6.1	Energy
6.1.1	Energy changes in a system and the ways energy is stored before and after such changes.
6.1.1.1	Energy stores and systems.

1. What is a system? **An object or group of objects.**
2. Describe 5 examples which demonstrate how the way energy is stored changes when a system changes. **An object projected upwards, a moving object hitting an obstacle, an object accelerated by a constant force, a vehicle slowing down and bringing water to the boil in an electric heater.**
3. Name eight energy stores. **Kinetic, electrostatic, gravitational potential, magnetic, internal, nuclear, chemical and elastic potential.**
4. Name 4 ways energy can be transferred between stores. **Mechanically, electrically, heating and radiation.**

6.1.1.2	Changes in energy.

1. What type of energy is associated with a stretched or compressed spring? **Elastic potential energy.**
2. What type of energy is associated with a moving object? **Kinetic energy.**
3. What type of energy is associated with an object lifted above ground level? **Gravitational potential energy.**
4. What is the equation for kinetic energy? **$E_k = 1/2 \times m \times v^2$ (kinetic energy = 1/2 x mass x velocity^2).**
5. What is the equation for potential energy? **$E_p = m \times g \times h$ (gravitational potential energy = mass x gravitational field strength x height).**
6. What are the units for energy? **Joules (J).**
7. What are the units for mass? **Kilograms (kg).**
8. What are the units for velocity? **Metres per second (m/s).**
9. What are the units for the spring constant? **Newtons per metre (N/m).**
10. What are the units for extension? **Metres (m).**
11. What are the units for height? **Metres (m).**
12. What are the units for gravitational field strength? **Newtons per kilogram (N/kg).**

6.1.1.3	Energy changes in systems.

1. What is the specific heat capacity of a substance? The amount of energy required to raise the temperature of 1kg of a substance by 1°C.
2. What are the units for specific heat capacity? Joules per kilogram per degree Celsius (j /kg/°C).
3. What are the units for temperature? Degrees Celsius (°C).
4. What does this symbol represent Δ? Change (delta).
5. How is Δθ calculated? Δθ = final temperature - initial temperature
6. Describe an experiment to determine the specific heat capacity of different materials. Measure the mass of a block of material (e.g. copper). Wrap the block in insulating material and insert a thermometer and heater into the block. Measure the initial temperature of the block. Place an ammeter in series with the heater to measure the current in the circuit. Place a voltmeter in parallel to the power source to calculate the potential difference. Turn the power supply on. Measure the temperature every minute for ten minutes. Calculate the power supplied using the formula P=VI. Use this to calculate the energy transferred using the formula E=Pt. Plot a graph of energy transferred against temperature. Calculate the gradient of the line. The SHC of the material is calculated by the formula (1/gradient). Repeat the experiment with different materials.

6.1.1.4	Power

1. What is power? The rate at which energy is transferred.
2. What is the unit of power? Watts (W).
3. What is the equation which links power and energy transferred? P = E / t (Power = energy transferred x time).
4. What is the equation which links power and work done? P = W / t (Power = work done / time).
5. What is the unit of work done? Joules (J)
6. What is the energy transfer of 1 joule per second equal to in watts? 1 watt = 1 joules / second

6.1.2	Conservation and dissipation of energy.
6.1.2.1	Energy transfers in a system.

1. Name three ways energy can change. **Transferred usefully, stored or dissipated.**
2. What 2 outcomes cannot happen to energy? **Energy cannot be created or destroyed.**
3. What is meant by "wasted" energy? **Energy is transferred to less useful stores.**
4. Describe, using two examples, how energy can be dissipated in a system. **Friction and thermal.**
5. Describe two ways of reducing unwanted energy transfers. **Lubrication and thermal insulation.**
6. Describe how the thermal conductivity of a material is related to energy transfer. **The higher the thermal conductivity of a material, the higher the rate of energy transfer by conduction.**
7. What factors will affect the rate of cooling of a building. **The thickness and thermal conductivity of the walls.**
8. Describe three ways to insulate a house. **Cavity wall insulation, loft insulation and double-glazing.**
9.

6.1.2.2	Efficiency.

1. What formula is used to calculate the efficiency of an energy transfer? **Efficiency = (useful output energy transfer/total input energy transfer) x 100**
2. What formula is used to calculate efficiency from power? **Efficiency = (useful power output /total power input)**
3. Name three ways of increasing the efficiency of an energy transfer (HT) **Insulation, lubrication and streamlining.**

6.1.3	National and global energy resources.

1. Name the 4 main non-renewable energy resources available on Earth. **Oil, coal, gas and uranium.**
2. Name the 7 main renewable energy resources available on Earth. **Solar, wind, waves, hydro-electricity, biofuel, tides and geothermal.**
3. What is a finite resource? **A resource that cannot be renewed and will run out.**
4. Define renewable energy. **A resource that can be replenished after use.**
5. Name the three main uses of energy resources. **Power production, transport and heating.**
6. Describe how energy resources are used for transport. **Petrol and diesel are used for vehicles. Some vehicles run on biofuels which are renewable.**
7. Describe how energy resources are used for heating. **Natural gas is used for heating in most homes in the UK. Geothermal energy is a renewable energy resource which can be used for heating.**
8. What are the advantages of wind power? **There are no fuel costs and minimal running costs.**
9. What are the disadvantages of wind power? **Start up costs are high. Electrical production stops when wind speed is too low or too high.**
10. What is the environmental impact of wind power? **No pollution. Spoils the view. Noisy.**
11. What are the advantages of solar cells? **There are no fuel costs and minimal running costs.**
12. What are the disadvantages of solar cells? **High start up costs. A reliable source in sunny countries, but less reliable in cloudy countries. Usually generates electricity on a small scale.**
13. What is the environmental impact of solar cells? **No pollution.**
14. What are the advantages of geothermal energy? **Free, reliable energy.**
15. What are the disadvantages of geothermal energy? **Not many suitable locations (volcanic area).**
16. What is the environmental impact of geothermal energy? **No pollution, little damage to the environment.**
17. What are the advantages of hydro-electric power? **Immediate electrical production in response to a surge in demand.**
18. What are the disadvantages of hydro-electric power? **High initial set up costs.**
19. What is the environmental impact of hydro-electric power? **No pollution, damage to the environment when building the dam, loss of habitat.**
20. What are the advantages of wave power? **Useful for coastal locations and islands.**
21. What are the disadvantages of wave power? **Unreliable energy production as waves are reduced when wind drops.**
22. What is the environmental impact of wave power? **No pollution, disturbs marine habitats, can be a hazard to boats.**
23. What are the advantages of tidal barrages? **No fuel costs and low running costs, a reliable source of energy.**

24. What are the disadvantages of tidal barrages? **Initial costs are high, limited to estuaries and coastal areas.**
25. What is the environmental impact of tidal barrages? **No pollution. The damming of estuaries disturbs habitats and prevents access by boats.**
26. What are the advantages of biofuels? **Renewable and carbon neutral.**
27. What are the disadvantages of biofuels? **Cost to refine is very high.**
28. What is the environmental impact of biofuels? **Natural habitats cleared to make plantations of biofuels.**
29. What are the advantages of nuclear power? **No greenhouse gases. Large amounts of energy produced on one site.**
30. What are the disadvantages of nuclear power? **Very high start up and running costs.**
31. What is the environmental impact of nuclear power? **Radioactive waste needs to be stored for thousands of years before it is safe. Potential for radioactive contamination from waste.**
32. What are the advantages of fossil fuels? **Cost effective production of energy.**
33. What are the disadvantages of fossil fuels? **Non-renewable.**
34. What is the environmental impact of fossil fuels? **Produce greenhouse gases and pollution.**
35. Describe the pattern of electrical consumption in the UK since 2000. **Electrical consumption in the UK has fallen.**
36. Describe how electricity in the UK is mainly produced? **Fossil fuels and nuclear power.**
37. Explain why the UK is trying to reduce fossil fuel powered power stations. **To reduce greenhouse emissions and become less reliant on non-renewable fuels.**
38. Explain why scientists cannot deal directly with the environmental issues on non-renewable energy. **Scientists can give advice to governments about how to tackle environmental issues, but political will is required to enforce legislation that will reduce fossil fuel use.**
39. What issues may prevent the building of a wind farm to provide clean energy for a city? **Local residents complaining about the noise and spoiling the view.**
40. What issues may prevent an individual using renewable energy in their day to day lives? **Renewable energy choices are generally more expensive. The location of a home may make it unfeasible to install solar panels (e.g. in a flat).** Explain why scientists cannot deal directly with the environmental issues on non-renewable energy. **Scientists can give advice to governments about how to tackle environmental issues, but political will is required to enforce legislation that will reduce fossil fuel use.**
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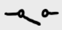
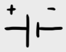
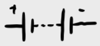
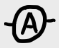
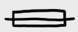
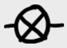
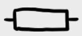
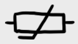
6.2	Electricity
6.2.1	Current, potential difference and resistance.
6.2.1.1	Standard circuit diagram symbols.

1. Draw the circuit diagram for an open switch. 
2. Draw the circuit diagram for a closed switch.
3. Draw the circuit diagram for a cell. 
4. Draw the circuit diagram for a battery. 
5. Draw the circuit diagram for a voltmeter. 
6. Draw the circuit diagram for an ammeter. 
7. Draw the circuit diagram for diode. 
8. Draw the circuit diagram for a LED. 
9. Draw the circuit diagram for a LDR. 
10. Draw the circuit diagram for a fuse. 
11. Draw the circuit diagram for a lamp. 
12. Draw the circuit diagram for resistor. 
13. Draw the circuit diagram for variable resistor. 
14. Draw the circuit diagram for thermistor. 

6.2.1.2	Electrical charge and current

1. What is required for electrical charge to flow through a closed circuit? **The circuit must include a source of potential difference.**
2. What is electric current? **A flow of electrical charge.**
3. How is the size of electric current defined? **The rate of flow of electrical charge.**
4. What is the equation which links charge flow, current and time? **$Q = I \times t$ (Charge flow = current x time).**
5. What is the unit of charge flow? **Coulomb (C)**
6. What is the unit of current? **Ampere (amps) (A)**
7. Describe the current at any point in a single closed loop. **The current has the same value at any point in a single closed loop.**

6.2.1.3	**Current, resistance and potential difference.**

1. What does the current through a component depend upon? **The resistance of the component and the potential difference across the component.**
2. What is resistance? **It is a measure of how easy or hard it is for current to flow through a component.**
3. What is the unit for resistance? **Ohms (Ω)**
4. Describe the relationship between current and resistance of a component given a fixed potential difference. **The greater the resistance the smaller the current.**
5. What is the equation that links potential difference, current and resistance? **V = I x R (potential difference = current x resistance)**
6. Identify the resistors with the following IV characteristics

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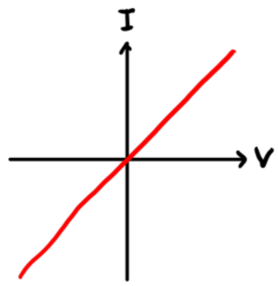
<td>
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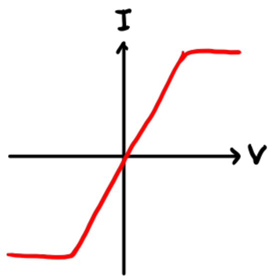
<td>
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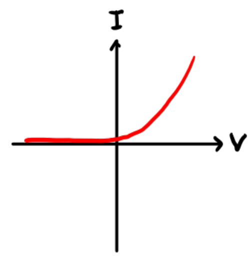
<td>
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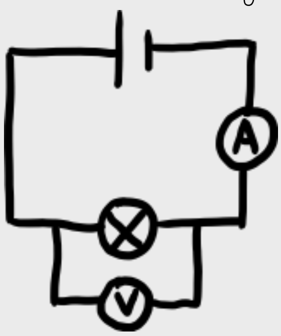
<tr>
<td>ohmic conductor</td>
<td>filament lamp</td>
<td>diode</td>
</tr>
</table>

1. Describe resistance in an ohmic resistor at a constant temperature. **The current is directly proportional to the potential difference. This means the resistance is constant as the current changes.**
2. Describe resistance in a diode. **Current flows through a diode in one direction only. The diode has a very high resistance in the reverse direction.**
3. Describe resistance in a filament lamp. **The resistance of a filament lamp increases as the temperature of the filament increases.**
4. Describe the resistance in a thermistor as the temperature increases. **The resistance of a thermistor decreases as the temperature increases.**
5. Suggest an application for a thermistor? **A thermostat.**
6. Describe the resistance in a LDR as light intensity increases. **The resistance of a LDR decreases as the light intensity increases.**
7. Suggest an application for a LDR. **A control circuit to switch on lights when it starts to get dark.**
8. Draw a circuit diagram to measure the resistance of a different components.



9. Describe an experiment to measure the I-V characteristics of a filament lamp, a diode and a resistor at constant temperature. **Set up a circuit with an ammeter in series with the component to be tested. Place a voltmeter in parallel to the component. Set the potential difference of the power pack to 2V and measure the current. Repeat for 4V, 6V, 8V and 10V. Turn the component around (to reverse the current). Again set the voltage to 2V on the power pack and record the current. The values on the ammeter and voltmeter will be 0 or negative values. Calculate the resistance of the component at different voltages using the formula R = V/I. Plot the results on a graph.**

6.2.2	Series and parallel circuits.

1. Name the two ways of joining electrical components in a circuit. **A series circuit or parallel circuit.**
2. Describe the current through components in a series circuit. **The components each have the same current.**
3. Describe potential difference in a series circuit with components. **The total potential difference of the power supply is shared between the components.**
4. Describe the resistance in a series circuit with two components. **The total resistance of two components is the sum of the resistance of each component.**
5. What is the formula to calculate resistance in a series circuit with two components. $R_{Sum} = R_1 + R_2$
6. Describe the current through components in a parallel circuit. **The total current is equal to the sum of the currents through the circuit.**
7. Describe the potential difference in a parallel circuit with components. **The potential difference across each component is the same.**
8. Describe the resistance in a parallel circuit with two components. **The total resistance of two components is less than the resistance of the smallest individual resistor.**
9. Explain why adding resistors in series increases resistance, but adding resistors in parallel decreases resistance. **Circuits in parallel, for a given potential difference, have more current for each loop added. Using R = V/I, an increase in current will lead to a decrease in resistance.**

6.2.3	Domestic uses and safety.
6.2.3.1	Direct and alternating potential difference.

1. What type of supply is mains electricity? **AC.**
2. What is the frequency of the UK mains supply? **50Hz.**
3. What is the potential difference of the UK mains supply? **230V.**
4. Describe alternating current. **The current constantly changes direction (50 times per second).**
5. Describe direct current. **The current flows in a constant direction.**
6. Describe direct potential difference. **A constant voltage.**
7. Describe alternating potential difference. **A voltage which keeps alternating between positive and negative values.**

6.2.3.2	Mains electricity.

1. Which wire in a plug or cable is brown? **Live**
2. Which wire in a plug or cable is blue? **Neutral**
3. Which wire in a plug or cable has green and yellow stripes? **Earth**
4. Describe the route electricity takes from the supply through the plug and its return?
   supply → live wire → fuse → appliance → neutral wire → supply
5. Name two safety features found in plugs. **Fuse and earth wire**
6. What safety feature in the plug protects the appliance? **Fuse**
7. What safety feature in the plug prevents electrocution? **Earth wire**
8. What is the potential difference between the live wire and the earth? **230V**
9. What is the potential difference of the neutral wire. **0V**
10. Why is the live wire dangerous even is the switch is closed? **There is a potential difference in the live wire. If your body provide a bridge between the live wire and earth a current would flow through you.**

6.2.4	Energy transfers.
6.2.4.1	Power.

1. What is the equation linking power, current and resistance. **$P = I^2R$ (power = current^2 x resistance).**
2. What is the equation linking power, potential difference and current? **$P = V \times I$ (power = voltage x current).**
3. Name the unit of power. **Watts.**
4. Name the unit of energy. **Joules.**
5. What is 1 watt equivalent to? **1 joule per second.**

1. What are everyday appliances designed to do? **Bring about energy transfers.**
2. What does the amount of energy transferred depend on? **How long the appliance is switched on for and the power of the appliance.**
3. Describe energy is transferred from a battery to an electric motor? **Chemical energy stores in a battery are transferred electrically to the kinetic energy of the motor.**
4. Describe how energy is transferred from mains electricity to a heating device? **Chemical energy stores (in fossil fuel) are transferred electrically to the internal energy store of the heating element.**
5. What occurs when charge flows in a circuit? **Work is done.**
6. What formula links energy transferred, power and time? **$E = P \times t$ (energy transferred = power x time).**
7. What formula links energy transferred, charge flow and potential difference. ($E = Q \times V$) **energy transferred = charge flow x potential difference**
8. Describe the relationship between domestic appliance power ratings and the changes in stored energy when they are in use. **The power rating indicates the maximum amount of energy transferred per second. The lower the power rating the less energy is used, so the cheaper it is to run.**

6.2.4.3	The National Grid.

1. What is the National Grid? **A system of cables and transformers.**
2. What do transformers do? **Transformers step up potential difference at the start of the National Grid and step down potential difference at the end of the Grid.**
3. Why is the National Grid efficient? **High voltage and low current decreases energy loss along the cables.**
4. What is the potential difference of electricity produced by power stations? 25000V
5. What is the potential difference of electricity carried by cables of the National Grid? 400000V
6. What is the potential difference of electricity carried to industrial workplaces? 11000V
7. What is the potential difference of electricity supplied to domestic homes? 230V

6.3	Particle model of matter
6.3.1	Changes of state and the particle model.
6.3.1.1	Density of materials.

1. What is the equation to calculate density? Density = mass / volume.
2. What is the unit of density? Kg/m^3.
3. What can the particle model be used to explain? The behaviour of solids, liquids and gases.
4. Explain the difference in density between the three states of matter. Solids are usually denser than liquids because the particles in a solid are more closely packed. Liquids are usually denser than gases because the particles in a liquid are more closely packed.
5. Describe an experiment to determine the density of different regular solid objects and liquids. Use a ruler to measure the length, width and height of the object. Calculate the volume from these. Use a balance to calculate the mass. Calculate the density using mass / volume.
6. Describe an experiment to determine the density of different irregular solid objects. Use a balance to measure the mass of the object. Add 50mL to a measuring cylinder. Place the object in the measuring cylinder. Record the new volume. Calculate the volume of the object by the difference between the volume of the measuring cylinder before and after. Calculate the density using mass / volume.
7. Describe an experiment to determine the density of a liquid. Measure the mass of the empty measuring cylinder. Add 50mL of liquid to the measuring cylinder. Measure the mass of the measuring cylinder. Calculate the mass of the liquid using mass of measuring cylinder and liquid - the mass of the empty measuring cylinder. Calculate the density using mass / volume.

6.3.1.2	Changes of state.

1. Name the six ways substance can change state. Melt, freeze, boil, evaporate, condense and sublimate.
2. What happens to the mass when a substance changes state? No change in mass.
3. State whether state changes are chemical or physical changes. Physical change.

6.3.2	Internal energy and energy transfers.
6.3.2.1	Internal energy.

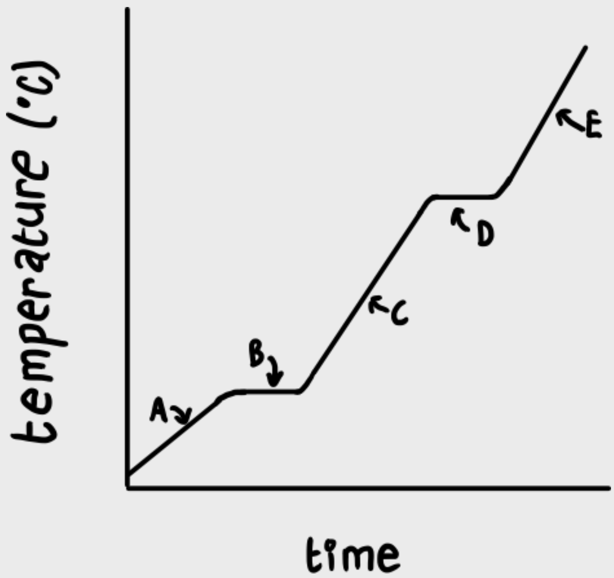
1. What is internal energy. The energy stored inside a system by the particles that make up the system.
2. What is the total internal energy the sum of? Total kinetic energy + total potential energy of the particles.
3. What is the effect of heating on a system? Heating changes the energy stored within the system by increasing the energy of the particles that make up the system.
4. What are the two possible results of heating a system? The temperature is raised or there is a change of state.

6.3.2.2	Temperature changes in a system and specific heat capacity.

1. What does the increase in temperature of a system depend upon? **The increase in temperature depends the mass, the type of material and the energy input into the system.**
2. What is specific heat capacity? **The amount of energy required to raise the temperature of one kilogram of a the substance by 1°C.**
3. What is the unit of specific heat capacity? **Joules per kilogram per degree Celsius (J/kg/°C).**

6.3.2.3	Changes of heat and specific latent heat.

1. What is latent heat? **The energy needed by a substance to change its state.**
2. What happens to the energy during a change of state? **The energy supplied changes the energy stored (internal energy) but does not change the temperature.**
3. Define specific latent heat. **The amount of energy required to change the state of one kilogram of a substance with no change in temperature (e.g. 1kg of water at 100°C becomes 1kg of steam at 100°C).**
4. What is the unit for specific latent heat? **Joules per kilogram (J/kg).**
5. What is the specific latent heat of fusion? **The energy required to change the state from a solid to a liquid.**
6. What is the specific latent heat of vaporisation? **The energy required to change the state from a liquid to a vapour (gas).**



7. Which part of the graph above shows the boiling point of the substance? **D.**
8. Which part of the graph above shows the melting point of a substance? **B.**
9. Which part of the graph above represents the substance in a solid state? **A.**
10. Which part of the graph above represents the substance in a liquid state? **C.**
11. Which part of the graph above represents the substance in a gaseous state? **E.**

6.3.3	Particle model and pressure.
6.3.3.1	Particle motion in gases.

1. Describe the movement of molecules in a gas. **Molecules are in constant random motion.**
2. What is the temperature of a gas related to? **The average kinetic energy of the molecules.**
3. Describe what happens to the pressure of a constant volume of gas if the temperature is increased. **The pressure increases.**
4. Describe what happens to the pressure of a constant volume of gas if the temperature is decreased. **The pressure decreases.**
5. Explain how the motion of molecules in the gas is related to both temperature and pressure. **As the temperature increases the speed of the molecules increase. As a result they collide with the sides of the container more often. This results in an increase in the pressure.**

6.4 Atomic structure

6.4.1 Atoms and isotopes.

6.4.1.1 The structure of an atom.

1. What is the approximate radius of an atom? **1 x 10^{-10}m.**
2. Describe the basic structure of an atom. **A positively charged nucleus composed of protons and neutrons surrounded by negatively charged electrons.**
3. What is the ratio between the radius of the nucleus and the radius of an atom? **1:10000**
4. Where is most of the mass of an atom found? **The nucleus.**
5. Describe how electrons are organised in an atom. **The electrons are found at different distances from the nucleus at different energy levels.**
6. What happens to an electron if it absorbs electromagnetic radiation? **The electrons moves further from the nucleus to a higher energy level.**
7. What happens to an electron if it emits electromagnetic radiation? **Moves closer to the nucleus to a lower energy level.**

6.4.1.2 Mass number, atomic number and isotopes.

1. How are the number of protons and the number of electrons related in an atom? **The number of protons is equal to the number of electrons.**
2. What is the overall charge of an atom? **They have no overall charge.**
3. What do atoms of the same element have the same number of? **Protons.**
4. What is the atomic number? **The number of protons in the atom.**
5. What is the mass number? **The sum of the protons and neutrons.**
6. What is an isotope? **Atoms of the same element with different numbers of neutrons.**
7. What do atoms form if they lose one or more outer electrons. **Ions.**
8. Calculate the number of electrons, protons and neutrons in the following atoms:

	${}^{1}_{1}H$	${}^{23}_{11}Na$	${}^{238}_{92}U$
Neutrons	0	12	146
Protons	1	11	92
Electrons	1	11	92

6.4.1.3	The development of the model of the atom.

1. Why might a scientific model be changed or replaced? **New experimental evidence.**
2. How did Democritus describe the atom? **Tiny spheres that could not be divided.**
3. What did J.J. Thomson discover and what model did he suggest as a result? **He discovered the electron and suggested the plum pudding model.**
4. Describe Thomson's model. **Negative electrons embedded in a ball of positive charge**
5. Describe the alpha particle scattering experiment. **Alpha particles were fired at a thin sheet of gold leaf. The particles where detected using a screen to see how they had been deflected.**
6. What were the results of the alpha particle scattering experiment. **Many of the alpha particles passed straight through the gold leaf or were deflected slightly (as expected). However some particles bounced of the gold leaf (not expected)**
7. What conclusion did Rutherford make from the results of the alpha particle scattering experiment. **The mass of the atom was concentrated in a small central nucleus.**
8. How did Bohr adapt Rutherford's model. **He suggested that electrons orbited the nucleus at specific distances.**
9. What sub-atomic particle did Rutherford discover in 1920 to explain the positive charge in an atom? **Proton.**
10. What sub-atomic particle did James Chadwick discover which explained isotopes? **Neutron.**

6.4.2	Atoms and nuclear radiation.
6.4.2.1	Radioactive decay and nuclear radiation.

1. What is radioactive decay? **The random process of an unstable atom releasing radiation to become more stable.**
2. What is activity? **The rate at which a source of unstable nuclei decays.**
3. What are the units of activity? **Becquerel (bq).**
4. What is the count-rate? **The number of decays recorded each second by a detector.**
5. Give an example of a detector of radioactive decay. **A Geiger-Muller tube.**
6. Name the four types of nuclear radiation. **Alpha particle (α), beta particle (β), gamma ray (γ) and neutron (n).**
7. What type of nuclear radiation emits a particle with no charge? **Neutron.**
8. What type of nuclear radiation emits electromagnetic radiation? **Gamma rays.**
9. What type of nuclear radiation emits a particle consisting of two neutrons and two protons? **Alpha particle.**
10. What type of nuclear radiation emits a particle consisting of one electron? **Beta particle.**
11. What type of nuclear emission emits a particle the same as a helium nucleus? **Alpha particle.**
12. What type of nuclear emission emits a negatively charged particle? **Beta particle.**
13. What type of nuclear emission emits a positively charged particle? **Alpha particle**
14. What type of nuclear emission causes a neutron to turn into a proton? **Beta particle.**
15. Complete the following table:

	Penetration	Range in air	Ionising power
alpha particle	Low	Low	High
beta particle	Medium	Medium	Medium
gamma ray	High	High	Low

6.4.2.2	Nuclear equations

1. What do nuclear equations represent? **Radioactive decay.**
2. What are the symbols for alpha particles and beta particles?

$^{4}_{2}He$ and $^{0}_{-1}e$

3. What can the emission of different types of nuclear radiation change? **They may cause the change in mass and/or charge of the nucleus**
4. What does alpha decay change? **Alpha particle emission cause the mass and charge of the of the nucleus to decrease (more negative).**
5. What does beta decay change? **Beta particle emission does not change the mass but does increase the charge of the nucleus (more positive).**
6. What does gamma decay change? **Gamma ray emission does not change the mass or charge of the nucleus.**
7. What does neutron decay change? **Neutron emission changes the mass but not the charge of a nucleus.**
8. Complete the following nuclear equation to show alpha decay.

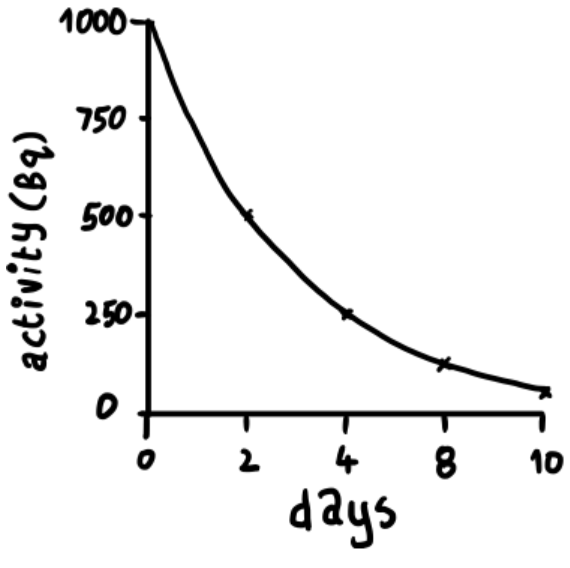
$^{219}_{86}\text{radon} \longrightarrow ^{215}_{84}\text{Polonium} + ^{4}_{2}He$

9. Complete the following nuclear equation to show beta decay.

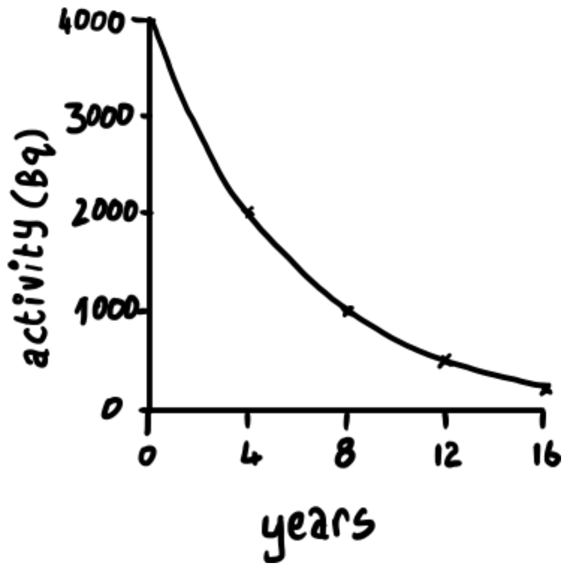
$^{14}_{6}\text{carbon} \longrightarrow ^{14}_{7}\text{nitrogen} + ^{0}_{-1}e$

6.4.2.3	**Half-lives and the random nature of radioactive decay.**

1. Describe the nature of radioactive decay. **Random.**
2. What is the half-life of a radioactive isotope? **The time it takes for the number of nuclei in a sample to halve, or the time it takes for the activity from an isotope to fall to half its initial level.**
3. Explain how half-life is related to the random nature of radioactive decay. **It cannot be predicted which radioactive atom in a sample will decay, you can calculate how long it would take for half the sample to decay.**
4. A 50g sample of radioactive isotope has a half-life of 3 years. What mass of isotope would remain after 9 years? **After 3 years 25g remain, after 6 years 12.5g remain, after 9 years 6.25g would remain.**
5. The activity of a sample is 1200Bq. After 10 days the activity is 300Bq. What is the half-life of the sample? **1200Bq decays to 600Bq which decays to 300Bq. Which is 2 half-lives. So one half-life = 5 days (10 days / 2)**
6. What is the net decline of an isotope that has been through 3 half-lives? **12.5%.**
7. What is the half life of the radioactive isotopes in the following graphs?



2 days



4 years

6.4.2.4	Radioactive contamination.

1. What is radioactive contamination? **The unwanted presence of radioactive materials on other materials.**
2. What causes the hazard from contamination? **The decaying atoms in the radioactive contamination.**
3. What affects the level of hazard? **The type of radiation emitted.**
4. What is irradiation? **The process of exposing an object to nuclear radiation.**
5. Compare the hazards of contamination and irradiation of an alpha source. **Contamination inside the body is very dangerous. Irradiation is less hazardous because of low penetration.**
6. Compare the hazards of contamination and irradiation of a beta source. **Less damaging inside the body due to less ionising. Irradiation can be dangerous especially at higher doses.**
7. Compare the hazards of contamination and irradiation of a gamma source. **Contamination carries a low risk but irradiation by gamma rays is highly hazardous.**
8. Explain why it is important for scientists to publish findings on the effect of radiation. **So the findings can be shared with other scientists and checked by peer review.**

6.5	Forces
6.5.1	Forces and their interactions
6.5.1.1	Scalar and vector quantities

1. Define the term scalar quantity. **A quantity with magnitude only.**
2. Define the term vector quantity. **A quantity with both magnitude and direction.**
3. Give four examples of scalar quantities. **Mass, distance, speed and temperature.**
4. Give four examples of vector quantities. **Acceleration, force, velocity and displacement.**
5. Explain how a vector quantity can be represented by an arrow. **The direction of the arrow represents the direction of the vector quantity and the length of the arrow represents the magnitude.**

6.5.1.2	Contact and non-contact forces

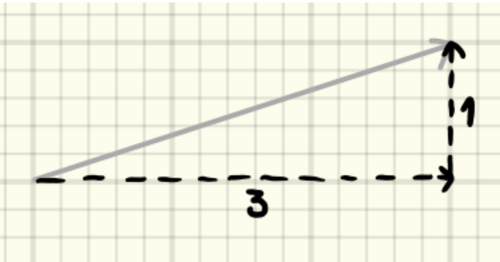
1. What is a contact force? **An interaction between two objects which are physically touching.**
2. What is a non-contact force. **An interaction between two objects which are physically separated.**
3. Give two examples of contact forces. **Friction, air resistance, tension and normal contact force.**
4. Give two examples of non-contact forces. **Gravitational force, magnetic force and electrostatic force.**
5. What type of quantity is force? **Vector**

6.5.1.3	Gravity

1. What is weight? **The force acting on an object due to gravity.**
2. What is the cause of the force of gravity close to the Earth? **The gravitational field around the Earth.**
3. What does the weight of an object depend on? **The gravitational field strength where the object is.**
4. What is the equation to calculate the weight of an object? **W = m x g (weight = mass x gravitational field strength.**
5. What is the unit of weight? **N (newtons).**
6. What is the unit of gravitational field strength? **N/kg (newtons per kilogram).**
7. Where is the weight of an object considered to act? **The centre of mass.**
8. How are the weight and mass of an object linked? **They are directly proportional.**
9. How can the weight of an object be measured? **Using a calibrated spring-balance (newtonmeter).**

6.5.1.4	Resultant forces

1. What is a resultant force? **A single force that can be used to replace a number forces acting upon an object. The resultant force has the same effect as all the other forces acting together.**
2. Explain how you would calculate the resultant force of two forces that act in a straight line? **Take one force away from the other to calculate the overall resultant force.**
3. Use the diagram to resolve the resultant force into two component forces



6.5.2	Work done and energy transfer

1. When is work done? **When a force causes an object to move through a distance (e.g. pushing a pram).**
2. What is the equation to calculate work? **W = F x s (work done = Force x distance)**
3. What is the unit of work? **Joules**
4. What is a newton-metre? **When a force of one newton causes a displacement of 1 metre.**
5. What is 1 newton-metre equal to? **1 joule.**
6. Describe the energy transfer when a person walks up a flight of stairs. **The higher the person gets the greater the gravitational potential energy they store.**
7. What is the result of work done against frictional forces acting upon an object. **This causes a rise in the temperature of the object.**

6.5.3	Forces and elasticity

1. State three ways the shape of an object can be changed. **Stretching, bending and compression.**
2. Explain why when changing the shape of an object more than one force needs to be applied. **If only one force was applied the object would simply move in the direction of the applied force.**
3. What is elastic deformation? **This is when an object that has been deformed returns to its original length and shape.**
4. What is inelastic deformation? **This is when an object that has been deformed does not return to its original length and shape.**
5. How is extension of an elastic object related to the force applied? **The extension of an object is directly proportional to the force applied (provided the limit of proportionality is not exceeded.**
6. What is the limit of proportionality? **This is the point at which the extension is no longer proportional to the force. On a force against extension graph, the line starts to curve after this point.**
7. What is the formula that combines force, spring constant and extension? **$F = k \times e$ (force = spring constant x extension).**
8. What is the unit for the spring constant? **N/m (newtons per metre).**
9. What is the unit for extension? **Metres.**
10. Explain the energy transfer when a force is applied to a spring. **A force that deforms a spring does work. Elastic potential energy is then stored in the spring. The work done is equal to the elastic potential energy stored (unless the spring is inelastically deformed).**
11. Explain why you would see a linear relationship between force and extension. **A linear relationship shows that the force is directly proportional to the extension.**
12. Explain why you would see a non-linear relationship between force and extension. **A non-linear relationship shows the limit of proportionality has been exceeded.**
13. Describe how you would calculate the spring constant from a graph if the force and extension have a linear relationship. **The gradient of the graph (force / extension) is equal to the spring constant.**
14. What equation would you use to calculate the work done by a spring? **$E_e = 1/2 \times k \times e^2$ (elastic potential energy = 1/2 x spring constant x (extension)^2**
15. Describe an experiment to investigate the relationship between force an extension for a spring. **Attach spring to a retort stand. Fix a graduated ruler behind the spring so that the extension can be measured. Measure the starting length of the spring. Add a 0.5N weight (50g) to the spring and measure the extension. Repeat for 1N, 1.5N, 2N, 2.5N, 3N, 3.5N, 4N, 4.5N and 5N. Plot a graph with extension along the horizontal axis and force on the vertical axis. If you get a curve at the top of the graph the limit of proportionality can be calculated. The spring constant can be calculated from the gradient of the straight line part of the graph.**

6.5.4	Forces and motion
6.5.4.1	Describing motion along a line.
6.5.4.1.1	Distance and displacement.

1. Define distance. **Distance is how far an object moves.**
2. What type of quantity is distance? **Scalar.**
3. Define displacement. **Displacement is the distance an object moves and the direction it travels.**
4. What type of quantity is displacement? **Vector.**
5. How should displacement be expressed? **Magnitude and direction e.g. 30m, North.**

6.5.4.1.2	Speed

1. What type of quantity is speed? **Scalar**
2. What four factors may affect the speed at which a person can walk, run or cycle. **Age, terrain, fitness and distance travelled.**
3. What are typical values for the speed of walking, running and cycling? **1.5 m/s, 3 m/s, 6 m/s.**
4. What are typical values for the speed of a car, a train and an aeroplane? **Car: 25m/s, train: 30m/s and aeroplane: 250m/s**
5. What is the typical speed of sound in air? **330 m/s.**
6. What equation links distance travelled, speed and time. **s=v x t (distance travelled = speed x time).**
7. What are the units for speed? **m/s.**

6.5.4.1.3	Velocity

1. What is velocity? **The speed of an object in a given direction.**
2. What type of quantity is velocity? **Vector.**
3. Explain why does motion of an object in a circle involves constant speed but changing velocity? **(HT) An object travelling in s circle is constantly changing direction. As a result its velocity will change constantly due to the change in direction.**

6.5.4.1.4	The distance-time relationship

1. How is the speed of an object calculated in a distance-time graph? **The gradient of the line**
2. How do you measure the speed of an object that is accelerating using a distance-time graph? **Draw a tangent and calculate the gradient of the tangent.**

6.5.4.1.5	Acceleration

1. What equation is used to calculate the average acceleration of an object? **$a = \Delta v / t$ (acceleration = change in velocity / time taken)**
2. What is the unit of acceleration? **m/s^2.**
3. What type of quantity is acceleration? **Vector.**
4. How is change in velocity (Δv) calculated? **Final velocity - initial velocity.**
5. What term is used to denote slowing down? **Deceleration**
6. How is acceleration calculated from a velocity-time graph? **Gradient (velocity / time)**
7. How is the displacement calculated from a velocity-time graph? **(HT) Area under the curve.**
8. What equation applies to objects with uniform acceleration? **$V^2 - U^2 = 2 \times a \times s$ (final velocity^2 - initial velocity^2 = 2 x acceleration x distance)**
9. What is the acceleration due to gravity of an object falling near the Earth's surface? **About 9.8 m/s^2.**
10. Describe what happens to an object that is falling through a fluid? **An object falling through a fluid (liquid or gas) will initially accelerate due to gravity. As the velocity increases so will drag as more particles hit the falling object. Eventually the drag will equal velocity and the resultant force will be zero. The object will then move at a constant speed called the terminal velocity.**

6.5.4.2	Forces, accelerations and Newton's Laws of motion.
6.5.4.2.1	Newton's First Law.

1. What is Newton's First Law? **If the resultant force acting on an object is zero then the object will remain stationary or will continue to move at the same velocity.**
2. Describe the effect of Newton's First Law on a vehicle driving at steady speed. **When a vehicle is travelled get at a steady speed the resistive forces (air resistance and friction) will be equal to driving force.**
3. According to Newton's First Law when will the velocity (the speed or direction) of an object change? **The velocity of an object will change if a resultant force acts upon the object.**
4. What is inertia? **(HT) The tendency of objects to remain at rest or continue with uniform motion.**

6.5.4.2.2	Newton's Second Law.

1. What is Newton's Second Law? **The acceleration of an object is proportional to the resultant force acting upon the object. It is inversely proportional to the mass of the object.**
2. What equation is used to calculate the resultant force on an object? **F = m x a (force = mass x acceleration).**
3. What is inertial mass a measure of? **(HT) The difficulty of changing the velocity of an object.**
4. Define inertial mass. **(HT) The ratio of force over acceleration**
5. What symbol would be used if a question asks for an estimated value? **~**
6. What symbol represents proportionality? **∝**
7. Describe an experiment to investigate the effect of varying force on the acceleration of a constant mass. **Set up a trolley attached to a piece of string. Run the string over a pulley at the end of a track. Set up a light gate to record acceleration. Mark a start line on the track. The distance between the start track and the light gate should be the same each time. Place all the masses in the trolley. Take the first mass and add to the string. Release the trolley from the start line and measure the acceleration. Take the next mass from the trolley and add to the string. Release the trolley and measure the acceleration. Repeat for each of the masses in the trolley (e.g. 50g, 100g, 150g, 200g, 250g). Plot results for force (in newtons) against acceleration.**

6.5.4.2.3	Newton's Third Law.

1. What is Newton's Third Law? **Whenever two objects interact, the forces they exert on each other are equal and opposite.**

6.5.4.3	Forces and braking.
6.5.4.3.1	Stopping distances.

1. What is the stopping distance of a vehicle? **The sum of the thinking distance and the braking distance.**
2. What is the thinking distance. **The distance travelled during the drivers reaction time.**
3. What is braking distance. **The distance travelled under braking force.**

6.5.4.3.2	Reaction time

1. What is the typical reaction time of person? **0.2s to 0.9s**
2. Name four factors which could affect a driver's reaction time. **Tiredness, drugs, alcohol and distractions.**
3. Describe two methods to calculate the reaction time of a person. **Using the drop ruler test, using a digital reaction timer.**

6.5.4.3.3	Factors affecting braking distance I

1. Name two road conditions which could affect the braking distance of a car? Wet and icy.
2. Name two ways in which a car in poor condition could affect the braking distance? Worn brakes and worn tyres

6.5.4.3.4	Factors affecting braking distance II

1. Describe what happens when a force is applied to the brakes of a vehicle in relation to energy transfer and work done. The work done by the friction force between the brakes and the wheel transfers kinetic energy (the cars slows down) to thermal energy in the brakes and tyres (the brakes get hot).
2. How is speed related to braking force if a vehicle needs to stop in a certain distance? The greater the speed, the greater the braking force required.
3. How is the braking force linked to deceleration? The greater the braking force the greater the deceleration of the vehicle.
4. What are the consequences of large decelerations? Overheating of the brakes and loss of control.
5. What equation can be used to estimate the uniform deceleration of a vehicle? (HT) $V^2 - U^2 = 2 \times a \times s$ (final velocity^2 - initial velocity^2 = 2 x acceleration x distance)

6.5.5	Momentum. (HT)
6.5.5.1	Momentum is a property of moving objects.

1. What is momentum a property of? A property of moving objects.
2. What is the formula for momentum? $\rho = m \times v$ (momentum = mass x velocity)
3. What is the unit for momentum? Kg m/s (kilogram metres per second)

6.5.5.2	Conservation of momentum.

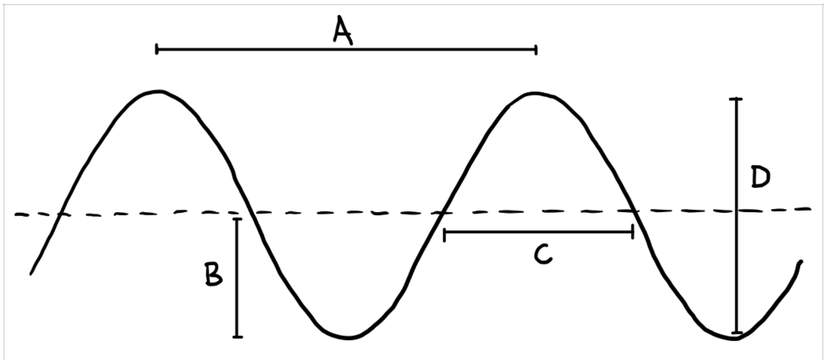
1. What is the law of conservation of momentum? The total momentum before a collision (or explosion) is equal to the total momentum after a collision (or explosion).
2. What is a closed system? A system where neither energy nor matter can leave.
3. Describe how the conservation of momentum is applied to a collision between two vehicles. Calculate the momentum of each each individual vehicle and add them together to get the total momentum before the collision. Calculate the individual momentum of each of the vehicles after the collision. Use the total momentum before the collision to help calculate an unknown variable after the collision.
4. Describe how conservation of momentum is applied to an explosion. An explosion is a special case where the momentum before the explosion is equal to zero. This means the momentum after the explosion must also equal zero. This is achieved by one of the components (e.g. bullet) having a positive velocity and one of the components (e.g. the rifle) having a negative velocity.

6.6	Waves
6.6.1	Waves in air, fluids and solids.
6.6.1.1	Transverse and longitudinal waves.

1. What are waves? **Waves transfer energy from one place to another without transferring matter.**
2. Describe the motion of a transverse wave. **The oscillations are perpendicular to the movement of travel.**
3. Describe the motion of a longitudinal wave. **The oscillations are parallel to the movement of travel.**
4. Give an example of a transverse wave. **Ripples on water, all electromagnetic waves and waves on a string.**
5. Give an example of a longitudinal wave. **Sound waves**
6. What does rarefaction mean? **An uncompressed section of a longitudinal wave.**
7. Give evidence for ripples of water waves to show that it is the wave that travels and not the water. **An object floating on water will move up and down as a wave passes underneath. Although the wave will move in one direction the floating object does not move with the wave.**

6.6.1.2	Properties of waves.

1. What is amplitude? **Amplitude is the maximum displacement of a point on a wave away from its undisturbed position.**
2. What is wavelength? **Wavelength is the distance from one point on a wave to the equivalent point on an adjacent wave.**
3. What is frequency? **Frequency is the number of waves that pass a point each second.**
4. What is the unit for frequency? **Hertz (Hz).**
5. What is the unit for wavelength? **Metres (m).**
6. What is the unit for period? **Seconds (s).**
7. What is wave speed? **Wave speed is the speed at which the energy is transferred (or the waves move) through the medium.**
8. What is the formula for wave speed (the wave equation). **Wave speed = frequency x wavelength ($v = f\lambda$).**
9. What is the unit for wave speed? **Metres per second (m/s).**
10. Which waves obey the wave equation? **All waves obey the wave equation.**
11. Describe a method to measure the speed of sound waves in air. **Place two microphones 1 metre apart. Attach microphones to a computer with software to detect sound waves. Start recording and make a sharp and loud sign. The software will record two distinct peaks. Use the computer to measure the time difference between the sounds detected by each microphone. This is the time it took the sound wave to travel 1 metre. The speed can be calculated using velocity = distance / time.**
12. Describe a method to measure the speed of ripples on a water surface. **Set up a ripple tank. Use a light to project the ripples onto a screen. Use a signal generator to move the dipper. You can count the number of waves that pass a point in 10 secs. Divide this figure by 10 to calculate the frequency. Turn on a strobe light. This will make the ripples appear to be still. You can then measure the length of 10 wavelengths. Divide this by 10 to calculate the wavelength. Use the frequency x wavelength to calculate wave speed.**
13. Identify wavelength and amplitude in the following diagram.



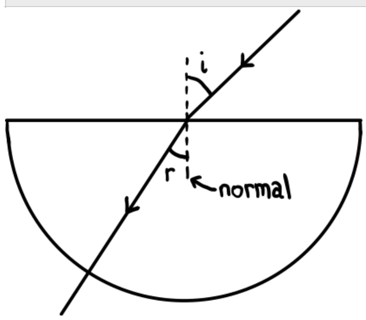
Wavelength = A Amplitude = B

6.6.2	Electromagnetic waves.
6.6.2.1	Types of electromagnetic waves.

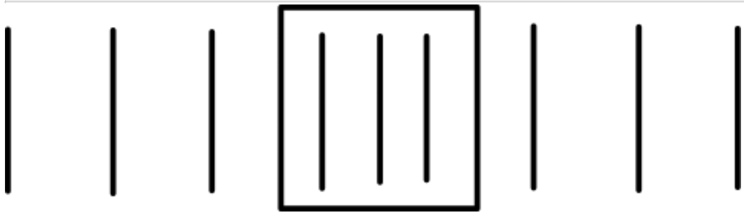
1. What are electromagnetic waves? **Transverse waves that transfer energy from a source to an absorber.**
2. What type of spectrum do electromagnetic waves form? **A continuous spectrum.**
3. What property do all electromagnetic waves share in a vacuum? **They all move at the same velocity**
4. How are waves in the electromagnetic spectrum grouped? **They are grouped by wavelength and frequency.**
5. List the 7 groups of the electromagnetic spectrum from long wavelength to short wavelength. **radio waves - microwaves - infrared - visible light - ultraviolet - x-rays - gamma rays.**
6. List the 7 groups of the electromagnetic spectrum from high frequency to low frequency. **gamma rays - x-rays - ultraviolet - visible light - infrared - microwaves - radio waves.**
7. Which part the electromagnetic spectrum do eyes detect? **Visible light.**
8. Describe the energy transfer of radio waves. **Radio waves transfer energy to the kinetic energy stores of electrons in radio receivers.**
9. Describe the energy transfer of microwaves. **Microwaves transfer energy to the kinetic energy stores of water molecules in the food.**
10. Describe the energy transfer of infrared waves. **A campfire emits infrared radiation. These are absorbed by objects and transferred to an objects internal energy store.**

6.6.2.2	Properties of electromagnetic waves 1.

1. Name 4 ways substances can affect electromagnetic waves (HT). **Substances may absorb, transmit, refract or reflect waves.**
2. What happens when waves are absorbed by a substance (HT)? **The waves transfers energy to the substances internal energy stores.**
3. What happens when waves are transmitted by a substance (HT)? **The wave carries on travelling through the substance.**
4. What happens when waves are refracted by a substance (HT)? **The wave will change speed as it crosses the boundary between one substance and another.**
5. What happens when waves are reflected by a substance (HT)? **The wave is neither absorbed or transmitted but its path is changed away from the substance.**
6. Explain why refraction changes in different substances (HT). **Different substance cause the waves to move at different velocities.**
7. Complete the following ray diagram to show the refraction of the wave between different media.



8. Complete the following wavefront diagrams to show the refraction of the wave between different media (HT).



9. Describe an experiment to investigate the amount of infrared radiation absorbed or radiated by a different surfaces. **Use a Leslie cube with four of the faces coloured with matt black paint, matt white paint, dull metal and shiny metal. Use an infrared thermometer to measure the temperature of a face. Fill the cube with hot water and place on a heat proof mat. Place the infrared thermometer at a fixed distance from a face and record the temperature. Repeat for each of the faces. Repeat the experiment to get two sets of results so an average can be calculated.**

6.6.2.3	Properties of electromagnetic waves 2.

1. How are radio waves produced (HT)? **Radio waves are produced by oscillations in electrical circuits (e.g alternating current).**
2. Describe what happens when radio waves are absorbed (HT)? **They create an alternating current with the same frequency as the radio wave itself.**
3. Describe the result when changes occur in atoms or nuclei. **Electromagnetic waves can be absorbed or generated by the atom or nuclei, over a wide frequency range.**
4. Describe the origin of gamma rays. **Changes in the nuclei of a unstable radioisotope leads to the emission of gamma rays.**
5. Name three waves of the electromagnetic spectrum that can be hazardous to human body tissue. **Gamma rays, x-rays and ultraviolet light.**
6. What do the effects of these hazardous waves depend upon? **The effect depends on the the type of radiation and the size of the dose.**
7. What is the unit of radiation dose? **Sievert**
8. What is the effect of ultraviolet radiation on human tissue? **Ultraviolet light causes skin to age prematurely and increase the risk of skin cancer.**
9. What type of radiation are X-rays and gamma rays? **Ionising radiation.**
10. What is the effect of X-rays and gamma rays on human tissue? **They can cause mutation of genes and cancer.**

6.6.2.4	**Uses and applications of electromagnetic waves.**

1. Name 2 applications of radio waves. **Television and radio.**
2. Name 2 applications of microwaves. **Satellite communication and cooking food.**
3. Name 3 applications of infrared. **Electrical heaters, cooking food and infrared cameras.**
4. Name an application of visible light. **Fibre optic communications.**
5. Name 2 applications of ultraviolet. **Energy efficient lamps and suntanning.**
6. Name two applications for X-rays and gamma rays. **Medical imaging and treatment.**
7. Explain briefly why radio waves are suitable for communication (HT). **Long wave signals can be transmitted and recieved without being in line of sight. Short wave signals can be bounced of the atmosphere to travel long distances.**
8. Explain briefly why microwaves are used by satellites (HT). **Microwaves used for communication are able to pass through the atmosphere to be picked up by satellites.**
9. Explain briefly why infrared is suitable for heating rooms (HT). **Infrared radiation from a heater is absorbed by an object and increases its internal energy stores.**
10. Explain briefly why light is suitable for fibre optic cables (HT). **Visible light is refracted which allows it to travel along long lengths of cable. It is not absorbed or scattered as it travels along.**
11. Explain briefly why ultraviolet radiation is useful for security marking (HT). **Under normal light the security mark will be invisible to thieves.**
12. Explain briefly why X-rays and gamma rays are used in medicine (HT). **X-rays are transmitted through flesh but are absorbed by denser material such as bone.**

6.7	Magnetism and electromagnetism
6.7.1	Permanent and induced magnets, magnetic forces and fields.
6.7.1.1	Poles of a magnet.

1. What are the poles of a magnet? **These are the places where the magnetic forces are the strongest.**
2. What happens when two magnets are brought close together? **They exert a force on each other.**
3. What force occurs when two like poles are brought close together? **The magnets repel each other.**
4. What force occurs when two unlike poles are brought close together? **The magnets are attracted to each other.**
5. What is a permanent magnet? **A magnet that produces its own magnetic field.**
6. What is an induced magnet? **A material that becomes a magnet when it is placed in a magnetic field.**
7. What type of force does an induced magnet always cause? **Attraction.**
8. What happens when an induced magnet is removed from the magnetic field? **It loses most of its magnetism quickly.**

6.7.1.2	Magnetic fields.

1. Name four types of magnetic material. **Iron, steel, cobalt and nickel.**
2. What is a magnetic field. **The region around the magnet where a force acts on magnetic material.**
3. What force occurs between a magnet and a magnetic material? **Attraction.**
4. What does the strength of the magnetic field depend upon? **The distance from the magnet.**
5. Where is the magnetic field strongest? **At the poles.**
6. What is the direction of the magnetic field at any point? **The direction is given the direction of the force that would act on a north pole placed at that point.**
7. What is the direction of the magnetic field line from pole to pole? **From the north pole to the south pole.**
8. What does a magnetic compass contain? **A small bar magnet.**
9. In what direction does the compass needle point? **The needle points in the direction of the earth's magnetic field.**
10. Describe how to plot the magnet field pattern of a magnet using a compass. **Move a compass around a magnet and plot the direction of the compass, using arrows, to build up a picture of the magnetic field.**
11. Evaluate the idea that the core of the Earth must be magnetic. **The behaviour of a bar magnet in a magnetic field shows that on earth they are affect by large magnetic field. As a result a compass can be used to point in a northern direction.**

6.7.2 The motor effect

6.7.2.1 Electromagnetism

1. What happens when a current flows through a conducting wire? **A magnetic field I'd produce around the wire.**
2. What does the strength of of the magnetic field in a conducting wire depend upon? **The strength of the magnetic field depends upon the current through the wire and the distance from the wire.**
3. What is a solenoid? **A coil of wire.**
4. Describe the magnetic field inside a solenoid. **The magnetic field is strong and uniform.**
5. Describe the magnetic field around a solenoid. **The magnetic field has a similar shape to a bar magnet.**
6. How can the strength of a solenoid be increased? **Adding an iron core to the solenoid.**
7. What is an electromagnet. **An electromagnet is a solenoid with an iron core.**

6.7.2.2 Fleming's left-hand rule (HT)

1. Describe the motor effect. **When a conductor is placed in a magnetic field, the magnet producing the field and the conductor exert a force on each other called the motor effect.**
2. What does the thumb represent in Fleming's left-hand rule? **Direction of motion.**
3. What does the first finger represent in Fleming's left-hand rule? **Direction of magnetic field.**
4. What does the second finger represent in Fleming's left-hand rule? **Direction of current.**
5. What is the unit of magnetic flux density? **Tesla (T).**
6. What is the symbol for magnetic flux density? **B.**

6.7.2.3 Electric motors (HT)

1. What does a current carrying coil of wire in a magnetic field tend to do? **Rotate.**
2. What are the directions of the forces on the coil in a motor? **One force acts up the other acts down.**
3. What swaps the contact every half turn in a motor? **Split ring commutator.**
4. Name two ways the direction of of the motor can be reversed. **Swapping the polarity of the dc supply or swapping the magnetic poles.**
5. Name three ways the speed of the motor can be increased. **Increasing the current, adding more turns to the coil or increasing the magnetic flux density.**