Physics Knowledge Organisers

Unit 1: Energy

Unit 2: Electricity

Unit 3: Particle model of matter

Unit 4: Radioactivity

Unit 5: Forces and Motion

Unit 6: Waves

Unit 7: Magnetism and Electromagnetism

Unit 8: Space Physics (*Triple only)

Physics Exam 1: Units 1-4
Physics Exam 2: Unit 5-7(*8)

Revision technique: Read, cover, write, check, repeat!

Read your notes.

Cover your notes up and write down as much as you can remember.

Check how you did. Did you miss any information out?

Repeat the whole process.

TIPS: Only try and do a few of the squares at a time.
Don't keep doing the ones you know well.
Keep repeating the ones you struggle to remember.

AQA GCSE Physics – Equations & Formulae (specification 8463 & 8464)

Unit 1: Energy

Equations to Learn

kinetic energy $= \frac{1}{2} \times$ mass $\times$ speed^2	$E_K = \frac{1}{2}mv^2$
GPE = mass $\times$ gravitational field strength $\times$ height	$E_P = mgh$
power $= \dfrac{\text{work done}}{\text{time taken}} = \dfrac{\text{energy transferred}}{\text{time taken}}$	$P = \dfrac{W}{t} = \dfrac{E}{t}$
efficiency $= \dfrac{\text{useful energy output}}{\text{total energy input}}$ efficiency $= \dfrac{\text{useful power output}}{\text{total power input}}$	

Equations given in the exam

elastic potential energy $= 0.5 \times$ spring constant x (extension)^2	$E_e = \frac{1}{2}ke^2$
change in thermal energy = mass $\times$ specific heat capacity $\times$ temperature change	$\Delta E = mc\Delta\theta$

Unit 2: Electricity

Equations to Learn

charge flow = current $\times$ time	$Q = I\,t$
potential difference = current $\times$ resistance	$V = I\,R$
total resistance = resistance of component 1 + resistance of component 2	$R_T = R_1 + R_2$
power = current $\times$ potential difference	$P = I\,V$
power = (current)^2 $\times$ resistance	$P = I^2R$
energy transferred = power $\times$ time	$E = Pt$
energy transferred = charge flow $\times$ potential difference	$E = QV$

Unit 3: Particle Model of Matter

Equations to Learn

density $= \dfrac{\text{mass}}{\text{volume}}$	$\rho = \dfrac{m}{V}$

Equations given in the exam

change in thermal energy = mass $\times$ specific heat capacity $\times$ temperature change	$\Delta E = mc\Delta\theta$
thermal energy for a change in state = mass $\times$ specific latent heat	$E = mL$
^ for a gas: pressure $\times$ volume = constant	$pV = constant$

Unit 6: Waves

Equations to Learn

wave speed = frequency $\times$ wavelength	$v = f\,\lambda$

Equations given in the exam

time period $= \dfrac{1}{\text{frequency}}$	$T = \dfrac{1}{f}$
^ magnification $= \dfrac{\text{image height}}{\text{object height}}$	$M = \dfrac{h_{image}}{h_{object}}$

* Higher tier only
^ Separate Physics only

Unit 4: Atomic Structure & Unit 8: Space

There are no equations in these sections of the course

Unit 7: Magnetism and Electromagnetism

Equations given in the exam

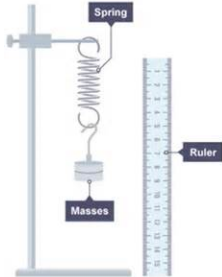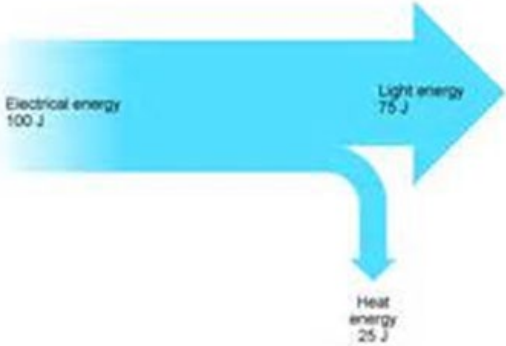|	
* Force = magnetic flux density $\times$ current $\times$ length of conductor in magnetic field	$F = BIl$
* $\dfrac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \dfrac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$	$\dfrac{V_P}{V_S} = \dfrac{N_P}{N_S}$
* ^ p.d across primary $\times$ current in primary = p.d. across secondary x current in secondary	$V_PI_P = V_SI_S$

Unit 5: Forces

Equations to Learn

weight = mass $\times$ gravitational field strength	$W = m\,g$
work done = force $\times$ distance (moved along the line of action of the force)	$W = Fs$
force = spring constant $\times$ extension	$F = ke$
moment of a force = force $\times$ distance (perpendicular to the direction of the force)	$M = Fd$
pressure $= \dfrac{\text{force normal to a surface}}{\text{area of that surface}}$	$p = \dfrac{F}{A}$
distance travelled = speed $\times$ time	$s = vt$
acceleration $= \dfrac{\text{change in velocity}}{\text{time taken}}$	$a = \dfrac{\Delta v}{t}$
$= \dfrac{\text{final velocity}-\text{initial velocity}}{\text{time taken}}$	$= \dfrac{v - u}{t}$
resultant force = mass $\times$ acceleration	$F = ma$
* momentum = mass $\times$ velocity	$p = mv$

Equations given in the exam

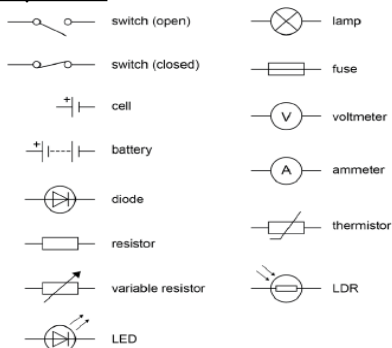|	
* ^ Pressure = height of column $\times$ density of liquid $\times$ gravitational field strength	$p = h\,\rho\,g$
^ (final velocity)^2 – (initial velocity)^2 = 2 $\times$ acceleration $\times$ distance	$v^2 - u^2 = 2as$
* ^ Force $= \dfrac{\text{change in momentum}}{\text{time taken}}$	$F = \dfrac{m\,\Delta v}{t}$

Energy CANNOT be created or destroyed

Energy types

* Gravitational Potential – Increased with height
* Kinetic Energy – Increased with speed
* Elastic Energy – Increased when stretched or squashed
* Thermal Energy – Gained when heated, often lost (wasted) to the surroundings

Energy Transfers

* Mechanically – When a force is applied
* Heating – When an object is heated
* Electrically – When an object is powered by electricity

A ball rolling down a hill: Gravitational Potential Energy is turned mechanically into kinetic energy

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Gravitational Energy $E_p = M \times G \times h$
(J) (Kg) (N/Kg) (m)

The higher an object or the more mass it has the more gravitational energy it has.

Kinetic Energy $E_k = \frac{1}{2} \times mass \times Velocity^2$
(J)   (Kg)   (m/s)

The faster and heavier an object the more kinetic energy it has.

Calculating Velocity
$E_p = M \times G \times H$
$= 2 \times 10 \times 3 = 60J$

$E_p = E_k \Rightarrow E_k = 60J$

$V = \sqrt{\frac{Ek}{\frac{1}{2} \times m}} = \sqrt{\frac{60}{\frac{1}{2} \times 2}} = 7.7 m/s$

2Kg

3m

Springs

When you add a force (weight) to a spring it extends.

Extension = Stretched length – original length

The energy stored in a spring can be calculate:

$E_e = \frac{1}{2} \times spring\ constant \times extension^2$
(J)   (N/m)   (m)

Power is a measure of how quickly energy is used. The shorter the time the more powerful it is.

Power = $\frac{Energy\ (J)}{Time\ (s)}$
(W)

Specific heat capacity (SHC)

The amount of energy needed to heat a 1Kg material by 1°C.

Heat Energy = Mass x SHC x Change in Temp
(J)   (Kg) (J/Kg°C)   (°C)

$C = \frac{E}{m \times \Delta\theta}$ $m = \frac{E}{c \times \Delta\theta}$ $\Delta\theta = \frac{E}{m \times c}$

This experiment only gives an estimate for the values calculated as energy is lost to the surroundings.

Heat Transfer

1.The higher the thermal conductivity of a material the higher the rate of heat transfer by conduction.

2. The more insulation a container/building has the slower the rate of heat transfer.

Renewable Sources of electricity
ALL turn a turbine to turn a generator.

* Wind (Wind turns a turbine)
* Hydroelectric (water turns a turbine)
* Waves/Tide (The sea turns a turbine)
* Geothermal (Heat from volcanoes used to boil water – make steam - turn a turbine)
* Biomass (Living material burnt to boil water)

Advantages of ALL
*Don't give out CO_2 which causes global warming
* Renewable (will NOT run out)
Disadvantages
They are **all** more expensive than fossil fuels
* Wind – Not always windy
* Hydroelectric – Can damage habitats
* Waves/Tides – Can damage habitats
* Geothermal – Only a few places on Earth
* Biomass – Carbon neutral (gives out CO_2 when burnt).

Electrical energy
100 J

Light energy
75 J

Heat energy
25 J

Efficiency $= \frac{Useful\ Energy\ Out}{Total\ Energy\ In} \times 100$

Efficiency $= \frac{Useful\ Power\ Out}{Total\ Power\ In} \times 100$

Answers for efficiency must be written as a percentage or a decimal. E.g 80% or 0.8

Static Electricity (Triple only)
Examples: Hair standing up after taking a jumper off, rubbing a balloon on your hair.

Static electricity is a build up of negative charges (electrons) which are then released. An object is charged if electrons are added or removed.

Circuit Symbols

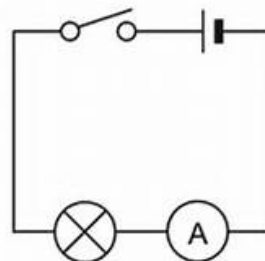|	
switch (open)	lamp
switch (closed)	fuse
cell	voltmeter
battery	ammeter
diode	thermistor
resistor	LDR
variable resistor	LED

Current
Current is the flow of charge (electrons) around a circuit.
* It is measured in Amps (A)
* It is measured using an Ammeter
* In a series circuit the current is the same everywhere.
* In a parallel circuit the current splits at each branch. The current through the cell is equal to the current through all the branches added together.

The ammeter must be placed in the circuit to take a reading.

Potential Difference (Voltage)
Potential Difference is the amount of energy transferred to a component by each unit of charge.
* It is measured in Volts (V)
* It is measured using a Voltmeter
* In a series circuit the PD of the cell is shared between all the components. The component with the highest resistance receives the most PD.
* In a parallel circuit each branch receives the same PD as the cell.

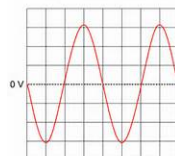The voltmeter must be placed in parallel with a component in order to measure the PD across it.

Resistance
Resistance is the measure of how hard it is for current to pass through a component.
* It is measured in Ohms (Ω)
* It is calculated using R=V/I
* If you add resisters in series the resistance increases, if you add resistance in parallel the resistance decreases.

AC & DC
* Alternating Current (AC) the current changes direction. UK mains supply is 230V and 50Hz.

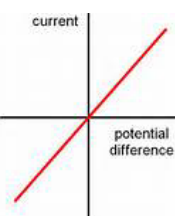* Direct Current (DC) flows in the same direction. DC comes from a battery or from a AC supply which has passed through a diode.

* The trace works like a graph, with time on the x-axis and voltage on the y-axis.

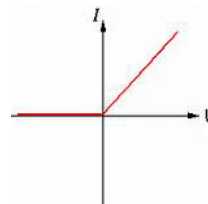## I-V Curves (Current-Voltage curves)

Fixed Resistor   **Filament Bulb**   **Diode**

* Fixed Resistor – Straight line shows it is a constant resistance. The steeper the line the lower the resistance.
* Filament Bulb – Resistance increases as the bulb heats up and ions vibrate more.
* Diode – Only allows current to flow in one direction.
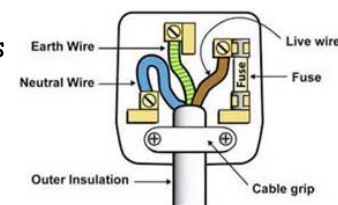
Thermistors and LDR's
They have the same shaped graph

* LDR's – Street lighting, cameras
* Thermistors – Ovens, fridges, central heating

Electrical Safety

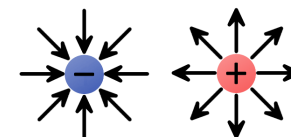The plug and wires are coated in plastic which doesn't conduct electricity.

Safety Devices
* Earth Wire – Only needed for devices with a metal casing. Provides a safe route for the current if the live wire touches the casing.
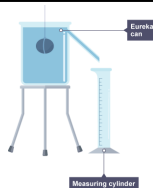
Electrical fields (Triple only)
Field lines travel away from the positive and towards the negative.

The closer you are to the charge, the stronger the electrical field

Density:

Density = $\dfrac{\text{Mass (kg)}}{\text{Volume (m}^3)}$ (kg/m³)

Calculating the density of an irregular shape, can be done using a Eureka can and measuring the volume of water displaced.

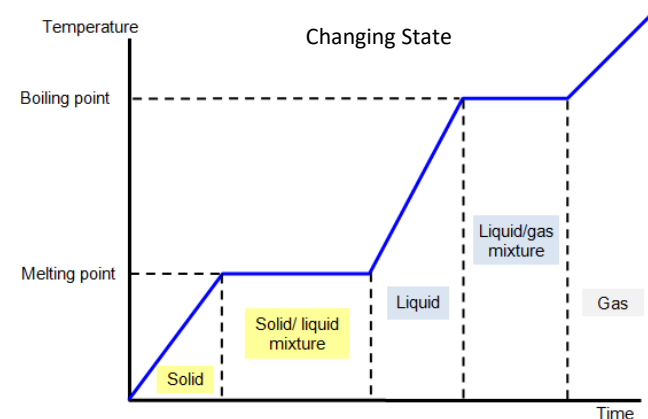| State of matter	Diagram of structure	Movement of particles	Can it be compressed?	Density
Solid		Vibrate around a fixed position. They don't have enough energy to move apart	No, the particles have no space between them to move into.	High, there are lots of particles in a unit of area.
Liquid		They have enough energy to move from place to place but are still attracted to each other	No, the particles have no space between them to move into.	Quite high, there are lots of particles in a unit of area.
Gas		The have so much energy that they are not attracted to each other. Collisions with containers cause pressure.	Yes, the particles have lots of space between them to move into.	Low, there are few particles in a unit of area.

Internal Energy

The energy in a substance is stored in its particles, this is called internal energy.

Internal energy = kinetic energy + potential energy.

Temperature: This is linked to the kinetic energy of the gas. The <u>higher</u> its temperature the <u>higher</u> its kinetic energy.
If the temperature remains constant so does the kinetic energy of the particles.

Changing State

When a material changes state (melting or boiling) its internal energy increases, but its <u>temperature does not.</u> This means that its kinetic energy remains constant until it has changed state.

Changing State

Specific Latent Heat

The specific latent heat of a substance is the energy needed to change 1kg of the substance with no change in state.

Energy = Mass × Specific Latent Heat
   (J)   (kg)   (J/kg)

$E = m \times L$

Specific heat of fusion: when turning from a solid into a liquid
Specific heat of vapourisation: when turning from a liquid into gas

Pressure and volume

Pressure × Volume = constant
   (Pa)   (m³)
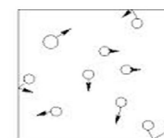
so $P_1 \times V_1 = P_2 \times V_1$

<u>Increasing</u> the volume of a gas (making the container bigger) whilst keeping the temperature constant will <u>decrease</u> the pressure of the gas.

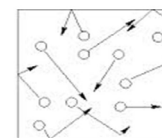Low pressure   High pressure

Temperature and pressure

Increasing the temperature of a gas increases the kinetic energy of the gas particles, this increases the number of collisions with the surface, this increases the pressure acting on the sides of the container.

Temperature and gas

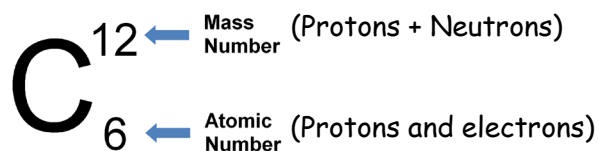Cool gas, fewer and less energetic collisions

Hot gas, more and more energetic collision

Particles move in <u>different directions</u> with a <u>range of speeds.</u>

As the particles hit the side of the container they create a net force which acts at right angles to the

Atoms

$$\text{C}^{12}_{6}$$

$\leftarrow$ **Mass Number** (Protons + Neutrons)

$\leftarrow$ **Atomic Number** (Protons and electrons)

Number of Neutrons =
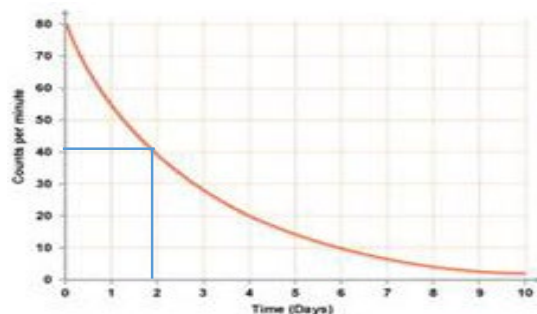Mass Number – Atomic number (12 - 6 = 6)

Isotopes: An isotope is an atom with the <u>same</u> number of protons but <u>different</u> number of neutrons.

Ions: An atom that has gained (positive ion) or lost (negative ion) electrons.

Some atoms are radioactive, they give out radiation from the nucleus. This is measured in Becquerels (Bq)

Alpha, Beta & Gamma

Name	What it is	What is its charge	What is its mass	Ionising Power	Absorbed by
Alpha	Helium nucleus	+2	+4	High	Paper/air
Beta	Electron	-1	Tiny	Medium	Thin steel
Gamma	EM Wave	0	0	Low	Thick Lead

Alpha Decay (Atomic number -2, mass number -4)

$$^{238}_{92}\text{U} \rightarrow {}^{234}_{90}\text{Th} + {}^{4}_{2}\alpha$$

Beta Decay (Atomic number +1, mass number 0)

$$^{14}_{6}\text{C} \longrightarrow {}^{14}_{7}\text{N} + {}^{0}_{-1}\beta$$

Atomic Structure

1. In 1901 JJ Thompson suggested the '**plumb pudding**' model for the atom. With negative particles stuck in the middle of positive charge

2. In 1909 Rutherford changed the accepted model using his alpha scattering experiment.

3a. He fired alpha particles at a sheet of gold foil.
3b. He expected them all to pass straight through
3c. Rarely one would bounce back
3d. This proved that the center of the atom was very small, held most of the mass and had a positive charge.
3e. The current model of the atom that we use today was born.

Half-life

The half-life of a radioactive source is **the time taken for half the material to decay**.
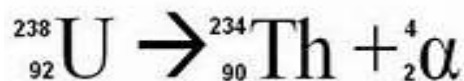

The half-life of the material above is 2 days.
The starting count was 80 half of it = 40
The time to get to 40 was 2 days.

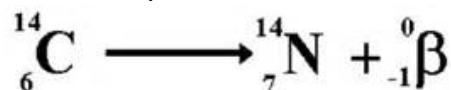In this example it would take: 2 days to get to get to 50%, 4 days to 25%, 6 days to get to

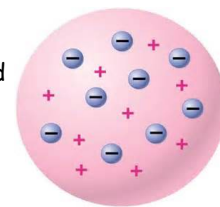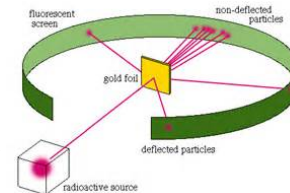## Nuclear fission (Triple Only)
1. Large radioactive atoms split in half (fission) because they are unstable.
2. When this happens a huge amount of <u>energy</u> is released.
3. <u>Neutrons</u> are released which hit and split more atoms, this is called a **chain reaction**.
4. This is the source of a nuclear power station or nuclear bomb's energy
5. Unfortunately a lot of <u>radioactive waste</u> is produced which stays radioactive for 1000's of years.

Nuclear Fusion (Triple Only)
1. Small light nuclei are forced together under huge heat and pressure – such as in the **core of the sun**.
2. The nuclei <u>repel</u> each other as they are both <u>positively</u> charged so it is hard to get them to fuse.
3. If the temperatures and pressures are large enough the nuclei will fuse to create a larger nuclei
4. A huge amount of <u>energy</u> is released
5. Fusion <u>doesn't</u> produce any radioactive waste
6. Scientists are yet to develop the technology to allow fusion to be used to produce electricity.

Radioactivity (Triple Only)
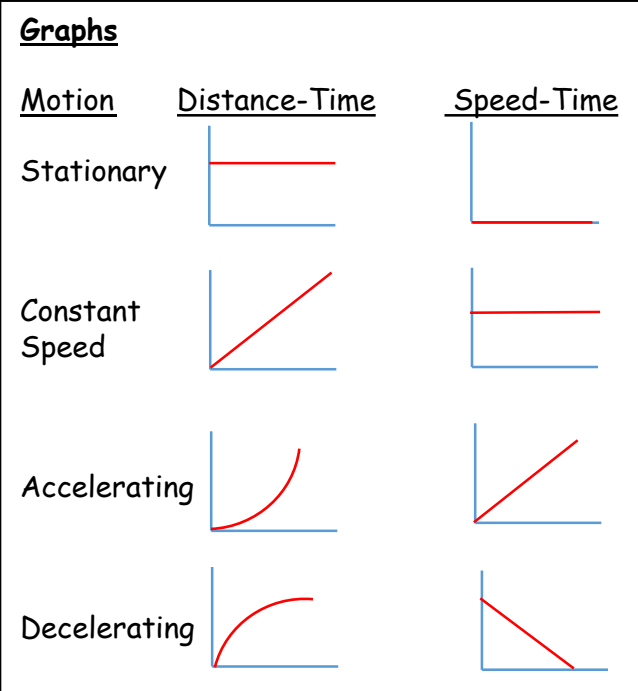Radioactive atoms decay and release ionizing particles (alpha, beta and gamma)

There is a constant level of naturally occurring radiation all around us, this is known as '**background radiation**'. This is <u>random</u> when measured.

Background radiation comes from rocks, the air, our food and the sun. Very little comes from <u>man-made</u> devices such as powerstations.

Radiation is **ionizing**, this means it can damage your DNA and in large doses can cause cancer. It can also be used to kill cancerous cells.
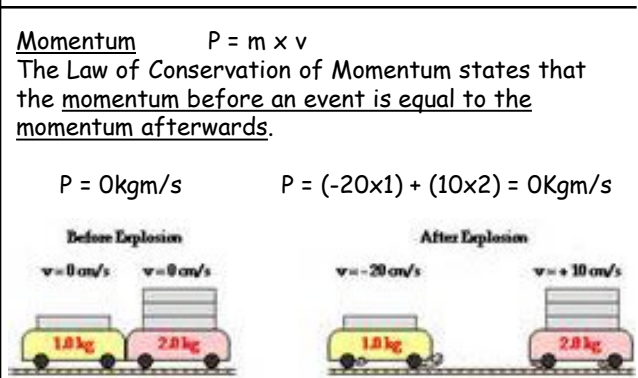
Professionals working with radioactive sources protect themselves using lead glass.

Contamination is when the source is inside you
Irradiation is when the source is outside you

AQA Science: Physics Unit 5 Revision Notes – Forces and Motion

Graphs

Motion	Distance-Time	Speed-Time
Stationary		
Constant Speed		
Accelerating		
Decelerating		

Velocity, Acceleration & Weight

Velocity means speed with a direction. Units: m/s

Acceleration means the rate of change of velocity. Units: m/s^2

Weight = Mass x Gravity (gravity = 10) (N)

Forces
Every force has a reaction force which is <u>equal</u> in size, <u>opposite</u> in direction and acts on a <u>different</u> object

Movement
Objects move by applying a force in one direction, the reaction pushes them in the opposite

Springs (Hooke's Law)

When you add a force (weight) to a spring it extends.

Extension = Stretched length – original length

Force = Constant x Extension (N)   (N/m)   (m)

<u>Elastic limit/limit of proportionality</u>. After this point it is permanently deformed

<u>Proportional (Straight line)</u>

Falling Objects
1. When an object is dropped it <u>accelerates</u> **as the force of <u>gravity</u> is larger than the force due to <u>air resistance.</u>**
2. **As it gets <u>faster</u> the <u>air resistance</u> increases.**
3. **Eventually the force due to <u>air resistance</u> is <u>equal</u> to the force due to <u>gravity</u>. This is known as <u>terminal velocity.</u>**
4. At terminal velocity the <u>resultant force is zero.</u>
5. The object remains at a <u>constant speed.</u>

Momentum   P = m x v
The Law of Conservation of Momentum states that the <u>momentum before an event is equal to the momentum afterwards</u>.

P = 0kgm/s   P = (-20x1) + (10x2) = 0Kgm/s

Car Safety

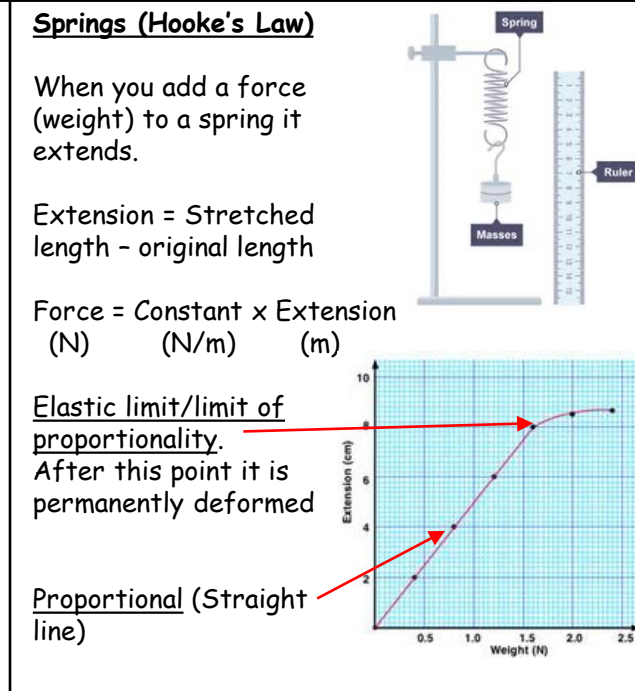**Stopping Distance = Thinking Distance + Braking Distance**

Thinking Distance is the <u>distance</u> travelled before the driver has reacted.
Affected by: Alcohol, drugs, tiredness, age.

Braking Distance is the <u>distance</u> travelled whilst the brakes have been applied.
Affected by: Weather conditions (Ice/Snow), condition of the tyres/brakes, road surface.

<u>Safety Devices – Seat belts, airbags, crumple zones</u>

These devices make the <u>time</u> taken to slow down in the event of a crash <u>longer</u>, which makes the <u>force</u> felt by the driver <u>smaller.</u>

Reaction time
Reaction time for an adult is between 0.2s and 0.9s. It can be tested using a stopwatch.

Moments & Levers (Triple Only)
Moment = Force x perpendicular distance
If an object is balanced then the clockwise moment is equal to the anti-clockwise moment.

Levers and gears are used to transmit and magnify the force applied.

Pressure in a fluid (Triple Only)
A fluid (liquid or gas) causes a force at right angles to any surface that touches it.

The deeper an object is in a fluid the greater the pressure, this is because there are more particles above it pressing down on it.
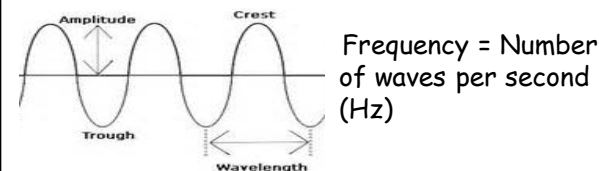
The pressure on the underside of a submerged object is greater than the pressure on top, this causes a resultant force = upthrust
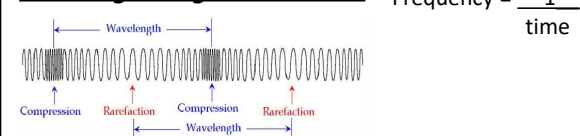
Wave types

Transverse: The particles move perpendicular to the direction of travel of the wave.
Examples: All EM spectrum eg radio, UV. S-wave

Longitudinal: The particles move parallel to the direction of travel of the wave.
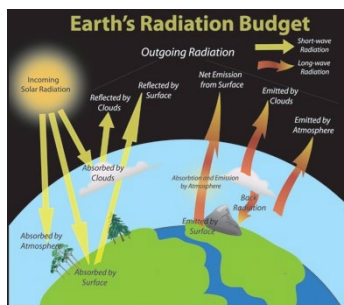Examples: Sound, P-waves

Labelling a transverse wave

Frequency = Number of waves per second (Hz)

Labelling a longitudinal wave

$$Frequency = \frac{1}{time}$$

Electromagnetic Spectrum

* They travel at the speed of light (3×10^8 m/s)
* They are all transverse waves
* They can all be reflected
* They can all be refracted

Gamma rays have the most energy and highest frequency, radio the lowest.
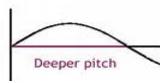Radio has the longest wavelength.

Uses
Radio – TV and Radio
Microwaves – Satellite communication
Infrared – Cooking food, remote controls
Visible – To see, fibre optics
x-rays and gamma – Medical imaging and treatments

Reflection

The image created by a mirror is:
* Virtual
*Equal in size
*Equal in distance
* Right way up

Refraction

*Light slows as it enters a denser medium (glass).
*It bends towards the normal
* Light speeds back up as it leaves the glass and bends away

Black body radiation (Triple Only)
All objects emit and absorb infrared radiation.
If it absorbs more than it emits the object's temperature will increase.
A perfect black body will emit and absorb all wavelengths of radiation.
The hotter a body the higher frequency of radiation it will emit – hotter object appear white/blue cooler ones red.

The Earth
If the radiation absorbed by the Earth is greater than the radiation emitted, the Earth's temperature will increase, this is global warming.

Sound (Triple Only)
* Sound is a longitudinal wave.
* It travels MUCH slower than light
* Sound travels faster in solids, slowest in gases.
* It needs a medium (particles) to travel through, it will not pass through a vacuum.
* Reflected sound is called an echo.
* The range of human hearing is 20-20000Hz

* Large amplitude = Loud

* High frequency = High pitched

Uses of sound
Ultra sound (sound above the range of human hearing) can be used to produce images of the body.
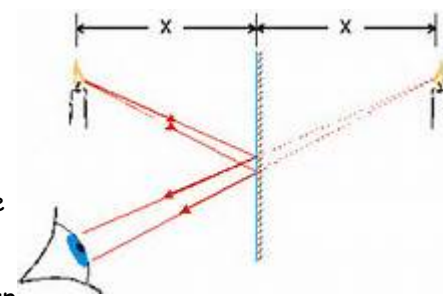
Seismic Waves (Triple Only)
P-waves pass through solids **and** liquids, S-waves only pass through solids. This allows us to build up a picture of the Earths inner structure
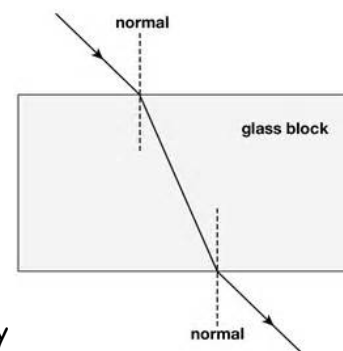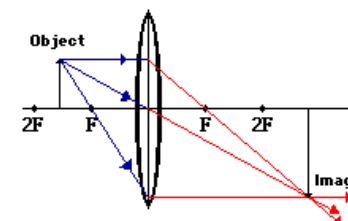
Lenses (Triple Only)
Convex lenses bring parallel rays of light to a focus.
The image produced can be real or virtual.
Concave lenses always produce a virtual image.

The image produced is real (the rays meet), upside down and magnified (The image arrow is bigger than the object)

Visible Light (Triple Only)
A red object absorbs all wavelengths of light except red which is reflected. If all wavelengths are reflected the object will appear white, if all wavelengths are absorbed the object will appear black.
A red filter will absorb all wavelengths of light except red which is transmitted.
If a red filter is placed next to a green one no light will pass through, it will look black.

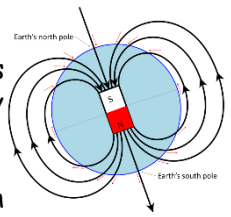## Permanent and Induced Magnets

Permanent magnets always have a magnetic field around them.
North pole and north pole – repel
South pole and south pole – repel
North pole and south pole - attract

Induced magnets are materials **(iron, steel, nickel and cobalt)** which become magnetic when they are placed in a magnetic field. They lose their magnetism when they are removed from the field.
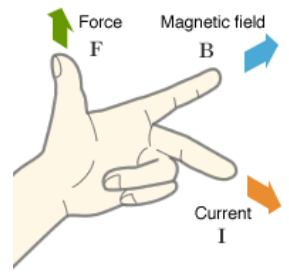Induced magnets always attract!

The Earth's liquid iron core produces a magnetic field. It's south magnetic pole is actually at the Earth's geographical North pole. So the north pole of a compass points north

Magnetic Fields

Magnetic field lines always point north to south.

We can plot the field lines by using:
a) iron filings
b) Plotting compasses.

The strongest part of a magnetic field is at the poles, you can see this as the field lines are closest together.

The further away you move from the pole the weaker the magnetic field becomes.

The Motor Effect

When an electrical current passes through a wire it produces a magnetic field in the direction shown in the diagram.

The larger the electrical current the stronger the magnetic field produced.

Solenoid
Coiling the wire to form a solenoid produces a magnetic field similar to a bar magnet.
The strength of the magnetic field can be increased by increasing the current or adding an iron core

Fleming's Left Hand Rule

If a wire carrying a current is placed in a magnetic field they both exert a force on each other. The force on the wire is shown using Fleming's Left Hand rule.

Electric Motor

If a loop of wire is placed within a magnetic field it will rotate.
The commutator changes the direction of the current around the loop every half turn, this ensures that it will continue to rotate. The current must be DC!!
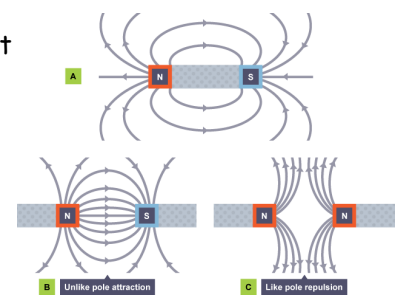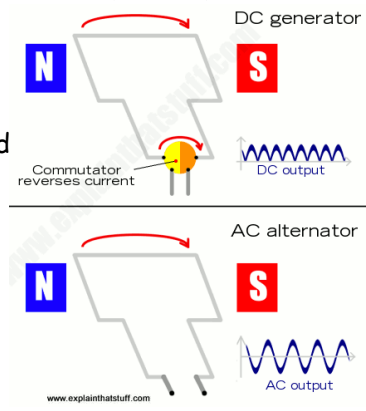
The Generator Effect (Triple Only)

As a coil of wire spins in a magnetic field an electrical current is produced

An alternating current (AC) is produced, unless a commutator is used which only allows the current to travel in one direction. This is a direct current (DC).
The current produced can be increased by:
* Spinning the coil faster
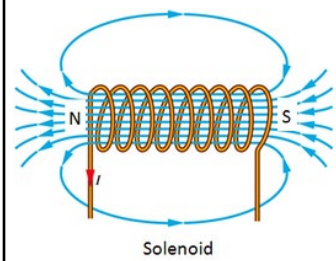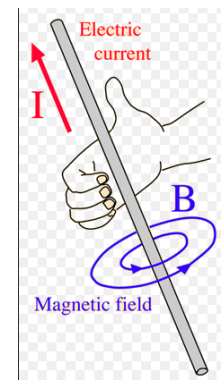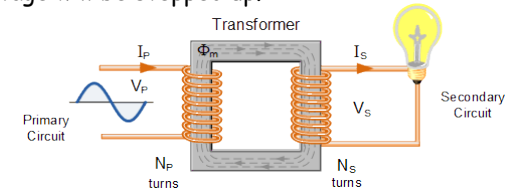* Having more coils
* Stronger magnetic field.

The current produces a magnetic field which opposes the original change in direction.

Transformers (Triple Only)

Transformers increase (step-up) or decrease (step-down) the voltage.
If there are more coils in the secondary side the voltage will be stepped up.

Transformers are used to step-up the voltage, which reduces the current, this makes it more efficient as less energy is wasted as heat. Step-down transformers are then used to make the voltage safe for public use.

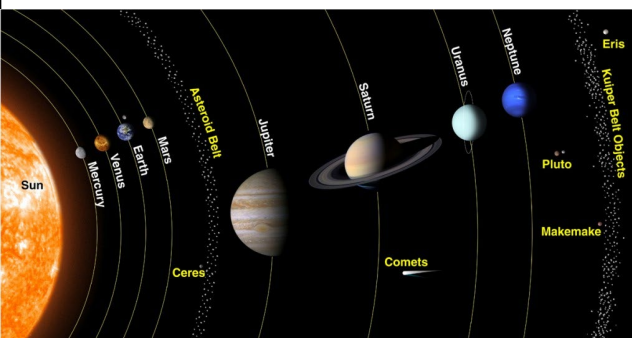If we assume that the transformer is 100% efficient then;

$$Power_p = Power_s$$
$$So: \quad I_p \times V_p = I_s \times I_s$$

The Solar System

Our star the sun is orbited by planets, dwarf planets, asteroids and comets. Moons orbit the planets. These are all natural satellites.

The sun was formed from a nebula pulled together by gravity 5 billion years ago.

Life-cycle of a star

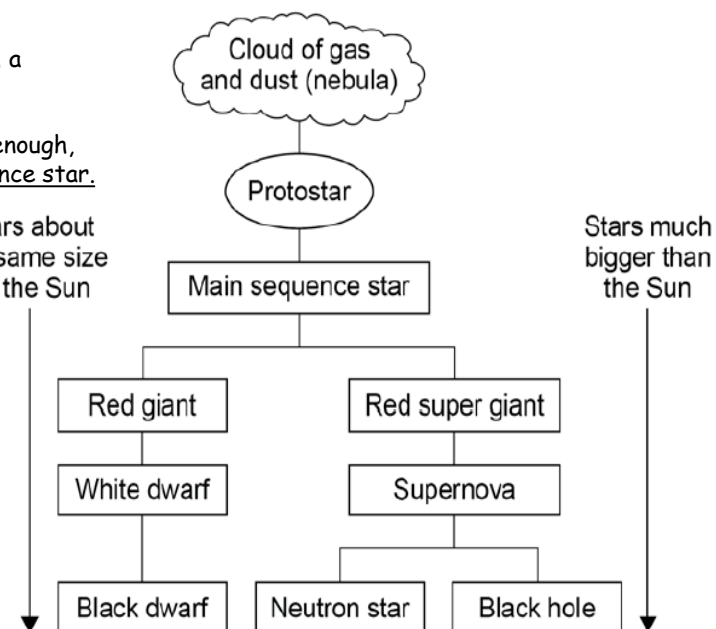* Gravity pulls dust together in a nebula to form a Protostar.

* When the temperature and pressure is great enough, nuclear fusion begins turning it into a mainsequence star.

* When the hydrogen runs out the star collapses as gravity is greater than the pressure from fusion. Heavier elements start to fuse expanding the star to form a red giant.

* When the heavier elements run out the star becomes either a white dwarf or explodes in a supernova depending on its size.

* The very largest mainsequence stars will eventually become black holes. Slightly smaller stars become neutron stars
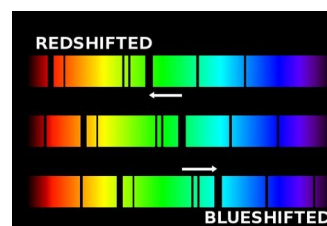

Making Elements

All elements up to iron are made through the fusion of smaller elements in the cores of stars. The larger and hotter the star the heavier the elements it can fuse.

All elements heavier than iron are fused during a supernova explosion. This then distributes these elements across the Universe.

Objects in Orbit

All objects in orbit are accelerating and their velocity is changing, this is because their direction is always changing. If it is a circular orbit then the speed will be constant.

If the speed of the object in orbit increases then the radius of the orbit must increase in order to keep it stable. If the speed reduces the radius must also reduce.

Redshift

Light from a star or galaxy can be used to produce an absorption spectrum. This includes absorption lines, Which indicate the elements present.

If a star or galaxy is moving towards us then the light from it shows a blueshift.

If the star or galaxy is moving away from us then it shows a red-shift.
ALL GALAXIES SHOW RED-SHIFT

The further away a galaxy is the faster it is moving away from us. We know this as it shows more redshift.

This proves that the universe is EXPANDING, this provides evidence for the BIG BANG theory.

The Big Bang theory

The Big Bang Theory suggests that the Universe started with a very small hot, dense region and has been expanding ever since.

This is supported by evidence from the red-shift of galaxies, observations of certain types of supernova and CMBR.

Cosmic Microwave Background Radiation (CMBR) is the left over radiation from the Big Bang and provides further evidence for the theory.

Evidence

Measurements have shown that the expansion of the Universe is increasing in speed.

Theories about Dark Mass and Dark Energy help to explain these observations, however more evidence is needed to confirm these ideas.