Physics Key Knowledge Paper 1

Equations

- Kinetic energy = ½ x mass x velocity^2 — KE = ½ mv^2
- Gravitational potential energy = mass x gravitational field strength x height — GPE = mgh
- Work done = force x distance — E = Fd
- Power = work done ÷ time — P = E ÷ t
- Efficiency = useful output energy ÷ total input energy

Specific heat capacity

- The energy required to raise the temperature of one kilogram of a substance by one degree Celsius

Energy transfers

- Energy cannot be created or destroyed
- Energy is often wasted as heat
- Ways of reducing unwanted energy transfer – lubrication, thermal insulation

Renewable resource	Advantages ☺	Disadvantages ☹
Solar	No CO_2 pollution Free	Not work at night/cloudy
Wind	No CO_2 pollution	Unreliable Eyesore
Tidal	No CO_2 pollution	Destroys habitats
Hydroelectric	No CO_2 pollution	Expensive Destroys habitats
Geothermal	No CO_2 pollution	Few areas suitable
Biofuel	Carbon neutral	Land needed to grow

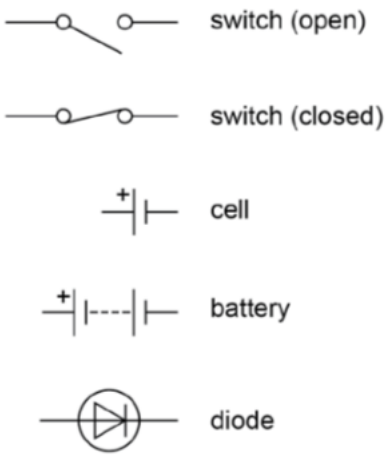
Non -renewable resource	Advantages ☺	Disadvantages ☹
Fossil fuels: Coal Oil Gas	Readily available	CO_2 pollution Acid rain Greenhouse effect Climate change
Nuclear	No CO_2 pollution	Expensive Radioactive waste

Topic 1 Energy

Physics Key Knowledge Paper 1

Equations

- Potential difference = current x resistance — V = IR
- Charge = current x time — Q = It
- Power = current x voltage — P = IV
- Power = current^2 x resistance — P = I^2R
- Energy transferred = power x time — E = Pt
- Energy transferred = charge x potential difference — E = QV



Electric current

- Is the flow of electrical charge
- Measured in amps (A)

Series circuits

- Current is the same through all components
- Potential difference is shared by components
- Total resistance of components is the sum (added total) of the resistance of each component

Parallel circuits

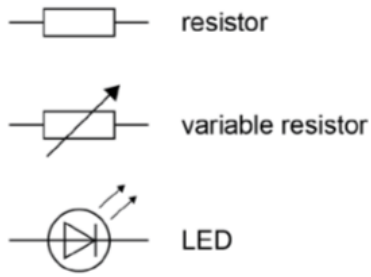
- Current is shared by components
- Potential difference is the same through all components
- Total resistance is less than the resistance of the smallest individual resistor

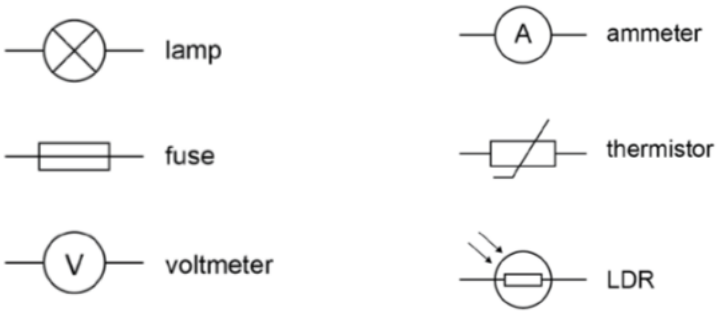
Mains electricity and wiring in plugs

- Is an ac supply – frequency of 50 Hz and 230 V
- Live wire – brown
- Neutral wire – blue
- Earth wire – green and yellow stripes

The National Grid

- A system of cables and transformers linking power stations to homes
- Step-up transformers increase the potential difference
- Step-down transformers reduce the potential difference
- This prevents energy being lost in the cables





Topic 2 Electricity

Physics Key Knowledge Paper 1

Equations

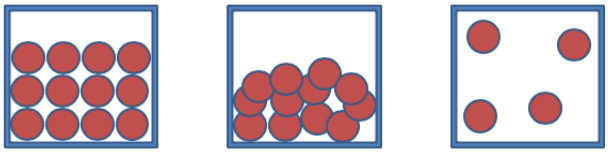
- Density = mass ÷ volume $\rho = m \div V$

Working out the density of an object

- Measure mass using scales
- Measure volume using a ruler if the object is a regular shaped solid
- If object is irregular shaped use a displacement can to measure volume
- Fill displacement can with water
- Submerge the object
- Catch the displaced water in a measuring cylinder – this is the volume
- Calculate density using the equations: Density = mass volume

Particle model of matter

- Solid Liquid Gas



Changes of state

- Solid → liquid: melting
- Liquid → gas: evaporation
- Gas → liquid: condensation
- Liquid → solid: freezing
- Solid → gas: sublimation

Particle motion in gases

- Temperature of a gas is related to the average kinetic energy of the molecules
- At a fixed volume, higher temperature = higher pressure

Specific heat capacity

- The amount of energy required to raise the temperature of one kilogram of a substance by one degree Celsius

Specific latent heat

- The amount of energy required to change the state of one kilogram of a substance with no change in temperature

Topic 3
Particle model of matter

Physics Key Knowledge Paper 1

Atomic models
- Plum pudding model – negative electrons embedded throughout the atom, rest of atom is positive
- Nuclear model – most of the mass of an atom in the nucleus, most of the atom is empty space

Structure of the atom
- Atomic number – number of protons in an atom
- Atomic mass – number of protons + neutrons added together
- Isotopes are atoms of the same element with a different number of neutrons

Radioactive decay
- Nucleus giving out radiation to become more stable
- This is a random process
- Activity is measured in becquerel (Bq)

Nuclear radiation
- Alpha particle – two neutrons and two protons
- Beta particle – high speed electron
- Gamma ray – electromagnetic radiation
- Neutron

Radiation	Mass	Charge	Range in air	Penetration power	Ionising ability
Alpha	4	+2	A few cm	Low	High
Beta	Very small	-1	A few m	Medium	Medium
Gamma	0	0	Very large	High	Low

Half-life
- The time it takes for half the number of radioactive nuclei to decay
- Half-life of a given isotope is always the same

Radioactive contamination and irradiation
- Contamination is the unwanted presence of materials containing radioactive atoms
- Irradiation is exposing an object to nuclear radiation

Precautions when using radioactive materials
- Tweezers
- Point away from the body
- Hold at arm's length
- Keep samples in lead lined boxes

Topic 4
Atomic structure

Physics Key Knowledge Paper 2

Equations

- Speed = distance ÷ time — $v = s \div t$
- Acceleration = change in velocity ÷ time — $a = (v - u) \div t$
- Weight = mass x gravitational field strength — $W = mg$
- Force = mass x acceleration — $F = ma$
- Work done = force x distance — $E = Fd$
- Force = spring constant x extension — $F = ke$
- Momentum = mass x velocity — $p = mv$ (Higher only)

Scalars and vectors

- Scalars have magnitude (number) only. Eg – speed, distance, time, energy, mass
- Vectors have magnitude and direction. Eg – velocity, displacement, acceleration, force, momentum

Contact and non-contact forces

- Contact forces – objects touching. Eg – friction, air resistance, normal contact force
- Non-contact forces – objects not touching. Eg – gravity, electrostatic, magnetic

Acceleration

- Acceleration is the change in velocity
- An object that slows down is decelerating (negative acceleration)

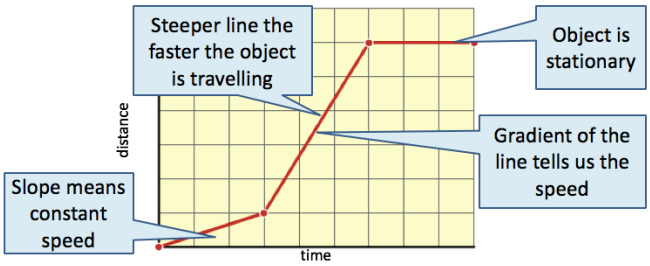
Newton's Laws

- First Law - An object at rest will remain at rest unless a force acts on it
- First Law - A moving object will continue to move in a straight line at a constant velocity unless a force acts on it
- Second Law - The acceleration of an object is proportional to the resultant force acting on the object
- Third Law - When two objects interact they exert equal and opposite forces on each other

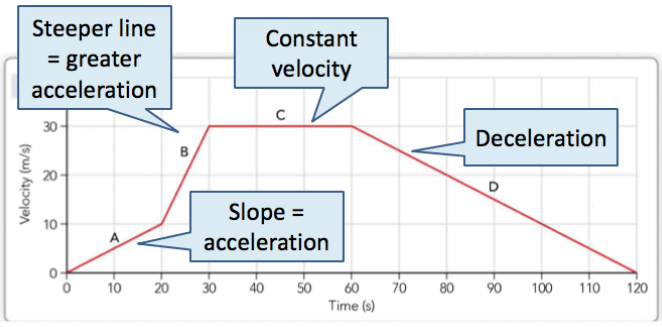
Stopping distances and braking distance

- Stopping distance = thinking distance + braking distance
- Factors that affect braking distance – icy or wet roads, worn tyres and brakes

Distance-time graph



Velocity-time graph



Distance travelled can be worked out by finding the area under the graph

Topic 5 Forces

Physics Key Knowledge Paper 2

Equations

- Wavespeed = frequency x wavelength $v = f \times \lambda$

Transverse waves

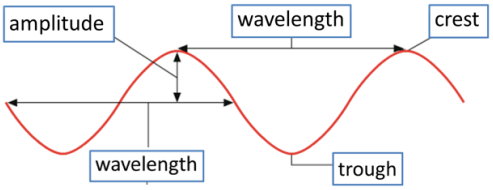
- Motion of particles is at right angles to direction of the wave
- Water waves
- EM waves

Longitudinal waves

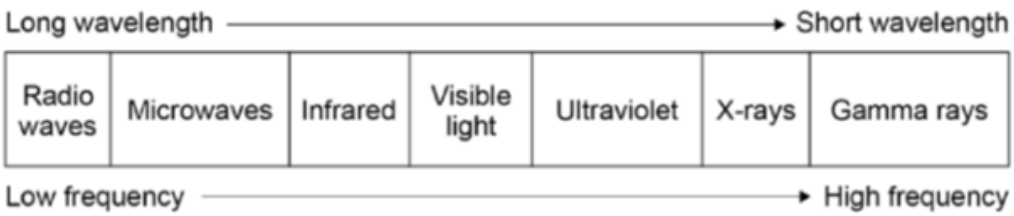
- Motion of particles is in the same direction as the movement of the wave
- Sound waves

Frequency and period

- Frequency is the number of waves passing a point in 1 second
- Period is the time taken for one wave to pass a point



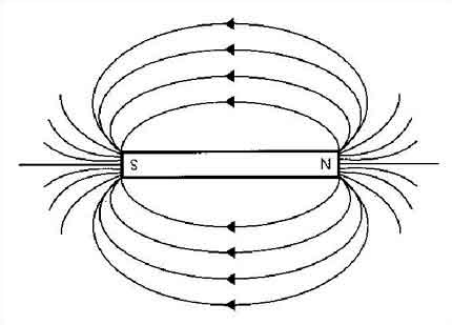
EM wave	Uses ☺	Dangers ☹
Radio waves	Communication Broadcasting – TV, radio	No danger
Microwaves	Cooking food, communication Mobile phones	Slight heating effect, depends on the frequency
Infra-red	Cooking food, night vision goggles Remote controls	Burns to skin
Visible light	Photography, fibre optics	Damage to eyes if bright enough
Ultraviolet	Security marking, sterilising water Sun tanning	Mutation in cells/DNA Cancer
X-rays	Hospitals, Luggage - airports	Mutation in cells/DNA Cancer
Gamma rays	Sterilising medical tools Detect/treat cancer, sterilising food	Mutation in cells/DNA Cancer

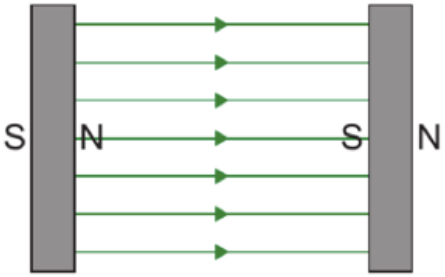


Topic 6 Waves

Magnets

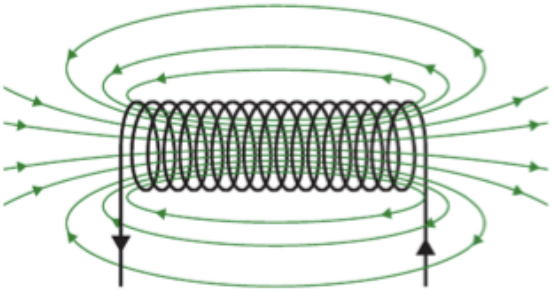
- Like poles repel, opposite poles attract
- Magnetic force strongest at the poles of a magnet
- A permanent magnet produces its own magnetic field
- An induced magnet is a material that becomes a magnet when placed in a magnetic field
- Magnetic materials – iron, steel, cobalt, nickel
- Magnetic field lines point from the north seeking pole to the south seeking pole
- Two flat magnets produce a uniform magnetic field





Electromagnetism

- When a current flows through a wire a magnetic field is produced around the wire
- A solenoid is a coil of wire
- The magnetic field around a solenoid is similar in shape to that of a bar magnet
- Adding an iron core increases the strength of the magnetic field in a solenoid
- An electromagnet is a solenoid with an iron core



b The magnetic field inside the solenoid is almost uniform near the centre of the coil.

Topic 7
Magnetism and electromagnetism

Physics Key Knowledge Paper 1

Equations

- Kinetic energy = _____
- Gravitational potential energy = _____
- Work done = _____
- Power = _____
- Efficiency = _____

Specific heat capacity

- The energy required to _____

Energy transfers

- Energy cannot be _____
- Energy is often wasted _____
- Ways of reducing unwanted energy transfer – _____

Renewable resource	Advantages ☺	Disadvantages ☹

Non -renewable resource	Advantages ☺	Disadvantages ☹

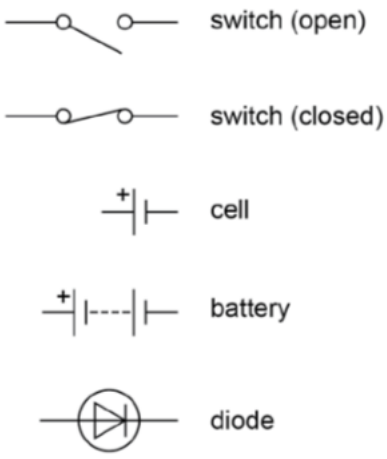
Physics Key Knowledge Paper 1

Equations

- Potential difference = _____
- Charge = _____
- Power = _____
- Power = _____
- Energy transferred = _____
- Energy transferred = _____
-

Electric current

- Is the _____
- Measured _____



Series circuits

- Current is _____
- Potential difference is _____
- Total resistance of components is _____

Parallel circuits

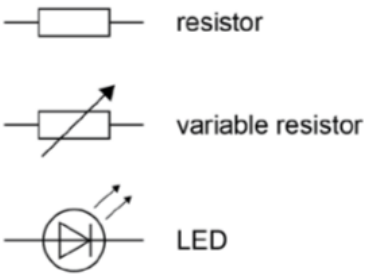
- Current is _____
- Potential difference is _____
- Total resistance is _____

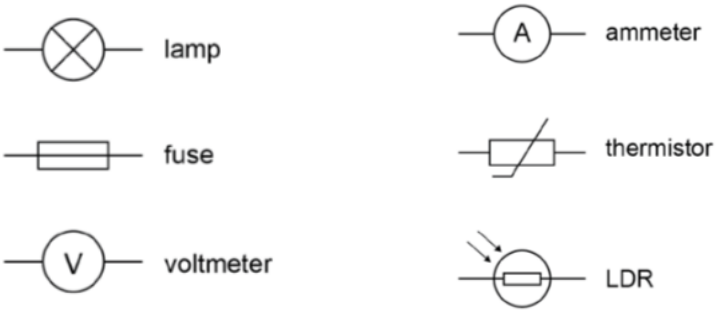
Mains electricity and wiring in plugs

- Is an ac supply – frequency of _____ Hz and _____ V
- Live wire – _____
- Neutral wire – _____
- Earth wire – _____

The National Grid

- A system of cables and transformers linking power stations to homes
- Step-up transformers increase _____
- Step-down transformers _____
- This prevents energy being _____





Topic 2 Electricity

Physics Key Knowledge Paper 1

Equations

- Density = _____

Working out the density of an object

- Measure mass _____
- Measure volume _____
- If object is irregular shaped use a _____
- Fill _____
- _____ the object
- Catch the _____
- Calculate _____

Particle model of matter

- Solid Liquid Gas

Changes of state

- Solid → liquid: _____
- Liquid → gas: _____
- Gas → liquid: _____
- Liquid → solid: _____
- Solid → gas: _____

Particle motion in gases

- Temperature of a gas is related _____
- At a fixed volume, higher temperature = _____

Specific heat capacity

- The amount of energy required to _____

Specific latent heat

- The amount of energy required to _____

Topic 3
Particle model of matter

Physics Key Knowledge Paper 1

Atomic models

- Plum pudding model – _____
- Nuclear model – _____

Structure of the atom

- Atomic number – _____
- Atomic mass – _____
- Isotopes are _____

Radioactive decay

- Nucleus giving out radiation to become more _____
- This is a _____ process
- Activity is measured in _____

Nuclear radiation

- Alpha particle – _____
- Beta particle – _____
- Gamma ray – _____
- Neutron

Radiation	Mass	Charge	Range in air	Penetration power	Ionising ability
Alpha					
Beta					
Gamma					

Half-life

- The time it takes for _____
- Half-life of a given isotope is always _____

Radioactive contamination and irradiation

- Contamination is _____
- Irradiation is _____

Precautions when using radioactive materials

- _____
- _____
- _____
- _____

Topic 4
Atomic structure

Physics Key Knowledge Paper 2

Equations

- Speed = _____
- Acceleration = _____
- Weight = _____
- Force = _____
- Work done = _____
- Force = _____
- Momentum = _____ (Higher only)

Scalars and vectors

- Scalars have _____
- Vectors have _____

Contact and non-contact forces

- Contact forces – _____
- Non-contact forces - _____

Acceleration

- Acceleration is _____
- An object that slows down is _____

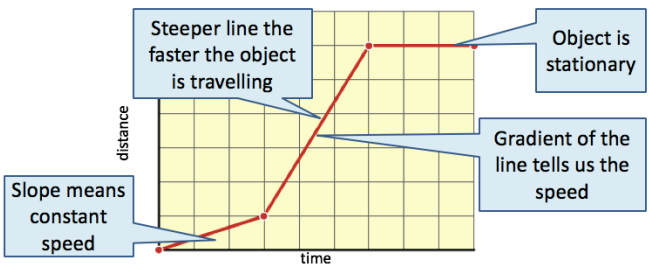
Newton's Laws

- First Law - An object at rest will _____
- First Law - A moving object will _____
- Second Law - _____
- Third Law - _____

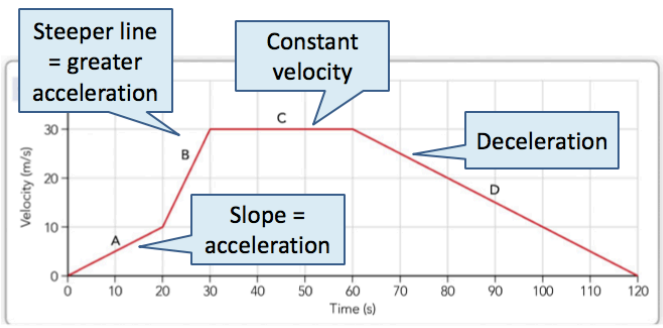
Stopping distances and braking distance

- Stopping distance = _____
- Factors that affect braking distance - _____

Distance-time graph



Velocity-time graph



Distance travelled can be worked out by finding the area under the graph

Topic 5 Forces

Physics Key Knowledge Paper 2

Equations

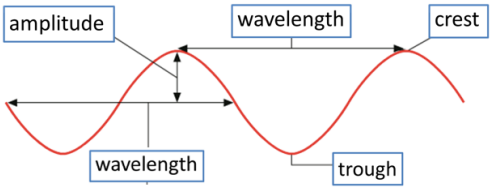
- Wavespeed = _____

Transverse waves

- Motion of particles is at _____
- Example: _____
- Example: _____

Longitudinal waves

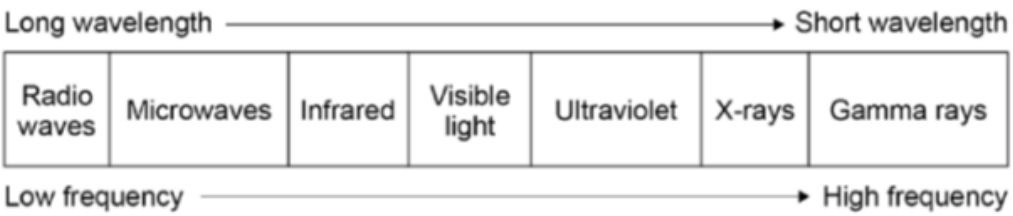
- Motion of particles is _____
- Example: _____



Frequency and period

- Frequency is _____
- Period is _____

EM wave	Uses ☺	Dangers ☹
Radio waves		
Microwaves		
Infra-red		
Visible light		
Ultraviolet		
X-rays		
Gamma rays		

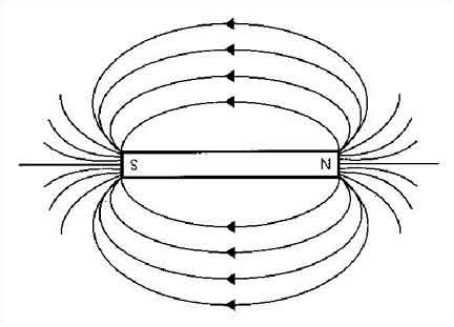


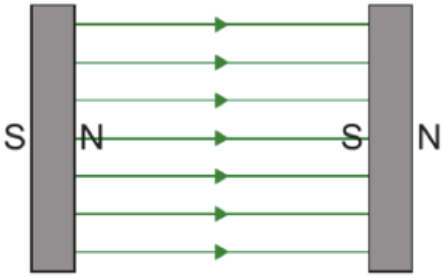
Topic 6 Waves

Physics Key Knowledge Paper 2

Magnets

- Like poles _____, opposite poles _____
- Magnetic force strongest _____
- A permanent magnet produces _____
- An induced magnet is _____
- Magnetic materials – _____
- Magnetic field lines point from the _____ to the _____
- Two flat magnets produce a _____





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- Adding an _____ increases the strength of the magnetic field in a solenoid
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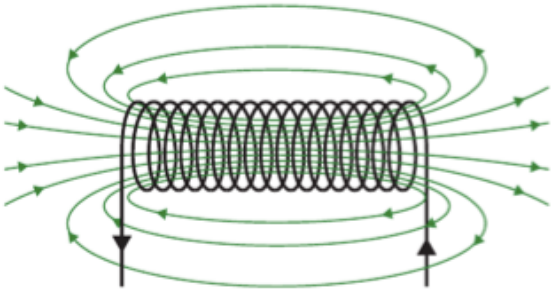

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Topic 7
Magnetism and electromagnetism