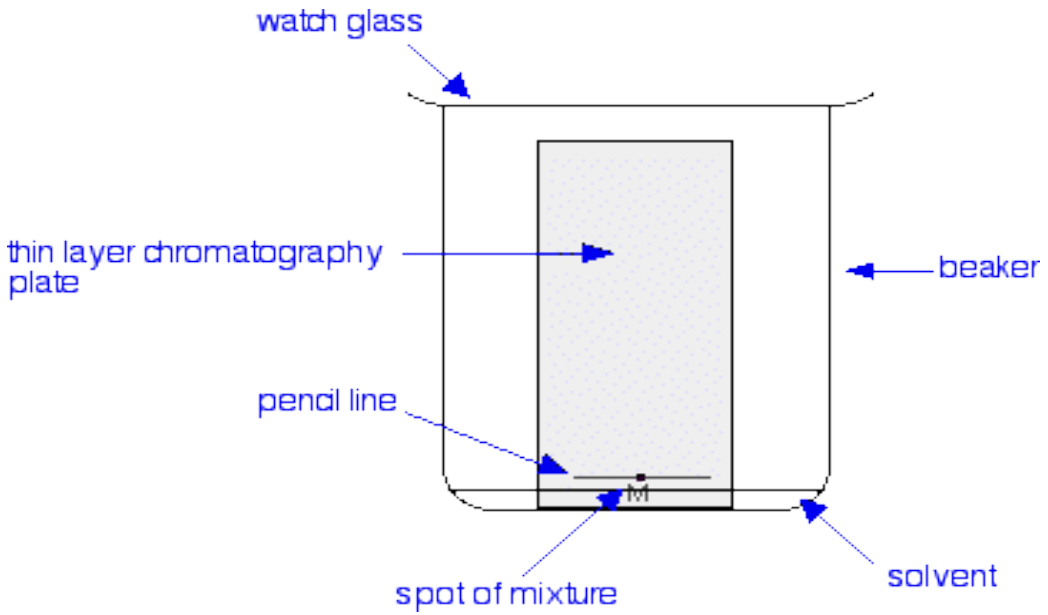
5. Lifecycle assessments assess the environmental impact of a product. Explain why they are open to bias. **(LCAs assess use of water, resources, energy and waste production. Not all of these can be easily quantified leading to misrepresentation)**

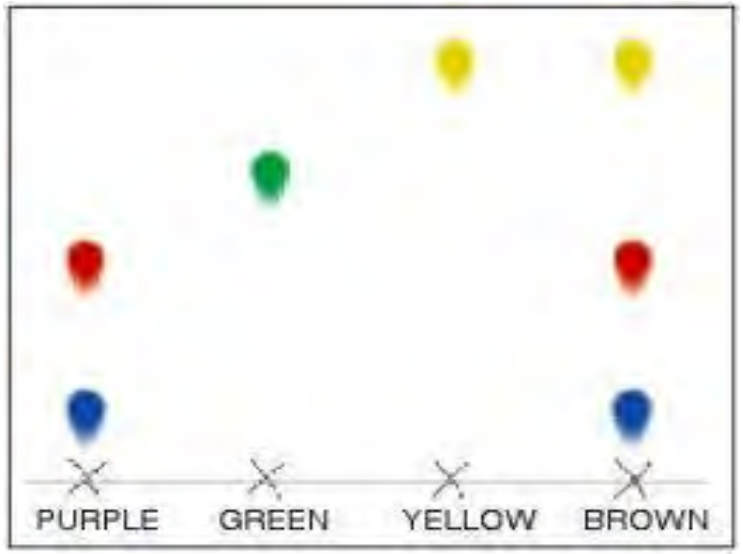
Required practical – rates of reaction





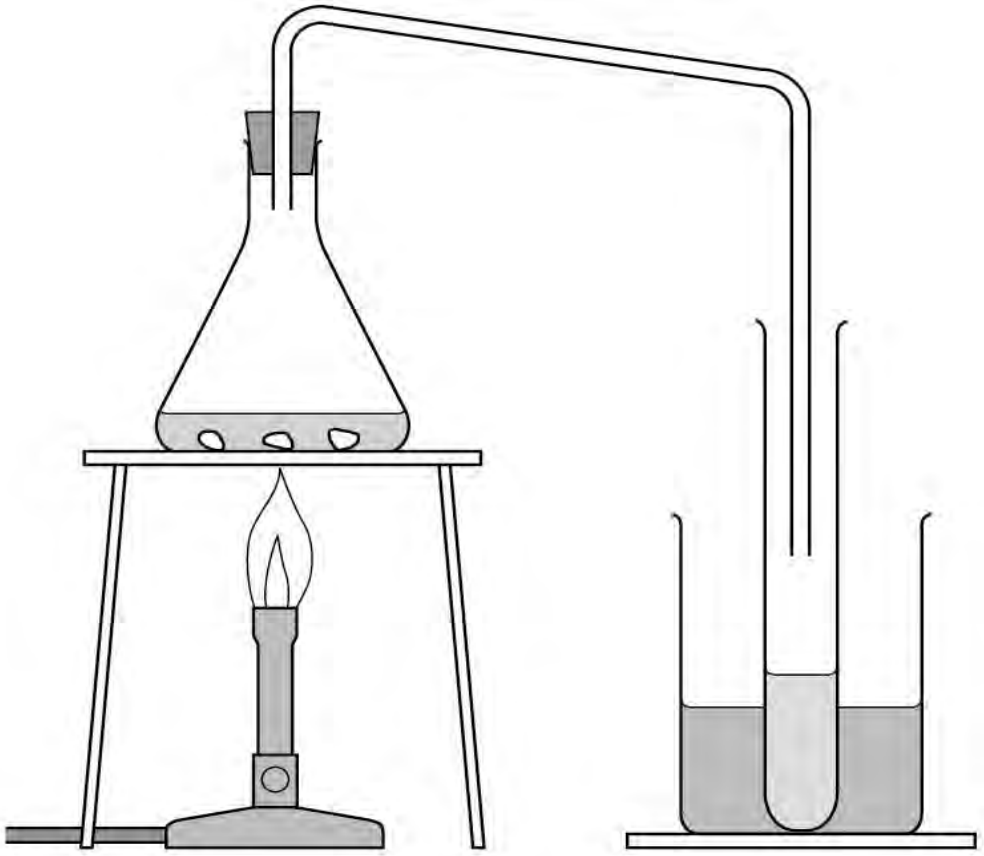
Required practical – chromatography

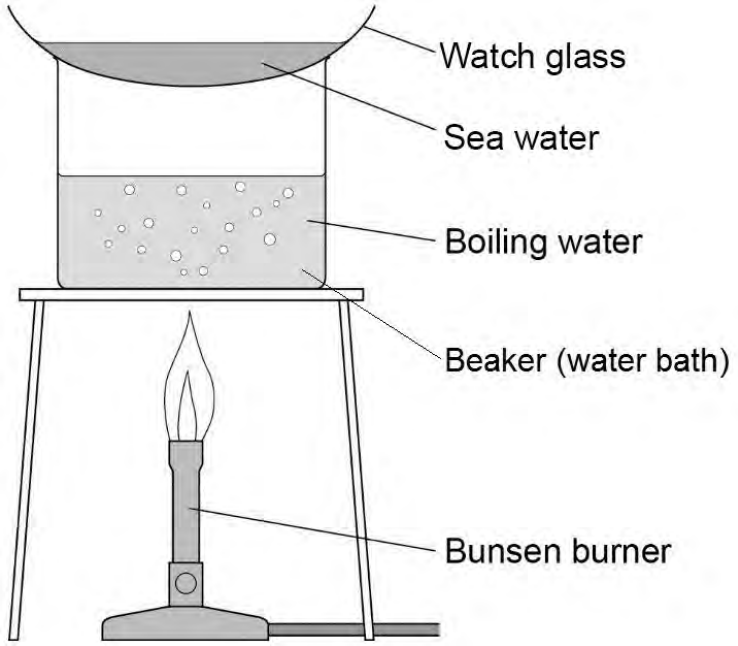




$$Rf = \frac{\text{distance travelled by spot}}{\text{distance travelled by solvent}}$$

Required practical – potable water





Gravitational Potential

The gravitational potential energy of an object i_____ when it moves up because w_____ is done on it to overcome the force of g_____.

Change in gravitational Potential (J) = mass (kg) x gravitational field strength (N/kg) x change in height (m)

Same thing can be written as:

Change in gravitational Potential (J) = Weight (N) x change in height (m)

e.g. Calculate the change in g.p when a student weighing 450N steps onto a box of height 0.8m.

Elastic potential energy

Elastic p_____ energy is the energy s_____ in an object when w____ is done on that object.

Elastic Potential Energy (J) = 0.5 x spring constant (k) x extension^2 $(m)^2$

Calculate elastic potential energy in a trampoline spring with a spring constant of 5000N/m that has stretched 12cm.

Energy & Work

When an object is moved by f_____, work is done is done.

Work done (J) = f_____ (N) x d_____ (m)

e.g. Calculate the work done when a force of 20N makes an object move 5m.

Work done to overcome f_____ is t_____ as energy to the t_____ energy stores of the objects that rub together and the s_____

P1 Conservation & Dissipation of Energy

Wasted energy is energy that is not u_____ and is t_____ by an undesired pathway. It is eventually transferred to the s_____ which become w_____. As energy d_____ it gets less and less u_____.

The law of conservation of energy states that energy cannot be c_____ or d_____

Efficiency of a device = $\frac{\text{useful output (J)}}{\text{total input (J)}}$

Why can the efficiency of a device never be 100%?

Calculate the power of a motor that transfers 10,000J in 30s.

Power (W) = $\frac{\text{energy (J)}}{\text{time (s)}}$

Name the energy stores:

- C_____
- E_____
- M_____
- E_____
- N_____
- T_____
- G_____
- K_____

Name the ways energy can be transferred:

- H_____
- E_____
- R_____
- M_____

Kinetic energy

The energy stored in a m_____ object depends on its m_____ and s_____.

Kinetic Energy (J) = 0.5 x mass (kg) x speed^2 $(m/s)^2$

Calculate the kinetic energy of a 1200kg mini cooper moving at 13m/s.

P1 Conservation & Dissipation of Energy

Gravitational Potential

The gravitational potential energy of an object increases when it moves up because work is done on it to overcome the force of gravity.

Change in gravitational Potential (J) = mass (kg) x gravitational field strength (N/kg) x change in height (m)

Same thing can be written as:

Change in gravitational Potential (J) = Weight (N) x change in height (m)

e.g. 450N x 0.8 = 360J

Elastic potential energy

Elastic potential energy is the energy stored in an object when work is done on that object.

Elastic Potential Energy (J) = spring constant (k) x extension^2 (m)^2

Calculate elastic potential energy in a trampoline spring with a spring constant of 5000N/m that has stretched 12cm.

$0.5 \times 5000 \times 0.12^2 = 36J$

Energy & Work

When an object is moved by force, work is done is done.

Work done (J) = force (N) x distance (m)

e.g. Calculate the work done when a force of 20N makes an object move 5m.

20 x 5 = 100J

Work done to overcome friction is transferred as energy to the thermal energy stores of the objects that rub together and the surroundings.

Name the energy stores:

- Chemical
- Electrostatic
- Magnetic
- Elastic potential
- Nuclear
- Thermal
- Gravitational potential
- Kinetic

Name the ways energy can

- Heating
- Electrically (moving charge)
- Radiation (light & sound)
- Mechanically (a force)

Wasted energy is energy that is not useful and is transferred by an undesired pathway. It is eventually transferred to the surroundings which become warmer. As energy dissipates it gets less and less useful.

The law of conservation of energy states that energy cannot be created or destroyed

Efficiency of a device = $\frac{\text{useful output (J)}}{\text{total input (J)}}$

Why can the efficiency of a device never be 100%?
Because some energy is always lost (dissipates) to the surroundings.

Calculate the power of a motor that transfers 10,000J in 30s.

Power (W) = $\frac{\text{energy (J)}}{\text{time (s)}}$ $\frac{10000}{30}$ 333.3W

Kinetic energy

The energy stored in a moving object depends on its mass and speed.

Kinetic Energy (J) = 0.5 x mass (kg) x speed^2 (m/s)^2

Calculate the kinetic energy of a 1200kg mini cooper moving at 13m/s.

101,400J

P2 Energy Transfer by Heating

The energy transferred per second through an insulating material depends on:

- T_____ d_____ across the material
- T_____ of material
- T_____ c_____ of the material.

The rate of energy transfer from a house can be reduced by:

-
-
-
-
-

Specific heat capacity

The specific heat capacity of a substance is the energy needed to raise the t_____ of _____kg by _____ °C.

Energy Transferred (J) = mass (kg) x specific heat capacity (J/kg/ °C) x temperature change (°C)

A pot is filled with 9kg of water at 10°C. Calculate how much heat energy would be needed to raise the temperature to 60°C. [specific heat capacity of water = 4200J/kg°C]

The greater the thermal conductivity of a material, the more e_____ per s_____ it transfers by c_____

Required Practical – insulating materials

Equipment:

- Various insulating materials
- 100ml measuring cylinder
- Kettle
- Thermometer
- Stopwatch
- 250ml Beaker

Method:

_____
_____
_____
_____
_____
_____
_____
_____

Dependent variable:
Independent variable:
Control variables:

-
-
-

P2 Energy Transfer by Heating

The energy transferred per second through an insulating material depends on:

- Temperature difference across the material
- Thickness of material
- Thermal conductivity of the material.

The rate of energy transfer from a house can be reduced by:

- Loft insulation
- Cavity wall insulation
- Foil between radiator & wall
- Double-glazed windows
- Thicker bricks on external walls

<u>Specific heat capacity</u>

The specific heat capacity of a substance is the energy needed to raise the temperature of 1kg by 1°C.

Energy Transferred (J) = mass (kg) x specific heat capacity (J/kg/ °C) x temperature change (°C)

A pot is filled with 9kg of water at 10°C. Calculate how much heat energy would be needed to raise the temperature to 60°C. [specific heat capacity of water = 4200J/kg°C]

9 x 4200 x 50 = 1,890,000J = 1,890kj

The greater the thermal conductivity of a material, the more energy per second it transfers by conduction.

Required Practical – insulating materials

Equipment:

- Various insulating materials
- 100ml measuring cylinder
- Kettle
- Thermometer
- Stopwatch
- 250ml Beaker

Method:

Use the measuring cylinder to measure out 100ml of hot water from the kettle. Pour this into the beaker which has one layer of insulating material wrapped around it. Record temperature. Time for 5 minutes. Re-record temperature. Repeat with different materials.

Dependent variable: temperature change
Independent variable: insulating material
Control variables:

- Time
- starting temperature of water
- Volume of water

In a power station:

Fuel heats w_____ → W_____ Turns to s_____ → S_____ Turns a t_____ → The t_____ turns a g_____

Non-renewable fuels are:

-
-
-
-

When f_____ f_____ are burnt they release c_____ d_____ which is a g_____ gas. This adds to g_____ warming and c_____ change. They also release s_____ dioxide which contributes to a_____ r_____

A biofuel is made from a l_____ thing. M_____ gas can be collected from manure, sewage or decaying rubbish and burned. Biofuels are r_____ because the biological material can regrow. They are also c_____ n_____ as the carbon the living thing takes in balances the amount that is released.

P3 Energy Resources

Energy source	How it works	Advantages	Disadvantages
Solar cells/ panels	Cells: transfer l_____ into e_____ energy. Panels: heat w_____ to supply a house or a generator.	Renewable. Cheap to run.	Unreliable. E_____ to buy. Lots are needed to generate enough power to be useful.
Geo-thermal	R_____ material in the E_____	Reliable Renewable	Limited where it can be used.
Nuclear	Nuclear power station uses p_____ and u_____. When the n_____ of these atoms split in two, e_____ is t_____ and it becomes hot.	No g_____ gases. Much more e_____ is transferred from each kg of fuel than f_____ fuel.	Creates r_____ waste. Safe in normal c_____, but an explosion could release radioactive waste. Expensive to d_____
Wind	Wind turns the blades which turns the g_____ on top of a narrow tower.	Renewable. No greenhouse gases.	U_____ Some people think they are u_____. Make n_____
Wave	Waves make a floating g_____ move up and down. A cable delivers e_____ to the shore.	Renewable. No greenhouse gases.	Need to withstand s_____. Lots of cables and buildings are needed, this can spoil areas of coastline. Can affect h_____.
Hydro-electric	R_____ water flows d_____ which drives a generator.	Renewable No greenhouse gases.	Need large a_____ which can f_____ habitats
T_____	Water is trapped behind a barrage at h_____ tide. This is then released through a generator.	Renewable No greenhouse gases.	Can affect river e_____ and h_____

In a power station:

Fuel heats water → water Turns to steams → steams Turns a turbine → The turbine turns a generator

A biofuel is made from a living thing. Methane gas can be collected from manure, sewage or decaying rubbish and burned. Biofuels are renewable because the biological material can regrow. They are also carbon neutral as the carbon the living thing takes in balances the amount that is released.

Non-renewable fuels are:

- Oil
- Gas
- Coal
- Nuclear

When fossil fuels are burnt they release carbon dioxide which is a greenhouse gas. This adds to global warming and climate change. They also release sulphur dioxide which contributes to acid rain.

P3 Energy Resources

Energy source	How it works	Advantages	Disadvantages
Solar cells/ panels	Cells: transfer light into electrical energy. Panels: heat water to supply a house or a generator.	Renewable. Cheap to run.	Unreliable. Expensive to buy. Lots are needed to generate enough power to be useful.
Geo-thermal	Radioactive material in the Earth	Reliable Renewable	Limited where it can be used.
Nuclear	Nuclear power station uses Plutonium and uranium. When the nucleus of these atoms split in two, energy is transferred and it becomes hot.	No greenhouse gases. Much more energy is transferred from each kg of fuel than fossil fuel.	Creates radioactive waste. Safe in normal conditions but an explosion could release radioactive waste. Expensive to decommission.
Wind	Wind turns the blades which turns the generator on top of a narrow tower.	Renewable. No greenhouse gases.	Unreliable. Some people think they are ugly. Make noise.
Wave	Waves make a floating generators move up and down. A cable delivers electricity to the shore.	Renewable. No greenhouse gases.	Need to withstand storms. Lots of cables and buildings are needed, this can spoil areas of coastline. Can affect habitats.
Hydro-electric	Reservoir water flows downhill which drives a generator.	Renewable No greenhouse gases.	Need large area which can flood habitats
Tidal	Water is trapped behind a barrage at high tide. This is then released through a generator.	Renewable No greenhouse gases.	Can affect river estuary and habitats.

P4 Electrical circuits

Current is the flow of c_____, which is caused by millions of e_____ passing through a component.

Complete the equations:

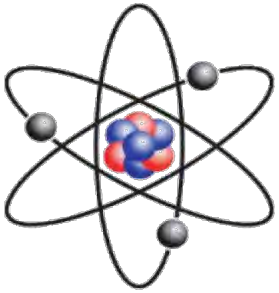
Charge flow, Q = _____,I x _____,t
(Coulombs, C) (amperes, A) (seconds, s)

Potential difference = _____,E (joules, j)
(Volts, V) ,Q (coulombs, c)

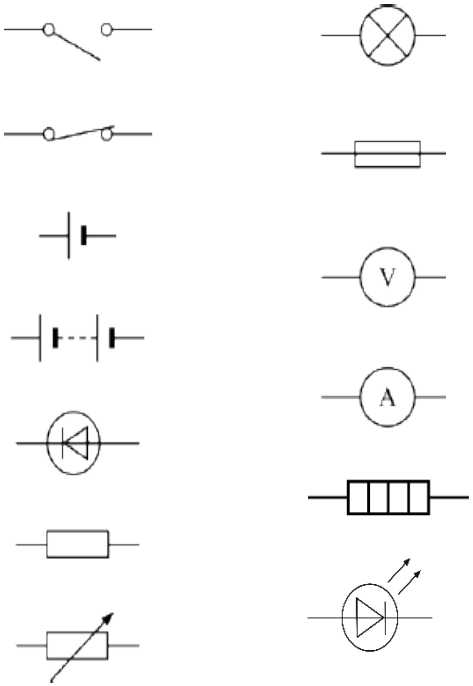
Resistance, R = _____, V (Volts, V)
(ohms, Ω) , I (amperes, A)

- In a s_____ circuit, the c_____ is the same through each component.
- In a s_____ circuit, the v____ of the power supply is s_____ between all component.
- The total resistance in a s_____ circuit is equal to the s_____ of the resistance of each c_____.

- The total current In a p_____ circuit, is e_____ to the sum of the current through each b_____.
- In a p_____ circuit, the v_____ across each component is the same.

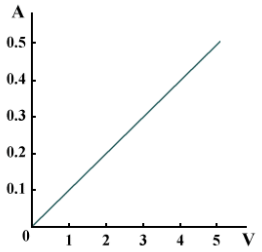


Name the electrical symbols:



- Ammeters are connected in _____.
- Voltmeters are connected in _____.
- As temperature increases in a lamp, resistance i_____.
- As temperature increases in a thermistor, the resistance d_____.

Current is d_____ p_____ to voltage. The gradient of the line shows r_____. The less steep the line, the g_____ the resistance..



P4 Electrical circuits

Current is the flow of charge, which is caused by millions of electrons passing through a component.

Complete the equations:

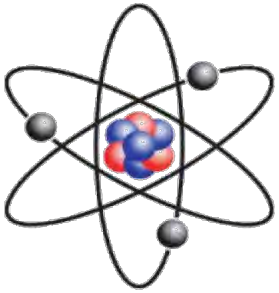
Charge flow, Q = _current ,I__ x __time___,t
(Coulombs, C) (amperes, A) (seconds, s)

Potential difference = _Energy transferred (joules, j)
(Volts, V) charge, Q (coulombs, c)

Resistance, R = ___potential difference, V (Volts, V)
(ohms, Ω) current, I (amperes, A)

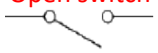
- In a series circuit, the current is the same through each component.
- In a series circuit, the voltage of the power supply is spread between all component.
- The total resistance in a series circuit is equal to the sum of the resistance of each component.

- The total current In a parallel circuit, is e_____ to the sum of the current through each b_____.
- In a parallel circuit, the v_____ across each component is the same.



Name the electrical symbols:

Open switch

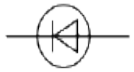


closed switch

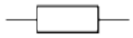
Cell

Battery

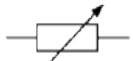
Diode



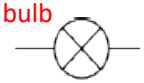
Fixed resistor



Variable resistor

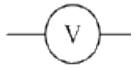


bulb



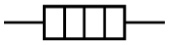
Fuse

Voltmeter

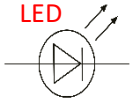


Ammeter

Heater

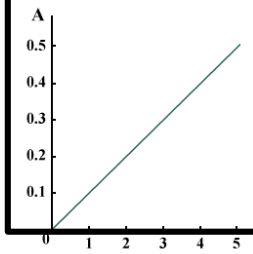


LED



- Ammeters are connected in series.
- Voltmeters are connected in parallel.
- As temperature increases in a lamp, resistance increases.
- As temperature increases in a thermistor, the resistance decreases.

Current is directly proportional to voltage. The gradient of the line shows resistance. The less steep the line, the greater the resistance..



P5 Electricity in the Home

Complete the equations:

Power, P = _____, E (joules, J)
(watts, W) time , t (seconds, s)

e.g. How much energy does a 40W light bulb transfer in 30 minutes?

Power, P = _____, I x _____, V
(watts, W) (amperes, A) (volts, V)

e.g. Calculate the power to a computer that has a current of 1.5A and 230V.

Charge flow, Q = _____, I x _____, t
(coulombs, C) (amperes, A) (seconds, s)

e.g. Calculate the charge flow in 40seconds when the current is 4A.

e.g. Calculate the current through a 600W, 230V hairdryer.

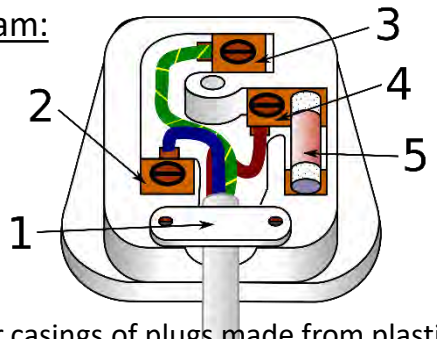
The correct fuse rating = watts/volts

e.g. Calculate which fuse (1A, 3A, 5A or 13A) you would use for the hairdryer above.

Give definitions:

- Direct current:
- Alternating current:
- Live wire:
- Neutral wire:
- The National Grid:
- Step-up transformers:
- Step-down transformers:
- Fuse:
- Short circuit:

Label the diagram:



Why are the outer casings of plugs made from plastic?

What does the longest pin in a plug connect to?

What metal are the pins made from? Why?

What metal are the wire made from? Why?

P5 Electricity in the Home

Complete the equations:

Power, P (watts, W) = energy transferred, E (joules, J) / time , t (seconds, s)

e.g. How much energy does a 40W light bulb transfer in 30 minutes? 40W x 1800S = 72,000J

Power, P (watts, W) = current, I (amperes, A) x potential difference, V (volts, V)

e.g. Calculate the power to a computer that has a current of 1.5A and 230V. 1.5 x 230 =

Charge flow, Q (coulombs, C) = current, I (amperes, A) x time, t (seconds, s)

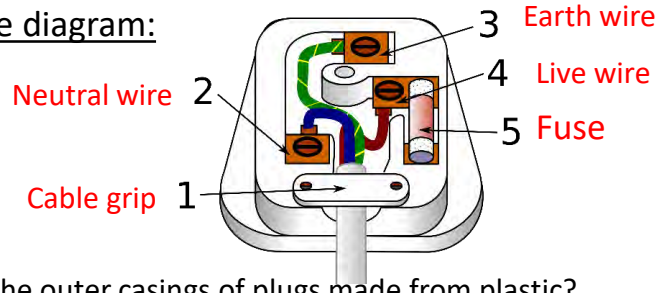
e.g. Calculate the charge flow in 40seconds when the current is 4A.
4x40 = 160C
e.g. Calculate the current through a 600W, 230V hairdryer.
600/230 = 2.6A
The correct fuse rating = watts/volts

e.g. Calculate which fuse (1A, 3A, 5A or 13A) you would use for the hairdryer above. 3A fuse because it would not melt with a 2.6A current. 5A would be too high.

Give definitions:

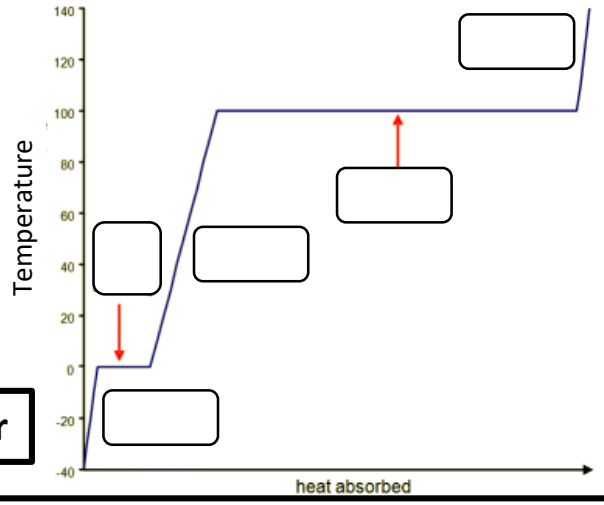
- Direct current: The current goes around the circuit in one direction only. E.g. in a torch.
- Alternating current: The current repeatedly reverses its direction. E.g. when you switch on a light at home.
- Live wire: This wire is dangerous as the voltage repeated switches from about -325V to +325V.
- Neutral wire: This wire is earthed at the local substation.
- The National Grid: A nationwide network of cables and transformers to get electricity to homes from power stations.
- Step-up transformers: Used at power stations to increase voltage in cables from 25,000V to 132,000V
- Step-down transformers: Used to supply electricity from the grid to consumers, it reduces the voltage.
- Fuse: A device between the live pin and live wire which melts with too much current to prevent damage.
- Short circuit: Where a live wire touches a neutral wire and a large current flows between them.

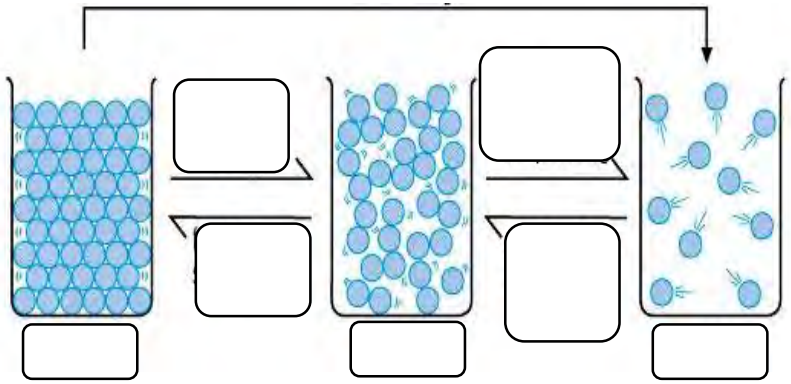
Label the diagram:



Why are the outer casings of plugs made from plastic?
Plastic is an electrical insulator to protect against the live wires inside.
What does the longest pin in a plug connect to? The earth wire so the metal case is earthed when plugged in.
What metal are the pins made from? Why? Brass, because it's a good conductor and doesn't rust. Copper isn't as hard as brass, although it is a better conductor.
What metal are the wire made from? Why? Copper, because it is a good electrical conductor and bends easily.

State	Flow?	Fixed shape?	Fixed volume?	Density	Particle energy	Particle movement	Forces between particles
Solid							
Liquid							
Gas							





P6 Molecules & Matter

- The freezing point of a substance is the same temperature as the_____point.
- The energy transferred to a substance as it changes state is called its _____ heat.
- The energy stored by particles in a substance is its _____ energy.
- This energy is sum of the k_____ energy of particles and their p_____energy.
- The specific latent heat of fusion is the energy needed to change ___kg of a substance from s_____ to l_____ at its m_____ p_____ (without a change in temperature)
- The specific latent heat of vaporisation of a substance is the energy needed to change ____kg from l_____ to v_____, at its b_____ p_____ (without a change in temperature)
- Specific latent heat = $\frac{\text{energy, J}}{\text{mass, kg}}$

Density of a substance is defined as its mass per unit volume.

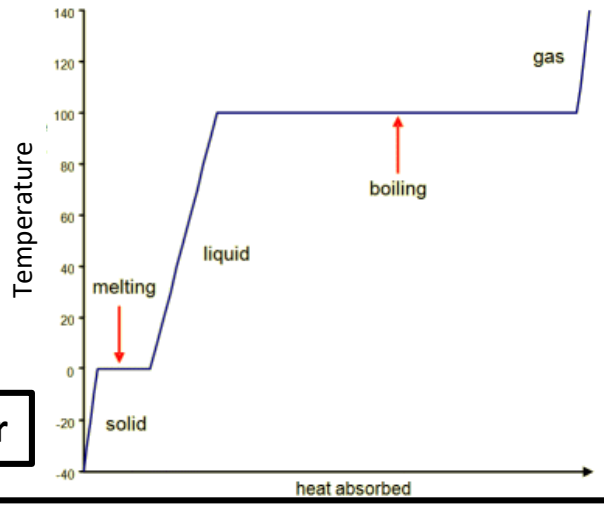
Density, $\rho = \frac{\text{mass, m (kilograms, kg)}}{\text{volume, V (metres}^2\text{, m}^2\text{)}}$

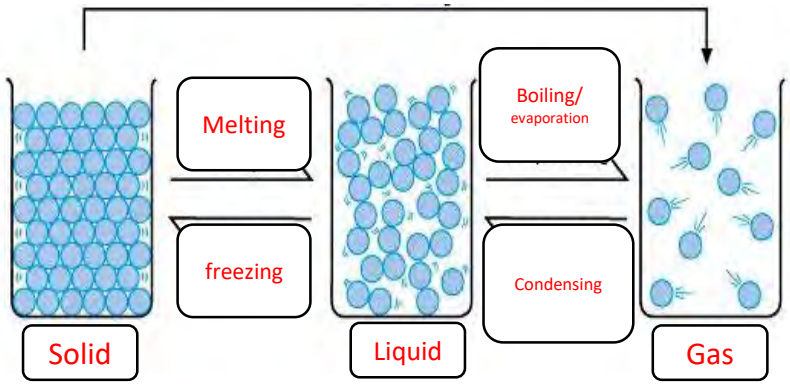
e.g. what is the density of a 20kg wooden post with a volume of $0.5m^2$?

1. What is gas pressure caused by?

2. What happens to gas pressure in a sealed container if temperature increases and why?

State	Flow?	Fixed shape?	Fixed volume?	Density	Particle energy	Particle movement	Forces between particles
Solid	No	Yes	Yes	High	Low	Vibrate	High
Liquid	Yes	No	Yes	Med	Med	Medium	Med
Gas	Yes	No	No	Low	High	Lots	Low





P6 Molecules & Matter

- The freezing point of a substance is the same temperature as the melting point.
- The energy transferred to a substance as it changes state is called its latent heat.
- The energy stored by particles in a substance is its internal energy.
- This energy is sum of the kinetic energy of particles and their potential energy.
- The specific latent heat of fusion is the energy needed to change 1kg of a substance from solid to liquid at its melting point (without a change in temperature)
- The specific latent heat of vaporisation of a substance is the energy needed to change 1kg from liquid to vapour, at its boiling point (without a change in temperature)
- Specific latent heat = $\frac{\text{energy, J}}{\text{mass, kg}}$

Density of a substance is defined as its mass per unit volume.

Density, $\rho = \frac{\text{mass, m (kilograms, kg)}}{\text{volume, V (metres}^2\text{, m}^2\text{)}}$

e.g. what is the density of a 20kg wooden post with a volume of $0.5m^2$? $20/0.5 = 40kg/m^3$

1. What is gas pressure caused by?

Random impacts of gas molecules on surfaces.

1. What happens to gas pressure in a sealed container if temperature increases and why? It increases as the molecules move faster so collide with more force, and there are more collisions per second.

Give definitions:

- Radioactive decay:
- Atomic number:
- Mass number:
- Isotope:
- Irradiated:
- Ionisation:
- Peer review:
- Count rate:
- Half-life:
- Becquerel (Bq):

Changes in the nucleus

What happens to the nucleus of an atom when it emits alpha radiation?

What happens to the nucleus of an atom when it emits beta radiation?

P7 Radioactivity

Radiation	Symbol	What is it stopped by?	What is made from?	Range in air
Alpha				
Beta				
Gamma				

Uses of radiation:

How do smoke alarms use radiation?

How is radiation used to control the thickness of metal foil?

Models of the atom

P____ p_____ model: Before 1914, scientists thought the a_____ was arranged with p_____ charged matter e_____ spread out and n_____ charged electrons buried inside.

Rutherford's model: There is a p_____ charged n_____ which makes up most of the m_____ of the atom.

Bohr's model: E_____ orbit the n_____ in specific distances and energy. E_____ move to a higher o_____ by a_____ radiation, or move to a l_____ orbit by e_____ radiation.

Give definitions:

- Radioactive decay: The random event of a radioactive atom emitting radiation.
- Atomic number: The number of protons n an atom.
- Mass number: The number of protons and neutrons in an atom.
- Isotope: A version of an element with a different number of neutrons.
- Irradiated: When an object has been exposed to ionising radiation.
- Ionisation: Atoms that have become charged by their electrons being knocked off by radiation.
- Peer review: Data is published and checked by other scientists.
- Count rate: The number of counts on a Geiger counter per second.
- Half-life: The average time taken for the count rate to fall by half for a particular isotope.
- Becquerel (Bq): Unit of activity, which is 1 decay/second.

Changes in the nucleus

What happens to the nucleus of an atom when it emits alpha radiation?
Atomic number goes down by 2, mass number goes down by 4.
What happens to the nucleus of an atom when it emits beta radiation?
Atomic number goes up by one, mass number is unchanged.

P7 Radioactivity

Radiation	Symbol	What is it stopped by?	What is made from?	Range in air
Alpha	α	Paper	2 protons & 2 neutrons	5cm
Beta	β	Aluminium sheet	Electron	1m
Gamma	γ	Thick lead sheet/concrete	Electromagnetic wave	unlimited

Models of the atom

Plum pudding model: Before 1914, scientists thought the atom was arranged with positively charged matter evenly spread out and negatively charged electrons buried inside.

Rutherford's model: There is a positively charged nucleus which makes up most of the mass of the atom.

Bohr's model: Electrons orbit the nucleus in specific distances and energy. Electrons move to a higher orbit by absorbing radiation, or move to a lower orbit by emitting radiation.

Uses of radiation:

How do smoke alarms use radiation? Alpha particles are emitted across a gap. This ionises the air so a current flows. When smoke absorbs the ions, the current stops and an alarm sounds.
How is radiation used to control the thickness of metal foil? Beta radiation is emitted through foil and detected the other side. If it stops, the foil is too thick and the rollers increase pressure and vice versa.

Gravitational Potential

The gravitational potential energy of an object i_____ when it moves up because w_____ is done on it to overcome the force of g_____.

Change in gravitational Potential (J) = mass (kg) x gravitational field strength (N/kg) x change in height (m)

Same thing can be written as:

Change in gravitational Potential (J) = Weight (N) x change in height (m)

e.g. Calculate the change in g.p when a student weighing 450N steps onto a box of height 0.8m.

Elastic potential energy

Elastic p_____ energy is the energy s_____ in an object when w____ is done on that object.

Elastic Potential Energy (J) = 0.5 x spring constant (k) x extension^2 $(m)^2$

Calculate elastic potential energy in a trampoline spring with a spring constant of 5000N/m that has stretched 12cm.

Energy & Work

When an object is moved by f_____, work is done is done.

Work done (J) = f_____ (N) x d_____ (m)

e.g. Calculate the work done when a force of 20N makes an object move 5m.

Work done to overcome f_____ is t_____ as energy to the t_____ energy stores of the objects that rub together and the s_____

P1 Conservation & Dissipation of Energy

Wasted energy is energy that is not u_____ and is t_____ by an undesired pathway. It is eventually transferred to the s_____ which become w_____. As energy d_____ it gets less and less u_____.

The law of conservation of energy states that energy cannot be c_____ or d_____

Efficiency of a device = $\frac{\text{useful output (J)}}{\text{total input (J)}}$

Why can the efficiency of a device never be 100%?

Calculate the power of a motor that transfers 10,000J in 30s.

Power (W) = $\frac{\text{energy (J)}}{\text{time (s)}}$

Name the energy stores:

- C_____
- E_____
- M_____
- E_____
- N_____
- T_____
- G_____
- K_____

Name the ways energy can be transferred:

- H_____
- E_____
- R_____
- M_____

Kinetic energy

The energy stored in a m_____ object depends on its m_____ and s_____.

Kinetic Energy (J) = 0.5 x mass (kg) x speed^2 $(m/s)^2$

Calculate the kinetic energy of a 1200kg mini cooper moving at 13m/s.

P1 Conservation & Dissipation of Energy

Gravitational Potential

The gravitational potential energy of an object increases when it moves up because work is done on it to overcome the force of gravity.

Change in gravitational Potential (J) = mass (kg) x gravitational field strength (N/kg) x change in height (m)

Same thing can be written as:

Change in gravitational Potential (J) = Weight (N) x change in height (m)

e.g. 450N x 0.8 = 360J

Elastic potential energy

Elastic potential energy is the energy stored in an object when work is done on that object.

Elastic Potential Energy (J) = spring constant (k) x extension^2 (m)^2

Calculate elastic potential energy in a trampoline spring with a spring constant of 5000N/m that has stretched 12cm.

$0.5 \times 5000 \times 0.12^2 = 36J$

Energy & Work

When an object is moved by force, work is done is done.

Work done (J) = force (N) x distance (m)

e.g. Calculate the work done when a force of 20N makes an object move 5m.

20 x 5 = 100J

Work done to overcome friction is transferred as energy to the thermal energy stores of the objects that rub together and the surroundings.

Name the energy stores:

- Chemical
- Electrostatic
- Magnetic
- Elastic potential
- Nuclear
- Thermal
- Gravitational potential
- Kinetic

Name the ways energy can

- Heating
- Electrically (moving charge)
- Radiation (light & sound)
- Mechanically (a force)

Wasted energy is energy that is not useful and is transferred by an undesired pathway. It is eventually transferred to the surroundings which become warmer. As energy dissipates it gets less and less useful.

The law of conservation of energy states that energy cannot be created or destroyed

Efficiency of a device = $\frac{\text{useful output (J)}}{\text{total input (J)}}$

Why can the efficiency of a device never be 100%?
Because some energy is always lost (dissipates) to the surroundings.

Calculate the power of a motor that transfers 10,000J in 30s.

Power (W) = $\frac{\text{energy (J)}}{\text{time (s)}}$ $\frac{10000}{30}$ 333.3W

Kinetic energy

The energy stored in a moving object depends on its mass and speed.

Kinetic Energy (J) = 0.5 x mass (kg) x speed^2 (m/s)^2

Calculate the kinetic energy of a 1200kg mini cooper moving at 13m/s.

101,400J

P2 Energy Transfer by Heating

The energy transferred per second through an insulating material depends on:

- T_____ d_____ across the material
- T_____ of material
- T_____ c_____ of the material.

The rate of energy transfer from a house can be reduced by:

-
-
-
-
-

Specific heat capacity

The specific heat capacity of a substance is the energy needed to raise the t_____ of _____kg by _____ °C.

Energy Transferred (J) = mass (kg) x specific heat capacity (J/kg/ °C) x temperature change (°C)

A pot is filled with 9kg of water at 10°C. Calculate how much heat energy would be needed to raise the temperature to 60°C. [specific heat capacity of water = 4200J/kg°C]

The greater the thermal conductivity of a material, the more e_____ per s_____ it transfers by c_____

Required Practical – insulating materials

Equipment:

- Various insulating materials
- 100ml measuring cylinder
- Kettle
- Thermometer
- Stopwatch
- 250ml Beaker

Method:

_____
_____
_____
_____
_____
_____
_____
_____

Dependent variable:
Independent variable:
Control variables:

-
-
-

P2 Energy Transfer by Heating

The energy transferred per second through an insulating material depends on:

- Temperature difference across the material
- Thickness of material
- Thermal conductivity of the material.

The rate of energy transfer from a house can be reduced by:

- Loft insulation
- Cavity wall insulation
- Foil between radiator & wall
- Double-glazed windows
- Thicker bricks on external walls

<u>Specific heat capacity</u>

The specific heat capacity of a substance is the energy needed to raise the temperature of 1kg by 1°C.

Energy Transferred (J) = mass (kg) x specific heat capacity (J/kg/ °C) x temperature change (°C)

A pot is filled with 9kg of water at 10°C. Calculate how much heat energy would be needed to raise the temperature to 60°C. [specific heat capacity of water = 4200J/kg°C]

9 x 4200 x 50 = 1,890,000J = 1,890kj

The greater the thermal conductivity of a material, the more energy per second it transfers by conduction.

Required Practical – insulating materials

Equipment:

- Various insulating materials
- 100ml measuring cylinder
- Kettle
- Thermometer
- Stopwatch
- 250ml Beaker

Method:

Use the measuring cylinder to measure out 100ml of hot water from the kettle. Pour this into the beaker which has one layer of insulating material wrapped around it. Record temperature. Time for 5 minutes. Re-record temperature. Repeat with different materials.

Dependent variable: temperature change
Independent variable: insulating material
Control variables:

- Time
- starting temperature of water
- Volume of water

In a power station:

Fuel heats w_____ → W_____ Turns to s_____ → S_____ Turns a t_____ → The t_____ turns a g_____

Non-renewable fuels are:

-
-
-
-

When f_____ f_____ are burnt they release c_____ d_____ which is a g_____ gas. This adds to g_____ warming and c_____ change. They also release s_____ dioxide which contributes to a_____ r_____

A biofuel is made from a l_____ thing. M_____ gas can be collected from manure, sewage or decaying rubbish and burned. Biofuels are r_____ because the biological material can regrow. They are also c_____ n_____ as the carbon the living thing takes in balances the amount that is released.

P3 Energy Resources

Energy source	How it works	Advantages	Disadvantages
Solar cells/ panels	Cells: transfer l_____ into e_____ energy. Panels: heat w_____ to supply a house or a generator.	Renewable. Cheap to run.	Unreliable. E_____ to buy. Lots are needed to generate enough power to be useful.
Geo-thermal	R_____ material in the E_____	Reliable Renewable	Limited where it can be used.
Nuclear	Nuclear power station uses p_____ and u_____. When the n_____ of these atoms split in two, e_____ is t_____ and it becomes hot.	No g_____ gases. Much more e_____ is transferred from each kg of fuel than f_____ fuel.	Creates r_____ waste. Safe in normal c_____, but an explosion could release radioactive waste. Expensive to d_____
Wind	Wind turns the blades which turns the g_____ on top of a narrow tower.	Renewable. No greenhouse gases.	U_____ Some people think they are u_____. Make n_____
Wave	Waves make a floating g_____ move up and down. A cable delivers e_____ to the shore.	Renewable. No greenhouse gases.	Need to withstand s_____. Lots of cables and buildings are needed, this can spoil areas of coastline. Can affect h_____.
Hydro-electric	R_____ water flows d_____ which drives a generator.	Renewable No greenhouse gases.	Need large a_____ which can f_____ habitats
T_____	Water is trapped behind a barrage at h_____ tide. This is then released through a generator.	Renewable No greenhouse gases.	Can affect river e_____ and h_____

In a power station:

Fuel heats water → water Turns to steams → steams Turns a turbine → The turbine turns a generator

A biofuel is made from a living thing. Methane gas can be collected from manure, sewage or decaying rubbish and burned. Biofuels are renewable because the biological material can regrow. They are also carbon neutral as the carbon the living thing takes in balances the amount that is released.

Non-renewable fuels are:

- Oil
- Gas
- Coal
- Nuclear

When fossil fuels are burnt they release carbon dioxide which is a greenhouse gas. This adds to global warming and climate change. They also release sulphur dioxide which contributes to acid rain.

P3 Energy Resources

Energy source	How it works	Advantages	Disadvantages
Solar cells/ panels	Cells: transfer light into electrical energy. Panels: heat water to supply a house or a generator.	Renewable. Cheap to run.	Unreliable. Expensive to buy. Lots are needed to generate enough power to be useful.
Geo-thermal	Radioactive material in the Earth	Reliable Renewable	Limited where it can be used.
Nuclear	Nuclear power station uses Plutonium and uranium. When the nucleus of these atoms split in two, energy is transferred and it becomes hot.	No greenhouse gases. Much more energy is transferred from each kg of fuel than fossil fuel.	Creates radioactive waste. Safe in normal conditions but an explosion could release radioactive waste. Expensive to decommission.
Wind	Wind turns the blades which turns the generator on top of a narrow tower.	Renewable. No greenhouse gases.	Unreliable. Some people think they are ugly. Make noise.
Wave	Waves make a floating generators move up and down. A cable delivers electricity to the shore.	Renewable. No greenhouse gases.	Need to withstand storms. Lots of cables and buildings are needed, this can spoil areas of coastline. Can affect habitats.
Hydro-electric	Reservoir water flows downhill which drives a generator.	Renewable No greenhouse gases.	Need large area which can flood habitats
Tidal	Water is trapped behind a barrage at high tide. This is then released through a generator.	Renewable No greenhouse gases.	Can affect river estuary and habitats.

P4 Electrical circuits

Current is the flow of c_____, which is caused by millions of e_____ passing through a component.

Complete the equations:

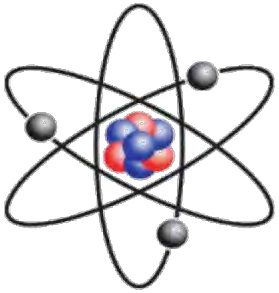
Charge flow, Q = _____,I x _____,t
(Coulombs, C) (amperes, A) (seconds, s)

Potential difference = _____,E (joules, j)
(Volts, V) ,Q (coulombs, c)

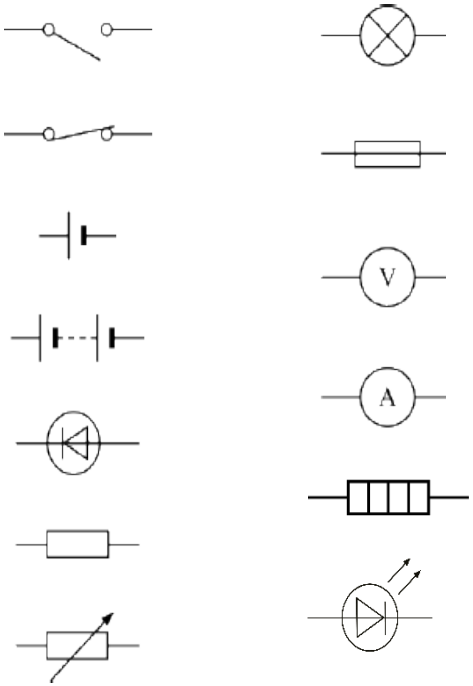
Resistance, R = _____, V (Volts, V)
(ohms, Ω) , I (amperes, A)

- In a s_____ circuit, the c_____ is the same through each component.
- In a s_____ circuit, the v____ of the power supply is s_____ between all component.
- The total resistance in a s_____ circuit is equal to the s_____ of the resistance of each c_____.

- The total current In a p_____ circuit, is e_____ to the sum of the current through each b_____.
- In a p_____ circuit, the v_____ across each component is the same.

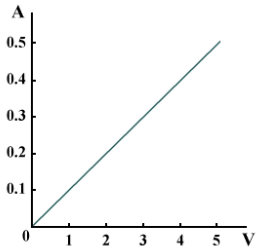


Name the electrical symbols:



- Ammeters are connected in _____.
- Voltmeters are connected in _____.
- As temperature increases in a lamp, resistance i_____.
- As temperature increases in a thermistor, the resistance d_____.

Current is d_____ p_____ to voltage. The gradient of the line shows r_____. The less steep the line, the g_____ the resistance..



P4 Electrical circuits

Current is the flow of charge, which is caused by millions of electrons passing through a component.

Complete the equations:

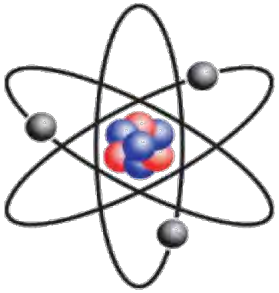
Charge flow, Q = _current ,I__ x __time___,t
(Coulombs, C) (amperes, A) (seconds, s)

Potential difference = _Energy transferred (joules, j)
(Volts, V) charge, Q (coulombs, c)

Resistance, R = ___potential difference, V (Volts, V)
(ohms, Ω) current, I (amperes, A)

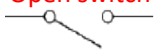
- In a series circuit, the current is the same through each component.
- In a series circuit, the voltage of the power supply is spread between all component.
- The total resistance in a series circuit is equal to the sum of the resistance of each component.

- The total current In a parallel circuit, is e_____ to the sum of the current through each b_____.
- In a parallel circuit, the v_____ across each component is the same.



Name the electrical symbols:

Open switch

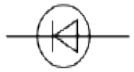


closed switch

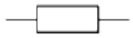
Cell

Battery

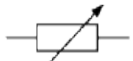
Diode



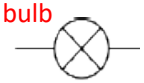
Fixed resistor



Variable resistor

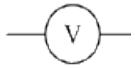


bulb



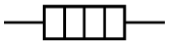
Fuse

Voltmeter

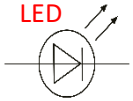


Ammeter

Heater

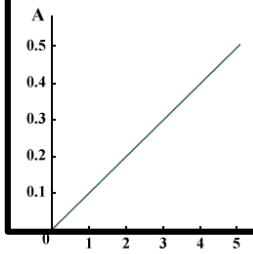


LED



- Ammeters are connected in series.
- Voltmeters are connected in parallel.
- As temperature increases in a lamp, resistance increases.
- As temperature increases in a thermistor, the resistance decreases.

Current is directly proportional to voltage. The gradient of the line shows resistance. The less steep the line, the greater the resistance..



P5 Electricity in the Home

Complete the equations:

Power, P = _____, E (joules, J)
(watts, W) time , t (seconds, s)

e.g. How much energy does a 40W light bulb transfer in 30 minutes?

Power, P = _____, I x _____, V
(watts, W) (amperes, A) (volts, V)

e.g. Calculate the power to a computer that has a current of 1.5A and 230V.

Charge flow, Q = _____, I x _____, t
(coulombs, C) (amperes, A) (seconds, s)

e.g. Calculate the charge flow in 40seconds when the current is 4A.

e.g. Calculate the current through a 600W, 230V hairdryer.

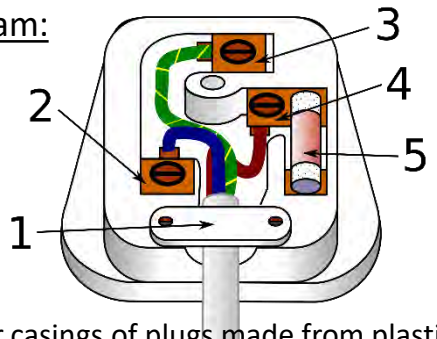
The correct fuse rating = watts/volts

e.g. Calculate which fuse (1A, 3A, 5A or 13A) you would use for the hairdryer above.

Give definitions:

- Direct current:
- Alternating current:
- Live wire:
- Neutral wire:
- The National Grid:
- Step-up transformers:
- Step-down transformers:
- Fuse:
- Short circuit:

Label the diagram:



Why are the outer casings of plugs made from plastic?

What does the longest pin in a plug connect to?

What metal are the pins made from? Why?

What metal are the wire made from? Why?

P5 Electricity in the Home

Complete the equations:

Power, P (watts, W) = energy transferred, E (joules, J) / time , t (seconds, s)

e.g. How much energy does a 40W light bulb transfer in 30 minutes? 40W x 1800S = 72,000J

Power, P (watts, W) = current, I (amperes, A) x potential difference, V (volts, V)

e.g. Calculate the power to a computer that has a current of 1.5A and 230V. 1.5 x 230 =

Charge flow, Q (coulombs, C) = current, I (amperes, A) x time, t (seconds, s)

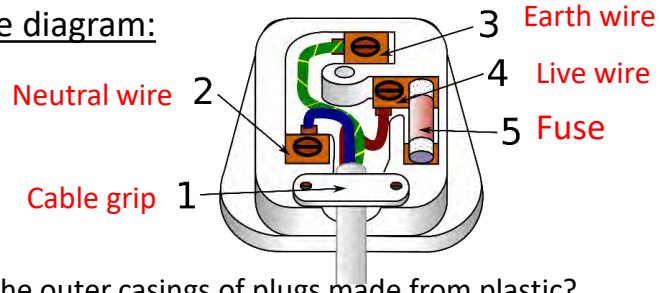
e.g. Calculate the charge flow in 40seconds when the current is 4A.
4x40 = 160C
e.g. Calculate the current through a 600W, 230V hairdryer.
600/230 = 2.6A
The correct fuse rating = watts/volts

e.g. Calculate which fuse (1A, 3A, 5A or 13A) you would use for the hairdryer above. 3A fuse because it would not melt with a 2.6A current. 5A would be too high.

Give definitions:

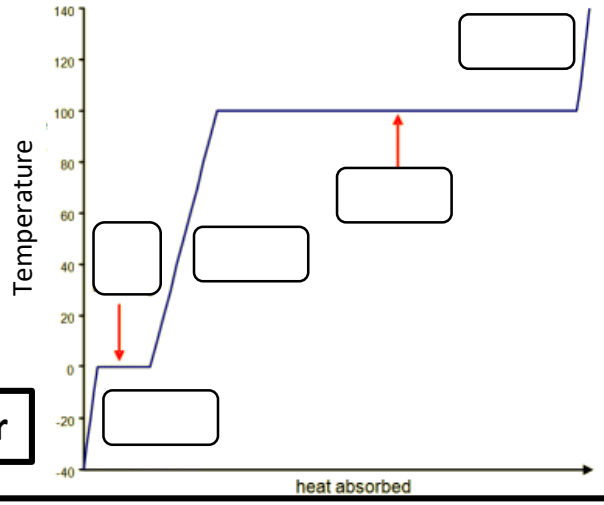
- Direct current: The current goes around the circuit in one direction only. E.g. in a torch.
- Alternating current: The current repeatedly reverses its direction. E.g. when you switch on a light at home.
- Live wire: This wire is dangerous as the voltage repeated switches from about -325V to +325V.
- Neutral wire: This wire is earthed at the local substation.
- The National Grid: A nationwide network of cables and transformers to get electricity to homes from power stations.
- Step-up transformers: Used at power stations to increase voltage in cables from 25,000V to 132,000V
- Step-down transformers: Used to supply electricity from the grid to consumers, it reduces the voltage.
- Fuse: A device between the live pin and live wire which melts with too much current to prevent damage.
- Short circuit: Where a live wire touches a neutral wire and a large current flows between them.

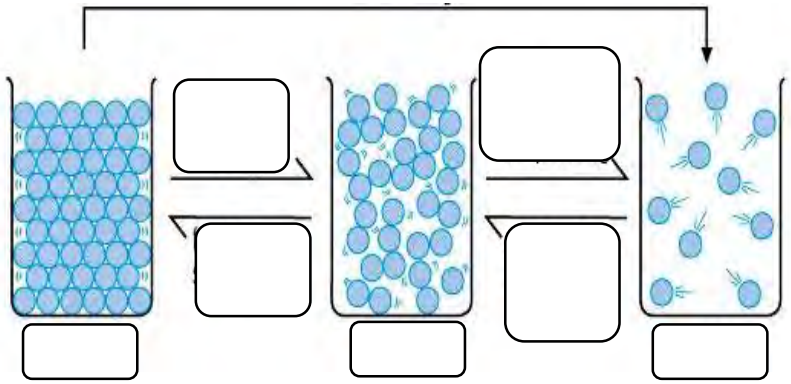
Label the diagram:



Why are the outer casings of plugs made from plastic?
Plastic is an electrical insulator to protect against the live wires inside.
What does the longest pin in a plug connect to? The earth wire so the metal case is earthed when plugged in.
What metal are the pins made from? Why? Brass, because it's a good conductor and doesn't rust. Copper isn't as hard as brass, although it is a better conductor.
What metal are the wire made from? Why? Copper, because it is a good electrical conductor and bends easily.

State	Flow?	Fixed shape?	Fixed volume?	Density	Particle energy	Particle movement	Forces between particles
Solid							
Liquid							
Gas							





P6 Molecules & Matter

- The freezing point of a substance is the same temperature as the_____point.
- The energy transferred to a substance as it changes state is called its _____ heat.
- The energy stored by particles in a substance is its _____ energy.
- This energy is sum of the k_____ energy of particles and their p_____energy.
- The specific latent heat of fusion is the energy needed to change ___kg of a substance from s_____ to l_____ at its m_____ p_____ (without a change in temperature)
- The specific latent heat of vaporisation of a substance is the energy needed to change ____kg from l_____ to v_____, at its b_____ p_____ (without a change in temperature)
- Specific latent heat = $\frac{\text{energy, J}}{\text{mass, kg}}$

Density of a substance is defined as its mass per unit volume.

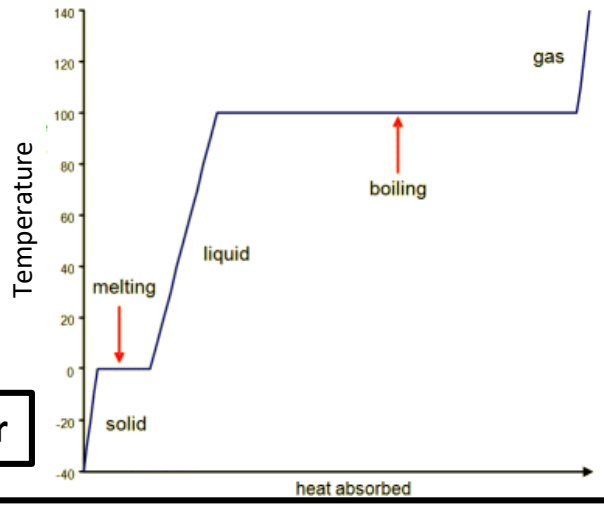
Density, $\rho = \frac{\text{mass, m (kilograms, kg)}}{\text{volume, V (metres}^2\text{, m}^2\text{)}}$

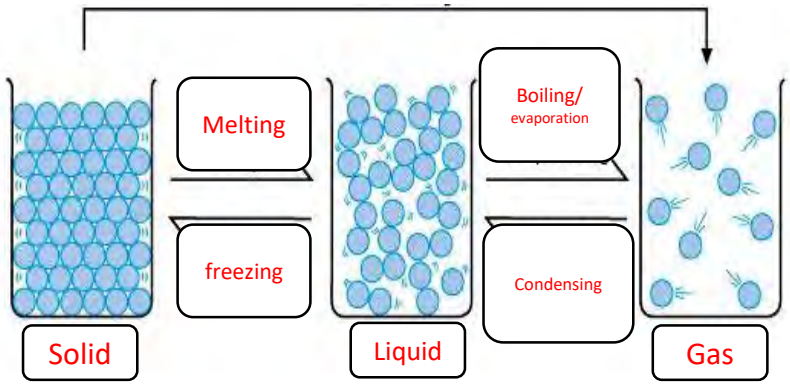
e.g. what is the density of a 20kg wooden post with a volume of $0.5m^2$?

1. What is gas pressure caused by?

2. What happens to gas pressure in a sealed container if temperature increases and why?

State	Flow?	Fixed shape?	Fixed volume?	Density	Particle energy	Particle movement	Forces between particles
Solid	No	Yes	Yes	High	Low	Vibrate	High
Liquid	Yes	No	Yes	Med	Med	Medium	Med
Gas	Yes	No	No	Low	High	Lots	Low





P6 Molecules & Matter

- The freezing point of a substance is the same temperature as the melting point.
- The energy transferred to a substance as it changes state is called its latent heat.
- The energy stored by particles in a substance is its internal energy.
- This energy is sum of the kinetic energy of particles and their potential energy.
- The specific latent heat of fusion is the energy needed to change 1kg of a substance from solid to liquid at its melting point (without a change in temperature)
- The specific latent heat of vaporisation of a substance is the energy needed to change 1kg from liquid to vapour, at its boiling point (without a change in temperature)
- Specific latent heat = $\frac{\text{energy, J}}{\text{mass, kg}}$

Density of a substance is defined as its mass per unit volume.

Density, $\rho = \frac{\text{mass, m (kilograms, kg)}}{\text{volume, V (metres}^2\text{, m}^2\text{)}}$

e.g. what is the density of a 20kg wooden post with a volume of $0.5m^2$? $20/0.5 = 40kg/m^3$

1. What is gas pressure caused by?

Random impacts of gas molecules on surfaces.

1. What happens to gas pressure in a sealed container if temperature increases and why? It increases as the molecules move faster so collide with more force, and there are more collisions per second.

Give definitions:

- Radioactive decay:
- Atomic number:
- Mass number:
- Isotope:
- Irradiated:
- Ionisation:
- Peer review:
- Count rate:
- Half-life:
- Becquerel (Bq):

Changes in the nucleus

What happens to the nucleus of an atom when it emits alpha radiation?

What happens to the nucleus of an atom when it emits beta radiation?

P7 Radioactivity

Higher:

An isotope has a half-life of 6 years. A sample has 60,000 radioactive nuclei. Calculate the number of radioactive nuclei remaining after 24 hours.

Radiation	Symbol	What is it stopped by?	What is made from?	Range in air
Alpha				
Beta				
Gamma				

Uses of radiation:

How do smoke alarms use radiation?

How is radiation used to control the thickness of metal foil?

Models of the atom

P____ p_____ model: Before 1914, scientists thought the a_____ was arranged with p_____ charged matter e_____ spread out and n_____ charged electrons buried inside.

Rutherford's model: There is a p_____ charged n_____ which makes up most of the m_____ of the atom.

Bohr's model: E_____ orbit the n_____ in specific distances and energy. E_____ move to a higher o_____ by a_____ radiation, or move to a l_____ orbit by e_____ radiation.

Give definitions:

- Radioactive decay: The random event of a radioactive atom emitting radiation.
- Atomic number: The number of protons n an atom.
- Mass number: The number of protons and neutrons in an atom.
- Isotope: A version of an element with a different number of neutrons.
- Irradiated: When an object has been exposed to ionising radiation.
- Ionisation: Atoms that have become charged by their electrons being knocked off by radiation.
- Peer review: Data is published and checked by other scientists.
- Count rate: The number of counts on a Geiger counter per second.
- Half-life: The average time taken for the count rate to fall by half for a particular isotope.
- Becquerel (Bq): Unit of activity, which is 1 decay/second.

Changes in the nucleus

What happens to the nucleus of an atom when it emits alpha radiation?
Atomic number goes down by 2, mass number goes down by 4.
What happens to the nucleus of an atom when it emits beta radiation?
Atomic number goes up by one, mass number is unchanged.

P7 Radioactivity

Higher:

An isotope has a half-life of 6 years. A sample has 60,000 radioactive nuclei. Calculate the number of radioactive nuclei remaining after 24 hours.

$60{,}000/2^4$

$= 60{,}000/16$

$= 3750$

Radiation	Symbol	What is it stopped by?	What is made from?	Range in air
Alpha	α	Paper	2 protons & 2 neutrons	5cm
Beta	β	Aluminium sheet	Electron	1m
Gamma	γ	Thick lead sheet/concrete	Electromagnetic wave	unlimited

Models of the atom

Plum pudding model: Before 1914, scientists thought the atom was arranged with positively charged matter evenly spread out and negatively charged electrons buried inside.

Rutherford's model: There is a positively charged nucleus which makes up most of the mass of the atom.

Bohr's model: Electrons orbit the nucleus in specific distances and energy. Electrons move to a higher orbit by absorbing radiation, or move to a lower orbit by emitting radiation.

Uses of radiation:

How do smoke alarms use radiation? Alpha particles are emitted across a gap. This ionises the air so a current flows. When smoke absorbs the ions, the current stops and an alarm sounds.
How is radiation used to control the thickness of metal foil? Beta radiation is emitted through foil and detected the other side. If it stops, the foil is too thick and the rollers increase pressure and vice versa.

1. 1
    a. State the equation that links wave speed, frequency and wavelength
    b. Calculate the wave speed of a sound wave with a frequency of 1320 Hz and a wavelength of 0.25 m

2.
    a. State the equation that links weight, mass and gravitational field strength
    b. Calculate the weight of a 7.6 kg mass on Earth (gravitational field strength 9.8 N/kg)

3.
    a. State the equation that links resultant force, mass and acceleration
    b. Calculate the resultant force acting on a car of mass 550 kg accelerating at 2.3 m/s^2

4.
    a. State the equation that links acceleration, change in velocity and time
    b. A car accelerates from 12 m/s to 30 m/s in 2.4 seconds

1. 1

    a. State the equation that links wave speed, frequency and wavelength

    Wave speed = frequency x wavelength

    a. Calculate the wave speed of a sound wave with a frequency of 1320 Hz and a wavelength of 0.25 m

    330 m/s

2.

    a. State the equation that links weight, mass and gravitational field strength

    Weight = mass x gravitational field strength

    a. Calculate the weight of a 7.6 kg mass on Earth (gravitational field strength 9.8 N/kg)

    74.48 N

3.

    a. State the equation that links resultant force, mass and acceleration

    Resultant force = mass x acceleration

    a. Calculate the resultant force acting on a car of mass 550 kg accelerating at 2.3 m/s^2

    1265 N

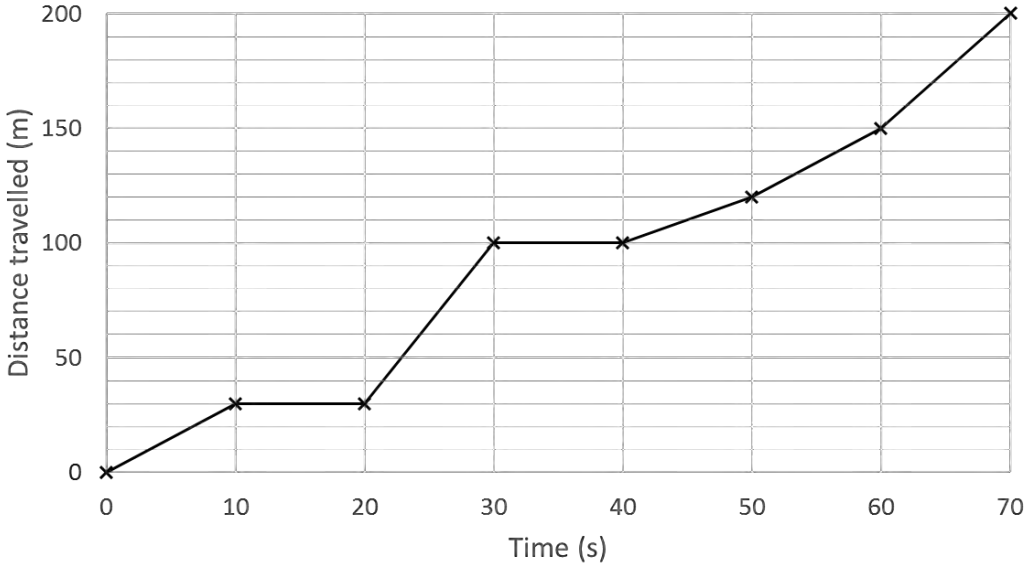
4.

    a. State the equation that links acceleration, change in velocity and time

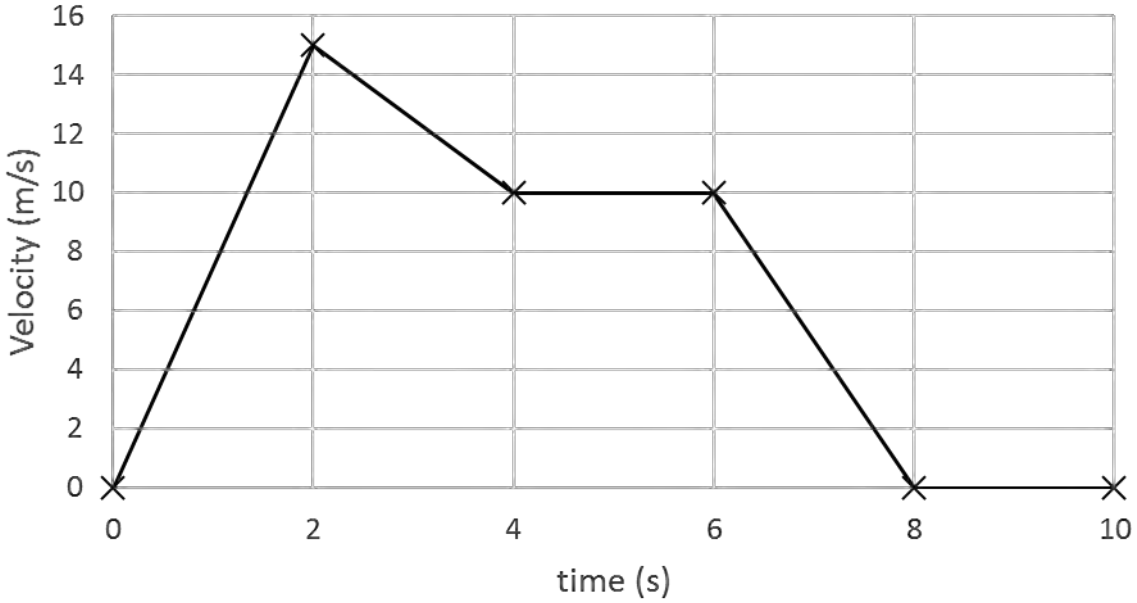
    Acceleration = change in velocity/time

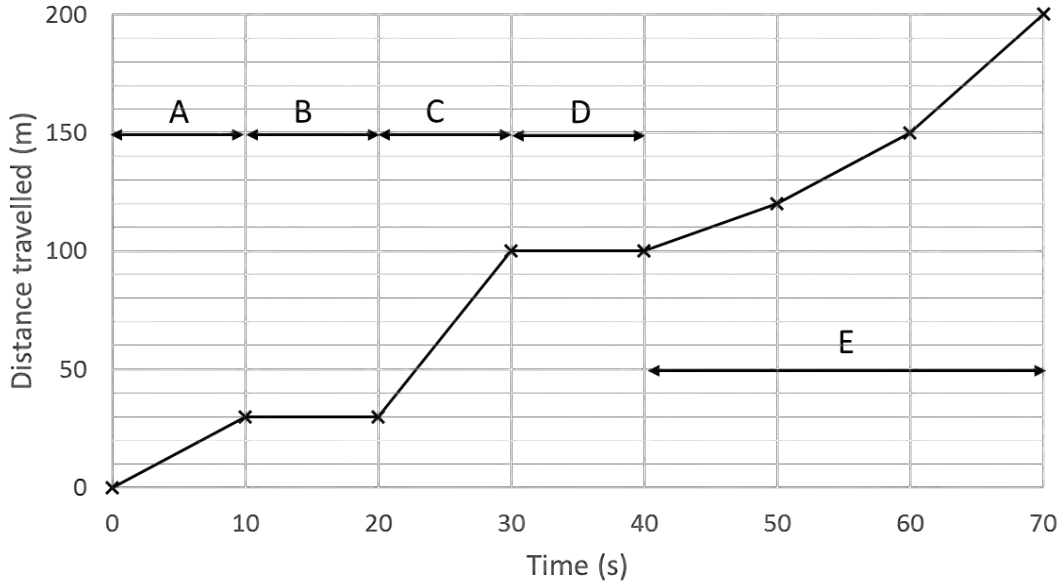
    a. A car accelerates from 12 m/s to 30 m/s in 2.4 seconds

    7.5 m/s^2

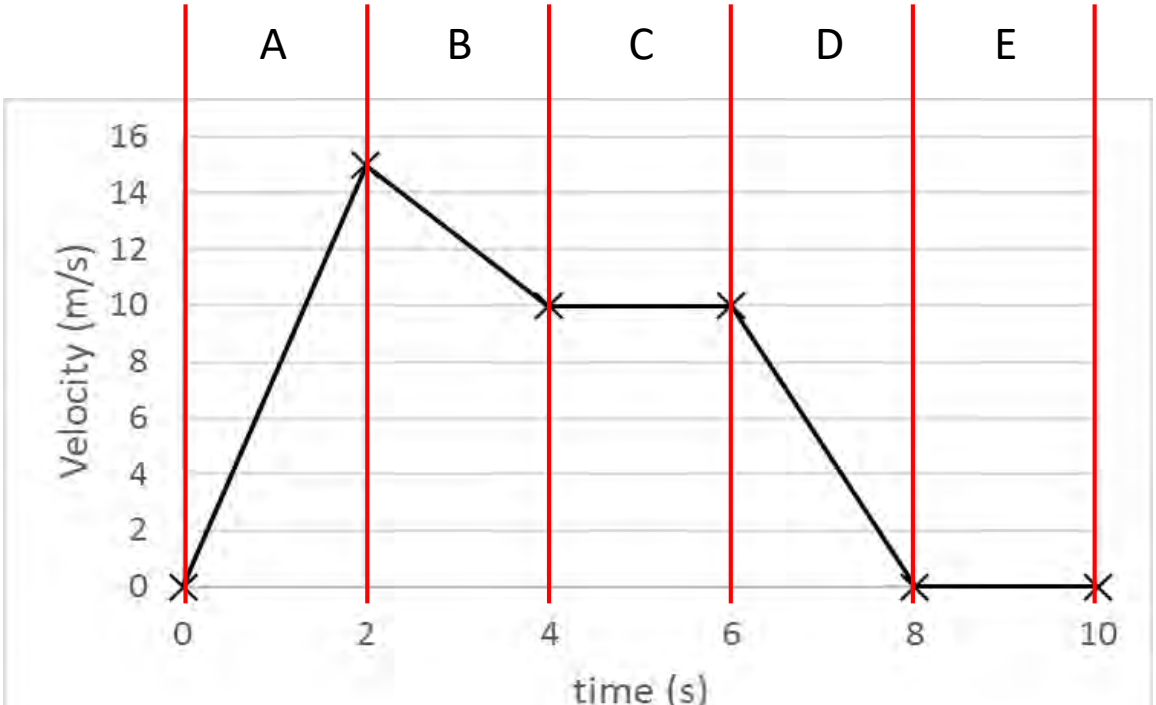


Describe these graphs





A. Constant speed
B. Stopped
C. (Higher) constant speed
D. Stopped
E. Accelerating



A. Accelerating
B. Decelerating
C. Constant speed
D. Decelerating
E. Stopped

Vectors or scalars?

Distance

Displacement

Speed

Velocity

Force

Acceleration

Mass

Vectors or scalars?

Distance

Displacement

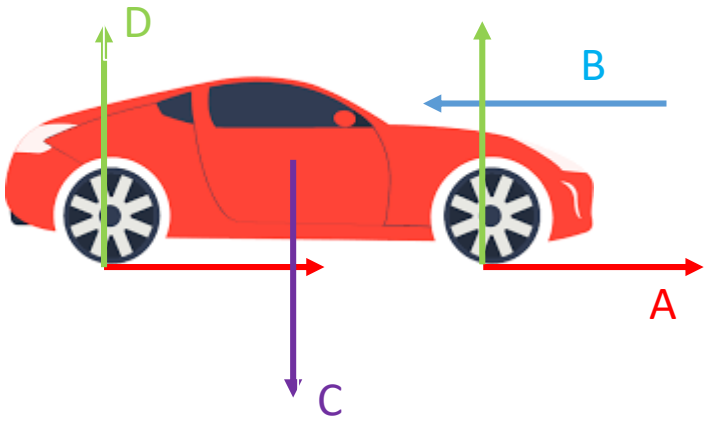
Speed

Velocity

Force

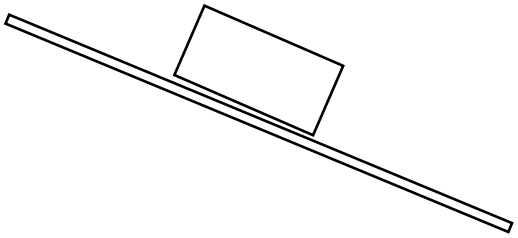
Acceleration

Mass

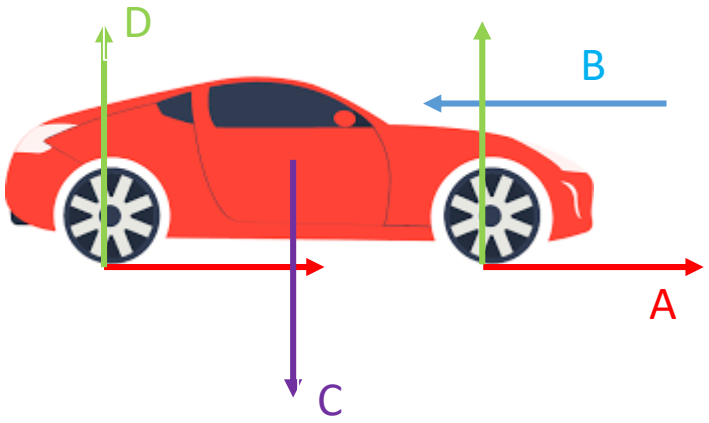


1. Force A is between the wheels and the road.
What is force A called?
2. Force B is caused by air particles hitting the car
What is force B called?
3. Force C is trying to pull the car down.
What is force C called?
4. Force D is caused by the road pushing up on the car
What is force D called?

5. Which of those forces is a non-contact force?
6. The total for force A is 500 N. If the car is moving at a constant speed what is the value of force B?

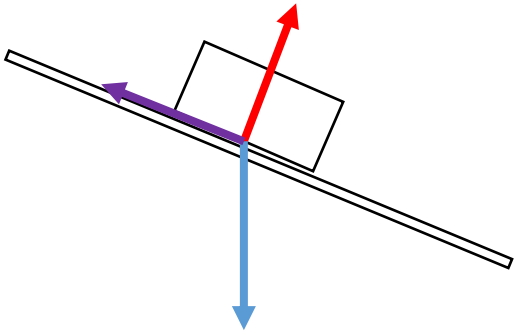


7. A block is placed on a slope, it is not moving. Draw force arrows on the block and label each force



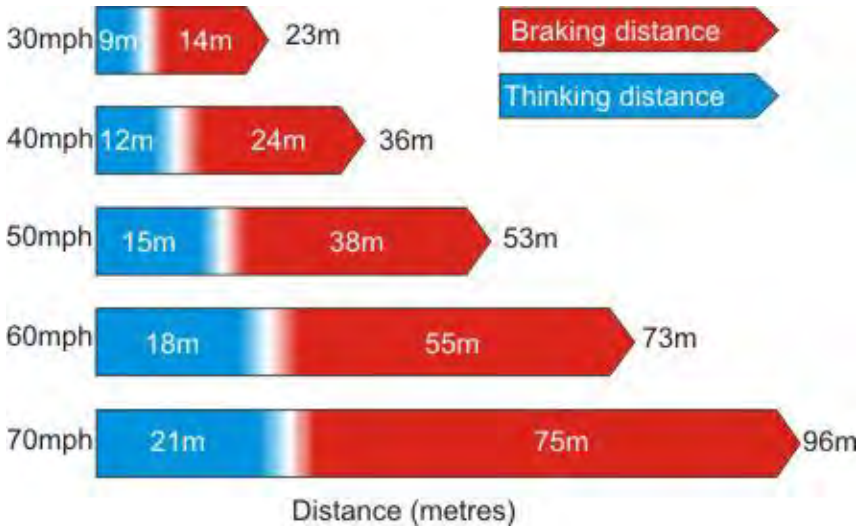
1. Force A is between the wheels and the road.
What is force A called? **Friction**
2. Force B is caused by air particles hitting the car
What is force B called? **Air resistance**
3. Force C is trying to pull the car down.
What is force C called? **Weight**
4. Force D is caused by the road pushing up on the car
What is force D called? **Normal contact force**

5. Which of those forces is a non-contact force? Weight
6. The total for force A is 500 N. If the car is moving at a constant speed what is the value of force B? 500N



7. A block is placed on a slope, it is not moving. Draw force arrows on the block and label each force Normal contact force, Weight, Friction

1. State what is meant by the thinking distance
2. State what is meant by the braking distance
3. State what is meant by the stopping distance?
4. What factors affect thinking distance?
5. What factors affect braking distance?
6. Why does drinking alcohol affect your stopping distance?
7. Why do worn tyres affect your stopping distance?



1. State what is meant by the thinking distance

Distance travelled during the reaction time

2. State what is meant by the braking distance

Distance travelled whilst the braking force is applied

3. State what is meant by the stopping distance?

Thinking distance + breaking distance

4. What factors affect thinking distance?

Distractions, age, tiredness, drugs, speed

5. What factors affect braking distance?

Conditions of: brakes, tyres, road. Going uphill or downhill, mass of the car, speed

6. Why does drinking alcohol affect your stopping distance?

Increases (**NOT** slower) reaction time

Increases thinking distance

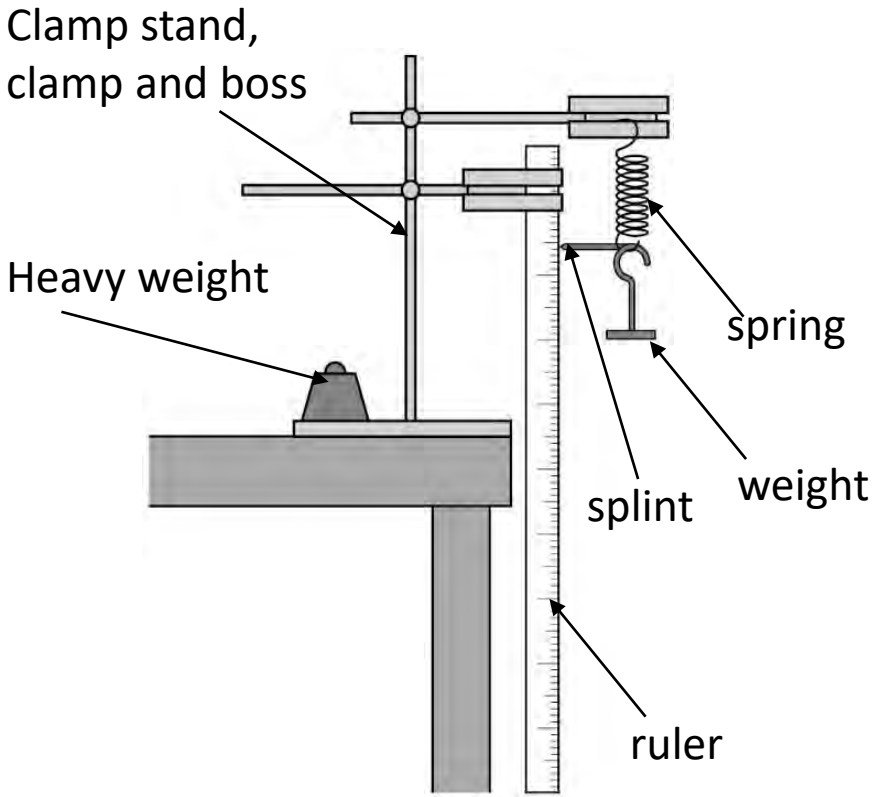
Stopping distance = thinking distance + braking distance

7. Why do worn tyres affect your stopping distance?

Reduces braking force/friction

Increases braking distance

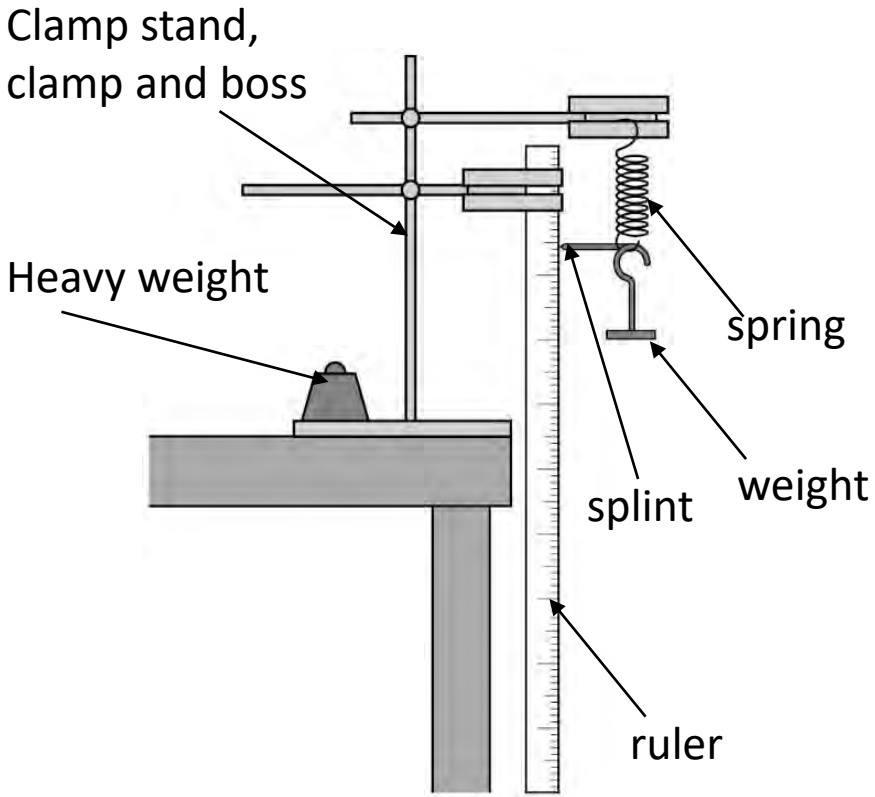
Stopping distance = thinking distance + braking distance



This experiment is to determine how the weight placed on a spring affects its extension.

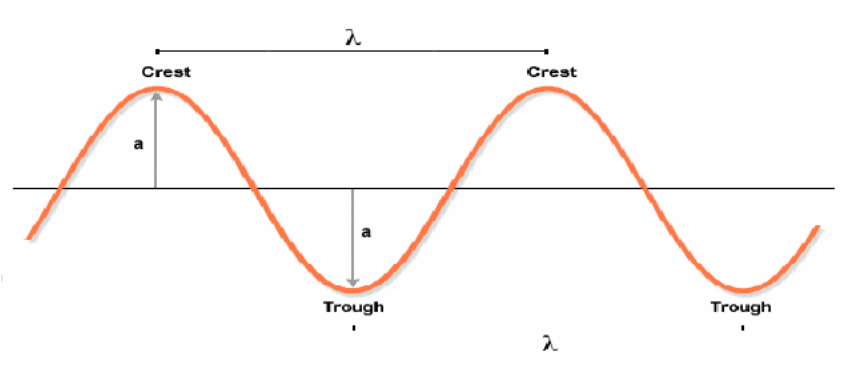
1. What is the:
   a. Independent variable
   b. Dependent variable

2. The spring will go back to its original length once the weight is removed. Is this as example of elastic or plastic deformation?

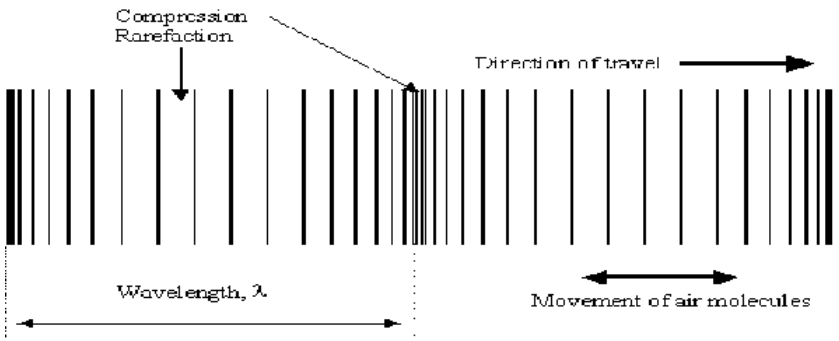


This experiment is to determine how the weight placed on a spring affects its extension.

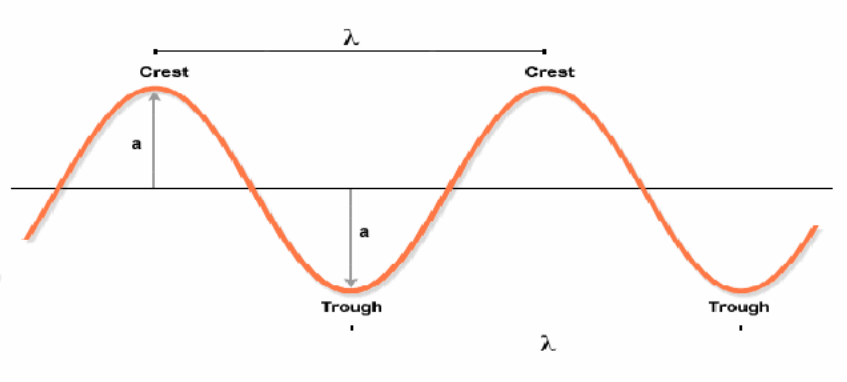
1. What is the:
   a. Independent variable
   weight
   a. Dependent variable
   extension
2. The spring will go back to its original length once the weight is removed. Is this as example of elastic or plastic deformation? Elastic deformation



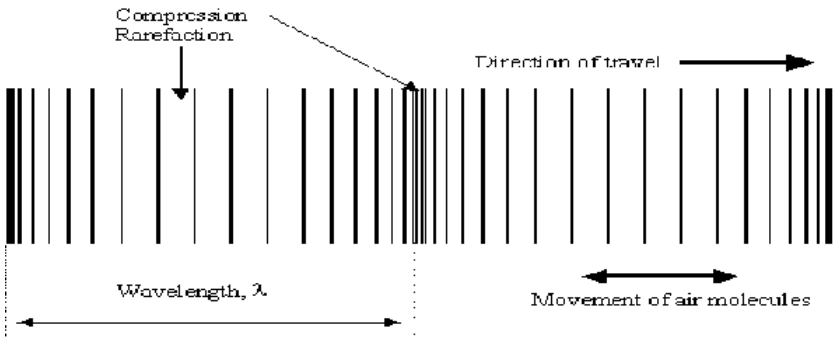
A transverse wave means the direction of oscillation is_____ to the direction of _____ transfer
An example of a transverse wave is….



A longitudinal wave means the direction of oscillation is_____ to the direction of _____ transfer
An example of a longitudinal wave is….



A transverse wave means the direction of oscillation is perpendicular to the direction of energy transfer
An example of a transverse wave is….light, water wave, seismic



A transverse wave means the direction of oscillation is parallel to the direction of energy transfer
An example of a longitudinal wave is….sound, seismic

Radio waves		**Infra-red**	**Visible**			**Gamma Rays**

1. Complete the missing waves in the electromagnetic spectrum

2. Which has the (a) Highest frequency (b) Lowest wavelength (c) fastest speed

(a) Gamma, (b) Radio waves, (c) They all travel at the speed of light

3. Which ones are dangerous? Why?

Gamma, X-rays and Ultraviolet. They are ionising so cause cancer

4. Which ones can be used for communication?

Radio waves – TV and radio
Microwaves – Satellite communication (eg mobile phone signals)
Infra red – TV remotes
Visible – Optical fibres for fast broadband

1.Draw the magnetic field around:

A wire

A bar magnet

N

S

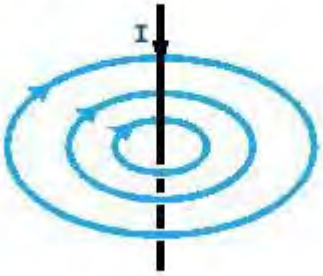
A solenoid

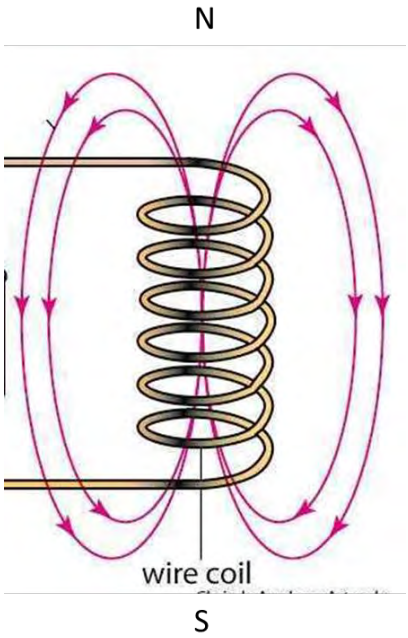
2. Add arrows to show the direction of the magnetic field

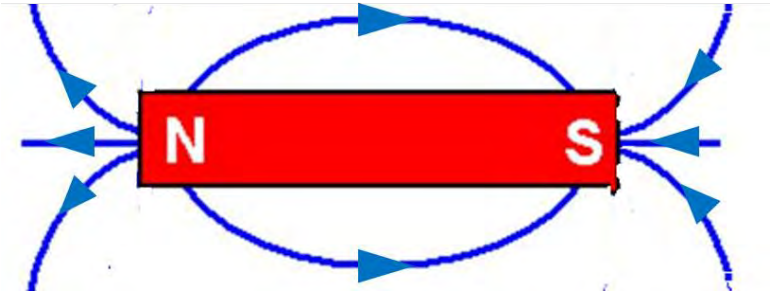
3. What happens to the magnetic field as you go further away from the magnet?

4. How do the field lines show this?

5. How can you make the solenoid stronger?







2. Add arrows to show the direction of the field

   North to south

3. What happens to the magnetic field as you go further away from the magnet?

   The further from the magnet the weaker the field

4. How do the field lines show this?

   The further apart the field lines the weaker the field

5. How can you make the solenoid stronger?

   More current, more coils, tighter coils, iron core

1

a. State the equation that links wave speed, frequency and wavelength
b. The speed of light is 3.0×10^8 m/s. Calculate the frequency of a microwave with a wavelength of 2.7 cm

2.

a. State the equation that links weight, mass and gravitational field strength
b. Calculate the mass of a car with a weight of 3.2 kN on Earth (g = 9.8 N/kg)

3.

a. State the equation that links resultant force, mass and acceleration
b. A tennis ball falls from a table. The weight of the tennis ball is 0.56 N and the drag acting on it is 0.34 N. The mass of the tennis ball is 57 g
    i. Calculate the resultant force on the ball
    ii. Calculate the acceleration experienced by the ball

4.

a. State the equation that links acceleration, change in velocity and time
b. A car accelerates from 12 m/s to 30 m/s in 2.4 seconds. Calculate the acceleration

1

a. State the equation that links wave speed, frequency and wavelength

Wave speed = frequency x wavelength

a. The speed of light is 3.0×10^8 m/s. Calculate the frequency of a microwave with a wavelength of 2.7 cm 1.1×10^{10} Hz

2.

a. State the equation that links weight, mass and gravitational field strength

Weight = mass x gravitational field strength

a. Calculate the mass of a car with a weight of 3.2 kN on Earth (g = 9.8 N/kg)

327 kg

3.

a. State the equation that links resultant force, mass and acceleration

Resultant force = mass x acceleration

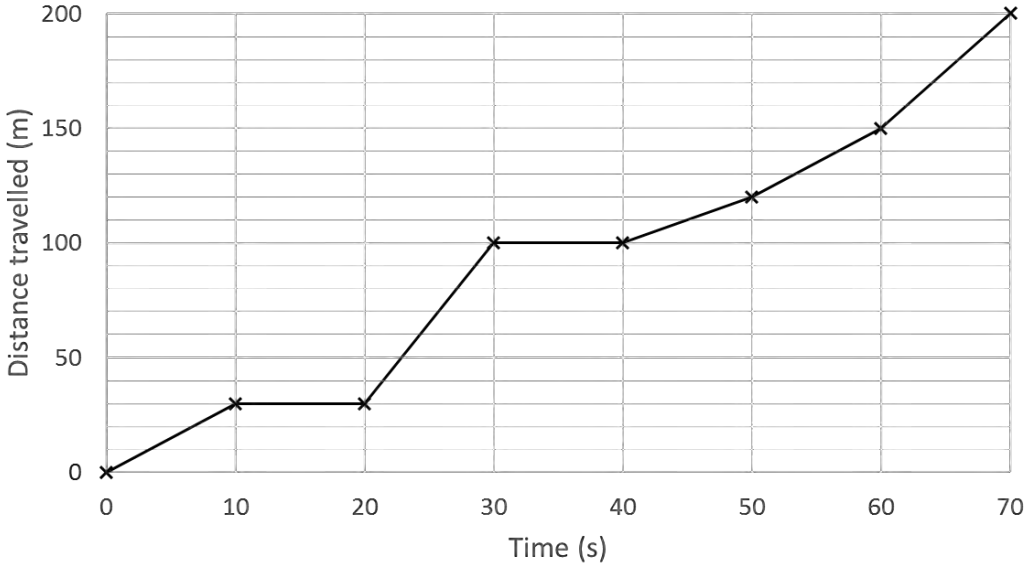
a. A tennis ball falls from a table. The weight of the tennis ball is 0.56 N and the drag acting on it is 0.34 N. The mass of the tennis ball is 57 g
   i. Calculate the resultant force on the ball 0.22 N
   ii. Calculate the acceleration experienced by the ball 3.9 m/s

4.

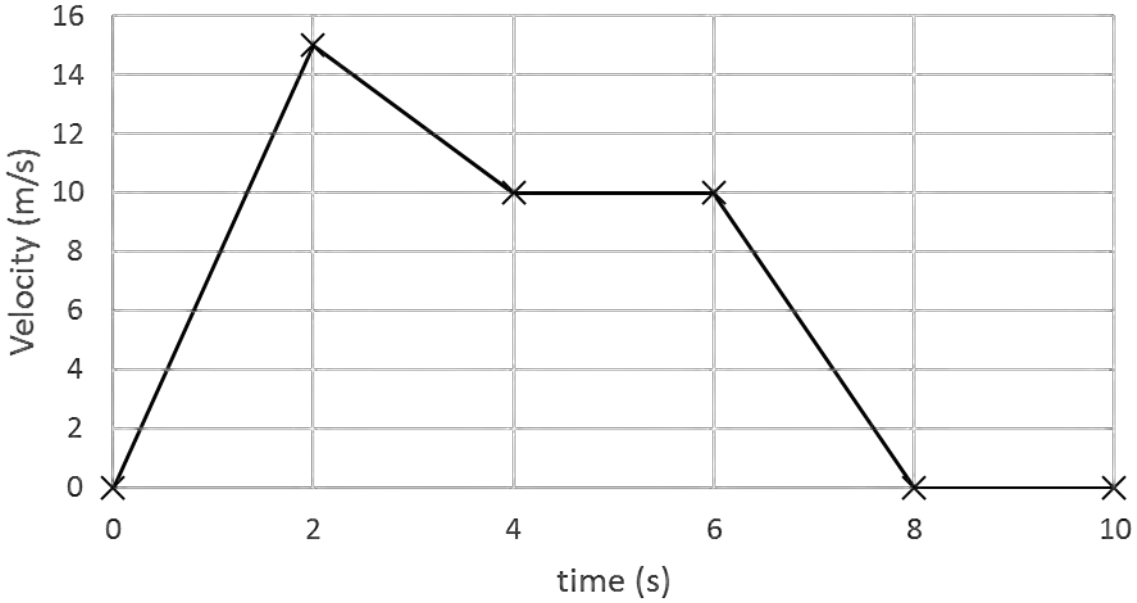
a. State the equation that links acceleration, change in velocity and time

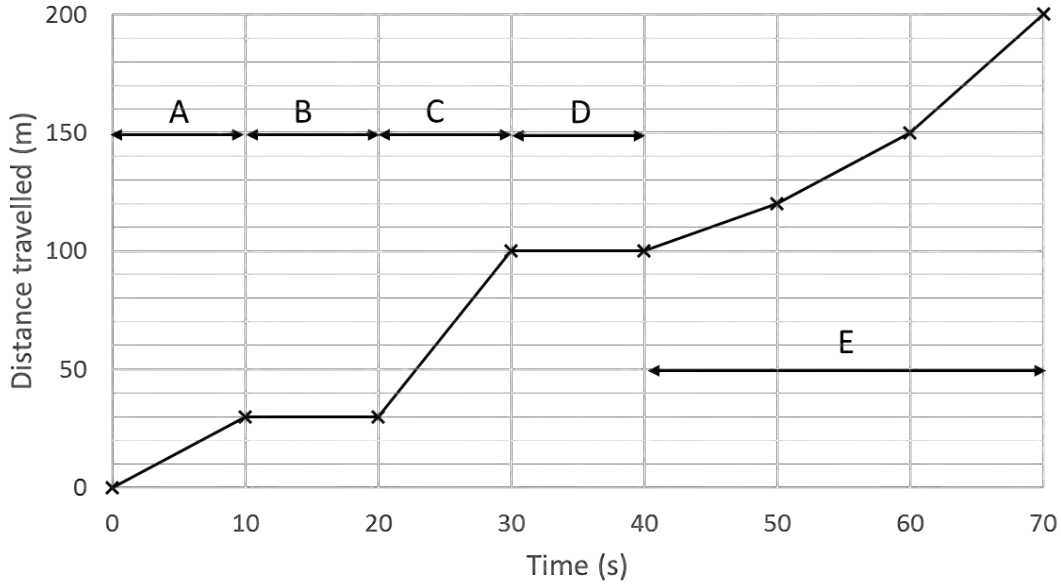
Acceleration = change in velocity/time

a. A car accelerates from 12 m/s to 30 m/s in 2.4 seconds. Calculate the acceleration 7.5 m/s^2

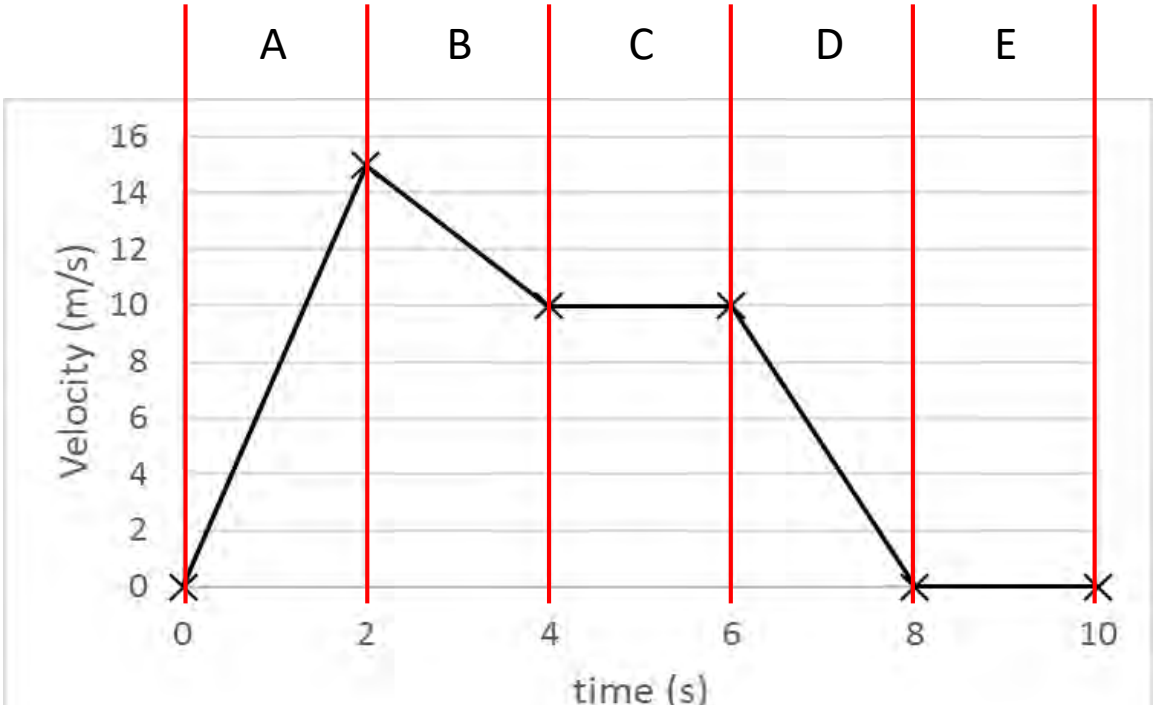


Describe these graphs





A. Constant speed
B. Stopped
C. (Higher) constant speed
D. Stopped
E. Accelerating



A. Accelerating
B. Decelerating
C. Constant speed
D. Decelerating
E. Stopped

Vectors or scalars?

Distance

Displacement

Speed

Velocity

Force

Acceleration

Mass

Vectors or scalars?

Distance

Displacement

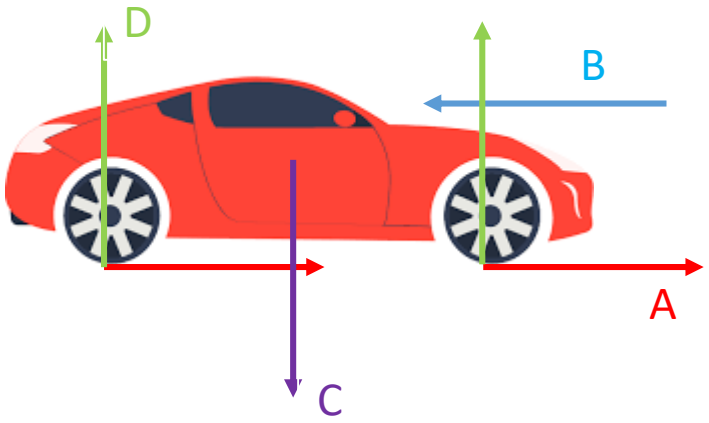
Speed

Velocity

Force

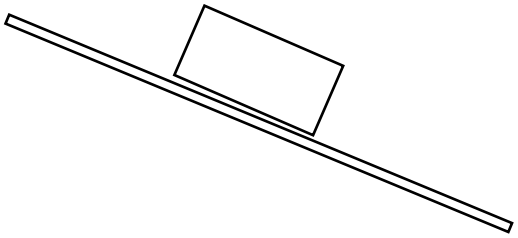
Acceleration

Mass

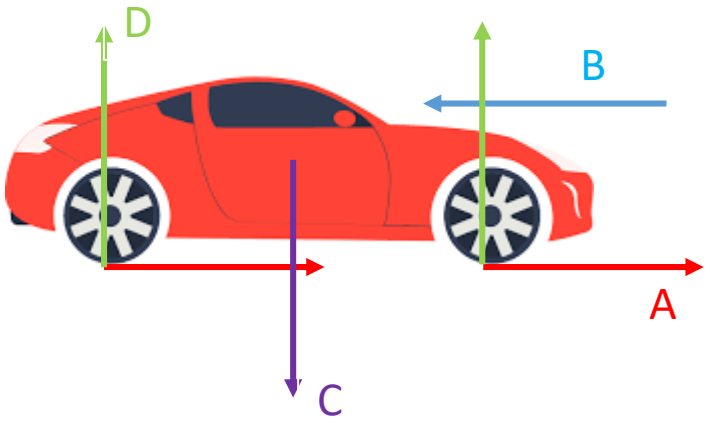


1. Force A is between the wheels and the road.
What is force A called?
2. Force B is caused by air particles hitting the car
What is force B called?
3. Force C is trying to pull the car down.
What is force C called?
4. Force D is caused by the road pushing up on the car
What is force D called?

5. Which of those forces is a non-contact force?
6. The total for force A is 500 N. If the car is moving at a constant speed what is the value of force B?

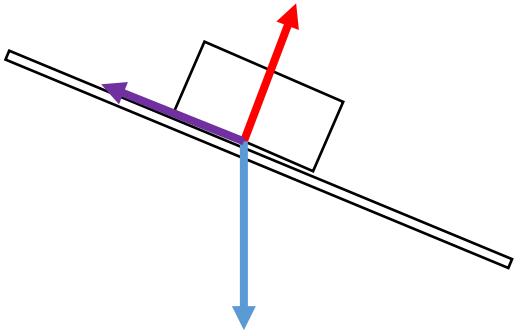


7. A block is placed on a slope, it is not moving. Draw force arrows on the block and label each force



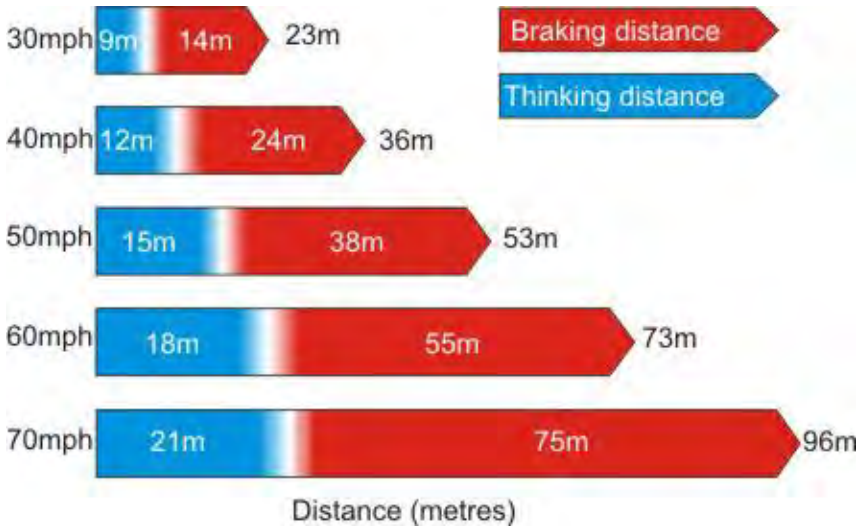
1. Force A is between the wheels and the road.
What is force A called? **Friction**
2. Force B is caused by air particles hitting the car
What is force B called? **Air resistance**
3. Force C is trying to pull the car down.
What is force C called? **Weight**
4. Force D is caused by the road pushing up on the car
What is force D called? **Normal contact force**

5. Which of those forces is a non-contact force? Weight
6. The total for force A is 500 N. If the car is moving at a constant speed what is the value of force B? 500N



7. A block is placed on a slope, it is not moving. Draw force arrows on the block and label each force Normal contact force, Weight, Friction

1. State what is meant by the thinking distance
2. State what is meant by the braking distance
3. State what is meant by the stopping distance?
4. What factors affect thinking distance?
5. What factors affect braking distance?
6. Why does drinking alcohol affect your stopping distance?
7. Why do worn tyres affect your stopping distance?



1. State what is meant by the thinking distance

Distance travelled during the reaction time

2. State what is meant by the braking distance

Distance travelled whilst the braking force is applied

3. State what is meant by the stopping distance?

Thinking distance + breaking distance

4. What factors affect thinking distance?

Distractions, age, tiredness, drugs, speed

5. What factors affect braking distance?

Conditions of: brakes, tyres, road. Going uphill or downhill, mass of the car, speed

6. Why does drinking alcohol affect your stopping distance?

Increases (**NOT** slower) reaction time

Increases thinking distance

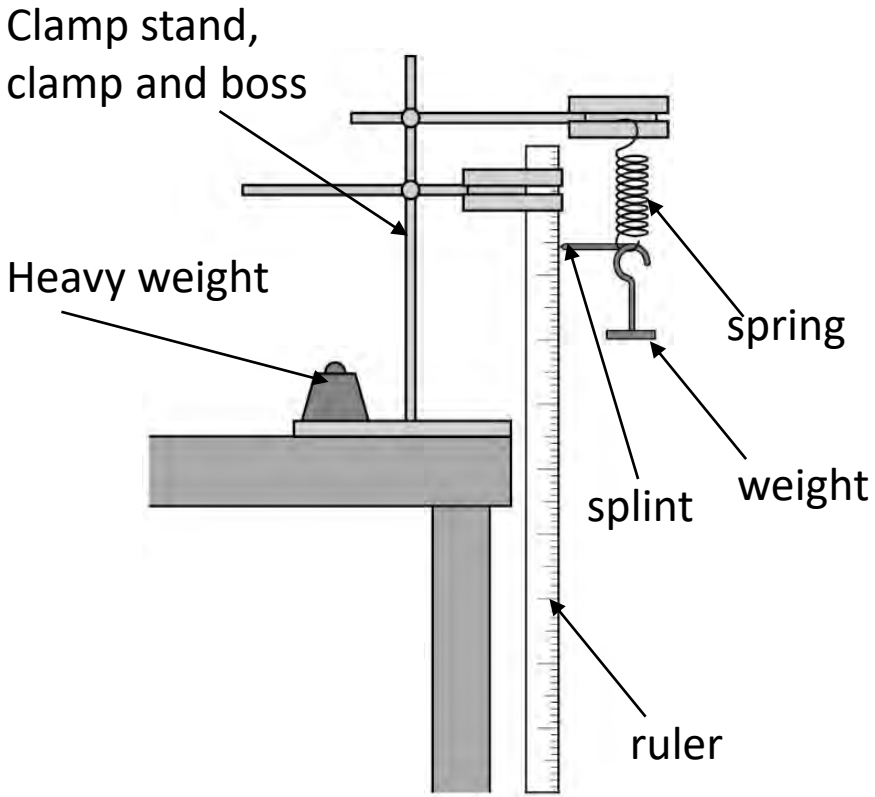
Stopping distance = thinking distance + braking distance

7. Why do worn tyres affect your stopping distance?

Reduces braking force/friction

Increases braking distance

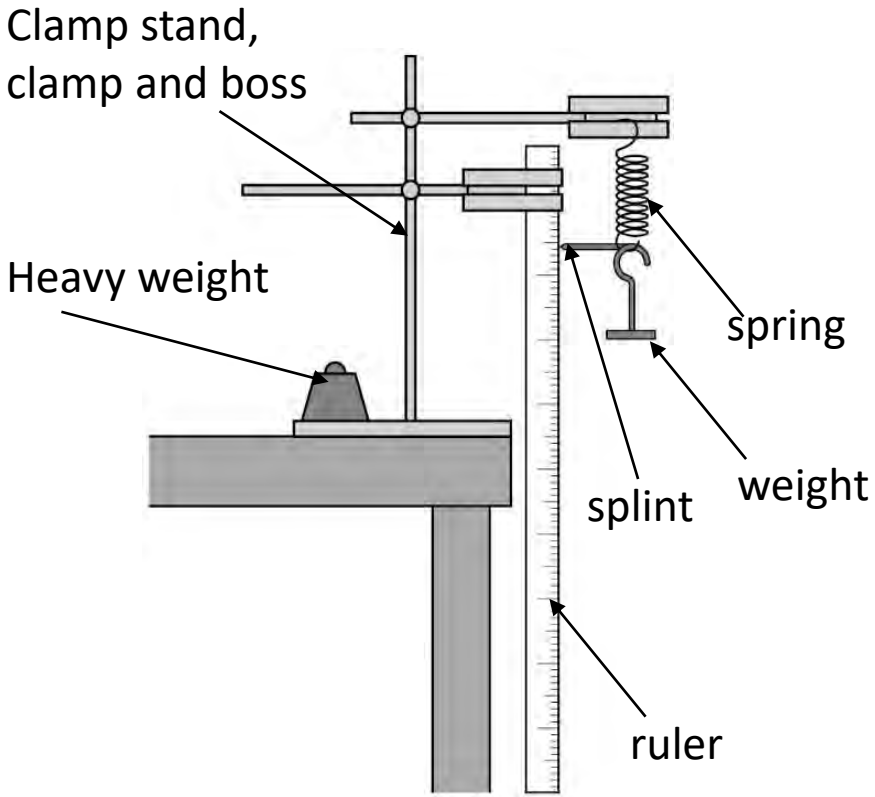
Stopping distance = thinking distance + braking distance



This experiment is to determine how the weight placed on a spring affects its extension.

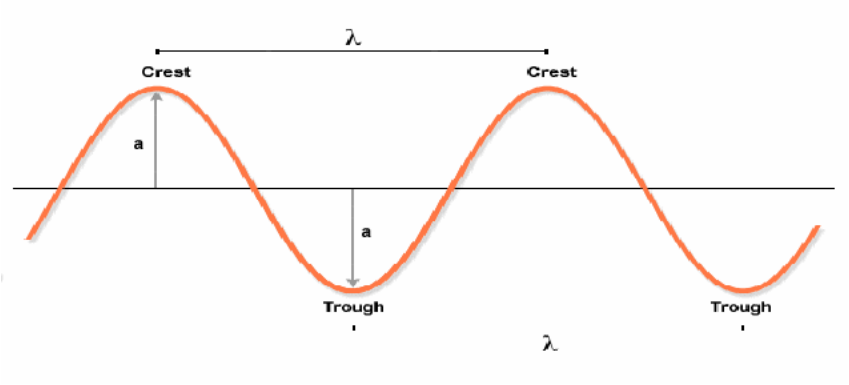
1. What is the:
   a. Independent variable
   b. Dependent variable

2. The spring will go back to its original length once the weight is removed. Is this as example of elastic or plastic deformation?

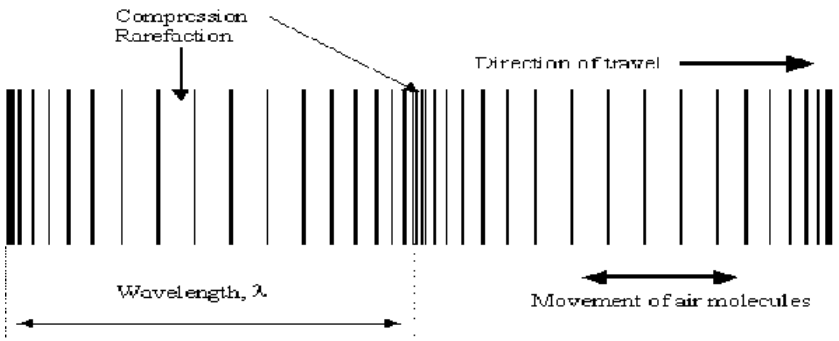


This experiment is to determine how the weight placed on a spring affects its extension.

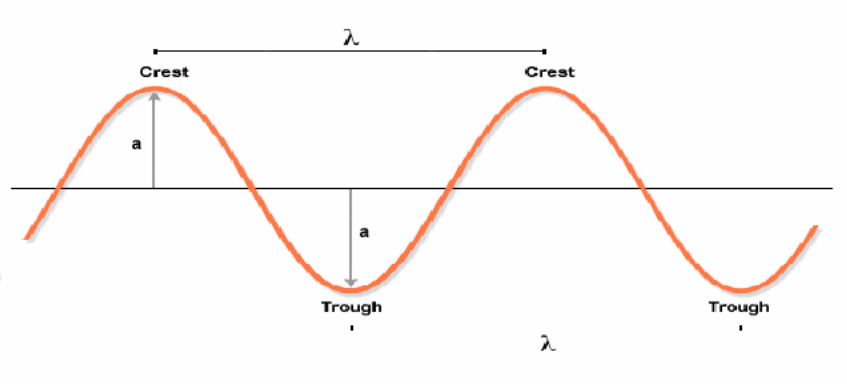
1. What is the:
   a. Independent variable
   weight
   a. Dependent variable
   extension
2. The spring will go back to its original length once the weight is removed. Is this as example of elastic or plastic deformation? Elastic deformation



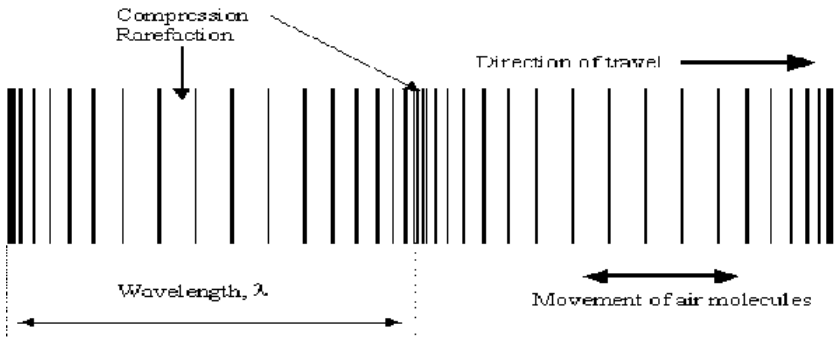
A transverse wave means the direction of oscillation is_____ to the direction of _____ transfer
An example of a transverse wave is….



A longitudinal wave means the direction of oscillation is_____ to the direction of _____ transfer
An example of a longitudinal wave is….



A transverse wave means the direction of oscillation is perpendicular to the direction of energy transfer
An example of a transverse wave is….light, water wave, seismic



A transverse wave means the direction of oscillation is parallel to the direction of energy transfer
An example of a longitudinal wave is….sound, seismic

Radio waves		**Infra-red**	**Visible**			**Gamma Rays**

1. Complete the missing waves in the electromagnetic spectrum

2. Which has the (a) Highest frequency (b) Lowest wavelength (c) fastest speed

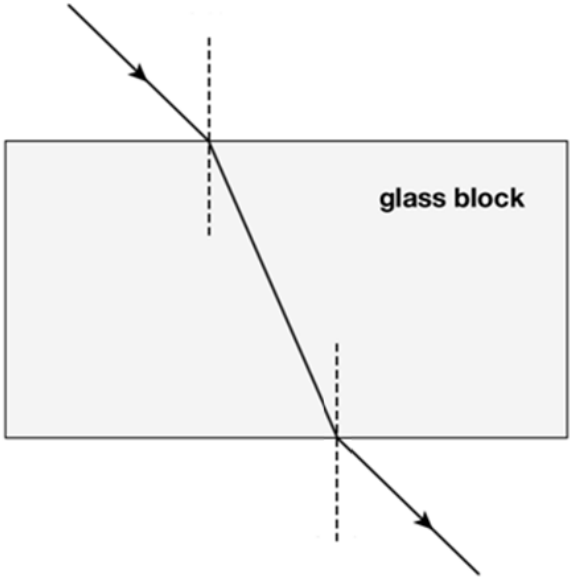
(a) Gamma, (b) Radio waves, (c) They all travel at the speed of light

3. Which ones are dangerous? Why?

Gamma, X-rays and Ultraviolet. They are ionising so cause cancer

4. Which ones can be used for communication?

Radio waves – TV and radio
Microwaves – Satellite communication (eg mobile phone signals)
Infra red – TV remotes
Visible – Optical fibres for fast broadband

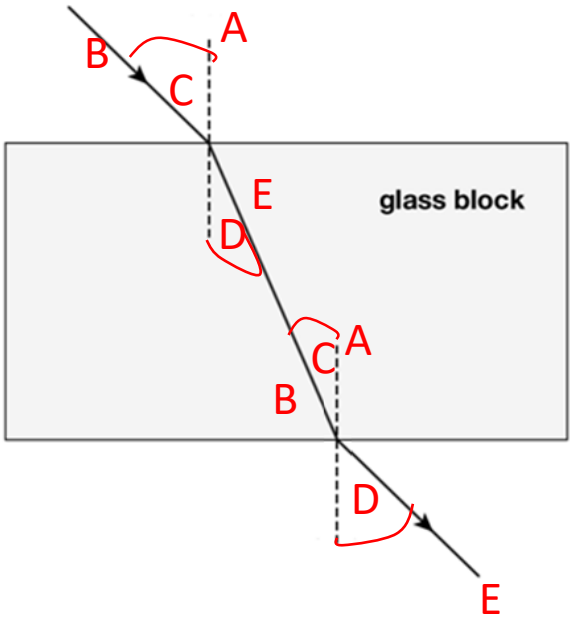


1. Draw the diagram and label with the following key terms

Normal
Incident ray
Angle of incidence
Angle of refraction
Refracted ray

You should use each term **twice,** once each time the ray reaches a boundary

2. Describe what happens to the speed at each boundary
3. Describe how the angle of incidence compares with the angle of incidence at each boundary
4. Apart from refraction, what two other things can happen to light when it hits a surface?



1. Draw the diagram and label with the following key terms

Normal - A
Incident ray -B
Angle of incidence - C
Angle of refraction - D
Refracted ray - E

You should use each term **twice,** once each time the ray reaches a boundary

2. Describe what happens to the speed at each boundary

At it goes into the block it slows down, as it leaves it speeds up

3. Describe how the angle of incidence compares with the angle of incidence at each boundary

Going into the block the angle of incidence is bigger than the angle of refraction

Leaving the block the angle of incidence is smaller than the angle of refraction

4. Apart from refraction, what two other things can happen to light when it hits a surface?

Absorbed or reflected

1.Draw the magnetic field around:

A wire

A bar magnet

N

S

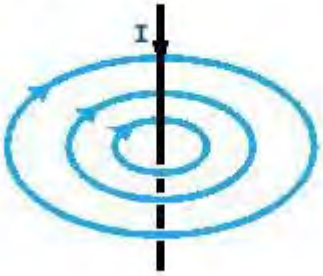
A solenoid

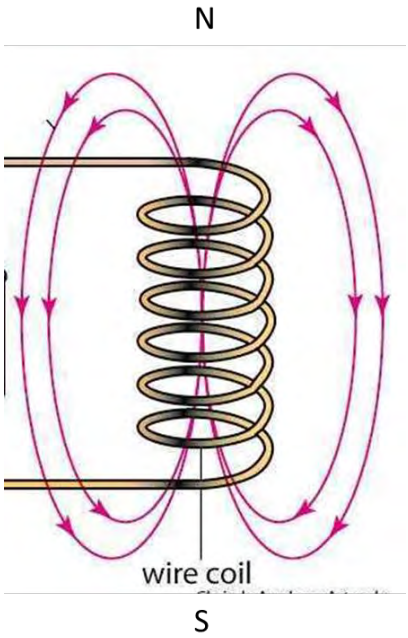
2. Add arrows to show the direction of the magnetic field

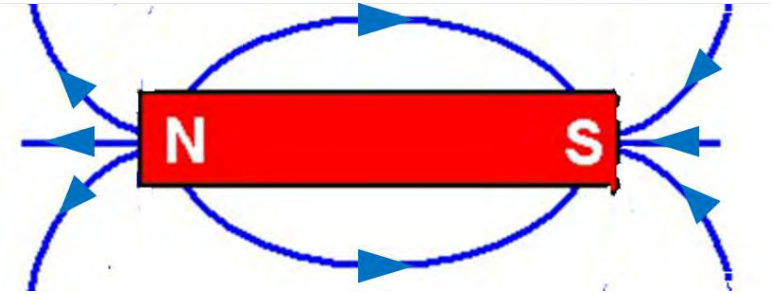
3. What happens to the magnetic field as you go further away from the magnet?

4. How do the field lines show this?

5. How can you make the solenoid stronger?







2. Add arrows to show the direction of the field

   North to south

3. What happens to the magnetic field as you go further away from the magnet?

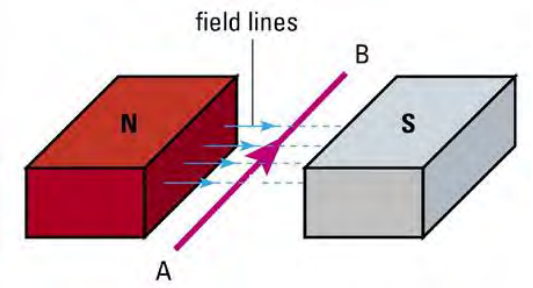
   The further from the magnet the weaker the field

4. How do the field lines show this?

   The further apart the field lines the weaker the field

5. How can you make the solenoid stronger?

   More current, more coils, tighter coils, iron core



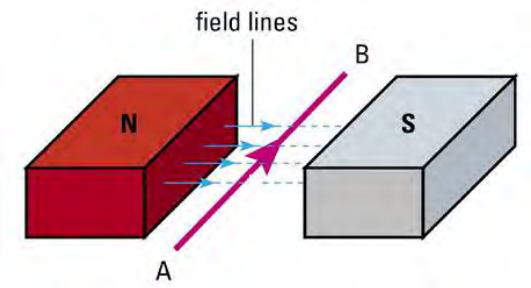
1. The current produces a _____ field

The wire's field _____ with the field of the permanent magnet

This causes a _____ on the wire

2. Which way will the force act?

3. How could you make the force bigger?



1. The current produces a magnetic field

The wire's field interacts with the field of the permanent magnet

This causes a force on the wire

2. Which way will the force act?

Downwards

3. How could you make the force bigger?

Bigger current, stronger magnets