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.

Y10 and 11 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.

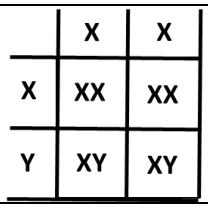
CB2 Cells and Control

	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	Bacteria <u>reproduce very quickly</u> compared to most other organisms. Helpful mutations inherited and population adapt to new conditions.

	including antibiotic resistance in bacteria.	
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 majority of people in a group are immunised, this provides protection to the few 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. They kill the bacteria cells or inhibit their production by interrupting cell wall synthesis, 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

SB6 Core knowledge

No	Question	Answer
1	What is a producer?	An organism that makes its own food using photosynthesis.
2	What is biomass?	The total mass of an organism after drying.
3	Describe photosynthesis in plants and algae	An endothermic reaction that uses light energy to react carbon dioxide and water to produce glucose and oxygen
4	What is the equation for photosynthesis	Carbon dioxide + water → glucose + oxygen
5	List three limiting factors of photosynthesis	Temperature, light intensity and carbon dioxide concentration
6	How does temperature limit the rate of photosynthesis?	If the temperature is not high enough, the rate of photosynthesis will not increase as the enzymes responsible cannot perform at their optimum rate.
7	What is the effect of increasing temperature on the rate of photosynthesis?	• The rate of photosynthesis will increase up to a maximum rate at the optimum temperature. • At higher temperatures the rate will decrease due to denaturation of the enzymes that carry out photosynthesis.
8	How does carbon dioxide affect the rate of photosynthesis?	As the concentration of carbon dioxide increases, the rate of photosynthesis also increases.
9	How does light intensity limit the rate of photosynthesis?	If the light intensity is not high enough, there will not be enough energy for photosynthesis
10	How can the effect of light intensity on rate of photosynthesis be investigated?	The rate of oxygen production by a plant can be measured at different light intensities.
11	How does the rate of photosynthesis change with light intensity?	The rate of photosynthesis is directly proportional to light intensity.
12	How does the rate of photosynthesis change with distance from a light source?	The rate of photosynthesis is inversely proportional to the distance from the light source- following the inverse square law.
13	How is the structure of a root hair cell adapted to absorb water and mineral ions?	a) Large surface area to volume ratio b) Maximises contact with the soil c) Thin cell walls to allow water molecules and mineral ions through quickly
14	How are xylem adapted to their function in the plant?	• Dead cells with no cytoplasm so lots of room inside.

		• No walls between cells so they form a hollow tube. • Thick walls made of lignin so they don't burst.
15	How are phloem adapted to their function in the plant?	• Companion cell use energy to pump sucrose inside • Sieve tubes made of cells with holes in the ends for liquids to move through • No nucleus and little cytoplasm in sieve tube cell so lots of room inside
16	What is transpiration?	The transportation of water molecules through the plant.
17	Describe the structure and function of the stomata	Stomata are pores in the underside of leaves that allow the diffusion of gases in and out of the leaf. Guard cells around the pore open and close it.
18	How is sucrose transported around the plant by translocation?	In phloem. Living companion cells use energy to pump sucrose inside sieve tubes. Increasing pressure causes sucrose solution to flow around plant.
19	How is the structure of a leaf adapted for photosynthesis and gas exchange?	a) Large surface area to absorb sunlight b) Palisade layer has lots of chloroplasts c) Xylem vessels supply water to cells d) Air spaces inside leaf allow carbon dioxide to diffuse into cells e) Stomata in underside allow gases to diffuse in and out
20	List environmental factors that could affect the rate of water uptake by a plant	Light intensity, air movement (wind), temperature
21	How is the rate of transpiration calculated?	Measure the distance the bubble in the potometer has moved in (e.g.) 20 minutes: $\frac{\text{Distance moved (mm)}}{\text{Time taken (min)}}$ = rate of transpiration (mm/min)

Unit 7 Animal coordination, control and homeostasis – core questions

1. Which system contains a collection of glands which produce hormones?	The endocrine system
2. Which gland produces insulin?	The pancreas
3. Which gland produces adrenaline?	The adrenal glands
4. State 3 ways in which adrenaline prepares the body for fight or flight	• Increased heart rate • Increased blood flow to muscles • Increased blood pressure • Stimulates liver to convert glycogen to glucose
5. Where is TRH produced?	Hypothalamus
6. Which gland releases TSH?	• The pituitary gland
7. Which gland produces Thyroxine?	Thyroid gland
8. How is the regulation of thyroxine production an example of negative feedback?	As thyroxine levels increase TRH production is decreased
9. State 2 hormones which control the menstrual cycle	**FSH** Oestrogen **LH** Progesterone

10. What is ovulation?	When an egg cell is released from an ovary
11. On what days of the menstrual cycle does menstruation occur?	Days 1-5
12. When does ovulation usually happen?	Day 14
13. (H) What does FSH do?	**Stimulates growth and maturation of egg follicle**
14. (H) The surge in LH at day 14 triggers….	**Ovulation (release of egg)**
15. Towards the end of the cycle the fall in oestrogen and progesterone trigger…..	Menstruation
16. What does hormonal contraception prevent?	The maturation of the egg follicle
17. Name 2 methods of contraception apart from the pill	Condom Diaphragm
18. Which hormone is released in response to high blood glucose?	Insulin
19. Which hormone is released in response to low blood glucose?	Glucagon
20. How is glucose stored in the liver and muscle cells?	As glycogen
21. What causes Type 1 diabetes?	Insulin is not produced from the pancreas
22. How can type 1 diabetes be treated?	Injecting insulin
23. What causes Type 2 diabetes?	Cells do not respond to the effect of insulin
24. How can Type 2 diabetes be treated?	Exercise; healthy diet; Medication
25. Describe negative feedback	An increase in one factor causes a decrease in another factor (and vice versa)

CB8

1	Which gas do we need for respiration?	Oxygen
2	Which gas is a waste product of respiration?	Carbon Dioxide
3	Where are food molecules absorbed into the blood?	Small intestine
4	What is urea?	A poison produced in your body when it breaks down amino acids
5	State 3 ways the alveoli are adapted for gas exchange	• Large surface area to volume rate • Thin alveolus cell wall • Thin capillary cell wall • Lots of capillaries
6	State 3 factors affecting the rate of diffusion	• Surface area • Concentration gradient • Diffusion distance
8	What is the function of red blood cells?	To transport oxygen
9	What is the function of white blood cells?	They are part of the immune system and help defend the body against infection
10	What is transported in plasma?	Transports dissolved substances around the body including glucose, hormones, water, urea, carbon dioxide
11	What is the function of platelets?	Help the blood to clot
12	How are arteries adapted to their function?	Thick, elastic walls to cope with high pressure

13	How are veins adapted to their function?	Thin flexible walls, Valves to stop low pressure blood flowing backwards
14	How are capillaries adapted to their function?	Very thin walls (only one cell thick) which allows for rapid diffusion of substances into and out of the blood.
15	What is the function of valves?	To prevent the backflow of blood into the heart
16	Which side of the heart pumps oxygenated blood around the body?	The left side
17	Which side of the heart is thicker?	The left ventricle
18	Put these words in order to describe the flow of blood into, around, and out of the heart, starting at the vena cava: Vena cava; left ventricle, right ventricle, pulmonary vein, aorta, right atrium; pulmonary artery; left atrium.	Vena cava → right atrium → right ventricle → pulmonary artery → pulmonary vein → left atrium → left ventricle → aorta
19	What does exothermic mean?	Energy is given out
20	Write the word equation for aerobic respiration	glucose + oxygen → carbon dioxide + water (+ energy)
21	Write the word equation for anaerobic respiration	glucose → lactic acid
22	Write the equation for cardiac output	Cardiac output = stroke volume x heart rate

CB9 Ecosystems and Material Cycles – Core Questions

1.	All the organisms that live and interact in an ecosystem form a…..	Community
2.	A community is made up of ……. of different species	Populations
3.	What does interdependence mean?	Interdependence is the dynamic relationship between all living things
4.	State 4 abiotic factors	• Temperature • Light • Water • Pollutants
5.	State 2 biotic factors	• Competition • Predation
6.	What is a parasite?	An organism whose survival depends on the presence of another species from which it takes food and other resources
7.	Give 4 examples of parasitism	• Fleas • head lice • tape worms • mistletoe
8.	What does the term ‘mutualism’ mean?	Organisms that exist in a close, mutually beneficial relationship where both aid the survival of the other.
9.	Give 4 examples of mutualism	• Oxpeckers that clean other species • Cleaner fish

		• Nitrogen fixing bacteria • Chemosynthetic bacteria in tube worms in deep sea vents
12.	How does fish farming help aquatic ecosystems?	It prevents overfishing of wild fish
13.	State 2 problems with fish farming	Fish are kept in small space, therefore: • Un-eaten food and faeces sinks to bottom of water and can affect wild organisms that live there. • Parasites and disease can spread more easily
14.	What is a non-indigenous species?	A species that is not natural to that environment
15.	How can the introduction of non-indigenous species affect an ecosystem?	It can cause problems for the native species that already exist in the ecosystem
16.	What can happen in an aquatic system if too much fertiliser is used on the soil	Eutrophication
17.	State the 2 nutrients found in fertiliser that can cause eutrophication	Nitrate Phosphate
18.	How does eutrophication cause a problem?	The algal bloom blocks sunlight. Plants die and bacteria builds up in the water. The bacteria uses up all the oxygen and all living things in the ecosystem die.
19.	How does reforestation benefit biodiversity?	It increases the number of species in the area
20.	What is conservation?	When an effort is made to protect a rare or endangered species or habitat
21.	What is food security?	Food security is having access to safe and healthy food at all times
22.	State 2 biological factors which could affect food security	• Increasing human population • Increasing animal farming • Impact of pests and pathogens • Environmental change caused by human activity • Sustainability issues
23.	What is the equation for photosynthesis?	Carbon dioxide + Water → Glucose and Oxygen Light is used to do this
24.	What is the word equation for respiration?	Glucose and Oxygen → Carbon dioxide + Water + (Energy)
25.	Which common greenhouse gas is released in combustion that is also released in respiration?	Carbon dioxide
26.	Which gas comprises nearly 80% of our atmosphere but cannot be used directly by plants and animals?	Nitrogen
27.	Where do nitrogen fixing bacteria live and what do they do?	The live in the soil or root nodules and they can 'fix' nitrogen gas from the air
28.	Which weather phenomenon can also convert nitrogen gas into nitrates?	Lightning
29	What is the role of decomposers? Give two examples.	Break down dead animals and plants Fungi, worms
30.	What can nitrifying bacteria in the soil do?	Convert ammonia into nitrates
31.	Why do plants need nitrates?	To make proteins for growth
32.	What is the role of denitrifying bacteria?	Convert nitrates to nitrogen gas and return it to the atmosphere.

33.	Identify 2 processes which cause water to change state in the water cycle	• Evaporation • Condensation
34.	What is desalination?	Obtaining fresh water from the sea or salty water
36.	State 3 factors that affect the rate of decomposition of food	• Temperature • Water content • Oxygen

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	1.	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.

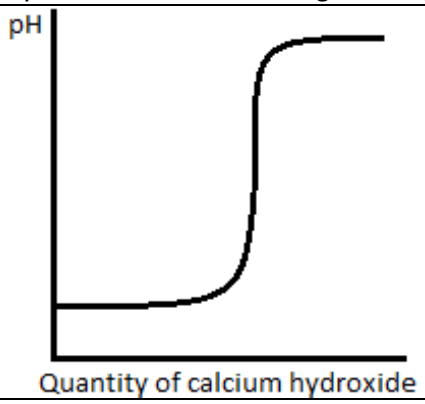
Methods of separating and purifying substance

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

66	What are acids and alkalis sources of?	Acids – hydrogen ions Alkalis – hydroxide ions
67	What are the colour changes of? 1. Litmus 2. Methyl orange 3. Phenolphthalein With acid and alkali?	<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>
68	What is the link between hydrogen ion concentration and pH?	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.
69	When calcium hydroxide is added slowly to hydrochloric acid the pH of the resulting solution changes. What would the graph of this look like?	
70	What pH could a concentrated acid have?	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.
71	Which would have a pH of 1? • 0.25M Sulphuric acid (a strong acid) • 10M Ethanoic acid (a weak acid)	Strong acids will always have low pH regardless of the concentration.
72	What is a base?	It is a substance that can react with an acid to make a salt and water.
73	What is an alkali?	A soluble base.
74	What type of reaction is it when an acid reacts with a base?	Neutralisation
75	What are the products of the following neutralisation reactions? 1. Metal + acid -->\ 2. Metal oxide + acid -->\ 3. Metal hydroxide + acid -->\ 4. Metal carbonate + acid -->\	1. Salt + hydrogen 2. Salt + water 3. Salt + water 4. Salt + water + carbon dioxide
76	What is the chemical test for? 1. Hydrogen 2. Carbon dioxide	1. Lit splint gives a squeaky pop. 2. Bubbling carbon dioxide through limewater turns it milky.
77	Explain why water is produced when an acid reacts with an alkali?	The hydrogen ions (H^+) from the acid react with the hydroxide ions (OH^-) from the alkali to form water (H_2O).

78	When preparing a soluble salt from an acid an insoluble reactant how do you ensure the salt is pure?	1. Use excess insoluble reactant to neutralise all the acid. 2. Filter the resulting mixture to remove the excess reactant.
79	How do you prepare a soluble salt when both the reactants are soluble?	Titration is used to ensure the reactants are mixed in the correct proportions.
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
94	What is the positive electrode called?	Anode
95	What is the negative electrode called?	Cathode
96	How do the ions move during electrolysis?	The cations migrate to the cathode. The anions migrate to the anode.
97	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	

	Anode	Cathode	Left in solution
1	Chlorine	Copper	
2	Chlorine	Hydrogen	Sodium hydroxide
3	Oxygen	Hydrogen	
4	Oxygen	Hydrogen	
5	Bromine	Lead	

98	What is the cathode half equation when water is electrolysed?	$2H^+ + 2e^- \rightarrow H_2$
99	What is the anode half equation when water is electrolysed?	$2O^{2-} \rightarrow O_2 + 4e^-$

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.

Y11 Chemistry

Topic 6- Groups in the periodic table

Group 1

1	What do we call group 1, group 7 and group 0 in the periodic table?	The alkali metals, the halogens and the noble gases.
2	In terms of electronic configuration, what do all the elements in: 1. Group 1 have in common? 2. Group 7 have in common? 3. Group 0 have in common?	They have: 1. 1 electron on their outer shell 2. 1 electron is needed to complete their outer shell. 3. A full outer shell of electrons.
3	How are the alkali metals different from transition metals?	1. They are soft (can be cut with a knife). 2. They have comparatively low melting points.
4	Describe the reaction of sodium with water.	1. The metal reacts and moves around the surface of the water. 2. The reaction gives off a gas. 3. The product of the reaction is soluble in the water.
5	What two products are formed when alkali metals are added to water?	A hydroxide and hydrogen gas.
6	State the order of reactivity in group one and explain it.	Reactivity increases as you go down the group. This is because the outer electron is further away from the nucleus and is therefore more easily lost.

Group 7

7	What are the colours and physical states of the halogens at room temperature?	Fluorine is a pale yellow gas. Chlorine is a yellow/green gas. Bromine is a brown liquid. Iodine is a grey solid.
8	What is the pattern in: 1. Boiling point 2. Colour intensity 3. Reactivity As you go down the halogen group?	1. Boiling point increases 2. Colour intensity increases 3. Reactivity decreases

9	What is the test for chlorine?	Chlorine turns damp litmus paper red and then bleaches it.
10	What is formed when halogens react with hydrogen?	Hydrogen halides. These can dissolve in water to from acids e.g. HCl, hydrogen chloride dissolves in water to form hydrochloric acid.
11	What is formed when halogens react with metals?	Metal halides. E.g. $2Fe + 3Cl_2 = 2FeCl_3$ (iron(III)chloride)
12	State the order of reactivity of the halogens and explain it.	Reactivity decreases as you go down the group.
13	If chlorine is added to sodium bromide solution what happens?	A displacement reaction takes place forming sodium chloride solution and bromine. This is because the chlorine is more reactive than the bromine.
14	When chlorine reacts with sodium bromide what type of reaction is it?	Displacement reaction which is a redox reaction.
15	When chlorine reacts with sodium bromide, what is oxidised and what is reduced? Explain your answer in terms of electrons.	The chlorine will gain electrons and therefore be reduced. The bromide ion will lose electrons and is therefore oxidised.
16	Why do the halogens become less reactive as you go down the group?	The halogens all need to gain an electron to complete their outer shells. The positive nucleus attracts the electron the halogens need to fill the outer shell. The halogens at the top of the group have less shells so the attractive force of the nucleus is much stronger as the gap is closer which makes them more reactive.

Group 0

17	Why are the noble gases unreactive?	They already have a full outer shell of electrons.
18	What are the properties of the noble gases?	1. Inertness (so used in welding and filament lamps). 2. Low density (used in balloons). 3. non-flammability.
19	What is the trend in density and boiling point as you go down the noble gas group?	Both the densities and the boiling points of the noble gases increase as you go down the group.

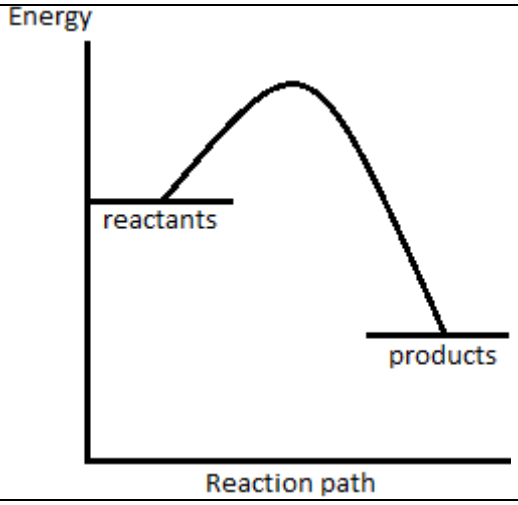
Topic 7 – Rates of reaction and energy changes

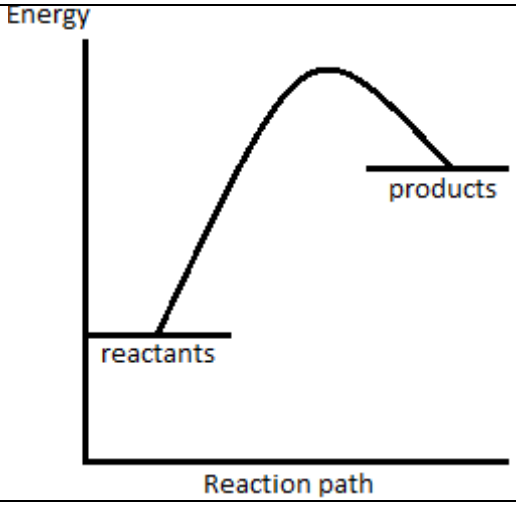
Rates of reaction

20	How could you monitor the rate of a reaction?	By looking at how quickly a product like a gas is produced, this could be done by collecting the gas in a syringe. Alternatively, by seeing how quickly a reactant is used up, this could be done by monitoring the mass of solid reactant.
21	If a reaction is to occur what 2 things need to happen between reacting particles?	The particles must collide and the collision must have enough energy.
22	Explain why increasing the temperature speeds up a reaction.	It gives the particles more energy so they collide more often and the collisions have more energy.
23	Explain why increasing the concentration of a solution speeds up a reaction.	It means there are more particles present so it will increase the number of collisions.
24	Explain why increasing the pressure on reactions involving gases speeds up the rate of reaction.	Increasing the pressure increases the number of gas particles present in a certain volume. This increases the number collisions between reacting particles, which increases the rate of reaction.
25	Explain how breaking up a solid reactant increases the rate of reaction.	Breaking up a solid increases the surface area. This means that there is a greater area of solid exposed for other particles to collide with. This increases the likelihood of a successful collision and therefore speeds up the reaction.

26	What happens to the rate as a reaction progresses and what would a rate of reaction graph look like?	Reactions start quickly and slow down as they progress. A rate curve will start off steep and the gradient will continually decrease to reflect the changing rate.
27	What is a catalyst?	A catalyst is a substance that speeds up the rate of a reaction without altering the products of the reaction, being itself unchanged chemically and in mass at the end of the reaction.
28	How does a catalyst speed up a reaction?	A catalyst provides an alternative route which requires less activation energy.
29	What are enzymes and what are they used for?	Enzymes are biological catalysts and they are used in the production of alcoholic drinks.

Heat energy changes in chemical reactions

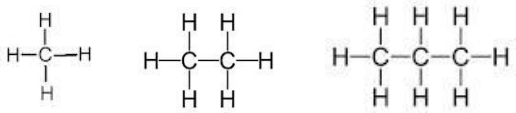
30	What is an exothermic reaction and give an example?	A reaction that gives out heat energy. For example combustion.
31	What is an endothermic reaction and give an example?	A reaction that takes in heat energy. For example photosynthesis.
32	Is the breaking of bonds exothermic or endothermic?	Endothermic.
33	Is the making of bonds exothermic or endothermic?	Exothermic.
34	Why is a reaction exothermic?	In an exothermic reaction less heat energy is needed to break bonds than is given out when new bonds are made.
35	Why is a reaction exothermic?	In an endothermic reaction less energy is released in forming bonds in the products than is required in breaking bonds in the reactants.
36	How do you calculate the energy change in a reaction?	Subtract the energy created when bonds are made from the energy needed to break the bonds in the reactants. If the answer is negative then the reaction is giving out energy and is exothermic.
37	What is the unit for measuring the energy change in reactions?	KJ mol^{-1} (kilojoule per mole)
38	What is meant by the term activation energy?	The energy needed for a reaction to start. This is equal to the energy needed to break all the reactants' bonds.
39	What does the reaction profile for an exothermic reaction look like?	

40	What does the reaction profile for an endothermic reaction look like?	

Topic 8- Fuels and Earth Science

Fuels

41	What is a hydrocarbon?	A hydrocarbon is a compound that contains hydrogen and carbon ONLY.
42	What is crude oil?	Crude oil is a complex mixture of hydrocarbons. Some of these hydrocarbons contain molecules in which carbon atoms are in chains and some where they are in rings. Crude oil is an important source of useful substances and a finite resource.
43	With respect to crude oil, what is a "fraction"?	A fraction is a simpler, more useful mixture of hydrocarbons with a similar boiling point, e.g. petrol or bitumen.
44	What is the name of the process used to separate crude oil into its fractions?	Fractional distillation.
45	How does the fractional distillation of crude oil work?	The crude oil is heated and boiled. The vapour is then passed into a cooling tower. The hot vapours rise up the tower and cool as they do so. The first substance in crude oil to change back to a liquid is bitumen and this falls to the bottom of the tower and exits, the hot vapours rise through the tower and pass through one-way traps. This process continues until all the fractions have been separated and the gases at room temperature leave at the top of the tower.
46	The fractions come off the fractionating column in the following order (starting from the top of the column). Name the uses of each fraction: a) Refinery gases b) Petrol c) Kerosene d) Diesel oil e) Fuel oil f) Bitumen	a) domestic heating and cooking b) fuel for cars c) fuel for aircraft d) fuel for some cars and trains e) fuel for large ships and in some power stations f) used to surface roads and roofs
47	Hydrocarbons in different fractions differ from each other in: Number of carbon atoms in their molecules, boiling points, ease of ignition (flammability) and viscosity (stickiness). a) which fraction has the most carbon atoms in its molecules (the longest carbon chain)? b) which fraction has the lowest boiling point?	a) bitumen b) refinery gases c) bitumen d) refinery gases

	c) which fraction is the hardest to ignite (least flammable)? d) which fraction has the lowest viscosity?	
48	Are alkanes saturated or unsaturated?	Saturated. (They have no carbon-carbon double bonds that can open up to bond with any more hydrogen atoms – they are saturated with hydrogen.)
49	What is the formula for a) methane b) ethane c) propane Draw the structures of these molecules	a) CH_4 b) C_2H_6 c) C_3H_8 
50	What is the formula for the alkenes a) ethene b) propene	a) C_2H_4 b) C_3H_6
51	What is a homologous series?	A homologous series is a series of compounds that have similar properties and the same general formula. A compound will differ by CH_2 in molecular formulae from neighbouring compounds. There will be a gradual change in physical properties as the carbon chain gets longer.
52	What are the reactants and products of the complete combustion of hydrocarbons?	Reactants – hydrocarbon and oxygen. Products - carbon dioxide and water ONLY. (Energy is released, but it is not a product, because it is not a chemical substance.)
53	What are the products of the incomplete combustion of hydrocarbons? Why are they different from the products of complete combustion?	Products – carbon monoxide and/or carbon and water. Incomplete combustion produces a mixture of carbon compounds.) Carbon monoxide (CO) and/or carbon (C) are produced because there is not enough oxygen available to form carbon dioxide (CO_2).
54	Why are we concerned about incomplete combustion?	Incomplete combustion can cause the release of carbon monoxide, which is toxic. The soot (carbon) produced can damage appliances.
55	What effect does carbon monoxide have on the body?	Carbon monoxide is toxic. It binds to heamoglobin and doesn't let go. It therefore reduces the amount of oxygen that's transported around the body by the blood depriving vital organs of oxygen. Unconsciousness and death follows.

Earth and Atmospheric Science

56	What is "acid rain", and how does it arise?	Acid rain is rain that is more acidic than normal. All fossil fuels (coal, gas and crude oil) contain impurities, particularly sulfur. When the fuel is burnt the

		sulfur combines with oxygen to produce sulfur dioxide gas. When water vapour in the atmosphere condenses the sulfur dioxide gas dissolves in it to form an acidic solution. This can then fall as rain and because it is more acidic than normal rainwater it is called "acid rain".
57	What are the problems associated with acid rain?	Acid rain makes rivers, lakes and soils acidic, harming the organisms living there. Acid rain damages the leaves and roots of plants and trees. Acid rain can speed up the weathering of limestone (rocks or buildings) and marble.
58	How are nitrogen oxides produced?	Many hydrocarbons are burnt in engines. The high temperatures involved mean that the nitrogen and oxygen from the air combine to produce oxides of nitrogen.
59	What is a nonrenewable fuel?	A fuel that once it has been used cannot be used again. E.g. kerosene, diesel, petrol, methane (from natural gas).
60	What is the cause of a sooty flame?	Incomplete combustion. (Not enough oxygen present to convert all the carbon in the hydrocarbon fuel to carbon dioxide, so carbon particles are one of the products of the reaction.)
61	Give an advantage and a disadvantage of combining hydrogen and oxygen in a fuel cell¸ rather than petrol, as a fuel for cars.	Advantage – hydrogen is a clean fuel. The only product of the combination of hydrogen and oxygen is water. Therefore no carbon dioxide, nitrogen oxide or acid rain would be produced. Disadvantage – hydrogen can be explosive/hydrogen is not readily available in filling stations at present /the process needed to produce the hydrogen fuel results in the production of carbon dioxide.
62	a) Explain what "cracking" is, and what products are made. b) Why do oil companies bother to carry out this reaction?	a) Cracking is the splitting (using heat) of a long chain saturated hydrocarbon (an alkane) to form a shorter chained alkane and an alkene. b) Shorter chained hydrocarbons make better fuels. Crude oil contains too many of the longer chained molecules, so oil companies crack them to i) **make more of the useful fuels**, and ii) **make alkenes** (which can be used to make polymers).
63	How was the earth's first atmosphere formed?	From gases produced by volcanic activity.
64	What are thought to be the relative proportions of the gases that formed the early atmosphere?	Little or no oxygen, large amounts of carbon dioxide, large amounts of water vapour and small amounts of other gases.
65	Why can't we be certain about how the earth's atmosphere formed?	There is only limited evidence (e.g. from rocks and ice cores) about the earth's early atmosphere.
66	How were the earth's oceans formed?	Water vapour, released by volcanoes, condensed to form the oceans.
67	How did the amount of oxygen in the atmosphere gradually increase?	Green plants evolved. The growth of these primitive plants used carbon dioxide and released oxygen by photosynthesis.
68	What is a chemical test for oxygen?	Oxygen will relight a glowing splint.
69	Describe the processes, other than photosynthesis, that reduced the amount of carbon dioxide in the atmosphere.	a) Carbon dioxide dissolved into the oceans. b) Dissolved carbon dioxide was incorporated into the shells of marine organisms. When marine

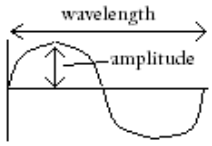
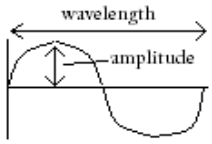
		organisms die their shells can eventually form carbonate rocks.
70	What is the greenhouse effect?	This is when various gases are added to the atmosphere, including carbon dioxide, methane and water vapour. These gases absorb heat radiated from the Earth and subsequently release the energy that keeps the Earth warm.
71	What evidence do we have for global warming and why can we not be absolutely certain about it?	Scientists have discovered a correlation between historical global temperature and carbon dioxide levels. They also know how much carbon dioxide we are presently adding to the atmosphere. We cannot be certain about this because of historical accuracy of the temperature and carbon dioxide levels and also due to uncertainties caused by the location where measurements are taken.
72	List the percentages of the gases in our modern atmosphere.	Nitrogen 78%, oxygen 21%, 1% other gases (argon, carbon dioxide and water vapour).
73	What are the potential effects on the climate of increased levels of carbon dioxide and methane caused by human activity?	The climate will warm up although we cannot be certain by how much. It is also suspected we will have a long term change in weather (e.g. more/less rain) and more extreme weather events.
74	How might the greenhouse effect be mitigated?	We would need to reduce the consumption of fossil fuels by looking at alternative sources of energy e.g. nuclear or renewables. Also, a different fuel for transport e.g. electricity or fuel cells.
75	Why can we not just stop burning fossil fuels to generate electricity?	Nuclear power is not liked by all and the waste is a risk and can be a problem for the environment. Solar and wind don't produce that much electricity so you would need thousands of solar and wind farms and this would take too much space and be extremely expensive. Generation from solar and wind is not always continuous.

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)	 A) 1,000,000,000 (10^9) B) 1,000,000 (10^6) C) 1000 (10^3) D) 0.01 (10^{-2})

	E) milli (m) F) micro (μ) G) nano (n)	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)
10	What is wave velocity and how is it different to wave speed?	• Wave velocity describes both how fast the wave is travelling (m/s) and in which direction. It is a vector quantity. • Wave speed is only how fast the wave is going (still m/s). It is a scalar quantity.
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).
12	Why is it better to measure the time taken for 10 waves and then divide by 10 to find the period rather than timing 1 wave experimentally?	More accurate because 1 wave might be too fast to time and human reaction times will be more significant over a shorter time.
13	What is the name given to describe the surface over which a wave has maximum and minimum values (peaks and troughs)?	Wavefront.
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.
15	As the speed of a wave increases, what happens to the wavelength of the wave? (Assuming that the frequency is constant).	The wavelength would get longer.
16	What 2 variables affect the speed of a wave?	The kind of wave it is and what the wave is moving through.

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).
23	H) What type of substances absorb waves?	• Light waves are absorbed by black materials. • Sound waves can be absorbed by soft furnishings.
24	H) What type of substances reflect waves?	• Mirror and shiny materials reflect light waves. • Hard flat surfaces reflect sound waves.
25	H) What type of substances transmit waves?	• Clear materials like glass and plastic transmit light waves. • Sound can be transmitted through thin materials like walls, doors and windows.
26	H) What property of the wave is the behaviour (absorption, transmission, reflect or refract) dependent on?	The wavelength of the wave.
27	What happens to light as it passes from one material to another?	Some of it will be reflected (bounced off) and some will be refracted (bent through).
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.
30	If light is allowed the travel into a glass block and out of the other side again, what would you notice about the incident ray and the emergent ray?	They will be parallel to each other. You might also notice the incident ray is slightly brighter than the emergent ray as some energy may have been absorbed by the glass as the wave is transmitted through.
31	H) If a wave travels 90° to the surface (along the normal line) of a material what will not change and what will change?	Direction will not change but speed still will. This means that the wavelength will change for a constant frequency but the direction of the wave will continue in a straight line and not bend.

32	H) What happens to a water wave as it travels from shallow water to deeper water?	It will speed up in deeper water. This will cause the wavelength to increase (for a fixed frequency) and if the waves arrive at the deep water at any angle other than 90°, they will change direction.
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)

1	What variable affects the speed of a light wave?	What the wave is moving through.
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
14	Describe the difference in the way muscle, fat and bone absorb or transmit x-rays and gamma rays.	X-rays are energetic, and have high velocities but are absorbed by denser materials such as bones Gamma rays are more energetic and have a higher velocity, they transmit through bones, muscle and fat.
15	H) What is the advantage of the Hubble space telescope?	As it is situated above the atmosphere so that light from distant objects enters it without being refracted or reflected which creates clearer images.

		It can detect EM radiations that are absorbed by the atmosphere.
16	Describe how changes in atoms and nuclei can be caused by absorbing EM radiations	• Changes to nuclei of atoms can also produce gamma radiation • Absorbing radiation can cause atoms to become ions.
17	Describe how changes in atoms and nuclei can emit EM radiations	• EM radiations are produced by changes in the electrons or nuclei in atoms • When materials are heated, this changes how electrons are arranged and can produced infrared or visible light.

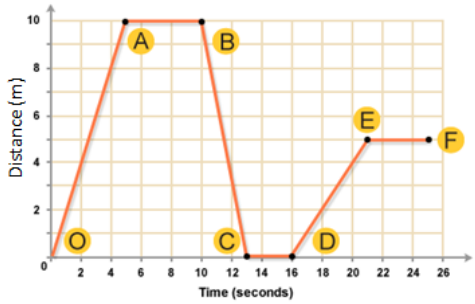
Topic 3- Radioactivity (Paper 5)

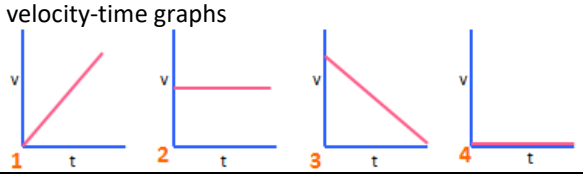
1	Describe the plum pudding model of the atom	A sphere of positive charge with electrons spread through it.
2	Describe the Bohr model of the atom	• It has a tiny, positively charged nucleus (containing almost all the mass in the form of protons and neutrons) • surrounded by negatively charged electrons in fixed energy levels (orbits or shells).
3	What is the typical size of an atom?	1×10^{-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.
5	Explain why ideas about the structure of the atom have changed over time.	New discoveries were made (like the electron and the charge on it, the neutron, proton and the positron) both using mathematics and experimentation.
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
11	What are the properties of beta radiation?	• Ionising • Fairly penetrating • They are affected by electric and magnetic fields because they are charged
12	What are the properties of gamma radiation?	• Weakly ionising • Very penetrating • Not affected by electric and magnetic fields

13	What are the properties of positron radiation?	• Ionising • Fairly penetrating • They are affected by electric and magnetic fields because they are charged
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.
17	What is the effect on the mass number (nucleon number) in alpha decay?	Decreases by 4.
18	What is the effect on the mass number (nucleon number) in gamma decay?	Nothing.
19	What is the effect on the mass number (nucleon number) in neutron decay?	Decreases by 1.
20	What is the effect on the atomic number (proton number) in alpha decay?	Decreases by 2.
21	What is the effect on the atomic number (proton number) in gamma decay?	Nothing.
22	What is the effect on the atomic number (proton number) in neutron decay?	Nothing.
23	In a nuclear equation what do you need to balance?	The mass number of the parent atom is the same as the total mass numbers of the new isotope and released particles. The atomic number of the parent atom is the same as the total atomic numbers of the new isotope and released particles.
24	When is gamma radiation emitted?	When a radioisotope undergoes <u>decay by alpha or beta</u> (+ or -) emission the nuclear rearrangement usually results in the <u>excess energy being released as gamma radiation</u>.
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
27	What information does the atomic number (proton number) tell you?	• How many protons there are in the nucleus of an atom, ion or isotope • and so what type of atom it is.
28	What information does the mass number (nucleon number) tell you?	The total number of protons + neutrons in the nucleus of an atom.
29	What happens to an atom when an alpha particle is near?	• Alpha particles are positively charged • They attract negatively charged electrons • Electrons are removed from atom • Atom becomes a positive ion
30	What happens to an atom when a beta+ particle is near?	• Beta+ particles are positively charged • They attract negatively charged electrons • Electrons are removed from atom • Atom becomes a positive ion
31	What happens to an atom when a beta- particle is near?	• Beta- particles are negatively charged • They repel negatively charged electrons • Electrons are removed from atom • Atom becomes a positive ion
32	How ionising are alpha particles?	Highly ionising as they have a +2 charge.

33	How ionising are beta particles?	Moderately ionising as they have a -1 charge or +1.
34	How ionising are gamma rays?	Weakly ionising as they are uncharged.
35	What stops alpha particles?	A few cm of air or thin paper.
36	What stops beta particles?	A few mm of a metal like aluminium
37	What stops gamma rays?	A few cm of a dense metal like lead will significantly reduce the amount of gamma rays getting through.
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
45	How can we calculate half-life on a graph?	1) Identify the initial count rate (let's say it is 80) 2) Divide this by 2 (80/2 = 40) 3) Draw a line on the graph from this value (40) 4) When you meet the line of best fit, draw a line to the x-axis 5) This is the half-life
46	How do you calculate half-life mathematically?	Calculate the amount of time it takes to halve the activity of a sample from the data provided.
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
50	Compare the three types of radiation outside the body.	• Alpha cannot penetrate. • Beta would be able to penetrate and would be absorbed by cells. • Gamma would be able to completely pass through the body and would be absorbed by cells.
51	Compare the three types of radiation inside the body.	• Alpha would not be able to escape from the body and would all be absorbed by localised cells. • Beta would be absorbed by cells as it passed through the body. • Gamma would be emitted from the body and would be absorbed by cells as it passed through the body.
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.
54	Why did scientists change their ideas about radioactivity over time?	Scientific knowledge changed over time as more observations and data were collected.

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
5	A cyclist travels a distance of 1800m in 2 minutes. What is their speed?	Equation: S = D / t Convert: Time needs to be in seconds: 2 x 60 = 120s Substitute: S = 1800m / 120s Calculate: S = 1800 / 120 = 15 Units: S = 15 m/s
6	How long did it take for a car to travel 30 metres when travelling at 0.6m/s?	Equation: t = D / S Substitute: t = 30m / 0.6m/s Calculate: t = 30 / 0.6 Units: t = 50s
7	A peregrine falcon can fly at speeds of 50m/s, at this speed how far can it travel in 7 seconds?	Equation: D = S x t Substitute: D = S x t Calculate: 50 x 7 = 350 Units: 350m
8	Describe how to calculate speed using a graph	• Find the value for time using the x-axis • Find the value for distance using the y-axis • Divide the value for distance by the value for 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
12	A car starts from 0m/s and reaches a velocity of 50m/s in 5 seconds, what is its acceleration?	Equation: A = (v – u) / t Substitute: A = (50m/s – 0m/s) / 5 Calculate: A = 50 / 5 Units: 10 m/s^2
13	What is the change in velocity if an object accelerates at a rate of $2m/s^2$ in 600 seconds	Equation: (v – u) = A x t Substitute: (v – u) = $2m/s^2$ x 600s Calculate: 2 x 600 = 1200 Units: (v – u) = 1200m/s

14	How long did it take for a car accelerating by -2.5m/s^2 when its initial velocity was 70m/s and its final velocity was 20m/s.	Equation: t = (v – u) / A Substitute: t = (20m/s – 70m/s) / -2.5m/s^2 Calculate: -50 / -2.5 = 20 Units: t = 20s
15	Use the equation: (final velocity – initial velocity) = 2 x acceleration x distance Calculate the initial velocity of an object when its final velocity was 16m/s when it accelerated by 1.5m/s for 3m.	Equation: (v-u) = 2 x a x d Substitute: (16-u) = 2 x 1.5 x 3 Calculate: 2 x 1.5 x 3 = 3 Substitute: (16-u) = 3 Calculate: u = 3 + 16 = 19 Units: 19m/s
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
19	Describe how to calculate acceleration using a graph	• Find the value for time using the x-axis • Find the value for final velocity using the y-axis • Find the value for initial velocity using the y-axis • Calculate the change in velocity by subtracting the initial velocity from the final velocity • Divide the change in velocity by time
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 F. car on motorway G. a commuter train H. a ferry I. an aeroplane J. light in a vacuum	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 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
24	What is a free-body diagram used to show?	The size and direction of the different forces acting on a single object.
25	What are action and reaction forces?	When 2 bodies interact (for example, your foot and a football) <u>they exert forces on each other</u> that are <u>equal in size</u> and <u>opposite in direction</u>.

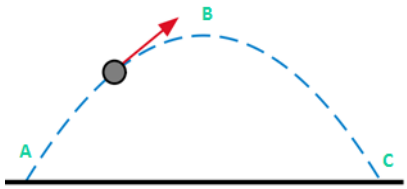
26	H) Describe the effects when 2 objects of different masses collide together	They will exert forces on each other that are equal in size and opposite in direction, but the effects will be different. The object with the smaller mass will move further than the object with the larger mass.
27	What is 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
29	What do resultant forces change?	• speed • direction • shape of an object
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)
36	A 1500kg car has an acceleration of $3.0m/s^2$, what is the force provided by the engine?	Equation: F = M x A Substitute: F = 1500kg x $3m/s^2$ Calculate: 1500 x 3 = 4500 Units: F = 4500N
37	A car accelerates at $6m/s^2$ as its engine provides a force of 7,800 N. What is the mass of the car?	Equation: M = F / A Substitute: M = 7,800N / $6m/s^2$ Calculate: M = 7,800 / 6 Units: M = 1,300kg
38	A jumbo jet has a mass of 40, 000,000g. If its engines produce a force of 800, 000 N, what will its acceleration be?	Equation: A = F / M Convert: Mass needs to be in kg, 40,000,000 / 1000 = 40,000 Substitute: A = 800,000 / 40,000kg Calculate: 800,000 / 40,000 Units: A = $20m/s^2$
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)
42	What is the weight of a 300kg planetary landing craft on the surface of the Earth?	Equation: W = M x GFS Substitute: W = 300kg x 10N Calculate: 300 x 10 = 3000 Units: W = 3000N
43	What is the mass of an object if the weight is 120N on Jupiter whose GFS is 25N/kg?	Equation: M = W / GFS Substitute: M = 120N / 25N/kg Calculate: M = 120 / 25 = 0.48 Units: M = 4.8kg
44	What is the GFS of Mars if a 150kg object has a weight of 570N?	Equation: GFS = W / M Substitute: GFS = 570N / 150kg Calculate: 570 / 150 = 3.8 Units: GFS = 3.8N/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.

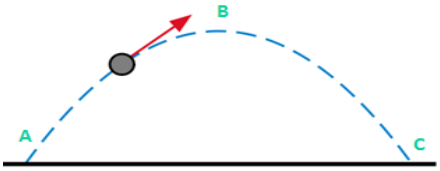
		The stronger the gravitational field strength, the heavier the weight. (For example a 1kg mass bag of sugar will weigh 9.8N on earth, and only 1.6N on the moon).
47	CORE PRACTICAL Describe how to investigate the relationship between force, mass and acceleration	1. Set up a ramp, with a trolley and light 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
48	A coin and a feather are dropped from the same height on earth. Which will hit the ground first and why?	The coin because it will have less air resistance acting on it.
49	A coin and a feather are dropped from the same height on the moon. Which will hit the ground first and why?	They will hit the ground at the same time because there is no air resistance on the moon (in a vacuum) and so both the coin and the feather will accelerate at the same rate.
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)
62	H) A 1200kg car travels along at 12 m/s, calculate its momentum.	Equation: Mo = Ma x V Substitute: Mo = 1200kg x 12m/s Calculate: Mo = 1200 x 12 = 14400 Units: Mo = 14,400 kg m/s
63	H) Calculate the velocity of a 250kg object if it's momentum is 5000 kg m/s.	Equation: V = Mo / Ma Substitute: V = 5000 kg m/s / 250kg Calculate: V = 5000 / 250 = 20 Units: V = 20 m/s
64	H) Calculate the mass of an object which has the momentum of 54, 000 kg m/s and travels at a velocity of 12m/s.	Equation: Ma = Mo / V Substitute: Ma = 54,000kg m/s /12m/s Calculate: Ma = 54,000 / 12 = 4500 Units: Ma = 4500 kg
65	H) State the equation for force which substitutes momentum	Force = change in momentum / time
66	H) What force is needed to get a 25kg stationary bicycle moving from 0m/s to 12 m/s in 5s?	Momentum at start = 25 × 0 = 0 kg m/s Momentum at end = 25 × 12 = 300 kg m/s Change in momentum = 300 – 0 = 300 kg m/s Equation: Force = change in momentum ÷ time Substitution: Force = 300kg m/s ÷ 5s Calculation: Force = 300 ÷ 5 = 60 Units: Force = 60N

67	H) A 1500kg car is travelling at 15m/s when it hits a wall. It comes to a stop in 0.07s. What is the force acting on the car?	Momentum at start = 1500 x 0 = 0 kg m/s Momentum at end = 1500 x 15 = 22,500 kg m/s Change in momentum = 0 – 22,500 = -22,500 kg m/s Equation: Force = change in momentum ÷ time Substitution: Force = -22,500 ÷ 0.07s Calculation: Force = -22,500 ÷ 0.07 = -321,429 Units: Force = -321,429N
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 <u>increase the time it takes to reduce the momentum of the vehicle to zero</u> and so they <u>reduce the force</u> 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)

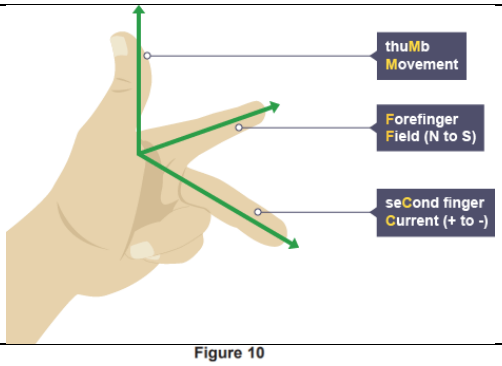
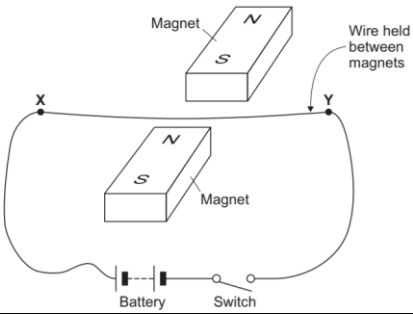
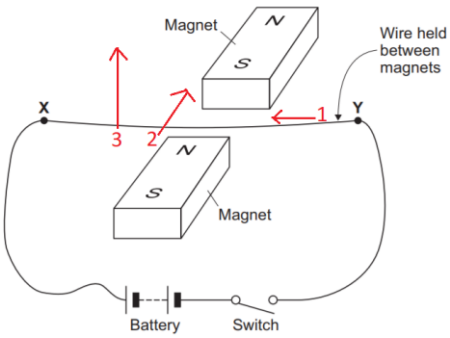
1	State the 2 energy transfers that happen in a solar battery charger.	Light energy to electrical energy Electrical energy to chemical energy
2	If 200 J of electrical energy is supplied to a bulb and 50 J is transferred as light energy, how much energy is wasted as heat?	200 – 50 = 150 J
3	What is the 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 <u>electrical energy</u> into <u>sound energy</u>
6	A student uses a solar powered battery charger to charge some batteries. What is the form of energy transferred into the battery charger?	<u>light energy</u> → electrical energy → <u>chemical energy</u>

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?	<u>Rate of cooling will decrease</u>, because <u>less energy escapes</u>.
23	If a building is made of materials that have a decreased thermal conductivity, what will happen to its rate of cooling?	<u>Rate of cooling will decrease</u>, because <u>less energy escapes</u>.
24	State the equation for energy efficiency.	$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$
25	A bulb is supplied with 200 J of electrical energy, but only 50 J is transferred as useful light energy. Calculate the efficiency of the bulb.	Efficiency = (useful energy transferred) ÷ (total energy supplied) = 50 ÷ 200 = 0.25
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) ΔGPE= m x g x Δh
29	A 25 kg object on Earth (g=10 N/kg) is lifted 2 m. Calculate its change in GPE.	Equation: ΔGPE= m x g x Δh Substitute: ΔGPE= 25kg x 10N/kg x 2m Calculate: 25 x 10 x 2 = 500 Units: 500 J
30	What is the gravitational potential energy gained by a 500kg car is lifted 15m on Earth (GFS=10N/kg)?	Equation: GPE = m x gfs x h Substitute: GPE = 500 x 10 x 15 Calculate: 500 x 10 x 15 = 75000 Units: GPE = 75,000 J
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 = $^1/_2$ x m x v^2
32	A 10 kg object is travelling at 5 m/s. Calculate its kinetic energy.	Equation: KE = $^1/_2$ x m x v^2 Substitute: KE = 0.5 x 10kg x (5m/s)^2 Calculate: 0.5 x 10 x 25 = 125 Units: 125 J
33	What is the kinetic energy transferred by a 2kg dog walking 2m/s?	Equation: KE = ½ x m x v^2 Conversions: 2m/s x 2m/s = 4m/s^2 Substitute: KE = ½ x 2kg x 4m/s^2 Calculate: KE = 0.5 x 2 x 4 Units: KE = 4J
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
40	State two ways of using solar power.	Solar cells convert energy from sunlight directly into electrical energy. Sunlight can be used to heat water.
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 6- Electromagnetic Induction (Paper 6)

1	Describe the interaction of like magnetic poles	They repel
2	Describe the interaction of unlike magnetic poles	They attract
3	Name 4 magnetic materials.	• iron • cobalt • nickel • steel
4	What is an induced magnet?	An object which is only a magnet only because it is in the magnetic field of another magnet
5	Name a material that an induced magnet could be made from.	any from iron, cobalt, nickel, steel
6	What is the difference between a permanent and induced magnet?	A permanent magnet is always magnetic An induced magnet is only magnetic when it is in the field of another magnet
7	What is a magnetic field?	The space around a magnet which affects magnetic materials
8	How can you find the shape of a magnetic field?	Use iron filings or plotting compasses
9	Describe how to use plotting compasses	1. Place your magnet on a sheet of paper 2. Draw a dot on the piece of paper close to the magnet 3. Place the compass so the N pole is next to the dot 4. Draw a new dot at the S pole of the compass 5. Place the compass so the N pole is next to the new dot and continue to repeat until the field reaches the edge of the sheet or returns to the magnet
10	Describe the shape of a magnetic field on a bar magnet or Earth	The magnetic field occurs all around a magnet/Earth. The magnetic field is strongest where lines are closer together.
11	Explain what evidence is used to support the theory that the Earth's core is magnetic	• Compass needles always points to a position near the Earth's north pole • A magnet suspended on a string will tilt relative to the horizontal by different amounts in different places, compass needles are weighted to keep them level
12	Describe how to show that current can create a magnetic field	Pass a current through a wire
13	Describe what effects the strength of the magnetic field in an electromagnetic field	• Increase the current passing through the wire • Decrease the distance from the wire
14	What is a solenoid?	A coil of wire with a current flowing through it (another name for an electromagnet)
15	How can you increase the magnetic field of an electromagnet/solenoid?	1. Place an iron core in the centre 2. Increase current 3. Increase number of coils
16	Describe the magnetic field inside a solenoid.	Uniform, along the centre of the coil
17	How can you create a magnetic field around a wire?	Pass a current through it
18	How can you change the direction of the field around a wire?	Change the direction of the current
19	Why is the magnetic field of a solenoid stronger inside the coil than outside it?	The fields from the two halves of the coil reinforce each other in the core to provide a strong almost uniform field and partially cancel each other out to give a weaker magnetic field outside the coil
20	H) Describe what a current carrying conductor (e.g. a wire) placed near a magnet experiences	A force that is equal and opposite to the magnet
21	H) Explain how a force is generated when using magnetic fields and a current carrying wire	• When a wire carrying a current is placed in a magnetic field • A force occurs because the wire creates a magnetic field • Which interacts with the magnetic field between the magnets • Creating a force at a perpendicular angle to the magnetic field
22	H) Recall Fleming's left hand rule	The force produced is perpendicular to both the current and magnetic field

		
23	H) On the diagram draw the following: 1. Flow of current 2. Magnetic field 3. Force acting on wire Figure 10 	Figure 10 
24	H) Recall the equation for calculating the force on a conductor at right angles to a magnetic field	F = B x I x *l*
25	H) A 50m long wire carries a current of 1.5A at right angles to the Earth's magnetic field. The magnetic flux density of the magnetic field is 0.000 08N/A m. Calculate the force on the wire	Equation: F = B x I x *l* Substitute: F = 0.000 08 x 1.5 x 50 Calculate: 0.000 08 x 1.5 x 50 = 0.006 Units: 0.006N
26	Describe the magnetic field between two flat magnets.	Uniform – has the same strength and direction everywhere
27	What is the motor effect?	A force produced when a current flows in a magnetic field
28	What does a transformer do?	Changes the potential difference of an AC electricity supply

Topic 7- Magnetism and their motorised effect (Paper 6)

1	H) Recall factors that affect the size and direction of an induced potential difference	• The number of turns in a coil of wire • How fast the magnetic field changes or moves past the coil • The direction of current
2	H) Describe how the magnetic field produced opposes the original change	If potential difference causes a current to flow in a wire, the magnetic field of this current opposes the original change
3	H) Explain how an alternating current in one circuit can induce a current in another circuit in a transformer	1. An alternating current in the primary coil creates a continuously changing magnetic field 2. This changing magnetic field induces a changing magnetic field in the secondary coil of the transformer 3. This in turn creates an alternating current in the secondary coil
4	H) What effect does a transformer have on alternating voltage?	A transformer can change the size of an alternating voltage
5	What is the national grid?	The wires and transformers that transfers electricity around the country
6	Explain why electrical energy is transferred at high voltages in the national grid	It <u>improves efficiency</u> by <u>reducing heat loss</u> in the transmission lines by allowing a lower current to be used.
7	Explain why electrical energy is transferred at low voltages for domestic use	It ensures voltages are low enough to be <u>safe</u> and <u>reduce the risk of electrocution</u>
8	Explain where and why step-up and step-down transformers are used in the transmission of electricity in the national grid	<u>Step up</u> transformers are used in power stations <u>before the national grid</u>

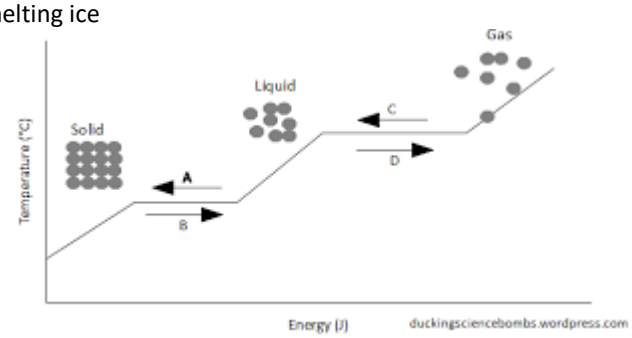
		Step down transformers are used before electricity enters factories and again before it enters homes, offices and shops.
9	Describe what change happens when a step-up transformer is used.	As the voltage increases the current decreases
10	H) State the equation used to calculate the number of coils or voltage on a transformer	primary voltage / secondary voltage = coils on primary / coils on secondary
11	H) A radio runs off the main supply but needs only a 23V supply. The transformer has 100 coils turns of wire in the primary coil. How many coils are needed in the secondary coil? (230V in mains supply)	Equation: $\frac{Vp}{Vs} = \frac{Np}{Ns}$ Substitute: $\frac{230V_p}{23V_s} = \frac{100_p}{N_s}$ Calculate: 230 / 23 = 10 Substitute: $10 = \frac{100_p}{N_s}$ Calculate: 100 / 10 = 10 Units: 10 coils
12	Use the power equation for calculating potential difference or current in a transformer	$V_P \times I_P = V_S \times I_S$
13	The primary coil of a transformer has a current of 2A with a potential difference of 50V. The current in the secondary coil is 25A. What is the potential difference across the secondary coil?	Equation: Vp x Ip = Vs x Is Substitute: 50 x 2 = Vs x 25 Calculate: 50 x 2 = 100 Substitute: 100 = Vs x 25 Calculate: 100 / 25 = 4 Units: 4V

Year 11 Physics Core Questions

Topic 8- Particle Model (Paper 6)

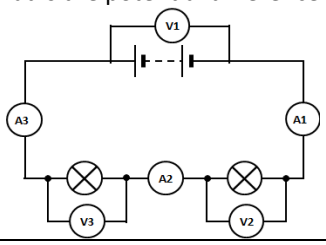
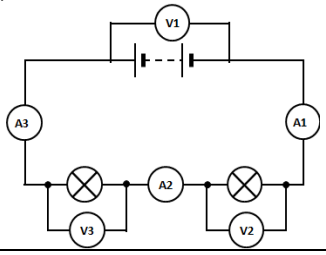
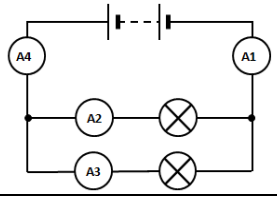
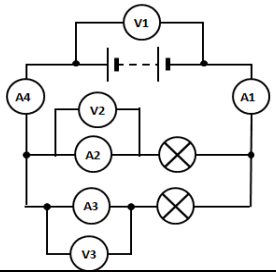
1	Use a simple kinetic theory model to explain solids in terms of movement and arrangement of particles	• Particles vibrate • Forces of attraction between particles are strong • Which is why particles do not flow • Solids keep their shape • Solids cannot be compressed
2	Use a simple kinetic theory model to explain liquids in terms of movement and arrangement of particles	• Particles flow • Particles have moderate forces of attraction • Liquids take shape of container • Liquids flow • Liquids cannot be compressed
3	Use a simple kinetic theory model to explain gases in terms of movement and arrangement of particles	• Particles move fast • Particles are far apart

		• Gases expand to fill container • Gases can be compressed
4	Recall and use the density equation	Density (kg/m^3) = mass (kg) / volume (m^3)
5	Calculate density of an object which has a mass of 250g and a volume of 30m^3.	Equation: Density = mass / volume Convert: 250g / 1000 = 0.25kg Substitute: D = 0.25 / 30 Calculate: 0.25 / 30 = 0.0083 Units: 0.0083 kg/m^3
6	What is the mass of an object which has the density of 12 kg/m^3 and a volume of 4m^3.	Equation: Mass = density x volume Substitute: M = 12 x 4 Calculate: 12 x 4 = 48 Units: 48 kg
7	Figure out the volume of an object which has the density of 20kg/m^3 and a mass of 500kg.	Equation: Volume = mass / density Convert: 500g / 1000 = 0.5kg Substitute: V = 0.5 / 20 Calculate: 0.5 / 20 = 0.025 Units: 0.025 m^3
8	CORE PRACTICAL Describe how to investigate the densities of solids and liquids	1. Fill a displacement can with water until the water just starts to come out of the spout 2. Find the mass of the solid using a balance 3. Hold a measuring cylinder under the spout 4. Add the solid to the water and measure the volume of water displaced 5. Calculate the density using the mass and volume measurements
9	Explain the differences in density between the different states of matter in terms of arrangements of atoms or molecules	Solids are the most dense because there are more particles in the same volume.
10	Describe what happens to mass when substances melt, freeze, evaporate, boil, condense or sublimate.	Mass is conserved
11	Define the term specific heat capacity	The specific heat capacity of a substance is the energy needed to increase the temperature of 1 kg of the substance by 1 °C.
12	Define the term specific latent heat	The specific latent heat (L) of a substance is the energy needed to melt or boil 1 kg of the substance.
13	Explain the difference between specific heat capacity and specific latent heat	Specific heat capacity is the amount of energy needed to heat 1kg by 1°C, Whereas specific latent heat is the amount of energy needed to melt or boil 1kg of a substance.
14	Calculate the change in thermal energy when 0.8kg of a solution with a specific heat capacity of 985J/kg°C is heated from 16°C to 61°C.	$\Delta\theta = 61 - 16 = 45$ Equation: $\Delta Q = m \times c \times \Delta\theta$ Substitute: $\Delta Q = 0.8 \times 985 \times 45$ Calculate: $0.8 \times 985 \times 45 = 35{,}460$ Units: 35,460J
15	What is the change in thermal energy when 0.9kg of a solution with a specific heat capacity of 268J/kg°C is heated from -84°C to -54°C?	$\Delta\theta = -54 - -84 = 30$ Equation: $\Delta Q = m \times c \times \Delta\theta$ Substitute: $\Delta Q = 0.9 \times 268 \times 30$ Calculate: $0.9 \times 268 \times 30 = 7236$ Units: 7236J
16	Calculate the change in thermal energy when 1.4kg of a solution with a specific heat capacity of 4182J/kg°C is heated from -13°C to 92°C.	$\Delta\theta = 92 - -13 = 105$ Equation: $\Delta Q = m \times c \times \Delta\theta$ Substitute: $\Delta Q = 1.4 \times 4182 \times 105$ Calculate: $1.4 \times 4182 \times 105 = 614{,}754$ Units: 614,754J
17	Calculate the amount of thermal energy required to evaporate a 1.4kg solution with a specific latent heat of 930 J/kg°C	Equation: Q = m x L Substitute: Q = 1.4 x 930 Calculate: 1.4 x 930 = 1302 Units: 1302J
18	Calculate the amount of thermal energy required to melt a 0.8kg solution with a specific latent heat of 3578 J/kg°C	Equation: Q = m x L Substitute: Q = 0.8 x 3578 Calculate: 0.8 x 3578 = 2862.4 Units: 2862.4J

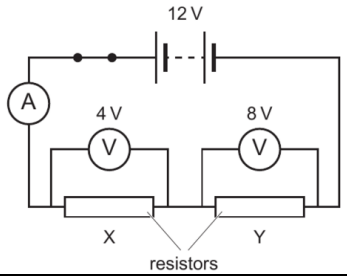
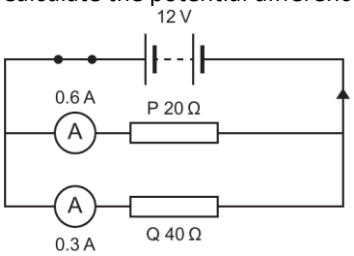
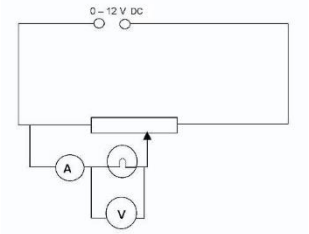
19	Calculate the amount of thermal energy required to evaporate a 1.9kg solution with a specific latent heat of 3194 J/kg°C	Equation: Q = m x L Substitute: Q = 1.9 x 3194 Calculate: 1.9 x 3194 = 6068.6 Units: 6068.6J
20	Explain ways of reducing unwanted energy transfer through thermal insulation	Gas is a poor conductor of heat So using layers to trap gases keeps objects warm Fluffy/hairy materials contain a lot of air so trap heat Bubble wrap and polystyrene have air trapped in it making them good insulators
21	CORE PRACTICAL Describe how to investigate the properties of water by determining the specific heat capacity of water	1. Place a polystyrene cup on a balance and fill with water 2. Measure the mass of the water filled polystyrene cup 3. Carefully remove the cup and add a thermometer 4. Add an immersion heater connected to a joulemeter 5. Record the temperature of the water every 5 minutes, stirring the water between readings
22	Describe what is happening in a temperature-time graph for melting ice  	A. Freezing B. Melting C. Condensing D. Evaporating/boiling
23	Explain the pressure of a gas in terms of the motion of its particles	Gas pressure is caused by the force of the collisions between the particles and the walls of its container.
24	Explain the effect of changing the temperature of a gas on the velocity of its particles	When the temperature is increased, the gas particles move faster and with more energy. The collisions become more frequent and have greater force.
25	Describe the term absolute zero	Absolute zero is the point at which the pressure of a gas drops to zero because the particles are no longer moving.
26	What is the temperature of absolute zero?	−273 °C
27	Convert these temperatures to kelvin a) 25 °C b) 93 °C c) -10 °C	a) 25 + 273 = 298 K b) 93 + 273 = 366 K c) -10 + 273 = 263 K
28	Convert these temperatures to Celsius a) 25K b) -93 K	a) 25 - 273 = - 248°C b) -93 - 273 = -366 °C

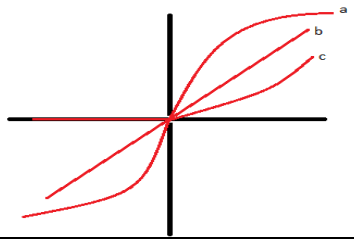
Topic 9- Electricity (Paper 6)

1	Describe the structure of the atom including the position, charge and masses of each sub-atomic particle	<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>
2	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	A)  B)  C)  D)  E) 

	K) Motor L) LED	F)  G)  H)  I)  J)  K)  L) 
3	Describe the differences between series and parallel circuits	• 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
4	If the potential difference across V2 is 2.5V and across V3 is 2.5V, what is the potential difference across V1?  	5V V1 = V2 + V3
5	If A1 read 3A, what would the current at A2 and A3 be?  	3A
6	If A1 = 3 A and A2 = 1A, what is the current measured at A3 and A4?  	A3 = 2A A4 = 3A (because the current after the junction must always equal the current before the junction)
7	If V2 has the potential difference of 5V, what is the potential difference of V1 and V3?  	They are both 5V
8	What happens to the current if you increase the potential difference (voltage) of a power pack/battery	The current increases
9	If you increase the resistance in a circuit, what happens to the current?	It decreases.
10	What is the unit for current, how do you measure it and how do you place it in a circuit?	Measured in Amps (A), using an ammeter which is placed in series in a circuit

11	What is the unit for potential difference, what equipment do you use to measure it and how do you place it in a circuit?	Measured in Volts (V), using a voltmeter which is placed parallel across a component
12	What is meant by potential difference?	Energy transferred per unit charge Therefore, a volt = a joule per coulomb
13	Recall the equation for calculating energy transferred in a circuit	Energy transferred = charge moved x potential difference
14	A charge of 150C flows through a component with a potential difference of 5V, how much energy is transferred?	Equation: E = Q x V Substitute: 150 x 5 Calculate: Energy transferred = 750 Units: energy transferred = 750J
15	A device is transfers 17366.4J of energy as 1447.2C of charge passes through it, what is the device's potential difference?	Equation: V = E / C Substitute: V = 17366.4 / 1447.2 Calculate: 17366.4 / 1447.2 = 12 Units: 12V
16	Calculate how much charge passes a point in a circuit when the potential difference across the point is 3.5V and the energy transferred is 2898J	Equation: C = E / V Substitute: C = 2898 / 3.5 Calculate: 2898 / 3.5 = 828 Units: C = 828C
17	Explain what electric current is	The rate of flow of charge/electrons
18	Recall the equation for calculating charge	Charge = current x time
19	A current of 5A flows for 10 seconds, how much charge has flowed through the circuit?	Equation: C = I x t Substitute: C = 5 x 10 Calculate: 5 x 10 = 50 Units: 50C
20	A wire has a charge of 72C flowing through it for a minute. Calculate the current.	Equation: I = C / t Substitute: I = 72 / 60 Calculate: 72 / 60 = 1.2 Units: 1.2A
21	The current flowing through an aluminium wire is 0.05A, the charge is 4.5C. How long was the current flowing for?	Equation: t = C / I Substitute: t = 4.5 / 0.05 Calculate: 4.5 / 0.05 = 90 Units: 90s
22	A current of 1.6A flows through a component for 90s, the potential difference across the component is 4V. Calculate the amount of energy transferred in the component.	Equation: C = I x t Substitute: C = 1.6 x 90 Calculate: charge = 144 Units: charge = 144C Equation: E = Q x V Substitute: E = 144 x 4 Calculate: energy transferred = 576 Units: 576J
23	What is needed to cause current to flow in a closed circuit?	A potential difference is needed
24	Explain the relationship between potential difference in the power supply and current in a circuit	A large potential difference causes electrons to flow faster in a circuit, and so increases current.
25	What component can be used to change the resistance in a circuit?	Variable resistor
26	Explain how changing resistance affects the current	Increasing resistance decreases current
27	Explain what causes resistance in a circuit	Electrons collide with metal ions
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)
32	Determine the resistance of this circuit if the current is 2.5A and the voltage is 3V	Equation: R = V/ I Substitute: R = 3V / 2.5A

		Calculate: 3 / 2.5 = 1.2 Units: R = 1.2 Ω
33	If the current in a circuit is 1.4A, and the resistance is 3Ω, what is the potential difference in the circuit?	Equation: V = I x R Substitute: V = 1.4A x 3Ω Calculate: 1.4 x 3 = 4.2 Units: V = 4.2V
34	Figure out the current when the resistance is 2.5Ω and the voltage is 13V.	Equation: I = V / R Substitute: I = 13V / 2.5Ω Calculate: 13 / 2.5 = 5.2 Units: I = 5.2A
35	Why is resistance greater when resistors are connected in series?	When <u>resistors are connected in series</u>, the <u>total resistance</u> of the circuit <u>is increased</u> because the <u>pathway becomes harder for current to flow through</u>.
36	Why is resistance less when resistors are connected in parallel?	When <u>resistors are connected in parallel</u> the total <u>resistance</u> of the circuit <u>is less</u> than the resistance of the individual resistors. This is <u>because there are now more paths for the current</u>.
37	If X has a resistance of 12Ω, calculate: A) The current flowing in the circuit B) The resistance of resistor Y  	A) Equation: I = V / R Substitute: I = 4 / 12 Calculate: 4 / 12 = 3 Units: 3A B) Equation: I = V / R Substitute: I = 4 / 12 Calculate: 4 / 12 = 3 Units: 3A
38	Calculate the potential difference across each resistor.  	Resistor P Equation: V = I x R Substitute: V = 0.6 x 20 Calculate: 0.6 / 20 = 12 Units: 12V Resistor Q Equation: V = I x R Substitute: V = 0.3 x 40 Calculate: 0.3 / 40 = 12 Units: 12V
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 <u>potential divider is best</u> to test a component. This is because the <u>current</u> through the component <u>and the potential difference</u> across it <u>can be reduced to zero</u>. This is <u>not possible with a variable resistor</u>.
42	A kettle uses the mains electricity at 230V. The current is 13A. What is the power of the kettle?	Equation: P = I x V Substitute: P = 13A x 230V Calculate: 13 x 230= 2990 Units: P = 2990W
43	What is the current flowing through a 36W device using a 12V power supply?	Equation: I = P / V Substitute: I = 36W / 12V Calculate: 36 / 12 =3A Units: I = 3A

44	What is the voltage of the power supply for a 144W device which has current of 16A flowing through it?	Equation: V = P / I Substitute: V = 144W / 16A Calculate: 144 / 16 = 9 Units: V = 9V
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)
54	What does resistance transfer electrical energy into?	Thermal energy
55	What happens to thermal energy generated from resistors?	It is dissipated to the surroundings
56	Name a device where the heating effect of an electric current is useful.	Toaster, kettle, oven...
57	Name a device where the heating effect of an electric current is not useful.	Light bulb, computer, radio…
58	Describe the advantages of the heating effect of an electric current	When used in a device which uses the heating effect to transfer thermal energy usefully e.g. a kettle transfers thermal energy generated from a resistor to heat water.
59	Describe the disadvantages of the heating effect of an electric current	When a device transfers thermal energy to the surroundings as a waste energy. E.g. a laptop transfers thermal energy to the surroundings instead of light or sound energy which are useful forms of energy transfers.
60	What is the unit for energy transferred?	Joule
61	How is energy calculated using an equation? (hint: combine the power calculations together!)	Energy = Current x Voltage x time E = I x V x t
62	What is the energy transferred when a radio uses a 12V supply for 15 minutes, and has a current of 3A?	Equation: E = I x V x t Convert: 15 minutes into seconds: 15 x 60 = 900s Substitute: E = 3A x 12V x 900s Calculate: 3 x 12 x 900 = 32400 Units: E = 32400J

63	What is the unit for electrical power?	Watt
64	What is power?	The rate of energy transferred from one form to another/others.
65	Describe the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use	The higher the power rating, the quicker the energy transfer taking place.
66	What unit do we measure power in?	Watts (W)
67	How can you calculate power using the energy transferred in an object and the time it is used for?	Power = Energy transferred/time taken P = E / t
68	What is the power of a device if it transfers 18,000J of energy in 10 minutes?	Equation: P = E / t Convert: time needs to be in seconds, 10 minutes x 60 = 600s Substitute: P = 18,000J / 600s Calculate: 18,000 / 600 Units: P = 30W
69	How long is a 50W device used for if it transfers 1.5kJ?	Equation: t = E / P Convert: Energy needs to be in J: 1.5kJ x 1000 = 1500J Substitute: t = 1500J / 50W Calculate: 1500 / 50 = 30 Units: t = 30s
70	How much energy is transferred when a 500W device is used for half an hour?	Equation: E = P x t Convert: Time needs to be in seconds: 0.5 hours x 60 = 30 minutes x 60 = 1800s Substitute: E = 500W x 1800s Calculate: 500 x 1800 = 900,000 Units: E = 900,000J
71	How can you calculate power using current and voltage?	Power = Current x voltage P = I x V
72	A kettle uses the mains electricity at 230V. The current is 13A. What is the power of the kettle?	Equation: P = I x V Substitute: P = 13A x 230V Calculate: 13 x 230 = 2990 Units: 2990 W
73	What is the current flowing through a 920W appliance that has a power supply of 230V?	Equation: I = P / V Substitute: I = 920 / 230 Calculate: 920 / 230 = 4 Units: 4A
74	A 5.2kW device has 40A flowing through it, what is the potential difference of the power supply?	Convert: 5.2kW x 1000 = 5,200W Equation: V = P / I Substitute: V = 5,200 / 40 Calculate: 5,200 / 40 = 130 Units: 130A
75	Recall the electrical power equation which uses current and resistance	Power = current^2 x resistance $P = I^2 \times R$
76	Calculate the power of a component when its resistance is 4Ω and the current flowing through it is 0.8A	Equation: $P = I^2 \times R$ Substitute: P = (0.8x0.8 = 0.64) x 4 Calculate: 0.64 x 4 = 2.56 Units: 2.56W
77	Calculate the current flowing through a 24W component when its resistance is 3Ω.	Equation: $I^2 = P / R$ Substitute: $I^2 = 24 / 3$ Calculate: 24 / 3 = 8 √8 = 2.82 Units: 2.82A
78	Calculate the resistance of a 30W component the current flowing through it is 0.9A	Equation: $R = P / I^2$ Substitute: R = 30 / (0.9 x 0.9 = 0.81) Calculate: 30 / 0.81 = 37.04 Units: 37.04Ω
79	What do the letters d.c. mean?	Direct current
80	What devices supply DC current?	Batteries and cells
81	Describe direct current	Electrons flow in one continuous direction
82	What do the letters a.c. mean?	Alternating current
83	What supplies AC current?	Generators
84	Describe alternating current	Electrons vibrate back and forth thousands of times a second
85	How many volts is the UK mains voltage?	230 V

86	What is the UK mains frequency?	50 Hz
87	Describe the function of the Earth wire	Used for safety Provides a short circuit between the casing of the device and the ground/Earth
88	Describe the function of the neutral wire	Creates a return path for the electricity to the power station
89	Describe the function of the live wire	Connects the appliance to the generators at the power station
90	Describe the function of the fuse	Used for safety Has a maximum volume of current allowed to flow through it Will melt if the current exceeds maximum amount Causing a break in the circuit Electricity/current can no longer flow
91	Explain why fuses should be connected in the live wire of a domestic circuit	So that if the current flowing through the live wire increases to a dangerous level, the fuse would break and prevent electricity flowing through the plug and to the appliance.
92	Explain why switches should be connected in the live wire of a domestic circuit	So that the electrical supply to the appliance can be turned off to stop current flowing to the appliance.
93	Explain the dangers of providing any connection between the live wire and earth	If the live wire makes a connection with the earth wire on the appliance casing It creates a completed circuit Electricity will not flow through the appliance. It results in a very large current Because the metal case has a very small resistance. Very dangerous, electrical shock is likely.
94	State the potential difference for each wire a) Earth wire b) neutral wire c) live wire	a) 0V b) 0V c) 230V
95	Describe how circuit breakers work	Circuit breakers are like a re-usable fuse which you can turn on and off. They will turn off automatically and instantly, if the current flowing through your home is too large
96	Describe the disadvantages of fuses	A fuse needs to be replaced when it breaks. A fuse has to melt and break before current can no longer flow through it- taking a much longer time and so it is still possible to be electrocuted if you are touching the device.
97	Describe the advantages of circuit breakers	A circuit breaker can be turned back on once a fault occurs A circuit breaker stops large volumes of current flowing through it very quickly

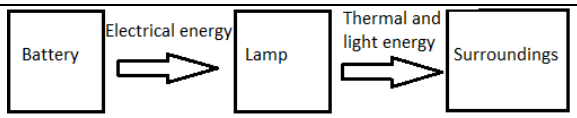
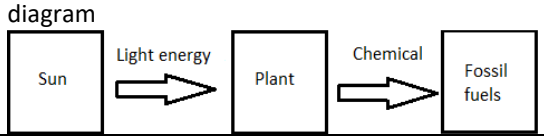
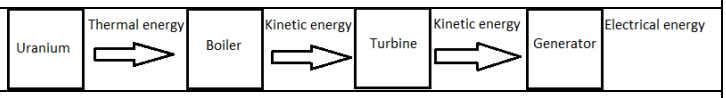
Topic 10- Forces and matter (Paper 6)

1	What is the minimum number of forces that need to be applied to an object to stretch/bend or compress it?	Two
2	What is meant by distortion?	Distortion is a change of shape when there is a force applied.
3	Describe the difference between elastic and inelastic distortion	Elastic object: Returns to its original shape when forces are removed Inelastic object: Does not return to its original shape
4	Recall the equation for calculating linear elastic distortion	Force (N) = spring constant (N/m) x extension (m)
5	Calculate the force applied on a spring when its spring constant is 30N/m and the extension length is 12cm.	Convert: 12cm ÷ 100 = 0.12m Equation: F = k x X Substitute: F = 30 x 0.12 Calculate: 30 x 0.12 = 360 Units: 3.6N
6	What is an elastic bands spring constant when a 0.25kg mass is hanging on it and it has extended by 0.0 5m	Equation: weight(force) = mass x GFS Substitute: force = 0.25 x 10 Calculate = 0.25 x 10 Units = 2.5N Equation: k = F / X Substitute: k = 2.5 / 0.05 Calculate: 2.5 / 0.05 = 50

		Units: 50N/m
7	Calculate how much a pogo stick's spring maximum elastic extension if the maximum mass to use the pogo stick is 45kg and the spring constant of the material used is 1,500N/m.	Equation: weight(force) = mass x GFS Substitute: force = 45 x 10 Calculate = 45 x 10 Units = 450N Equation: X = F / k Substitute: X = 450 / 1,500 Calculate: 450 / 1,500 = 0.30 Units: 0.30m
8	Recall the equation for calculating the work done in a stretching spring	Energy transferred (J)= 0.5 x spring constant (N/m) x extension^2 (m)
9	Calculate the energy transferred when a spring with a spring constant of 50N/m stretches 0.15m	Equation: E = ½ x k x X^2 Substitute: E = 0.5 x 50 x 0.15 Calculate: 0.5 x 50 x 0.15 = 3.75 Units: 3.75J
10	Calculate the work done when an elastic band is stretched by 6cm if its spring constant is 35N/m.	Convert: 6cm ÷ 100 = 0.06m Equation: E = ½ x k x X^2 Substitute: E = 0.5 x 35 x 0.06 Calculate: 0.5 x 35 x 0.06 = 1.05 Units: 1.05J
11	Calculate the work done if a string with a spring constant of 47N/m extends by 22cm.	Convert: 22cm ÷ 100 = 0.22m Equation: E = ½ x k x X^2 Substitute: E = 0.5 x 47 x 0.22 Calculate: 0.5 x 47 x 0.22 = 5.17 Units: 5.17J
12	Describe the relationship between the length of a spring and the force applied to it before it reaches its elastic limit	The force and length have a linear relationship. The graph would be a straight line (directly proportional)
13	Describe the relationship between the extension of a spring and the force applied to it before it reaches its elastic limit	The force and length have a linear relationship. The graph would be a straight line (directly proportional)
14	Explain the relationship between the extension of a spring and the force applied to it before it reaches its elastic limit	As the force doubles, the extension will double as well.
15	Describe the relationship between the extension of a spring and the force applied to it after it reaches its elastic limit	The force and extension would have a non-linear relationship. The graph would be a curved line.
16	CORE PRACTICAL Describe how to investigate the extension and work done when applying forces to a spring	1) Set up the apparatus so a spring is hanging from a clamp stand 2) Measure the length of the spring using a ruler 3) Hang a 1N weight on the spring 4) Measure the length of the spring 5) Calculate the extension length (extended length – original length) 6) Repeat first 5 steps with increasing weights
17	How would you calculate the spring constant from a graph of extension against force?	From the gradient of the graph (extension along the x axis and force on the y axis).
18	Do stiffer springs have a higher or lower spring constant?	Higher because you would need to apply more force to get the same extension.

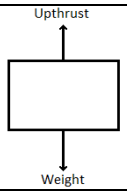
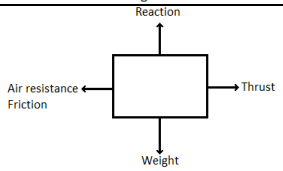
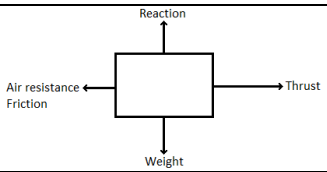
Topic 11- Energy- forces doing work (Paper 6)

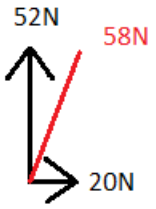
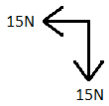
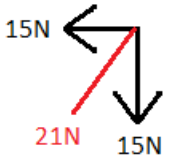
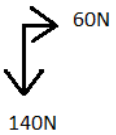
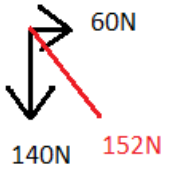
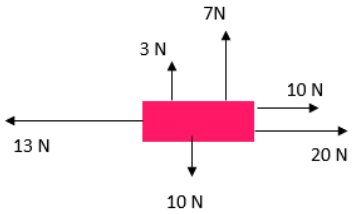
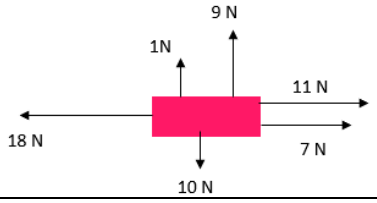
1	Describe the energy changes when a motor lifts a container	The motor uses stored chemical energy (in the fossil fuel burned) and transfers this into thermal, sound and kinetic energy. The kinetic energy is transferred into GPE as the container is lifted.
2	Describe the energy changes when a person uses a bow and arrow	A person uses stored chemical energy and is transferred into kinetic energy as the person bulls the bow back. This is transferred into stored elastic energy. When released the stored elastic energy is transferred into kinetic energy and GPE until the bow falls to the floor where it is transferred into sound and thermal energy.

3	Draw an energy transfer diagram for a torch	
4	Describe what is happening in this energy transfer diagram 	A plant is absorbing light energy from the sun and transferring it into chemical energy through the process of photosynthesis. Over millions of years the plant has been transformed into a fossil fuel which is a stored chemical energy.
5	Draw an energy transfer diagram for a nuclear power station	
6	Identify the different ways that the energy of a system can be changed	1) through work done by forces 2) in electrical equipment 3) in heating
7	Recall the equation for work done	Work done (J) = Force (N) x Distance moved in direction of resultant force (m)
8	What is the unit for work done?	Joules
9	Describe how to measure the work done by a crane moving a container	Measure the distance the object has moved using a ruler Measure the weight of the container using a Newton meter Calculate work done by multiplying the distance and force
10	Calculate how much work is done when a fish that weighs 1.2N is lifted 80cm by a fishing rod.	Convert: 80cm ÷ 100 = 0.8m Equation: WD = F x D Substitute: WD = 1.2 x 0.8 Calculate: 1.2 x 0.8 = 0.96 Units: 0.96J
11	A person transfers a TV up a flight of stairs which is 3.5m long. It uses 2450J of energy, what was the weight of the TV?	Equation: F = WD / D Substitute: F = 2450 / 3.5 Calculate: 2450 / 3.5 = 700 Units: 700N
12	How far can a motor pull an object which weighs 1500N if it can only transfer a maximum of 3,600J	Equation: D = WD / F Substitute: D = 3600 / 1500 Calculate: 3600 / 1500 = 2.4 Units: 2.4m
13	What is the force if the work done is 30J when an object is moved 4m?	Equation: F = WD / D Substitute: F = 30J / 4m Calculate: 30 / 4 = 7.5 Units: F = 7.5N
14	Calculate the distance an object when it is moved with a force of 30N, if the work done is 900J.	Equation: D = WD / F Substitute: D = 900J / 30N Calculate: 900 / 30 = 30 Units: D = 30m
15	Sharon lifts a 5N weight 50cm, calculate the energy transferred and describe the energy changes	Equation: WD = F x D Convert: distance needs to be in metres= 50cm becomes 0.5M Substitute: WD = 5N x 0.5 Calculate: 5 x 0.5 = 2.5 Units: WD = 2.5J Sharon transfers 2.5J of chemical energy into kinetic and then GPE
16	Explain, using examples, how in all system changes energy is dissipated so that it is stored in less useful ways	All energy transfers eventually dissipate heat and sound energy to the surroundings which is wasteful. For example, a torch transferring light and heat energy to the surroundings
17	How are all mechanical processes wasteful?	Mechanical processes become wasteful as they cause a rise in temperature so dissipating thermal energy to the surroundings
18	What is a definition of power?	The amount of energy transferred every second (Joule per second (J/S))
19	Recall the power equation	Power (W) = work done (J) x time (s)
20	What is the unit for power?	Watt (W)
21	What can be measured in joules per second?	Power
22	Calculate the power of an object if the work done is 800J in 400s	Equation: P = WD / t Substitute: P = 800J / 400s Calculate: 800 / 400 = 2 Units: P = 2W

23	When the power of an object is 2W, how much energy is transferred every second?	2J/s
24	What is the work done if a 500W crane moves a box in 1,800s?	Equation: WD = P x t Substitute: WD = 500W x 1,800s Calculate: 500 x 1,800 = 900,000 Units: WD = 900,000s
25	How fast can a 1,600W machine move an object which would require 32,000J?	Equation: t = WD / P Substitute: t = 32,000J / 1,600W Calculate: 32,000 / 1,600 = 20 Units: t = 20s
26	How can you combine work done = force x distance and power = work done / time	Power = (force x distance) / time
27	A motorbike accelerates over 40m, it uses a force of 6000N and takes 5 seconds to travel the 40m. What power did the engine produce?	Equation 1: Work done = F x d Substitute: Work done = 6000N x 40m Calculate: Work done = 240,000 J Equation 2: Power = work done / time taken Substitute: Power = 240,000J / 5 Calculate: Power = 240,000 / 5 = 48,000 Units: Power = 48,000W or 48kW Or Equation: P = (F x D) / t Substitute: P = (6000 x 40) / 5 Calculate: 240,000 / 5 = 48,000 Units: 48,000W

Topic 12- Forces doing work (Paper 6)

1	Describe, with examples, how objects can interact a) at a distance without contact b) by contact	a) gravity, magnetism, static electricity b) contact force, thrust, up thrust, air resistance, friction, water resistance
2	Draw a vector diagram to show how the Earth and moon interact	
3	Draw a vector diagram to show how 2 oppositely charged objects interact	
4	Draw a vector diagram to show how ca book resting on a table interact with the table	
5	H) Draw a free body force diagram for a duck sitting on the surface of the water	
6	H) Draw a free body force diagram for a person walking at constant speed	
7	H) Draw a free body force diagram for a car accelerating	
8	H) Describe how to calculate the resultant force using a vector diagram	1) (If required) Draw arrows to scale to represent the forces acting on an object 2) Draw lines with the existing force arrows to make a parallelogram 3) Draw a line diagonal of the parallelogram, this is the resultant force 4) Measure the length of the resultant force line and use the scale to calculate the size

9	H) Draw a scale drawing of a vector diagram (1cm = 10N) and calculate the resultant force for the free body diagram below:  	
10	H) Draw a scale drawing of a vector diagram (1cm = 10N) and calculate the resultant force for the free body diagram below:  	
11	H) Draw a scale drawing of a vector diagram (1cm = 10N) and calculate the resultant force for the free body diagram below:  	
12	H) Explain what the resultant force is on this object  	1) Add forces acting in the same direction 2) Subtract forces acting in the opposite direction 3) The resultant force of this object is 7N to the right
13	H) Explain what the resultant force is on this object  	1) Add forces acting in the same direction 2) Subtract forces acting in the opposite direction 3) The resultant force of this object is 0N, all forces are balanced