Year 10

Paper 1

Biology

Mastery Matrix:

Topic	Course	Tier	Learning statement
Types of cell	A	F	Describe the structure of plant, animal and bacteria cells, classifying as prokaryotic and eukaryotic cells.
Types of cell	A	F	Identify and explain the functions of sub-cellular structures
Specialised cells	A	F	Describe the difference between '*cell differentiation'* and '*cell division'*
Specialised cells	A	F	Describe how cells are specialised and explain their roles (*animal cells: sperm cells, nerve cells, muscle cells. Plant cells: root hair, xylem and phloem*).
Specialised cells	A	F	Define '*tissue', 'organ' and 'organ system'* and explain how they work together to create a functioning '*organism'*
Microscopy	A	F	Compare and contrast electron and light microscopes
Microscopy	A	F	Define *'magnification'* and '*resolution'*
Microscopy	A	F	Calculate magnification using a formula (magnification = size of image ÷ size of real object)
Microscopy	A	F	Explain how electron microscopy has improved our understanding of subcellular structures
Microscopy	A	F	Define and apply the prefixes '*centi'*, '*milli'*, '*micro'* and *'nano'*
Microscopy	A	F	**RP Microscopy:** Use a light microscope to observe, draw and label a selection of plant and animal cells. A scale magnification must be included.
Cell division (mitosis)	A	F	Define, locate and rank in terms of size, *'Genes', 'Chromosomes', 'DNA' and 'nucleus'*
Cell division (mitosis)	A	F	Explain the process of *'mitosis'* and the '*cell cycle'* (when, where, how and why)
Cell division (mitosis)	A	F	Describe what stem cells are, where they can be found and how the can be used
Cell division (mitosis)	A	F	Explain the process of *'therapeutic cloning'*
Cell division (mitosis)	A	F	Evaluate the risks and benefits, including the social and ethical implications, of using stem cells in treatments
Cell division (mitosis)	A	F	Explain how plants can be cloned from stem cells and the benefits of doing this
Introducing pathogens and types of disease	A	F	Define '*health*'
Introducing pathogens and types of disease	A	F	List factors that affect mental and physical health
Introducing pathogens and types of disease	A	F	Define '*pathogens*' and explain the difference between '*communicable'* and '*non-communicable'* diseases
Introducing pathogens and types of disease	A	F	Explain how '*viruses'*, '*bacteria'*, '*protists'* and '*fungi'* are spread in animals and plants
Introducing pathogens and types of disease	A	F	Describe the how bacteria and virus cause problems within the body
Introducing pathogens and types of disease	A	F	State 4 ways to reduce or prevent the spread of communicable diseases
Detailed disease case studies	A	F	Describe three viral diseases in details – the effects, how they are spread, how people are trying to reduce its impact (Measles, HIV and Tobacco Mosaic Virus)
Detailed disease case studies	A	F	Describe two bacterial diseases in detail – the effects, how they are spread, how people are trying to reduce its impact (Gonorrhoea and Salmonella)

Detailed disease case studies	A	F	Describe one fungal disease in detail – the effects, how it is spread, how people are trying to reduce its impact (Rose Black Spot)
Detailed disease case studies	A	F	Describe one protist disease in detail – the effects, how it is spread, how people are trying to reduce its impact (malaria)
Preventing pathogen	A	F	Describe how the body prevents entry of pathogens into the body
Preventing pathogen	A	F	Describe how the immune system tackles pathogens once they have made it into the body (phagocytosis, antibody production and antitoxin production)
Preventing pathogen	A	F	Explain how vaccines work
Preventing pathogen	A	F	Discuss the global use of vaccination in the prevention of disease
Preventing pathogen	A	F	Explain the use of antibiotics and other medicines
Developing new medicines	A	F	Describe how bacteria have developed resistance to antibiotics – in particular MRSA (and use this as an example of evolution)
Developing new medicines	A	F	Explain the issues with the development of new antibiotics in the race against antibiotic resistance and what we can do as a society to reduce the rate of development of antibiotic resistance bacteria (linking to medicine and agriculture)
Developing new medicines	A	F	Describe how many new drugs are still developed from plants and microorganisms (including digitalis and aspirin)
Developing new medicines	A	F	Explain how preclinical and clinical trials are used to test new drugs (including tests for safety, effectiveness, toxicity and dosage)
Developing new medicines	A	F	Compare and contrast painkillers and antibiotics
Developing new medicines	A	F	Explain the benefits and drawbacks of antibiotics and limitations of antivirals
Using and interpreting data	A	F	Describe situations where types of diseases interact (poor physical health, viruses causing cancer, pathogens -> allergic reactions, immune system defects -> more susceptible to infectious disease)
Using and interpreting data	A	F	Translate numerical information between tables and graphs
Using and interpreting data	A	F	Construct and interpret bar charts and histograms
Breathing and respiration	A	F	Describe the purpose of cellular respiration, recalling the word & symbol equation for aerobic respiration
Breathing and respiration	A	F	Explain how the body responds to exercise in terms of heart rate, breathing rate and breath volume
Breathing and respiration	A	F	Explain when anaerobic respiration occurs in humans and recall the word equation for this process
Breathing and respiration	A	F	Explain what is meant by the term 'oxygen debt'
Breathing and respiration	A	F	Explain anaerobic respiration in yeast, recalling the word equation for this process
Breathing and respiration	A	F	Describe how this process of anaerobic respiration (fermentation) is used by humans in the manufacturing industry
Breathing and respiration	A	F	Label the structure and describe the function of the human lungs (including how they are adapted for gaseous exchange)
Blood and the heart	A	F	Describe the structure and function of the human heart
Blood and the heart	A	F	Describe the roles of the four blood vessels associated with the heart
Blood and the heart	A	F	Describe the 3 different types of blood vessel in the body and their structure
Blood and the heart	A	F	Carry out rate calculations for blood flow
Blood and the heart	A	F	Describe how our body controls our natural resting heart rate
Blood and the heart	A	F	Describe the composition of blood and know the functions of each of the components

Blood and the heart	A	F	Draw blood cells from under a microscope and recognise different types of blood cells from a photo or diagram, explaining how they are adapted to their functions
Blood and the heart	A	F	Describe coronary heart disease
Blood and the heart	A	F	Describe what a 'stent', 'statin', 'mechanical/biological valve replacement', 'pacemaker' and 'transplant' are
Blood and the heart	A	F	Evaluate the advantages and disadvantages of treating cardiovascular diseases using drugs, mechanical devices or transplants
Blood and the heart	A	F	Evaluate risks associated with the use of blood products
Interpreting disease data	A	F	Construct and interpret frequency tables and diagrams
Interpreting disease data	A	F	Apply the techniques of scientific sampling to disease incident information
Interpreting disease data	A	F	Discuss the human and financial cost of non-communicable diseases (individual, local community, national and global level)
Interpreting disease data	A	F	Describe the causal mechanisms of some risk factors for non-communicable diseases (causes of: cardiovascular disease, type 2 diabetes, brain and liver function, lung disease and lung cancer, cancers and foetal damage) including the effects of diet, alcohol and smoking
Interpreting disease data	A	F	Use a scatter diagram to identify a correlation between two variables (linking to disease incidence)
Digestion	A	F	Describe what the digestive system is
Digestion	A	F	Explain the role of enzymes in the digestive system making reference to 'lock and key'
Digestion	A	F	Explain how carbohydrates, proteins and lipids are synthesised, broken down and used, making reference to sugars, amino acids, fatty acids and glycerol
Digestion	A	F	Link carbohydrase (amylase), protease, lipase & bile to the breakdown of particular food groups, identifying where they are produced
Digestion	A	F	**RP Food Tests:** Use qualitative reagents to test for a range of carbohydrates, proteins and lipids
Digestion	A	F	Describe the effects of temperature and pH on the rate of enzyme reactions and investigate the effect of pH on the rate of reaction of amylase
Digestion	A	F	**RP Enzymes:** Investigate the effect of pH on the rate of reaction of amylase enzyme
Digestion	A	F	Define 'metabolism'
Digestion	A	F	Calculate the rate of given chemical reactions
Digestion	A	F	Explain the 5 processes that contribute to our metabolism (starch formation, lipid formation, protein synthesis, respiration and protein breakdown)
Diffusion	A	F	Define 'diffusion' and give examples of diffusion in plants and animals (gas exchange and urea in the kidney)
Diffusion	A	F	Explain how different factors affect the rate of diffusion (concentration, surface area, temperature)
Diffusion	A	F	Calculate surface area: volume ratios
Diffusion	A	F	Explain how surface area: volume ratio of a single celled organism (amoeba) allows sufficient molecule transport
Diffusion	A	F	Explain adaptations for exchange materials in: small intestines, lungs, gills, roots and leaves
Photosynthesis	A	F	Draw and label an unspecialised plant cell and a palisade, root hair, xylem and phloem specialised cell
Photosynthesis	A	F	Describe the 5 tissues and name the key organs in the plant
Photosynthesis	A	F	Label a transverse section of a leaf
Photosynthesis	A	F	Describe the process of osmosis
Photosynthesis	A	F	Calculate the rate of water uptake by a plant
Photosynthesis	A	F	Calculate the percentage change in mass following osmosis
Photosynthesis	A	F	Analyse and draw graphs relating to osmosis
Photosynthesis	A	F	**RP Osmosis:** Analyse the range of concentrations of solutions on the change in mass of plant tissue
Photosynthesis	A	F	Describe the process of active transport and explain why it is necessary
Photosynthesis	A	F	Compare diffusion, osmosis and active transport

Photosynthesis	A	F	Describe the process of active transport and how root hair cells are adapted to this
Photosynthesis	A	F	Describe the process of transpiration and translocation (including the structure and function of stomata).
Photosynthesis	A	F	Explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration
Photosynthesis	A	F	Calculate surface area, volume and mean in transpiration investigation
Photosynthesis	A	F	Analyse data from graphs and tables relating to transpiration experiments
Photosynthesis	A	F	Describe in detail the location, function and adaptations of xylem tissue, phloem tissue, stomata and guard cells
Photosynthesis	A	F	Describe the process of photosynthesis
Photosynthesis	A	F	Recall the word and symbol equation for photosynthesis
Photosynthesis	A	F	Explain the effects of temperature, light intensity, carbon dioxide intensity and the amount of chlorophyll on the rate of photosynthesis
Photosynthesis	A	F	Analyse data and calculate rates of photosynthesis and limiting factors from graphs and tables
Photosynthesis	A	F	Translate information between tabulated and graphical form (from tables to graphs) selecting the appropriate scale for axes
Photosynthesis	A	F	**RP Photosynthesis:** Investigate the effect of light intensity on the rate of photosynthesis on an aquatic plant
Photosynthesis	A	F	Describe how glucose is used after photosynthesis
Photosynthesis	A	F	Explain the use of nitrate ions within plants
Photosynthesis	A	F	Use tests to identify starch, glucose and proteins

Knowledge organiser:

	Paper:	**B1**
	Topic:	**Types of cells (B.1)**
1	What is the main difference between a prokaryotic and eukaryotic cell?	Eukaryotic have their DNA contained within a nucleus
2	Give an example of a eukaryotic cell.	Animal and plant cells
3	Give an example of a prokaryotic cell.	Bacteria
4	Eukaryotic cells have which sub-cellular structures?	Cell membrane, cytoplasm and genetic material in a nucleus.
5	What is the function of cell wall?	Supports/ Strengthens the cell
6	What is the function of mitochondria?	Where respiration takes place
7	What is the function of the nucleus?	Controls the activities of the cell
8	What us the function of cell membrane?	Controls what enters/exits the cell
9	What is the function of the vacuole?	Store sugars and salts
10	What is the function of chloroplasts?	Absorb light for photosynthesis
11	What is the function of cytoplasm?	Where chemical reactions of the cell take place
12	What is the approximate size of a prokaryotic cell	0.1-5.0 µm
13	What is the approximate size of a eukaryote cells	10-100µm
14	Which is bigger? A prokaryotic or eukaryotic cell?	Eukaryotic
15	What is meant by "micro"	1/1,000,000th (1 millionth)
	Topic:	**Specialised cells (B.2)**
1	Define "cell differentiation"	A cell becoming specialised to perform a particular function
2	Define "cell division"	The splitting of a cell into two genetically identical daughter cells
3	Name 3 specialised cells found in the animals and 3 in plants	Animals: Muscle cell, nerve cell, sperm cell Plants: Root hair cell, phloem, xylem
4	State the function of a muscle cell	Produce movement
5	State one adaptation of a muscle cell	Lots of mitochondria for releasing energy
6	State the function of a sperm cell	Fertilise the female egg
7	State three adaptations of a sperm cell	*Tail for movement *Lots of mitochondria to release energy *Enzymes in its head to penetrate egg
8	State the function of a nerve cell	Carry information from one part of the body to another

9	State two adaptations of a nerve cell	*Dendrites to connect to other neurones *Long axon to cover large distances
10	State the function of a root hair cell	Absorb water and minerals from the soil
11	State two adaptations of a root hair cell	*Large surface area *Thin cell wall
12	State the function of a xylem cell	Carry water from roots to leaves
13	State two adaptations of a xylem cell	*Lignin to strengthen cells *End walls broken down to form hollow tubes
14	State the function of a phloem cell	Transport glucose within a plant
15	State two adaptations of a phloem cell	*less sub-cellular structures *end walls have sieve plates to allow glucose through
	Topic:	**Microscopy (B.3)**
1	How do you calculate the magnification?	magnification = size of image/size of object
2	Which microscope has the highest magnification?	electron microscopes
3	Which microscope has the lowest resolution?	Light microscope
4	Which microscope produces 3D images?	Scanning and transmission Electron microscope
5	Which microscope shows colours?	Light microscope
6	Which microscope allows to see inside an object?	Transmission Electron Microscope
7	Which microscope shows black and white images?	Scanning and transmission electron microscope
8	Which sub-cellular structures can you see with a higher resolution?	Mitochondria and ribosomes
9	Define "tissue"	A group of similar specialised cells working together to fulfil a function
10	Define "organ"	A group of different tissues working together to fulfil a function
11	Define "organ system"	A group of different organs working together to fulfil a function
12	Put into order of size (smallest to largest): cell, organism, nucleus, tissue, organ system, organ	nucleus, cell, tissue, organ, organ system, organism
13	What is meant by "centi"?	1/100th (1 hundredth)
14	What is meant by "milli"	1/1000th (1 thousandth)
15	What is meant by "nano"	1/1,000,000,000th (1 billionth)
	Topic:	**Cell division (mitosis) (B.4)**
1	Put in order of size (smallest to largest): genes, chromosomes, DNA, cell, nucleus	DNA, gene, chromosome, nucleus, cell
2	Name the 3 stages of the cell cycle	Interphase, Mitosis, Cytokinesis
3	Describe the three things that happen during interphase	1) The cell grows, 2) chromosomes are copied, 3) more mitochondria and ribosomes are made
4	Describe what happens during mitosis	Chromosomes pulled to opposite ends of the cell
5	Describe what happens during cytokinesis	Cell membrane and cytoplasm split in two
6	State why the cell cycle is important	More cells are made for growth and repair
7	State what is produced in the cell cycle	Two genetically identical daughter cells
8	Mitosis produces which type of cells?	Diploid cells
9	Define "stem cell"	An undifferentiated cell
10	Name 3 places where stem cells can be found in humans	Embryos, adult bone marrow, meristem
11	State two conditions that stem cells can be used to treat in humans	Paralysis and type 1 diabetes
12	State two uses of stem cells in plants	1) Clone rare species 2) produce disease resistant crops
13	Describe what is meant by "therapeutic cloning)	Using clones of a patient's own stem cells to treat them
14	Which cells are required for therapeutic cloning?	Egg cell and a normal body cell from patient
15	State two objections to using stem cells in treatment	Potential transfer of viral infections and ethical/religious objections
	Topic:	**Introducing pathogens and types of disease (B.7)**
1	Define "health"	State of physical and mental well being
2	What is the name for a disease that can be passed on from person to person?	Communicable (or infectious)
3	What is the name for a disease that can NOT be passed on from person to person?	Non-communicable

4	State three factors other than disease that can have an impact on health	Diet, stress, life events
5	State one consequence of long term physical ill health	Depression
6	What is the name given to a disease causing microorganism?	Pathogen
7	Define "risk factors"	Factors that are linked to an increased rate of disease
8	State three risk factors for cardiovascular disease	Diet, smoking and exercise
9	State one risk factor for type 2 diabetes	Obesity
10	Name 2 organs effected by drinking alcohol	Brain and Liver
11	Name 2 potential impacts of smoking	Lung disease and lung cancer
12	State a risk factor for cancer	Contact with carcinogens (including ionising radiation)
13	State two lifestyle factors that can impact an unborn baby's development	Smoking and drinking alcohol
14	Why is a sample of people used when investigating risk factors for diseases?	Too time consuming/impractical to sample whole population
	Topic:	**Detailed disease case studies (B.8)**
1	Name 4 types of pathogen	Virus, bacteria, fungi, protist
2	Name 3 viral diseases	Measles, HIV, TMV (tobacco mosaic virus)
3	Name 2 bacterial diseases	Salmonella & Gonorrhoea
4	Name 1 fungal disease	Rose black spot
5	Name 1 protist disease	Malaria
6	State 2 symptoms of measles	Fever. Red skin rash
7	State 2 symptoms of HIV	Flu-like symptoms. AIDS
8	State 1 symptom of TMV	Discolouration of leaves
9	State 2 symptoms of salmonella	Fever. Cramps. Vomitting . Diarrhoea
10	State 2 symptoms of gonorrhoea	Thick yellow/green discharge. Pain urinating
11	State 2 symptoms of rose black spot	Purple/black spots on leaves. Leaves turn yellow & drop off
12	How is measles spread & prevented?	Spread: Air Prevented: Vaccination
13	How is Gonorrhoea spread & prevented?	Spread: Sex Prevented: Condoms
14	How is Rose Black Spot spread & prevented?	Spread: Direct contact Prevented: Fungicide & destroying affected leaves
15	How is Salmonella spread & prevented?	Spread: Food Prevented: Cooking thoroughly & washing hands
	Topic:	**Preventing pathogens from making us unwell (B.9)**
1	State 3 ways that pathogens can be spread	Direct contact, water, air
2	How do bacteria make us feel unwell?	Produce toxins (poisons) that damage tissues
3	How do viruses make us feel unwell?	Live & reproduce in cells causing cell damage
4	Name 4 of the body's non-specific defence systems	Skin, nose, trachea, stomach
5	How does the skin prevent pathogens from making us unwell?	Prevent them from entering body
6	How does the nose prevent pathogens from making us unwell?	Mucus to trap dirt & pathogens, ciliated cells to sweep it out
7	How does the trachea prevent pathogens from making us unwell?	Mucus to trap dirt & pathogens, ciliated cells to sweep it out
8	How does the stomach prevent pathogens from making us unwell?	Stomach acid to kill pathogens
9	State three ways that white blood cells can help to defend us against pathogens	Phagocytosis, antibody production, antitoxin production
10	Which type of white blood cell carries out phagocytosis?	Phagocytes
11	Which type of white blood cell carries out antibody and antitoxin production?	Lymphocytes
12	State one thing that can trigger cancers to form	Viruses in cells
13	What causes tumours to form?	Changes in cells that lead to uncontrolled growth and division
14	Define "benign tumour"	Growth of abnormal cells contained in ONE area in a membrane
15	Define "malignant tumour"	Growth of abnormal cells that SPREAD to other parts of the body in blood and INVADE other tissues.
	Topic:	**Developing new medicines (B.10)**
1	State three ways that drugs can be produced	Extracted from plants, microorganisms & synthesised

2	Where does the heart drug digitalis originate from?	Foxgloves (plant)
3	Where does the pain killer aspirin originate from?	Willow trees
4	Where does the antibiotic penicillin originate from?	Penicillium mould
5	State three things that drugs are tested and trialled for before use	1) Toxicity (safe), 2) efficacy (does it work), 3) dose (quantity)
6	What is used to test drugs during preclinical testing?	Cells, tissues & live animals
7	Who are medicines tested on in stage 1 of clinical trials?	Healthy volunteers (low doses - test for toxicity)
8	Who are medicines tested on in stage 2 of clinical trials?	Patient volunteers (low doses - test for efficacy & dose)
9	What is a double blind trial?	Neither experimenter or patient knows if they are taking medicine or placebo
10	What is a placebo?	A substance that contains no medicine (a control)
11	What is the name for the injection given to patients to prevent them from catching an infectious disease?	Vaccination
12	Describe step 1 of vaccinations	1) small quantity of dead/inactive pathogen
13	Describe step 2 of vaccinations	2) white blood cells produce correct antibody (slowly)
14	Describe step 3 of vaccinations	3) pathogen enters body & WBC produce correct antibodies (quickly)
15	State two benefits of vaccination	Prevent illness in an individual & prevent spread to others
	Topic:	**Breathing and respiration (B.14)**
1	What is the name of respiration with oxygen?	Aerobic
2	What is the name of respiration that occurs without oxygen?	Anaerobic
3	What is the word equation for aerobic respiration	Oxygen + glucose -> carbon dioxide + water
4	What is the balanced symbol equation for aerobic respiration	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
5	What is the word equation for anaerobic respiration in animals	Glucose -> Lactic acid
6	What is the balanced symbol equation for anaerobic respiration in animals	$C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$
7	What is the word equation for anaerobic respiration in yeast and plant cells	Glucose -> Ethanol + carbon dioxide
8	What is anaerobic respiration in yeast cells called?	Fermentation
9	What happens to your breathing and heart rate when you exercise?	Increase
10	What is the name of the main organ in the respiratory system?	Lungs
11	What is the name of the sheet of muscle beneath the lungs?	Diaphragm
12	What is the scientific name for the windpipe?	Trachea
13	What is the scientific name for the air sac?	Alveoli
14	The windpipe divides into two tubes when it reaches the lungs. What are these tubes called?	Bronchi/bronchus
15	State three uses of energy in organisms	1) Chemical reactions to build larger molecules, 2) movement, 3) keeping warm
	Topic:	**The Heart (B.15)**
1	Which type of vessel leaves the heart?	Arteries
2	Which type of vessel enters the heart?	Veins
3	What is the name of the 4 chambers of the heart?	Top: Left/right Atrium Bottom: Left/right ventricle
4	Where is the body's natural pacemaker (cells that control the bodies resting heart rate)?	Right atrium
5	What is the name of the blood vessel that enters the heart from the body?	Vena Cava
6	What is the name of the blood vessel that enters the heart from the lungs?	Pulmonary vein
7	What is the name of the blood vessel that goes to the lungs from the heart?	Pulmonary artery

8	What is the name of the blood vessel that goes from the heart to the rest of your body?	Aorta
9	Which side of the heart is thicker?	Left
10	Which side of the heart pumps oxygenated blood out of it and which side pumps deoxygenated?	Oxygenated = Left Deoxygenated = Right
11	What is the name for removing a heart from one person and placing it into another person?	Transplant
12	What is the name of the drug that reduces that amount of cholesterol in a person's body?	Statins
13	Which organ does a statin effect?	Liver
14	State 3 adaptations of a red blood cell	*no nucleus, *biconcave shape, *small
15	State 2 adaptations of a white blood cell	Cytoplasm contains enzymes, flexible cell membrane
	Topic:	**The Blood (B.16)**
1	Which type of blood vessel has thin walls but a large lumen?	Vein
2	Which type of blood vessel has thick walls but a small lumen?	Artery
3	Which type of blood vessel has valves?	Veins
4	Which type of blood vessel has a pulse?	Artery
5	Give one non-surgical intervention that can reduce the changes of heart disease/a heart attack	Exercise/diet
6	What is the name of the specialised cell that is designed to carry oxygen?	Red Blood Cell
7	What is the name of the specialised cell that is designed to fight pathogens?	White Blood Cell
8	What is the name of the specialised cell that helps to clot our blood?	Platelets
9	What is the name of the liquid part of blood that carries dissolved substances?	Plasma
10	Give one substance that is carried in the plasma of blood	Carbon dioxide/urea/glucose
11	What is the name of the substance that can block arteries?	Cholesterol
12	What is the name of a disease that occurs when the blood vessels in the muscle of the heart get blocked?	Coronary Heart Disease
13	What are the blood vessels that provide the heart with oxygen called?	Coronary arteries
14	What is the name of the piece of wire mesh put inside a blood vessel to keep it open?	Stent
15	State the equation to calculate blood flow rate calculations	Cardiac output = heart rate x stroke volume (cm^3/min) (beats/min) (cm^3)
	Topic:	**Digestion (B.17)**
1	Which enzyme breaks down lipids, carbohydrates and proteins?	Lipids = lipase carbohydrates = amylase Proteins = protease
2	Which enzyme is produced by the salivary glands?	Amylase
3	What is the name of the leaf shaped organ that produces enzymes?	Pancreas
4	What is the name of the organ that produces bile?	Liver
5	What is the name of the organ that stores bile?	Gall bladder
6	Is bile acidic or alkaline?	Alkaline
7	What is added to the stomach to kills pathogens?	Hydrochloric acid
8	What is the name of the process that breaks down large globules of fat into smaller ones?	Emulsification
9	Write the word equation for the digestion of carbohydrates	Starch -> glucose
10	Write the word equation for the digestion of proteins	Proteins -> amino acids

11	Write the word equation for the digestion of fats	lipids -> fatty acids + glycerol
12	Which part of the digestive system are nutrients and water absorbed into the blood from?	Nutrients = small intestine Water = large intestine
13	What is the scientific name for the food pipe?	Oesophagus
14	What is the name of the process where food is pushed down the food pipe?	Peristalsis
15	Name the food group that cannot be digested in the body	Fibre
	Topic:	**Transport in cells (diffusion, active transport and osmosis) (B.19)**
1	Substances moving from a high concentration to a low concentration is called…	Diffusion
2	Two examples of diffusion in humans are:	CO_2 + O_2 in gas exchange, urea from cells to blood
3	Three factors that affect the rate of diffusion are:	Concentration gradient, temperature, surface area of the membrane
4	How are single celled organisms adapted for diffusion?	Large surface area: volume ratio
5	How is the small intestine adapted for exchanging materials?	*Villi for large S.A. *villi one cell thick *good blood supply
6	How is the lungs adapted for exchanging materials?	*Alveoli large surface area: volume ratio, surface is moist, good blood supply
7	How is the gills adapted for exchanging materials?	*large S.A. *moist *good blood flow to maintain concentration gradient
8	How is the roots adapted for exchanging materials?	*Large SA to volume ratio *lots of mitochondria for respiration -> energy for active transport
9	How is the leaves adapted for exchanging materials?	*Stomata *thin so that distance for diffusion is smaller
10	Four ways that to increase the rate of transport	*Large surface area, thin membrane, efficient blood supply (in animals), well ventilated (in animals)
11	Water moves from a dilute to concentrated solution across a partially permeable membrane via...	Diffusion
12	Pure water will move into a potato because	Of osmosis
13	(RP) How can you tell the concentration of sugar in a piece of potato?	1) Place into different concentrations of sugar solution. 2) Plot graph 3) Find concentration where mass doesn't change
14	When a substance moves against the concentration gradient, it is called.	Active transport
15	Active transport requires _____ from _____.	energy respiration
	Topic:	**Structure of a plant (B.21)**
1	What is the name of the plant tissue where new cells are made?	Meristem
2	What is the name of the specialised plant cell adapted to absorb water & nutrients from the soil?	Root Hair Cell
3	What is the name of the specialised plant cell adapted to open and close the stomata of a plant?	Guard Cell
4	Which word describes a guard cell (a) filled with water? (b) that has very little water	(a) filled = Turgid (b) lacking water = flaccid
5	What is the name of the specialised cell that is adapted to absorb lots of light energy in the leaf?	Palisade cell
6	What is the chemical in chloroplasts that allow plant cells to absorb lots of light energy?	Chlorophyll
7	Which type of plant tissue is made up of sieve cells and companion cells?	Phloem
8	What is the name for the hole in a leaf that allows gases in and water out?	Stoma/Stomata
9	What is the name of the plant tissue that is made up of a hollow tube of dead cells?	Xylem
10	Which tissue in a plant transports water?	Xylem
11	Which tissue in a plant transports glucose?	Phloem
12	In which plant organ is glucose made?	Leaf

13	What is the name for the process that converts water and carbon dioxide into glucose and oxygen?	Photosynthesis
14	Which organ of a plant is designed to absorb water?	Root
15	Which organ of a plant is designed to transport substances from the roots to the leaves and vice versa?	Stem
	Topic:	**Transport in plants (B.23)**
1	Define the term "osmosis"	Movement of water from a dilute solution to a concentrated solution through a semi permeable membrane
2	How do you calculate rate of water uptake by a plant?	volume of water absorbed ÷ time taken
3	How do you calculate percentage change in mass following osmosis?	Change in mass/initial mass x 100
4	When looking at an osmosis graph (change in mass of unknown substance vs concentration of known sucrose solution) - how can you identify the concentration of the unknown substance?	When the line of best fix crosses the X axis
5	Which piece of equipment is used to cut a cylindrical piece of potato?	A cork borer
6	What is the name given to a semi permeable piece of tubing?	Visking tube
7	Which substance moves into a plant by osmosis?	Water
8	How are root hair cells adapted for osmosis?	Large surface area and large vacuole
9	Define 'active transport'	Movement of substances from a dilute to a concentrated solution against the concentration gradient. Requires energy
10	Name a substance that is moved into plants by active transport	Mineral ions
11	How are root hair cells adapted for active transport?	Lots of mitochondria for respiration
12	Define "diffusion"	Movement of particles from an area of high concentration to an area of low concentration
13	Name one substance that moves into a leaf by diffusion	Carbon dioxide
14	Name two substance that moves out of a leaf by diffusion	Oxygen and water
15	Which cells open and close to control the diffusion of substances from a leaf?	Guard cells
	Topic:	**Transpiration and translocation (B.24)**
1	Name the process by which glucose is moved from a leaf to other parts of the cell	Translocation
2	What is the scientific name given to the evaporation of water from a leaf?	Transpiration
3	On which side of the leaf are there more stomata?	Underside/lower
4	What is covering the top layer of the leaf to reduce the loss of water?	Waxy Cuticle
5	Which organ in a plant does water enter through?	Root
6	Do guard cells become flaccid or turgid when it is very sunny?	Turgid
7	Do stomata open or close when it is night time?	Close
8	Describe the structure of xylem	Hollow tubes strengthened with lignin
9	Describe the structure of phloem	Elongated cells with a sieve plate and companion cell
10	How do you calculate surface area of a cuboid?	Sum of all the 2D faces
11	State four factors that increases the rate of transpiration	1) High wind intensity 2) high light intensity 3) arid (dry) 4) high temperature
12	Why does high wind intensity increase transpiration?	Increases concentration gradient
13	Why does high light intensity increase transpiration?	Causes stomata to open
14	Why does arid conditions increase the rate of transpiration?	Increases concentration gradient

15	Why does high temperature increase the rate of transpiration?	Water particles have more kinetic energy
	Topic:	**Photosynthesis (B.25)**
1	Name the two reactants in photosynthesis	Carbon Dioxide and water
2	Name the two products formed in photosynthesis	Oxygen and glucose
3	Write the word equation for photosynthesis	Carbon dioxide + water -> oxygen and glucose
4	Write the symbol equation for photosynthesis	$CO_2 + H_2O \rightarrow O_2 + C_6H_{12}O_6$
5	Describe what happens to the rate of photosynthesis as temperature increases	Rate increases and then decreases
6	Describe what happens to the rate of photosynthesis as light intensity increases	Rate increases and then remains constant
7	Describe what happens to the rate of photosynthesis as carbon dioxide increases	Rate increases and then remains constant
8	State one limiting factor for photosynthesis	Light, Chlorophyll, carbon dioxide
9	Name the plant used to investigate the effect of different factors on rate of photosynthesis	Elodea (pondweed)
10	How can you calculate the rate of photosynthesis of an aquatic plant?	Count the number of O_2 bubbles produced in a minute
11	How can you more accurately calculate the rate of photosynthesis of an aquatic plant?	Record volume of gas produced (using a gas syringe)
12	Which cells are adapted for increased photosynthesis?	Palisade cells
13	How are palisade cells adapted for increased rates of photosynthesis?	Lots of chloroplasts (and chlorophyll)
14	State three limiting factors for photosynthesis	1) Carbon dioxide concentration, 2) Temperature, 3) Light intensity
15	In a variegated leaf, why do some parts appear white?	There is no chlorophyll
	Topic:	**The products of photosynthesis (B.26)**
1	State 5 uses of glucose produced during photosynthesis	1) respiration, 2) stored as insoluble starch, 3) stored as fats/oils 4) making cellulose, 5) making amino acids
2	State two substances required for making proteins in plants	Nitrate ions and glucose
3	Which substance is used to test for the presence of starch?	Iodine solution
4	What colour will iodine solution turn in the presence of starch?	Blue/black
5	What colour will iodine solution turn if no starch is present?	Remains orange
6	Which substance is used to test for the presence of sugar?	Benedict's solution
7	What colour will benedict's solution turn in the presence of sugar?	Red (lots of sugar), orange (some sugar), green (small amount of sugar)
8	What colour will benedict's solution turn if no glucose is present?	Remains blue
9	Which substance is used to test for the presence of protein?	Biuret's solution
10	What colour will biuret solution turn in the presence of protein?	Purple
11	What colour will biuret solution turn if no protein is present?	Remains blue
12	Which substance is used to test for the presence of lipids (fats)?	Ethanol
13	What colour will ethanol solution turn in the presence of fats?	Creamy white
14	What colour will ethanol solution turn if no fat is present?	Remains colourless
15	Describe the relationship between a light's distance from a plant and rate of photosynthesis (HT only)	power ÷ distance squared (inverse square law)

	Topic:	**Exercise and metabolism (B.40)**
1	What is the effect of exercise on heart rate during exercise?	Increase
2	What is the effect of exercise on breathing rate and breathing volume during exercise?	Increases
3	Why does heart rate, breathing rate and breathing volume increase during exercise	Supply muscles with more oxygenated blood
4	Which type of respiration occurs if there is insufficient oxygen available?	Anaerobic respiration
5	State two effects of long periods of anaerobic respiration	Build-up of lactic acid and oxygen debt
6	Where is lactic acid broken down? (HT only)	The liver
7	How is lactic acid broken down?	Reacts with oxygen to convert to glucose
8	Define "oxygen debt"	Amount of O2 required to break down lactic acid
9	How would the lung capacity of an athlete compare to a non-athlete	Larger
10	How would the resting heart rate of an athlete compare to a non-athlete?	Lower
11	Define "metabolism"	Sum of all reactions in a cell/body
12	During metabolism, glucose is converted into which three substances?	1) Starch, 2) glycogen, 3) cellulose
13	During metabolism, lipids are formed from which molecules?	1 molecule glycerol, 3 molecules fatty acids
14	During metabolism, which substances are used for form amino acids?	Glucose and nitrate ions
15	State two ongoing processes that are part of metabolism	Respiration and deamination
	Topic:	**RP: Microscopy (B1) (B.41)**
1	What is the aim of the investigation?	To investigate and view the sub-cellular structures of plant and animal cells using a microscope.
2	What type of microscope is used to view the cells?	Light microscope
3	What type of tissue is used?	A thin layer of onion skin
4	How is the slide prepared?	1) Drop of water added to glass slide 2) Thin layer of onion skin placed onto glass slide 3) Drop of iodine added onto the onion skin 4) Cover slip placed on top
5	What do we need to ensure is not present on the slide?	Air bubbles
6	Why is iodine used to prepare the slides?	To dye the sub-cellular structures and make them easier to see
7	Which magnification is used to first view the cells?	x10
8	How do you first find the cells under the microscope?	By turning the coarse-focusing wheel
9	How do you see the cell sin more detail?	By turning the fine-focusing wheel
10	Which sub-cellular structures should you be able to identify?	nucleus, cell wall, vacuole, cell membrane and cytoplasm
11	Which structures cannot be seen with a light microscope?	ribosomes, mitochondria
12	What type of microscope would you need to use to improve the resolution of the image?	electron microscope
13	What is the formula to calculate the magnification?	magnification = size of image / size of real object
14	How do you rearrange the formula to find the size of the real object?	size of real object = size of image / magnification
15	How do you convert from mm to µm?	x by 1000
	Topic:	**RP: Osmosis (B3) (B.43)**
1	What is the independent variable?	The concentration of the solution
2	What is the dependent variable?	The percentage change in mass

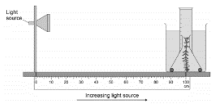
3	Name 5 control variables	1)Length of potato 2) Diameter of potato 3) Volume of solution 4) Time potato is left for 5) Temperature of solution
4	Give 3 ways to make the results accurate	1) Read the volume of the solution from the meniscus 2) Dab the potatoes dry before measuring the mass 3) Use a digital top pan balance
5	Name one risk and precaution	Risk = cutting yourself with the potato borer Precaution = push the borer down towards the desk not upwards
6	What is the purpose of the distilled water?	To act as a control to compare your results to
7	How is the concentration inside the tissue estimated?	Plot a graph of concentration against % change in mass and find where the line of best fit crosses 0%
8	How is the percentage change in mass calculated?	% change in mass = change in mass / initial mass
9	What is percentage change calculated rather than just the change?	The potato may be slightly different sizes and shapes to begin with
10	Why does the tissue increase in mass?	Water has entered the tissue by osmosis in more dilute solutions
11	How can you tell if there has been an increase in mass?	The % change in mass is +ve
12	Why does the tissue decrease in mass?	Water has left the tissue by osmosis in more concentrated solutions
13	How can you tell if there has been a decrease in mass?	The % change in mass is -ve
14	What does no change in mass mean?	The concentration of the solution is the same as the concentration inside the tissue
15	What are possible variations on this method?	1) Using any other vegetable/plant tissue 2) Using any other food substance 3) Using a salt solution
	Topic:	**RP: Food tests (B4) (B.44)**
1	How are the food samples prepared?	Mash up using a pestle and mortar, add distilled water, filter to make a solution.
2	What reagent is used to test for starch?	Iodine
3	What is the negative result for starch (no starch)?	orange/brown
4	What is the positive result for starch (starch is present)?	blue/black
5	What is the reagent used to test for sugars?	Benedict's
6	What conditions are needed for Benedict's?	Water bath at 80°C for 5 min
7	What is the negative result for sugars (no sugars present)?	blue
8	What is the positive result for sugars (sugars are present)?	green --> orange –-> red
9	What reagent is used to test for lipids?	Ethanol followed by distilled water
10	What must be done to the solution when ethanol is added?	Shaken
11	What is a negative result for lipids (no lipids present)?	No white emulsion forms
12	What is a positive result for lipids (lipids present)?	A white emulsion forms
13	What reagent is used to test for proteins?	Biuret solution (copper sulphate + sodium hydroxide)
14	What is a negative result for proteins (no proteins present)?	blue
15	What is a positive result for proteins (proteins present)?	purple
	Topic:	**RP: Enzymes (B5) (B.45)**
1	What is the independent variable?	pH of buffer solution
2	What is the dependent variable?	time taken for starch to break down into simple sugars (iodine solution to turn from black to brown)

3	Name 5 control variables	1) Volume of starch solution2) Temperature of solution3) How the mixture is stirred4) Volume of amylase solution5) Time intervals
4	What piece of equipment is used to place the test solution in?	Spotting tile
5	How is the temperature controlled?	Using a water bath
6	Name one risk and precaution	Iodine is an irritant so avoid contact with skin
7	How do you know when all of the starch is broken down?	Samples of solution in the spotting tiles turn back to orange/brown
8	How can accuracy of the measurements be improved?	1) Remove the first drop of solution as soon as the amylase is added 2) Use a pipette to measure each drop accurately 3) Start the timer immediately
9	Why must the solution be constantly mixed?	To ensure that all of the amylase and starch bind to each other
10	Name one random error	Different sizes of drops of solution added to the spotting tile
11	What has happened to amylase below pH6 and above pH 7?	Amylase has denatured
12	How can the rate of reaction be calculated?	rate = 1 / time
13	How will the results be displayed?	Plotting a graph of pH against rate
14	What results should you see?	A curve with the rate reaching an optimum at approximately pH7
15	What are possible variations on this method?	1) Investigating the effect of pH on any other enzyme 2) Investigating the effect of temperature on any enzyme
	Topic:	**RP: Photosynthesis (B6) (B.46)**
1	What is the independent variable?	Distance from the light source (light intensity)
2	What is the dependent variable?	Number of bubbles per minute
3	Name 3 control variables	1) Temperature of the water 2) Carbon dioxide concentration 3) Colour of the light
4	How is the rate of photosynthesis measured?	rate = total O_2 produced / time
5	How is the volume of oxygen measured?	Counting the number of bubbles per minute
6	How is the light intensity changed?	Changing the distance of the beaker from the light
7	Name one random error	Counting the bubbles incorrectly
8	Give one way to make the results more accurate	Increase the amount of time you count the bubbles for
9	How is the concentration of carbon dioxide controlled?	Adding sodium hydrogen carbonate to the solution
10	Give an alternative way to measure the volume of gas produced?	Volume of water displaced from a measuring cylinder
11	Name one risk and precaution	The lamp may be hot so do not touch it
12	How is the temperature controlled?	Water bath
13	How is the pondweed controlled?	Same species, same age and same length
14	What results should you see?	As the light intensity increases, the rate photosynthesis increases
15	What are possible variations on this method?	1) Investigate the effect of different coloured lights 2) Investigate the effect of temperature 3) Investigate the effect of CO_2 concentration

Required practicals

Name	Variables	Equipment	Method	Expected conclusion	Possible variations
B1 - Microscopy	Big Question: Investigate the structure of plant and animal cells using a microscope.	*A microscope *Slides of animal cells *Slides of plant cells	1) Put the slide on the stage 2) Turn the nose piece to the lowest power objective lens 3) Move the stage until it is almost touching the objective lens 4) Look through the eyepiece and turn the coarse adjustment knob so that the stage moves down. Do this until the cells come into focus. 5) Use the fine adjustment knob to bring the cells into clear focus. 6) Switch the nose piece to a higher power lens. 7) Use the fine adjustment knob to bring the cells back into focus. 8) Draw and label some of the cells. 9) Write your magnification underneath the drawing 10) Multiply the objective magnification by the eyepiece magnification.	You should be able to identify the nucleus, cell wall, vacuole, cell membrane, chloroplasts and the cytoplasm.	Given an image and asked to work out magnification or real size

B3 – Osmosis	**Big Question:** Investigate the effect of a range of concentrations of salt or sugar on the mass of plant tissue **IV** – Concentration of sugar solution **DV** – Percentage change in mass of potato **CV** – Length of potato, diameter of potato, volume of sucrose solution, duration potato is left for	*A potato *A cork borer *A ruler *A 10cm3 measuring cylinder *Labels *5 boiling tubes *A test tube rack *Paper towels *A scalpel *A white tile *A range of sugar solutions (of different concentrations) *Distilled water *A top pan balance (accurate to 0.01g).	1) Use the cork borer to cut five potato cylinders of the same diameter 2) Use the scalpel to trim the potato cylinders to the 3cm long. 3) Measure the mass of each potato cylinder using a top pan balance and record in a results table. 4) Record the mass of each cylinder 5) Measure 10cm3 of each concentration of sugar solution into 4 of the boiling tube. 6) Measure 10cm3 of distilled water and add into the fifth boiling tube 7) Add one potato cylinder into each boiling tube 8) Leave the potato cylinders in the solution for 48 hours. 9) Remove the potato cylinders using the forceps and blot them dry with paper towel. 10) Measure the new mass of each potato cylinder and record in the results table. 11) Calculate the percentage change in mass of each potato cylinder and plot a graph against concentration.	When the potato cylinder doesn't change mass, the concentration of sugar in the solution is the same as the concentration of sugar in the potato	Investigate the effect of a range of salt concentrations on a potato cylinder Investigate the effect of a range of concentrations on sugar on the size of a visking tube/raisin
B4 – Food tests	**Big Question**: Use qualitative reagents to test for carbohydrates (starch and sugars), lipids, proteins	**For all:** *Food sample *Test tube *Pipettes **Benedict's test for sugars** *Benedict's solution *Water bath *Thermometer **Iodine test for starch** *Iodine solution **Lipids – ethanol** *Ethanol *Distilled water **Biuret test for protein:** *Biuret solution A (Copper sulphate) *Biuret solution B (sodium hydroxide)	**Benedict's test for sugar** 1) Set up a waterbath. 2) Put some of the food sample into a test tube. 3) Add a few drops of Benedict's solution to the sample 4) Put the test tube in the waterbath at 80°C for 5 minutes. 5) Note down any colour changes in your results table. **Iodine test for starch** 1) Put the food sample in the test tube 2) Add a few drops of iodine solution 3) Record colour changes **Ethanol test for lipids:** 1) Put a food sample into the test tube 2) Add a few drops of distilled water 3) Shake gently 4) Record any observations **Biuret test for protein** 1) Put a food sample into the test tube. 2) Add 1cm3 of bieuret solution A (copper sulphate). Add 1 cm3 of Biuret solution B (sodium hyudroxide). 3) Shake to mix 4) Record colour changes.	**Benedict's test:** No sugar: Blue Sugar: green/orange/red (most sugar!) **Iodine test:** No starch: orange/brown Starch: blue/black **Ethanol test:** If lipids present, a white milky layer of oil should form on top of the mixture **Biuret test:** No protein: Blue Protein: Purple	May also reference Sudan (III) for fats – forms a red layer on top of the mixture

B5 – Enzymes	**Big Question:** Investigate the effect of pH on the rate of reaction of amylase **IV** – pH of buffer solution **DV** – time taken for starch to break down into simple sugars (iodine solution to turn from black to brown) **CV** – Volume of starch solution, temperature of solution, whether the mixture is stirred	**Big question:** *10 test tubes *Test tube rack *Water bath *Thermometer *Spotting tile *5cm^3 measuring cylinder *Pipettes *Glass rod *Stop clock *Starch solution *Amylase solution *Iodine solution *Buffer solutions (range of pH values)	1) Heat the water bath to 35°C. 2) Add 2cm3 of each buffer solution into individual test tubes. Label each. 3) Add 20cm3 of starch solution into test tube labelled "starch". 4) Put a thermometer in the starch to monitor the temperature. 5) Add 10cm3 of Amylase solution to another test tube. Label "amylase". 6) Put all test tubes into the water bath. 7) Allow the solutions to reach 35°C. 8) Add one drop of iodine into each depression on the spotting tile. 9) When all solutions reach 35°C, take one test tube of buffer solution, add the 2cm3 of starch and 2cm3 of amylase solution. Stir mixture with a glass rod. 10) Start a stop clock. 11) After 10 seconds use a pipette to add 2cm3 of the solution to one depression on the tile. 12) Continue to do every 10 seconds until the iodine solution turns from black to orange (showing the starch has been broken down into glucose).	As pH increases, rate of reaction should increase and then begin to decrease again as enzymes become denatured.	Investigate the effect of temperature/volume of amylase on rate of reaction of amylase Investigate the effect of temperature on the rate of reaction of protease/lipase (hint: Think about the indicator you would need to use!!)
B6 – Photosynthesis	**Big Question:** Investigate the effect of light intensity on the rate of photosynthesis of pondweed. **IV:** distance from light source to pondweed **DV:** volume of O_2 produced **CV:** temperature of the water, carbon dioxide concentration, colour of the light	*A beaker *A filter funnel *Plastercine *A measuring cylinder *A 10cm piece of pondweed *A light source *A metre rule *A stop clock	1) Put your 10cm piece of pond weed into a beaker of water. 2) Cover the pondweed with an inverted (upside down) filter funnel – raised off the bottom of the beaker with plastercine. 3) Fill the measuring cylinder with water and gently position as in the diagram. 4) Use the ruler to position the beaker and pondweed 100cm away from the light source. 5) Start the stop clock. 6) Count the number of bubbles released in three minutes. 7) Record the volume of gas collected in the measuring cylinder in the same three minutes. 8) Repeat with the light source at 80cm, 60cm, 40cm, 20cm away. 9) Calculate rate of CO_2 production by doing: $\frac{\text{Total } CO_2 \text{ produced}}{\text{Time}}$	The closer the light source, the more gas (O_2) will be produced in the three minutes.  	Investigate the effect of different coloured lights on rate of photosynthesis Investigate the effect of temperature on photosynthesis Investigate the effect of CO_2 tablets on photosynthesis

Chemistry

Mastery Matrix:

Topic	Course	Tier	Learning statement
Elements & Compounds	A	F	Describe and draw a model of the three states of matter
Elements & Compounds	A	F	Use the particle model to explain melting, boiling, freezing and condensing
Elements & Compounds	A	F	Identify a substance's state using its melting and boiling point
Elements & Compounds	A	F	Classify a substance as an element or compound
Elements & Compounds	A	F	Identify the symbol for the first 20 elements
Elements & Compounds	A	F	Name common compounds from their formula
Mixtures	A	F	Use key terms (soluble, insoluble, solute, solvent and solution) correctly to describe a substance dissolving
Mixtures	A	F	Explain how to separate given mixtures (filtration, crystallisation, simple distillation, fractional distillation, chromatography)
Structure of an atom	A	F	Describe the plum pudding model of the atom
Structure of an atom	A	F	Describe the current (nuclear) model of the atom giving the relative charge and mass of the subatomic particles
Structure of an atom	A	F	Recall the radius of an atom and its nucleus
Structure of an atom	A	F	Calculate protons, neutrons and electrons for an atom linking to mass and atomic number
Structure of an atom	A	F	Draw the electronic structure and work out the electronic configuration for a given atom
Structure of an atom	A	F	Define an 'isotope'
Structure of an atom	A	F	Link isotopes to relative atomic mass to explain why this is an average
Structure of an atom	A	F	Calculate the relative atomic mass of an element given the percentage abundance of its isotopes
Structure of an atom	A	F	Calculate the relative formula mass of a substance
Metals in the periodic table	A	F	Describe how Mendeleev has arranged the periodic table
Metals in the periodic table	A	F	Explain why something is classified as a metal or non-metal
Metals in the periodic table	A	F	Describe the uses of metals
Metals in the periodic table	A	F	Define a 'chemical reaction' and given examples
Metals in the periodic table	A	F	Explain what an alloy is and how it's properties differ from a pure metal
Groups in the periodic table	A	F	Describe the key properties (state, easy to cut, appearance) of group 1
Groups in the periodic table	A	F	Describe and explain how the reactivity changes as you move down group 1 (oxygen, chlorine, water)
Groups in the periodic table	A	F	Describe the key properties (molecular mass, boiling and melting point) of group 7
Groups in the periodic table	A	F	Describe and explain how the reactivity changes as you move down group 7
Groups in the periodic table	A	F	Describe the key properties (boiling point, density, reactivity) of group 0
Groups in the periodic table	A	F	Describe and explain how the reactivity changes as you move down group 0
Types of bonding	A	F	Describe the structure and properties of giant ionic structures
Types of bonding	A	F	Link the structure of giant ionic structures to its properties
Types of bonding	A	F	Describe the structure and properties of simple covalent structures
Types of bonding	A	F	Describe the structure and properties of giant covalent structures (including diamond, graphite and silica)
Types of bonding	A	F	Compare and contrast giant carbon structures (diamond, graphite, graphene and fullerene – Buckminster fullerenes and nanotubes as examples)
Types of bonding	T	F	Describe two uses of nanotechnology

Types of bonding	A	F	Describe how a substance bonds metallically
Types of bonding	A	F	Link the structure of giant metallic structures to their properties
Describing chemical reactions	A	F	Write a word equation for a given reaction
Describing chemical reactions	A	F	Write a balanced symbol equation for a given reaction
Describing chemical reactions	A	F	Include appropriate state symbols in an equation
Describing chemical reactions	A	F	Compare the mass of reactants and products when looking at a word equation, linking this to the theory of 'conservation of mass' (metal and oxygen, thermal decomposition of metal carbonates)
Describing chemical reactions	A	F	Calculate 'uncertainty' for a given set of measurements
Reactions of metals	A	F	Describe the reaction of given metals with oxygen
Reactions of metals	A	F	Describe the reaction of given metals with water
Reactions of metals	A	F	Describe the reactions of given metals with acids (magnesium, zinc and iron with hydrochloric and sulphuric acid)
Reactions of metals	A	F	Predict products from given reactants
Acids & alkalis	A	F	Identify the ions produced by different acids and alkalis
Acids & alkalis	A	F	Describe the pH scale and how to test pH using universal indicator or a pH probe
Acids & alkalis	A	F	Describe neutralisation reactions (alkalis and bases, metal carbonates and acid)
Acids & alkalis	A	F	Deduce the formulae of salts from their given ions
Acids & alkalis	A	F	Explain the method for producing soluble salts
Acids & alkalis	A	F	**RP Making Salts:** Prepare a pure dry sample of a soluble salt from an insoluble oxide or carbonate
Acids & alkalis	A	F	Recall the ionic equation for neutralisation
Acids & alkalis	A	F	Explain how to use a titration to measure the volume of an acid or an alkali
Reactivity of metals	A	F	Use evidence to rank metals in order of reactivity
Reactivity of metals	A	F	Predict what would happen in a displacement reaction between two substances
Electrolysis	A	F	Link reactivity to how metals are extract from their ore
Electrolysis	A	F	Describe how electrolysis is carried out
Electrolysis	A	F	Explain the electrolysis of molten compounds e.g. Lead bromide
Electrolysis	A	F	Predict what is produced at each electrode
Electrolysis	A	F	Explain how electrolysis can be used to extract metals from their ores
Electrolysis	A	F	Explain how electrolysis can be used to determine the presence of hydrogen in an aqueous solution
Electrolysis	A	F	**RP Electrolysis:** Investigate what happens when aqueous solutions are electrolysed (including the development of a hypothesis)
Exothermic and Endothermic reactions	A	F	Explain how energy is conserved in reactions
Exothermic and Endothermic reactions	A	F	Define and give examples and uses of exothermic and endothermic reactions
Exothermic and Endothermic reactions	A	F	Evaluate data to decide whether a reaction is exothermic or endothermic
Exothermic and Endothermic reactions	A	F	**RP Temperature Changes:** Investigate the variables that affect temperature changes in reacting solutions
Exothermic and Endothermic reactions	A	F	Define activation energy
Exothermic and Endothermic reactions	A	F	Use reaction profiles to show energies of reactants and products and link to exothermic and endothermic and draw simple reaction profiles for endothermic and exothermic reactions.
Exothermic and Endothermic reactions	A	F	Explain whether energy is supplied or released when bonds are broken and made (HT only)
Exothermic and Endothermic reactions	A	F	Calculate the overall energy change in a reaction using bond energies and use this to decide if a reaction is endothermic or exothermic (HT only)

Chemical calculations	D	F	Calculate the relative formula mass of a substance (double only)
Volumes and concentrations	A	F	Calculate the mass of solute in a given volume of solution
Volumes and concentrations	A	F	Explain how the mass of a solute and the volume of a solution is related to the concentration (HT only)
Types of bonding	D	F	Name the three types of bonds that can form (double only recap)
Types of bonding	D	F	Explain how atoms bond ionically (double only recap)
Types of bonding	D	F	Use different models to represent the ions in an ionic compound (double only recap)
Types of bonding	D	F	Evaluate the use of different models of representation (double only recap)
Types of bonding	D	F	Work out the empirical formula for different ionic compounds (double only recap)
Types of bonding	D	F	Describe and explain the properties of ionic compounds (double only recap)
Types of bonding	D	F	Explain how atoms bond covalently (double only recap)
Types of bonding	D	F	Use different models to represent the atoms in a covalent compound (hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia, methane) (double only recap)
Types of bonding	D	F	Describe the structure of diamond, graphite, graphene and fullerenes (double only recap)
Types of bonding	D	F	Explain the properties of simple and giant covalent compounds (double only recap)
Types of bonding	D	F	Describe the structure of a polymer (double only recap)
Types of bonding	D	F	Work out the molecular formula of a substance given a model or diagram of its structure (double only recap)
Types of bonding	D	F	Explain how atoms bond metallically (double only recap)
Types of bonding	D	F	Describe and explain the properties of giant metallic structures (double only recap)

Knowledge organiser:

	Paper:	**C1**
	Topic:	**The Three States (C.1)**
1	In which state do atoms have strong bonds between them?	Solid
2	Describe motion of particles in a solid, liquid and gas	S = Vibrating, L = Sliding, G = quick & random
3	In which state can diffusion NOT happen?	Solid
4	In which states, can particles not be compressed?	Solid & liquid
5	Which state is the least dense?	Gas
6	Which state is the densest?	Solid
7	In which state are there weaker forces between particles?	Gases
8	In which state do particles remain in a fixed position?	Solid
9	What is the name for the change of state when a solid change to a liquid?	Melted
10	What is the name for the change of state when a liquid changes to a gas?	Evaporation
11	What is the name for the change of state when a gas changes to a liquid?	Condensation
12	What is the name for the change of state when a liquid changes to a solid?	Freezing/solidifying
13	What is the name for the temperature where a liquid turns into a gas?	Boiling point
14	What is the name for the temperature where a solid turns into a liquid?	Melting point
15	Why is there no overall temperature change when a substance is changing state?	The particles are absorbing thermal energy to overcome the forces between them. The particles are absorbing thermal energy to overcome the forces between them. Particles are absorbing the thermal energy to overcome the forces between them.

	Topic:	**Elements, compounds (C.2)**
1	What is the name for substances made of only ONE type of atom?	Elements
2	What is the name for substances made of two or more types of atoms NOT chemically bonded together?	Mixtures
3	What is the name for substances made of two or more types of atoms chemically BONDED together?	Compounds
4	What is the formula for water?	H_2O
5	What is the formula for Methane?	CH_4
6	Define "alloy"	A mixture of a metal and at least one other element
7	Why are alloys harder than pure metals?	Different sized atoms distort the regular rows so that the layers can't slide over each other
8	What is the word for an element that always exists as two atoms bonded together?	Diatomic
9	Is an alloy an element, compound or mixture?	Mixture
10	What is the formula for glucose?	$C_6H_{12}O_6$
11	Which elements exist diatomically?	N_2, H_2, O_2 and all of group 7
12	How many electrons can be held in the first shell and then second and third shell of an atom?	First shell is TWO, all other shells EIGHT
13	What is the different between Ar (relative atomic mass) and Mr (relative molecular mass)	Ar = for an element Mr = for a compound
14	Define "ion"?	An electrically charged atom that has gained or lost electrons
15	How do you calculate Ar of an element	It is it's mass number
	Topic:	**Mixtures (C.3)**
1	Define "pure" substance	A single element or compound
2	What temperature is the melting point of water?	0^oC
3	What temperature is the boiling point of water?	100^oC
4	Define "formulation"	A mixture designed as a useful product
5	Give three examples of a formulation	Fuel, paint, alloys
6	Define "soluble"	Can dissolve
7	Define "insoluble"	Cannot dissolve
8	Define "solute"	A solid which can dissolve
9	Define "solvent"	A liquid in which a solid will dissolve
10	Define "solution"	A mixture of a dissolved solute and solvent
11	What is filtration used to separate?	An insoluble solid and a liquid
12	What is crystallisation used to separate?	A soluble solid and a solvent (collect solid)
13	What is simple distillation used to separate?	A soluble solid and a solvent (collect liquid)
14	What is fractional distillation used to separate?	Liquids with different boiling points
15	What is chromatography used to separate?	Different colours of ink or dye
	Topic:	**Chromatography (C.4)**
1	What are the two "phases" in chromatography?	Mobile and stationary phase
2	What is the "mobile phase" in chromatography	The solvent (that travels up the paper)
3	What is the "stationary phase" in chromatography	The paper
4	Why should the start line be drawn in pencil?	Because pencil will not dissolve and affect the results.
5	Why should the start line sit above the solvent?	So that the dots of ink or dye do not wash off the paper
6	Why do the dots of ink or dye need to be the same size?	To make it a fair test
7	How is the Rf value calculated?	Rf = distance by dye / distance by solvent
8	What does a high Rf value tell us?	The substance is more soluble and travelled further
9	What does a low Rf value tell us?	The substance is less soluble and travelled less distance
10	What should the Rf value always be?	A number between 0 - 1
11	What solvents are used in chromatography?	Water, alcohol, acetone
12	Where should the distance moved by the dye be measured from?	The same place each time (top, bottom or middle)
13	What is chromatography used for?	To separate different coloured compounds (dyes or inks)

14	How will temperature affect the rate of chromatography?	The higher the temperature, the faster the rate
15	How can chromatography be used to identify an unknown substance?	Compare with a known substance
	Topic:	**Structure of an atom (C.5)**
1	What is the charge, relative size and location of a proton?	Charge: 1+, Size = 1, Location = Nucleus
2	What is the charge, relative size and location of a neutron?	Charge: 0, Size = 1, Location = Nucleus
3	What is the charge, relative size and location of an electron?	Charge: -1, Size = 1/2000, Location = Shells
4	What is the radius of an atom?	0.1 nm (1×10^{-10}m)
5	What is the radius of a nucleus?	1×10^{-14}m
6	Define "atomic number"	No. of protons in an atom
7	Define "atomic mass number"	Sum of protons and neutrons in an atom
8	Define isotope?	Atoms of the same element that have the same number of protons but different numbers of neutrons
9	What was the Dalton model of the atom?	Atoms = tiny spheres
10	Describe Thompson's 'Plum Pudding' model of an atom.	Ball of positive charge with electrons embedded throughout
11	Describe Rutherford's model of the atom	Dense, positive mass in the centre (the nucleus)
12	Describe the Neil's Bohr model of the atom	Positive nucleus orbited by negative electrons
13	Describe Chadwick's 'Nuclear Model' of an atom	Neutrons & protons in a +ve nucleus, -ve electrons in shells
14	What is the name for the current model of the atom?	Nuclear model
15	What 3 things did the alpha scattering experiment prove?	1) Nucleus = positive (deflected & reflected +ve α particles) 2) Nucleus = dense mass in centre of atom, 3) Rest = empty space
	Topic:	**The periodic table (C.6)**
1	How are elements arranged in the periodic table?	In order of atomic number (lowest to highest)
2	What does the column (group) in the periodic table tells us?	Number of electrons in the outer shell
3	What are the rows of the periodic table called?	Periods
4	What did Mendeleev do when creating the modern periodic table?	Left gaps to make the pattern fit
5	Where are alkali metals found in the periodic table?	Group 1
6	Where are non-metals found in the periodic table?	Right
7	Name the groups in the periodic table (1, 7, 0)	1 = Alkali metals, 7 = Halogens, 0 = Noble gases
8	State 3 properties of group 7	Non-metal, highly reactive, diatomic
9	What happens to reactivity as you move down group 7?	They become less reactive - it is harder to gain an electron
10	What is the name of the elements found in the middle of the periodic table that are not part of a group?	Transition metals
11	Give 4 properties of metals	1) High melting point, 2) Good thermal and electrical conductors, 3) Ductile, 4) Malleable
12	Give 3 properties of non-metals	1) Low melting point, 2) Poor thermal and electrical conductors, 3) Brittle
13	Give 5 properties of the alkali metals	1) Highly reactive, 2) Low melting and boiling points, 3) Low density, 4) Shiny when cut, 5) Soft
14	What is formed when alkali metals react with water?	Alkaline metal hydroxide
15	What happens to reactivity as you move down group 1?	They become more reactive - it is easier to lose their outer electron.
	Topic:	**Types of bonding (C.7)**
1	Which type of bonding occurs between metals and non-metals?	Ionic
2	Which type of bonding occurs between non-metals?	Covalent
3	Which type of bonding occurs between metals?	Metallic
4	When electrons leave the shells of an atom, they are said to be ……?	Delocalised
5	Which type of ions are formed by metals?	Positive ions
6	Which type of ions are formed by non-metals?	Negative ions
7	What is graphene?	A single layer of graphite

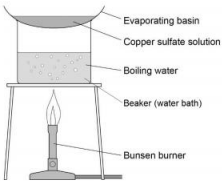
8	What is a fullerene?	Hollow carbon structures
9	What is Buckminster Fullerene?	Spherical carbon shape with 60 carbon atoms
10	What is an allotrope?	Two or more different physical arrangements of the same atom e.g. diamond, graphite, graphene
11	What is a carbon nanotube?	A cylindrical fullerene with a very high length to diameter ratio
12	Describe what happens in ionic bonding	Electrons are transferred from a metal atom to a non-metal atom = strong electrostatic attraction between oppositely charged ions
13	Describe what happens in covalent bonding	Electrons are shared between atoms = strong electrostatic attraction between electrons and nucleus
14	Describe what happens in metallic bonding	Electrons become delocalised creating a sea of negative charge = strong electrostatic attraction with positive metal ions & sea of delocalised electrons
15	Why do noble gases not form compounds?	Because they already have a full outer shell of electrons
	Topic:	**Properties of materials (C.8)**
1	State two properties of simple covalent molecules	1) Low melting & boiling point, 2) Poor conductor of thermal & electrical energy
2	State three properties of diamond	1) Hard, 2) Poor electrical conductor, 3) Good thermal conductor
3	State two properties of graphite	1) Soft & slippery, 2) Conducts electricity
4	State two properties of silicon dioxide	1) Hard, 2) Doesn't conduct electricity
5	Why do metals and graphite conduct electricity?	Delocalised electrons can move through structure carrying electrical charge
6	Why do ionic compounds, metallic compounds and giant covalent compounds have high melting and boiling points?	Strong INTRAmolecular bonds/forces = difficult to move apart
7	Why do simple compounds have low melting and boiling points?	Weak INTERmolecular bonds/forces = easy to move apart
8	Why do ionic compounds conduct electricity when molten/aqueous?	Ions are free to move carrying charge
9	Name the structure that ionic bonding forms	Giant ionic lattice
10	State three examples of giant covalent structures	Diamond, graphite, silicon dioxide
11	Name the two types of structure that can be formed from covalent bonding	Simple covalent molecules, giant covalent structures
12	How are unreactive metals (e.g. gold) removed from their ore?	They are native (unreactive so don't form an ore)
13	How are metals LESS reactive than carbon removed from their ore?	They are reduced (reacted with) by carbon
14	How are metals MORE reactive than carbon removed from their ore?	Electrolysis
15	What is reduction & oxidation (in terms of electrons)? (HT only)	Oxidation = Is Loss of electrons, Reduction = Is Gain electrons, (OIL RIG)
	Topic:	**Describing chemical reactions, reactions of metals and gas tests (C.9)**
1	metal + oxygen ->	metal oxide
2	metal + water ->	metal hydroxide + hydrogen gas
3	metal + acid ->	metal salt + hydrogen gas
4	Define oxidation (in terms of oxygen)	Addition of oxygen to an element
5	Define reduction (in terms of oxygen)	Removal of oxygen from a compound
6	What is the law of conservation of mass?	No atoms are lost or made during a reaction (mass of reactants = mass of products)
7	acid + alkali (or base) ->	salt + water
8	If sulphuric acid reacts with a metal, what will the salt end in?	_____ sulphate
9	If nitric acid reacts with a metal, what will the salt end in?	_____ nitrate
10	metal carbonate + acid ->	metal salt + water + carbon dioxide
11	If hydrochloric acid reacts with a metal, what will the salt end in?	_____ chloride

12	What is the test for hydrogen gas?	A burning splint will make a squeaky pop
13	What is the test for carbon dioxide gas?	Limewater will turn cloudy
14	What is the test for oxygen gas?	A glowing splint will relight
15	What is the test for chlorine gas?	Damp litmus paper will be bleached and turned white
	Topic:	**Acids and Alkalis (C.10)**
1	Which ions make a solution alkaline?	OH^- (hydroxide)
2	Which ions make a solution acidic?	H^+
3	Give 3 ways to measure the pH of a substance	Litmus paper, universal indicator, pH probe
4	What pH and colour is universal indicator in a strongly ACIDIC solution?	pH 1 - 3 (red)
5	What pH and colour is universal indicator in a strongly ALKALINE solution?	pH10-14 (purple)
6	What pH and colour is universal indicator in a weak ACID?	pH 4-6 (orange/yellow)
7	What pH and colour is universal indicator in a weak ALKALI?	pH8-9 (blue)
8	What colour is methyl orange in acid and alkali?	Red (acid), orange (alkali)
9	What colour is phenolphthalein in acids and alkali?	Colourless (acid), pink (alkali)
10	What is the difference between the solubility of alkalis and bases?	Alkalis are soluble and bases are insoluble
11	What is the definition of a) strong acid and b) weak acid?	a) Strong acid completely ionises (breaks down into its ions) in water, b) Weak acid partially ionises in water
12	Give 3 examples of a strong acid (H only)	Hydrochloric acid, sulphuric acid, nitric acid
13	List the steps in making a soluble salt	1) Add solid to heated acid until no more reacts (in excess), 2) Filter excess solid, 3) Leave for 24hrs for water to evaporate (crystallisation), 4) Dab dry
14	State three examples of weak acids (H only)	Ethanoic acid, citric acid and carbonic acid
15	What does a decrease in pH by one-unit mean? (HT only)	The hydrogen ion concentration increases by a factor of 10
	Topic:	**Electrolysis (C.12)**
1	Define 'electrolysis'	A substance is decomposed (broken down) using electricity
2	Why can electrolysis only occur if an ionic substance is molten or aqueous?	The ions are free to move
3	What is the name of the negative and positive electrode?	Negative: Cathode Positive: Anode
4	Which ions are attracted to the anode and which to the cathode?	Anode = negative Cathode = positive
5	Define "electrolyte"	Ions in a solution that are free to move and can conduct electricity
6	What happens when ions get to an electrode?	Gain or lose electrons becoming neutral atoms again
7	What happens at the anode?	Electrons transferred from the ion to the anode and the non-metal forms
8	What happens at the cathode?	Electrons transferred from the cathode to the ion and a metal is formed
9	When is hydrogen formed from an aqueous solution?	If the metal is MORE reactive than hydrogen
10	When is a metal (not hydrogen) formed from an aqueous solution?	If the metal is LESS reactive than hydrogen
11	State one use of electrolysis	Extracting a reactive metal from its ore
12	Which useful product could be removed from the solution left after electrolysis of dilute sodium chloride solution?	Sodium hydroxide (bleach)
13	What would be formed at the anode in electrolysis of dilute sodium chloride solution?	Chlorine gas
14	What would be formed at the cathode in electrolysis of dilute sodium chloride solution?	Hydrogen
15	When will oxygen be produced at the anode?	When the solution does NOT contain HALIDE ions. Otherwise the halogen is produced.

	Topic:	Endothermic and exothermic reactions (C.14)
1	Which type of reaction releases energy into the surroundings?	Exothermic
2	Which type of reaction absorbs energy from the surroundings?	Endothermic
3	In an exothermic reaction, what has more energy in it? The products or the reactants?	Reactants
4	In an endothermic reaction, what has more energy in it? The products or the reactants?	Products
5	Define "activation energy"	Minimum amount of energy that particles must collide with to react
6	Is energy released when bonds are broken or bonds are made? (HT only)	Made
7	Is energy absorbed when bonds are broken or bonds are made? (HT only)	Broken
8	What would happen to the temperature of the surroundings in an exothermic reaction?	Increase
9	What would happen to the temperature of the surroundings in an endothermic reaction?	Decrease
10	Give three examples of endothermic reactions	Thermal decomposition reactions Citric acid + sodium hydrogen carbonate Sports injury packs
11	Give two examples of exothermic reactions	Self-heating cans Hand warmers
12	What is the other name for an energy level diagram?	Reaction profile
13	What is the substance called that reduces the activation energy required by a reaction?	Catalyst
14	Do Exothermic or endothermic reactions require a bigger activation energy?	Endothermic
15	What is the unit for temperature?	Degrees Celsius
	Topic:	**Rates of reaction (C.17)**
1	What are the two equations for calculating mean rate of reaction?	mean ROR = quantity of reactant used/time take or quantity of product formed/time taken
2	If the mass of the product or reactant is given in grams, which unit should you use for the rate?	g/s
3	If the volume of the product or reactant is given in cm^3, which unit should you use for the rate?	cm^3/s
4	If the amount of the product or reactant is given in moles, which unit should you use for the rate? (HT only)	0
5	What does a steep gradient on a graph tell us about the rate of a reaction?	The rate of reaction is fast
6	What does a flat line (0 gradient) on a graph tell us about the rate of a reaction?	The reaction has stopped
7	What has a higher surface area? A powder or lumps of a substance	Powder because more particles are exposed and able to successfully collide
8	How does increasing concentration increase rate of reaction?	More particles -> more frequent successful collisions
9	How does increasing temperature increase rate of reaction?	Particles have more kinetic energy -> more collisions with activation energy
10	How does increasing pressure increase rate of reaction?	Particles closer together -> more frequent successful collisions
11	How does a catalyst increase rate of reaction?	Provides an alternative pathway for the reaction with a lower activation energy
12	What is activation energy?	The minimum amount of energy that particles must have to react
13	State 4 factors that affect rate of reaction	Pressure (in gases), concentration, temperature, a catalyst
14	How can you measure volume of gas produced?	Gas syringe
15	How can you use turbidity (cloudiness) to measure rate of reaction?	Record time for a cross to disappear

	Topic:	Chemical calculations, volumes and concentrations (C.19)
1	State the 'law of conservation of mass'	No atoms are lost or made during a chemical reaction
2	The sum of the Mr of the reactants must equal	The sum of the Mr of the products
3	State one example of when a reaction may APPEAR to lose mass	When a gas is produced and escapes
4	State the value of Avogadro's constant (HT only)	6.02×10^{23}
5	State the equation to calculate moles from mass and Mr (HT only)	Moles (mol) = mass (g) /Mr
6	State how to calculate Mr (relative formula mass)	The sum of the Ar (atomic masses) of each atom
14	When a symbol equation is balanced, what is shown by the large numbers in front of a formula e.g. 2HCl?	The ratio of moles of each substance
15	What is the volume of 1 mole of any gas at room temperature and pressure?	$24dm^3$
	Topic:	**Alkanes and alkenes (C.28)**
1	Name the first 4 alkenes	Ethene, propene, butene, pentene
2	What is the difference between an alkane and an alkene?	Alkanes have single C-C bonds, alkenes have double C=C bonds
3	What does saturated mean?	Single bonds only
4	Do alkenes or alkanes burn with a smoky flame?	Alkenes
5	What is the test for an alkene?	Turns orange bromine water colourless
6	How many carbons does "meth" tell us a compound contains?	1
7	How many carbons does "eth" tell us a compound contains?	2
8	How many carbons does "pro" tell us a compound contains?	3
9	How many carbons does "but" tell us a compound contains?	4
10	How many carbons does "pent" tell us a compound contains?	5
11	What is the general equation for combustion?	Hydrocarbon + oxygen -> water + carbon dioxide
12	What is a hydrocarbon?	A compound containing only carbon and hydrogen
13	What is the general formula for an alkane?	CnH_2n+_2
14	What is the general formula for an alkene?	CnH_2n
15	Which type of hydrocarbon is saturated - alkanes or alkenes?	Alkanes

Required practicals

C1 – Making Salts	Big Question: How do you prepare a pure, dry sample of a soluble salt from an insoluble salt?	*Dilute sulphuric acid *Measuring cylinder *Copper oxide powder *Spatula *Glass rod *100cm3 beaker *250cm3 beaker *Bunsen burner *Tripod *Gauze *Heatproof mat *Filter funnel and paper *Small conical flask *Evaporating basin	1) Measure 40cm3 of sulphuric acid and add to a beaker. 2) Heat the acid gently. Turn off the Bunsen burner. 3) Add copper oxide power to the acid until it stops reacting. Stir continuously. 4) Filter the solution to remove excess insoluble copper oxide 5) Pour the filtrate into an evaporating basin and heat gently over a water bath. 6) As soon as crystals start to form, leave the evaporating dish for 24 hours. 7) Pat the crystals dry between two pieces of filter paper. Note: Evaporation is the changing of water from a liquid to a gas, crystallisation is the formatino of crystals from a concentrated subsance. Note: *Carbonates tend to be insoluble *Sulphates, nitrates, chlorides tend to be soluble		You will remove the insoluble black copper oxide from the mixture by filtering. You will remove the water through evaporation. Blue crystals of copper sulphate will form – the slower the cool, the larger they will be. These are TOXIC, do not ingest (eat).	Explain have lithium sulphate can be produced from lithium carbonate and sulphuric acid. Explain how to prepare an insoluble salt from a soluble salt - (react two soluble salts and a precipitate will form, filter, wash with water, then dry in an oven).

C3 - Electrolysis	**Big Question**: Investigate the products formed during electrolysis of an aqueous solution.	*copper chloride solution *sodium chloride solution *100cm^3 beaker *Petri dish lid *2 carbon electrodes *2 crocodile clips *low voltage power supply *blue litmus paper *forceps	1) Pour approximately 50cm^3 copper (II) chloride solution into the beaker. 2) Add the petri dish lid and insert the carbon rods through the holes. The rods must not touch each other. 3) Attach crocodile leads to the rods. Connect the rods to the dc terminals of a low voltage power supply. 4) Select 4 V on the power supply and switch on. 5) Look at both electrodes and record your observations. 6) Use forceps to hold a piece of blue litmus paper in the solution next to the anode. Record your observation. 7) Rinse the electrochemical cell apparatus and collect a new set of electrodes. 8) Repeat steps 1–8 using the other solution sodium chloride.	$CuCl_2$ solution will form copper at the cathode (-ve electrode) and chlorine at the anode (+ve electrode). This will bleach the litmus paper. NaCl will form hydrogen at the cathode (because it the metal is more reactive than hydrogen) and chlorine at the anode (positive electrode).	Investigate the products formed during electrolysis of aqueous copper sulphate. Describe how you would carry out electrolysis of molten zinc chloride.
C4 – Temperature Changes	**Big Question 1:** Investigate the variables that affect temperature changes in reacting solutions. IV: Volume of NaOH DV: Temperature change CV: Volume of HCl	*dilute hydrochloric acid *dilute sodium hydroxide solution *a polystyrene cup and lid *250 cm^3 beaker *10 cm^3 measuring cylinder *50 cm^3 measuring cylinder *a thermometer	1) Measure 30cm^3 of dilute HCl and add it to the polystyrene cup. 2) Stand the cup inside the beaker 3) Use the thermometer to measure the temperature of the acid and record in a results table. 4) Add 5cm^3 of NaOH solution, add the lid and stir gently. 5) When the temperature stops rising, record the temperature on the thermometer. 6) Repeat steps 4-5 adding a further 5cm^3 each time until 40cm^3 of NaOH has been added. 7) Wash out the equipment and repeat the experiment two more times so that you can remove anomalies and calculate an accurate mean.	Temperature should increase until the point where the same volumes of acid and alkali are added and then should decrease slightly as you are adding more cold alkali but not producing any more reactions (acid becomes the limiting reactant).	Investigate the temperature changes involved in the reaction between water and calcium chloride (exothermic). Investigate the temperature changes involved in the reaction between ethanoic acid and sodium carbonate (endothermic).

Physics

Mastery Matrix

	Course	Tier	Learning statement
Energy Types	A	F	Describe ways in which energy can be transferred within a system
Energy Types	A	F	Describe ways to store energy
Energy Types	A	F	Describe the law of conservation of energy
Energy Types	A	F	Describe concepts of open and closed systems
Energy Types	A	F	Describe ways to reduce unwanted energy transfers
Energy Types	A	F	Link energy loss to insulation and thermal conductivity
Energy Types	A	F	Define renewable and non-renewable energy resources
Energy Types	A	F	Compare & contrast energy resources in terms of reliability, cost and political, environmental & social factors
Work, power and efficiency	A	F	Define and calculate work done using E=Pt and E=fd
Work, power and efficiency	A	F	Define and calculate power using P=VI and E = Pt
Work, power and efficiency	A	F	Describe examples of applications of power in everyday life
Work, power and efficiency	A	F	Use and rearrange both equations for calculating efficiency
Elastic Objects & potential energy	A	F	Describe elastic and inelastic deformation
Elastic Objects & potential energy	A	F	Explain the effect of forces on elastic objects
Elastic Objects & potential energy	A	F	Describe Hooke's Law qualitatively and using the equation F = ke
Elastic Objects & potential energy	A	F	Explain 'word done' when applied to stretching or compressing a spring
Elastic Objects & potential energy	A	F	Explain the difference between a linear and a non-linear relationship
Elastic Objects & potential energy	A	F	Interpret data from a force extension investigation
Elastic Objects & potential energy	A	F	**RP Force and Extension:** Investigate the relationship between force and extension for spring (Hooke's Law)
Elastic Objects & potential energy	A	F	Use the elastic potential energy equation ($Ee=1/2ke^2$)
Elastic Objects & potential energy	A	F	Use and rearrange the equation for kinetic energy ($Ek=1/2mv^2$)
Elastic Objects & potential energy	A	F	Use and rearrange the equation for gravitational potential energy (Eg=mgh)
Nuclear Physics	A	F	Describe the structure and size of an atom
Nuclear Physics	A	F	Calculate the number of protons, neutrons and electrons in an atom
Nuclear Physics	A	F	Describe how electrons can change energy level
Nuclear Physics	A	F	Describe isotopes
Nuclear Physics	A	F	Describe what an ion is
Nuclear Physics	A	F	Describe the development of the model of the atom (Plum-pudding, Rutherford, Neils Bohr and Chadwick).
Radioactive decay and Radiation	A	F	Describe what radioactive decay is
Radioactive decay and Radiation	A	F	Recall the definition and units for activity and count rate
Radioactive decay and Radiation	A	F	Describe what makes up alpha, beta, gamma and neutron radiation

Radioactive decay and Radiation	A	F	Describe the properties of each type of radiation
Radioactive decay and Radiation	A	F	Use nuclear equations to represent radioactive decay
Radioactive decay and Radiation	A	F	Define half-life
Radioactive decay and Radiation	A	F	Complete half-life calculations from graphs or other data
Radioactive decay and Radiation	A	F	Describe the impact and precautions for radioactive contamination
Radioactive decay and Radiation	A	F	Analyse data about the effects of radiation on people
Density	A	F	Use and rearrange $\rho = m/v$
Density	A	F	Draw simple diagrams to model the difference between solids, liquids and gases
Density	A	F	Link the arrangement of atoms and molecules to different densities of the states
Density	A	F	**RP Density:** Determine the densities of regular and irregular solid objects and liquids
Changes of state and latent heat	A	F	Describe how mass is conserved during changes of state
Changes of state and latent heat	A	F	Explain why changes of state are physical changes
Changes of state and latent heat	A	F	Define internal energy
Changes of state and latent heat	A	F	Explain the effect of heating on the energy within a system and calculate energy change during a state change.
Changes of state and latent heat	A	F	Describe 'latent heat' of a material including specific latent heat of fusion and specific latent heat of vaporisation
Changes of state and latent heat	A	F	Explain and calculate 'specific latent heat' using the $E=mL$
Changes of state and latent heat	A	F	Interpret heating and cooling graphs that include changes of state
Specific Heat Capacity	A	F	Explain the differences between 'heat' and 'temperature'
Specific Heat Capacity	A	F	Define and calculate specific heat capacity
Specific Heat Capacity	A	F	Use and rearrange equations for calculating specific heat capacity
Specific Heat Capacity	A	F	**RP Specific Heat Capacity:** Investigate the specific heat capacity of materials
Specific Heat Capacity	A	F	Distinguish between specific heat capacity and specific latent heat
Gas Pressure and Fluid Pressure	A	F	Describe the motion of particles in a gas and relate this to pressure, kinetic energy and temperature
Gas Pressure and Fluid Pressure	A	F	Explain the relationship between temperature and pressure of a gas at constant volume
Electricity Introduction	A	F	Identify the key circuit symbols.
Electricity Introduction	A	F	Define current, charge and potential difference.
Electricity Introduction	A	F	Use and rearrange equations for calculating current.
Electricity Introduction	A	F	Predict the current at given points within a series and parallel circuit.
Electricity Introduction	A	F	Predict the potential difference (voltage) at given points within a series and parallel circuit.

Electricity Introduction	A	F	Describe the relationship between current, potential difference and resistance.
Electricity Introduction	A	F	Use and rearrange equations for calculating current, potential difference and resistance.
Electricity Introduction	A	F	Recall units for current, potential difference and resistance.
Series and Parallel Circuits	A	F	Compare and contrast series and parallel circuits in terms of current and potential difference.
Series and Parallel Circuits	A	F	Calculate resistance in series circuits and describe resistance in parallel circuits.
Series and Parallel Circuits	A	F	**RP Resistance:** Use circuit diagrams to set up circuits to investigate the factors affecting resistance (length of a wire at constant temperature and combinations of resistors in series and parallel.)
Ohmic/Non-ohmic and types of resistors	A	F	Describe the relationship between current and potential difference in ohmic conductors.
Ohmic/Non-ohmic and types of resistors	A	F	Explain how resistances change in thermistors and LDRs.
Ohmic/Non-ohmic and types of resistors	A	F	List the applications of thermistors and LDRs.
Ohmic/Non-ohmic and types of resistors	A	F	Interpret graphs to determine whether relationships are linear or non-linear.
Ohmic/Non-ohmic and types of resistors	A	F	**RP I-V Characteristics:** Investigate V-I characteristics using circuits.
Mains electricity	A	F	Describe the properties of mains electricity in the UK (A.C., Frequency and Voltage)
Mains electricity	A	F	Explain the difference between direct and alternating potential difference
Mains electricity	A	F	Describe the three core cables and the wires that they are made up of and the dangers of these
Energy and Power of Electricity	A	F	Use and rearrange the P=IV equation (electrical power)
Energy and Power of Electricity	A	F	Use and rearrange the $P=I^2R$ equation (electrical power)
Energy and Power of Electricity	A	F	Describe energy transfers in electrical appliances
Energy and Power of Electricity	A	F	Use and rearrange E=Pt
Energy and Power of Electricity	A	F	Use and rearrange E=QV
Energy and Power of Electricity	A	F	Explain how the power of a circuit is related to potential difference, current and energy
The National Grid	A	F	Describe the components of the national grid
The National Grid	A	F	Explain the role of step up and step down transformers in the national grid and use this to explain why it is an efficient system for transferring energy

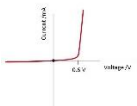
Knowledge organiser:

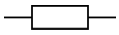
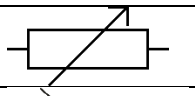
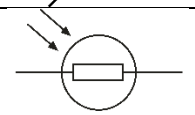
	Paper:	**P1**
	Topic:	**Energy Types (P.1)**
1	What type of energy do all moving objects have?	Kinetic energy
2	The law of conservation of energy states what three things that can happen to energy	Transferred usefully, stored or dissipated
3	Which word means 'wasted into the surroundings'?	Dissipated
4	When energy is wasted, it is usually which energy types?	Thermal and sound
5	The law of conservation of energy states that which two things cannot happen to energy?	Created or destroyed
6	What can be done to moving parts in a system to reduce heat loss by friction?	Lubrication (adding oil/grease)
7	What name is given to a material which does not conduct thermal energy well?	Thermal insulator
8	What name is given to a material which allows thermal energy to pass through it easily?	Thermal conductor
9	What is the unit for energy?	Joules (J)
10	What type of heat transfer travels through solids?	Conduction
11	What type of heat transfer happens only in fluids (gas and liquids)?	Convection
12	Which is the only type of thermal energy transfer can occur in a vacuum?	Radiation
13	Which dissipates less thermal energy? Thin walls or thick walls?	Thick
14	Which dissipates less thermal energy? Walls with large or small area	Small
15	Which dissipates less thermal energy? Large or small temperature difference	Small
	Topic:	**Work power and efficiency (P.2)**
1	Equation for work done.	Work done =Force x distance
2	Units for work done.	Joules (J)
3	What is work done?	Energy transferred.
4	Units for power.	Watts (W)
5	Equation for power.	Power = Energy transferred/time
6	Units for time.	seconds (s)
7	Define power.	Rate at which energy is transferred.
8	One watt is the same as…	1 joule per second.
9	Equation for efficiency in terms of energy	efficiency = useful output energy transfer/total input energy transfer
10	Equation for efficiency in terms of power	efficiency = useful output power/total input power
11	Units for efficiency	No units
12	Units for force	Newtons (N)
13	One Joule is the same as…	one Newton-metre
14	The minimum value of efficiency	0
15	The maximum value of efficiency	1
	Topic:	**Elastic objects and potential Energy (P.3)**
1	What is the equation for elastic potential energy?	Ee=1/2ke2 Elastic potential energy (J) = 1/2 x spring constant (N/m) x extension (m)
2	What is the equation for kinetic energy?	Ek = 1/2 mv2 Kinetic energy (J) = 1/2 x mass (Kg) x velocity2 (m/s)
3	What is the equation for gravitational potential energy?	Eg=mgh Gravitational potential energy (J) = mass (kg) x gravitational field strength (N/kg) x height (m)
4	Which equation describes Hooke's Law?	F = ke Force (N) = spring constant (N/m) x extension (m)
5	What type of energy is stored in a stretched elastic band?	Elastic potential energy

6	What type of energy is stored in a squashed up tennis ball?	Elastic potential energy
7	What needs to be applied for an object to change shape?	A force
8	Define the term for an object returning to its original shape after being stretched	Elastic deformation
9	Define the term for an object not returning to its original shape after being stretched	Inelastic deformation
10	Identify the Law: "The extension of a spring is directly proportional to the force applied to it."	Hooke's Law
11	What sort of energy is stored in a bungee cord?	Elastic potential energy
12	What do you call the point at which Hooke's Law no longer applies?	The limit of proportionality
13	In a graph of Hooke's Law, what happens at the limit of proportionality?	Line no longer straight, it will curve
14	What is the equation for "gravitational potential energy"?	Eg = mgh
15	What is the equation for Kinetic Energy?	Ek=1/2mv2
	Topic:	**Nuclear physics (P.21)**
1	What is the size of the atom?	1×10^{-10}m
2	Which two sub atomic particles are found in the nucleus?	Protons and neutrons
3	What is the radius of nucleus compared to radius of atom?	1/10000 of the size (one ten thousandth of the size)
4	Electrons go up an energy level when… (HT only)	They absorb electromagnetic radiation.
5	Electrons move down an energy level when… (HT only)	They emit electromagnetic radiation.
6	Are atoms positive, negative or neutral?	Neutral
7	What is the atomic number?	Number of protons
8	What is the mass number?	Number of protons AND neutrons.
9	What is an "ion"?	A charged atom (lost or gained electrons)
10	What are isotopes?	Atoms of the same element with the SAME number of protons but a DIFFERENT number of neutrons.
11	Describe the plum pudding model	The atom is a ball of positive charge with negative electrons embedded in it
12	What is the name of the current model of the atom?	Nuclear model
13	State two conclusions from the alpha scattering experiment	1) mass of an atom is concentrated in a nucleus in the centre 2) nucleus is positive
14	State the conclusion provided by Niels Bohr	Electrons orbit the nucleus
15	State the conclusion provided by James Chadwick	Discovered neutrons
	Topic:	**Radioactive decay and radiation (P.22)**
1	What two words can we use to describe the process of radioactive decay?	Random and unpredictable
2	What is the word to describe the rate at which a source of unstable nuclei decays	Activity
3	What is the word to describe the number of decays recorded each second by a detector	Count rate
4	What is the equipment for measuring radiation?	Geiger-Muller tube
5	Name the four types of nuclear radiation	alpha particle, beta particle, gamma ray, neutron
6	Describe the structure of an alpha particle	2 neutrons & 2 protons (helium nucleus)
7	What is a beta particle?	A negative electron
8	What is a gamma ray?	An electromagnetic wave
9	Three main types of radiation in order of high to low ionising power.	alpha, beta, gamma
10	Three main types of radiation in order of high to low penetrating power.	gamma, beta, alpha
11	Which materials are able to stop each type of radiation?	Alpha = paper, beta = aluminium, gamma = nothing, thick lead absorbs some of it
12	Distances alpha, beta and gamma can go in air.	Alpha: 3-5cm, Beta: 15cm, Gamma: several metres.
13	Define "irradiation"	Exposing an object to nuclear radiation. The irradiated object does not become radioactive.
14	Define "half-life"	The time it takes for the number of unstable nuclei of the isotope in a sample to halve

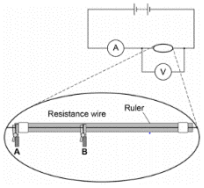
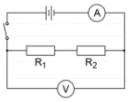
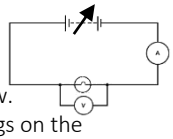
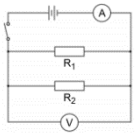
15	Define "radioactive contamination"	The unwanted presence of radioactive atoms on other materials
	Topic:	**Background decay and radiation (P.23)**
1	State two natural sources of background radiation	Rocks and cosmic rays
2	State two man made sources of background radiation	Fallout from nuclear weapons testing, nuclear accidents
3	Define 'background radiation'	Radiation around us all the time.
4	Define 'radiation dose'	The amount of radiation that is absorbed by a person (Sv)
5	Would a long or short half-life radioactive material be more dangerous in the long term?	Long half-life material.
6	State 2 medical uses of nuclear radiation	Exploring internal organs, control/destruction of unwanted tissue.
7	Why is using nuclear radiation to treat a tumour a risk?	The radiation might cause a tumour
8	Give an example of an internal organ that would be explored with radiation	Intestines - to look for blockages.
9	Would you use a short or long half-life material for using a tracer in the intestine?	Short - an hour or so - you don't want to leave the hospital if you are still give out high levels of radiation.
10	What kind of radiation is used to look at internal organs?	Beta
11	Why can't alpha be used to look at internal organs?	Stopped by skin
12	What kind of radiation is used to destroy tumours?	Gamma rays (sometimes beta)
13	Why is gamma used to destroy tumours?	Most ionising & can penetrate the skin and bones
14	Why is a long half-life material high risk?	It will still be giving out radiation in years to come
15	State 2 factors that affect the amount of background radiation people are exposed to	Occupation (job) & location
	Topic:	**Nuclear fission and fusion (P.24)**
1	Define 'Nuclear fission'	Splitting a large & unstable nucleus.
2	State 2 examples of elements that undergo fission.	Uranium & plutonium
3	Spontaneous fission is rare. What usually causes fission?	An unstable nucleus absorbs a neutron
4	State the 3 products of nuclear fission	2 smaller nuclei, 2 or 3 neutrons, gamma rays
5	In what form is energy released in a fission reaction?	Gamma rays
6	How do the sizes of the two nuclei produced in a fission reaction compare?	Roughly the same size.
7	The nuclei and neutrons produced have after a fission reaction have _____?	Kinetic energy
8	What is a chain reaction?	Neutrons from a fission reaction are absorbed by another nucleus & start another fission reaction
9	How is a fission reaction in a nuclear power station controlled?	Control rods absorb neutrons (slow down the chain reaction)
10	In a nuclear weapon, is the chain reaction controlled or uncontrolled?	Uncontrolled.
11	Define 'nuclear fusion'	The joining of two light nuclei to form a heavier nucleus with some mass converted to energy.
12	Where does nuclear fusion happen?	In stars e.g. the sun.
13	Why does nuclear fusion happen in the sun?	High temperature & pressure
14	Why does fusion need a high temperature and pressure?	To overcome the repulsion force between the 2 positive nuclei
15	State two elements that undergo nuclear fusion	Hydrogen and helium
	Topic:	**Density (P.25)**
1	State the equation for density	ρ =m/v Density (kg/m3) = mass (kg) / volume (m3)
2	State the units for density	Kilograms per metre cubed (kg/m3)
3	State the units for volume	Meters cubed, (m3)
4	How do you calculate the volume of a cube?	V = lxlxl or l3 Volume (m3) = length (m) x length (m) x length (m)
5	How do you calculate the volume of a cuboid?	V = l x w x h Volume (m3) = length (m) x width (m) x height (m)
6	State two drawbacks of the particle model	1) assumes particles are all small solid spheres 2) doesn't show bonds between atoms
7	Describe the particle model of solids	Particles all touching (bonded) in rows

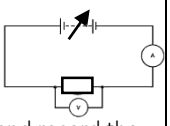
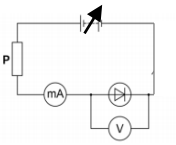
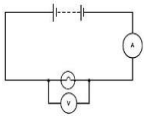
8	Describe the particle model of liquids	Particles randomly placed, almost all particles touching.
9	Describe the particle model of gases	Particles placed randomly, none or very few touching.
10	Name the five changes of state	Sublimation, condensing, boiling, freezing and melting
11	Describe the state change in sublimation	Solid to gas
12	How do the particles move in a solid?	Vibrate in a fixed position
13	How do you calculate the density of an irregular shape?	Submerge in water to calculate the volume, use a balance to measure the mass.
14	How do you calculate the density of a regular shape?	Calculate the volume using l x b x h, use a balance to measure the mass
15	How do the particles move in a gas?	Randomly, in all directions
	Topic:	**Changes of state, latent heat and specific heat capacity (P.26)**
1	Define 'conservation of mass'	Total mass is the same before and after a reaction
2	Why does temperature not change during a state change?	Energy used to make/break bonds increasing the internal energy not temperature
3	Define "internal energy"	Energy stored inside a system by the particles
4	How do we calculate internal energy?	Sum kinetic and potential energy of all particles
5	How does heating affect the internal energy of a system?	It increases it
6	State the equation for change in thermal energy	$\Delta E = m c \Delta \theta$ Change in energy (J) = mass (kg) x specific heat capacity (J/Kg°C) x change in temperature (°C)
7	State the units for specific heat capacity	Joules per kilogram per degree Celsius, J/kg °C
8	Define "specific heat capacity"	Amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.
9	Define "latent heat"	The energy needed for a substance to change state
10	Define "specific latent heat of vaporisation"	The amount of energy required to boil one kilogram of the substance with no change in temperature
11	Define "specific latent heat of fusion"	The amount of energy required to freeze one kilogram of the substance with no change in temperature
12	Equation for specific latent heat.	$E = m L$ Energy (J) = mass (kg) x specific latent heat (J/kg)
13	State the units for specific latent heat	Joules per kilogram, J/kg
14	Describe the key property of a substance with a high specific heat capacity	Will store a lot of energy per kilogram
15	What does a flat section on a heating and cooling graph represent?	Changes of state
	Topic:	**Gas and fluid pressure (paper 1) (P.27)**
1	Describe the motion of particles in a gas.	Random movement
2	How do we determine the temperature of a gas?	Average kinetic energy of the molecules
3	State two factors that will influence gas pressure	1) temperature, 2) volume
4	If a gas is held at a constant volume, describe the relationship between temperature and pressure	Directly proportional
5	Why does increasing temperature increase the pressure of a gas (if held at a constant volume)?	Particles collide with the side of the container: (a) more frequently and (b) with more energy
13	Gas pressure causes a force at ___degrees to the container wall.	90
14	State 2 factors that increase when work is done on a gas	Internal energy and temperature
15	State a situation where doing work on a gas increases the temperature	Bicycle pump
	Topic:	**Electricity introduction (P.29)**
1	What does LED stand for?	Light emitting diode.
2	What does LDR stand for?	Light dependent resistor.
3	State the equation for charge flow	$Q=It$ Charge flow © = current (A) x time (S)
4	State the units for charge flow	Coulombs (C)
5	Define 'electrical current'	Flow of electrical charge
6	What do the symbols I, t and Q represent?	I - current, t - time, Q - charge flow.
7	State the units for resistance	Ohms (Ω)

8	How does resistance affect current?	The higher the resistance, the lower the current (inversely proportional)
9	What is an ohmic conductor?	Electrical component where current and voltage are DIRECTLY PROPORTIONAL
10	What is a non-ohmic conductor?	Electrical component where current and voltage are NOT directly proportional
11	Write Ohm's law as an equation	V=IR
12	Units for potential difference.	Volts (V)
13	State the units for current.	Amperes (A)
14	Which piece of equipment is used to measure current in a circuit?	Ammeter
15	Which piece of equipment is used to measure voltage in a circuit?	Voltmeter
	Topic:	**Series and parallel circuits (P.30)**
1	Do series circuits have one loop or multiple loops?	1 loop
2	Do parallel circuits have one loop or multiple loops?	Multiple loops
3	Describe the distribution of current in a series circuit	It is the same everywhere
4	Describe the distribution of potential difference in a series circuit	Split between components
5	Describe the distribution of current in a parallel circuit	Split up in the different loops
6	Describe the distribution of potential difference in a parallel circuit	The same in each loop
7	Name the component used to measure current	Ammeter
8	Name the component used to measure voltage	Voltmeter
9	Are voltmeters connected in series or parallel?	in parallel
10	Are ammeters connected in series or parallel?	In series
11	State the equation for calculating resistance in a series circuit	Rtotal = R1 +R2
12	How do you calculate total resistance in a series circuit?	Sum the resistance of each component
13	What affect does adding resistors have in a series circuit on the resistance?	Increases the total resistance
14	What affect does adding resistors have in a parallel circuit on the resistance?	Decreases the total resistance
15	Equation for resistance in a parallel circuit:	1/Rtotal = 1/R1 + 1/R2
	Topic:	**Ohmic/non-ohmic types of resistors (P.31)**
1	In ohmic components, which two variables are directly proportional?	Current and potential difference
2	If current and potential difference are directly proportional, what does this tell us about the resistance?	It is constant (gradient on IV graph).
3	Sketch an IV graph for an ohmic conductor	
4	Sketch a graph an IV for a filament bulb.	
5	Sketch a graph an IV graph for a diode.	
6	Name 4 non-ohmic conductors	Filament bulb, diodes, thermistors, LDRs
7	Why are filament light bulbs non-ohmic?	Current ↑, temperature ↑, resistance ↑
8	Describe the relationship between current and potential difference for a diode.	Current only flows in one direction (has a very high resistance in the other direction)
9	Describe the relationship between temperature and resistance in a thermistor.	Temperature ↑, resistance ↓
10	State one use of a thermistor	Thermostat

11	Describe the relationship between light intensity and resistance in an LDR	Light intensity ↑, resistance ↓
12	State a use of an LDR	Switching lights on when it gets dark e.g. street lamps.
13	Draw the symbol of a resistor.	
14	Symbol of a variable resistor.	
15	Symbol of LDR	
	Topic:	**Mains electricity (P.32)**
1	Is mains electricity AC or DC?	AC
2	What do AC and DC mean?	Alternating current Direct current.
3	State the frequency of UK mains supply	50Hz
4	State the potential difference of UK mains supply	230V
5	What are the names of the three wires in a three core cable	Live, neutral, earth.
6	State the colour of a)earth wire, b)live wire, c) neutral wire	a)Green and yellow stripes, b)brown, c)blue
7	State the function of the live wire.	Carries alternating potential difference from the supply
8	State the function of the neutral wire.	Completes the circuit
9	Function of the earth wire.	Safety wire to remove excess potential difference (to stop the appliance becoming live)
10	State the potential difference between the live wire and earth wire.	230V
11	State the potential difference of the neutral wire.	At or close to 0V
12	State the potential difference of the earth wire.	0V unless there is a fault.
13	State the equation for electrical power (that uses potential difference)	P= IV
14	State two things that affect the amount of energy an appliance transfers	Power and time (E=Pt)
15	State the equation we use to calculate the energy transferred by a device that uses charge flow	E = QV
	Topic:	**Energy and power of electricity and the National Grid (P.33)**
1	State the equation that links current, potential difference and power	P = IV power (W) = current (I) x potential difference (V)
2	State the equation that links current, power and resistance	P = I2R Power (W) = current2 (A) x resistance (Ω)
3	State the two most commonly wasted forms of energy	Thermal and sound
4	When energy is wasted, what happens to it?	It is dissipated into the environment
5	State the equation that links time, energy and power	E=Pt energy (J) = power (W) x time (s)
6	State the equation that links energy, potential difference and charge flow	E = QV energy (J) = charge flow (C) x potential difference (V)
7	What is the national grid composed of?	Cables and transformers linking power stations to consumers.
8	What is the national grid used for?	Supplying electrify to houses
9	State the effect of step up transformers on potential difference	Increases p.d.
10	State the effect of step down transformers on potential difference	Decreases p.d.
11	State the effect of step up transformers on current.	Decreases current.
12	State the effect of step down transformers on current.	Increases current.
13	Why are step up transformers used?	To reduce energy loss from cables (thermal)
14	Why are step down transformers used?	To reduce the potential difference to make it safe for domestic use.

15	Why is the national grid efficient?	Transformers reduces heat loss from wires when electricity travels long distances

P1 – Specific Heat Capacity	**Big Question 1:** Determine the specific heat capacity of a material IV: Material DV: Temperature change CV: Energy input, time, mass of the block	*3 metal blocks (copper, iron, aluminium) *a thermometer *a pipette to put water in the thermometer hole *a 12 V immersion heater *a 12 V power supply *an ammeter and a voltmeter *five connecting leads *a stop clock *a balance.	1) Measure the mass of the copper block using the top pan balance. 2) Wrap insulation around the block. 3) Place the heater in the larger hole in the block 4) Connect the ammeter and power pack and heater in series and the voltmeter in parallel across the heater. 5) Use a pipette to add a small amount of water to the other hole and put the thermometer in this hole. 6) Set the power pack to 12V and turn it on. 7) Record the ammeter and voltmeter readings 8) Measure the temperature of the copper block and start the stop clock. 9) Record the temperature every minute for 10 minutes. 10) Record your results and use this to calculate the specific heat capacity of the copper block. 11) Repeat with the iron and aluminium blocks.	Aluminium has the highest SHC and copper the lowest. *The energy required to raise 1kg of a substance by 1 degree Celsius. Substances with high specific heat capacity take a long time to heat up but also a long time to cool down.*	You will be required to calculate power and then use this to work out energy. You will also need to work out the gradient from a graph of work done vs temperature change.
P3 - Resistance	**Big Question 1**: Investigate the effect of the length of a wire on resistance IV: Length of wire DV: Resistance CV: Thickness of the wire **Big Question 2**: Investigate the effect of different combinations of resistors in series and in parallel.	**Big Question 1:** *a power supply *ammeter *voltmeter *crocodile clips *resistance wire *metre rule *connecting leads *a battery or suitable power supply *a switch *ammeter *voltmeter *crocodile clips *two 10 Ω resistors *connecting leads	**Big Question 1:**  1) Set up the circuit as shown in the diagram below. 2) Place the crocodile clips A and B 10cm apart on the wire. 3) Turn on the power pack and measure the readings for the voltmeter and ammeter at this distance. 4) Turn off the power pack so that the wire does not overheat. 5) Move the crocodile clips so that they are 20cm, 30cm, 40cm and 50cm apart and repeat steps 3 & 4.  6) Calculate resistance for each length of wire. 7) Repeat the experiment three times and remove any anomalies so that you can calculate an accurate mean. **Big Question 2:**  1) Set up the circuit as shown below. 2) Switch on and record the readings on the ammeter and the voltmeter. 3) Calculate the total resistance of the series circuit. 4) Set up the circuit for two resistors in parallel. 5) Calculate the total resistance of the parallel circuit.  	**Big Question 1:** As length of wire increases, resistance should increase in a directly proportional relationship. This is because there are more ions for the electrons to collide with. **Big Question 2:** Total resistance in the series circuit should be approximately 20Ω. Total resistance in the series circuit should be less than 10Ω.	Investigate the relationship between thickness of a wire and resistance. Investigate the resistance of individual resistors in a series and parallel circuit.

P4 – IV characteristics & Ohms' Law	**Big Question:** Use circuits to investigate the I-V characteristics of a filament lamp, diode and a resistor.	**Filament light bulb/resistor:** *ammeter *voltmeter *wires *filament lamp *variable power pack *resistor **Diode:** *Milliammeter *voltmeter *wires *diode *variable power pack *resistor labelled P	**A filament light bulb/resistor:** 1) Use the circuit diagram to set up your circuit. 2) Record the readings on the ammeter and voltmeter. 3) Adjust the voltage on the power pack. 4) Repeat the reading on the ammeter and voltmeter. 5) Switch the wires around on the power pack so that the current is flowing in the opposite direction.  6) Continue to vary the voltage and record the readings on the ammeter and voltmeter. 7) Repeat the experiment but swapping the filament light bulb for a resistor. **A diode:** 1) Lower the potential difference to less than 5V.  2) Set up the circuit as shown to the right. 3) Record the readings on the milliammeter and voltmeter. 4) Adjust the potential difference several times to collect several pairs of readings. 5) Swap the wires so that the current flows in the opposite direction and take 4 more pairs of readings.	Use the results to draw a graph to show the characteristics of each component. **Filament Bulb:**  **Resistor:**  **Diode**: 	
P5 – Density	**Big Question:** Determine the density of regular and irregularly shaped objects.	**Regular objects:** *various regular shaped objects *30cm ruler *digital balance **Irregular objects:** *a digital balance * a displacement can * various measuring cylinders *beaker of water and an extra empty beaker *paper towels *a selection of irregularly shaped objects. **A liquid** *a digital balance *a 100cm3 measuring cylinder *sugar solution of unknown concentration	**Regular objects:** 1) Calculate the volume of the object using length x width x height. 2) Record the mass of the object using the top pan balance 3) Calculate the density by dividing mass by volume. **Irregular objects:** 1) Measure the mass of the irregular shaped object using a top pan balance. 2) Put the displacement can on a wooden block with the spout above an empty beaker. 3) Fill the can with water until the water drips from the spout. 4) Replace the beaker with the measuring cylinder which will give the most accurate reading. 5) Place the object into the displacement can until it is completely submerged. 6) Collect the water and this will give you the volume of the object. 7) Divide this by the object's mass to give the density. **A liquid:** 1) Measure the mass of an empty measuring cylinder. 2) Add 100cm3 of sugar solution into it and record the mass. 3) Use this to calculate the mass of the liquid (total mass – mass of measuring cylinder). 4) Then calculate the liquid's density by doing mass/volume.	Solids should be denser than liquids/porous objects.	You may be asked to identify an object by calculating its density and then looking it up on a density table.