Aylsham High School Science Department

KS4 Combined Science Core Questions

Y10 and Y11

You can help improve your child's understanding, confidence and attainment in science by testing them on the core questions they have been taught in their science lessons.

Combined science is now a 2 year course, students will have to recall information taught over this long period of time, it is important to prevent forgetting of concepts learnt in this time period. Learning core questions is a key part of preparing for this new challenge.

Your child's teachers are testing them regularly in lessons, they will be tested on the core questions already taught.

Your child will know who their science teacher is, if you need to contact them regarding the core knowledge they are expected to be learning, please see the table of emails below.

Y10 Biology Questions

SB1 Core Knowledge

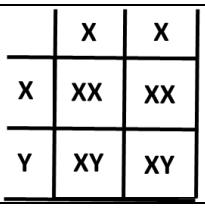
	Question	Answer
1	What is the function of the nucleus in cells?	Contains DNA
2	What is the function of the cell membrane?	To control which substances enter and exit the cell.
3	What is the function of the mitochondria in cells?	Releases energy. Where aerobic respiration occurs.
4	What is the function of the ribosome in cells?	Making proteins.
5	Name three structures that you might find inside a plant cell but *not* inside an animal cell.	Cell wall, vacuole, chloroplast.
6	What is the function of the chlorophyll in cells?	Traps light energy to be used in photosynthesis.
7	What is the function of the vacuole in plant cells?	Stores cell sap.
8	What is the function of the cell wall in plants?	Contains cellulose to provide support.
9	Prokaryotic cells (e.g. bacteria) differ from eukaryotic cells (e.g. animal) in what way?	Prokaryotic cells don't have a nucleus (they have chromosomal and plasmid DNA instead)
10	What are the small loops of DNA in bacteria called?	Plasmid DNA
11	In what way are sperm and eggs cells similar to each other but different to body cells?	Haploid nucleus. They contain half as many chromosomes as body cells.
12	List four ways that sperm cells are adapted for their function.	They have an acrosome, haploid nucleus, many mitochondria and a tail
13	List three ways that egg cells are adapted for their function.	They hold nutrients in their cytoplasm, have a haploid nucleus and changes occur in the cell membrane after fertilisation
14	How are the cells that line the small intestine specialised for their function of absorbing food?	They have many tiny folds called microvilli that give them a large surface area.
15	How have developments in microscope technology helped us understand more about cells?	A higher magnification using electron microscopes has allowed us to see more detail including more sub-cellular structures.
16	What is 30 µm in mm?	0.03 mm (be ready for other examples)
17 H	**What is 1150000 m in standard form?**	**1.15×10^6 m (be ready for other examples)**
18	How do you calculate the total magnification of a microscope?	Eyepiece lens magnification x objective lens magnification
19	How do you calculate the actual length of a magnified image?	Actual length = magnified length ÷ magnification
20	Which stain is used when viewing plant cells?	Iodine
21	Why might a scientist add methyl blue to an animal cell sample before viewing it under a microscope?	It is a stain that makes objects in the slide more visible.
22	What is an enzyme?	A biological catalyst made of protein
23	List three cellular reactions that enzymes catalyse	Respiration, photosynthesis, digestion, protein synthesis and DNA replication.
24	Which enzyme breaks down protein? Name the product formed.	Protease breaks down protein into amino acids
25	Which enzyme breaks down fat? Name the product formed.	Lipase breaks down fat into fatty acids and glycerol
26	Which enzyme breaks down carbohydrate? Name the product formed.	Carbohydrases such as amylase break down carbohydrates into sugars.

27	What is the uniquely shaped 'pocket' on the outside of an enzyme called?	The active site
28	What do we call substances that fit into the active site for enzymes to work on?	Substrates
29	Which model do we use to explain how enzymes work?	Lock and key model
30	State three conditions that might affect the rate at which an enzyme works.	Temperature, pH and substrate concentration
31	Which two conditions could affect the shape of an enzyme's active site?	Temperature and pH
32	What is a denatured enzyme?	An enzyme that has an active site which has changed shape and no longer allows the substrate to fit.
33	Define diffusion	Substances moving from high to low concentration (down a concentration gradient).
34	Define osmosis	The overall movement of solute molecules in a solution across a partially permeable membrane from a dilute solution to a more concentrated one.
35	Define active transport.	The movement of substances from an area of low concentration into an area of higher concentration. This requires energy.

CB2 Cells and Control

	Question	Answer
1	What are the stages of mitosis?	Interphase, prophase, metaphase, anaphase, telophase and cytokinesis
2	Why do cells do mitosis?	Growth, repair and asexual reproduction
3	Describe mitosis	The production of two diploid daughter cells, genetically identical to each other and the parent cell.
4	What is cancer?	Uncontrolled mitosis. Rapid cell division can cause tumours that can damage the body.
5	How is growth different in plants and animals?	In animals, cells divide then differentiate. In plants they divide, elongate then differentiate.
6	What is growth?	Growth is an increase in size as a result of an increase in number or size of cells.
7	What process leads to the creation of specialised cells?	Differentiation
8	How are percentile charts used to monitor growth?	Mass and length/height of babies are checked on a graph to compare to others the same age. Babies should remain on or around the same percentile line as they grow.
9	How can percentage change be calculated?	(Final value- initial value)/initial value x 100
10	What are stem cells?	Cells that divide repeatedly over a long period of time to produce cells that can differentiate.
11	What are plant stem cells called?	Meristems
12	What is the difference between adult and embryonic stem cells?	Embryonic stem cells can differentiate to produce any kind of cell. Adult stem cells usually only produce specialised cells of one tissue type.
13	List two benefits associated with the use of stem cells in medicine	Benefits- can treat different diseases caused by damaged cells. Can be used to test new drugs and treatments on.
14	List two risks associated with the use of stem cells in medicine	Risks- if stem cells continue to divide this could cause cancer. Also if stem cells from one person are placed in another they could be killed by the immune system and be 'rejected'.
15	What is the Central Nervous System (CNS) made up of?	The brain and the spinal cord
16	Describe the structures and functions of the parts at each end of a neurone.	Dendrite- tiny branches that receive impulses from receptor cells Axon terminal- allows signal to be transmitted to the next cell
17	What is the function of the myelin sheath?	Insulator. Speeds up the signal.
18	What are neurotransmitters? Where are they released?	Chemicals that are released at an axon terminal and diffuse across the synapse (gap) between neurones to pass on a signal.
19	What are the steps in the reflex arc?	Stimulus>receptor>sensory neurone>relay neurone> motor neurone> effector> response.

SB3 Core Knowledge

	Question	Answer
1	State two advantages of asexual reproduction	No need to find a mate Quick to take advantage of resources
2	State a disadvantage of asexual reproduction	Almost no genetic variation- less adaptable to changes
3	State an advantage of sexual reproduction	Genetic variation for greater adaptability
4	State two disadvantage of sexual reproduction	Need to find a mate Desirable characteristics are not always passed on
5	What are gametes?	Haploid sex cells (e.g. eggs ,sperm, pollen)
6	Describe the products of meiosis	Cell division that produces four haploid daughter cells- genetically different to parent cell. These are gametes (sex cells).
7	What is a genome?	A complete set of chromosomes/ full set of DNA
8	Describe the structure of DNA	Two strands in a double helix, joined together by complementary bases with weak hydrogen bonds between each other.
9	How do the bases form complimentary pairs in DNA?	Cytosine- Guanine (with 3 weak Hydrogen bonds) Adenine- Thymine (with 2 weak Hydrogen bonds)
10	What is a gene?	A section of DNA with the instructions for making a single protein.
11	When extracting DNA from fruit, what is the role of the detergent solution?	It breaks down the membranes around the cell and the nucleus.
12	When extracting DNA from fruit, what substance is used to precipitate DNA?	(ice-cold) ethanol
13	What are alleles?	Different versions of the same gene
14	What is an organisms genotype?	The combination of alleles an organism has for a characteristic (e.g. Bb).
15	What is a phenotype?	What an organism looks like (as a result of its genotype)
16	How do alleles result in differences in the characteristics inherited by an individual?	Inheriting different combinations of alleles result in different characteristics being 'expressed'.
17	Describe the genotype BB	Homozygous dominant (be prepared for other examples)
18	State the sex chromosomes contained within a male and a female body cell.	Male = xy. Female = xx.
19	Draw a punnett square to show that the chance conceiving a girl is 50%	
20	Define mutation.	A change in a gene that results in a new allele.
21	When does mutation usually occur?	During cell division.
22	How often will a mutation lead to a change in the phenotype of an organism? Why?	Very rarely. Most characteristics are the result of more than one gene.
23	What is the human genome project?	A project to map all 3.3 billion complementary bases in a full set of 46 human chromosomes.
24	State two ways that information about a person's genome could be useful in medicine?	1. Identifying their risk of developing certain diseases. 2. Identifying which medicines will work best for them.
25	What causes genetic variation?	Sexual reproduction and mutation

26	What defines data for discontinuous variation?	The data can only take a limited set of values (e.g. colour, sex)
27	What do we call variation where the data collected can be any value in a range?	Continuous variation
28	What name do we give the bell-shaped curve that continuous data for variation often forms?	A normal distribution

SB4 Core Knowledge

	Question	Answer
1	What are the five key stages in Darwin's theory of evolution by natural selection?	1. Genetic variation 2. Change causes competition 3. Natural selection (survival of the 'fittest') 4. Inheritance (successful genes are passed on) 5. Evolution (over many years)
2	Explain how the emergence of resistant organisms supports Darwin's theory of evolution including antibiotic resistance in bacteria.	Bacteria reproduce very quickly compared to most other organisms. Helpful mutations inherited and population adapt to new conditions.
3	What fossil evidence do we have for the evolution of humans?	A Ardi from 4.4 million years ago b Lucy from 3.2 million years ago c Leakey's discovery of fossils from 1.6 million years ago
4	Describe the changes seen in fossils as early humans have evolved.	Humans have become taller, larger skulls (bigger brain volume) and have shorter arms.
5	Explain how we can date fossils and tools.	Carbon dating. Comparing them to other samples already dated. Using the age of the rock formation they were found in.
6	Describe how tools have developed over time	Tools have become sharper and changed shapes as humans evolved, more modern tools have become more sophisticated
7	What are the five kingdoms used to classify all living organisms?	Animals, Plants, Fungi, Prokaryotes and Protists.
8	Describe how genetic analysis has led to the suggestion of the three domains rather than the five kingdoms classification method	Some single-celled organisms were found to have genes more similar to plants and animals than to prokaryotes.
9	What are the three domains and how are organisms classified into them?	Archaea- no nucleus, genes contain unused sections of DNA Bacteria- no nucleus, no unused sections in genes Eukarya – has nucleus, unused sections in genes
10	What is a binomial name?	A two word Latin name (written in *italics*) from the genus and species of an organism E.g. *Homo sapiens*
11	What is selective breeding?	Selecting organisms with desirable characteristics, Breeding them Selecting offspring that have inherited those characteristics for further rounds of breeding.
12	What has the impact of selective breeding been on food plants and domesticated animals?	Food plants (crops): higher yield, nutritional value, pest and disease resistance and also tolerance to common weather conditions. Domesticated animals: grow faster, healthier, are more fertile, produce higher yields of meat, milk or wool and have temperaments useful for their role.
13	What is genetic engineering?	A process which involves modifying the genome of an organism to introduce desirable characteristics.
14	**Describe how a bacterium can be genetically modified to produce human insulin.**	**Restriction enzymes are used to remove the human insulin gene from the human chromosome and to cut open the plasmid- creating 'sticky ends' of overhanging bases. DNA ligase enzymes are used to insert the human gene into the**

		plasmid. Then the plasmid containing human insulin gene inserted into a bacterium.
15	Evaluate the benefits of genetic engineering in modern agriculture and medicine.	Benefits: Can get desirable characteristics quickly . Genes can be moved between species. E.g. insulin producing bacteria
16	Evaluate risks of genetic engineering in modern agriculture and medicine, including practical and ethical implications	Risks: risk of cross breeding, unknown health effects of eating GM foods. If the gene mutates further we are unsure of the effects.
17	Evaluate the benefits of selective breeding in modern agriculture and medicine.	Benefits: 'natural' process using only the genes that exist in the species, Achievable for many plant and animal owners. Can produce organisms better suited to our needs.
18	Evaluate the risks of selective breeding in modern agriculture and medicine, including practical and ethical implications	Risks: inbreeding, lack of genetic diversity that could cause a failure to meet the unknown needs of the future or put all organisms at risk of the same disease/ environmental condition.

SB5 Core knowledge

No	Question	Answer
1.	How does the World Health Organisation define health?	A state of complete physical, mental and social well-being, not merely an absence of disease or infirmity.
2.	What is a disease?	A problem with the structure or function of the body that is not the result of an injury.
3.	What is a communicable disease?	A disease caused by pathogens that can pass from an infected person to other people.
4.	What is a non-communicable disease?	A disease which is not passed from person to person.
5.	What factors can interact to cause a non-communicable disease?	1. Genetics 2. Malnutrition 3. Lifestyle
6.	Give 3 lifestyle factors and the non-communicable diseases they may cause.	1. Exercise and diet – obesity and malnutrition 2. Alcohol – liver disease / cirrhosis 3. Smoking – cardiovascular disease
7.	Why does the presence of one disease lead to a greater chance of getting another disease?	The first disease may: • Harm the immune system • Damage the body's natural defences • Stop an organ system from working effectively
8.	What body measurements and calculations can be taken to measure overall health?	BMI = $\frac{\text{Weight (kg)}}{\text{height (m}^2\text{)}}$ Hip:waist ratio
9.	How can cardiovascular disease be treated?	1. Life-long medication 2. Surgical procedures 3. Lifestyle changes
10.	What is a pathogen?	An organism that causes a communicable disease
11.	What type of organisms are pathogens?	Bacteria, fungi, viruses and protists.
12.	Name and describe two common bacterial infections.	1 Cholera (bacteria) causes diarrhoea 2 Tuberculosis (bacteria) causes lung damage
13.	Name and describe a common fungal infection.	Chalara ash dieback (fungi) causes leaf loss and
14.	Name and describe a common protist infection.	Malaria causes damage to blood and liver
15.	Name and describe a common viral infection.	HIV destroys white blood cells, leading to the onset of AIDS
16.	How are tuberculosis (bacteria) pathogens spread?	Airborne – through coughs and sneezes.
17.	How could the spread of tuberculosis be reduced or prevented?	Good hygiene
18.	How are Chalara ash dieback (a fungus) pathogens spread?	Airborne – as spores
19.	How could the spread of Chalara ash dieback be reduced or prevented?	Improve biosecurity- not importing or moving infected trees or soil
20.	How are cholera (bacteria) pathogens spread?	Through untreated water
21.	How could the spread of cholera be reduced or prevented?	Good hygiene, improving cleanliness of water supplies

22.	How are malaria (a protist) pathogens spread?	Animal vectors (e.g. mosquito)
23.	How could the spread of malaria be reduced or prevented?	Killing mosquitoes, use of mosquito nets
24.	How are STIs (sexually transmitted diseases) transmitted?	By contact with sexual fluids (vaginal fluid and semen)
25.	Name two STIs and say what organism causes them.	1. Chlamydia (bacteria) 2. HIV (virus)
26.	How can the spread of STIs be reduced or prevented?	1. Screening the population for STIs 2. Screening donated blood for STIs 3. Use of condoms during sex 4. Preventing drug users from sharing needles
27.	List 3 physical barriers which provide us with protection from pathogens.	1. Mucus in the nose 2. Cilia in the trachea 3. Skin
28.	List 3 chemical barriers which provide us with protection from pathogens.	1. Lysozymes in tears 2. Saliva and vaginal fluid 3. Hydrochloric acid in the stomach
29.	What type of protein do pathogens have on their surface?	Antigens
30.	What type of lymphocyte will be activated by a pathogen getting into the body?	One which has antibodies which fit with the pathogen's antigens.
31.	Describe 2 ways lymphocytes respond to an antigen.	1. Divide to produce many identical lymphocytes. 2. Secrete antibodies which destroy the pathogen.
32.	What are memory lymphocytes? What is their role?	Lymphocytes which stay in the blood to respond to a second infection. The secondary response is much faster and you are immune to the pathogen.
33.	What is a vaccine?	A drug which triggers immunity to a pathogen. It contains an inactive form of the pathogen.
34.	What are the advantages to immunisation?	Protects an individual from a particular disease for many years. Some diseases are eradicated Reduces risk of epidemics Less chance of long term illness as a result of the infection Herd immunity protects those not immunised Using a vaccine is cheaper than treating a very ill person
35.	Name a disadvantage to immunisation.	Some chance of side effects- some side effects can be severe.
36.	What is herd immunity?	When the <u>majority of people in a group are immunised</u>, this <u>provides protection to the few</u> people who are not by reducing the chance of coming into contact with an infected person.
37.	Why are antibiotics useful? How do they work?	They are used to treat bacterial infections. <u>They kill the bacteria</u> cells or <u>inhibit their production by interrupting cell wall synthesis,</u> but do not harm the organism being treated.
38.	List the stages in the development of new drugs, including antibiotics.	• Discovery • Development • Preclinical testing • Clinical testing

Y10 chemistry Topic 1- Key concepts

1	What is an atom?	The smallest particle that has the properties of a chemical element.
2	Describe the structure of an atom.	A nucleus containing protons and neutrons, surrounded by electrons in shells.
3	What are the relative charges and masses of protons, neutrons and electrons.	Protons: mass 1, charge +1 Neutrons: mass 1, charge 0 Electrons: mass almost zero, charge -1.
4	Why do atoms contain the same number of protons and electrons?	Atoms are neutrally charged so they must have the same number of positive particles (protons) as negative particles (electrons)
5	How would you describe the size of the nucleus relative to the rest of the atom?	Very small
6	Where is most of the mass of the atom found?	In the nucleus.
7	What is the mass number of an element?	The total number of protons and neutrons.
8	What is the atomic number of an element?	The number of protons.
9	The number of which particle is unique to an element and gives it its identity?	Protons
10	If an atom contains 12 protons, how many electrons will it have?	12.
11	If an atom has a mass number of 23 and an atomic number of 11, how many protons, neutrons and electrons does it contain?	11 protons 11 electrons 23-11 = 12 neutrons
12	What is an isotope?	Two or more atoms of the same element (the same number of protons) but with a different number of neutrons.
13	What is the relative atomic mass, (A_r)?	The relative mass of an atom compared to the mass of an atom of carbon-12.
14	Why do some elements have a relative atomic mass that is not a whole number.	The relative atomic mass is an average mass of all the isotopes that make up the element.
15	What is the formula for calculating relative atomic mass of an element from the relative mass and abundance of its isotopes?	$\frac{(\%\text{ abundance x atomic mass}) + (\%\text{ abundance x atomic mass})}{100} = \text{relative atomic mass}$

The periodic table

16	How did Mendeleev arrange the elements known at the time into a periodic table?	By using the mass number and the properties of the elements and the properties of their compounds of the elements.
17	How did Mendeleev use his table?	To predict the existence and properties of some elements that were still to be discovered.
18	Why does Mendeleev's method of organising elements in order of increasing atomic mass not always work?	The relative abundancies of some elements isotopes means they can be placed in the wrong place.
19	How are elements in the modern periodic table arranged?	In order of increasing atomic number in rows called periods and elements with similar properties are placed in the same vertical columns called groups.
20	Where are the non-metals found in the periodic table?	At the top on the right hand side.
21	What do all elements in the same row of the periodic table have in common?	They have the same number of shells of electrons.
22	What do all elements in the same column of the periodic table have in common?	They have the same number of electrons in their outer shell (and therefore have similar chemical properties).

Ionic Bonding

23	What is an ion?	A charged atom or group of atoms.
24	Describe how an ionic bond is formed.	A metal loses electron(s) to a non-metal. This results in the metal becoming a positively charged ion (cation) and the non-metal a negatively charged ion (anion). These oppositely charged ions then attract.
25	Is a cation positively or negatively charged?	Positive
26	Is a anion positively or negatively charged?	Negative
27	What charge do the ions have when formed from elements in group: a. 1 b. 2 c. 6 d. 7	a. + b. 2+ c. 2- d. -
28	What do the compound endings: 1) ide 2) ate mean?	1) ide – a compound of only the named substances 2) ate – a compound of the named substances and oxygen
29	What is the formula of the compounds formed from: a. Mg^{2+} and Cl^{-} b. Na^{+} and O^{2-}?	a. $MgCl_2$ b. Na_2O
30	Describe the structure of ionic substances.	Ionic substances are a regular arrangement of oppositely charged ions held together in a lattice structure by strong electrostatic forces.
31	How many electrons does Mg^{2+} have? Mg has an atomic number of 12	10
32	Name and explain two physical properties of covalent, simple molecular compounds.	1. They have low melting and boiling points because there are weak intermolecular forces of attraction between molecules. 2. They do not conduct electricity because the molecules are not charged.

Covalent Bonding

33	Describe what happens in covalent bonding?	Two non-metals overlap their outer electron shells and share at least one pair of electrons.
34	What does covalent bonding result in the formation of?	Molecules
35	Name and explain two physical properties of ionic compounds.	1. They have high melting and boiling points because there are strong electrostatic forces holding the oppositely charged ions in place, therefore a lot of energy is needed to separate the ions. 2. They can conduct electricity when molten or in aqueous solution (dissolved in water) because the ions are free to move and carry their charge.

Types of substance

36	Describe the structures of 1) diamond and 2) graphite	1. Each carbon atom is held in place by 4 strong covalent bonds to other carbon atoms. This arrangement is replicated throughout the whole structure creating a giant structure. 2. Each carbon atom is held in place by 3 strong covalent bonds. This creates flat layers of carbon atoms which stack on top of each other. The unused outer electron on each carbon atom sits between these layers and is delocalised (free to move).
37	Why is diamond used in cutting tools?	Diamond is very hard because all the carbon atoms are joined by 4 strong covalent bonds.
38	Why does diamond have such a high melting point?	In diamond each carbon atom is held in place by 4 strong covalent bonds and it takes a lot of energy to break these bonds.
39	Why does graphite conduct electricity?	In graphite each carbon forms 3 bonds, this leaves one electron left over from each carbon atom which sits between the graphite layers and is free to move and carry a charge.
40	Why can graphite act as a lubricant?	The layers of carbon atoms in graphite are only very weakly joined and are therefore free to slide past each other.
41	What are fullerenes? Explain its properties in terms of its structure and bonding.	C_{60} is one example where 60 carbons bond together covalently making a structure that looks like a football. These are simple molecules and behave as such. It is possible to 'dope ' the C_{60} with metal atoms and it then becomes a superconductor.
42	What is graphene? Explain its properties in terms of its structure and bonding.	Graphene is like graphite, just 1 layer thick. It therefore conducts electricity and for its thickness is very strong.
43	Describe polythene's structure	Polythene is an example of a polymer. It is a large molecule containing chains of carbon atoms surrounded by hydrogen.
44	Describe the bonding in metals	All metals form positive ions and their outer electrons are delocalised and sit between the metal ions (forming a 'sea of electrons').
45	Why do metals conduct electricity?	There are free electrons in the metallic structure that can move.
46	Why are metals malleable?	They bend because the ions can slide over one another.
47	Why is it difficult to represent models of compounds on paper?	Compounds are normally 3 dimensional and contain different sized atoms. This can give them particular shapes that are hard to draw clearly in 2 dimensions (on paper).
48	What are the properties of most metals?	Shiny solid, high melting points, high density and good conductors of electricity.

Calculations involving masses

49	What is an empirical formula?	The simplest ratio of the elements in a compound.
50	What is the law of conservation of mass?	During any chemical reaction no particles are created or destroyed. So, the overall mass of the reactants must equal the mass of the products.
51	What unit do we use for concentration?	G dm^{-3} (grams per decimetre cubed)
52	What is 1 mole of particles?	The Avogadro constant (6.02×10^{23} particles).
53	What is the formula to calculate moles?	Moles = Mass/Relative formula mass

Topic 2- States of matters and mixtures

States of matter

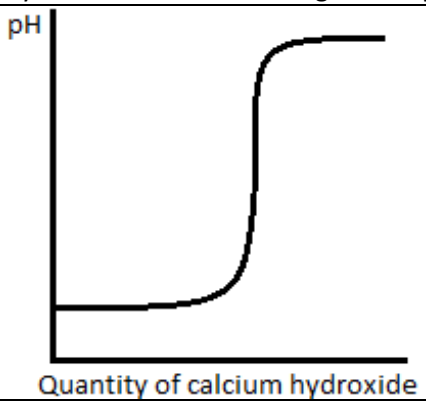
54	What are the 3 states of matter?	Solid, liquid and gas
55	Name the interconversion between the: 1. Solid to the liquid state 2. Liquid to the gaseous state 3. gaseous state to the liquid state 4. Liquid to the solid state	1. Melting 2. Evaporating (or if heated to boiling point – Boiling) 3. Condensing 4. Freezing
56	Describe how the particles arrangement, movement and energy changes during melting.	The particles energy increases on heating causing the vibrations between particles to increase to an extent that they break free from their regular arrangement and start moving over one another.
57	Describe how the particles arrangement, movement and energy changes during melting.	The particles energy decreases on cooling causing the particles to slow down and become attracted to other particles.

Methods of separating and purifying substance

58	What is the difference between a pure substance and a mixture?	A pure substance is made of just one thing whereas a mixture is made of more than one substance which are not chemically joined.
59	What type of mixtures can be separated by each of these techniques? 1. Simple distillation 2. Fractional distillation 3. Filtration 4. Crystallisation 5. Paper chromatography	1. A dissolved solid where you want to keep the liquid or 2 liquids with very different boiling points. 2. A large sample of a mixture of liquids with similar boiling points 3. An insoluble solid and a liquid. 4. A dissolved solid where you do not want the liquid. 5. A small sample of a mixture of liquids.
60	What is Chromatography?	A separating technique used to separate mixtures of soluble substances by running a solvent (mobile phase) through the mixture on the paper (stationary phase) which causes the substances to move at different rates over the paper.
61	How can you use paper chromatography to identify a substance?	Each substance will run a specific distance up the paper and have its own unique R_f.
62	In chromatography, define the R_f value.	$R_f = \frac{\text{distance moved by the component}}{\text{distance moved by the solvent}}$
63	How can ground water be made potable?	Sedimentation, filtration and chlorination
64	How can sea water be made potable?	Distillation.
65	Why must water used in analysis not contain any dissolved salts?	Dissolved salts could cause an analysis to give a false positive result. In other words you might get a positive result for something that isn't really there.

Topic 3 Chemical change

Acids

<table>
<tr><td>66</td><td>What are acids and alkalis sources of?</td><td>Acids – hydrogen ions
Alkalis – hydroxide ions</td></tr>
<tr><td>67</td><td>What are the colour changes of?
1. Litmus
2. Methyl orange
3. Phenolphthalein
With acid and alkali?</td><td><table><tr><td></td><td>Acid</td><td>Alkali</td></tr><tr><td>Litmus</td><td>red</td><td>blue</td></tr><tr><td>Methyl orange</td><td>red</td><td>yellow</td></tr><tr><td>Phenolphthalein</td><td>colourless</td><td>pink</td></tr></table></td></tr>
<tr><td>68</td><td>What is the link between hydrogen ion concentration and pH?</td><td>The higher the concentration of hydrogen ions the lower the pH (a stronger acid). As the hydrogen ion concentration increases by a factor of 10, the pH of the solution decreases by 1.The higher the concentration of hydroxide solutions the higher the pH.</td></tr>
<tr><td>69</td><td>When calcium hydroxide is added slowly to hydrochloric acid the pH of the resulting solution changes. What would the graph of this look like?</td><td> 
</td></tr>
<tr><td>70</td><td>What pH could a concentrated acid have?</td><td>Anything between 1 and 6. Acid concentration refers to the dilution with water. A strong acid can still have a lot of hydrogen ions in solution even when it is of a weak concentration.</td></tr>
<tr><td>71</td><td>Which would have a pH of 1?
• 0.25M Sulphuric acid (a strong acid)
• 10M Ethanoic acid (a weak acid)</td><td>Strong acids will always have low pH regardless of the concentration.</td></tr>
<tr><td>72</td><td>What is a base?</td><td>It is a substance that can react with an acid to make a salt and water.</td></tr>
<tr><td>73</td><td>What is an alkali?</td><td>A soluble base.</td></tr>
<tr><td>74</td><td>What type of reaction is it when an acid reacts with a base?</td><td>Neutralisation</td></tr>
<tr><td>75</td><td>What are the products of the following neutralisation reactions?
1. Metal + acid →
2. Metal oxide + acid →
3. Metal hydroxide + acid →
4. Metal carbonate + acid →</td><td>1. Salt + hydrogen
2. Salt + water
3. Salt + water
4. Salt + water + carbon dioxide</td></tr>
<tr><td>76</td><td>What is the chemical test for?
1. Hydrogen
2. Carbon dioxide</td><td>1. Lit splint gives a squeaky pop.
2. Bubbling carbon dioxide through limewater turns it milky.</td></tr>
<tr><td>77</td><td>Explain why water is produced when an acid reacts with an alkali?</td><td>The hydrogen ions (H^+) from the acid react with the hydroxide ions (OH^-) from the alkali to form water (H_2O).</td></tr>
<tr><td>78</td><td>When preparing a soluble salt from an acid an insoluble reactant how do you ensure the salt is pure?</td><td>1. Use excess insoluble reactant to neutralise all the acid.
2. Filter the resulting mixture to remove the excess reactant.</td></tr>
<tr><td>79</td><td>How do you prepare a soluble salt when both the reactants are soluble?</td><td>Titration is used to ensure the reactants are mixed in the correct proportions.</td></tr>
</table>

80	How would you prepare a sample of pure, dry hydrated copper sulfate crystals starting from copper oxide.	1. Add excess copper oxide to sulfuric acid and place in a water bath to gently heat. 2. Filter the mixture to remove excess copper oxide. 3. Evaporate the mixture, this can be heated to start with but it must be left to evaporate at room temperature to produce hydrated crystals.
81	How do you carry out an acid-alkali titration, using burette, pipette and a suitable indicator, to prepare a pure, dry sample of sodium chloride?	1. Fill a burette with hydrochloric acid. 2. Measure 25 cm^3 of sodium hydroxide using a pipette and place in a conical flask. 3. Add a few drops of phenolphthalein indicator. 4. Place the conical flask on a white tile underneath the burette. 5. Run in hydrochloric acid fairly quickly at first whilst continually stirring. 6. When the neutralisation point is approaching start to add the acid drop wise. 7. Stop adding the acid the moment the indicator goes clear. 8. Repeat the titration 2 further times and average results. 9. Carry out titration one final time, this time without indicator to ensure the salt produced is pure. Stop adding acid when the average quantity previously identified has been added.
82	Are the common sodium, potassium and ammonium salts soluble or insoluble?	Soluble
83	Are nitrates soluble or insoluble?	Soluble
84	Are common chlorides soluble or insoluble? And what is the exception to the rule?	Soluble, except silver chloride and lead chloride.
85	Are common sulfates soluble or insoluble? And what is the exception to the rule?	Soluble, except lead sulphate, barium sulphate and calcium sulphate.
86	Are common carbonates and hydroxides soluble or insoluble? And what is the exception to the rule?	Soluble, except sodium, potassium and ammonium.
87	What is a precipitate?	A solid formed from two reacting solutions.
88	What is the name of the insoluble precipitate formed when lead nitrate reacts with potassium chloride?	Lead chloride
89	How do you prepare a pure, dry sample of an insoluble salt?	Mix reacting solutions together in order to get the precipitate, then filter the precipitate out of the solution, wash it with distilled water and dry it.

Electrolytic processes

90	What is an electrolyte?	An ionic compound in either the molten state or dissolved in water.
91	What is electrolysis?	A chemical process that decomposes an electrolyte using electrical energy from a direct current (DC) supply.
92	What are positively charged ions called?	Cations
93	What are negatively charged ions called?	Anions

<table>
<tr><td>94</td><td>What is the positive electrode called?</td><td>Anode</td></tr>
<tr><td>95</td><td>What is the negative electrode called?</td><td>Cathode</td></tr>
<tr><td>96</td><td>How do the ions move during electrolysis?</td><td>The cations migrate to the cathode.
The anions migrate to the anode.</td></tr>
<tr><td>97</td><td>What products are formed in the electrolysis of the following electrolytes:
1. Copper chloride solution
2. Sodium chloride solution
3. Sodium sulphate solution
4. Water acidified with sulphuric acid
5. Molten lead bromide</td><td><table><tr><th></th><th>Anode</th><th>Cathode</th><th>Left in solution</th></tr><tr><td>1</td><td>Chlorine</td><td>Copper</td><td></td></tr><tr><td>2</td><td>Chlorine</td><td>Hydrogen</td><td>Sodium hydroxide</td></tr><tr><td>3</td><td>Oxygen</td><td>Hydrogen</td><td></td></tr><tr><td>4</td><td>Oxygen</td><td>Hydrogen</td><td></td></tr><tr><td>5</td><td>Bromine</td><td>Lead</td><td></td></tr></table></td></tr>
<tr><td>98</td><td>What is the cathode half equation when water is electrolysed?</td><td>$2H^+ + 2e^- \rightarrow H_2$</td></tr>
<tr><td>99</td><td>What is the anode half equation when water is electrolysed?</td><td>$2O^{2-} \rightarrow O_2 + 4e^-$</td></tr>
</table>

Topic 4- Extracting metals and equilibria

Obtaining and using metals

100	Define oxidation and reduction.	Oxidation is loss of electrons and reduction is gain of electrons.
101	When water is electrolysed are the hydrogen ions oxidised or reduced?	Reduced
102	Does oxidation happen at the anode or cathode?	Anode
103	When purifying copper using electrolysis would you make the impure copper the anode or the cathode?	Anode
104	Write the half equation for the formation of copper at the cathode.	$Cu^{2+} + 2e^- \rightarrow Cu$
105	Magnesium produces small bubbles of gas when placed in water; it reacts rapidly with steam and acid. Lithium bubbles fizzes on the surface of water. Which is more reactive?	Lithium.
106	What is a displacement reaction?	A redox reaction in which a more reactive element displaces a less reactive element from its compound. Both metals and non-metals take part in displacement reactions.
107	In metal displacement reactions, is the reactive metal oxidised or reduced?	Oxidised
108	Where are most metals obtained from?	Ores found in the Earth's crust.
109	Name a metal that is not extracted from an ore and explain why.	Gold because it is so unreactive it doesn't combine with oxygen in the environment.
110	When metals are extracted are ores oxidised or reduced?	Reduced
111	Describe how iron is extracted from its ore.	Iron ore (iron oxide) is heated with carbon (the carbon displaces the iron. The iron is reduced – loses its oxygen to the carbon).
112	Describe how aluminium is extracted from its ore.	Aluminium is extracted by electrolysis.
113	Explain why aluminium is extracted in this way, and not by simply heating it with carbon.	Aluminium is a reactive metal. Reactive metals bond strongly to the other elements in their ores. It requires a lot of energy to break these chemical bonds. Electrolysis can provide large amounts of electrical energy to separate the metal from the other elements in the ore. All reactive metals have to be extracted by electrolysis. The disadvantage is that this method is expensive.
114	Why is iron not extracted from its ore using electrolysis?	It is cheaper to displace it with carbon.
115	How does the phyto extraction of copper work?	Some plants absorb copper compounds through their roots, the plant is then burnt and the copper extracted from the ash.
116	What is bioleaching?	A method of extracting copper that involves bacteria absorbing copper compounds. The bacteria then produce solutions called leachates which contain copper compounds from which the copper can be extracted.
117	Would you expect a metal low down the reactivity series to be susceptible to oxidation?	No, unreactive metals are much less likely to react with oxygen.

118	Why do we recycle scrap metal?	1. It can often be cheaper to recycle rather than extract new metal from its ore. 2. Recycling cuts waste which could otherwise harm the environment. 3. Preserves the remaining raw materials on the planet.
119	What does a lifetime assessment of a product involve?	Evaluating the effect on the environment of: 1. Manufacturing 2. Using 3. Disposing

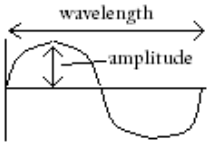
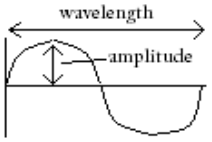
Reversible reactions and equilibria

120	What does this symbol mean? $\rightleftharpoons$	It shows a reaction is reversible
121	What is meant by the term 'dynamic equilibrium'?	A reversible reaction is said to be in dynamic equilibrium when the rate of the forward reaction is equal to the rate of the backward reaction.
122	How can you change the equilibrium of a reversible reaction?	By changing the conditions, for example temperature and pressure.
123	What is the equation for the Haber process?	$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$
124	Where are the reactants obtained from in the Haber process?	The nitrogen is extracted from air and the hydrogen is obtained from natural gas.
125	What is the chemical formula for ammonia?	NH_3
126	What are the conditions used in the Haber process?	• temperature 450 °C • pressure 200 atmospheres • iron catalyst
127	How does increasing the temperature affect the yield of ammonia?	The production of ammonia is exothermic so increasing the temperature reduces the yield.
128	If increasing the temperature reduces the yield of ammonia why is a temperature of 450 °C used?	450 °C is a compromise, the temperature is raised to increase the rate of reaction even though it decreases the yield.
129	How does increasing the pressure affect the yield of ammonia?	4 molecules of reactants are needed to make 2 molecules of ammonia. If the pressure is raised more ammonia is produced because that would reduce the number of particles present.
130	How does adding a catalyst affect the yield of ammonia?	It does not affect the yield it just increases the rate.
131	How would the position of a dynamic equilibrium be affected by? 1. temperature? 2. pressure? 3. concentration?	1. Increasing the temperature will move the dynamic equilibrium in the direction of the endothermic reaction. 2. Increasing the pressure will move the dynamic equilibrium towards the side where there are less gas molecules. 3. Increasing the centration of a substance will move the equilibrium to reduce the concentration of that substance.

Physics Key Concepts (Paper 5 and 6)

1	What is the standard unit and symbol for A) distance B) mass C) time D) temperature	 A) metre, m B) kilogram, kg C) second, s D) kelvin, K
2	What is the derived unit and symbol for A) Frequency B) Force C) Energy D) Power E) Pressure F) Electric charge G) Electric potential difference H) Electric resistance I) Magnetic flux density	 A) hertz, Hz B) newton, N C) joule, J D) watt, W E) pascal, Pa F) coulomb, C G) volt, V H) ohm, Ω I) tesla, T
3	Write the decimal of A) giga (G) B) mega (M) C) kilo (k) D) centi (c) E) milli (m) F) micro (μ) G) nano (n)	 A) 1,000,000,000 (10^9) B) 1,000,000 (10^6) C) 1000 (10^3) D) 0.01 (10^{-2}) E) 0.001 (10^{-3}) F) 0.000001 (10^{-6}) G) 0.000000001 (10^{-9})
4	How do you convert minutes into hours	Divide minutes value by 60
5	How do you convert minutes into seconds	Multiply minutes value by 60
6	Convert the following into standard form:	
7	In calculation questions what must you remember to do?	Substitute in values in standard units, show working out clearly and show the units on the answer. Triangles are a tool to help us re-arrange equations.

Topic 1- Waves (Paper 5)

1	What do waves transfer?	Energy and information but not matter.
2	What evidence is there that waves do not transfer matter?	• For water waves, a float on the surface of the water will move only up and down not across the water. • For sound waves, an air particle will vibrate back and forth not travel across the room.
3	Give examples of longitudinal waves	• Sound waves (including ultrasound and infrasound) • Seismic P (primary) waves
4	Describe a longitudinal wave	The direction of the vibration is parallel to the direction of the energy travel
5	Describe a transverse wave	The direction of the vibration is perpendicular to the direction of the energy travel
6	Give examples of transverse waves	All of the electromagnetic waves (including light, seismic S (secondary) waves, water waves and waves on a string.)
7	What is the wavelength and what is it measured in?	The length of 1 complete wave cycle. It is measured in meters (m). 
8	What is the amplitude and what is it measured in?	The distance from the centre of a wave to the top of the wave. It is measured in meters (m). 
9	What is the frequency of a wave and what is it measured in?	The number of waves in 1 second and the unit is Hertz (Hz)
11	What is the period of a wave and what is it measured in?	The time for 1 complete wave. It is measured in seconds (s).
14	As the wavelength of a wave increases, how is its frequency changed? (Assuming that it is travelling at a constant speed).	The frequency would decrease.
17	What happens to the speed of sound as you move from gas to liquid to solid?	• It increases. • This is because there are more particles to pass on the vibrations.
18	What is the speed of sound in a vacuum?	0 m/s. Sound cannot travel through a vacuum as there are no particles to pass on the vibrations.
19	Which two equations can be used to find the velocity of a wave?	• Distance / time • frequency x wavelength.
20	CORE PRACTICAL Describe how to measure the velocity of sound in a gas like air.	1. Use a signal generator to produce a sound of known frequency. 2. Connect 2 microphones to an oscilloscope to detect the sound waves in front of the speaker. 3. Move 1 microphone away until the waveforms are aligned. 4. Measure the distance between the microphones as this is the wavelength of the sound wave. 5. The speed (in m/s) will be frequency (Hz) x wavelength (m).
21	CORE PRACTICAL Describe how to measure the velocity of a wave in a liquid like water.	1. Use a ripple tank to create water waves. 2. Measure the distance between 2 peaks, this is the wavelength. 3. Find the frequency by counting the number of waves past a point in 10s and divide by 10. 4. The speed (in m/s) will be frequency (Hz) x wavelength (m). 5. Alternatively, mark 2 points on the side of the ripple tank and time how long it takes 1 wave to travel between the 2 points. 6. Measure the distance of the 2 points. 7. The speed (in m/s) will be distance (m) divided by time (s).

22	CORE PRACTICAL Describe how to measure the velocity of sound in a solid like steel.	1. Suspend the steel rod and hit it with a hammer. 2. Use a frequency app to record the peak frequency (or a microphone and oscilloscope). 3. Measure the length of the steel rod. 4. Wavelength = 2 x length and so divide the length by 2 to find wavelength. 5. The speed (in m/s) will be frequency (Hz) x wavelength (m).
28	What is refraction and what causes it?	Refraction is the bending (change of direction) of a wave as it passes between different materials. H) It is caused by the slowing down or speeding up of the wave as it travels from one density to a different density.
29	As light travels from a more dense material to a less dense material, what direction will it bend in?	Away from the normal line.
	As a wave enters a less dense material, what direction will it bend in?	Towards the normal
33	CORE PRACTICAL Describe how to investigate refraction in a rectangular block	1. Place a rectangular glass block on plain paper 2. Draw around the block 3. Shine a ray of light through the block 4. Mark where the light travels on the paper with crosses 5. Remove the block and join the lines up with a pencil 6. Measure the angles of incidence and refraction 7. Change the angle of incidence and repeat steps 4 & 5

Topic 2- Light and the electromagnetic spectrum (Paper 5)

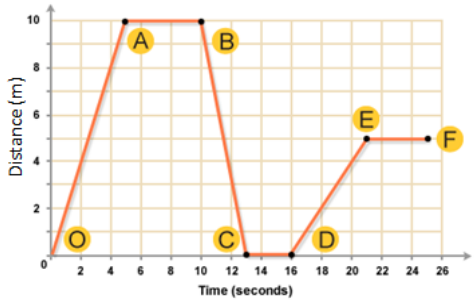
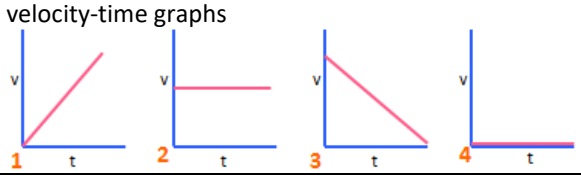
2	What are the colours of light in the visible spectrum? (Start with the longest wavelength)	Red, Orange, Yellow, Green, Blue, Indigo, Violet.
3	What is the order of waves in the electromagnetic spectrum? (Start with the longest wavelength)	Radio waves, Microwaves, Infrared waves, Visible light, Ultraviolet rays, X-rays, Gamma rays.
4	Which part or parts of the electromagnetic spectrum can we detect with our eyes?	Only visible light.
5	Which travels faster in a vacuum light or radio waves?	Neither, all electromagnetic waves travel at the same speed in a vacuum (3×10^8 m/s).
6	Which end of the electromagnetic spectrum has waves of the longest wavelength?	Radio waves
7	Which end of the electromagnetic spectrum has waves of the highest frequency?	Gamma rays
8	What are the harmful effects of excessive exposure to: 1. Microwaves 2. Infrared 3. Ultraviolet 4. X-rays and gamma rays?	1. Internal heating of body cells 2. Skin burns 3. Damage to surface cells and eyes, leading to skin cancer and eye conditions 4. Mutation or damage to DNA/cells in the body, causes cancer
9	What can happen to an atom if it is exposed to harmful electromagnetic waves?	• The atom may gain enough energy to have an electron removed. • This leaves it charged and so it becomes an ion.
10	As the frequency of a wave increases, what happens to the potential danger?	The danger increases because of the increased energy.
11	H) What can be used to produce radio waves in a transmitter?	• Oscillations in electrical circuits in the transmitter. • These oscillations can induce radio waves.
12	Name some of the uses of: 1. Radio waves 2. Microwaves 3. Infrared 4. Visible light 5. Ultraviolet 6. X-rays 7. Gamma rays	1. Broadcasting, communications and satellite transmissions. 2. Cooking, communications and satellite transmissions 3. Cooking, thermal imaging, short range communications, optical fibres, TV remote controls and security systems. 4. Vision, photography and illumination. 5. Security marking, fluorescent lamps, detecting forged bank notes, disinfecting water. 6. Observing the internal structure of objects, airport security scanners and medical X-rays. 7. Sterilising food and medical equipment and the detection of cancer and its treatment.
13	Name 3 types of ionising electromagnetic radiation that transfer energy?	Short frequency UV rays, X-rays and gamma rays
17	Describe how changes in atoms and nuclei can emit EM radiations	• <u>EM radiations are produced</u> by <u>changes in the electrons or nuclei in atoms</u> • When materials are heated, this <u>changes how electrons are arranged</u> and can <u>produced infrared or visible light</u>.

Topic 3- Radioactivity (Paper 5)

1	Describe the plum pudding model of the atom	A sphere of positive charge with electrons spread through it.
2	Describe the Bohr model of the atom	• It has a tiny, positively charged nucleus (containing almost all the mass in the form of protons and neutrons) • surrounded by negatively charged electrons in fixed energy levels (orbits or shells).
3	What is the typical size of an atom?	1 x 10^{-10} m (0.1 nanometres)
4	Describe Rutherford experiment and state what it proved about the atom	• Geiger and Marsden carried out an experiment where alpha particles were fired at some gold foil. • Alpha particles are repelled by positive charge. • It was detected that most of the alpha particles went straight through the foil • 5but a small number (1/8000) of the alpha particles w6ere deflected through anything from 1° to 180° • Rutherford explained the results and said that most of the atom is empty space, the nucleus is tiny. • The nucleus contains most of the mass and it is positively charged.
6	Describe an alpha particle	• Made of 2 protons and 2 neutrons • Same as a helium nucleus • A charge of +2 • relative mass of 4
7	Describe a beta negative particle	• A high energy electron • Released from the nucleus of the atom • A charge of -1 • A relative mass of 1/2000
8	Describe a beta positive (positron) particle	• The anti-particle to the electron • Released from the nucleus of the atom • A charge of +1 • A relative mass of 1/2000
9	Describe a gamma ray	• A high frequency electromagnetic wave • Released from the nucleus of an atom alongside alpha or beta • No charge • No mass
10	What are the properties of alpha radiation?	• They are highly ionising • But not very penetrating • They are affected by electric and magnetic fields because they are charged • Absorbed by a few cm of air or thin paper.
11	What are the properties of beta+/- radiation?	• Ionising • Fairly penetrating • They are affected by electric and magnetic fields because they are charged • Absorbed by a few mm of a metal like aluminium
12	What are the properties of gamma radiation?	• Weakly ionising • Very penetrating • Not affected by electric and magnetic fields • Absorbed by a few cm of a dense metal like lead will significantly reduce the amount of gamma rays getting through
14	What is the relationship between the number of protons and the number of electrons in an atom?	• They are equal • So the atom has no overall charge
15	What happens in beta minus decay in terms of particles?	• A neutron becomes a proton + an electron. • This causes the atomic number (proton number) to increase by 1 • The mass number (nucleon number) stays the same.
16	What happens in beta plus decay in terms of particles?	• A proton becomes a neutron + a positron.

		• This causes the atomic number (proton number) to decrease by 1 • The mass number (nucleon number) stays the same.
24	When is gamma radiation emitted?	When a radioisotope undergoes decay by alpha or beta (+ or -) emission the nuclear rearrangement usually results in the excess energy being released as gamma radiation.
25	What are the dangers of ionising radiation?	In low doses, can cause cancer as there may be damage to DNA. In high doses, can cause skin burns, radiation sickness and even death.
26	What precautions are taken to ensure the safety of patients and staff involving in using radiation medically?	• Radiation is monitored • Dose and exposure time are limited • People are also protected with screening and protective clothing
38	What is meant by background radiation?	Radiation that is around us all the time.
39	Why are there regional variations in the levels of background radiation?	• 50% of the background radiation is due to radioactive radon gas • Granite rock contains uranium which breaks down it into radon gas • Some parts of the country have higher concentrations of granite in the ground • and so, they have a greater concentration of radon and background radiation
40	Where does most the background radiation come from?	Natural sources, such as: • radon gas • rocks and soil • cosmic rays from outer space and the sun Man-made sources, such as: • building products • medical uses like X-rays • nuclear power
41	What is meant by the activity of a source?	How many decays there are every second from a radio-isotope.
42	What is activity measured in?	Becquerels (Bq)
43	How does activity vary with time?	Activity decreases with time.
44	What is half-life?	The time it takes for half of the un-decayed nuclei to decay
47	A sample of air contains 6 mg of radon. Radon has a half-life of 4 days. Calculate the mass of the radon remaining after 8 days.	Calculation of number of half-lives: 8 ÷ 4 = 2 (half-lives) Evaluation of mass: 6 ÷ 2 = 3 ÷ 2 = 1.5 (mg)
48	What is the danger of ionising radiation?	• Damage to cells and tissues causing cancers or mutations. • Possible deformities at birth in future generations.
49	How should radioactive samples be handled safely?	• Always point sources away from yourself and others • Never handle sources with your fingers – use tongs
52	Describe two ways of measuring and detecting radiation.	1. Geiger-Muller tube 2. Photographic film.
53	What is the difference between contamination and irradiation?	• An object or person would be contaminated if unwanted radioactive particle gets on them or into them. • The object or person would be irradiated if exposed to radiation.

Topic 4- Forces and motion (Paper 5)

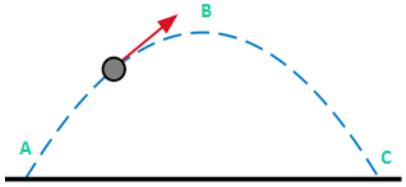
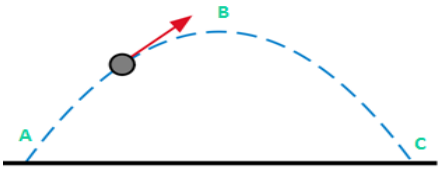
1	Explain the difference between a scalar and vector quantity	A vector has: magnitude/size direction A scalar quantity has: It has a magnitude/ size But no direction
2	Name examples of a scalar quantity	Distance Speed Mass energy
3	Name examples of a vector quantity	Displacement Velocity Acceleration Force/weight momentum
4	Recall the equation for speed	Speed = distance ÷ time
9	Using a distance time graph, describe what is happening to the object between O and A, A and B and B and C? 	O and A: The object is accelerating forwards A and B: The object is stationary B and C: The object is moving backwards
10	How do you calculate change in velocity?	Change in velocity = final velocity – initial velocity v – u
11	Recall the equation for acceleration	Acceleration = (final velocity – initial velocity) ÷ time
16	Give 2 examples of how an object can accelerate.	1) If it's speeding up or slowing down. 2) If it's changing direction.
17	Describe the motion of each objects on these velocity-time graphs 	1) The object is accelerating quickly 2) The object is moving at a constant speed 3) The object is decelerating 4) The object is stationary
18	Describe how to calculate the distance an object has travelled using a velocity-time graph	By measuring the area under the graph
20	CORE PRACTICAL What equipment can be used to experimentally find the speed of a moving object?	• You can time it with a stopwatch over a set distance but this will be subject to human error. • A more accurate way would be to use light gates. • As the object passes the first gate, the timing starts and as it crosses the second gate the timing stops. • If the distance is known between the two points, the average speed can be calculated. • Using a card of known length, to interrupt the light beam, the actual speed at each light gate can be calculated. • This would allow changes in speed to be measured, for example accelerations.
21	Estimate the speeds of these: A. a strong breeze B. sound in air C. walking pace D. cycling pace E. car in built up area	A. Strong breeze 25m/s B. sound in air 330m/s C. walking pace 1.4m/s D. cycling pace 6m/s E. car in built up area 10.5m/s F. car on motorway 31m/s

	F. car on motorway G. a commuter train H. a ferry I. an aeroplane J. light in a vacuum	G. commuter train 55m/s H. a ferry 18m/s I. an aeroplane 250 m/s J. light in a vacuum 300000000m/s.
22	What is the acceleration due to gravity on earth? (g)	10 m/s^2
23	Estimate the accelerations of these: A. an ordinary car B. a supercar C. a person on a bicycle D. a rollercoaster E. a bullet from a gun	A. An ordinary car 3 m/s^2 B. a supercar 6 m/s^2 C. a person on a bicycle 0.5m/s^2 D. a rollercoaster 40m/s^2 E. a bullet 1000000 m/s^2
25	What are action and reaction forces?	When 2 bodies interact (for example, your foot and a football) they exert forces on each other that are equal in size and opposite in direction.
27	What is the extra left-over force called in an unbalanced situation?	Resultant
28	How do you calculate the resultant force?	• Forces acting in the same direction are added together • Forces acting in the opposite direction are subtracted
30	When the forces on an object are balanced, what is the resultant force and what effect will it have?	As the forces are balanced there is no resultant force and so there will be no change to the object's speed, direction or shape
31	Name two common resistance forces that slow objects down.	1. Friction 2. Air resistance
32	If the resistance forces on a moving object are equal in size with the thrust forces exerted on it – what is the acceleration of the object?	As the forces are balanced there is no resultant force and so there will be no acceleration. The object will remain at constant speed.
33	If the resistance forces on a moving object are smaller in size with the thrust forces exerted on it – what is the acceleration of the object?	It will accelerate in the direction of the thrust force.
34	If the resistance forces on a moving object are greater in size with the thrust forces exerted on it – what is the acceleration of the object?	It will decelerate.
35	Which equation states Newton's second law?	F=ma (resultant force = mass x acceleration)
39	What are the two different units for gravity and why are they different?	• m/s^2 (metres per second per second) the acceleration due to gravity • N/kg (newtons per kilogram) the gravitational field strength
40	Why is mass a scalar quantity and weight a vector quantity?	• Mass is the amount of matter. • It is a scalar quantity because it only has size (measured in kg). • Weight is a force due to gravity. • It has a size (measured in N) and a direction.
41	How is weight calculated?	Weight (N) = Mass (kg) x g (N/kg)
45	How can weight be measured?	Using a force meter (Newton meter).
46	How is weight affected by the gravitational field strength?	Weight will change depending on the gravitational field strength of the planet, moon etc that the object is on. The stronger the gravitational field strength, the heavier the weight. (For example a 1kg mass bag of sugar will weigh 9.8N on earth, and only 1.6N on the moon).
47	CORE PRACTICAL Describe how to investigate the relationship between force, mass and acceleration	1. Set up a ramp, with a trolley and light gates 2. Stick a card to the top of the trolley 3. Release the trolley at the top of the ramp 4. Record the time it takes for the trolley to pass each light gate 5. Increase the mass on the trolley and repeat steps 4 and 5
50	As speed increases, what happens to air resistance?	As an object gets faster, air resistance increases.
51	What is terminal velocity?	When the forces of a moving object are balanced and there is no resultant force, the object travels at a constant speed this is called terminal velocity.
52	What is the acceleration of an object that has reached terminal velocity?	0 m/s^2 (It cannot accelerate as there is no resultant force)
53	Describe how the forces acting on a ball change as it starts to fall from the sky	1. At the start of the fall the weight is greater than air resistance 2. The weight remains constant but the air resistance increases as the ball accelerates 3. Until the weight is balanced out by the air resistance.

		4. At this point the ball is moving at a constant speed, this is known as the terminal velocity.
54	H) Explain what is happening to the velocity of an object which is moving in a circle.	Because velocity is a vector and the direction of the object is changing constantly, the velocity of the object is also changing constantly.
55	H) When an object moves in a circle at a constant speed, why is it accelerating?	There is a change of velocity over time, therefore the object is accelerating.
56	H) When an object moves in a circle at a constant speed, what causes the acceleration? (what must there be for an object to move in a circle?)	A resultant force.
57	H) What is this resultant force called?	Centripetal force.
58	H) What direction is the centripetal force in?	Towards the centre of the circle.
59	H) What is inertial mass?	It is a measure of how difficult it is to change the velocity of the object. It is defined as the ratio of resultant force over acceleration (m= F/a) as described by newton's second law.
60	H) Describe what is meant by momentum	Momentum is a measure of the tendency of an object to keep moving, or how hard it is to stop it moving.
61	H) State the equation for momentum	Momentum (kg m/s) = mass (kg) x velocity (m/s)
65	H) State the equation for force which substitutes momentum	Force = change in momentum / time
68	H) What is meant by conservation of momentum?	The total momentum before a collision is equal to the total momentum after a collision. (Remember - direction is really important here!).
69	What is the thinking distance?	The distance travelled in the time it takes the driver to react. It is measured in m.
70	Which factors affect the thinking distance?	• speed of the vehicle • the driver's reaction time (age, drugs, alcohol, distractions etc) • weather
71	What is the braking distance?	The distance travelled in the time it takes between the driver applying the brakes and the vehicle stopping. It is measured in m.
72	Which factors affect the braking distance?	• mass of the vehicle • speed of the vehicle • the condition of the brakes • road conditions (frictional forces) • weather
73	How do you calculate stopping distance?	Thinking distance + Braking distance. It is measured in m.
74	How do crumple zones, air bags and seat belts help protect passengers?	They all are designed to increase the time it takes to reduce the momentum of the vehicle to zero and so they reduce the force on the passengers.
75	Estimate the forces involved in: A. a squash ball hitting a wall B. a car hitting a wall C. 2 cars hitting each other	A. A squash ball hitting a wall 30N B. a car hitting a wall 200 000N C. 2 cars hitting each other 300 000N

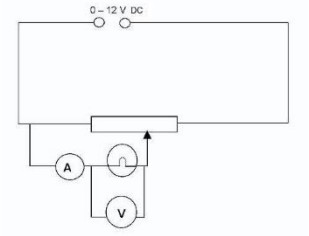
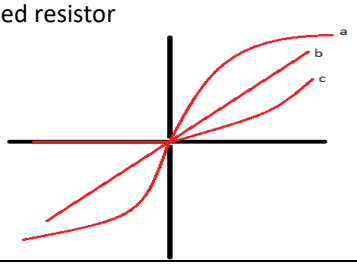
Topic 5- Conservation of energy (Paper 5)

3	What is the law of conservation of energy?	Energy can never be created or destroyed, only transferred from one store (or form) to another.
4	Name 9 different forms of energy and an example of an object which emits them	1. Light – phone 2. Sound- radio 3. Thermal- fire 4. Kinetic- a person cycling 5. Chemical- battery/food/fuel 6. Electrical- television 7. Elastic- bow and arrow 8. Gravitational potential energy- a plane in flight 9. Nuclear- uranium
5	Describe the energy transfer taking place in a loudspeaker.	A loudspeaker transfers electrical energy into sound energy
6	A student uses a solar powered battery charger to charge some batteries. What is the form of energy transferred into the battery charger?	light energy → electrical energy → chemical energy
7	An objected is lifted upwards, what is the energy transfer that takes place?	Kinetic energy is transferred to gravitational energy.
8	A moving object crashes into a wall. What types of energy does its kinetic energy get transferred into?	• Heat • Sound
9	An object is accelerated by a force, what type of energy does it gain?	Kinetic energy
10	A moving vehicle applies its brakes, what type of energy does its kinetic energy get transferred into and where is most of this energy stored?	• Heat • Stored in the brakes
11	What happens to electrical energy when using a kettle to boil water?	Some is transferred usefully to heat energy in the water and some is wasted heating the surroundings.
12	When energy transfers happen in a closed system, what is the net change in the total energy of that system?	There is no net change (of total energy) in a closed system.
13	What is efficiency?	A measure of how much of the energy is transferred into a useful energy type.
14	When a mechanical process wastefully transfers energy to heat, what happens to the heat?	Heat is dissipated, heating the surroundings.
15	A stiff bicycle chain wastefully dissipates some energy as heat and sound. Describe how this unwanted energy transfer can be reduced.	Lubricate the chain to reduce friction.
16	H) Suggest how efficiency can be increased	• Reducing the amount of waste energy • Reducing friction by using lubrication • Ensuring all fuels are burned in an engine • Using all of the heat produced that would have otherwise been wasted
17	A boiler's hot water tank wastefully dissipates some of its heat energy to its surroundings. Describe how this unwanted energy transfer can be reduced.	Insulate the tank to slow down the rate at which heat is lost to the surroundings.
18	State the three ways that energy can be transferred by heating.	Conduction, convection, radiation.
19	Describe conduction	In conduction vibrations are passed between particles in a solid.
20	Describe convection	In convection, particles that are heated become less dense and rise. A convection current is produced.
21	Describe radiation	Radiation is the only energy transfer which can travel in a vacuum, it is an electromagnetic wave.
22	If the thickness of a buildings walls are increased, what will happen to its rate of cooling?	Rate of cooling will decrease, because less energy escapes.
23	If a building is made of materials that have a decreased thermal conductivity, what will happen to its rate of cooling?	Rate of cooling will decrease, because less energy escapes.

24	State the equation for energy efficiency.	$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$
26	At which point will the ball have the maximum/greatest gravitational potential energy? 	B has the greatest gravitational potential energy
27	What energy changes are occurring between B and C? 	Gravitational potential energy is decreasing as it transfers into an increasing amount of kinetic energy, thermal energy and sound energy
28	State the equation for calculating a change in gravitational potential energy.	change in gravitational potential energy (J) = mass (kg) × gravitational field strength (N/kg) × change in vertical height (m) $\Delta GPE = m \times g \times \Delta h$
31	State the equation for calculating the kinetic energy of an object.	kinetic energy (J) = $^1/_2$ × mass (kg) × speed^2 ((m/s)^2) $KE = {}^1/_2 \times m \times v^2$
34	State 2 non-renewable energy sources.	1. Fossil fuels (oil, natural gas and coal) 2. Nuclear power
35	Suggest disadvantages to using nuclear power	• Waste produced is radioactive and will be dangerous for millions of years • Expensive to dispose of waste • Expensive to build power station • Expensive to decommission (dismantle power station safely) • Any major accidents would have serious consequences
36	Why are many countries trying to reduce the amount of fossil fuels they use?	1. To reduce pollution and contribution to climate change. 2. To make remaining supplies last longer.
37	Which type of fossil fuel power station releases the least pollution (per unit of electrical energy produced)?	Natural gas
38	Name 6 renewable power sources.	1. Solar power 2. Wind turbines 3. Hydro-electricity 4. Tidal power 5. Bio-fuel/biomass 6. Geothermal power
39	Why are bio-fuels considered to be “carbon neutral”?	They release the same amount of carbon dioxide when burning the plant as the amount of carbon dioxide absorbed by the plant as it grew
41	Why are bio-fuels not always completely “carbon-neutral”?	Additional carbon dioxide is released farming the bio-fuel crops and in the process of turning them into fuel.
42	Give one reason why is it currently impractical to use renewable resources and nothing else?	-Many renewable resources take up a lot of space. -Some renewables (e.g. solar) aren’t always available. -Renewables can be expensive to set up.

Topic 9- Electricity (Paper 6)

<table>
<tr><td>1</td><td>Describe the structure of the atom including the position, charge and masses of each sub-atomic particle</td><td>
<table>
<tr><td></td><td>Proton</td><td>Neutron</td><td>Electron</td></tr>
<tr><td>Location</td><td>Nucleus</td><td>Nucleus</td><td>Orbits/shells</td></tr>
<tr><td>Charge</td><td>Positive</td><td>Neutral</td><td>Negative</td></tr>
<tr><td>Mass</td><td>1</td><td>1</td><td>1/1835 (0)</td></tr>
</table>
</td></tr>
<tr><td>2</td><td>Draw electric circuit component symbols
A) Battery
B) Resistor
C) Diode
D) Switch
E) Variable resistor
F) Thermistor
G) Voltmeter
H) Lamp
I) LDR
J) Ammeter
K) Motor
L) LED</td><td>A) 
B) 
C) 
D) 
E) 
F) 
G) 
H) 
I) 
J) 
K) 
L)  </td></tr>
<tr><td>3</td><td>Describe the differences between series and parallel circuits</td><td>• Series circuits have one route/loop
• Current is the same throughout a series circuit
• Voltage provided by the power supply is shared by the components in a series circuit
• Parallel circuits have junctions where electricity splits/re-joins
• Current splits and recombines at junctions
• Voltage provided by the power supply is the same across all components</td></tr>
<tr><td>8</td><td>What happens to the current if you increase the potential difference (voltage) of a power pack/battery</td><td>The current increases</td></tr>
<tr><td>9</td><td>If you increase the resistance in a circuit, what happens to the current?</td><td>It decreases.</td></tr>
<tr><td>10</td><td>What is the unit for current, how do you measure it and how do you place it in a circuit?</td><td>Measured in Amps (A), using an ammeter which is placed in series in a circuit</td></tr>
<tr><td>11</td><td>What is the unit for potential difference, what equipment do you use to measure it and how do you place it in a circuit?</td><td>Measured in Volts (V), using a voltmeter which is placed parallel across a component</td></tr>
<tr><td>12</td><td>What is meant by potential difference?</td><td>Energy transferred per unit charge
Therefore, a volt = a joule per coulomb</td></tr>
<tr><td>13</td><td>Recall the equation for calculating energy transferred in a circuit</td><td>Energy transferred = charge moved x potential difference</td></tr>
<tr><td>17</td><td>Explain what electric current is</td><td>The rate of flow of charge/electrons</td></tr>
<tr><td>18</td><td>Recall the equation for calculating charge</td><td>Charge = current x time</td></tr>
<tr><td>23</td><td>What is needed to cause current to flow in a closed circuit?</td><td>A potential difference is needed</td></tr>
<tr><td>24</td><td>Explain the relationship between potential difference in the power supply and current in a circuit</td><td>A large potential difference causes electrons to flow faster in a circuit, and so increases current.</td></tr>
<tr><td>25</td><td>What component can be used to change the resistance in a circuit?</td><td>Variable resistor</td></tr>
<tr><td>26</td><td>Explain how changing resistance affects the current</td><td>Increasing resistance decreases current</td></tr>
<tr><td>27</td><td>Explain what causes resistance in a circuit</td><td>Electrons collide with metal ions</td></tr>
</table>

28	Explain what happens when resistance increases in a circuit	When resistance increases in a circuit, electrons collide more frequently with metal ions. This decreases the flow of electrons. Which is a decrease of current. And an increase of resistance.
29	Suggest how to decrease resistance in a metal	• Use metal wires with lower resistance • Use shorter wires • Use thicker wires • Decrease the temperature
30	Recall the equation for calculating potential difference	Potential difference = current x resistance
31	What is the unit for resistance?	Ohms (Ω)
35	Why is resistance greater when resistors are connected in series?	When resistors are connected in series, the total resistance of the circuit is increased because the pathway becomes harder for current to flow through.
36	Why is resistance less when resistors are connected in parallel?	When resistors are connected in parallel the total resistance of the circuit is less than the resistance of the individual resistors. This is because there are now more paths for the current.
39	How are components tested in a circuit?	1. The component is connected to a potential divider or variable resistor 2. An ammeter is placed in series with the component 3. A voltmeter is placed parallel to the component
40	Draw a circuit diagram to show how to test a component in a circuit	
41	Which method is best for testing components?	Using a potential divider is best to test a component. This is because the current through the component and the potential difference across it can be reduced to zero. This is not possible with a variable resistor.
45	CORE PRACTICAL Describe how to construct an electrical circuit to investigate the relationship between potential difference, current and resistance for a filament lamp and resistor.	1) Set up the circuit so the resistor is in series with an ammeter and a voltmeter is parallel to the component 2) Set the power supply to the lowest voltage 3) Record the current and voltage 4) Repeat step 2-3 increasing the voltage of the power supply 5) Replace the resistor with 2 filament lamps
46	How does a diode work?	It only allows current to pass through it in one direction.
47	Which of the following graphs shows how current varies with potential difference for: 1) Filament lamp 2) Diode 3) Fixed resistor 	1) Filament lamp – graph a 2) Diode – graph c 3) Fixed resistor – graph b
48	Explain why the resistance changes for a filament lamp as the potential difference of the power supply is increased	As voltage increases, wire gets hotter, metal ions increase vibrations and there is an increase in electron collisions, resulting in higher resistance.
49	Explain why the resistance changes for a diode as the potential difference of the power supply is increased	Resistance is very high in the opposite direction, which does not allow current to flow. In the normal direction, resistance increases as metal ions vibrate more resulting in more electron collisions.
50	Explain why the resistance changes for a fixed resistor as the potential difference of the power supply is increased	At a constant temperature metal ions do not increase in vibrations, this maintains the number of electron collisions, this results in the resistance staying the same.

51	What is an LDR?	Light dependent resistor The resistance in the component changes depending on the light intensity shining on it
52	How does the resistance of a light dependant resistor change with light intensity?	As light intensity increases, the resistance decreases, which increases the current (flow of electrons)
53	What happens to the resistance and current in a thermistor as you increase temperature?	As the temperature increases, the resistance decreases, which increases the current (flow of electrons)