This is your starting point . . .

SP

. . . the end is up to you!

'I will take responsibility for my learning, be intellectually curious and work independently at school and at home.'

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Year 11

SCIENCE: PHYSICS

EXAM BOARD: AQA **COURSE CODE: 8463**

TOPIC NUMBER	TOPIC
1	ENERGY
2	ELECTRICITY
3	PARTICLE MODEL
4	ATOMIC STRUCTURE
5	WAVES
6a	FORCES
6b	FORCES IN MOTION
7	MAGNETISM AND ELECTROMAGNETISM
8	SPACE PHYSICS (TRIPLE ONLY)

- The contents of the SP is taken directly from the exam specification.
- Learning and quizzing yourself on this information will increase your grades in science.
- Staff will set you sections to learn for homework and test you in lessons.
- The best ways to learn the information are to use 'look, cover, write, check' or to make flashcards.
- Please look after this document a replacement will incur a charge.
- Combined science students please do not learn the boxes marked 'triple only'.

Name: .... Tutor Group: ....

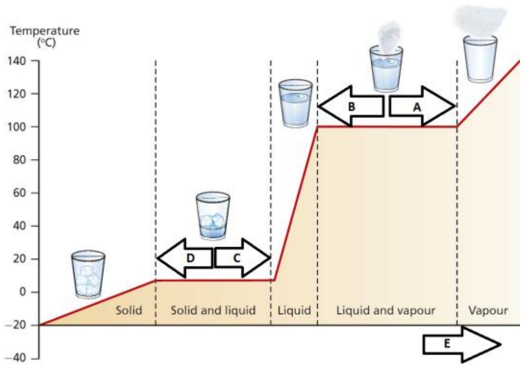
Physics Topic 1: Particle model

1. Density

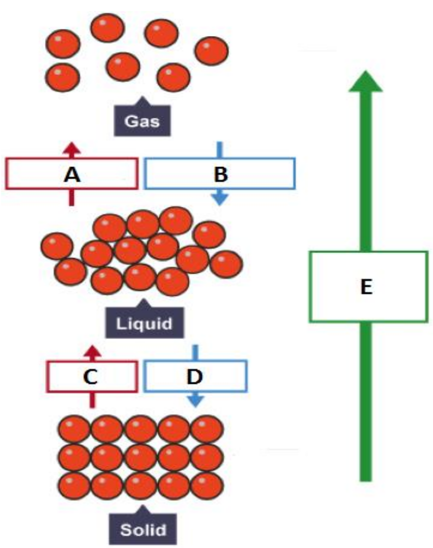
$$\rho = \frac{m}{V}$$

Symbol	Meaning	Unit
ρ	density	kg/m^3
m	mass	kg
V	volume	m^3

2. Changes of state



A. Evaporation/ Vaporisation
B. Condensation
C. Melting/ Fusion
D. Freezing
E. Increasing internal energy



3. The specific heat capacity

Energy transferred, ΔE (joules, J) **=** **mass, m** (kilograms, kg) **x** **Specific heat capacity, c** (joule per kilogram per degree Celsius, J/kg°C) **x** **Temperature change, Δθ** (degree Celsius, °C)

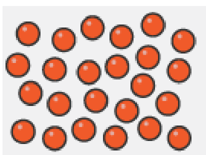
To find the specific heat capacity of a substance the equation can be rearranged to: $c = \frac{\Delta E}{m\Delta\theta}$

4. The specific latent heat

Energy transferred, ΔE (joules, J) **=** **mass, m** (kilograms, kg) **x** **Latent heat, L** (joule per kilogram J/kg)

To find the specific latent heat of a substance the equation can be rearranged to: $L = \frac{\Delta E}{m}$

5. Gas properties

Diagram	
Arrangement of particles	Randomly arranged Far apart
Movement of particles	Brownian motion
Energy of particles	Very high energy
Density of substance	Very low density

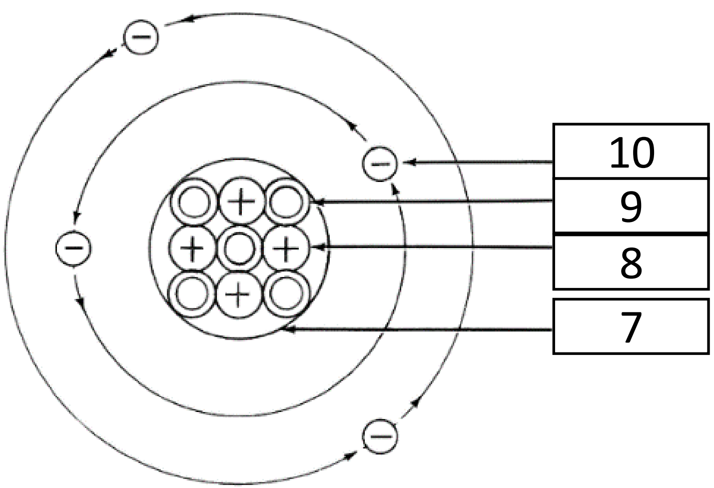
6. Pressure in gases (TRIPLE ONLY)

change	effect	reason
Increase Pressure	Increase volume	More particles so more collisions Increase the force stretching the balloon until the forces balance
Decrease pressure	Decrease volume	Less particles so less collision. Decrease the force causing the balloon to contract until the forces balance
Formula	**pV=constant**	**If fixed mass and constant temperature**

Physics topic 2: Atomic structure

1. Keywords

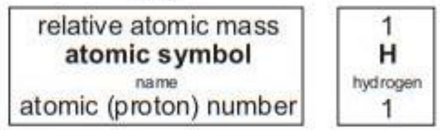
1. Atom	The smallest possible piece of an element. Has a radius of 0.1nm (or 1×10^{-10}m).
2. Element	A substance in which all the atoms have the same atomic number.
3. Isotope	Atoms with the same number of protons but different numbers of neutrons.
4. Molecule	Two or more atoms bonded together
5. Compound	Two or more different atoms bonded together
6. Mixture	At least two different elements or compounds together. Can be separated easily.
7. Nucleus	The centre of an atom. Contains protons and neutrons
8. Proton	A positively charged particle found in the nucleus
9. Neutron	A neutral particle found in the nucleus. Has no charge
10. Electron	A negatively charged particle found in energy levels (shells) around the nucleus



2. Properties of sub-atomic particles

Particle	Relative mass	Relative charge	Location
Proton	1	+1	Nucleus
Neutron	1	0	Nucleus
Electron	0	-1	Shells

Key

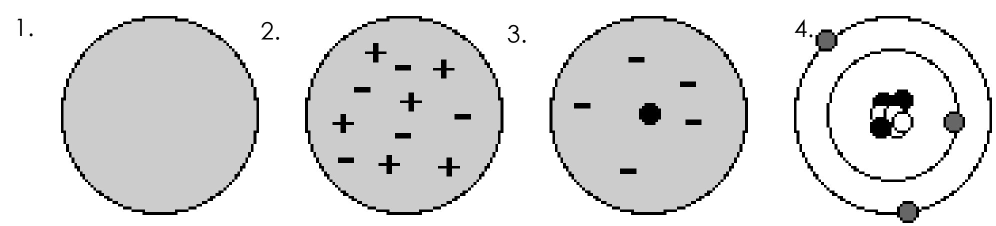


3. Using the periodic table

Number of..	Is the…	Found by..
Protons	Atomic (proton) number	Smaller number on periodic table
Electrons	Atomic (proton) number	Smaller number on periodic table
Neutrons	Difference between the atomic mass and atomic number	Big number – small number

4. History of the atom

Discovery	By	Model	Diagram
Solid particle called atom	John Dalton	Particle: solid spheres	1
The electron	JJ Thompson	Plum pudding: positive 'cake' with negative 'plums'	2
Nucleus	Rutherford	Nuclear: Positive nucleus surrounded by electrons	3
Neutron	James Chadwick	Nuclear: Now with protons and neutrons in nucleus	3
Energy levels (shells)	Niels Bohr	Planetary: Electrons now 'orbit' in different shells	4



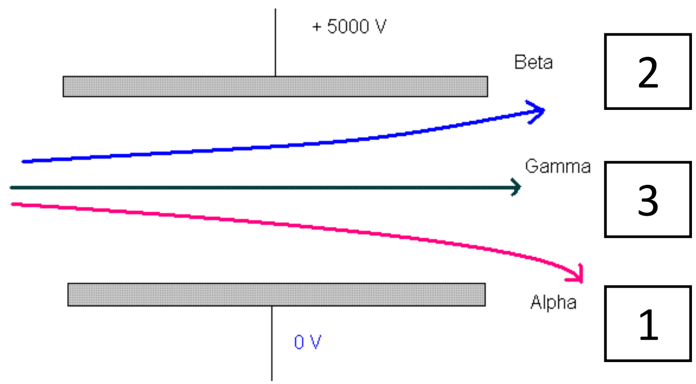
5. Radioactive decay keywords

Unstable	The ability for a nucleus to decay
Radioactive decay	The RANDOM process of radiation being released by a nucleus. A different element in formed
Nuclear radiation	The energy and particles released when an unstable nucleus decays
Activity	How quickly a radioactive sample decays
Becquerel	The unit of activity
Geiger-Muller tube	A device to measure the count rate of a radioactive source
Count rate	The number of radioactive decays per second
Ionising power	How well it knocks off electrons and damages cells
Half life	The time it takes half of a group of radioactive nuclei to decay
Radioactive contamination	Unwanted hazardous materials containing radioactive atoms
Peer review	When the findings of one expert are double checked by another expert to make sure they are correct

7. Background radiation (TRIPLE ONLY)

Background radiation is the radiation all around us all the time

Natural sources:	Man-made sources:
• Rocks	• Fallout from weapons testing
• Cosmic rays	• Fallout from nuclear incidents



6. Ionising radiation

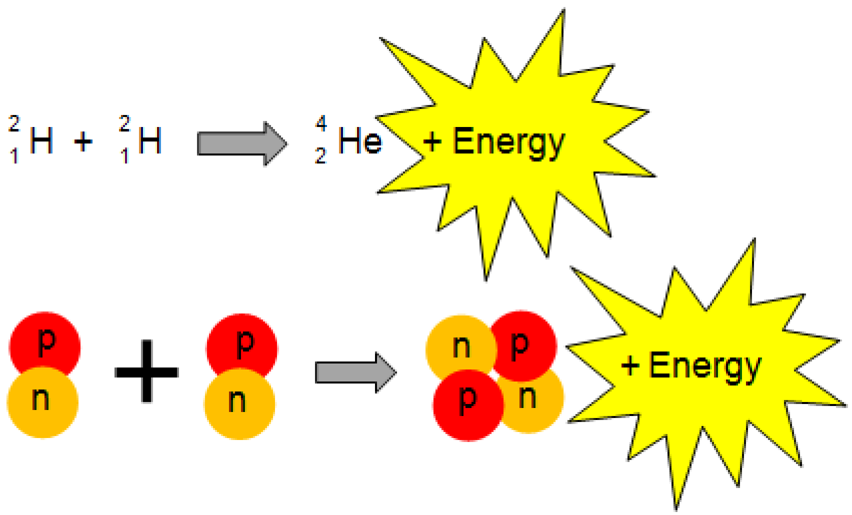
	Name	Symbol	Made of	Charge	Range in air	Penetration	Ionising power
1	Alpha	α	Helium nucleus $^{4}_{2}He$	**+2**	5 cm	Blocked by paper and skin	High
2	Beta	β	Fast moving electron $^{0}_{-1}e$	**-1**	15 cm	Blocked by thick aluminium	Medium
3	Gamma	γ	Electromagnetic wave	N/A	Very long	Blocked by thick lead	low

8. Uses of nuclear radiation (TRIPLE ONLY)

Use	Half life	Penetration power	Ionising power	Preferred emitter
Exploring internal organs	A few hours	Med-high	Low	Gamma
Radiotherapy	A few years	High	Med/Low	Gamma (or Beta)

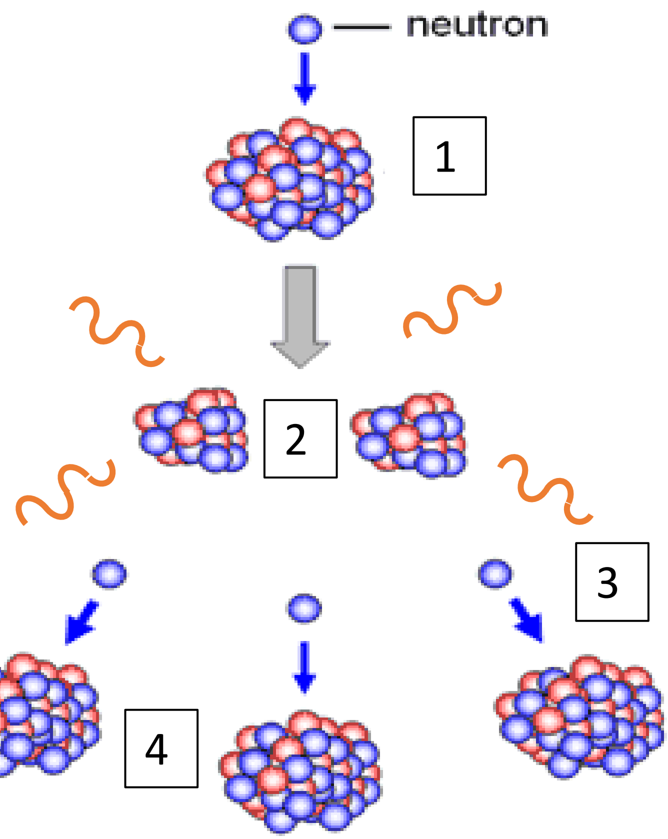
9. Nuclear Fission vs Fusion (TRIPLE ONLY)

Nuclear fission	When a large nuclei breaks into smaller nuclei releasing energy	E.g: • Nuclear power stations • Atomic bombs • The core of the Earth
Nuclear fusion	When small nuclei join together to form larger nuclei. Some mass in converted into energy	E.g: • The Sun • Hydrogen bombs



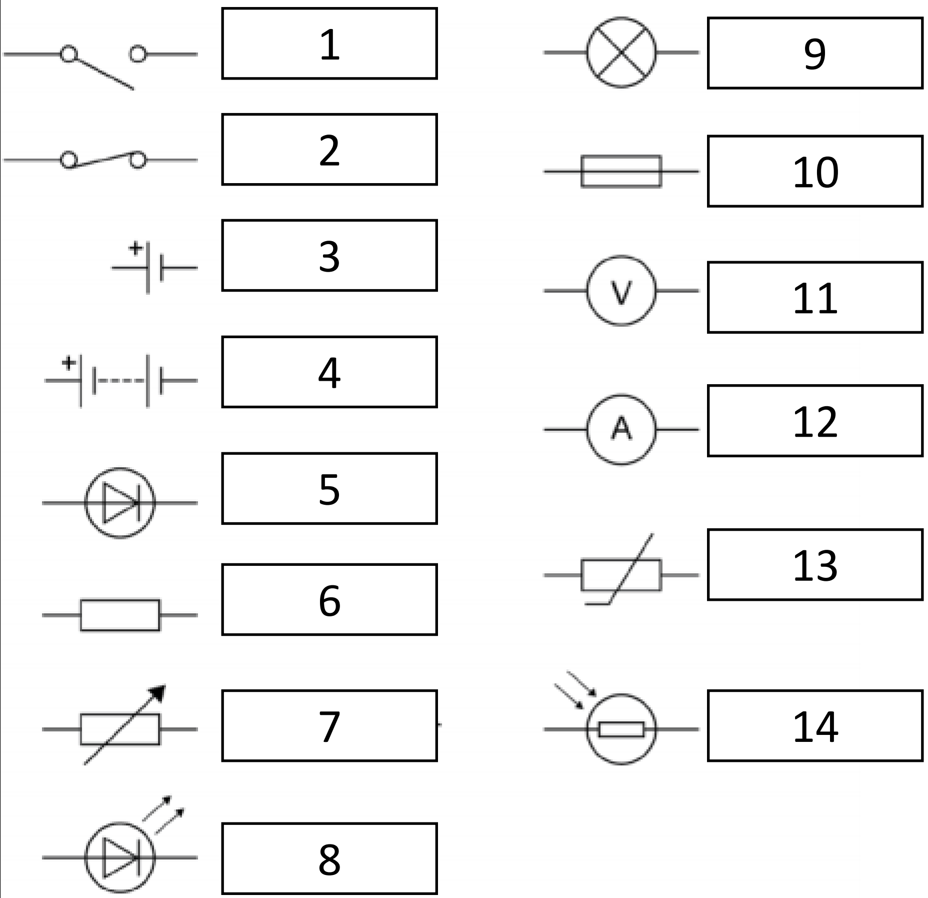
10. Nuclear fission (TRIPLE ONLY)

1	A slow neutron hits the nucleus
2	The nucleus becomes unstable and splits roughly in half
3	3 neutrons and gamma rays are released
4	These neutrons hit other nuclei causing a chain reaction
5	If this is uncontrolled then it will result in an explosion



Physics topic 3: Electricity

1. Standard circuit diagram symbols



1	Switch (open)	8	LED (light emitting diode)
2	Switch (closed)	9	Lamp (bulb)
3	Cell	10	Fuse
4	Battery	11	Voltmeter
5	Diode	12	Ammeter
6	Resistor	13	Thermistor
7	Variable resistor	14	LDR (light-dependent resistor)

2. Electrical charge and current

Charge flow = current x time
$Q = I \times t$

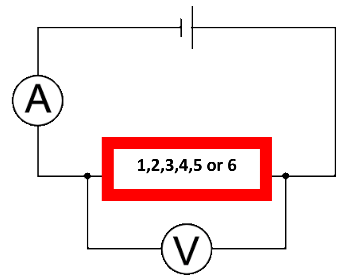
Q = Charge (in coulombs C)
I = Current (in amps A)
t = Time (in seconds s)

3. Resistance

Potential difference = current x resistance
$V = I \times R$

V = Potential difference/voltage (in volts V)
I = Current (in amps A)
R = Resistance (in ohms Ω)

4. IV characteristics and required practical



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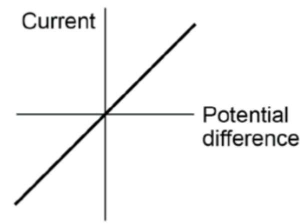

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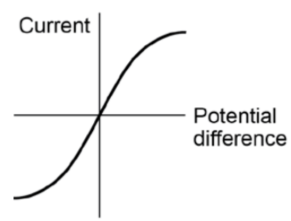

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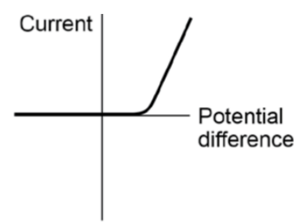

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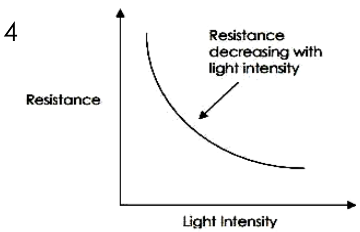

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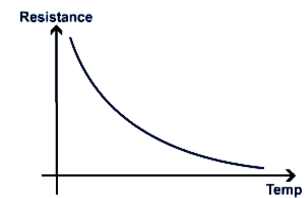

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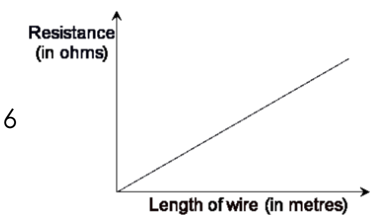
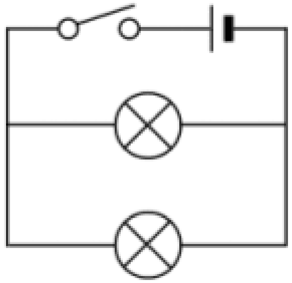


1	Ohmic resistor
2	Filament bulb
3	Diode
4	LDR
5	Thermistor
6	Resistance in a wire

5. Series and parallel circuits

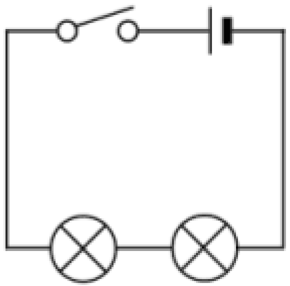
Parallel Circuits

- The current splits at the junction.
- The voltage is the not shared.



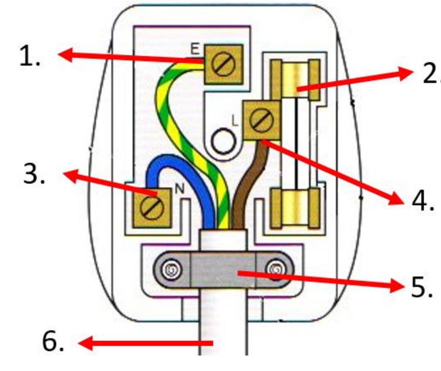
Series Circuits

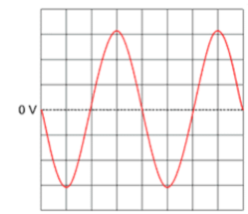
- The current does not split and is the same everywhere
- The voltage is shared
- $R_{TOTAL} = R_1 + R_2 + R_3 \ldots$



6. Mains electricity keywords

1. Earth wire	Prevents danger from short circuits
2. Fuse	Melts if current gets too high
3. Neutral wire	Carries the current away from plug
4. Live wire (230v)	Carries current to plug
5. Cable grip	Prevents a loose wire if cable is pulled
6. Double insulated cable	Prevents electric shock
7. Alternating current (AC)	Current which changes direction 50 times a second (50 Hz). Found in the mains.
8. Direct current (DC)	Current that only travel in one direction. Found in batteries.





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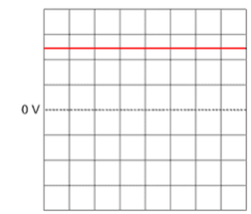


8.

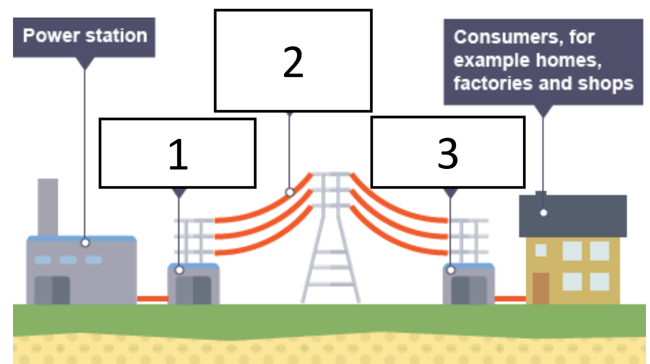
7. Electrical power

power = current^2 x resistance	$P = I^2R$
power = current x potential difference	$P = IV$
energy transferred = charge flow x potential difference	$E = QV$

Symbols and their units

Symbol	Meaning	Unit	Meaning
V	Potential difference	V	Volts
I	Current	A	Amps
R	Resistance	Ω	Ohms
Q	Charge	C	Coulombs
P	Power	W	Watts
E	Energy	J	Joules

8. The National grid



1.Step up transformer	Increase the voltage of the AC
2.High voltage transmission cables	High voltage reduces energy loss
3.Step down transformer	Decreases the voltage of the AC

9. Static electricity keywords (TRIPLE ONLY)

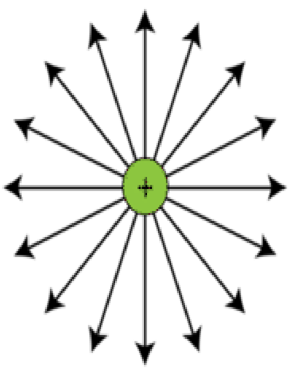
Insulator	Material which holds electrical charge and does not conduct it
Friction	Force which transfers electrons from one insulator to the other
Electrons	Negatively charged particles in atoms. They are the only charges that can move
Electrostatic force	The force between two charges
Van der Graaff generator	Machine used to generate static electricity

Electrostatic force rules (TRIPLE ONLY)

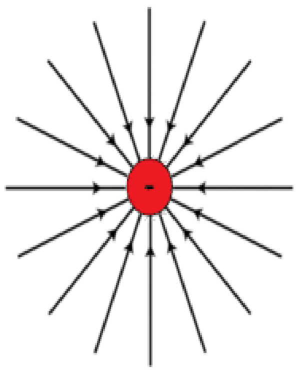
Charges	Force	Diagram
- and -	repel	(a)
+ and -	attract	(b)
+ and +	repel	(a) But with positive charges and field lines in opposite direction

Electrostatic Field Lines (TRIPLE ONLY)

Charge	Direction
Positive +	Away from point
Negative -	Towards point

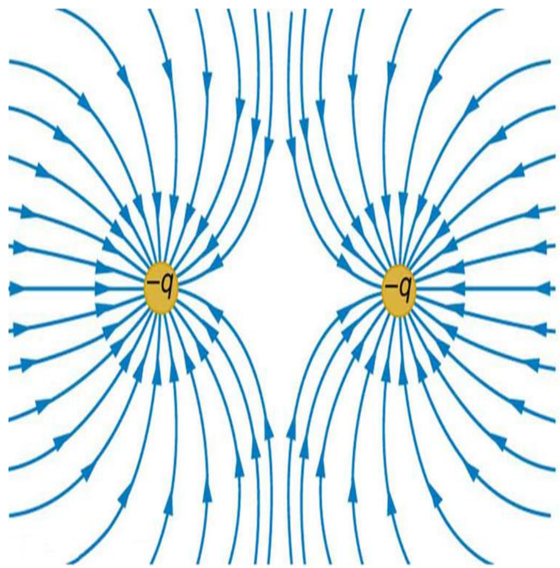


Electric field lines of a positive point charge

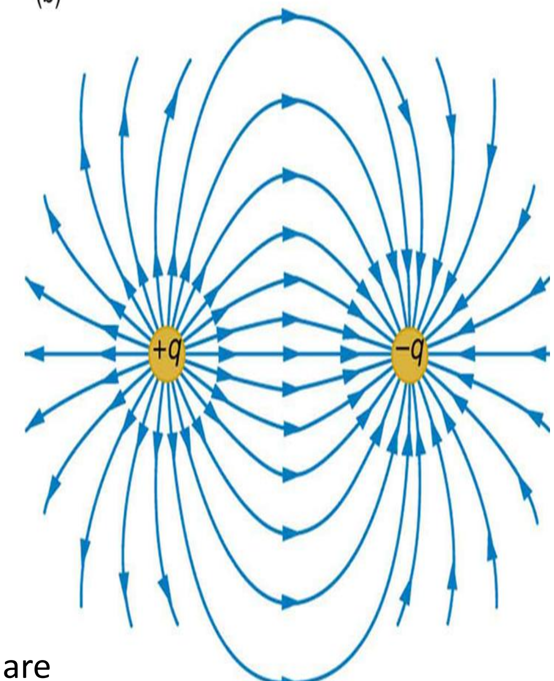


Electric field lines of a negative point charge

(a)



(b)

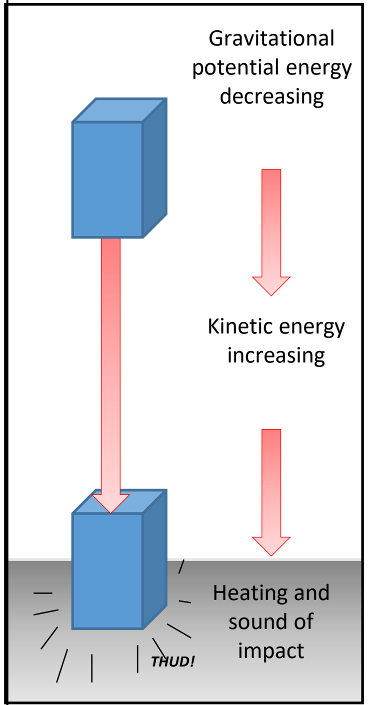


The larger the charge the more field lines are drawn. However, they remain equally spaced about the charge.

Physics topic 4: Energy

1. Key Term	Definition
Kinetic energy (KE)	The energy an object has because it is moving
Gravitational potential energy (GPE)	The energy an object has because of its position above the surface of the Earth or other planet
Elastic potential energy	The energy stored in a springy object when you stretch or squash it
Thermal energy	The energy a substance has because of its temperature
Chemical energy	The energy stored in fuels, food, and batteries
Conservation of energy	Energy cannot be created or destroyed only transferred.
Work done	The energy transferred by a force or electric current
Dissipation	The process of energy being transferred or lost to the surroundings
Friction	A force that opposes movement
System	An object or group of objects
Closed system	An isolated system where no energy transfers take place into or out of the energy stores in the system.
Useful energy	Energy in the place it is wanted in the form that it is needed in
Wasted energy	Energy that is not usefully transferred, usually as thermal.
Energy Store	A term used to describe how an object contains energy. They can be filled or emptied.
Pathway	The method by which energy is transferred from one store to another.

2. Conservation of energy in action



A falling object:

1. Work is done by the force of gravity pulling the object down.
2. The amount of energy in the gravitational store decreases.
3. The amount of energy in the kinetic store increases.
4. Some energy is transferred to the thermal store of the object and the surrounding air as a result of air resistance.
5. When the object hits the floor and stops moving the gravitational and kinetic stores are both empty.
6. The energy has been transferred to the thermal store of the surroundings by heating and by a sound wave.
7. The total amount of energy has remained the same it is now in a different store.

3. Pathways for Energy Transfer:

Heating	Energy is always transferred from hot objects to colder ones until they are at the same temperature
Action of Forces	Work is done by forces to make an object move or to prevent it from moving (friction).
Waves	Mechanical waves – sound, water, seismic Electromagnetic waves - light
Electric Current	Transfers energy from the battery or power supply to the components of an electrical circuit

4. Equations to recall and apply

Equation in words	Equation in symbols	Units
Kinetic Energy = ½ x mass x velocity^2	$E_K = \frac{1}{2} mv^2$	Energy – Joules (J) Mass – Kilograms (kg) Velocity – metres per second (m/s)
Gravitational Energy = mass x gravitational field strength x height	$E_G = mgh$	Energy – Joules (J) Mass – Kilograms (kg) Gravitational field strength – Newtons per kilogram (N/kg) Height – metres(m)
Work done = Force Applied x Displacement	$W = Fs$	Work done – Joules (J) Force – Newtons (N) Displacement – metres (m)
Elastic Energy = ½ x spring constant x extension^2	$E_E = \frac{1}{2} ke^2$	Energy – Joules (J) Extension – metres (m) Spring Constant – Newtons per metre (N/m)
Electrical Work = Charge Flow x Potential Difference	$E = QV$	Electrical Work – Joules (J) Charge – Coulombs (C) Potential Difference – Volts (V)

5. Power

1. The more powerful an appliance, the faster the rate at which it transfers energy
2. **Power, P** (watts, W) = **Energy transferred to appliance, E** (joules, J) / **Time taken for energy to be transferred, t** (seconds, s)
3. The power wasted by an appliance = total power input - useful power output

6. Calculating efficiency

1. Efficiency = Useful output energy transferred by the device / Total input energy supplied to the device
2. Efficiency = Useful power out / Total power in
3. The answer from the calculation above must always be between 0 and 1
4. No device can be more than 100% efficient.
5. Machines waste energy because of friction between their moving parts, air resistance, electrical resistance, and noise.

7. Energy Resources

Energy Resource	Renewable	Advantages	Disadvantages
Fossil Fuels	No	• Low cost. • Easily transportable. • Reliable.	• Produces large amounts of Carbon Dioxide. • Coal produces Sulfur Dioxide.
Nuclear	No	• Generates a lot of electricity. • Reliable. • High energy density	• Expensive to construct and run. • Produces dangerous radioactive waste which will last for thousands of years.
Solar	Yes	• No fuel costs. • No pollution.	• Expensive to set up. • Doesn't work at night.
Wave	Yes	• No fuel costs. • Reliable.	• Can damage marine ecosystems. • Not everywhere is near water.
Tidal	Yes	• No fuel costs. • No pollution. • Reliable.	• Can damage marine ecosystems. • Not everywhere is near water. • Expensive to construct.
Wind	Yes	• No fuel costs. • No pollution.	• Not always reliable. • Noisy. • Some think they are ugly (eyesore).
Geothermal	Yes	• No fuel costs. • No pollution.	• Very few areas where it is accessible.
Biomass	Yes	• Low cost. • Readily available. • Carbon neutral.	• Large scale land use requiring lots of water. • Destruction of habitat to grow crops.
Hydro-electric	Yes	• No fuel costs. • Reliable. • Easily controlled.	• Requires flooding land to build

Carbon neutral: a process by which no extra carbon is released to the atmosphere.

Physics topic 5: Waves

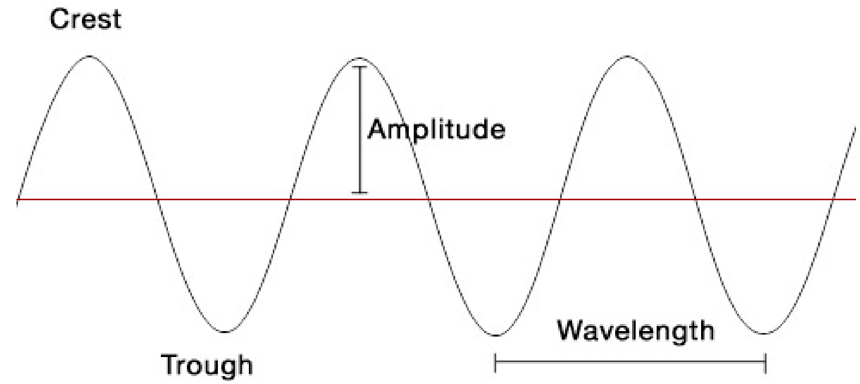
1. Keywords	
Transverse wave	A wave where the vibration is perpendicular to the direction of travel
Longitudinal wave	A wave where the vibrations are parallel to the direction of travel
Mechanical wave	A vibration that travels through a substance (e.g. sound)
Frequency	The number of wave fronts passing a fixed point every second (measured in Hz)
Period	The time for one complete wave
Ultrasound	Sound above 20,000Hz
Superposition	When two waves meet and affect each other
Reflection	When waves bounce off a surface
Echo	Reflection of sound that can be heard

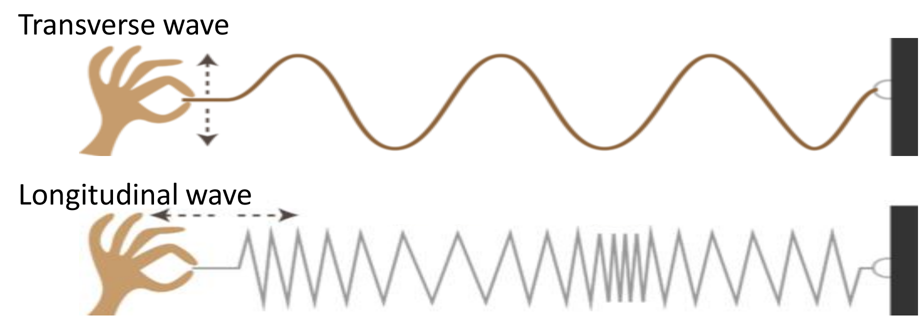
2. Period and frequency

$$T = \frac{1}{f}$$

T	Period (s)
f	Frequency (Hz)

3. Comparing types of wave





Comparing waves:	Light wave	Mechanical wave
Type of wave	Transverse	Longitudinal
Can they travel through a vacuum?	Yes	No. Mechanical waves can only pass through a solid, liquid or gas
Can they be reflected?	Yes. By smooth shiny surfaces	Yes. By smooth surfaces
Can they be absorbed?	Yes. By dark surfaces	Yes. Rough surfaces absorb sound
Can superposition occur?	Yes	Yes

4. Wave equation

$$v = f\lambda$$

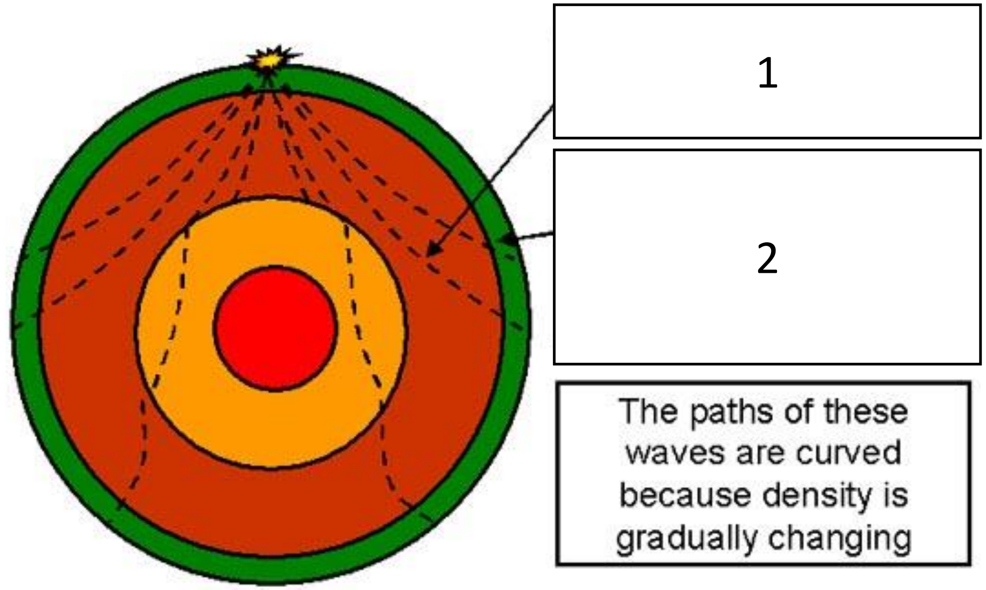
v	Wave speed (m/s)
f	Frequency (Hz)
λ	Wave length (m)

5. Uses of ultrasound (HT PHYSICS ONLY)

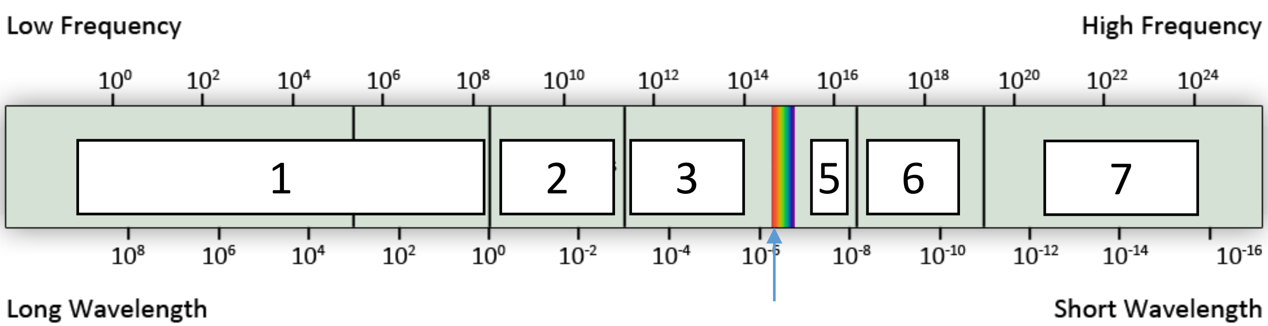
Use	How it works
Cleaning jewellery	The vibrations of the wave shake the dirt lose
Scanning the human body	The waves are partially reflected at different tissue boundaries
Industrial imaging	The waves can detect flaws in metal castings as they are partially reflected by cracks
Physiotherapy	Energy from the wave is absorbed by body tissue and relieves pain

6. Seismic waves produced by earthquakes (HT PHYSICS ONLY)

1	S waves	Transverse	Only travel through solid
2	P waves	Longitudinal	Travel through the earth and are refracted when they pass through different density medium



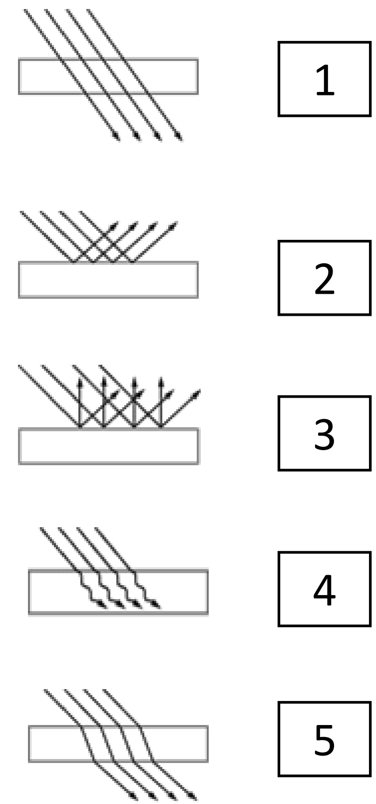
7. The electromagnetic spectrum



	Name	Notes
1	Radio	Produced by oscillations in circuits (HT)
2	Microwaves	
3	Infrared	Thermal energy
4	Visible	
5	Ultra violet	Skin damage
6	X rays	Cause cancer
7	Gamma rays	Cause cancer

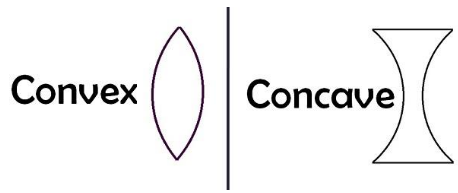
8. The properties of EM waves on materials (HT ONLY)

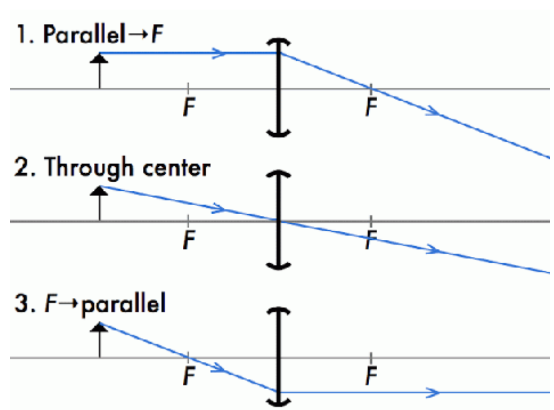
1	Transmission
2	Specular Reflection
3	Diffuse Reflection
4	Absorption
5	Refraction



9. Uses of EM waves

Name	Use
Radio	Radio and TV
Microwaves	Satellite communication, cooking food
Infrared	Electric heaters, cooking food, infra-red cameras
Visible	Fibre optic communication
Ultra violet	Energy efficient lamps, sun tanning
X rays	Imaging bones
Gamma rays	Radiotherapy, medical imaging





10. Lenses (physics only)

$$magnification = \frac{image\ height}{object\ height}$$

11. Black body radiation (physics only)

emit	give out
absorb	Take in
Black body	An object that absorbs all the radiation shone on it. It is the best possible emitter

12. Perfect black bodies and radiation

1	The intensity of black body radiation depends on temperature
2	The hotter the object the more radiation is emitted
3	The hotter the object the greater the increase in the proportion of shorter wavelengths
4	White hot is hotter than red hot

Physics topic 6a: Forces

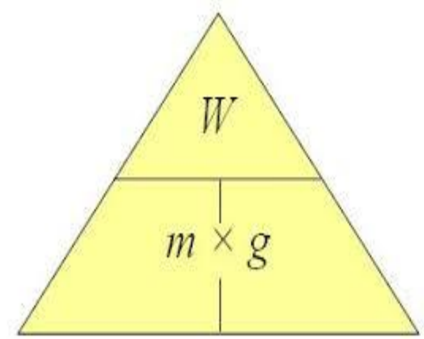
1. Forces keywords	
Force	Something that makes a change happen
Magnitude	The value of a force in newtons
Scalar	Things that have magnitude but not direct
Vector	Things that have a magnitude and a direction. Forces are always vectors
Contact force	Can only act when two things touch
Non-contact force	Can act on things not touching
Balanced (forces)	When forces are equal and opposite each other also called equilibrium
Unbalanced (forces)	When opposing forces are not equal to each other
Resultant (force)	The overall force once all the forces are considered
Force arrows	Show direction and size of a force
Newton	Unit force is measured in
Newton meter	A spring calibrated so it has a scale to measure force
Centre of mass	A point in the middle of an object where all its mass acts
Elastic	A material that returns to its original shape after being deformed
Plastic	A material that does NOT return to its original shape after being deformed

2. Types of force

Force	Between	Contact or non-contact	Example
Friction	Two moving surfaces	Contact	Brakes
Upthrust	A solid object and a fluid (liquid or gas)	Contact	Boat
Reaction	Two solid objects	Contact	Book on shelf
Air resistance	A moving object and air	Contact	Plane
Gravity	Two masses	Non-contact	You and the earth
Tension	Two ends of an elastic material	Contact	Spring
Magnetic	Magnets and magnetic materials	Non-contact	Magnet picking up a nail

3. Calculating weight

Symbol	Name	Calculated by..
W	Weight (N)	= Mass x Gravity
m	Mass (Kg)	= Weight ÷ Gravity
g	Gravitational field strength	= Weight ÷ mass
On earth g = 10 N/kg		



4. Calculating work

Symbol	Name	Calculated by..
W	Work (J)	= Force x Distance
F	Force (N)	= Work ÷ Distance
s	Distance (m)	= Work ÷ Force

$$W = Fs$$

5. Hooke's law

Symbol	Name	Calculated by..
F	Force (N)	= Spring constant x Extension
k	Spring constant (N/m)	= Force ÷ Extension
e	Extension (m)	= Force ÷ Spring constant

$$F = ke$$

6. Energy stored in a spring

Symbol	Name	Calculated by..
Ep	Elastic potential energy stored (J)	$Ep = \frac{1}{2}ke^2$
$\frac{1}{2}$	Half (0.5)	N/A
k	Spring constant (N/m)	$k = \frac{2\,Ep}{e^2}$
e	Extension (m)	$e = \sqrt{\frac{2\,Ep}{k}}$

$$Ep = \frac{1}{2}ke^2$$

To calculate extension:
1. Measure the original length of the object
2. Measure the stretched length of the object
3. Extension = stretched length – original length

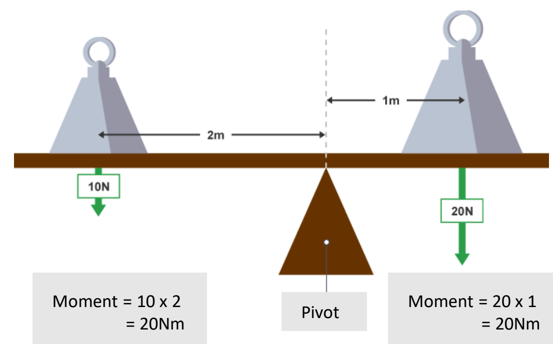
7. Moments:

1.To calculate a moment you need to know:
- How much force is being applied (Newtons, N)
- The distance from the pivot that the force is being applied (Meters, m)

Moment = force x distance

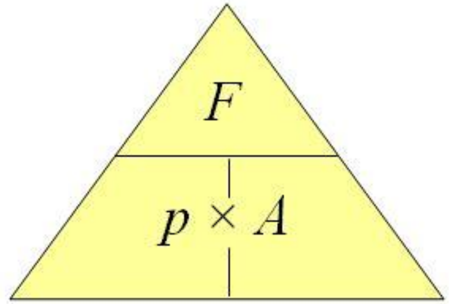
2.The unit for moment is newton metre (Nm)

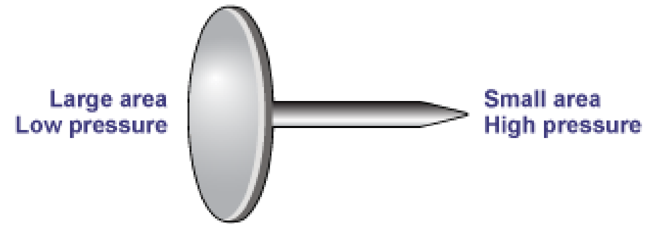
3.A small force over a large distance can generate the same moment as a large force over a small distance.



8. Calculating pressure

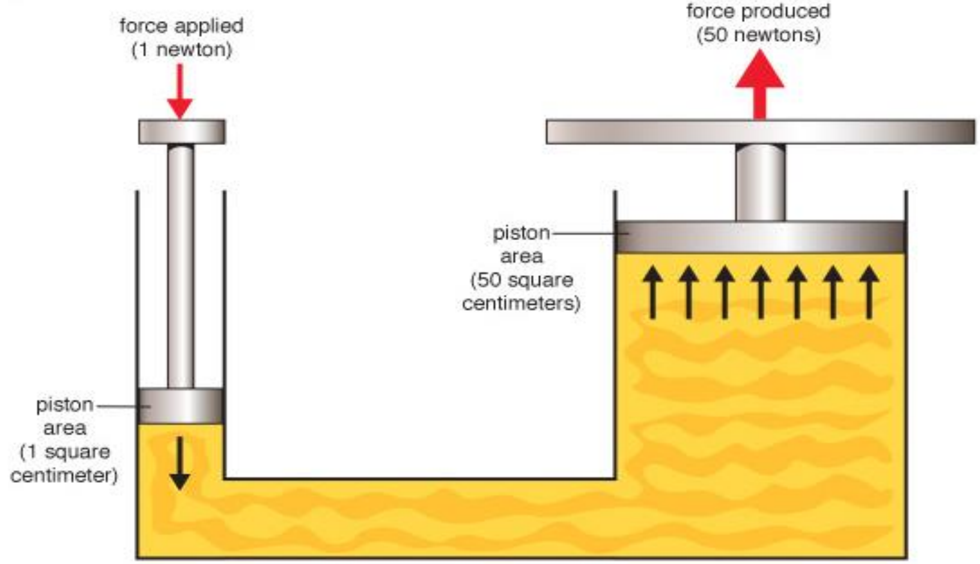
Symbol	Name	Calculated by..
F	Force (N)	= pressure x area
p	Pressure (Pa = n/m²)	= force ÷ area
A	Area (m²)	= force ÷ pressure





9. Calculating pressure in column of liquid (HT ONLY)

Symbol	Name	Calculated by..
g	Gravitational field strength (10 N/Kg)	$g = \frac{p}{h\rho}$
p	Pressure (Pa =n/m²)	$p = h\rho g$
h	Height (m)	$h = \frac{p}{g\rho}$
ρ	Density (kg/m³)	$\rho = \frac{p}{gh}$
$p = h\rho g$		



In a hydraulic system the pressure is constant through the fluid. This multiplies the effect of the applied force on the left. However, the distance moved by the piston on the right is reduced by the same ratio.

$$\frac{F_{right}}{F_{left}} = \frac{A_{right}}{A_{left}} = \frac{d_{left}}{d_{right}}$$

F = force (N)
A = area (cm² or m²)
d = distance moved (m)

Physics topic 6b: Forces in motion

1. Keywords	
Speed	Distance ÷ time. Scalar quantity
Velocity	Distance (in a certain direction) ÷ time. Vector quantity
Distance	How far and object moves. Scalar quantity
Displacement	The straight line distance from the start point to the end point. Vector quantity
Terminal velocity	The maximum speed reached when the forces are balanced

2. Typical speeds	
Walking	1.5 m/s
Running	3 m/s
Cycling	6 m/s
Sound	330 m/s

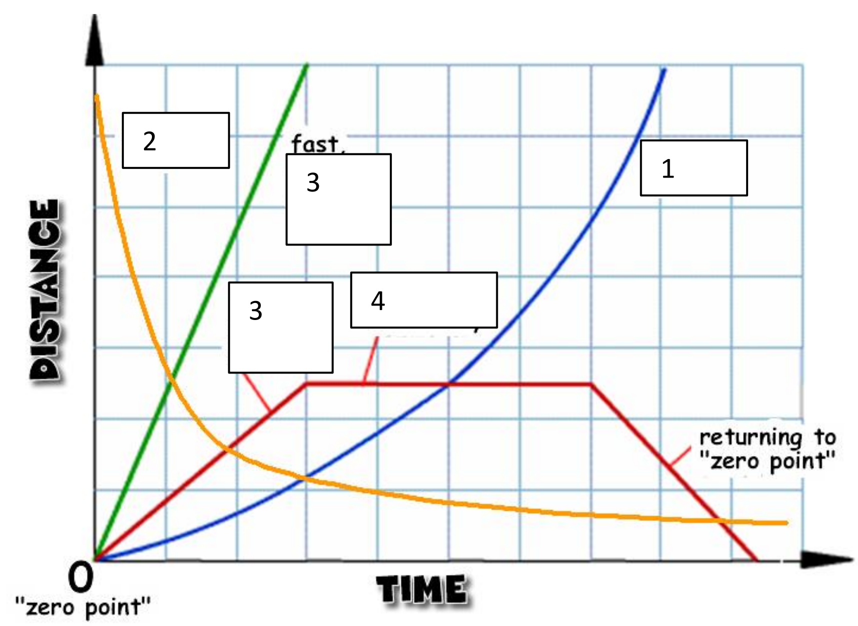
3. Calculating speed

Symbol	Name	Calculated by..
S	Distance (m)	= speed x time
v	Speed/Velocity (m/s)	= distance ÷ time
t	Time (s)	= distance ÷ speed

$$S = v\,t$$

4. D/T graph keywords

Keyword	Meaning	Position on distance time graph
Accelerate	Speeding up	1
Decelerate	Slowing down	2
Constant speed	Staying the same speed	3
Stationary	Not moving	4
Speed	Distance covered in a certain time	The steepness of the line



5. Acceleration

a	Acceleration (m/s²)	$a = \frac{\Delta v}{t}$
Δv	Change in velocity (m/s)	$\Delta v = at$
t	Time (s)	$t = \frac{\Delta v}{a}$

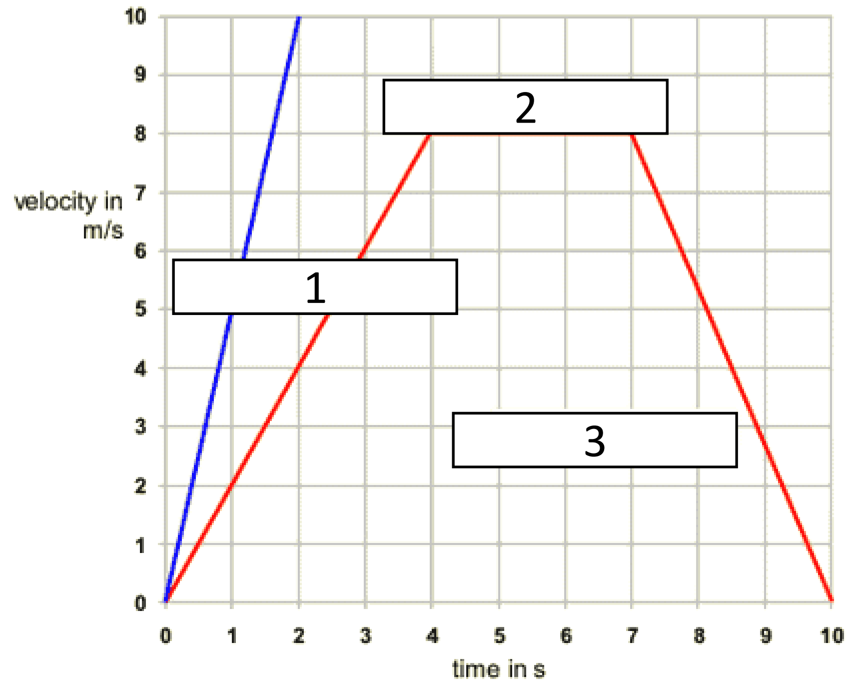
$$a = \frac{\Delta v}{t}$$

7. Uniform acceleration

$$v^2 - u^2 = 2as$$

v	Final velocity (m/s)
u	Start velocity (m/s)
a	Acceleration (m/s²)
s	Distance (m)

6. Velocity-time graphs



1	Constant acceleration
2	Constant speed/velocity
3	Constant deceleration
HT	Area under graph = total distance travelled

8. Newtons laws of motion

1st	If the resultant force on an object is zero the object either remains stationary or at a constant speed
2nd	Force = mass x acceleration
3rd	When two objects interact the forces are equal and opposite

9. Forces and braking

Stopping distance	The thinking distance + braking distance
Thinking distance	The distance travelled in the time it takes to react (typically 0.2s)
Factors affecting thinking distance	1. Tiredness 2. Drugs 3. Alcohol 4. Distractions (phones)
Braking distance	The distance travelled under a braking force
Factors affecting braking distance	1. Road conditions (ice, water) 2. Tyre condition 3. Brake condition

10. Momentum (HT ONLY)

p	Momentum (Kgm/s)	p=mv
m	Mass (Kg)	m=p÷v
v	Velocity (m/s)	v=p÷m
Conservation of momentum	The total momentum before = the total momentum after	

11. Changes in momentum (PHYSICS ONLY)

$$F = \frac{m\Delta v}{\Delta t}$$

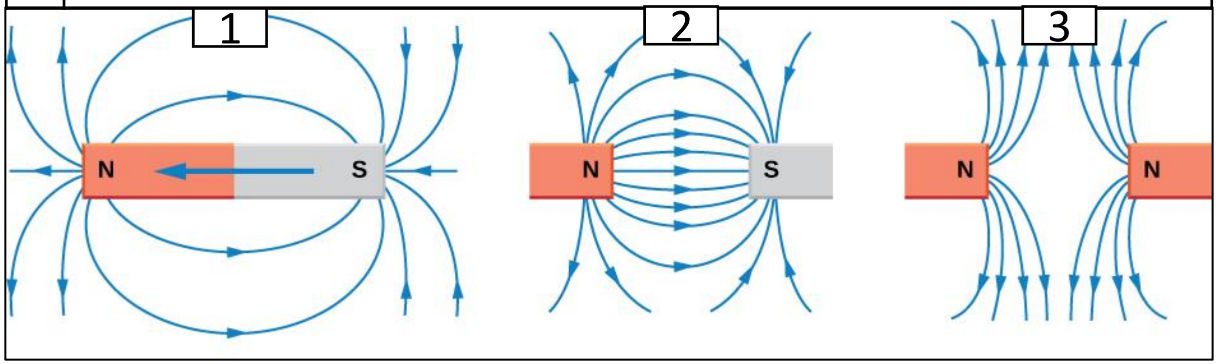
F	force	N
$m\Delta v$	Change in momentum	Kgm/s
Δt	Change in time	s

To reduce the force we need to extend the collision time

Physics topic 7 Magnetism and electromagnetism

1. Keywords	
Permanent magnet	A material which is always magnetic
poles	the place where the magnetic force is strongest north and south (many field lines)
Magnetic field lines	The lines that show the direction of magnetic force. The closer the stronger the force is. Arrows go from north to south poles
Induced magnet	A material that becomes a magnet when placed in a magnetic field
Magnetic material	A material that can be attracted to a magnet (iron, steel, cobalt and nickel)
Electromagnet	A magnet which works when an electric current flows. A solenoid with an iron core
Solenoid	A coil of wire that can become an electromagnet
Compass	Shows the direction of a magnetic field. Used to plot a magnetic field
Current	The conventional current runs from + to - .
Magnetic flux density (B)	The strength of the magnet lines per m^2 (measured in T (tesla))

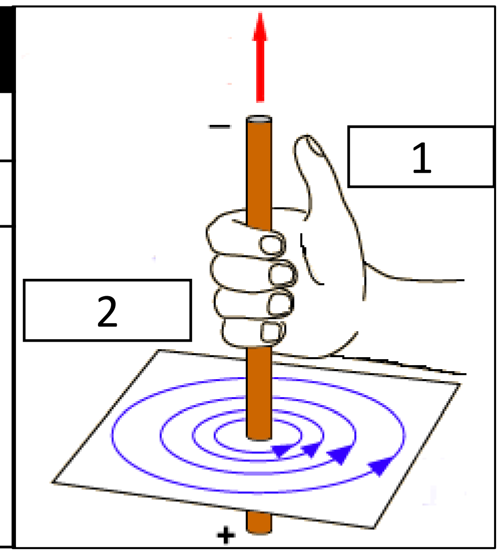
2. Magnetic field lines and force	
1	Magnetic field lines on a magnet
2	Magnetic field lines of attraction between opposite poles
3	Magnetic field lines of repulsion between like poles



3. Electromagnetic field on a wire	
1	Direction of current
2	Direction of magnetic field

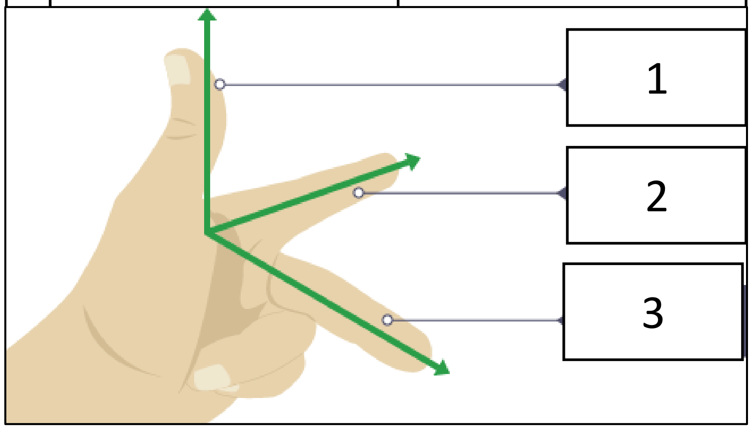
The strength of the magnetic field depends on:
A: The current
B: The distance from the wire.

Shaping the wire into a solenoid makes the field stronger



4. Fleming's left-hand rule (HT ONLY)

	Which finger	What it means
1	Thumb	Movement/Force
2	First finger	Field (north to south)
3	Second finger	Current (+ to -)



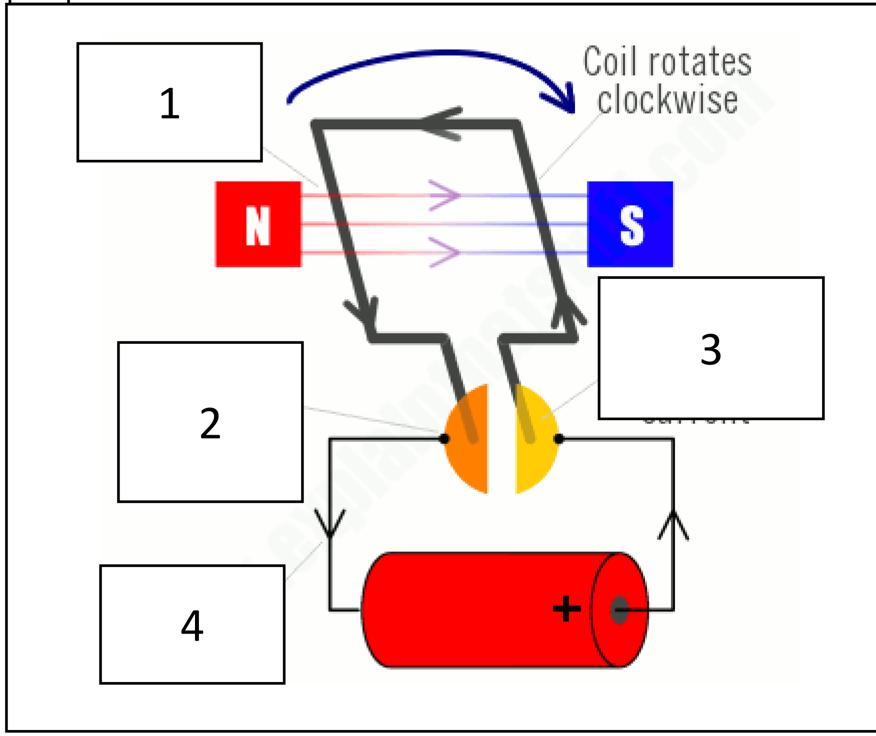
5. Factors that affect the size of the force on the conductor (HT ONLY)

$$F = BIl$$

F	Force (N)
B	Magnetic flux density (Tesla, T)
I	Current (A)
l	Length (m)

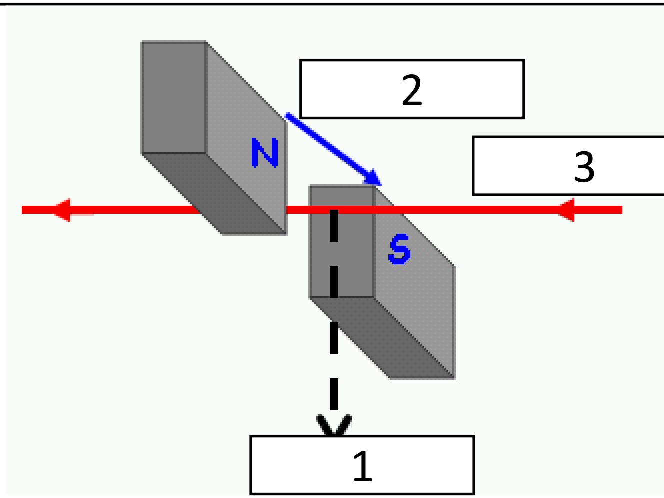
6. Electric motors (HT ONLY)

1	Magnetic field
2	Brushes carry current to commutator
3	Commutator reverses current
4	Electric current



7. The generator effect (PHYSICS HT ONLY)

1	Force moves wire
2	Wire cuts magnetic field
3	Current is induced in wire

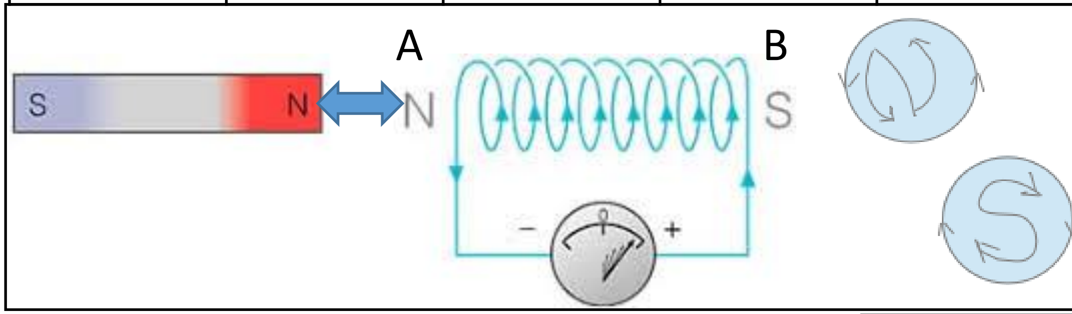


9. Using the generator effect (PHYSICS HT ONLY)

Alternator	Generates alternating current
Dynamo	Generates direct current
Microphones	Convert pressure variations in sound into electric current

8. Factors that affect the size and direction of induced current/potential difference (PHYSICS HT ONLY)

Magnetic pole	Pushed in or pulled out	Direction of current	Induced polarity of A	Magnet and coil
North	In	Anticlockwise	North	Repel
North	Out	Clockwise	South	Attract
South	In	Anticlockwise	South	Repel
South	Out	Clockwise	North	Attract



10. Transformers (PHYSICS HT ONLY)

Vp	Potential difference across primary coil (Volts)
np	Number of turns in primary coil
Ip	Current in primary coil (Amps)
Vs	Potential difference across secondary coil (Volts)
ns	Number of turns in secondary coil
Is	Current in secondary coil (Amps)

Work out voltage change:

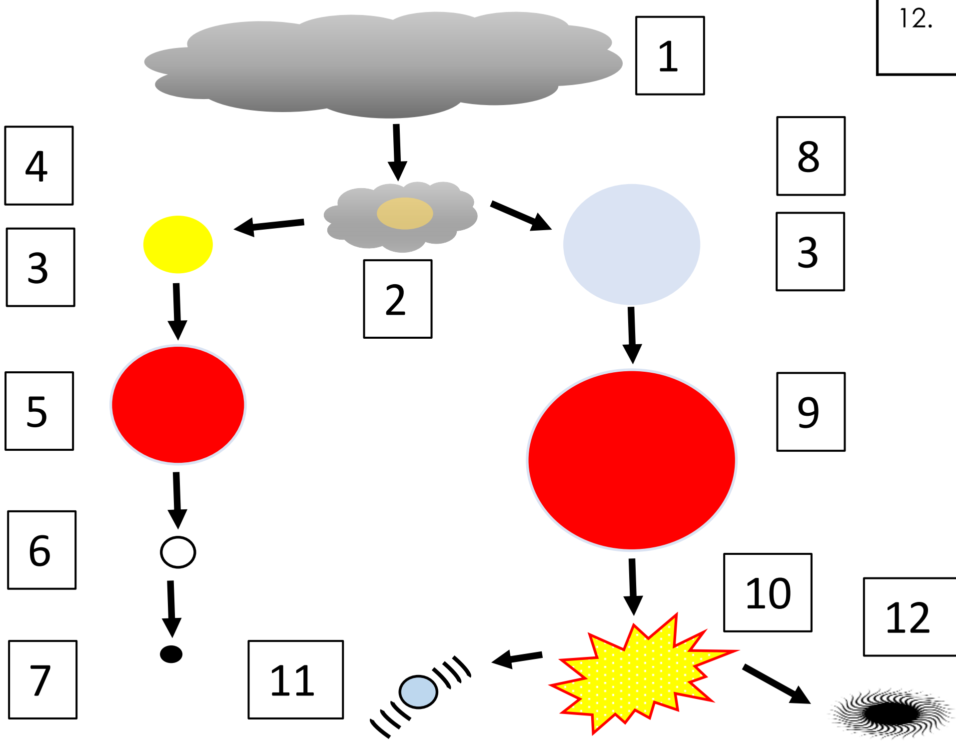
$$\frac{V_p}{V_s} = \frac{n_p}{n_s}$$

Work out power output:

$$V_p I_p = V_s I_s$$

Physics topic 8: Space physics (TRIPLE ONLY)

1. Life cycle of a star			
1. **Cloud of gas (nebula):** Begins to collapse due to gravity and heat up			
2. **Protostar:** formed as fusion begins			
3. **Main sequence star:** Stable star when gravity is balanced by expansion. Hydrogen fuses into Helium			
4.	For Stars about the same size as the Sun:	8.	For Stars much bigger than the Sun:
5.	**Red giant:** fuses Helium into heavier elements	9.	**Red super giant:** fuses Helium into heavier elements
6.	**White dwarf:** Collapsed star becomes white hot	10.	**Supernova:** Red super giant collapses causing a cataclysmic explosion forming the heaviest elements
7.	**Black dwarf:** Collapsed star cools	11.	**Neutron star:** Extremely dense core left from supernova
		12.	**Black hole:** If neutron star is huge enough it collapses so no light can escape



2. Orbital motion	
Satellite	A natural or man made object that orbits a planet
Orbit	gravity continuously pulling an object around (object always falls)
Velocity	Continual changes even though speed does not
Stable orbit	If distance reduces speed must increase

3. Red shift	
Definition	When an object moves away from an observer the light colour becomes redder.
Observation	The further the object is the greater its red shift
Conclusion	That the universe is expanding from a central point
The Big Bang	Theory used to explain the red shift evidence. The idea of the universe was created by a hot and dense singularity exploding outwards

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Y11 GCSE Exam Dates

Y11 Mock(s):

Y11 PPE(s):

Final GCSE(s):

Success Programme Sessions:

Revision Guide (if applicable):

Notes