

Paper 2 knowledge booklet

TRIPLE

Name: _____

Science Class: _____

Science Teacher: _____

Instructions:

1. Learn each of the quiz questions and answers off by heart. This could be done by:
 - turning them into flash cards and testing yourself
 - using 'look, cover, write, check'
 - asking a friend or family member to quiz you
2. Practice applying your knowledge by:
 - Take each learning statement from the Mastery matrix and prove you can do it by answering that statement in your revision notebook.
 - For any statement you cannot answer, use your revision guide to make notes and try to re-learn it.
 - If you are still stuck, use YouTube or ask a friend to re-explain.
3. Make a list of any bits of the knowledge that you are still struggling to remember or understand. At this point you can ask you teacher to explain it again.
4. Keep track of how much revision you are doing using the '200 To Great Challenge'.

Top tips for revision:

Ditch... ❌	Instead... ✅
Re-reading or highlighting your notes hundreds of times.	Turn each note into a quiz question and test yourself repeatedly on this.
Leaving your revision until the night before.	Start your revision now.
Spending hours on only one topic.	Spend 15 minutes on one topic, have a 2 minute break, and then move onto a new topic.
Ignoring things you find difficult, hoping that they won't come up in the exam.	Mix up your revision by moving from one topic to another one, then coming back to the first topic later on.

Biology

Mastery Matrix:

Unit	Topic	Learning statement	Tier	Course	Revision Guide (double)	Revision Guide (triple)	1	2	3
Cell Biology	Cell division (mitosis)	Describe how cloning can be used in “cuttings”, “tissue cultures”, “embryo transplants”, “adult cell cloning” (triple only)	F	T		B83			
Cell Biology	Sexual and asexual reproduction (meiosis)	Explain the process of sexual reproduction and link this to variation	F	A	64	B74			
Cell Biology	Sexual and asexual reproduction (meiosis)	Explain the process of meiosis which leads to the formation of gametes	F	A	64	B74			
Cell Biology	Sexual and asexual reproduction (meiosis)	Explain the process of asexual reproduction	F	A	64	B74			
Cell Biology	Sexual and asexual reproduction (meiosis)	Model the behaviour of chromosomes during meiosis	F	A	64	B74			
Cell Biology	Sexual and asexual reproduction (meiosis)	Compare advantages and disadvantages of sexual and asexual reproduction (triple only)	F	T		B75			
Cell Biology	The DNA code	Describe the structure of DNA	F	A	65	B76			
Cell Biology	The DNA code	Explain how genes code for a particular sequence of amino acids which in turn code for a particular protein (triple only)	F	T		B77			
Cell Biology	The DNA code	Explain what the human genome is and the importance of mapping it	F	A	65	B76			
Cell Biology	The DNA code	Use genetic crosses to predict outcomes of a monohybrid cross	F	A	66	B79			
Communicable Diseases	Developing new medicines	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)	F	A	44	B81			
Communicable Diseases	The Brain	Describe the structure and the role of the brain (triple only)	F	T		B49			
Communicable Diseases	The Brain	Identify three specific parts of the brain from a diagram and explain their specific functions – cerebral cortex, cerebellum, medulla (triple only)	F	T		B49			
Communicable Diseases	The Brain	Explain some difficulties in investigating brain function and treating brain damage and diseases (triple only)	F	T		B49			
Communicable Diseases	The Brain	Explain how neuroscientists have mapped regions of the brain to particular functions (triple only)	F	T		B49			
Communicable Diseases	The Brain	Evaluate the risks and benefits of procedures carried out on the brain and the nervous system (triple only)	F	T		B49			
Communicable Diseases	The Eye	Describe the function of the eye (triple only)	F	T		B49			
Communicable Diseases	The Eye	Label a diagram of the eye (triple only)	F	T		B49			
Communicable Diseases	The Eye	Explain the process of accommodation (triple only)	F	T		B49			
Communicable Diseases	The Eye	Explain the causes of short sightedness (myopia) and long sightedness (hyperopia) (triple only)	F	T		B49			
Communicable Diseases	The Eye	Describe how these defects are treated and how new technologies are helping to improve this (triple only)	F	T		B49			
Communicable Diseases	The Eye	Interpret ray diagrams, showing these two defects and showing how spectacle lens correct this (triple only)	F	T		B49			
Human Biology	Kidneys	Describe the function of the kidneys (triple only)	F	T		B51			
Human Biology	Kidneys	Describe how urea is formed from excess amino acids (triple only)	F	T		B51			
Human Biology	Kidneys	Explain how the kidneys produce urine (triple only)	F	T		B51			
Human Biology	Kidneys	Use bar charts & tables of glucose, ions & urea to analyse data from before & after filtration (triple only)	F	T		B51			
Human Biology	Kidneys	Describe the effect of ADH on the permeability of the kidney tubules and link to the ‘negative feedback loop’ (triple only)	F	T		B51			
Human Biology	Kidneys	Explain how kidney failure may be treated (including dialysis and kidney transplant) (triple only)	F	T		B51			
Human Biology	Kidneys	Evaluate treating organ failure with mechanical devices e.g. transplant (triple only)	F	T		B51			
Plant Biology	Introducing ecosystems	Define “ecosystem”	F	A	74	B86			

Plant Biology	Introducing ecosystems	Define 'interdependence' and explain what species depend on	F	A	74	B86			
Plant Biology	Introducing ecosystems	Describe what plants and animals 'compete' with each other for	F	A	74	B86			
Plant Biology	Introducing ecosystems	Describe structural, behavioural and functional adaptations of organisms	F	A	75	B87			
Plant Biology	Introducing ecosystems	Define extremophiles linking to the conditions that they inhabit (bacteria in deep sea vents)	F	A	75	B87			
Plant Biology	Interdependence	Interpret data from graphs and tables relating to predator and prey relationships predicting numbers of species based on changes in this data	F	A	77	B89			
Plant Biology	Interdependence	List biotic and abiotic factors and explain how changes in them would affect a given community	F	A	74	B86			
Plant Biology	Interdependence	Define primary, secondary and tertiary consumers	F	A	77	B89			
Plant Biology	Interdependence	Explain the role of producers in food chains	F	A	77	B89			
Plant Biology	Interdependence	Use a range of experimental methods to calculate the abundance and distribution of species in a given ecosystem	F	A	75	B87			
Plant Biology	Interdependence	RP Field Investigations (a - triple only): Measure the population size of a common species (b - double & triple) Investigate the effects of a factor on the distribution of a species using sampling techniques	F	A	75	B87			
Plant Biology	Interdependence	Describe the differences in the trophic levels of organisms within an ecosystem (triple only)	F	T		B89			
Plant Biology	Interdependence	Describe the numbering system of trophic levels and the importance of each level (triple only)	F	T		B92			
Plant Biology	Interdependence	Describe the role of decomposers within an ecosystem (triple only)	F	T		B88			
Plant Biology	Interdependence	Construct accurate pyramids of biomass (triple only)	F	T		B92			
Plant Biology	Interdependence	Explain how biomass is lost between the different trophic levels (triple only)	F	T		B92			
Plant Biology	Interdependence	Describe quantitatively the proportion of energy transferred between trophic levels and use this to calculate efficiency (triple only)	F	T		B92			
Plant Biology	Plant Hormones	Identify 3 plant hormones and their effects within plants (triple only)	F	T		B54+B55			
Plant Biology	Plant Hormones	Describe the processes of phototropism, geotropism/gravitropism (triple only)	F	T		B54			
Plant Biology	Plant Hormones	Describe how the 3 plant hormones are used in agriculture and horticulture (triple only)	F	T		B55			
Plant Biology	Plant Hormones	RP Plant Responses: Investigate the effect of light or gravity on the growth of newly generated seeds (triple only)	F	T		B55			
Plant Biology	Natural Recycling	Describe the carbon cycle and its importance	F	A	76	B88			
Plant Biology	Natural Recycling	Describe the water cycle and its importance	F	A	76	B88			
Plant Biology	Natural Recycling	Explain factors that affect the rate of decay, calculating rate changes using this to explain how to speed up the production of compost (triple only)	F	T		B88			
Plant Biology	Natural Recycling	Explain how biogas generators can be used to produce a fuel (triple only)	F	T		B88			
Plant Biology	Natural Recycling	RP Decay: Investigate the effects of temperature on the rate of decay of fresh milk by measuring pH change (triple only)	F	T		B88			
Plant Biology	Natural Recycling	Evaluate the impact of environmental factors on the distribution of a species (temperature, availability of water, atmospheric gas composition) (triple only)	F	T		B90			
Plant Biology	Humans and the environment	Define biodiversity and explain its importance	F	A	78	B90			
Plant Biology	Humans and the environment	Explain in detail human impact on biodiversity (waste management, pollution, land use, deforestation, global warming)	F	A	78	B90			
Plant Biology	Humans and the environment	Describe and evaluate some of the programs used to reduce the negative effects of humans on ecosystems and biodiversity (breeding programs, protection/regeneration of rare habitats, reintroduction of field margins and hedgerows, reduction of deforestation, reduction of carbon emissions, increased recycling)	F	A	78	B90-92			
Plant Biology	Humans and the environment	Describe 6 biological factors threatening food security (triple only)	F	T		B92			
Plant Biology	Humans and the environment	Define 'sustainability' (triple only)	F	T		B92			
Plant Biology	Humans and the environment	Explain how to improve the efficiency of food production (triple only)	F	T		B93			
Plant Biology	Humans and the environment	Describe and evaluate modern farming techniques (including: intensive farming, sustainable fisheries and sustainable farming) (triple only)	F	T		B93			

Plant Biology	Humans and the environment	Explain how microorganisms can be cultured for food (e.g. fungus fusarium -> mycoprotein) (triple only)	F	T		B93			
Evolving organisms	Classifying organisms	Describe the role of Carl Linnaeus in development of a classification system (kingdom, phylum, class, order, family, genus, species)	F	A	72	B84			
Evolving organisms	Classifying organisms	Explain the binomial naming system of organisms	F	A	72	B84			
Evolving organisms	Classifying organisms	Define 'species' (linking to future fertility and breeding)	F	A	72	B84			
Evolving organisms	Classifying organisms	Explain how classification models have developed over time due to improvements in microscopy and biochemistry)	F	A	72	B84			
Evolving organisms	Natural selection and evolution	Describe and explain the theory of 'natural selection' and 'evolution'	F	A	68	B80			
Evolving organisms	Natural selection and evolution	Describe the role of Charles Darwin and his book 'The origin of species' on the development of the theory of evolution and the issues he had with getting people to accept this theory (triple only)	F	T		B80			
Evolving organisms	Natural selection and evolution	Explain the theory of Jean Baptiste Lamarck and the theory of evolution (triple only)	F	T		B81			
Evolving organisms	Natural selection and evolution	Explain the role of Alfred Russell Wallace in developing the theory of evolution and his pioneering work on speciation (triple only)	F	T		B80			
Evolving organisms	Natural selection and evolution	Describe the evidence for evolution including antibiotic resistant and the fossil record	F	A	69	B81			
Evolving organisms	Natural selection and evolution	Describe what a fossil is and explain how they form and explain why these cannot be used as evidence for how life began on Earth	F	A	69	B81			
Evolving organisms	Natural selection and evolution	Interpret information from evolutionary trees	F	A	73	B85			
Evolving organisms	Natural selection and evolution	Explain what extinction is and describe factors which may contribute to the extinction of a species	F	A	72	B84			
Evolving organisms	Natural selection and evolution	Explain the role of Mendel and other scientists on our changing understanding of genetics (triple only)	F	T		B80			
Evolving organisms	Selective breeding & genetic engineering	Describe selective breeding and explain the potential benefits and risks of this process (linking to disease resistance in crops, animals with more milk and meat, large or unusual flowers and domestic dogs with a gentle nature)	F	A	70	B82			
Evolving organisms	Selective breeding & genetic engineering	Define 'genetic engineering'	F	A	70	B82			
Evolving organisms	Selective breeding & genetic engineering	Describe the main steps in genetic engineering	HT	A	71	B82			HT
Evolving organisms	Selective breeding & genetic engineering	Give examples of genetic engineering (including crop resistance to diseases, insect attack and herbicides, crops with bigger, better fruits and bacterial cells used in the production of insulin)	F	A	71	B82			
Evolving organisms	Selective breeding & genetic engineering	Evaluate the use of genetic engineering and modification and describe the potential uses of this in the future	F	A	71	B83			
Evolving organisms	The Nervous System	Describe the structure of the nervous system	F	A	51	B48			
Evolving organisms	The Nervous System	Explain how it is adapted for its function and why it is important	F	A	51	B48			
Evolving organisms	The Nervous System	Describe the pathway of a message from stimulus to response	F	A	51	B48			
Evolving organisms	The Nervous System	Describe the design of a reflex arc and explain its purpose	F	A	51	B48			
Evolving organisms	The Nervous System	Use tables and graphs to extract information about reflex actions	F	A	51	B48			
Evolving organisms	The Nervous System	RP Reaction Time: Plan and carry out an investigation into the effect of a factor on human reaction time	F	A	51	B48			
Evolving organisms	Homeostasis	Define 'homeostasis' and explain why it is important	F	A	50	B46			
Evolving organisms	Homeostasis	List three factors controlled by homeostasis in the human body (blood glucose concentration, temperature, water levels)	F	A	50	B46			
Evolving organisms	Homeostasis	Explain how these automatic systems are controlled	F	A	50	B46			
Evolving organisms	Homeostasis	Describe what monitors and controls body temperature (triple only)	F	T		B46			
Evolving organisms	Homeostasis	Explain the role of the skin in thermoregulation (triple only)	F	T		B47			
Evolving organisms	Homeostasis	Describe and explain the body's response to extreme body temperature (triple only)	F	T		B47			
Evolving organisms	The endocrine system	Describe the principals of hormonal coordination including what makes up the endocrine system	F	A	52	B50			

Evolving organisms	The endocrine system	Describe what hormones are and label six glands in the body	F	A	52	B50			
Evolving organisms	The endocrine system	Describe the role of the pituitary gland	F	A	52	B50			
Evolving organisms	The endocrine system	Explain the roles of thyroxine (produced by the thyroid gland) and adrenaline (produced by the adrenal gland) linking this to negative feedback loops (HT only)	HT	A	52	B50			
Evolving organisms	The endocrine system	Describe and explain how the body controls blood glucose concentration (making reference to glucose, glycogen, glucagon, negative feedback cycle, insulin and the pancreas)	F	A	53	B50			
Evolving organisms	The endocrine system	Explain the effect on cells of osmotic changes in bodily fluids (triple only)	F	T		B51			
Evolving organisms	The endocrine system	Describe how water ions and urea are lost from the body (triple only)	F	T		B51			
Evolving organisms	Diabetes	Explain type 1 and type 2 diabetes and how they can be treated	F	A	53	B50			
Evolving organisms	Diabetes	Compare and contrast the two types of diabetes	F	A	53	B50			
Evolving organisms	Diabetes	Compare data (from graphs) regarding blood glucose levels in people with and without diabetes	F	A	53	B50			
Evolving organisms	Hormones in the reproductive system	Describe the roles of FSH, LH, Oestrogen and progesterone in the menstrual cycle	F	A	54	B52			
Evolving organisms	Hormones in the reproductive system	Describe the roles of oestrogen and progesterone in puberty	F	A	54	B52			
Evolving organisms	Hormones in the reproductive system	Interpret graphs relating to hormone levels in the menstrual cycle (HT only)	HT	A	54	B52			
Evolving organisms	Hormones in the reproductive system	Link hormone cycles to ovulation and menstruation	F	A	54	B52			
Evolving organisms	Hormones in the reproductive system	Evaluate hormonal and non-hormonal methods of contraception (oral, injection, implant, skin patch, condoms, diaphragms, intrauterine device, spermicidal agents, abstinence, sterilisation)	F	A	55	B53			
Evolving organisms	Hormones in the reproductive system	Explain why issues around contraception are not answered solely by the field of Science	F	A	55	B53			
Evolving organisms	Hormones in the reproductive system	Explain the process of embryo screening and evaluate based on ethical, social and economic perspectives	F	A	55	B53			
Evolving organisms	Hormones in the reproductive system	Explain the use of FSH and LH as a fertility drug (HT only)	F	T	55	B53			
Evolving organisms	Hormones in the reproductive system	Explain IVF (in vitro fertilisation) (HT only)	HT	A	55	B53			
Evolving organisms	Hormones in the reproductive system	Explain how developments in microscopy have enabled IVF treatments to be improved (HT only)	HT	A	55	B53			
Evolving organisms	Hormones in the reproductive system	Evaluate social and ethical issues and risks from the perspective of patients and doctors in IVF (HT only)	HT	A	55	B53			
Evolving organisms	Hormones in the reproductive system	Compare nervous system and hormonal responses	F	A	54	B52			

Knowledge organiser:

	Paper:	B2
	Topic:	Sexual and asexual reproduction (meiosis) (B.5)
1	Another word for sex cells is...	gametes
2	State the 2 gametes in animals	Sperm & egg cells
3	State the 2 gametes in flowering plants	Pollen & egg cells
4	State the number of parents involved in sexual reproduction	2
5	State the number of parents involved in asexual reproduction	1
6	Describe the cells produced from mitosis	2 genetically identical daughter cells
7	Describe the cells produced from meiosis	4 genetically different daughter cells
8	What is mitosis used for?	Growth and repair
9	What is meiosis used for?	Making gametes
10	Define "diploid cell"	A cell with a full set of chromosomes
11	Define "haploid cell"	A cell with half of the number of chromosomes
12	How many divisions occur in mitosis?	1
13	How many divisions occur in meiosis?	2
14	Are haploid or diploid cells produced during mitosis?	Diploid
15	Are haploid or diploid cells produced during meiosis?	Haploid
	Topic:	The DNA code (B.6)
1.	State the name of the genetic material found in the nucleus of a cell	DNA
2.	Describe the structure of DNA	Double helix
3.	State the name given to one molecule of DNA	Chromosome
4.	State the name of a small section of DNA	A gene
5.	What does a gene code for?	A sequence of amino acids which join to form a specific protein
6.	Define the "human genome"	The sequence of the human DNA
7.	State 3 reasons for mapping the human genome	1) locating disease causing genes 2) treating inherited disorders 3) tracing human migration patterns
8.	Define "homozygous"	two of same alleles e.g. BB
9.	Define "heterozygous"	Two different alleles e.g. Bb
10.	Define "dominant"	always expressed
11.	Define "recessive"	Expressed only with 2 of this allele present
12.	Define 'genotype'	The 2 alleles present e.g. Bb
13.	Define 'phenotype'	The characteristic expressed e.g. brown eyes
14.	Is cystic fibrosis caused by a dominant or recessive allele?	Recessive
15.	Is Huntingdon's caused by a dominant or recessive allele?	Dominant
	Topic:	The Brain and eye (triple only) (B.13)
1.	State the location & function of the cerebral cortex	Outer section - perception, memory, language
2.	State the location & function of the cerebellum	Base of brain - balance & co-ordination of voluntary movement
3.	State the location & function of the medulla	In brain stem - controls involuntary functions e.g. breathing
4.	Why is it difficult to investigate brain function?	Lots of different areas work together
5.	State three ways of investigating brain functions & regions	Brain damage patients, electrical stimulation of brain regions, MRI scanning
6.	State two changes that can occur in the eye	Accommodation (for focussing on near/far objects) Adaptation to dim/bright light
7.	State two things that the eye organ is sensitive to	Light intensity & colour
8.	State the name of the coloured part of our eye that expands in bright light and contracts in dim light.	Iris
9.	State the name of the whole in the front of our eye that allows light in	Pupil
10.	What happens to the size of the iris and pupil during bright light	Pupil = small Iris = big
11.	What is the name for the light detecting cells at the back of the eye?	Retina
12.	What happens to the eye during accommodation for focussing on near objects?	1) Ciliary muscles contract 2) Suspensory ligaments loosen 3) lens is thick -> more refraction
13.	What happens to the eye during accommodation for focussing on far objects?	1) Ciliary muscles relax 2) Suspensory ligaments pulled tight 3) lens is thin -> less refraction
14.	State the name for short sightedness	Myopia (focal point in front of retina)
15.	State the name for long sightedness	Hyperopia (focal point past retina)
	Topic:	Kidneys (triple only) (B.18)
1.	When amino acids are broken down by the liver, what is produced?	Amino acid -> ammonia (toxic) -> urea

2.	What is the name for the process where amino acids are converted into ammonia?	Deamination
3.	Where in the body are amino acids converted into ammonia?	The liver
4.	Why is ammonia converted straight into urea?	Because it's toxic
5.	What is the name for the process where useful substances are reabsorbed from urine into the blood?	Selective reabsorption
6.	What are the tiny tubes in the kidney called?	Tubules
7.	Which hormone controls the water level in the body?	Antidiuretic hormone (ADH)
8.	Where is the hormone that controls the water level in the body released from?	Pituitary gland
9.	What happens to the amount of ADH released when there is too much water in the blood?	Very little ADH released
10.	What happens to the amount of ADH released when there is too little water in the blood?	A lot of ADH released
11.	Name a treatment for kidney failure?	Dialysis or transplant
12.	What is the name of the blood vessel going into and out of the kidney?	In: Renal ARTERY Out: Renal VEIN
13.	What type of transport is used for water to be reabsorbed from the kidney tubules into the blood?	Osmosis
14.	What type of transport is used for glucose/mineral ions to be reabsorbed from the kidney tubules into the blood?	Active Transport
15.	Why is protein not filtered out of the blood by the nephron?	Too big
	Topic:	Introducing ecosystems and interdependence (B.20)
1.	State the name given to a habitat and all of the organisms living inside of it?	Ecosystem
2.	What is the name for living factors that affect species?	Biotic
3.	What is the name for non-living factors that affect an environment?	Abiotic
4.	State the 3 types of adaptations that exist	1) Structural 2) Behavioural 3) Functional
5.	State 4 things that animals compete for	Water, mates, territory, food
6.	State 4 things that plants compete for	Nutrients, Water, Space, Light
7.	What is the scientific word for species relying on each other?	Interdependence
8.	Similar organisms that can breed together to produce fertile offspring are known to be the same _____?	Species
9.	Name 7 abiotic factors	1) Light intensity, 2) temperature, 3) moisture, 4) soil pH, 5) wind intensity, 6) CO ₂ levels (plants) 7) oxygen levels (aquatic animals)
10.	Name 4 biotic factors	1) food availability, 2) new predators, 3) new pathogens, 4) species outcompeting
11.	What is the name given to an organism that lives in an extreme environment?	Extremophile
12.	What is the name given to the TYPE of organism that absorbs sunlight and uses it to produce glucose?	Producer
13.	What type of animal feeds off of the dead remains of other animals?	Scavenger
14.	State two experimental techniques used to determine the abundance and distribution of a species	Transect (line across an environment) & quadrat (1m metal square)
15.	What is the name given to the type of sampling that is done along a line?	Transect
	Topic:	Interdependence (triple only) (B.22)
1.	Which organisms make up the trophic level 1?	Plants and algae (producers)
2.	Which type of organisms make up trophic level 2?	Primary consumers/herbivores
3.	Which type of organisms make up trophic level 3?	Secondary consumers/carnivores
4.	Which type of organisms make up trophic level 4?	Tertiary consumers/carnivores
5.	What is the name given to a carnivore that has no predators?	Apex predator
6.	What is the name given to an organism that breaks down dead plant and animal matter?	Decomposer
7.	How do decomposers break down dead plant and animal matter?	Secreting enzymes
8.	How do decomposers absorb food molecules?	Diffusion
9.	What is the name given to the diagram drawn to represent the amount of biomass found at each trophic level?	Pyramid of biomass
10.	Which trophic level is always found at the bottom of a pyramid of biomass?	Trophic level 1
11.	What happens to the amount of biomass as you move up the food chain?	It decreases
12.	Approximately what percentage of incident energy from light is transferred into plants during photosynthesis?	0.01
13.	Approximately what percentage of biomass is transferred from each trophic level to the trophic level above?	0.1

14.	Which is biomass lost between trophic levels?	1) lost as faeces 2) lost as CO ₂ , water and urea 3) used as glucose in respiration
15.	How do you calculate the efficiency of biomass transfer between each trophic level?	Biomass transferred/initial biomass x 100
	Topic:	Plant hormones (triple only) (B.27)
1.	What is the name of a plant's response to (a) light (b) gravity (triple only)	(a) light = phototropism (b) gravity = gravitropism/geotropism
2.	Which plant hormone initiates seed germination? (triple only)	Gibberellins
3.	Which hormone causes cell division and fruit ripening (triple only)	Ethene
4.	State three uses of auxins	1) weed killer, 2) rooting powder, 3) tissue culture
5.	State one use of ethene	Controlling fruit ripening
6.	State three uses of gibberellins	1) end seed dormancy, 2) promote flowering 3) increase fruit size
7.	When a shoot grows towards the light, what kind of tropism is demonstrated?	Positive phototropism
8.	When a root grows away from the light, what kind of tropism is demonstrated?	Negative phototropism
9.	When a root grows down (with gravity), what kind of tropism is demonstrated?	Positive geotropism
10.	When a shoot grows up (against gravity), what kind of tropism is demonstrated?	Negative geotropism
11.	How does auxin cause a shoot to grow towards light?	Auxin moves to shady side -> elongation of cells
12.	How does auxin cause a plant to against gravity?	Auxin moves to lower side -> elongation of cells
13.	State the names of 3 plant hormones	1) Ethene, 2) Gibberellins, 3) Auxin
14.	Which transport method is used to move auxin from the tip of a plant to other parts?	Diffusion
15.	Which part of a plant contains lots of new forming cells?	Meristem
	Topic:	Natural recycling (triple only) (B.28)
1.	How do plants remove carbon from the air?	Photosynthesis (CO ₂ in)
2.	How is carbon moved from living organisms back into the air?	Respiration (CO ₂ released)
3.	How is carbon moved from fossil fuels back into the air?	Combustion (CO ₂ released)
4.	How is carbon moved from dead organisms into the air?	Decomposition (by decomposers) (CO ₂ released)
5.	What is the scientific name for rain?	Precipitation
6.	How does water move from lakes/the sea into the air?	Evaporation
7.	Which process leads to cloud formation?	Condensation
8.	What is the name of evaporation of water from plants?	Transpiration
9.	State 3 factors that affect the rate of decay (triple only)	Temperature, water, availability of oxygen
10.	State one human use of decomposition (triple only)	Making compost
11.	Which gas is produced by a biogas generator? (triple only)	Methane
12.	Describe the effect of temperature on rate of decay (triple only)	increase temp -> increase decay (to 37°C)
13.	Which enzyme breaks down the fat in milk? (triple only)	Lipase
14.	State the colour of phenolphthalein in acidic and alkaline conditions (triple only)	Alkaline (pink) Acid (colourless)
15.	How do decomposers feed? (triple only)	Secrete enzymes, small food molecules diffuse into decomposer
	Topic:	Humans and the environment (B.29)
1.	Define "biodiversity"	variety of all the different species on earth/within an ecosystem
2.	Why is increased biodiversity good?	Increases ecosystem stability
3.	State three ways that humans can cause water pollution	Sewage, fertilisers, toxic chemicals
4.	State three ways that humans can cause air pollution	Smoke, acidic gases
5.	State three ways that humans can cause land pollution	Landfill sites, toxic chemicals
6.	State 4 ways that humans are decreasing the land available for living organisms	building, quarrying, farming, dumping waste
7.	State two uses of peat	Fuel & fertiliser
8.	What is the name for 'cutting down trees'	Deforestation
9.	State two reasons for deforestation occurring	Land for farming & growing biofuels
10.	State 5 ways that humans are trying to increase biodiversity	1) Breeding endangered species 2) protecting rare habitats 3) Hedgerows 4) Afforestation 5) Recycling
11.	Define "food security" (triple only)	Having enough food to feed a population
12.	State 5 factors threatening food security (triple only)	1) Increasing birth rate, 2) changing diets, 3) new pests/pathogens, 4) environmental changes, 5) conflicts
13.	State two ways of intensively farming (triple only)	1) restricting movement, 2) controlling temperature of surroundings
14.	State two ways that fishing can be made more sustainable (triple only)	1) Controlling net size, 2) introducing fishing quotas
15.	State two uses of biotechnology (triple only)	Culturing microorganisms for food and modifying bacteria to produce human insulin
	Topic:	Classifying organisms (B.30)

1.	Name the 7 classification levels proposed by Carl Linnaeus (in order)	Kingdom, Phylum, Class, Order, Family, Genus, Species
2.	What does "binomial" literally mean?	Two names
3.	What do the two parts of a binomial name tell us?	(i) Genus (ii) Species
4.	Who introduced the 'domain' level to the classification system?	Carl Woese
5.	State two pieces of evidence that helped scientists to add the additional 'domain' level to the classification system	*better understanding of biochemical processes *being able to look at DNA
6.	State the meaning of the domain "archaea"	Primitive bacteria usually living in extreme environments (DNA is NOT contained in a nucleus)
7.	State the meaning of the domain "bacteria"	DNA is NOT contained in a nucleus, don't live in extreme environments
8.	State the meaning of the domain "eukaryote"	Their DNA is contained in a nucleus (protists, fungi, plant and animals)
9.	Define "species"	organisms that can breed together to produce FERTILE offspring
10.	List the 5 'classes' of classification	Mammals, reptiles, birds, fish, amphibians
11.	List 4 ways a species can become extinct slowly	*New predators *New diseases *Changes to the environment over time *More successful competitors
12.	State one way a species can become extinct rapidly	Catastrophic event e.g. volcanic eruption
13.	State the purpose of an evolutionary tree	A diagram used to show how closely related we think organisms are to each other
14.	State two pieces of evidence used to create an evolutionary tree	Fossil records and DNA samples
15.	List the 5 kingdoms?	Prokaryote, Protocista, Fungi, Animals, Plants
	Topic:	Natural selection and evolution (B.31)
1.	State three factors that can cause variation in a species	The environment, random mutations, sexual reproduction
2.	Define 'evolution'	The gradual change in the inherited characteristics of a population over time
3.	If enough variation occurs over time due to evolution, a new _____ is created	species
4.	What was Charles Darwin's theory called?	Theory of evolution through natural selection
5.	State the 4 steps to natural selection?	*Variation (Sexual reproduction/random Mutations) *environment Changes *better adapted organisms Survive and Reproduce *pass on their Genes to their offspring
6.	State three reasons why Darwin's theory was not originally accepted	*didn't know HOW characteristics were inherited *people believed GOD created all living things *Insufficient EVIDENCE
7.	What is a fossil?	The remains of an organism from hundreds of thousands of years ago
8.	List 4 ways a fossil may have formed	*hard parts of animals not decaying properly *conditions didn't allow decay *minerals replaced parts of the organism as it decayed *traces (e.g. footprints) preserved
9.	Describe how scientists use fossils	As evidence of how organisms have changed over time (evolution)
10.	Explain why fossils can't be used to provide evidence of how life began on Earth	Fossil record is incomplete (there are gaps)
11.	Explain why there are gaps in the fossil record	*Early animals had soft bodies so decayed easily *Geological activities destroyed fossils
12.	What is an antibiotic-resistant bacterium?	A bacteria that cannot be killed by an antibiotic
13.	What was the name of Charles Darwin's book?	The origin of species 1859
14.	Describe Jean-Baptiste Lamarck's (incorrect) theory (triple only)	Changes that occur DURING an organisms lifetime can be inherited by its offspring
15.	List the 3 steps in speciation (Alfred Wallace's theory) (triple only)	*Separation (e.g. by water) *Adaptation *Reproductive isolation (organisms so different they can't interbreed)
	Topic:	Selective breeding and genetic engineering (B.32)
1.	Describe Gregor Mendel's main discovery (triple only)	Inheritance of each characteristic is determined by 'units' that are passed on to descendants unchanged
2.	Describe the purpose of selective breeding	Humans breed plants & animals with particular desirable characteristics
3.	State two reasons to use selective breeding	*produce food crops *produce domesticated animals
4.	List 4 steps in selective breeding	1) Choose parent with desired characteristic 2) Breed them together 3) Choose best offspring 4) Continue over many generations
5.	State 4 examples of characteristics that you may selectively breed an organism for	*Disease resistance (food crops) *More milk/meat (animals) *Gentle nature (domestic animals) *Large/unusual flowers
6.	State one disadvantage of selective breeding in animals	Inbreeding -> health issues
7.	State one disadvantage of selective breeding in crops	Crops have very similar DNA so disease can kill them all

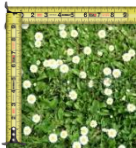
8.	Why was Mendel's work initially not accepted?	*He was a monk *He didn't publish his work in a well know journal
9.	Who discovered the structure of DNA?	Franklin, Watson & Crick
10.	Describe "gene theory"	The idea that genes are "units" of inheritance
11.	Define "genetic engineering"	Modifying (changing) the genome (genes) of an organism to give a desired characteristic
12.	State two examples of genetic engineering in practice	*Bacterial cells engineered to produce insulin *Plant crops engineered to be resistant to disease/have bigger better fruits
13.	Describe the 4 stages of genetic engineering	1) select desired characteristic 2) isolate gene 3) insert gene into vector 4) replicate
14.	Define "vector"	A ring of DNA (plasmid) or an organism that carries a gene from one organism into another
15.	Is the allele dominant or recessive for (a) Huntingdon's disease (b) cystic fibrosis?	(a) Huntingdon's = dominant (b) Cystic fibrosis = recessive
	Topic:	The nervous and endocrine system (B.33)
1.	Define "CNS"	Central Nervous System (brain and spinal cord)
2.	Define "PNS"	Peripheral Nervous System (neurones)
3.	Define "stimulus"	A change in the environment detected by receptors e.g. light, temperature, pressure, smell
4.	Define "receptor"	Specialised cells that detects the stimulus e.g. tongue, skin, nose, eye
5.	Define "effector"	Muscle/gland that responds to the motor neurone to cause a change
6.	Define "sensory neurone"	Neurone carrying electrical impulse FROM receptor to CNS
7.	Define "motor neurone"	Neurone carrying electrical impulse FROM the CNS to effector
8.	Define "relay neurone"	Neurone carrying electrical impulse from one part of the CNS to another
9.	Define "reflex response"	Rapid response which does not use conscious part before response occurs
10.	Describe how messages are sent through the nervous system	Through neurones (electrical)
11.	Describe how messages are sent through the endocrine system	Through blood (chemical)
12.	Which system (nervous or endocrine) transfers messages around the body quicker?	Nervous
13.	Which system (nervous or endocrine) does the response last for longer?	Endocrine
14.	Which gland is called the 'master gland'?	The pituitary gland
15.	Define "synapse"	A gap or junction between two neurons
	Topic:	Homeostasis (B.34)
1.	Name the 6 glands/organs in the endocrine system	Thyroid gland, pituitary gland, pancreas, adrenal gland, testes, ovaries
2.	State the hormone that is released from the adrenal gland and its effect on the body	Adrenaline - "fight or flight" (heart rate increases, blood directed to muscles, air passages dilate)
3.	State the hormone that is released from the thyroid gland and its effect on the body	Thyroxine - increases metabolism (chemical reactions)
4.	State the hormones that is released from the pituitary gland and their effect on the body	FSH (egg development) & LH (ovulation)
5.	State the hormone that is released from the testes and its effect on the body	Testosterone - puberty & sperm production (in boys)
6.	State the hormones that is released from the ovaries and their effect on the body	Oestrogen - causes uterus lining to rebuild Progesterone - maintains uterus lining
7.	Which two systems help to control homeostasis?	Nervous system and endocrine system
8.	Which disease is linked to an inability to control your blood glucose levels?	Diabetes
9.	Define "homeostasis"	Regulation of internal conditions of a cell or organism to maintain optimum conditions
10.	State three reasons for organisms requiring homeostasis	*So cells don't burst (too much water) *so enzymes work properly (temperature *so chemical reactions occur (water and glucose)
11.	State 4 things that are regulated in the body	Body temperature, blood glucose, water levels, ion levels
12.	Which part of the body detects and controls body temperature	Thermoregulatory centre (in the brain)
13.	State three ways that your body increases your body temperature if you get too cold	*Muscles contract and relax (shiver) to release thermal energy due to respiration *blood vessels in skin constrict to reduce blood flow and thermal energy loss *hairs on arms stand on end, trapping air beneath them
14.	State three ways that your body decreases it's temperature if you get too hot	*Sweat glands release sweat which evaporates - transferring thermal energy to the air *blood vessels in skin dilate so blood flow increases and more thermal energy lost *Hairs on arms lay flat

15.	What happens to the enzymes in your body if you get (a) too hot (b) too cold	(a) too hot = denatured (b) too cold = work too slowly
	Topic:	Diabetes (B.35)
1.	Which organ monitors and controls your blood glucose concentration?	The Pancreas
2.	Which hormone is released if there is too much glucose in the blood?	Insulin
3.	Which hormone is released if there is too little glucose in the blood?	Glucagon
4.	Describe the effect of insulin have in the body?	(Soluble) glucose stored in the muscle & liver cells as (insoluble) glycogen
5.	Describe the effect of glucagon have in the body?	(Insoluble) glycogen turned into (soluble) glucose and released from liver and muscle cells into blood
6.	Describe what is wrong with a person if they have type one diabetes and how it is treated	Not producing enough insulin (genetic) -> treat with insulin injections
7.	Describe what is wrong with a person if they have type two diabetes and how it is treated	Insulin not having an effect on the muscle/liver cells -> treat with controlled diet and exercise
8.	State the hormones that is released from the pancreas and it's effect on the body	Insulin - decreases blood glucose Glucagon - increases blood glucose
9.	Define "gland"	An organ that releases a hormone into the blood
10.	Define "hormone"	A chemical messenger that travels in the blood and targets organs
11.	Define 'negative feedback' (higher tier only)	Our body's way of monitoring changes in internal conditions and then responding to these changes so that homeostasis is regained
12.	Which type of diabetes is inherited?	Type one
13.	Which type of diabetes is caused by lifestyle	Type two
14.	How do glucagon & insulin travel around the body?	In blood
15.	State a risk factor for type 2 diabetes	Obesity
	Topic:	Hormones in the reproductive system (B.36)
1.	State the function of FSH (follicle stimulating hormone)	Causes egg to mature
2.	State where FSH is produced	Pituitary Gland
3.	State the hormone that FSH stimulates the production of (HT only)	Oestrogen from ovaries
4.	State the effect of oestrogen	Causes uterus lining to build up
5.	Which hormone inhibits FSH release? (HT only)	Oestrogen
6.	Which hormone does oestrogen stimulate? (HT only)	Luteinising hormone (LH)
7.	State the effect of luteinising hormone (LH) on the body	Causes ovulation
8.	Where is luteinising hormone produced?	Pituitary Gland
9.	Where is progesterone produced?	The empty egg follicle (corpus luteum)
10.	State the role of progesterone	Maintains uterus lining Inhibits FSH & LH
11.	Name 3 non-hormonal methods of contraception	Barrier method (diaphragm or condoms), abstinence, spermicide, sterilisation, some intrauterine devices
12.	Name 3 hormonal methods of contraception	Oral contraceptive pill, implant, injection, some intrauterine devices
13.	What does IVF stand for?	In Vitro Fertilisation (outside of the body)
14.	What are the 4 stages of IVF? (higher tier only)	1) Mother given FSH & LH to stimulate maturation of several eggs 2) eggs collected from mother and fertilised by sperm in lab 3) Fertilised eggs develop into embryos 4) Two embryos inserted into mothers uterus
15.	What is embryo screening?	Check embryo for genetic diseases and decide whether or not to use/abort the embryo
	Topic:	RP: Reaction time (B7) (B.47)
1.	What is the independent variable?	Attempt number
2.	What is the dependent variable?	Reaction time (s)
3.	Name 3 control variables	1) Same hand used 2) Same person dropping ruler 3) Hand placed in same position each time
4.	How is the reaction time measured?	A ruler is dropped and caught and the distance on the ruler is recorded
5.	Name one source of error in the method	Measuring the distance from a different place on the ruler each time
6.	Give two ways to improve the accuracy of the results	1) Measure from above the thumb 2) Use a computer programme
7.	How do we turn the distance on the ruler to a reaction time?	Use a conversion chart to turn the distance into a time
8.	Name the equipment	Metre rule, chair, table, partner
9.	Describe where the hand should be placed	Place the forearm of your arm across the table with your hand overhanging the edge of the table
10.	Describe where the ruler should start from	The bottom of the ruler at 0cm between the thumb and forefinger

11.	Describe how the ruler should be dropped	Your partner drops the ruler without telling you
12.	Describe how the ruler should be caught	As quickly as you can between thumb and forefinger
13.	Name one risk in the investigation	Care should be taken to avoid injury from the falling ruler
14.	What results should you see?	As the number of practice attempts increases, the reaction time decreases
15.	What are possible variations on this method?	1) Effect of sugary drinks 2) Effect of caffeine 3) Effect of age
	Topic:	RP: Plant responses (B8) (triple only) (B.48)
1.	What is the independent variable?	The amount of light (dark, partial light, full light)
2.	What is the dependent variable?	Height of seedlings
3.	Name 3 control variables	1) Type of seed 2) Volume of water 3) Number of seedlings in dish
4.	Give one precaution in the investigation	Wash hands after touching seedlings
5.	Name the equipment needed	mustard seeds, 3 petri dishes, cotton wool, ruler, water
6.	Name the 3 conditions of the seedlings	1) No light 2) Partial light 3) Full light
7.	How is the height of the seedlings measured?	Using a ruler
8.	How do you make the measurements more accurate?	Measure the height of 10 seedlings each day and calculate a mean
9.	How will you represent the data?	Plot a line graph of mean height against the day
10.	Name one error in the investigation	Not measuring the seedling from the base to the top
11.	What will happen the seedlings in full light?	They will grow towards the light source
12.	What will happen to the seedlings in partial light?	They will grow towards the light source
13.	What will happen to the seedlings in the dark?	1) They will grow the tallest 2) The leaves will be small and yellow
14.	Why is there more growth in no light?	The seedling grow faster to find the light
15.	What are possible variations on this method?	Effect of gravity on growth
	Topic:	RP: Field investigations (B9) (B.49)
1.	What is the first aim?	Investigating the population size of a plant species using random sampling
2.	How do we prepare the area we are investigating?	Lay out two measuring tapes at right angles to each other
3.	Name the equipment	a 25 cm x 25cm quadrat, a 30 m tape measure, a clipboard, a pen, paper.
4.	How do we ensure the sample is random?	Choose random co-ordinates and place the quadrat in these places
5.	What are the steps in the method?	1) Place the quadrat down and count the number of organisms inside. 2) Repeat for 10 quadrats 3) Calculate the mean
6.	How do we work out an estimate for the whole area?	estimated population size = (area sampled /total area) x mean number of organisms counted
7.	How can we improve the accuracy of the estimate?	increase the number of quadrat throws and calculate the mean
8.	Why might the estimate be inaccurate?	Not all parts of the area contain an equal distribution of the organism and so the sample may not be representative
9.	What is the second aim?	Investigating the effect of light intensity on plant distribution using a transect line.
10.	How do we set up a transect line?	Place a tape measure from one part of the area to another
11.	How do we measure the number of organisms?	Place a quadrat down and count the number of organisms inside
12.	How do you measure the change in distribution of the organism?	Move the quadrat 1m along the transect and count the number of organisms. Repeat every 1m.
13.	How do you measure the light intensity?	Use a light meter or light probe
14.	How do you represent the data?	Plot a graph of light intensity against number of organisms
15.	What are possible variations on this method?	1) Effect of pH 2) Effect of temperature 3) Effect of carbon dioxide levels 4) Distance from a factory/road
	Topic:	RP: Rate of decay (B10) (triple only) (B.50)
1.	What is the independent variable?	The temperature of the solutions
2.	What is the dependent variable?	The time taken for the indicator to turn yellow
3.	Name 3 control variables	1) Volume of milk 2) Volume of lipase 3) Volume of sodium carbonate
4.	Why is this method only a model for decay?	Decay in milk is too slow
5.	Name the indicator used	Cresol red
6.	How is each temperature maintained?	Using a water bath
7.	Name the enzyme, the substrate and the product	Lipase breaks down lipids into fatty acids and glycerol

8.	What observation is made when 'decay' has occurred?	The Cresol red turns from purple (alkaline) to yellow (acidic)
9.	What product makes the solution acidic?	Fatty acids
10.	Name one risk and precaution in the method	Cresol red is an irritant so goggles should be worn and skin washed immediately if it comes into contact
11.	How can you make the results more accurate?	Use a measuring syringe, use a digital water bath, repeat at more temperatures
12.	Why is a measuring syringe more accurate than a measuring cylinder?	It has a smaller meniscus and less of the solution remains inside the syringe
13.	Name one error in the investigation	Starting and stopping the timer at the incorrect time
14.	What results should you see?	As temperature increases, rate of decay should increase up to 40°C. It should then decrease as enzymes become denatured.
15.	What are possible variations on this method?	Effect of lipase concentration

Required practicals

Practical	Variables	Equipment	Method	Expected conclusion	Possible variations
B7 – Reaction Time	<p>Big Question: Investigate the effect of sugar on reaction time.</p> <p>IV – Sugar eaten prior to investigation DV – Reaction time CV – no distractions in the room, using the dominant hand to catch the ruler, the rest of their diet must be the same</p>	<p>*Metre ruler *Chair *Table</p>	<ol style="list-style-type: none"> Person 1 & 2 drinks a non-sugary drink twenty minutes before the test (this is a control). Person 1 sits on chair with arm on the table. Person 2 holds the ruler vertically with the 0cm mark in between person 1's finger and thumb. Tell person 1 to prepare to catch the ruler. Drop the ruler Person 1 catches the ruler as quickly as they can and records the number just above the person's thumb. Repeat three times. Repeat the test with person 1. Person 1&2 drinks a sugar free drink twenty minutes before the next test. Repeat the experiment steps 1-9. 	<p>Sugary drink leads to faster reaction times</p>	<p>Investigate how gender affects reaction time</p> <p>Investigate how caffeine affects reaction time</p> <p>Investigate the effect of age on reaction time</p>
B8 – Plant responses (triple only)	<p>Big Question: Investigate the effect of light on newly germinated seedlings</p> <p>IV – Light intensity DV – Change in height of seedlings CV – Temperature, mineral content of soil, water content of soil, pH</p>	<p>*White mustard seedlings *Three petri dishes *Cotton wool *Ruler *Water</p>	<ol style="list-style-type: none"> Soak equal sized pieces of cotton wool in equal volumes of water and place into each petri dish Plant 10 mustard seeds in each dish and allow to germinate in a warm place. Water each day with equal volumes of water. Remove some of the germinated seeds so that there are just 5 seeds in each petri dish. Measure the seedlings height. Place one dish into low light, one into medium light and one into high light intensity. Leave for 5 days watering with the same volume of water each day. Record their height. Calculate the mean change in height. 	<ol style="list-style-type: none"> Seedlings in the dark have biggest change in height – this is because they are growing quickly to reach the light Leaves in the dark are small and yellow – this is because there is no sunlight for photosynthesis Seedlings in full or partial light have grown towards the light source 	<p>Investigate how the angle of a petri dish affects growth of a newly germinated seedling</p> <p>Investigate how mineral content affects growth of a newly germinated seedling.</p>
B9 – Field Investigations	<p>Big Question (1): Estimate the number of daisies in this field. (RANDOM SAMPLING)</p> <p>Big Question (2): Describe how light intensity effects the distribution of grass. (QUADRAT SAMPLING)</p> <p>Big Question 2: IV – Light intensity DV – Grass coverage CV - area of quadrat, soil water content, temperature</p>	<p>Big question 1: *1m² quadrat *2 x tape measures *Bag of numbers for random selection</p> <p>Big question 2: *Light intensity meter *Tape measure *1m² quadrat</p>	<p>Big Question 1:</p> <ol style="list-style-type: none"> Get a 1m² quadrat. Mark the edge of the field with a tape measure Mark the second edge (at a right angle) with a second tape measure. Choose two numbers from a bag and use these as the co-ordinates to identify a random position in the field. Place the quadrat here and count the number of daisies. Repeat multiple times and then calculate an average. Multiple this by the area of the field.  <p>Big Question 2:</p> <ol style="list-style-type: none"> Place a transect (a line) from inside a shady part of a forest into the bright light. Place the quadrat at the start of the transect and record the approximate area covered in grass plants. Measure the light intensity using a light intensity meter. Repeat steps 2-3 at regular intervals along the transect. 	<p>Big Question 2: Increase in light intensity should cause an increase in grass plants.</p>	<p>Investigate how the number of lichens changes as you move further from the main road.</p> <p>Investigate the number of woodlice changes as you move further from a lake.</p>

B10 – Rate of decay (triple only)	<p>Big Question: Investigate the effect of temperature on rate of decay of fresh milk</p> <p>IV – Temperature DV – pH of fresh milk (lactose converted to lactic acid causing pH to decrease) CV – volume of lipase solution, volume of milk, whether the mixture is stirred or not.</p>	<p>*full fat milk *sodium carbonate solution *lipase solution *250cm³ beaker *5 boiling tubes *x2 syringes *dropping pipette *thermometer *Stopwatch *cresol red *waterbath *ice</p>	<ol style="list-style-type: none"> 1) Set 5 waterbaths to different temperatures (20°C, 40°C, 60°C, 80°C). In one, place ice to reduce the temperature to 0°C 2) Add 5cm³ of milk, 7cm³ of sodium carbonate solution and 5 drops of cresol red indicator into each of the five boiling tubes and place into each waterbath. The indicator should turn purple. 3) Place a boiling tube of lipase solution into each waterbath. 4) Use a thermometer to all the solutions have reached the temperature of the waterbath they are in. 5) Remove one of the boiling tubes from the water bath and use a pipette to add 1cm³ of lipase solution to the mixture. 6) Start the stopwatch. 7) Stop the stopwatch when the solution has turned yellow. 8) Repeat with the other 4 temperatures. 	As temperature increases, rate of decay should increase up to 40°C. It should then decrease as enzymes become denatured.	Investigate how concentration of lipase solution affects decay.
Practical	Variables	Equipment	Method	Expected conclusion	Possible variations
B7 – Reaction Time	<p>Big Question: Investigate the effect of sugar on reaction time.</p> <p>IV – Sugar eaten prior to investigation DV – Reaction time CV – no distractions in the room, using the dominant hand to catch the ruler, the rest of their diet must be the same</p>	<p>*Metre ruler *Chair *Table</p>	<ol style="list-style-type: none"> 11) Person 1 & 2 drinks a non-sugary drink twenty minutes before the test (this is a control). 12) Person 1 sits on chair with arm on the table. 13) Person 2 holds the ruler vertically with the 0cm mark in between person 1's finger and thumb. 14) Tell person 1 to prepare to catch the ruler. 15) Drop the ruler 16) Person 1 catches the ruler as quickly as they can and records the number just above the person's thumb. 17) Repeat three times. 18) Repeat the test with person 1. 19) Person 1&2 drinks a sugar free drink twenty minutes before the next test. 20) Repeat the experiment steps 1-9. 	Sugary drink leads to faster reaction times	<p>Investigate how gender affects reaction time</p> <p>Investigate how caffeine affects reaction time</p> <p>Investigate the effect of age on reaction time</p>

Chemistry

Mastery Matrix:

Unit	Topic	Learning statement	Tier	Course	Revision Guide (double)	Revision Guide (triple)	1	2	3
Chemistry Fundamentals	Mixtures	Define 'pure substances' and explain the difference between its scientific and everyday meaning	F	A	140	C84			
Chemistry Fundamentals	Mixtures	Use melting and boiling point data to establish pure substances from mixtures	F	A	140	C84			
Chemistry Fundamentals	Mixtures	Describe what a 'formulation' is and give examples (Fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods)	F	A	140	C84			
Chemistry Fundamentals	Mixtures	Describe the two phases (stationary and mobile) of chromatography and its purpose	F	A	140	C84			
Chemistry Fundamentals	Mixtures	Calculate Rf values	F	A	141	C85			
Chemistry Fundamentals	Mixtures	Interpret chromatograms to decide whether a substance is pure or a mixture	F	A	140	C84			
Chemistry Fundamentals	Mixtures	RP Chromatography: Use paper chromatography to investigate the colours within different substances and calculate Rf values	F	A	140	C84			
Chemistry Fundamentals	Mixtures	Explain the difference in difficulty of separating compounds compared to mixtures	F	A	88+89	C8+C9			
Chemistry Fundamentals	Metals in the periodic table	Describe corrosion as a reaction and explain how to prevent it (triple only)	F	T		C18			
Chemistry Fundamentals	Metals in the periodic table	Explain what an alloy is and how its properties differ from a pure metal	F	A	101	C18			
Chemistry Fundamentals	Metals in the periodic table	Link the properties and use of different alloys to their composition (bronze, brass, gold, steel, aluminium alloys) (triple only)	F	T		C19			
Chemistry Fundamentals	Groups in the periodic table	Describe the gas test for carbon dioxide, hydrogen, oxygen and chlorine	F	A	141	C85			
Investigative Chemistry	Acids & alkalis	RP Neutralisation: Determine the reacting volume of a solution of strong acid and strong alkali by titration linking to concentration (triple only)	F	T		C35			
Investigative Chemistry	Chemical tests	Explain how to use silver nitrate solution in the presence of dilute nitric acid to test for halide ions (chloride, bromide, iodide) (triple only)	F	T		C87			
Investigative Chemistry	Chemical tests	Explain how to use barium chloride solution in the presence of dilute hydrochloric acid to test for sulphate ions (triple only)	F	T		C87			
Investigative Chemistry	Chemical tests	RP Identifying Ions: Use all of the chemical tests listed above to test for the presence of different ions (testing for metal ions: flame tests, hydroxide solutions and testing for negative ions – halides, sulphate ions, and carbonates) (triple only)	F	T		C86+C87			
Reacting substances	Rates of reaction	Calculate the mean rate of reaction	F	A	124	C60			
Reacting substances	Rates of reaction	Recall the units for mass (g), volume (cm ³) and rate (g/s, cm ³ /s, mol/s)	F	A	124	C60			
Reacting substances	Rates of reaction	Draw tangents on curves in order to calculate rates of reaction	F	A	125	C61			
Reacting substances	Rates of reaction	Explain the collision theory and link to activation energy	F	A	124	C60			
Reacting substances	Rates of reaction	Describe and explain factors that affect rates of reaction (concentration, pressure, surface area, catalysts and temperature)	F	A	124+125+126	C60+C61+C62			
Reacting substances	Rates of reaction	Plot and interpret graphs showing rates of reaction	F	A	125	C61			
Reacting substances	Rates of reaction	Explain why one reactant is used in excess in a chemical reaction	F	A	105	C33			
Reacting substances	Rates of reaction	Describe what is meant by 'a limiting reactant'	F	A	105	C33			
Reacting substances	Rates of reaction	RP Rates of Reaction: Investigate how changes in concentration affect the rates of reactions by measuring volume of the gas and change of colour	F	A	125	C61			
Reacting substances	Rates of reaction	Give examples of catalysts	F	A	126	C62			
Reacting substances	Rates of reaction	Draw a reaction profile for a catalysed reaction	F	A	121	C57			
Reacting substances	Reversible reactions	Use the appropriate symbol to denote a reversible reaction	F	A	126	C62			
Reacting substances	Reversible reactions	Explain energy changes in reversible reactions (ammonium chloride and hydrated copper sulphate)	F	A	126	C63			

Reacting substances	Reversible reactions	Explain what is meant by the term 'equilibrium'	F	A	127	C63			
Reacting substances	Reversible reactions	Explain and use Le Chatelier principle to make predictions about reactants and products (HT only)	HT	A	127	C63			
Reacting substances	Reversible reactions	Explain the effect of changing concentration, pressure and temperature on equilibrium (HT only)	HT	A	127	C63			
Humans and the Earth	The Earths Early Atmosphere	Describe the composition of the atmosphere and how long this has been the case	F	A	143	C89			
Humans and the Earth	The Earths Early Atmosphere	Describe the development from early atmosphere to present day	F	A	142	C88			
Humans and the Earth	The Earths Early Atmosphere	Draw links between the early Earth's atmosphere and that of other planets (Mars and Venus)	F	A	142	C88			
Humans and the Earth	The Earths Early Atmosphere	Evaluate different theories regarding the Earth's early atmosphere	F	A	142	C88			
Humans and the Earth	The Earths Early Atmosphere	Explain why oxygen levels increased and carbon dioxide levels decreased (linking to photosynthesis and sedimentation)	F	A	143	C89			
Humans and the Earth	Global Warming	Describe the term 'greenhouse gases' and give three examples (water vapour, carbon dioxide and methane)	F	A	144	C90			
Humans and the Earth	Global Warming	Describe the 'greenhouse effect' linking to the wavelength of radiation	F	A	144	C90			
Humans and the Earth	Global Warming	Describe the effect of human activities on the levels of greenhouse gases, recalling two that affect methane and two that affect carbon dioxide	F	A	144	C90			
Humans and the Earth	Global Warming	Explain how peer review evidence have linked these activities to global climate change	F	A	144	C90			
Humans and the Earth	Global Warming	Explain why it is difficult to model this and how this has led to simplification, speculation and biased opinions in the media	F	A	144	C90			
Humans and the Earth	Global Warming	Describe 4 potential effects of global climate change	F	A	145	C91			
Humans and the Earth	Global Warming	Discuss the scale, risks and environmental implication of global climate change	F	A	145	C91			
Humans and the Earth	Global Warming	Describe what is meant by the term 'carbon footprint'	F	A	145	C91			
Humans and the Earth	Global Warming	Describe actions to reduce our carbon footprint and explain why these actions may have limited impact	F	A	145	C91			
Humans and the Earth	Air pollution	Describe combustion as a major source of atmospheric pollution	F	A	144	C90			
Humans and the Earth	Air pollution	Name gases release when fuels such as coal are burnt (carbon dioxide, water vapour, carbon monoxide, sulphur dioxide and nitrogen oxides) and predict which of these would be produced from a given fuel composition	F	A	143	C89			
Humans and the Earth	Air pollution	Describe 'particulates'	F	A	144	C90			
Humans and the Earth	Air pollution	Describe issues arising from carbon dioxide, sulphur dioxide, nitrogen oxides and particulates	F	A	144	C90			
Humans and the Earth	Finite resources	Recalls that humans use the Earth's resources to provide; warmth, shelter, food, transport (through timber, clothing, fuels/energy and other materials)	F	A	146	C92			
Humans and the Earth	Finite resources	Define what is meant by the term 'finite resource'	F	A	146	C92			
Humans and the Earth	Finite resources	Define what is meant by the term 'sustainable development' and explain the role that chemistry plays in developing agricultural and industrial processes	F	A	146	C92			
Humans and the Earth	Finite resources	Explain how some natural products are being replaced by some agricultural and synthetic products	F	A	146	C92			
Humans and the Earth	Water and waste	Describe the properties of potable water (is safe to drink) linking to purity, salt and microbe levels	F	A	146	C92			
Humans and the Earth	Water and waste	Describe the different sources of drinking water in the UK and the process that it must undergo before it is potable	F	A	146	C92			
Humans and the Earth	Water and waste	Describe the process of desalination (distillation or reverse osmosis)	F	A	146	C92			
Humans and the Earth	Water and waste	Evaluate the methods to produce potable water (linking to location and potential water supply)	F	A	146	C92			
Humans and the Earth	Water and waste	RP Water Purification: Analyse and purify water samples from different sources, including pH, dissolved solids and distillation	F	A	147	C93			
Humans and the Earth	Water and waste	Explain why large amounts of waste water are produced (urban life styles and industrial processes)	F	A	147	C93			
Humans and the Earth	Water and waste	Explain what needs to be removed from sewage and agricultural waste in comparison with industrial waste water	F	A	147	C93			
Humans and the Earth	Water and waste	Describe the 4 steps of sewage treatment	F	A	147	C93			
Humans and the Earth	Water and waste	Compare the relative ease of obtaining potable water from waste, the ground and salt water	F	A	146	C92			

Humans and the Earth	Life Cycle Assessments	Explain how phytomining and bioleaching and scrap iron and electrolysis can be used to extract copper from low grade ores	HT	A	147	C93			
Humans and the Earth	Life Cycle Assessments	Describe what is meant by the term 'life cycle assessment'	F	A	148	C95			
Humans and the Earth	Life Cycle Assessments	Describe the 4 stages of a life cycle assessment	F	A	148	C95			
Humans and the Earth	Life Cycle Assessments	Explain that water resources, energy and waste production can be easily quantified whereas pollutant effects are hard to quantify	F	A	148	C95			
Humans and the Earth	Life Cycle Assessments	Describe how simplified life cycle assessments can be used in a biased manner to support advertising claims in the media	F	A	148	C95			
Humans and the Earth	Life Cycle Assessments	Use data to carry out LCA for shopping bags made from plastic and paper	F	A	148	C95			
Humans and the Earth	Life Cycle Assessments	Explain how we can reduce our use of limited resources (reduce, reuse, recycle)	F	A	149	C95			
Humans and the Earth	Making Materials	Explain how to produce clay ceramics (triple only)	F	T		C94			
Humans and the Earth	Making Materials	Describe what factors affect the properties of polymers	F	T		C70			
Humans and the Earth	Making Materials	Compare low density and high density poly(ethane)	F	T		C70			
Humans and the Earth	Making Materials	Compare and contrast thermosetting and thermosoftening polymers explaining the differences	F	T		C71			
Humans and the Earth	Making Materials	Explain what 'composites' are and give some examples	F	T		C95			
Humans and the Earth	Making Materials	Explain how glass is produced	F	T		C94			
Humans and the Earth	Making Materials	Compare the composition and melting points of soda-lime glass and borosilicate glass	F	T		C94			
Humans and the Earth	Making Materials	Discuss the environmental impact of using metal, glass, building materials, clay ceramics and plastics linking to the use of these limited resources and the energy used to extract and process them.	F	T	149	C95			
Humans and the Earth	Making Materials	Explain ways that we can reduce this environmental impact	F	T	149	C95			
Humans and the Earth	The Haber Process and Fertilisers	State what is produced in the Haber process and explain how ammonia produced from this process is used (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	List the raw materials for the Haber process and where they are sourced from (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	Recall the conditions required for the Haber process to take place (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	Recall the word and symbol equation for the Haber process (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	Explain how the ammonia is removed and the hydrogen and nitrogen are recycled (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	Interpret graphs of reaction conditions for Haber process versus rate (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	Apply the principals of dynamic equilibrium to the Haber process (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	Explain how these conditions are manipulated to produce optimum quantities of the desired products (triple only)	F	T		C96			
Humans and the Earth	The Haber Process and Fertilisers	Describe what NPK fertilisers are (triple only)	F	T		C97			
Humans and the Earth	The Haber Process and Fertilisers	Describe how NPK fertilisers are produced industrially (triple only)	F	T		C97			
Humans and the Earth	The Haber Process and Fertilisers	Describe how sources of NPK are produced/found (ammonium salts, nitric acid and potassium chloride and phosphate rock) (triple only)	F	T		C97			
Organic Chemistry	Alkanes and Alkenes	Explain what crude oil is and how it is formed	F	A	136	C64			
Organic Chemistry	Alkanes and Alkenes	Define 'alkanes' and give the general formula	F	A	136	C64			
Organic Chemistry	Alkanes and Alkenes	Recall the formulae and structures for the first 4 alkanes (methane, ethane, propane and butane)	F	A	137	C65			

Organic Chemistry	Alkanes and Alkenes	Define 'alkenes' and give the general formula	F	A	138	C66			
Organic Chemistry	Alkanes and Alkenes	Recall the formulae and structures for the first 4 alkenes (ethene, propene, butane, pentene)	F	A	138	C67			
Organic Chemistry	Alkanes and Alkenes	Define the terms 'saturated' and 'unsaturated' and link to alkanes and alkenes	F	A	136	C64+C66			
Organic Chemistry	Alkanes and Alkenes	Use the bromine test to identify whether there are alkanes or alkenes present	F	A	139	C67			
Organic Chemistry	Fractional Distillation	Explain the process of fractional distillation	F	A	136	C64			
Organic Chemistry	Fractional Distillation	Name and describe the uses (fuels and feedstock for the petrochemical industry e.g. solvents, lubricants, polymers and detergents) of each of the fractions produced (petrol, diesel, kerosene, heavy fuel oil and LPG)	F	A	136	C64			
Organic Chemistry	Fractional Distillation	Describe why carbon can form such a vast array of natural and synthetic compounds	F	A	136	C64			
Organic Chemistry	Fractional Distillation	Explain how the size of hydrocarbon is linked to their boiling point, viscosity and flammability	F	A	136	C64			
Organic Chemistry	Fractional Distillation	Describe the combustion of hydrocarbons and write balanced symbol equations	F	A	137	C65			
Organic Chemistry	Cracking	Describe what is meant by 'cracking'	F	A	138	C66			
Organic Chemistry	Cracking	Describe why cracking is required	F	A	138	C66			
Organic Chemistry	Cracking	Describe the methods and conditions used for 'catalytic cracking' and 'steam cracking'	F	A	138	C66			
Organic Chemistry	Cracking	Recall the uses of alkenes produced during cracking (polymers)	F	A	138	C70			
Organic Chemistry	Cracking	Balance chemical equations for cracking	F	A	138	C66			
Organic Chemistry	Organic Compounds	Define an 'organic compound' (triple only)	F	T		C68			
Organic Chemistry	Organic Compounds	Identify the different functional groups of organic compounds (alkanes, alkenes, alcohols, carboxylic acids) from their formulae/structural diagram (triple only)	F	T		C68+C69			
Organic Chemistry	Organic Compounds	Describe the reactions and conditions between alkenes and hydrogen, water, the halogens (Cl, Br, I) and oxygen (triple only)	F	T		C67			
Organic Chemistry	Organic Compounds	Draw the displayed structural formulae for the products of the reactions between alkenes, hydrogen, water, halogens and oxygen (triple only)	F	T		C67			
Organic Chemistry	Alcohols	Recall the formulae and structures for the first 4 alcohols (methanol, ethanol, propanol and butanol) (triple only)	F	T		C68			
Organic Chemistry	Alcohols	Recall the main uses of these alcohols (triple only)	F	T		C68			
Organic Chemistry	Alcohols	Describe the reactions between alcohols and sodium, oxygen, water and an oxidising agent (triple only)	F	T		C68			
Organic Chemistry	Alcohols	Explain how ethanol is produced by fermentation (triple only)	F	T		C68			
Organic Chemistry	Alcohols	Write balanced symbol equations for the reactions of alcohols with oxygen (triple only)	F	T		C68			
Organic Chemistry	Alcohols	Recall the formulae and structures for the first 4 carboxylic acids (methanoic acid, ethanoic acid, propanoic acid and butanoic acid) (triple only)	F	T		C69			
Organic Chemistry	Alcohols	Describe the reactions between carboxylic acids and carbonates and alcohols (triple only)	F	T		C69			
Organic Chemistry	Alcohols	Describe what happens when carboxylic acids dissolve in water (triple only)	F	T		C69			
Organic Chemistry	Alcohols	Explain why carboxylic acids are weak acids in terms of ionisation and pH (triple only)	F	T		C69			
Organic Chemistry	Alcohols	Draw the structure of ethyl ethanoate (triple only)	F	T		C69			
Organic Chemistry	Polymerisation	Describe the process of addition polymerisation (triple only)	F	T		C70			
Organic Chemistry	Polymerisation	Represent addition polymers using structural equations (triple only)	F	T		C70			
Organic Chemistry	Polymerisation	Draw diagrams to show the conversion of a monomer to a polymer and vice versa (triple only)	F	T		C70			
Organic Chemistry	Polymerisation	Explain the process of condensation polymerisation (triple only)	F	T		C71			
Organic Chemistry	Polymerisation	Use simple diagrams to show condensation polymerisation e.g. ethane diol and hexanedioic acid reacting together (triple only)	F	T		C71			
Organic Chemistry	Polymerisation	Describe the structure of amino acids (triple only)	F	T		C69			

Organic Chemistry	Polymerisation	Describe how amino acids form polypeptides by condensation polymerisation (triple only)	F	T		C69			
Organic Chemistry	Polymerisation	Link this to the structure of DNA and the importance of polymers in producing proteins, cellulose and starch (triple only)	F	T		C68			
Organic Chemistry	Polymerisation	Name the monomers that make up DNA (nucleotides), protein (amino acids), starch (glucose) and cellulose (triple only)	F	A		C68			

Knowledge organiser:

	Paper:	C2
	Topic:	Reversible reactions and low grade copper ores (C.18)
1	What is a reversible reaction?	A reaction that can go both forwards (to form the products) and backwards (to form the reactants)
2	Give two examples of reversible reactions	Ammonium chloride \rightleftharpoons ammonia + hydrogen chloride Hydrated copper sulphate (blue) \rightleftharpoons anhydrous copper sulphate (white) + water
3	Is ammonium chloride \rightarrow ammonia + hydrogen chloride an endothermic or exothermic reaction?	Endothermic
4	What is it called when the forward and reverse reactions occur at exactly the same rate?	Equilibrium
5	The effects of changing conditions on a system at equilibrium can be predicted using ...? (HT only)	Le Chatelier's Principle
6	Which 3 factors affect the position of equilibrium?	Pressure (gases), temperature, concentration
7	When the pressure of a system is increased, equilibrium will shift towards which side? (HT only)	Least molecules
8	When the pressure of a system is decreased, equilibrium will shift towards which side? (HT only)	Most molecule
9	When the temperature of a system is increased, the equilibrium will shift towards which side? (HT only)	Endothermic reaction
10	When the temperature of a system is decreased, the equilibrium will shift towards which side? (HT only)	Exothermic reaction
11	If the concentration of the reactants are increased, which reaction will be favoured? (HT only)	The forwards reaction (to make more product)
12	If the concentration of the reactants are decreased, which reaction will be favoured? (HT only)	The backwards reaction (to make more reactants)
13	What is a closed system?	A reaction (system) where no reactants are added or products removed.
14	What is the symbol for a reversible reaction?	\rightleftharpoons
15	What is the general equation for a reversible reaction?	$A + B \rightleftharpoons C + D$
	Topic:	The Earth's Early Atmosphere (C.20)
1	When did the Early Atmosphere form?	4.6 billion years ago
2	State the four gases present in the Early Atmosphere?	Carbon dioxide (70%), methane (10%), ammonia (10%) and water vapour (10%)
3	Where did the gases in the early atmosphere come from?	Volcanic activity
4	What are the 2 most prevalent gases in the atmosphere today?	Nitrogen (78%) and Oxygen (21%)
5	How much carbon dioxide is there in the Earth's atmosphere today?	0.0004
6	State the substances that have trapped carbon dioxide under the ground	Fossil Fuels and Sedimentary rocks
7	Name the process by which the oceans are thought to have formed	Condensation of water vapour
8	Where do our current levels of nitrogen come from?	Volcanoes
9	Name the process that converts carbon dioxide into oxygen.	Photosynthesis
10	Which organism is responsible for releasing nitrogen from plants?	Bacteria
11	State the naturally occurring phenomenon that is believed to have converted gases into nitrogen?	Lightening
12	State the process that releases nitrogen from organisms on death	Decomposition
13	State the 4 processes that lead to a reduction in CO ₂ between the Early Atmosphere and today.	1) Dissolved in seas 2) Trapped in rocks 3) Photosynthesis 4) Trapped in fossil fuels
14	Name the process that caused an increase in oxygen levels	Photosynthesis
15	Which two organisms caused an increase in oxygen levels?	Algae and green plants
	Topic:	Global warming and air pollution (C.21)
1	Name the 3 greenhouse gases	Water, Methane, carbon dioxide
2	Name the greenhouse gas produced by rice fields	Methane (CH ₄)
3	Name the three types of radiation emitted by the sun	Infrared (long wave), visible light (short wave) and UV (short wave)
4	Name the one type of radiation emitted by the Earth	Infrared radiation (long wave)
5	What happens to the majority of radiation emitted by the sun when it gets to the Earth's atmosphere?	It passes through (is transmitted)

6	What happens to the majority of radiation emitted by the Earth when it reaches the atmosphere?	It is absorbed
7	State 2 human activities that increase the amount of carbon dioxide in the atmosphere	Burning fossil fuels, deforestation
8	State 3 human activities that increase the amount of methane in the atmosphere	Decaying organic matter, growing rice, cattle farming
9	Why is global climate change difficult to model?	Involves many factors
10	What is the main cause of global climate change?	Increase in average global temperature
11	State 6 potential effects of global climate change	1) Ice caps melting 2) Sea level rising 3) Loss of habitats 4) Desertification 5) Changes in migratory patterns 6) Drought
12	Define 'carbon footprint'	The total amount of CO ₂ and other greenhouse gases emitted over the full life cycle of a produce, service or event
13	State three ways we can reduce our carbon footprint?	1) recycle 2) take public transport 3) use renewable energies
14	State two effect of carbon particulates (soot) being released into the atmosphere	Global dimming & asthma
15	State the effect of sulphur dioxides and nitrogen oxides being released into the atmosphere	Acid rain & respiratory problems
	Topic:	Finite resources, water and waste (C.22)
1	State 4 factors that humans use the Earth's resources for	Warmth, Shelter, Food, Transport
2	State 4 products gained from the Earth	Food, Timber, Clothing, Fuel
3	Define "finite"	Will run out
4	Define "sustainable development"	Development that meets the needs of the current generation without compromising the ability to meet the needs of future generations
5	State two examples of synthetic materials that are replacing natural materials	Artificial leather, Synthetic rubber
6	What is the name given to water that is safe to drink?	Potable
7	State the two stages of making potable water from a lake or river	1) Filter bed 2) Sterilise (with chlorine) 3) Add fluoride
8	Why is fluoride added to drinking water?	Reduce tooth decay
9	State three things that can be used to sterilise water	UV, ozone, chlorine
10	State two ways that desalination can be carried out	Reverse osmosis or distillation
11	State one disadvantage of desalination.	Requires large amounts of energy
12	Is potable water pure?	No, it contains lots of minerals
13	Describe the two steps in desalination	1) Heat water (evaporation) 2) Cool (condensation)
14	State the 4 stages of waste water treatment	1) Screening, 2) Sedimentation, 3) Anaerobic digestion (sewage), 4) Aerobic biological treatment (effluent)
15	What are the 4 stages of an LCA?	1) Extracting & processing raw materials 2) Manufacturing and packing 3) Use during its life 4) Disposal
	Topic:	Alternative methods of extracting metals (HT only) (C.24)
1	Define high-grade and low-grade ore.	High-grade ore is a rock containing lots of a metal, low-grade ore is a rock containing a small amount of a metal
2	State three reasons why copper is a useful metal (HT only)	1) Good conductor, 2) Easily bent, 3) Unreactive with water
3	How can copper be extracted from copper-rich ores? (HT only)	Smelting = heating the copper ore with carbon in a furnace
4	How can copper be purified after smelting? (HT only)	Electrolysis
5	Name the method for extracting copper from a salt. (HT only)	Electrolysis
6	Where do copper ions move to during electrolysis? (HT only)	The cathode
7	Name the method used to extract copper using scrap iron. (HT only)	Displacement
8	Which metal is used in reduction of low grade copper extraction? (HT only)	Iron
9	Why are we running out of copper-rich ores? (HT only)	Because of extensive mining of copper in the past.
10	State two alternative methods of extracting copper rather than using copper-rich ores. (HT only)	Phytomining (using contaminated land), Bioleaching (using low-grade ores)
11	Why are phytomining and bioleaching more environmentally friendly? (HT only)	They don't involve digging up and moving large quantities of rock, or produce lots of waste.
12	State the 3 steps in phytomining (HT only)	1) Grow plants on low grade ore, 2) Plants absorb and store copper, 3) Burn plants to produce ash
13	State the organism used in bioleaching and the solution produced (HT only)	Bacteria, Leachate
14	State the two steps in removing copper from the copper filled ash produced in phytomining (HT only)	1) Dissolve in water, 2) displacement/electrolysis

15	State how copper is removed from the leachate produced in bioleaching (HT only)	Displacement or electrolysis
	Topic:	Making materials (ceramics, polymers and glass) (C.26)
1	What is the name of household glass? (triple only)	Soda-lime glass
2	How is soda-lime glass made? (triple only)	Heating sand, sodium carbonate and limestone
3	What is the advantage of borosilicate glass? (triple only)	Melts at a higher temperature
4	What is borosilicate glass made from? (triple only)	Sand and boron trioxide
5	How are pottery, bricks and clay ceramics made? (triple only)	Shape wet clay and heat in furnace
6	Which monomer are low density and high density polyethene made from? (triple only)	Ethene
7	State one use of LD polyethene (triple only)	Plastic bags
8	State one use of HD polyethene (triple only)	Plastic bottles
9	State the name of the type of polymer that can be melted and reshaped (triple only)	Thermosoftening polymers
10	State the name of the type of polymer that can NOT be melted and reshaped (triple only)	Thermosetting polymers
11	What is the difference between the structure of thermosetting polymers and the structure of thermosoftening polymers? (triple only)	Thermosetting polymers have crosslinks
12	What is it called if a material has a binder holding together fibres of other materials (triple only)	Reinforcement
13	Give two examples of composites (triple only)	Fibreglass and concrete
14	Give three properties of high density polyethene (triple only)	High melting point, strong, inflexible
15	Give three properties of low density polyethene (triple only)	Low melting point, not strong, flexible
	Topic:	The Haber Process (C.27)
1	Which elements do NPK fertilisers contain? (triple only)	Nitrogen, phosphorous, potassium
2	How is the nitrogen part of the fertiliser made? (triple only)	Reacting ammonia with acid
3	What is the word equation for the Haber process? (triple only)	nitrogen + hydrogen --> ammonia
4	Complete the word equation Ammonia + sulphuric acid -> (triple only)	Ammonium sulphate + hydrogen
5	What is the symbol equation for the Haber process? (triple only)	$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
6	What is used to create the phosphate part of NPK fertilisers? (triple only)	Phosphate rock + acid
7	What is used to create the potassium part of the NPK fertiliser? (triple only)	Potassium chloride and potassium sulphate are mined from the ground
8	What is ammonia used for? (triple only)	To make fertiliser, nitric acid, ammonium salts
9	Is the forward reaction in the Haber process endothermic or exothermic? (triple only)	Exothermic
10	Which three conditions are required for the Haber process? (triple only)	450°C 200atm Iron catalyst
11	Complete the word equation phosphate rock + phosphoric acid -> (triple only)	Calcium phosphate
12	What must the elements in NPK fertilisers form for them to be used effectively? (triple only)	Compounds
13	What is the Haber process used to manufacture? (triple only)	Ammonia
14	What are the raw materials for the Haber process? (triple only)	Nitrogen & hydrogen
15	How do we obtain hydrogen for the Haber process? (triple only)	Reacting methane with steam
	Topic:	Fractional Distillation (C.29)
1	Which part of the fractional distillation column is the hottest?	The bottom
2	Which part of the fractional distillation column is the coldest?	The top
3	Where do short chain hydrocarbons condense and collect?	At the top of the column
4	Where do long chain hydrocarbons condense and collect?	At the bottom of the column
5	Put the fractions of crude oil into order (short chain first!)	Petroleum gases, Petrol, Kerosene, Diesel oil, heavy fuel oil
6	What are the two industries that make use of the products of fractional distillation?	Petrochemical & fuel industry
7	State 3 properties of short chain hydrocarbons	*low MP/bp, *volatile *low viscosity
8	State 3 properties of long chain hydrocarbons	*high MP/bp, *not volatile *high viscosity
9	Why is cracking done?	There is a higher demand for shorter chain hydrocarbons
10	What is cracking?	Thermal decomposition reaction breaking long chain hydrocarbons into short ones
11	What are the two types of cracking?	Steam & catalytic cracking
12	What are the stages of thermal cracking?	1) hydrocarbons heated until vaporised, 2) vapour passed over hot catalyst, 3) thermal decomposition takes place
13	What are the stages of steam cracking?	1) hydrocarbons mixed with steam, 2) heated to a high temperature

14	What are the two products of cracking?	Short chain alkanes and an alkene
15	What can the alkenes be used for?	To make new compounds, polymers and alcohol
	Topic:	Organic compounds (triple only) (C.30)
1	Define "organic compound"	A compound containing carbon
2	What is the functional group in an "alcohol"	"-OH"
3	What is the functional group in a carboxylic acid?	"-COOH"
4	What is the functional group in an ester?	"-COO"
5	What is the functional group in an amino acid?	"-NH ₂ "
6	What is produced when an alkene reacts with water?	An alcohol
7	What is produced when an alkene reacts with hydrogen?	An alkane
8	What is produced when an alkene reacts with oxygen?	Carbon dioxide and water
9	What are the conditions required for the reaction of an alkane with hydrogen or water?	A catalyst
10	What happens when a carboxylic acid reacts with a carbonate?	Carbon dioxide, a salt and water
11	What is the pH of a carboxylic acid?	pH 4-6 (weak acid)
12	Why are carboxylic acids "weak" acids?	Partially ionise in water
13	Name the first 4 carboxylic acids	Methanoic acid, ethanoic acid, propanoic acid, butanoic acid
14	0	0
15	0	0
	Topic:	Alcohols (triple only) (C.31)
1	What is a functional group?	The part of a molecule that gives it its properties.
2	What is an homologous series?	A group of molecules that have the same functional group.
3	Name 3 examples of homologous series	alcohols, esters, carboxylic acids
4	What is the functional group in an "alcohol"	"-OH"
5	State two ways that alcohol can be produced	*hydration of ethene, *fermentation of glucose
6	State two uses of alcohol	Fuel and for alcoholic drinks
7	Name the first 4 alcohols	Methanol, ethanol, propanol, butanol
8	What is produced when an alcohol reacts with sodium?	Hydrogen and a salt
9	What happens when alcohol reacts with oxygen?	A carboxylic acid is formed
10	State the general word equation for combustion of alcohol	alcohol + oxygen → water + carbon dioxide
11	What happens when an alcohol is reacted with a carboxylic acid?	An ester is produced
12	Describe one property of an ester	It is sweet smelling
13	Name the ester formed from the reaction of ethanoic acid and ethanol	Ethyl ethanoate
14	What is the pH of alcohol?	pH 7
15	State two properties of alcohol	It is flammable and toxic
	Topic:	Polymerisation (triple only) (C.32)
1	Define "polymerisation"	Joining many monomers together to form a long chain
2	Name the two types of polymerisation	Addition and condensation polymerisation
3	What happens during addition polymerisation?	Many monomers (alkenes) join to make a polymer
4	Name the polymer made from many ethene monomers	Poly(ethene)
5	What happens during condensation polymerisation?	Many monomers join together to make a polymer and water is lost as a by-product
6	What is the functional group in a diacid?	Two "COOH" groups
7	What is the functional group in a diol?	Two "OH" groups
8	What is the waste product of condensation polymerisation?	Water
9	State 4 example of polymerisation in nature	Formation of - DNA, Proteins, Cellulose and starch
10	What is the monomer in DNA?	Nucleotides
11	What is the monomer in protein?	Amino acids
12	What is the monomer in cellulose?	Glucose
13	What is the monomer in starch?	Glucose
14	Describe the structure of an amino acid	Amino acids contain two functional groups: amine (NH ₂) and carboxyl (COOH)
15	What is formed when ethane diol and hexanedioic acid react?	Terylene (a type of polyester)
	Topic:	RP: Rates of reaction (C5) (C.39)
1	What is the aim of experiment 1?	Investigate how concentration affects rate of reaction (using volume of gas produced)
2	What is the independent variable of experiment 1?	Concentration of hydrochloric acid
3	What is the dependent variable of experiment 1?	Volume of gas produced in 30 seconds
4	Name 3 control variables of experiment 1	1) length of magnesium 2) volume of acid 3) whether the mixture is stirred
5	How is the gas collected?	A bung attached to a delivery tube is placed in the conical flask
6	Give two ways the volume of gas can be measured	1) Gas syringe 2) Displacement of water

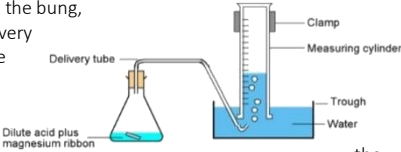
7	Give the most accurate way to measure the volume of gas produced	Using a gas syringe
8	What results should you see?	As the concentration increases, the volume of gas increases
9	Name one error	Gas escapes from the conical flask
10	What is the aim of experiment 2?	Investigate how concentration affects rate of reaction (using turbidity – aka cloudiness)
11	What is the independent variable of experiment 2?	Concentration of sodium thiosulphate
12	What is the dependent variable of experiment 2?	Time taken for the cross to disappear
13	Name 3 control variables of experiment 2	1) concentration of acid 2) size/thickness of the cross 3) stirring the solutions
14	What results should you see?	As the concentration increases, the time taken for the cross to disappear decreases
15	What are possible variations in this method?	1) Effect of temperature 2) Effect of volume 3) Effect of a catalyst

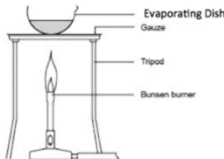
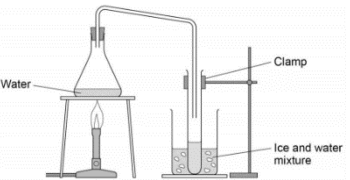
	Topic:	RP: Chromatography (C6) (C.40)
1	What is the aim of the experiment?	Investigate the colours that are found within a mixture of food colourings
2	What is the independent variable?	Dye/ink colour
3	What is the dependent variable?	Rf value
4	Name 3 controls variables	1) Start point of the colour 2) Size of the coloured dot 3) Start point of the solvent
5	Name 3 sources of error	1) Starting line drawn in ink 2) Solvent above the starting line 3) Dots too close together or too big
6	Why is a pencil used to draw the starting line?	To avoid any dye in a pen also moving up the paper
7	Name 3 types of solvent that can be used	Water, alcohol and acetone
8	How should the distance of the dye be measured?	Use a ruler to measure the distance between the starting line and the centre of the dye
9	How should the distance moved by the solvent be measured?	Use a ruler to measure the distance between the starting line and the top of the solvent line/curve
10	How is the Rf value calculated?	$R_f \text{ value} = \frac{\text{distance moved by dye}}{\text{distance moved by solvent}}$
11	How do you use the Rf value to identify the unknown substance?	Compare with a known value from a data base
12	How could you identify the unknown substance visually?	Observe which known colours the unknown dye lines up with on the chromatography paper
13	What is used to transfer the dyes to the chromatography paper?	Capillary tube
14	What are the units for the Rf value?	No units
15	What are possible variations in this method?	Investigate whether this pen is a pure colour or a mixture.

	Topic:	RP: Ion testing (C7) (triple only) (C.41)
1	What is the aim of the experiment?	Identify the ions in ionic compounds
2	Name the 4 tests	1) Flame tests 2) Carbonate tests 3) Sulfate tests 4) Halide tests
3	Describe the steps in flame tests	1) Pour 1cm ³ of each metal chloride solution into a test tube 2) Dip the loop into the solution 3) Place the loop into the blue flame of the Bunsen burner. Observe the colour.
4	Describe the results in flame tests	Li = crimson Na = Yellow K = Lilac Ca = orange-red Copper = green
5	Why is the blue flame used?	So that coloured flames can be seen more clearly (yellow flame would hide colour of some metal ions)
6	Describe the steps in sulfate tests	1) Pour 1cm ³ of each sodium solution into a different test tubes 2) Add a few drops of dilute HCl into each test tube 3) Add 1cm ³ of barium chloride solution to each test tube
7	Describe the results in sulfate tests	White precipitate forms
8	What is the precipitate that has formed?	Barium sulfate
9	Describe the steps in carbonate tests	1) Pour 1cm ³ of each sodium solution into a different test tube 2) Pour 1cm ³ of limewater into the 6th test tube. 3) Add 1cm ³ of dilute HCl to each sodium solution.

		4) Collect the gas using a pipette and bubble through the limewater solution.
10	Describe the results in carbonate tests	If limewater turns cloudy = carbonate ions present
11	Why does the limewater turn cloudy?	Acid reacts with carbonate ions to produce CO ₂ gas.
12	Describe the steps in halide tests	1) Pour 1cm ³ of each sodium solution into different test tubes 2) Add a few drops of dilute nitric acid to each solution 3) Add 1cm ³ of silver nitrate solution to each test tube
13	Describe the precipitate results in halide tests	Bromide = cream Iodide = yellow Chloride = white
14	What are the precipitates formed?	Silver bromide, silver iodide, silver chloride
15	What is a precipitate?	An insoluble solid in a liquid
	Topic:	RP: Water purification (C8) (C.42)
1	What is the aim of experiment 1?	To determine if a sample of water is pure
2	What is the independent variable?	The sample of water
3	What is the dependent variable?	pH and mass of dissolved solids
4	Name the control variable	Volume of water
5	How is the pH of the samples tested?	Using universal indicator
6	What should the pH be?	7 (green)
7	How do we test for dissolved solids?	1) Weigh an empty evaporating basin 2) Fill evaporating basin with water sample 3) Heat gently using Bunsen burner 4) Re-weight basin once water has evaporated
8	If water contains dissolved solids (is impure) what would we see?	The mass of the basin would increase
9	What is the aim of experiment 2?	To purify a sample of water to make it potable
10	What process can be used to purify water?	Distillation
11	Name the changes in state that occur during distillation	Evaporation --> condensation
12	How is the water evaporated?	Heating the conical flask gently
13	How is evaporated water collected?	Using a delivery tube and bung
14	How is the water condensed back into a liquid?	Placing the test tube in a beaker of iced water
15	How can we test if the water is pure?	Use cobalt chloride paper to test whether the substance is water (it will turn blue -> pink).
	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?	C _n H _{2n+2}
14	What is the general formula for an alkene?	C _n H _{2n}
15	Which type of hydrocarbon is saturated - alkanes or alkenes?	Alkanes

Required practicals

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">C5 – Rates of reaction</p>	<p>Big Question 1: Investigate how concentration affects rate of reaction (using volume of gas produced)</p> <p>IV – Concentration of hydrochloric acid DV – Volume of gas produced in 30 seconds CV – length of magnesium, volume of acid, whether the mixture is stirred.</p> <p>Big Question 2: Investigate how concentration affects rate of reaction (using turbidity – aka cloudiness)</p> <p>IV – Concentration of sodium thiosulphate DV – Time taken for the cross to disappear CV - concentration of acid, size of the cross, thickness of cross, whether the mixture is stirred or not.</p>	<p>Big question 1: (volume of gas) *Safety goggles *conical flask *delivery tube *gas syringe *clamp stand *clamp *stopwatch *magnesium ribbon (3cm lengths) *1.0M HCl and 1.5M HCl</p> <p>Big question 2: (turbidity) *Sodium thiosulphate *Distilled water *1.0M HCl *Conical flask *Black cross *Stopwatch</p>	<p>Big Question 1: (volume of gas)</p> <ol style="list-style-type: none"> 1) Measure 50cm³ of 1.0M HCl using a measuring cylinder and add to the conical flask. 2) Add the magnesium strip to the HCl. 3) Add the bung, delivery tube and gas syringe to the top of the conical flask. 4) Start the stop watch immediately. 5) Record the volume of gas produced every 10 seconds for 100seconds. 6) Repeat using the 1.5M HCl instead. <p>Alternative method of measuring volume of gas:</p> <ol style="list-style-type: none"> 1) Set up the equipment as shown in the diagram. 2) Measure 50cm³ of 1.0M HCl using a measuring cylinder and add to the conical flask. 3) Set up a trough of water with an upturned measuring cylinder also full of water. 4) Add the magnesium strip to the HCl. 5) Add the bung, delivery tube to the top of the conical flask. 6) Start the stop watch immediately. 7) Record the volume of gas produced every 10 seconds for 100seconds. 8) Repeat using the 1.5M HCl instead.  <p>Big Question 2: (turbidity)</p> <ol style="list-style-type: none"> 1) Measure 10cm³ of sodium thiosulphate and add to the conical flask. 2) Measure 40cm³ of distilled water and add to the conical flask. 3) Put the conical flask on the black cross. 4) Measure and add 10cm³ of HCl to the conical flask. 5) Swirl the flask gently and start the stop clock. 6) Stop the stop clock when you can no longer see the black cross. 	<p>As concentration increases, rate of reaction should increase.</p>	<p>Investigate how temperature affects rate of reaction.</p> <p>Investigate how addition of a catalyst affects rate of reaction.</p> <p>Investigate how volume of a reactant affects rate of reaction.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">C6 – Paper chromatography</p>	<p>Big Question: Investigate the colours that are found within a mixture of food colourings</p> <p>IV – Ink colour DV – Rf value CV - Start point of the colour, size of the coloured dot, start point of the solvent</p>	<p>*Beaker *Wooden splint *Chromatography paper *4 food colourings 'A' - 'D' *mixture of food colourings 'U' *5 glass capillary tubes *paper clip *ruler *pencil</p>	<ol style="list-style-type: none"> 1) Use a ruler to draw a pencil 'origin' line 2cm from the bottom of the chromatography paper. 2) Mark 5 pencil dots at equal intervals along this line 3) Use a glass capillary tube to put each coloured dot onto a pencil dot 4) Label each spot in pencil 5) Pour water into the beaker to 1cm. 6) Clip the chromatography paper to the wooden splint with the spots at the bottom. 7) Carefully hang into the beaker. 8) Wait for the water to travel $\frac{3}{4}$ of the way up the paper. 9) Remove the paper from the beaker and draw a pencil line at the top of the solvent (this is the solvent front line). 10) Hang the paper to dry it. 11) Measure the distance between the two pencil lines and then between the start line and the middle of each spot of ink. 12) Use this to calculate the Rf value (distance moved by solute/distance moved by solvent). 	<p>You should be able to identify the colours A-D in the mixture as they should have the same Rf value as the colours A-D.</p>	<p>Investigate whether this pen is a pure colour or a mixture.</p>

C7 – Ion testing (triple only)	<p>Big Question: Identify the ions in ionic compounds</p> <p>Test 1: Flame tests (Lithium, sodium, potassium, calcium, copper)</p> <p>Test 2: Carbonate tests</p> <p>Test 3: Sulphate tests</p> <p>Test 4: Halide tests (chloride, bromide, iodide)</p>	<p>Test 1: Flame tests: *chloride solutions of each of the metals *wire loop *Bunsen burner</p> <p>Test 2: Carbonate tests *sodium solutions *pipette *6 test tubes *limewater *test tube rack *HCl</p> <p>Test 3: Sulphate tests *sodium solutions *HCl *barium chloride solution *5 test tubes *test tube rack</p> <p>Test 4: Halide tests (chloride, bromide, iodide) *sodium solutions *dilute nitric acid *silver nitrate solution</p>	<p>Test 1: Flame tests (Lithium, sodium, potassium, calcium, copper) 1) Pour 1cm³ of each metal chloride solution into a test tube 2) Dip the loop into the solution 3) Place the loop into the blue flame of the Bunsen burner. Observe the colour.</p> <p>Test 2: Carbonate tests 1) Pour 1cm³ of each sodium solution into a different test tube 2) Pour 1cm³ of limewater into the 6th test tube. 3) Add 1cm³ of dilute HCl to each sodium solution. 4) If bubbles are produced, collect the gas using a pipette and bubble through the limewater solution.</p> <p>Test 3: Sulphate tests 1) Pour 1cm³ of each sodium solution into a different test tubes 2) Add a few drops of HCl into each test tube 3) Add 1cm³ of barium chloride solution to each test tube</p> <p>Test 4: Halide tests (chloride, bromide, iodide) 1) Pour 1cm³ of each sodium solution into different test tubes 2) Add a few drops of dilute nitric acid to each solution 3) Add 1cm³ of silver nitrate solution to each test tube</p>	<p>Flame tests: Li = crimson Na = Yellow K = Lilac Ca = orange-red Copper = green</p> <p>Carbonate tests: If limewater turns cloudy, it is a carbonate!</p> <p>Sulphate tests: produce a white precipitate when they react with barium chloride solution</p> <p>Halide test Bromide = cream Iodide = yellow Chloride = white</p>	
C8 – Water purification	<p>Big Question: Analyse and purify a water sample to make sure it is safe to drink (potable!).</p> <p>IV – Water sample DV – Mass of solids dissolved in 10cm³ AND pH CV - Volume of water tested</p>	<p>*10cm³ of each water sample *universal indicator *Bunsen burner *tripod *gauze *heat proof mat *clamp *clamp stand *conical flask and delivery tube with bung *boiling tube *ice bath *cobalt chloride paper</p>	<p>1) Test each sample of water with universal indicator and record the pH</p> <p>2) Weigh the evaporating basin.</p> <p>3) Pour 10cm³ of the sample into an evaporating basin and heat using the equipment set up below.</p> <p>4) Weigh the cooled evaporating basin and then calculate the mass of solids in the basin.</p>  <p>To gain pure water:</p> <p>1) Set up</p>  <p>simple distillation equipment as shown in the diagram.</p> <p>2) Heat the water until it boils. 3) Collect the condensed water in the boiling tube. 4) Use cobalt chloride paper to test whether the substance is water (it will turn blue -> pink).</p>	<p>All water will have some dissolved substances in it unless it has been distilled.</p>	

Physics

Mastery Matrix

Unit	Topic	Learning statement	Tier	Course	Revision Guide (double)	Revision Guide (triple)	1	2	3
Energy and Waves	Elastic Objects & potential energy	Describe elastic and inelastic deformation	F	A	160	P10			
Energy and Waves	Elastic Objects & potential energy	Explain the effect of forces on elastic objects	F	A	160	P10			
Energy and Waves	Elastic Objects & potential energy	Describe Hooke's Law qualitatively and using the equation $F = ke$	F	A	161	P10			
Energy and Waves	Elastic Objects & potential energy	Explain 'word done' when applied to stretching or compressing a spring	F	A	161	P10			
Energy and Waves	Elastic Objects & potential energy	Explain the difference between a linear and a non-linear relationship	F	A	160	P10			
Energy and Waves	Elastic Objects & potential energy	Interpret data from a force extension investigation	F	A	160	P10			
Energy and Waves	Elastic Objects & potential energy	RP Force and Extension: Investigate the relationship between force and extension for spring (Hooke's Law)	F	A	161	P11			
Energy and Waves	Waves	Describe what is meant by 'a wave'	F	A	182	P30			
Energy and Waves	Waves	Describe the difference between longitudinal and transverse waves giving examples for both	F	A	182	P30			
Energy and Waves	Waves	Describe amplitude, wavelength (λ), wave speed (v), frequency (f) and period of a wave (T) and give units for each	F	A	182	P30			
Energy and Waves	Waves	Use and rearrange $T = 1/f$	F	A	183	P30			
Energy and Waves	Waves	Use and rearrange $v = f \lambda$	F	A	183	P31			
Energy and Waves	Waves	Identify amplitude and wavelength from diagrams of a wave	F	A	182	P30			
Energy and Waves	Waves	Describe the method to measure the speed of sound in air and the speed of ripples on the water surface	F	A	183	P31			
Energy and Waves	Waves	RP Waves: Make observations to identify the suitability of apparatus for measuring frequency, wavelength and speed of waves in a ripple tank and waves on a string or elastic cord.	F	A	183	P31			
Energy and Waves	Electromagnetic Waves	Describe what 'electromagnetic waves' are	F	A	184	P36			
Energy and Waves	Electromagnetic Waves	Recall the order of EM waves & recall their frequency and wavelength and give examples of the uses of these	F	A	186	P36			
Energy and Waves	Electromagnetic Waves	Explain how EM waves are generated and absorbed	F	A	186	P36			
Energy and Waves	Electromagnetic Waves	Explain the hazardous effects of UV, X-rays and Gamma rays	F	A	187	P37			
Energy and Waves	Electromagnetic Waves	Link the properties of EM waves to their practical application (HT only)	HT	A		P36			
Energy and Waves	Electromagnetic Waves	Apply knowledge of reflection, refraction, transmission and absorption to EM waves (HT only)	HT	A		P32+P33			
Energy and Waves	Electromagnetic Waves	RP Radiation and Absorption: investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface	F	A	186	P37			
Energy and Waves	Electromagnetic Waves	Explain how radio a radio works using EM waves (HT only)	HT	A	187	P37			
Energy and Waves	Sound waves and Light Waves	Describe the properties of light and explain how light travels. (triple only)	F	T		P32			
Energy and Waves	Sound waves and Light Waves	Describe reflection of waves at a boundary (triple only)	F	T		P32			
Energy and Waves	Sound waves and Light Waves	Construct ray diagrams to show reflection (triple only)	F	T		P32			
Energy and Waves	Sound waves and Light Waves	Compare 'specular reflection' and 'diffuse reflection' (triple only)	F	T		P40			
Energy and Waves	Sound waves and Light Waves	Show how properties of a sound wave changes as it moves from one medium to another (refraction) (triple only)	F	T		P32			
Energy and Waves	Sound waves and Light Waves	Use wave front diagrams as a way to explain refraction (triple only)	F	T		P32			
Energy and Waves	Sound waves and Light Waves	RP Light: Investigate the reflection and refraction of light by different substances (triple only)	F	T		P32			
Energy and Waves	Sound waves and Light Waves	Describe what a convex and concave lens is and the image that would be produced by them drawing ray diagrams to illustrate this (triple only)	F	T		P38			
Energy and Waves	Sound waves and Light Waves	Use the equation magnification = image height / Object height (triple only)	F	T		P38			
Energy and Waves	Sound waves and Light Waves	Explain how colour of objects is determined (triple only)	F	T		P40			

Energy and Waves	Sound waves and Light Waves	Explain how colour filters work (triple only)	F	T		P40			
Energy and Waves	Sound waves and Light Waves	Define transparent and translucent (triple only)	F	T		P40			
Energy and Waves	Sound waves and Light Waves	Explain what a sound wave is and how the ear detects them (triple only)	F	T		P33			
Energy and Waves	Sound waves and Light Waves	Recall the range of normal human hearing (20Hz to 20kHz) (triple only)	F	T		P33			
Energy and Waves	Sound waves and Light Waves	Describe some examples of processes that convert between sound waves and vibrations (triple only)	F	T		P33			
Energy and Waves	Sound waves and Light Waves	Explain reflection, refraction, absorption and transmission of sound waves at a boundary. (triple only)	F	T		P34			
Energy and Waves	Sound waves and Light Waves	Explain how waves can be used for detection and exploration of structures (ultrasound, seismic, echo sounding) (triple only)	F	T		P34			
Forces and Motion	Forces introduction	Define scalar and vector quantities	F	A	158	P8			
Forces and Motion	Forces introduction	Use arrows to represent vector quantities	F	A	158	P8			
Forces and Motion	Forces introduction	Define contact and non-contact forces giving examples of each	F	A	158	P8			
Forces and Motion	Forces introduction	Define weight and gravity	F	A	158	P8			
Forces and Motion	Forces introduction	Use $W = m \times g$	F	A	159	P9			
Forces and Motion	Forces introduction	Describe what the centre of mass is	F	A	158	P8			
Forces and Motion	Forces introduction	Explain how to measure weight using a calibrated spring balance (i.e. a Newton meter)	F	A	159	P9			
Forces and Motion	Resultant forces	Calculate and define resultant forces	F	A	159	P9			
Forces and Motion	Resultant forces	Use free body diagrams to show forces	F	A	159	P9			
Forces and Motion	Resultant forces	Use vector diagrams to illustrate the resolution of forces and determine resultant forces (scale drawings) (HT only)	HT	A	159	P9			
Forces and Motion	Speed and velocity	Explain the difference between distance and displacement	F	A	162	P14			
Forces and Motion	Speed and velocity	Define 'speed' and explain factors that affect the speed a person walks, runs or cycles at (including average speeds for these activities)	F	A	162	P14			
Forces and Motion	Speed and velocity	Recall typical speeds for different types of transportation (TBC – bus, train, car, aeroplane!) using – correctly.	F	A	162	P14			
Forces and Motion	Speed and velocity	Recall the speed of sound in air	F	A	162	P14			
Forces and Motion	Speed and velocity	State that most moving objects have varying speed including sound, wind, travelling people	F	A	162	P14			
Forces and Motion	Speed and velocity	Use and rearrange $s = v \times t$ (speed = d/t equation!)	F	A	162	P14			
Forces and Motion	Speed and velocity	Calculate average speed for non-uniform motion	F	A	162	P14			
Forces and Motion	Speed and velocity	Define 'velocity'	F	A	162	P14			
Forces and Motion	Speed and velocity	Describe circular motion (HT only)	HT	A	163	P15			
Forces and Motion	Distance time and velocity time graphs	Draw and interpret distance time graphs and use these to determine speed	F	A	163	P15			
Forces and Motion	Distance time and velocity time graphs	Draw tangents on a distance time graph to determine speed of an accelerating object (HT only)	HT	A	163	P15			
Forces and Motion	Distance time and velocity time graphs	Use and rearrange the equation $a = \Delta v / t$ (calculating acceleration)	F	A	164	P16			
Forces and Motion	Distance time and velocity time graphs	Estimate the magnitude of every day acceleration	F	A	164	P16			
Forces and Motion	Distance time and velocity time graphs	Draw and interpret velocity time graphs in order to calculate acceleration	F	A	164	P16			
Forces and Motion	Distance time and velocity time graphs	Use velocity time graphs to calculate distance/displacement (HT only)	HT	A	164	P16			
Forces and Motion	Falling objects	Apply the equation $v^2 - u^2 = 2as$ (For moving and falling objects) [Newton's equations of motion]	F	A	164	P16			
Forces and Motion	Falling objects	Recall the value for acceleration due to gravity ($9.8m/s^2$)	F	A	166	P18			
Forces and Motion	Falling objects	Explain the acceleration of objects through fluids (terminal velocity) – making reference to parachutes travelling through air	F	A	166	P18			

Forces and Motion	Falling objects	Draw and interpret velocity time graphs for objects that reach terminal velocity	F	A	166	P18			
Forces and Motion	Newton's Laws	Describe and explain Newton's first law	F	A	163	P15			
Forces and Motion	Newton's Laws	Explain the concept of inertia (HT only)	HT	A	163	P15			
Forces and Motion	Newton's Laws	Describe and explain Newton's second law using $F = m a$	F	A	165	P17			
Forces and Motion	Newton's Laws	Define inertial mass (HT only)	HT	A	165	P17			
Forces and Motion	Newton's Laws	Estimate the forces involved in large accelerations for every day road transport using - correctly.	F	A	164	P16			
Forces and Motion	Newton's Laws	RP Acceleration: Investigate the effects of varying force on the acceleration of an object with a constant mass and the effects of varying the mass on the acceleration produced by a constant force	F	A	165	P17			
Forces and Motion	Stopping Distances	Define 'stopping distance', 'thinking distance' and 'braking distance'	F	A	168	P20			
Forces and Motion	Stopping Distances	Recall typical values for reaction times (0.2-0.9 seconds)	F	A	168	P20			
Forces and Motion	Stopping Distances	Describe factors that effect a drivers reaction time	F	A	168	P20			
Forces and Motion	Stopping Distances	Explain methods used to measure human's reaction times	F	A	168	P20			
Forces and Motion	Stopping Distances	Describe factors affecting 'braking distance'	F	A	169	P21			
Forces and Motion	Stopping Distances	Predict how the distance for a vehicle to make an emergency stop varies over a range of speeds	F	A	169	P21			
Forces and Motion	Stopping Distances	Explain the energy transfers when a vehicle brakes	F	A	169	P21			
Forces and Motion	Stopping Distances	Link braking force, deceleration and stopping distances	F	A	169	P21			
Forces and Motion	Stopping Distances	Explain the dangers caused by large decelerations	F	A	169	P21			
Forces and Motion	Stopping Distances	Interpret graphs relating speed to stopping distance (triple only)	F	T		P20			
Forces and Motion	Stopping Distances	Estimate the forces involved in the deceleration of road vehicles (HT only)	HT	A	169	P21			
Forces and Motion	Momentum	Define 'momentum' using $p = m v$ (HT only)	HT	A	166	P18			
Forces and Motion	Momentum	Explain conservation of 'momentum' (HT only)	HT	A	167	P19			
Forces and Motion	Momentum	Complete calculations about the collision of two objects using the momentum equation (triple only)	F	T		P19			
Forces and Motion	Momentum	Combine $F = m a$ and $a = \Delta v/t$ to give the equation $F = m\Delta v/\Delta t$ to show force = the rate of change of momentum (triple only)	F	T		P18			
Forces and Motion	Momentum	Explain safety features with reference to momentum (air bags, seat belts, gym crash mats, cycle helmets and cushioned playground surfaces) (triple only)	F	T		P19			
Forces and Motion	Moments	Describe and explain Newton's third law	F	A	166	P18			
Forces and Motion	Moments	Describe examples in which forces cause rotation (triple only)	F	T		P11			
Forces and Motion	Moments	Define moment and use and rearrange the equation $M = F \times d$ (triple only)	F	T		P11			
Forces and Motion	Moments	Describe moments for a balanced for a balanced object (triple only)	F	T		P11			
Forces and Motion	Sound Waves	Explain how insulating materials can become electrically charged (triple only)	F	T		P64			
Forces and Motion	Sound Waves	Explain what a sound wave is and how the ear detects them (triple only)	F	T		P33			
Forces and Motion	Sound Waves	Show how properties of a sound wave changes as it moves from one medium to another (refraction) (triple only)	F	T		P33			
Forces and Motion	Sound Waves	Recall the range of normal human hearing (20Hz to 20kHz) (triple only)	F	T		P33			
Forces and Motion	Sound Waves	Describe some examples of processes that convert between sound waves and vibrations (triple only)	F	T		P33			
Forces and Motion	Sound Waves	Explain reflection, refraction, absorption and transmission of sound waves at a boundary. (triple only)	F	T		P34			
Forces and Motion	Sound Waves	Explain how waves can be used for detection and exploration of structures (ultrasound, seismic, echo sounding) (triple only)	F	T		P34			

Radioactivity and Particles	Gas Pressure and Fluid Pressure	Explain gas contraction and expansion (triple only)	F	T		P85			
Radioactivity and Particles	Gas Pressure and Fluid Pressure	Use and rearrange $p = F / A$ (triple only)	F	T		P12			
Radioactivity and Particles	Gas Pressure and Fluid Pressure	Calculate differences in pressure at different depths in liquids (triple only)	F	T		P12			
Radioactivity and Particles	Gas Pressure and Fluid Pressure	Explain what causes upthrust (triple only)	F	T		P13			
Radioactivity and Particles	Gas Pressure and Fluid Pressure	Describe factors which influence floating and sinking (triple only)	F	T		P13			
Radioactivity and Particles	Gas Pressure and Fluid Pressure	Describe what the 'atmosphere' is and explain how density changes with altitude (triple only)	F	T		P12			
Radioactivity and Particles	Gas Pressure and Fluid Pressure	Explain what causes atmospheric pressure and how this changes with height/altitude (triple only)	F	T		P12			
Electricity and Astrophysics	Astrophysics and Cosmology	Describe the main parts of the solar system (triple only)	F	T		P94			
Electricity and Astrophysics	Astrophysics and Cosmology	Explain the life cycle of a star making reference to our sun and stars more massive than our sun (triple only)	F	T		P94			
Electricity and Astrophysics	Astrophysics and Cosmology	Explain how elements are made in our solar system (triple only)	F	T		P95			
Electricity and Astrophysics	Astrophysics and Cosmology	Explain how planets and satellites maintain their circular orbits (triple only)	F	T		P96			
Electricity and Astrophysics	Astrophysics and Cosmology	Describe similarities and differences between planets, moons and artificial satellites (triple only)	F	T		P96			
Electricity and Astrophysics	Astrophysics and Cosmology	Link gravity and velocity in circular orbits (triple only)	F	T		P96			
Electricity and Astrophysics	Astrophysics and Cosmology	Link radius and speed in stable orbits (triple only)	F	T		P96			
Electricity and Astrophysics	Astrophysics and Cosmology	Explain what the big bang theory is (triple only)	F	T		P97			
Electricity and Astrophysics	Astrophysics and Cosmology	Explain the effects of red-shift (triple only)	F	T		P97			
Electricity and Astrophysics	Astrophysics and Cosmology	Explain how red-shift provides evidence for the big bang theory (triple only)	F	T		P97			
Electricity and Astrophysics	Astrophysics and Cosmology	Explain how recent observations provide evidence for the expanding universe (triple only)	F	T		P97			
Electricity and Astrophysics	Astrophysics and Cosmology	Give examples of things in the universe that scientists do not understand i.e. dark mass and dark energy (triple only)	F	T		P97			
Electricity and Astrophysics	Back body radiation	Explain what a 'perfect black body' is (triple only)	F	T		P41			
Electricity and Astrophysics	Back body radiation	Describe the factors that affect the intensity and wavelength of infrared emissions (triple only)	F	T		P41			
Electricity and Astrophysics	Back body radiation	Describe the rates of radiation emission for an object and apply this to the Earth (triple only)	F	T		P41			
Electricity and Astrophysics	Back body radiation	Draw and interpret diagrams to explain how radiation effects the temperature of the Earth (global warming) (triple only)	F	T		P41			
Applying forces and energy	Magnetism	Describe the polarity of magnets and list 4 magnetic materials	F	A	206	P66			
Applying forces and energy	Magnetism	Explain the difference between a permanent and induced magnet	F	A	206	P66			
Applying forces and energy	Magnetism	Describe the force between a magnet and a magnetic material	F	A	206	P66			
Applying forces and energy	Magnetism	Describe the direction and strength of a magnetic field around a magnet	F	A	206	P66			
Applying forces and energy	Magnetism	Explain how compasses work	F	A	206	P66			
Applying forces and energy	Magnetism	Describe how to make an electromagnet and how to increase its strength	F	A	207	P67			
Applying forces and energy	Magnetism	Interpret diagrams of electromagnetic devices in order to explain how they work (triple only)	F	T		P67			
Applying forces and energy	The motor effect and the generator effect	Describe the motor effect and use this to explain how electric motors work (HT only)	HT	A	208	P68			
Applying forces and energy	The motor effect and the generator effect	Explain and apply Fleming's left hand rule (HT only)	HT	A	209	P68			
Applying forces and energy	The motor effect and the generator effect	Recall factors that affect the size of the force on a conductor (HT only)	F	A	208	P67			
Applying forces and energy	The motor effect and the generator effect	Use and rearrange the equation $F = B I L$ (HT only)	HT	A	208	P68			
Applying forces and energy	The motor effect and the generator effect	Explain how loudspeakers and headphones work (triple only)	F	T		P69			
Applying forces and energy	The motor effect and the generator effect	Explain how potential difference/current can be induced in a circuit (the generator effect!) (triple only)	F	T		P70			

Applying forces and energy	The motor effect and the generator effect	Recall factors that can affect the size of the generator effect (triple only)	F	T		P70			
Applying forces and energy	The motor effect and the generator effect	Apply principals of the generator effect to: a dynamo, microphone, transformers (triple only)	F	T		P70			
Applying forces and energy	The motor effect and the generator effect	Draw and interpret graphs of potential difference generated in a coil against time (triple only)	F	T		P70			

Knowledge organiser:

	Paper:	P2
	Topic:	Waves (P.4)
1	What are the two types of waves?	Transverse and longitudinal
2	What type of wave is sound?	Longitudinal
3	What type of wave is visible light?	Transverse
4	How do the particles that make up a wave transfer energy?	They oscillate (vibrate)
5	What are the 4 properties of a wave?	Frequency, amplitude, wavelength, period
6	Define "frequency"	The number of waves passing a fixed point per second (hertz, Hz)
7	Define "amplitude"	Maximum displacement that any particle achieves from its undisturbed position (metres)
8	Define "wavelength"	Distance from one point on a wave to the same point on the next wave (metres)
9	Define "period"	Time taken for 1 complete oscillation (seconds)
10	State the equation to calculate the period of a wave	$T=1/f$ Period (s) = 1/ frequency (Hz)
11	State the equation to calculate wave speed	$v = f \times \lambda$ wave speed (m/s) = frequency (Hz) x wavelength (m)
12	State the relationship between speed and wavelength	They are directly proportional
13	In a transverse wave, oscillations are _____ to the direction of energy transfer	perpendicular
14	In a longitudinal wave, oscillations are _____ to the direction of energy transfer	parallel
15	What do waves transfer?	Energy (not matter)
	Topic:	Electromagnetic waves 1 (P.5)
1	What type of waves are electromagnetic waves?	Transverse
2	At what speed do all electromagnetic waves travel?	Speed of light (300,000,000m/s)
3	What do the different types of electromagnetic waves vary in?	Frequency
4	List the electromagnetic waves in order of frequency from lowest to highest	Radio waves, microwaves, infrared waves, visible light, ultraviolet, X-Rays, gamma rays
5	Which sub-cellular structure is damaged by ionising radiation?	DNA
6	Which type of wave is the most ionising?	Gamma Rays
7	Which wave is used in medical imaging?	X-Rays
8	Which wave is used in telecommunications?	Radio waves and microwaves
9	Which wave has the longest wavelength?	Radio waves
10	State 3 properties shared by all electromagnetic waves	1) All travel at the speed of light 2) All transverse 3) All travel through a vacuum
11	Which wave has the shortest wavelength?	Gamma rays
12	State 1 risk associated with UV rays	Skin cancer
13	Which two types of waves are ionising radiation?	X-Rays and Gamma Rays
14	Which wave can be detected by the human eye?	Visible light
15	Which 3 rays can have hazardous effects on the human body?	UV, X-Ray and Gamma rays
	Topic:	Electromagnetic waves 2 (P.6)
1	What is produced by oscillations in electrical circuits? (HT only)	Radio waves
2	What happens when a radio wave is absorbed? (HT only)	Alternating current produced
3	What causes EM waves to be generated/absorbed?	Changes in atoms/nuclei of atoms
4	State two effects of UV waves	Cause skin to age prematurely, increase risk of skin cancer
5	State two effects of X-rays and gamma rays	1) mutations of genes, 2) cancer
6	State two uses of radio waves	TV and radio
7	State 2 uses of microwaves	Satellite communication and cooking food
8	State 3 uses of infrared	Electrical heaters, cooking food, infrared cameras
9	State 1 use of visible light	Fibre optic communication
10	State 2 uses of UV waves	Energy efficient lamps and sun tanning
11	State two uses of X-rays and gamma rays	Medical imaging and treatments
12	Why are radio waves used in television and radio? (HT only)	Can be reflected from atmosphere due to wavelength
13	Why are microwaves used in cooking? (HT only)	Frequency matches frequency of water particles vibrating
14	Why are microwaves used in satellite communication?(HT only)	Frequency allows them to pass through atmosphere

15	Why are X-rays and gamma rays used in medical imaging? (HT only)	Highly ionising and penetrating
	Topic:	Sound and light waves introduction (P.7)
1	What type of waves are sound waves?	Longitudinal
2	What type of waves are light waves?	Transverse
3	Light waves travel in _____	Straight lines
4	Why can sound waves not travel in a vacuum	A vacuum has no particles
5	What happens to the speed of a light wave as it enters a more dense medium	The first part of the light wave slows down
6	Which state does a sound wave travel fastest in?	Solid
7	Which state does a sound wave travel slowest in?	Gas
8	What happens to the direction of a light wave as it enters a different medium?	The light wave changes direction towards the normal
9	What must sound waves travel through?	A medium
10	When light and sound waves reach a boundary between mediums (materials) what four things can happen to them?	Reflected, refracted, absorbed, transmitted
11	What happens to the loudness of a sound wave when it's amplitude increases?	The loudness increases
12	What happens to the pitch of a sound wave when it's frequency increases?	The pitch increases (gets higher)
13	Do light waves vary their speed?	No, they all travel at the same speed
14	What is the amplitude of a sound wave related to?	It's volume
15	What is the frequency and wavelength of a sound wave related to?	It's pitch
	Topic:	Properties of waves (triple only) (P.8)
1	State 3 things that can happen to waves when they reach a boundary	Reflected, transmitted or absorbed
2	State the name of a reflected sound wave	Echo
3	What happens when a sound wave travels through a solid?	The solid particles vibrate
4	Name the 4 main parts of the ear	1) Pinna, 2) Ear drum, 3) Cochlea, 4) Auditory nerve
5	Why is human hearing limited?	Limited frequency range in which sound waves can convert to vibrations in solids
6	What is the range of normal human hearing?	20Hz - 20kHz
7	State two uses of ultrasounds	Medical and industrial imaging
8	Name one object that converts sound waves into electrical waves	Microphone
9	State the two types of waves produced by earthquakes	P-waves and S-waves
10	Which type of wave are P-waves and S-waves?	P-waves = longitudinal S-waves = transverse
11	Which type of earthquake wave travels in solids only?	S-waves
12	Which type of earthquake wave travels in solids AND liquids?	P-waves
13	What have P-waves and S-waves provided evidence for?	Structure and size of Earth's core
14	Name two animals that use echolocation	Bats and dolphins
15	State one use of echolocation by humans	Measuring water depth
	Topic:	Light waves - reflection (triple only) (P.9)
1	Visible light is made up of a _____ of colours	spectrum
2	What determines the colour of visible light?	It's wavelength and frequency
3	Which type of reflection occurs from a smooth surface in a single direction?	Specular reflection
4	Which type of reflection occurs from a rough surface and causes scattering of light?	Diffuse reflection
5	How does a colour filter work?	Absorbs certain wavelength and transmits others
6	What determines the colour of an opaque object?	Which wavelengths of light are most strongly reflected
7	What colour does an object occur if all wavelengths of light are REFLECTED equally?	White
8	What colour does an object occur if all wavelengths of light are ABSORBED equally?	Black
9	What is the name given to an object that transmits all light?	Transparent
10	What is the name given to an object that transmits some light?	Translucent
11	When drawing a ray diagram, what is the name given to the line drawn at 90° to the object?	The normal
12	What is the name given to the light ray that goes INTO an object?	Incident ray
13	What is the name given to the light ray that is reflected from an object?	Normal
14	What is the rule that links the angle of incidence and the angle of reflection?	Angle of incidence = Angle of reflection

15	Recall the colours of light from low frequency to high frequency	ROYGBIV
	Topic:	Light waves - refraction (triple only) (P.10)
1	Describe what happens to a wave as it moves from a less dense to a more dense medium	It refracts
2	Describe the change in speed and direction of a wave that is moving from a less dense to a more dense medium	1) Slows down, 2) changes direction towards the normal
3	Describe the change in speed and direction of a wave that is moving from a more dense to a less dense medium	1) Speeds up, 2) changes direction away from the normal
4	What is the symbol for a convex lens?	\leftrightarrow
5	What is the symbol for a concave lens?	$\rightarrow<$
6	What is the name given for the point where light rays converge?	Focal point
7	What is the equation of calculating magnification?	Magnification = image height/object height
8	Which term means an image is upside down compared to the object?	Inverted
9	Which term means an image is bigger than the real object?	Magnified
10	Which term means an image is smaller than the real object?	Diminished
11	What is a "real" image?	Can be projected onto a screen & formed on opposite side of lens to object
12	What is a "virtual" image?	Cannot be projected onto a screen & formed on same side of lens to object
13	When drawing a diagram for light rays passing through a lens, what is the point called where the rays meet/cross?	Converge
14	When drawing a diagram for light rays passing through a lens, what is the point called where the rays spread out from each other?	Diverge
15	What is the name given for the line drawn through the middle of a lens? (from the bottom of an object?)	Principal axis
	Topic:	Forces introduction (P.11)
1	Scalar quantities have only _____	magnitude
2	Vector quantities have _____ and _____	magnitude and direction
3	Magnitude is another word for _____	Size
4	State 3 scalar quantities	Distance, speed, time
5	State 3 vector quantities	Displacement, velocity, acceleration
6	How can you show the size of a vector on a diagram?	Use an arrow.
7	What is the name of the type of force that occurs when the objects are physically touching?	Contact forces
8	What is the name of the type of force that occurs when the objects are separated?	Non-contact
9	Which type of force is magnetic force?	Non-contact
10	Which type of force is weight?	Non-contact
11	Which type of force is tension?	Contact
12	Which type of force is upthrust?	Contact
13	Define "weight"	The force acting on an object due to gravity
14	Define "gravitational field strength"	The pull of the Earth on an object
15	What is the equation for calculating weight?	Weight (N) = Mass (Kg) X Gravitational Field Strength (N/Kg)
	Topic:	Scalar and vector quantities (P.12)
1	A _____ force is a single force that has the same effect as all the original forces acting together.	resultant
2	What two things happens to objects if the forces acting on them are balanced?	Stay still or constant speed
3	State two effects on an object if the forces acting upon it are unbalanced?	Accelerate/decelerate/change direction/squash or stretch
4	To calculate the resultant force in one direction you _____ the forces acting up/down or left/right.	subtract
5	What is the name given to a diagram that shows the forces acting upon an object	Free body diagram
6	Weight can be measured using a _____	Newton meter or spring balance
7	The point at which all the mass of an object acts is called _____	the centre of mass
8	Resolve the forces means turn two forces into _____	one force/resultant force
9	To work out the centre of mass of a regular shape, you should _____	draw the lines of symmetry
10	To work out the centre of mass of an irregular shape, you should _____	do the plumb line experiment
11	Which type of force occurs when air pushes you back?	Air resistance

12	What are the four forces acting on an accelerating boat?	Weight, thrust, upthrust, water resistance
13	State the units for weight	Newtons (N)
14	State the units for mass	Kilograms (kg)
15	State the units for gravitational field strength	Newtons per kilogram (N/Kg)
	Topic:	Speed and velocity (P.13)
1	What is the difference between distance and displacement?	Distance = scalar, displacement = vector
2	Define "speed"	Distance covered in a given time
3	What is the equation linking displacement, velocity and time?	displacement = velocity x time $s (m) = v (m/s) \times t (s)$
4	State three factors that may affect the speed a person walks	Age, terrain, fitness
5	State the typical speed for a person walking	1.5m/s
6	State the typical speed for a person running	3m/s
7	State the typical speed for a person cycling	6m/s
8	State the speed of sound in air	330m/s
9	State the speed of light in air	300,000,000m/s
10	Describe the motion of an object traveling in a circle	Constant speed, changing velocity
11	Which piece of equipment is used to measure time?	Stopwatch
12	How is speed calculated for non-uniform motion?	Average speed (m/s) = distance (m) / time (s) $s = d / t$
13	Define "velocity"	Speed in a given direction
	Topic:	Distance and velocity-time graphs (P.14)
1	State the axes in a distance time graph	X axis = time, Y axis = distance
2	Describe what is meant by a flat horizontal line (—) on a distance-time graph?	The object is stationary
3	Describe what is meant by a straight diagonal line (/) away from the x-axis on a distance-time graph?	Object is moving at a constant speed AWAY from start
4	Describe what is meant by a straight diagonal line (\) towards the x-axis on a distance-time graph?	Object is moving at a constant speed back TOWARDS the start
5	How do you calculate the speed of an object using a distance-time graph if the speed is constant?	Calculate gradient ($\Delta Y / \Delta X$)
6	If an object is not travelling at a constant speed, how will this motion be shown on a distance time graph?	A curve
7	How do you calculate the speed of an object using a distance time graph if the speed is not constant (the line is a curve!)?	Draw a tangent & calculate gradient
8	What does a steeper line on a distance-time graph represent?	An object moving faster
9	Describe the axes on a velocity-time graph	X-axis = time, Y-axis = velocity
10	Describe what is meant by a flat horizontal line (—) on a velocity-time graph?	The object is moving at a constant velocity
11	Describe what is meant by a straight diagonal line (/) away from the x-axis on a velocity-time graph?	Object is accelerating
12	Describe what is meant by a straight diagonal line (\) towards the x-axis on a velocity-time graph?	Object is decelerating
13	What do you calculate when you calculate the area under a velocity-time graph? (HT only)	Total distance travelled
14	How do you calculate acceleration (if it is constant - a straight line) from a velocity time graph?	Calculate gradient ($\Delta Y / \Delta X$)
15	How do you calculate acceleration (if it is changing - a curved line) from a velocity time graph?	Draw a tangent & calculate gradient
	Topic:	Falling objects and Newton's laws (P.15)
1	State the equation to calculate uniform acceleration when given velocity and distance	$(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$ $v^2 - u^2 = 2as$
2	What is the acceleration of an object free falling due to gravity close to the Earth?	9.8m/s ²
3	What are the two forces acting upon a falling object?	Weight and air resistance
4	Describe the motion of an object as it begins to fall through a fluid	It accelerates (weight is bigger than air resistance)
5	As an object continues to fall through a fluid, the weight remains the same, describe what happens to the air resistance as the object gains speed?	Air resistance increases
6	What is the term that given to describe the motion of an object when it's weight and the air resistance acting upon it are equal?	Terminal velocity
7	Describe what happens to the forces acting upon a parachuter when they open their parachute	Air resistance ↑, weight stays constant
8	According to Newton's First Law, what will affect an object's velocity?	A resultant force

9	According to Newton's First Law, if the resultant force acting upon a stationary object is zero, what will happen?	The object remains stationary
10	According to Newton's First Law, if the resultant force acting upon a moving object is zero, what will happen?	Moves with at same velocity
11	What is the term given to the tendency of an object to continue in their state of rest or uniform motion? (HT only)	Inertia
12	Which objects have a large inertia? (HT only)	Objects with a large mass
13	According to Newton's 2nd Law state what is the relationship between acceleration and force?	Directly proportional
14	According to Newton's 2nd Law state what is the relationship between acceleration and mass?	Inversely proportional
15	Write Newton's Second Law as an equation	Resultant force (N) = mass (kg) x acceleration (m/s ²) F = ma
Topic:		Stopping distances (P.17)
1	Define "stopping distance"	Thinking distance + braking distance
2	Define "thinking distance"	The distance travelled during the driver's reaction time
3	Define "braking distance"	The distance travelled under the braking force
4	What are the typical values for reaction time	0.2-0.9 seconds
5	State 4 factors that effect a driver's reaction time	Tiredness, alcohol, drugs, distractions
6	State 3 factors that may affect braking distance	Adverse weather conditions (ice/snow/wet), worn tyres, worn brakes
7	What happens to a vehicles braking distance when a car is travelling faster?	Increases
8	Which force causes a car to slow down?	Friction (between brakes and wheels)
9	Describe the energy transfers that occur when a force is applied to a car's brakes	Kinetic energy of car -> thermal energy in the brakes
10	Why is a car travelling at high speed stopping suddenly dangerous?	Need larger braking force -> large deceleration
11	State 2 dangers of large decelerations	Overheating brakes and skidding car
12	Define "adverse"	Bad
13	What is 'inertial mass' (HT only)	A measure of how hard it is to change an object's velocity
14	Define "inertial mass"	The ratio of force over acceleration
15	What does this symbol mean? "~"	Approximately
Topic:		Momentum (HT only) and Moments (triple only) (P.18)
1	Define "momentum" (HT only)	Momentum = mass x velocity $p = m \times v$ (kg m/s) (kg) (m/s)
2	Define "conservation of momentum" (HT only)	Total momentum before an event = total momentum after event
3	State the equation to calculate change in momentum (HT only)	$F = (m \Delta v) / \Delta t$ when (m Δv) is Δp
4	State the relationship between force and momentum (HT only)	Force equals rate of change of momentum
5	Describe how safety features including seat belts, gym crash mats and cycle helmets work (linking to momentum) (HT only)	Increase time -> decrease rate of change of momentum -> decrease force
6	What causes an object to rotate? (triple only)	Forces
7	Give 2 examples of forces causing rotation (triple only)	Pushing down on a door handle, pushing a door shut (due to hinge)
8	Define "moment" (triple only)	The turning effect of a force
9	Define "moment" using an equation (triple only)	moment = force x distance $M = F \times d$ (Nm) (N) (m)
10	Describe the moments in a balanced object (triple only)	Total clockwise moment = total anticlockwise moment
11	What are gears and levers used for? (triple only)	Transmit and multiply rotational forces
12	0	0
13	0	0
14	0	0
15	0	0
Topic:		Gas and fluid pressure (paper 2) (triple only) (P.28)
1	Define "fluids"	Liquids or gases
2	Describe the force caused by pressure in a fluid	Force at right angles to the surface
3	Equation for pressure at the surface of a fluid or solid.	pressure = force / area $p = F / A$ (Pa) (N) (m ²)
4	How does pressure change as the height of a column of liquid above that point increases?	The pressure increases.
5	Units for density.	kg/m ³
6	Equation for pressure due to a column of liquid.	pressure = height x density x gravitational field strength $p = h \rho g$ (Pa) (m) (kg/m ³) (N/kg)
7	What causes upthrust?	Submerged objects experiences a greater pressure on the bottom surface than the top creating a resultant force.

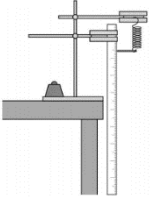
8	State 2 factors that affect floating and sinking	Density of object, density of fluid
9	Why does an object sink? (link to forces)	Upthrust less than weight
10	Define "the atmosphere"	A thin layer of air around the earth
11	Describe what happens to the atmosphere as you move higher (increase altitude)	Gets less dense
12	What happens to the number of air molecules as you get higher	Decreases
13	What causes atmospheric pressure?	Air molecules colliding with a surface
14	Describe what happens to atmospheric pressure as altitude increases	It decreases
15	State one impact of changing atmospheric pressure	Ears "popping"
	Topic:	Astrophysics and cosmology 1 (triple only) (P.35)
1	What makes up our solar system?	The sun (a star), eight planets, their moons & dwarf planets.
2	Give one example of natural satellites?	Moons
3	Which galaxy is our solar system in?	The Milky Way
4	How was the Sun formed?	A cloud of dust and gas pulled together by gravitational attraction.
5	What is a nebula?	A cloud of dust and gas.
6	Name the stages in the life cycle of a small star (e.g. the sun)	Nebula -> protostar -> main sequence star -> red giant -> white dwarf -> black dwarf
7	Name the stages in the life cycle of a massive star.	Nebula -> protostar -> main sequence star -> red giant -> supernova -> neutron star OR black hole.
8	How are all naturally occurring chemical elements produced?	Fusion in stars.
9	How are elements heavier than iron produced?	Fusion in supernovae
10	How are elements distributed throughout the universe?	In supernovae explosions
11	Which force maintains planets and satellites in circular orbits?	Gravity
12	Describe the forces acting upon a star	Fusion energy causes expansion, gravitational pull causes collapse
13	State a difference between a planet and a moon	Planets orbits sun, moons orbit planets
14	Give an example of a natural satellite	Our moon
15	Give a difference between a natural satellite and an artificial satellite	Artificial satellites put into orbit by man
	Topic:	Astrophysics and cosmology 2 (triple only) (P.36)
1	What is the general name for a force causing circular motion?	centripetal force (acting towards to the centre)
2	Which force is the centripetal force causing a massive object to orbit another massive object	Gravitational force (towards centre)
3	In circular motion, why is the speed constant but the velocity not?	direction is constantly changing
4	To keep the time for one orbit constant, if the speed increases what happens to the radius?	increases
5	Describe what happens to the speed of galaxies as they get further apart	Increases
6	How does the distance of a galaxy affect the wavelength of observed light?	Increases it even more.
7	What is red shift?	An observed increase in the wavelength of light from most distant galaxies (light appears red)
8	What does red-shift provide evidence for?	Space is expanding
9	What does red-shift provide support for?	The Big Bang theory
10	What is the Big Bang theory?	The universe began from a very small region that was extremely hot and dense
11	What does blue-shift suggest?	That an object in space is moving closer to us
12	State two areas of space research that are still not understood by scientists	Dark mass and dark energy
13	State the order of the colours of light	Red, orange, yellow, green, blue, indigo, violet ROYGBIV
14	Which colour of light has the longest wavelength?	Red
15	Which colour of light has the shortest wavelength?	Violet
	Topic:	Black body radiation (triple only) (P.37)
1	All objects _____ and _____ infrared radiation	Emit and absorb
2	What is the relationship between temperature of an object and the amount of infrared radiation it emits?	Hotter -> increased infrared radiation
3	What does "incident on it" mean?	Hitting it
4	Define a perfect "black body"	An object that absorbs all of the radiation incident on it and is the best possible emitter
5	State two variables of infrared radiation that are dependent on the temperature of a body	Intensity and wavelength
6	Describe the relationship between absorbing and emitting radiation for a body at a constant temperature	Occurs at same rate
7	When does the temperature of a body increase?	Absorbs radiation quicker than it emits it

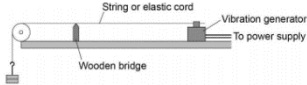
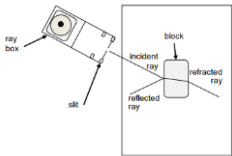
8	State 3 factors that effect the temperature of the Earth	1) Rate of absorption, 2) rate of emission, 3) reflection of radiation into space
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
	Topic:	Magnetism (P.38)
1	Define "poles" on a magnet	The place where the magnetic force is the strongest
2	What do two magnets next to each other do?	Exert a force on each other
3	What is the effect of two like poles on each other? (e.g. N-N)	Repel
4	What is the effect of two different poles on each other? (e.g. N-S)	Attract
5	What type of force are attraction and repulsion?	Non-contact
6	Define "permanent" magnet	Produces its own magnetic field
7	Define "induced" magnet	A material that becomes a magnet when placed in a magnetic field
8	What happens to an induced magnet when it is removed from the magnetic field?	Loses all of its magnetism
9	What is the region around a magnet where magnetic force has an effect called?	Magnetic field
10	Name 4 magnetic materials	Iron, steel, cobalt, nickel
11	Describe the force between a magnet and a magnetic material	Attraction
12	State one factor that effects the strength of a magnetic field	Distance from magnet
13	What direction do the magnetic field lines go when drawn around a magnet?	North (seeking) pole to south (seeking) pole
14	How do you plot magnetic field lines around a magnet?	Use a compass to identify north and join dot to dot
15	How does a compass work for navigation?	The core of the Earth is magnetic!
	Topic:	Motor effect (P.39)
1	What happens when a current flows through a wire?	A magnetic field is produced around wire
2	State two factors that affect the strength of the magnetic field around a wire	Current & distance from the wire
3	How do you determine the direction of the magnetic field around a wire?	Fleming's right hand rule (thumb = current direction, fingers = magnetic field direction)
4	What is a solenoid?	A coil of wire
5	Describe the shape of the magnetic field around a solenoid	Same as a bar magnet
6	How can you increase the strength of a solenoid?	Increase current, increase number of coils, add iron core
7	Define an "electromagnet"	A solenoid (coil of wire) with an iron core
8	What is the term given to "the force exerted by a conductor and a permanent magnet on each other"? (HT only)	The motor effect
9	What does each part of Fleming's left-hand rule stand for? (HT only)	ThuMb - thrust (motion), First finger - Force, seCond finger - Current
10	What is the equation used to work out the force acting on a conductor? (HT only)	Force = magnetic flux density x current x length $F = B I l$ (N) (T) (A) (m)
11	What tends to happen to a coil of wire when placed into a magnetic field?	It rotates
12	Name two pieces of equipment that use the motor effect	Loudspeakers and headphones
13	Describe how a speaker works	Oscillations in electrical current -> vibrations of a speaker cone -> oscillations of air particles (sound waves)
14	0	0
15	0	0
	Topic:	Generator effect & Transformers (triple only) (P.40)
1	How is a potential difference 'induced' in a wire?	An electrical conductor moves in a magnetic field or a magnet is moved into a coil of wire
2	When does an induced potential difference cause an induced current?	When the wire is in a complete circuit
3	What is the name given to a current being induced in a conductor?	The generator effect
4	When a current is induced in a wire, what is produced?	A magnetic field that opposes the original change
5	What effects the direction of induced potential difference/induced current	Direction of the movement of the conductor or magnet
6	State 3 factors that increase the induced potential difference/current	1) increased speed of movement, 2) increased magnetic field strength, 3) number of coils increases
7	State one device that makes use of the generator effect	Microphones

8	How does a microphone work?	Air particles oscillate (sound wave) which causes diaphragm of microphone to oscillate which causes a magnet to move into and out of coil of wire inducing oscillating current
9	What is a transformer made out of?	A primary and secondary coil
10	What is used to make the core of the transformer?	Iron
11	Why is an iron core used?	Easily magnetised
12	What is the equation used to calculate current and voltage in the primary and secondary coil?	$V(s) \times I(s) = V(p) \times I(p)$
13	How does a transformer work?	A.C. in primary coil -> alternating magnetic field -> induced alternating P.D. in secondary coil
14	Which has more coils in a step-up transformer?	Secondary coil
15	Which has more coils in a step-down transformer?	Primary coil
	Topic:	RP: Hooke's Law (P6) (P.46)
1	Define Hooke's law	Force is directly proportional to extension of a spring
2	In this RP, you are investigating the relationship between force and extension of a spring. What would be the IV?	Force
3	In this RP, you are investigating the relationship between force and extension of a spring. What would be the DV?	Extension of the spring
4	Which piece of equipment attaches the clampstand to the work bench?	G-clamp
5	Which piece of equipment is used to hold the top of the spring?	Boss head clamp
6	State two potential hazards and give a safety precaution you could take to minimize the risk of each	1) Weights falling on your toes – clamp the clamp stand to the work bench 2) Spring scratching your eye - wear safety goggles
7	What is one common mistake during this practical?	Measuring length of spring not extension
8	What is it called when a spring no longer returns to its original shape?	Elastic limit
9	What is meant by extension?	How much longer the spring has got
10	How could you check the results were repeatable?	Do the each reading 3 times and check you get the same results each time
11	How could you check the results were reproducible?	Someone else replicates your study and check whether they get the same results
12	Which piece of equipment is used to measure extension?	Ruler
13	Which piece of equipment is used to hold the clamp?	Clamp stand
14	Which symbol means directly proportional?	\propto
15	What kind of graph would you plot?	A scattergraph with line of best fit
	Topic:	RP: Forces, mass and acceleration (P7) (P.47)
1	Which equation links force, mass and acceleration?	$F = ma$
2	The first experiment is looking at the relationship between force, and acceleration. What would be the IV?	Force
3	The first experiment is looking at the relationship between force, and acceleration. What would be the DV?	Acceleration
4	The first experiment is looking at the relationship between force, and acceleration. What would be the CV?	Mass
5	What do you mark on the work bench during experiment 1?	20cm intervals
6	Which piece of equipment is used to measure the 20cm intervals?	Ruler
7	What is recorded when the car passes over each 20cm interval?	The time
8	Which piece of equipment accurately records time?	Light gates
9	How do you change the force acting on the trolley?	Add more weight to the end of the string that is pulling the trolley
10	The first experiment is looking at the relationship between mass and acceleration. What would be the IV?	Mass of the trolley
11	The first experiment is looking at the relationship between mass and acceleration. What would be the DV?	Acceleration of the trolley
12	The first experiment is looking at the relationship between mass and acceleration. What would be the CV?	Force applied to the trolley
13	How do you change the mass of the trolley?	Add a weight to the top of it
14	What is the expected relationship for mass and acceleration?	Inversely proportional
15	What is the expected relationship for force and acceleration?	Directly proportional
	Topic:	RP: Waves (P8) (P.48)
1	Which piece of equipment is used to investigate water waves?	Ripple tank
2	Which piece of equipment generates the waves in the water?	Motor and bar
3	How do we see the water waves when using a ripple tank?	Shine light through water and look at the shadows created
4	How do you measure the wavelength of the water waves?	Using a ruler

5	Why do you measure across multiple waves and divide by the number of waves?	Means you are measuring the mean length (more accurate)
6	How do you measure the frequency of water waves?	Count how many pass a point in 10 seconds and then divide by 10.
7	How do you calculate wave speed?	velocity = frequency / wavelength $v = f / \lambda$ (m/s) (Hz) (m)
8	What is the piece of equipment that generates waves in a piece of string?	A vibration generator
9	Which piece of equipment is used to measure the length of the wave?	A meter ruler
10	How do you determine the frequency of the waves in the piece of string?	Read it from the power supply
11	What is the most common error made when measuring the wavelength?	Only measuring half of the wave
12	What is the relationship between wave speed and frequency?	Directly proportional
13	What is the unit for wavelength?	Metres (m)
14	What is the unit for frequency?	Hertz (Hz)
15	What is the unit for wave speed?	Metres per second
	Topic:	RP: Light (P9) (triple only) (P.49)
1	Which piece of equipment produces a single ray of light?	Ray box
2	Which piece of equipment is used to measure the angle of incidence and the angle of reflection?	Protractor
3	What is the line drawn at 90° to the surface called?	The normal
4	What is the light ray that enters the mirror/glass block called?	The incident ray
5	What is the light ray that leaves the glass block called?	The refracted ray
6	What is the light ray that is reflected from the mirror called?	The reflected ray
7	What is the angle between the normal and the incident ray called?	The angle of incidence
8	What is the angle between the normal and the reflected ray called?	Angle of reflection
9	What is the relationship between the angle of incidence and the angle of reflection?	They are equal
10	What happens to a light ray when it enters a more dense material?	It slows down, moves towards the normal
11	What happens to a light ray when it enters a less dense material?	Speeds up, moves away from the normal
12	What is the term given to a wave changing speed and therefore direction when it crosses the boundary between two different materials?	Refraction
13	What is called when a wave hits a surface and bounces back?	Reflection
14	Is a light wave transverse or longitudinal?	Transverse
15	Is a water wave transverse or longitudinal?	Transverse
	Topic:	0
1	The aim of this investigation is to investigate the amount of infrared radiation radiated from different surfaces. What is the IV?	Type of surface
2	The aim of this investigation is to investigate the amount of infrared radiation radiated from different surfaces. What is the IV?	Type of surface
3	The aim of this investigation is to investigate the amount of infrared radiation radiated from different surfaces. What is the DV?	Infrared radiation emitted
4	The aim of this investigation is to investigate the amount of infrared radiation radiated from different surfaces. What are 2 CVs	Area of surface, thickness of surface
5	What is the name of a metal cube with different coloured surfaces?	Leslie cube
6	Which piece of equipment is used to measure the amount of infrared radiation emitted from the surface?	Infrared detector
7	What are the 4 surfaces of our leslie cube?	Matt black, matt white, shiny white, shiny silver
8	What is one hazard and the safety precaution taken?	Leslie cube is hot and might burn you! Use gloves to touch.
9	What is placed inside the Leslie cube?	Hot water
10	Which surface should be the best emitter?	Matt black
11	Which surface should be the worst emitter?	Shiny white
12	How could you check your findings were repeatable?	Do the experiment again and see whether you got the same results
13	How could you check your results were reproducible?	Get someone else to do a similar experiment and see if they got the same results

14	What is the most common error in this experiment?	Holding the infrared detector at different distances from the surface
15	What type of radiation is infrared?	Transverse (EM wave)
	Topic:	Physics equations (paper 2) (S.11)
1	Recall the equation to calculate weight	Weight = mass x gravitational field strength $W = mg$ (N) (kg) (N/Kg)
2	Recall the equation to calculate work done when you know the force applied and the distance	Work done = force x distance $W = Fs$ (E) (N) (m)
3	What is the equation to calculate force extension of a spring (Hooke's Law)	Force applied to a spring = spring constant x extension $F = ke$ (N) (N/m) (m)
4	How do you calculate distance when you know speed and time?	Distance = speed x time $s = vt$ (m) (m/s) (s)
5	How do you calculate acceleration when you know the change in velocity?	acceleration = change in velocity/time taken $a = \Delta v/t$ (m/s ²) (m/s) (t)
6	How do you calculate force when you know mass and acceleration?	Force = mass x acceleration $F = ma$ (N) (kg) (m/s ²)
7	How do you calculate momentum?	Momentum = mass x velocity $p = m \times v$ (kg m/s) (kg) (m/s)
8	How do you calculate wave speed?	wave speed = frequency x wavelength $v = f\lambda$ (m/s) (Hz) (m)
9	What does this symbol mean? "="	Equals
10	What does this symbol mean? "<"	Less than
11	What does this symbol mean? "<<"	Significantly less than
12	What does this symbol mean? ">>"	Significantly more than
13	What does this symbol mean? ">"	More than
14	What does this symbol mean? "∝"	Directly proportional
15	What does this symbol mean? "≈"	Approximately

P6 – Hooke's Law	<p>Big Question: Investigate the relationship between force and extension and a spring</p> <p>IV – Force (weight) DV – Extension of spring CV - ruler is vertical, measuring from same point on the spring</p>	<ul style="list-style-type: none"> *spring *metre ruler *splint (to act as pointer) *10N weight stack *clamp stand *two boss head clamps *G-clamp to clamp equipment to table *safety goggles 	<ol style="list-style-type: none"> 1) Set up the equipment as shown in the diagram 2) Make sure that the ruler is at the top of the spring. 3) Measure the length of the spring before adding any weights. 4) Add 1N of weight to the bottom of spring 5) Measure the length of the spring with the weight and use this to calculate the extension of the spring. 6) Repeat this, adding an additional 1N weight each time. 		<p>Force will be directly proportional to extension until the spring reaches its limit of proportionality.</p>	<p>Investigate a spring to find its limit of proportionality.</p> <p>Investigate the relationship between force and extension of a rubber band.</p>
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<p>P7 – Forces, mass and acceleration</p>	<p>Big Question 1: How does force affect acceleration when a constant mass is used? IV – Force DV - Acceleration CV - Mass</p> <p>Big Question 2: How does mass affect acceleration when a constant force is used? IV – Mass DV – Acceleration CV – Force</p>	<ul style="list-style-type: none"> *trolley *metre ruler *Pencil *bench pulley *string *weight stack *stopwatch *blu-tac 	<p>Big Question 1:</p> <ol style="list-style-type: none"> 1) Use the ruler to measure 20cm intervals on the work bench and mark with a pencil. 2) Attach the bench pulley to the end of the bench 3) Tie a length of string to the trolley 4) Pass the string over the pulley and attached the weight stack to the other end of the string 5) Hold the trolley at the start point. 6) Attached 1N of weight to the string. 7) Release the toy car and start the stop watch. 8) Record the time at each 20cm interval and at 100cm. 9) Repeat using 0.8N, 0.6N, 0.4N, 0.2N. <p>Big Question 2:</p> <ol style="list-style-type: none"> 1) Repeat steps 1-5 2) Place 200g of mass onto the trolley 3) Hold the trolley at the start line. 4) Add 1N of weight to the end of the string 5) Release the toy car and start the stop watch. 6) Record the time at each 20cm interval and at 100cm. 7) Repeat placing 400g, 600g, 800g and 1000g. 	<p>As force increases, acceleration should increase (directly proportional).</p> <p>As mass increases, acceleration should decrease (inversely proportional)</p>	<p>Use light gates to investigate the effect of force on acceleration when mass is kept constant.</p> <p>Use light gates to investigate the effect of mass on acceleration when mass is kept constant.</p>
<p>P8 – Waves</p>	<p>Big Question 1: Investigate the properties of water waves</p> <p>IV = Frequency of wave DV = Wavelength CV = Amplitude, weight on end of string</p> <p>Big Question 2: Investigate the properties of waves in solids</p>	<p>Big Question 1:</p> <ul style="list-style-type: none"> *ripple tank *water *lamp *metre ruler <p>Big Question 2:</p> <ul style="list-style-type: none"> *vibration generator *power pack *string *set of 1N masses *table *pulley 	<p>Big Question 1:</p> <ol style="list-style-type: none"> 1) Set up the ripple tank. 2) Pour water into the tank and adjust the rod so that it touches the surface of the water. 3) Switch on the lamp and motor. 4) Place a meter at ruler at right angles to the waves shown on the projector. 5) Measure across as many waves as you can and then divide by the number of waves. This gives the wavelength. 6) Count the number of waves passing a point in 10 seconds. Then divide this by 10 to give the frequency. 7) Use the wave speed equation to calculate wave speed. <p>Big Question 2:</p> <ol style="list-style-type: none"> 1) Set up the equipment as shown below. 2) Switch on the vibration generator 3) Use a metre ruler to measure the wavelength of a wave 4) Read the frequency of the waves from the power supply 5) Use the wave speed equation to calculate wave speed. 		
<p>P9 – Light (triple only)</p>	<p>Big Question 1: Investigate the reflection of light by a surface</p> <p>IV = angle of incidence DV = angle of reflection CV = type of surface</p> <p>Big Question 2: Investigate the refraction of light by different surfaces</p> <p>IV = type of material DV = angle of refraction CV = angle of incidence</p>	<ul style="list-style-type: none"> *ray box *slit *white piece of paper *glass block *Perspex block *protractor 	<p>Big Question 1:</p> <ol style="list-style-type: none"> 1) Place the glass block on to a piece of paper and draw around it. 2) Add a 90° line and label it "normal". 3) Use a pencil and a protractor to mark the angle of incidence: 20°, 40°, 60°, 80°. 4) Shine the light ray from the 20° mark to the point where the normal meets the glass block. 5) Then mark the light ray that is being reflected from the glass block and measure the angle of reflection. <p>Big Question 2:</p> <ol style="list-style-type: none"> 1) Repeat steps 1 & 2. 2) Shine the light ray so that it meets the glass block at the normal. 3) Mark the path of incoming and outgoing rays with crosses. 4) Join the crosses using a ruler. 5) Use your protractor to measure the angle of incidence and angle of refraction at each boundary between the air and glass. 6) Repeat using a Perspex block. 	<p>Angle of incidence is equal to angle of reflection.</p> <p>When a light wave travels from air to glass, it slows down and moves towards the normal.</p> <p>When a light wave travels from glass to air, it speeds up and moves away from the normal.</p>	

P10 – Radiation and Absorption	<p>Big Question: Investigate the amount of infrared radiation radiated from different surfaces.</p> <p>IV – Type of surface DV – Infrared radiation emitted CV - Area of surface, thickness of surface, temperature of water inside container, distance between surface and infrared detector.</p>	<p>*Leslie cube (a metal box with each side painted a different finish, black matt, shiny silver, black shiny, white matt. *Heat proof mat *Infrared detector *Kettle</p>	<ol style="list-style-type: none"> 1) Put the Leslie cube on a heat-proof mat. 2) Fill the cube with very hot water and put the lid on the cube. 3) Use the detector to measure the amount of infrared radiation emitted from each surface. 	<p>Best emitter: Matt black</p>	
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Equations for Physics:

These are the equations you must know for physics that are not given to you in the exam.

Paper 1	
kinetic energy = $0.5 \times \text{mass} \times (\text{velocity})^2$	$E_k = \frac{1}{2}mv^2$
gravitational potential energy = mass x gravitational field strength x height	$E_p = mgh$
power = $\frac{\text{energy transferred}}{\text{time}}$	$P = \frac{E}{t}$
power = $\frac{\text{work done}}{\text{time}}$	$P = \frac{W}{t}$
efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
efficiency = $\frac{\text{useful power output}}{\text{total power output}}$	
charge flow = current x time	$Q = It$
potential difference = current x resistance	$V = IR$
power = potential difference x current	$P = VI$
power = (current) ² x resistance	$P = I^2R$
energy transferred = charge flow x potential difference	$E = QV$
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{v}$
pressure = $\frac{\text{force}}{\text{surface area}}$ (triple only)	$p = \frac{F}{A}$
Paper 2	
weight = mass x gravitational field strength	$W = mg$
work done = force x distance	$W = Fs$
force applied to a spring = spring constant x extension	$F = ke$
distance travelled = speed x time	$s = vt$
acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{\Delta v}{t}$
resultant force = mass x acceleration	$F = ma$
momentum = mass x velocity	$p = mv$
wave speed = frequency x wavelength	$v = f\lambda$