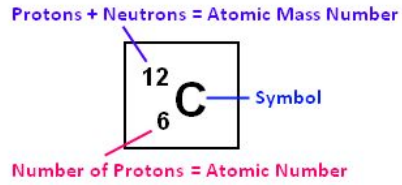
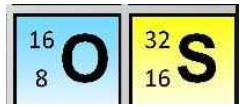
Chemistry: The Periodic table

Keywords	Definition
Atomic number	The number of protons in the nucleus of an atom
Mass number	The number of protons and neutrons in an atom
Elements	A class of substances that cannot be separated into simpler substances
Compounds	Compounds are formed when two or more atoms are chemically combined
Mixtures	Two or more substances that are not chemically bonded
Neutrons	A subatomic particle which has zero charge and the same mass as a proton
Protons	A subatomic particle which has a positive charge and the same mass as a neutron
Electrons	A subatomic particle which has a negative charge and has a very small mass.
Metal ore	Naturally occurring rocks that contain metal or metal compounds in sufficient amounts

Identifying elements in the Periodic table

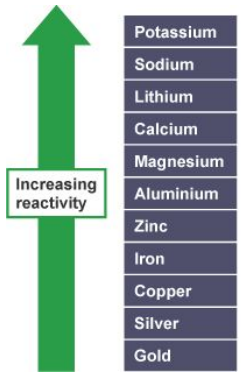




e.g. Oxygen has an atomic number of 8 and a mass number of 16.
This means that Oxygen has 8 protons and 8 neutrons

e.g. Sulphur has an atomic number of 16 and a mass number of 32.
This means that Sulphur has 16 protons and 16 neutrons.

The reactivity series



The reactivity series
A more reactive metal will displace a less reactive metal from a compound.

e.g. AB + C → AC + B
Here B in AB has been displaced by C as C is more reactive.

Extracting Metals using the reactivity series
Metals can be extracted from their ores, depending on their positions on the reactivity series

Properties of metals and nonmetals

Properties	Metals	Non-metals
Appearance	Shiny	Dull
Hardness	Very hard or hard	Brittle
Malleability	Malleable	Non-malleable
Ductility	Ductile	Non-ductile
Heat conduction	Good conductor	Bad conductor
Conduction of electricity	Good conductor	Bad conductor
State	Solid	Solid, liquid, gases
Density	Higher	Lower

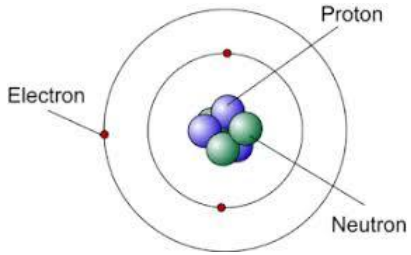
Elements, Compounds and Mixtures

Compounds are made from atoms of different elements joined by chemical bonds. They can only be separated by a chemical reaction. E.g. Sodium Chloride

Mixtures are made from molecules of elements and compounds that are simply mixed together, without chemical bonds. Mixtures can be separated using various techniques

Elements consist of only one kind of atom and can not be broken down into a simpler form of matter.

The Atom

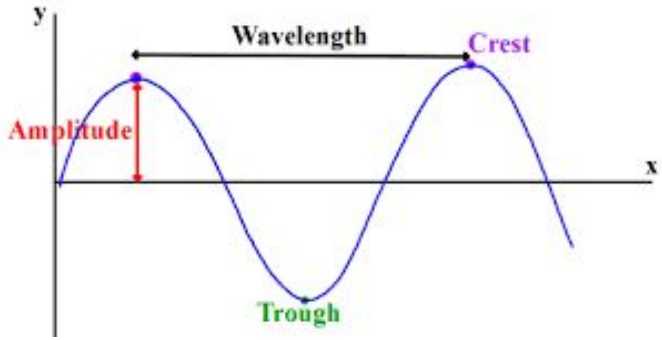


Protons, Neutrons, and Electrons			
	Charge	Mass (amu)	Location
Proton	+1	1	nucleus
Neutron	0	1	nucleus
Electron	−1	0	orbitals

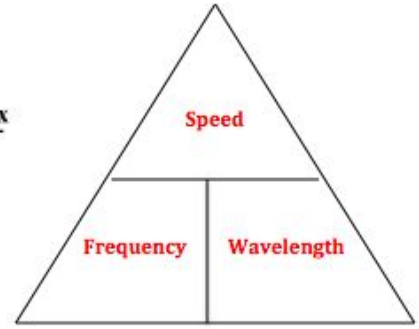
Physics: Waves

Keyword	Definition
Amplitude	The height of a wave
Frequency	The number of waves per second
Wavelength	The length of a wave between two crests or two troughs
Wave speed	The speed at which waves travel
Trough	The lowest point on a wave
Crest	The highest point on a wave
Reflection	The process by which light and heat are sent back from a surface and do not pass through it.
Dispersion	The separation of electromagnetic radiation into different wavelengths
Diffraction	A change in the direction of a sound wave or a light wave caused by the presence of another medium in its path.
Longitudinal waves	In longitudinal waves, the vibrations are along the same direction as the direction of travel.
Transverse waves	In transverse waves, the vibrations are at right angles to the direction of travel

Labelling different parts on a wave



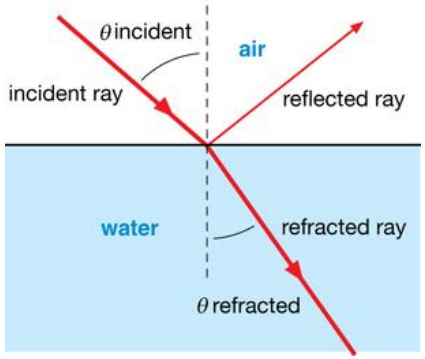
Formula to calculate wave speed



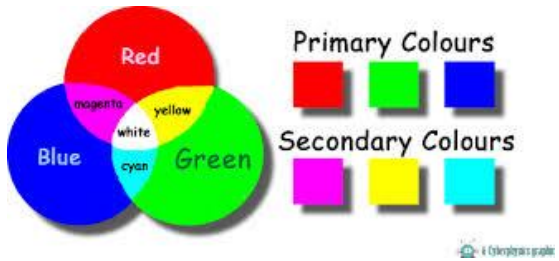
Wave speed = Frequency x Wavelength

- Wave speed is measured in m/s
- Frequency is measured in Hz
- Wavelength is measured in m

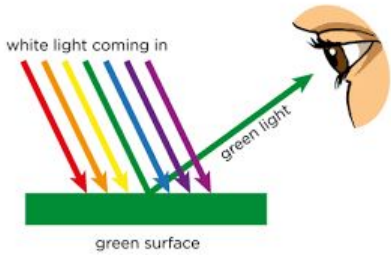
Labelling different parts of diagrams



Seeing different colours



In the example below, white light is absorbed. And the surface appears green because only the green light is reflected.



Comparing Sound waves and Light waves

Sound waves	Light waves
• Longitudinal • Cannot travel through a vacuum • Can be reflected • Can be refracted • Can be diffracted	• Transverse • Can travel through a vacuum • Can be reflected • Can be refracted • Can be diffracted

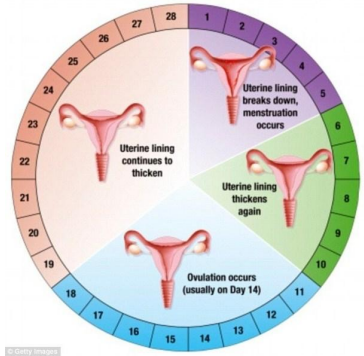
Biology: Reproduction

Keyword	Definition
Menstruation	The process in a woman of discharging blood and other material from the lining of the uterus
Gamete	Sex cells. (sperm cells are produced in males and egg cells are produced in females)
Gestation	The process or period of developing inside the womb between conception and birth
Fallopian tube/Oviduct	Either of a pair of tubes along which eggs travel from the ovaries to the uterus.
STI	Sexually transmitted infections
Fertilisation	The action or process of fertilizing an egg or a female animal or plant, involving the fusion of male and female gametes to form a zygote.
Embryo	An unborn or unhatched offspring in the process of development
Placenta	Responsible for providing oxygen and nutrients, and removing waste substances. It grows into the wall of the uterus and is joined to the foetus by the umbilical cord
Contraception	Birth control used to prevent pregnancy
Ovaries	Where eggs cells are produced and stored in females
Testicles	Where sperm cells are produced and stored in males

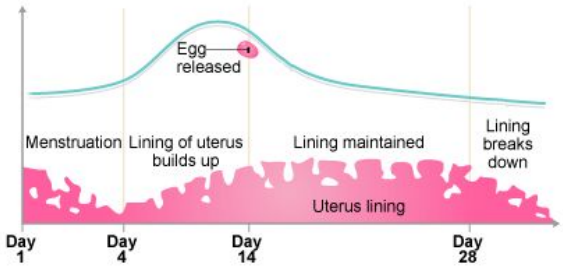
Hormones in the menstrual cycle

Hormone	Secreted by...	Function
FSH (follicle stimulating hormone)	Pituitary gland	Causes maturing of eggs Stimulates ovaries to release oestrogen
LH (luteinising hormone)	Pituitary gland	Triggers the release of egg from the ovary
Oestrogen	Ovaries	Stops the production of FSH. Stimulates the release of LH from the pituitary gland.

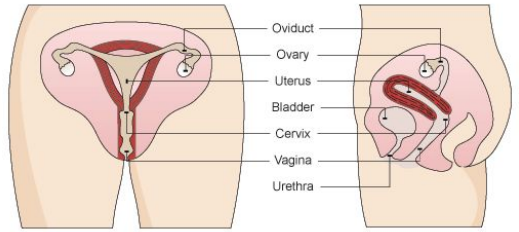
The Menstrual cycle



The graph below shows how the lining of the uterus changes throughout the menstrual cycle



Labelling the male and female reproductive organs

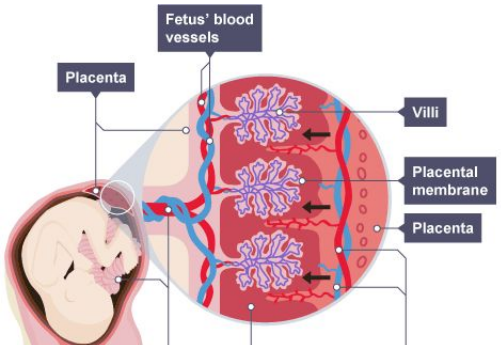


Contraceptive methods

- The pill- 91% effective
- Patch- 91% effective
- Condom- 82% effective (99% effective against STI's)

Using condoms can prevent these STI'S

- Gonorrhea
- Chlamydia
- HIV



The role of the placenta

The mother's blood does not mix with the blood of the fetus, but the placenta lets substances pass between the two blood supplies:

- oxygen and nutrients **diffuse** across the placenta from the mother to the fetus
- carbon dioxide and other waste substances diffuse across the placenta from the fetus to the mother

The role of the amniotic fluid

The fetus

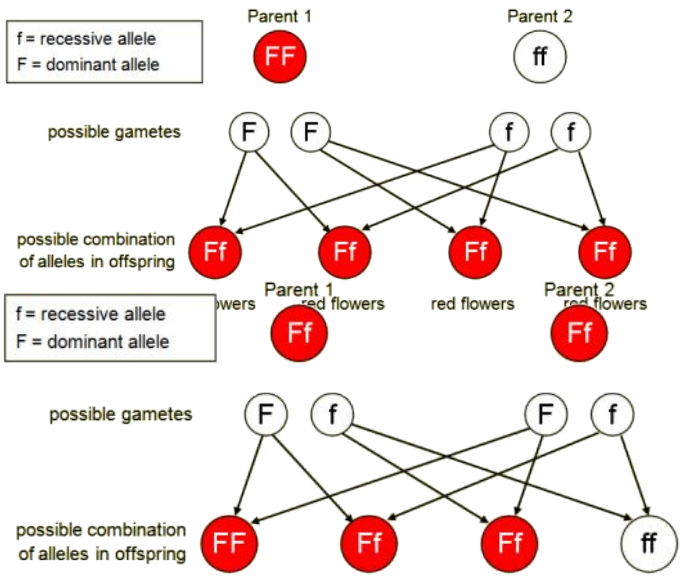
The amniotic fluid is a liquid which protects the fetus which protects the fetus from the following:

- Knock and bumps
- Temperature changes

Biology: Variation

Keyword	Definition
Recessive	A gene that can be masked by a dominant gene.
Dominant	A relationship between alleles of one gene
Allele	Some characteristics, such as eye colour and the shape of the earlobe, are controlled by a single gene. These genes may have different forms called alleles
Heterozygous	The genetics term heterozygous refers to a pair of genes where one is dominant and one is recessive
Homozygous	When an individual has two of the same allele, whether dominant or recessive
Classification	The arrangement of animals and plants in taxonomic groups according to their similarities
Invertebrates	Animals that do not have a backbone
Vertebrates	Animals that do have a backbone

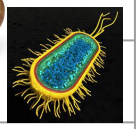
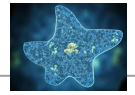
Gregor Mendel's genetic diagrams



Examples of Variation

- Inherited
  - Eye colour, Shape of nose, Skin colour, Foot size, Blood type, Tongue rolling
- Environmental
  - Weight, Language, Accent, Education, Religion, Culture
- Continuous
  - Height, Weight, Hair length, Foot size
- Discontinuous
  - Gender, Eye colour, Tongue rolling, Blood type

Classifying organisms

Group name	Example	image
Animals	Cats, Dogs, Humans, Fish	
Plants	All green plants	
Fungi	Moulds, Mushrooms, Yeast	
Prokaryotes	Bacteria, Algae	
Protoctists	Ameoba, Chlorella and Plasmodium	

- Gregor Mendel (1822-1884) studied the inheritance of different characteristics in pea plants.

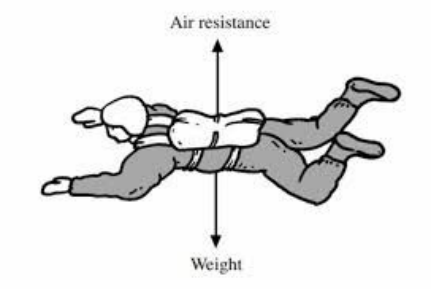
In a genetic diagram, you need to show

- The possible alleles for a particular characteristic.
- There should be two alleles from one parent, and two from the other parent, making four altogether.
- You then draw lines to show all the possible ways that these alleles could be paired in the offspring.
- There should be four possible ways (but some or all of them could be repeated).

Keyword	Definition
Mass	A measure of how many particles is in an object
Resultant force	The overall force acting on an object
Acceleration	The rate of change in speed of a moving object
Gravity	The force exerted by a mass on another mass
Stationary	When an object is at rest (not moving)
Constant speed	When an object is travelling at the same speed

Drawing Force diagrams

- Arrows must be labelled with the type of force acting
- Arrows must point away from the object
- The length of the arrows show the size of the force



Naming forces

- Gravity or Weight
- Air resistance
- Friction
- Upthrust
- Drag
- Push
- Pull
- Twist

Newton's 1st law

When all the forces acting on an object are balanced, then the object is either:

- Moving at a constant speed

OR

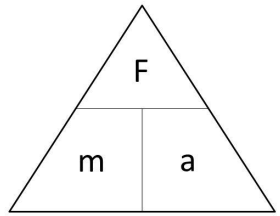
- Is stationary

Example

Let's consider this camel standing on the road. The camel is stationary and so the two forces acting on the camel are balanced.

Newton's 2nd law

When an unbalanced force acts on an object, the direction of the object's acceleration is the same as the direction of the unbalanced force.



Force = Mass X Acceleration

Force is measured in Newtons (N)
Mass is measured in kg
Acceleration is measured in m/s^2

Example

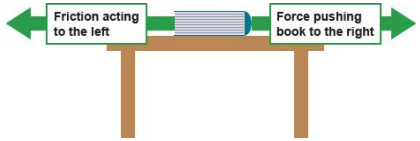
Q: A car of mass 600 kg, feels a resultant force of 35N. Calculate the acceleration.

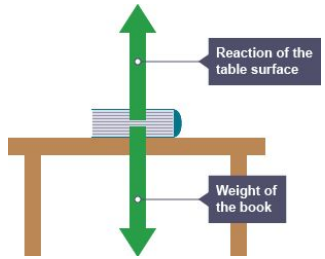
$a = F/m = 35/600 = 0.583\ m/s^2$

Newton's 3rd law

Every action has an equal and opposite reaction. Therefore, if object A exerts a force on object B, then object A will exert an equal and opposite force on B. (Forces will be equal in size and opposite in direction)

Example of equal an opposite forces acting on an object





Biology: Photosynthesis

Keyword	Definition
Photosynthesis	The process by which plants use light energy to produce glucose
Chloroplast	This is where photosynthesis takes place
Chlorophyll	Chlorophyll traps sunlight for photosynthesis
Glucose	A simple sugar which is an important energy source in living organisms
Transpiration	The process where plants absorb water through the roots and then give off water vapor through pores in their leaves
Carbohydrates	Substances, found in certain kinds of food, that provide you with energy

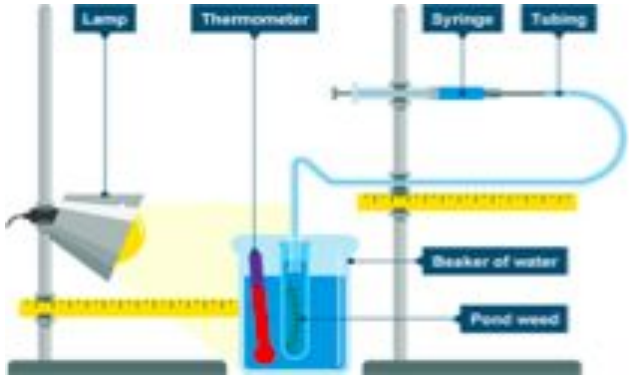
Word Equation

carbon dioxide + water ⟹ oxygen + glucose

Symbol Equation

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

Investigating how light affects the rate of photosynthesis



Independent variable
We are changing the intensity of light

Dependent variable
We are measuring the gas collected in the syringe

Control variables
Same plant and the same amount of water used to keep it a fair test

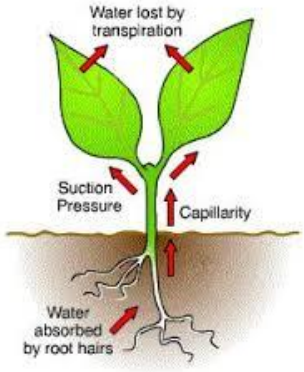
How does water enter a plant?

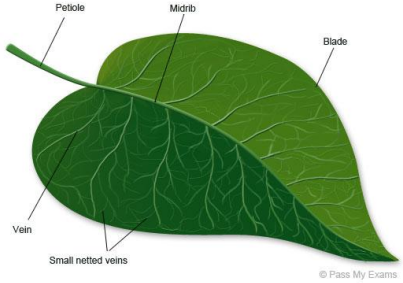
Transpiration causes water to evaporate and diffuse out of the leaf. More water is then drawn out through the leaf in order to replace this lost water. The xylem cells make a continuous tube from the leaf, down the stem to the roots, this acts like a drinking straw, producing a flow of water and dissolved minerals from roots to leaves.

When water is scarce, or the roots are damaged, it increases a plant's chance of survival if the transpiration rate can be slowed down. Plants can do this themselves by wilting, or it can be done artificially, like removing some of the leaves from cuttings before they have chance to grow new roots.

Factors affecting the transpiration rate

Light- Transpiration is faster in bright light
Temperature- Transpiration is faster in high temperatures
Wind- Transpiration is faster in windy conditions
Humidity- Transpiration is slower in humid conditions





How are leaves adapted to Photosynthesis?

- Large surface area
  - Allows absorption of more light
- Thin
  - provides a short distance for carbon dioxide to diffuse into the leaf
- Contain chlorophyll
  - Absorbs sunlight to transfer energy into chemicals
- Network of veins
  - To support the leaf and transport water and carbohydrates
- Stomata
  - Allow carbon dioxide to diffuse into the leaf

Biology: Respiration

Keyword	Definition
Aerobic respiration	Respiration which requires oxygen
Anaerobic respiration	Respiration which does not require oxygen
Diffusion	The movement of a substance from a high concentration to a low concentration
Deoxygenated blood	Blood that does not contain oxygen
Oxygenated Blood	Blood that does contain oxygen

Word and symbol equations for Aerobic respiration

Glucose + Oxygen → Carbon dioxide + Water

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

Word and symbol equations for Anaerobic respiration

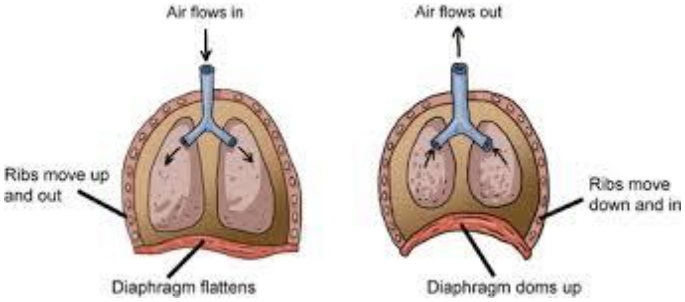
glucose → lactic acid + energy

$C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$ + energy

Comparing Aerobic and Anaerobic respiration

Aerobic respiration	Anaerobic respiration
Uses oxygen	Does not use oxygen
High amount of energy released	Low amount of energy released
Carbon dioxide and water is produced	Ethanol or Lactic acid is produced

Breathing



Inhale

- Ribcage expands
- Diaphragm contracts, making room for the air
- Pressure inside the chest is lowered and air is sucked into the lungs.

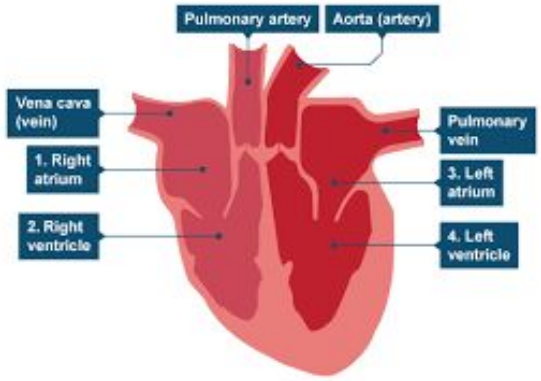
Exhale

- Ribcage drops inwards and downwards
- Diaphragm relaxes, moving back upwards, decreasing the volume of the chest
- Pressure inside the chest increases and air is forced out

Effects of smoking

- Addiction
- Diabetes
- Emphysema
- Heart Disease
- Leukemia (Blood Cancer)
- Pharyngeal (Throat) Cancer

The structure and the functions of the heart and blood vessels



Arteries

- Carry blood away from the heart (always oxygenated apart from the pulmonary artery which goes to the lungs)
- Have thick muscular walls
- Have small passageways for blood (internal lumen)
- Contain blood under high pressure

Veins:

- Carry blood to the heart (always de-oxygenated apart from the pulmonary vein which goes from the lungs to the heart)
- Have thin walls
- Have larger internal lumen
- Contain blood under low pressure
- Have valves to prevent blood flowing backwards

Capillaries

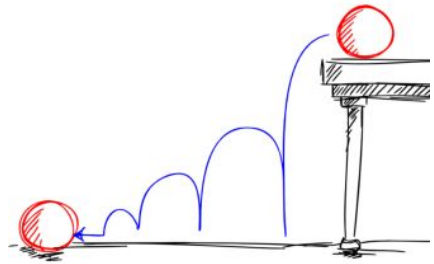
- Found in the muscles and lungs
- Microscopic – one cell thick
- Very low blood pressure
- Where gas exchange takes place. Oxygen passes through the capillary wall and into the tissues, carbon dioxide passes from the tissues into the blood

Keyword	Definition
Efficiency	The proportion of the energy supplied that is transferred in useful ways
Work done	The energy transferred when an object is moved through a certain distance distance by a force
Power	The rate of work done

Law of Conservation of energy

Energy is never created nor destroyed. Energy stays the same and is only transferred from one form to another.

Example: A ball is dropped from a height. This means that the gravitational potential energy is converted into kinetic energy as the ball falls.



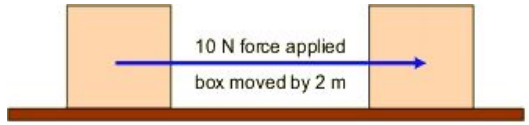
Types of energies

- Gravitational potential energy
- Elastic energy
- Thermal energy
- Light energy
- Sound energy
- Kinetic energy
- Chemical energy

Work done

Work is done whenever a force moves something. Whenever work is done energy is transferred from one place to another. Both energy and work are measured in joules, J.

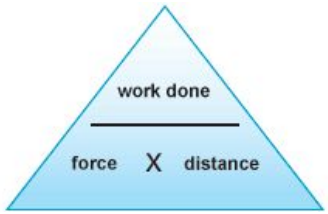
Example:



A box is moved by 2m by a force of 10N. Therefore Work is done on the box.

Other examples of work done: Walking up the stairs, lifting heavy objects, pulling a sledge and pushing a shopping trolley.

Calculating Work Done



Work done = Force X Distance

Work done is measured in Joules (J)
Force is measured in Newtons (N)
Distance is measured in meters (m)

Example
Q: An object is pushed 5m with a force of 8N. Calculate the Work done

W = 5 x 8 = 40J

Energy efficiency

The efficiency of a device is the proportion of the energy supplied that is transferred in useful ways.

Calculating Energy efficiency

The efficiency of a device such as a lamp can be calculated using this equation:

Efficiency= (useful energy transferred ÷ energy supplied) × 100

Filament lamp

10% of the electrical energy is transferred into (useful) light energy
90% of is transferred into (wasteful) heat energy

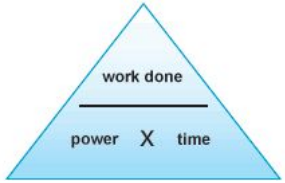
Energy saving lamp

75% of the electrical energy is transferred into (useful) light energy
25% of is transferred into (wasteful) heat energy

In this case the energy saving lamp is is more efficient as more energy is transferred into (useful) light energy

Power

Power is a measure of how quickly energy is transferred.



Power = work done/ time

Power is measured in Watts (W)
Work done is measured in Joules (J)
Time is measured in seconds (s)