

Paper 2 knowledge booklet

COMBINED FOUNDATION TIER

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)	1	2	3
Cell Biology	Sexual and asexual reproduction (meiosis)	Explain the process of sexual reproduction and link this to variation	F	A	64			
Cell Biology	Sexual and asexual reproduction (meiosis)	Explain the process of meiosis which leads to the formation of gametes	F	A	64			
Cell Biology	Sexual and asexual reproduction (meiosis)	Explain the process of asexual reproduction	F	A	64			
Cell Biology	Sexual and asexual reproduction (meiosis)	Model the behaviour of chromosomes during meiosis	F	A	64			
Cell Biology	The DNA code	Describe the structure of DNA	F	A	65			
Cell Biology	The DNA code	Explain what the human genome is and the importance of mapping it	F	A	65			
Cell Biology	The DNA code	Use genetic crosses to predict outcomes of a monohybrid cross	F	A	66			
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			
Plant Biology	Introducing ecosystems	Define "ecosystem"	F	A	74			
Plant Biology	Introducing ecosystems	Define 'interdependence' and explain what species depend on	F	A	74			
Plant Biology	Introducing ecosystems	Describe what plants and animals 'compete' with each other for	F	A	74			
Plant Biology	Introducing ecosystems	Describe structural, behavioural and functional adaptations of organisms	F	A	75			
Plant Biology	Introducing ecosystems	Define extremophiles linking to the conditions that they inhabit (bacteria in deep sea vents)	F	A	75			
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			
Plant Biology	Interdependence	List biotic and abiotic factors and explain how changes in them would affect a given community	F	A	74			
Plant Biology	Interdependence	Define primary, secondary and tertiary consumers	F	A	77			
Plant Biology	Interdependence	Explain the role of producers in food chains	F	A	77			
Plant Biology	Interdependence	Use a range of experimental methods to calculate the abundance and distribution of species in a given ecosystem	F	A	75			
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			
Plant Biology	Natural Recycling	Describe the carbon cycle and its importance	F	A	76			
Plant Biology	Natural Recycling	Describe the water cycle and its importance	F	A	76			
Plant Biology	Humans and the environment	Define biodiversity and explain its importance	F	A	78			
Plant Biology	Humans and the environment	Explain in detail human impact on biodiversity (waste management, pollution, land use, deforestation, global warming)	F	A	78			
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			
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			
Evolving organisms	Classifying organisms	Explain the binomial naming system of organisms	F	A	72			
Evolving organisms	Classifying organisms	Define 'species' (linking to future fertility and breeding)	F	A	72			
Evolving organisms	Classifying organisms	Explain how classification models have developed over time due to improvements in microscopy and biochemistry)	F	A	72			
Evolving organisms	Natural selection and evolution	Describe and explain the theory of 'natural selection' and 'evolution'	F	A	68			

Evolving organisms	Natural selection and evolution	Describe the evidence for evolution including antibiotic resistant and the fossil record	F	A	69			
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			
Evolving organisms	Natural selection and evolution	Interpret information from evolutionary trees	F	A	73			
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			
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			
Evolving organisms	Selective breeding & genetic engineering	Define 'genetic engineering'	F	A	70			
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			
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			
Evolving organisms	The Nervous System	Describe the structure of the nervous system	F	A	51			
Evolving organisms	The Nervous System	Explain how it is adapted for its function and why it is important	F	A	51			
Evolving organisms	The Nervous System	Describe the pathway of a message from stimulus to response	F	A	51			
Evolving organisms	The Nervous System	Describe the design of a reflex arc and explain its purpose	F	A	51			
Evolving organisms	The Nervous System	Use tables and graphs to extract information about reflex actions	F	A	51			
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			
Evolving organisms	Homeostasis	Define 'homeostasis' and explain why it is important	F	A	50			
Evolving organisms	Homeostasis	List three factors controlled by homeostasis in the human body (blood glucose concentration, temperature, water levels)	F	A	50			
Evolving organisms	Homeostasis	Explain how these automatic systems are controlled	F	A	50			
Evolving organisms	The endocrine system	Describe the principals of hormonal coordination including what makes up the endocrine system	F	A	52			
Evolving organisms	The endocrine system	Describe what hormones are and label six glands in the body	F	A	52			
Evolving organisms	The endocrine system	Describe the role of the pituitary gland	F	A	52			
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			
Evolving organisms	Diabetes	Explain type 1 and type 2 diabetes and how they can be treated	F	A	53			
Evolving organisms	Diabetes	Compare and contrast the two types of diabetes	F	A	53			
Evolving organisms	Diabetes	Compare data (from graphs) regarding blood glucose levels in people with and without diabetes	F	A	53			
Evolving organisms	Hormones in the reproductive system	Describe the roles of FSH, LH, Oestrogen and progesterone in the menstrual cycle	F	A	54			
Evolving organisms	Hormones in the reproductive system	Describe the roles of oestrogen and progesterone in puberty	F	A	54			
Evolving organisms	Hormones in the reproductive system	Link hormone cycles to ovulation and menstruation	F	A	54			
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			
Evolving organisms	Hormones in the reproductive system	Explain why issues around contraception are not answered solely by the field of Science	F	A	55			
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			
Evolving organisms	Hormones in the reproductive system	Compare nervous system and hormonal responses	F	A	54			

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:	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) CO2 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 (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:	Humans and the environment (B.29)
1.	Define by "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
	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
	Topic:	Selective breeding and genetic engineering (B.32)
1.	Describe the purpose of selective breeding	Humans breed plants & animals with particular desirable characteristics
2.	State two reasons to use selective breeding	*produce food crops *produce domesticated animals
3.	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
4.	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
5.	State one disadvantage of selective breeding in animals	Inbreeding -> health issues
6.	State one disadvantage of selective breeding in crops	Crops have very similar DNA so disease can kill them all
7.	Why was Mendel's work initially not accepted?	*He was a monk *He didn't publish his work in a well know journal
8.	Who discovered the structure of DNA?	Franklin, Watson & Crick
9.	Describe "gene theory"	The idea that genes are "units" of inheritance
10.	Define "genetic engineering"	Modifying (changing) the genome (genes) of an organism to give a desired characteristic
11.	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
12.	Describe the 4 stages of genetic engineering	1) select desired characteristic 2) isolate gene 3) insert gene into vector 4) replicate
13.	Define "vector"	A ring of DNA (plasmid) or an organism that carries a gene from one organism into another
14.	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 (neurons)
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.	Which type of diabetes is inherited?	Type one
12.	Which type of diabetes is caused by lifestyle	Type two
13.	How do glucagon & insulin travel around the body?	In blood
14.	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 effect of oestrogen	Causes uterus lining to build up
4.	State the effect of luteinising hormone (LH) on the body	Causes ovulation
5.	Where is luteinising hormone produced?	Pituitary Gland
6.	Where is progesterone produced?	The empty egg follicle (corpus luteum)
7.	State the role of progesterone	Maintains uterus lining Inhibits FSH & LH
8.	Name 3 non-hormonal methods of contraception	Barrier method (diaphragm or condoms), abstinence, spermicide, sterilisation, some intrauterine devices
9.	Name 3 hormonal methods of contraception	Oral contraceptive pill, implant, injection, some intrauterine devices
10.	What does IVF stand for?	In Vitro Fertilisation (outside of the body)

11.	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: 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

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>
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>
Practical	Variables	Equipment	Method	Expected conclusion	Possible variations
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Chemistry

Mastery Matrix:

Unit	Topic	Learning statement	Tier	Course	Revision Guide (double)	1	2	3
Chemistry Fundamentals	Mixtures	Define 'pure substances' and explain the difference between its scientific and everyday meaning	F	A	140			
Chemistry Fundamentals	Mixtures	Use melting and boiling point data to establish pure substances from mixtures	F	A	140			
Chemistry Fundamentals	Mixtures	Describe what a 'formulation' is and give examples (Fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods)	F	A	140			
Chemistry Fundamentals	Mixtures	Describe the two phases (stationary and mobile) of chromatography and its purpose	F	A	140			
Chemistry Fundamentals	Mixtures	Calculate Rf values	F	A	141			
Chemistry Fundamentals	Mixtures	Interpret chromatograms to decide whether a substance is pure or a mixture	F	A	140			
Chemistry Fundamentals	Mixtures	RP Chromatography: Use paper chromatography to investigate the colours within different substances and calculate Rf values	F	A	140			
Chemistry Fundamentals	Mixtures	Explain the difference in difficulty of separating compounds compared to mixtures	F	A	88+89			
Reacting substances	Rates of reaction	Calculate the mean rate of reaction	F	A	124			
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			
Reacting substances	Rates of reaction	Draw tangents on curves in order to calculate rates of reaction	F	A	125			
Reacting substances	Rates of reaction	Explain the collision theory and link to activation energy	F	A	124			
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			
Reacting substances	Rates of reaction	Plot and interpret graphs showing rates of reaction	F	A	125			
Reacting substances	Rates of reaction	Explain why one reactant is used in excess in a chemical reaction	F	A	105			
Reacting substances	Rates of reaction	Describe what is meant by 'a limiting reactant'	F	A	105			
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			
Reacting substances	Rates of reaction	Give examples of catalysts	F	A	126			
Reacting substances	Rates of reaction	Draw a reaction profile for a catalysed reaction	F	A	121			
Reacting substances	Reversible reactions	Use the appropriate symbol to denote a reversible reaction	F	A	126			
Reacting substances	Reversible reactions	Explain energy changes in reversible reactions (ammonium chloride and hydrated copper sulphate)	F	A	126			
Reacting substances	Reversible reactions	Explain what is meant by the term 'equilibrium'	F	A	127			
Humans and the Earth	The Earth's Early Atmosphere	Describe the composition of the atmosphere and how long this has been the case	F	A	143			
Humans and the Earth	The Earth's Early Atmosphere	Describe the development from early atmosphere to present day	F	A	142			
Humans and the Earth	The Earth's Early Atmosphere	Draw links between the early Earth's atmosphere and that of other planets (Mars and Venus)	F	A	142			
Humans and the Earth	The Earth's Early Atmosphere	Evaluate different theories regarding the Earth's early atmosphere	F	A	142			
Humans and the Earth	The Earth's Early Atmosphere	Explain why oxygen levels increased and carbon dioxide levels decreased (linking to photosynthesis and sedimentation)	F	A	143			
Humans and the Earth	Global Warming	Describe the term 'greenhouse gases' and give three examples (water vapour, carbon dioxide and methane)	F	A	144			
Humans and the Earth	Global Warming	Describe the 'greenhouse effect' linking to the wavelength of radiation	F	A	144			
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			
Humans and the Earth	Global Warming	Explain how peer review evidence have linked these activities to global climate change	F	A	144			

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			
Humans and the Earth	Global Warming	Describe 4 potential effects of global climate change	F	A	145			
Humans and the Earth	Global Warming	Discuss the scale, risks and environmental implication of global climate change	F	A	145			
Humans and the Earth	Global Warming	Describe what is meant by the term 'carbon footprint'	F	A	145			
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			
Humans and the Earth	Air pollution	Describe combustion as a major source of atmospheric pollution	F	A	144			
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			
Humans and the Earth	Air pollution	Describe 'particulates'	F	A	144			
Humans and the Earth	Air pollution	Describe issues arising from carbon dioxide, sulphur dioxide, nitrogen oxides and particulates	F	A	144			
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			
Humans and the Earth	Finite resources	Define what is meant by the term 'finite resource'	F	A	146			
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			
Humans and the Earth	Finite resources	Explain how some natural products are being replaced by some agricultural and synthetic products	F	A	146			
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			
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			
Humans and the Earth	Water and waste	Describe the process of desalination (distillation or reverse osmosis)	F	A	146			
Humans and the Earth	Water and waste	Evaluate the methods to produce potable water (linking to location and potential water supply)	F	A	146			
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			
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			
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			
Humans and the Earth	Water and waste	Describe the 4 steps of sewage treatment	F	A	147			
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			
Humans and the Earth	Life Cycle Assessments	Describe what is meant by the term 'life cycle assessment'	F	A	148			
Humans and the Earth	Life Cycle Assessments	Describe the 4 stages of a life cycle assessment	F	A	148			
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			
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			
Humans and the Earth	Life Cycle Assessments	Use data to carry out LCA for shopping bags made from plastic and paper	F	A	148			
Humans and the Earth	Life Cycle Assessments	Explain how we can reduce our use of limited resources (reduce, reuse, recycle)	F	A	149			
Organic Chemistry	Alkanes and Alkenes	Explain what crude oil is and how it is formed	F	A	136			
Organic Chemistry	Alkanes and Alkenes	Define 'alkanes' and give the general formula	F	A	136			
Organic Chemistry	Alkanes and Alkenes	Recall the formulae and structures for the first 4 alkanes (methane, ethane, propane and butane)	F	A	137			
Organic Chemistry	Alkanes and Alkenes	Define 'alkenes' and give the general formula	F	A	138			
Organic Chemistry	Alkanes and Alkenes	Recall the formulae and structures for the first 4 alkenes (ethene, propene, butene, pentene)	F	A	138			
Organic Chemistry	Alkanes and Alkenes	Define the terms 'saturated' and 'unsaturated' and link to alkanes and alkenes	F	A	136			

Organic Chemistry	Alkanes and Alkenes	Use the bromine test to identify whether there are alkanes or alkenes present	F	A	139			
Organic Chemistry	Fractional Distillation	Explain the process of fractional distillation	F	A	136			
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			
Organic Chemistry	Fractional Distillation	Describe why carbon can form such a vast array of natural and synthetic compounds	F	A	136			
Organic Chemistry	Fractional Distillation	Explain how the size of hydrocarbon is linked to their boiling point, viscosity and flammability	F	A	136			
Organic Chemistry	Fractional Distillation	Describe the combustion of hydrocarbons and write balanced symbol equations	F	A	137			
Organic Chemistry	Cracking	Describe what is meant by 'cracking'	F	A	138			
Organic Chemistry	Cracking	Describe why cracking is required	F	A	138			
Organic Chemistry	Cracking	Describe the methods and conditions used for 'catalytic cracking' and 'steam cracking'	F	A	138			
Organic Chemistry	Cracking	Recall the uses of alkenes produced during cracking (polymers)	F	A	138			
Organic Chemistry	Cracking	Balance chemical equations for cracking	F	A	138			

Knowledge organiser:

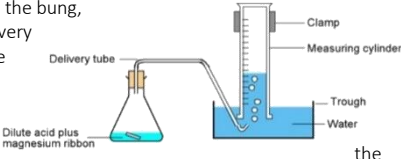
	Paper:	C2
	Topic:	Reversible reactions and low grade copper ores (C.18)
1	What is a reversible reaction?	A reaction that can go both forwards (to form the products) and backwards (to form the reactants)
2	Give two examples of reversible reactions	Ammonium chloride \rightleftharpoons ammonia + hydrogen 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
6	Which 3 factors affect the position of equilibrium?	Pressure (gases), temperature, concentration
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

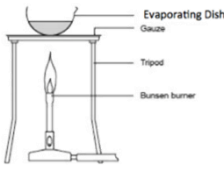
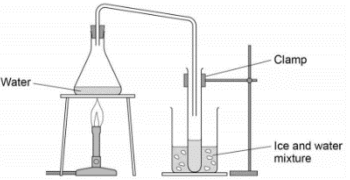
14	Name the process that caused an increase in oxygen levels	Photosynthesis
15	Which two organisms caused an increase in oxygen levels?	Algae and green plants
	Topic:	Global warming and air pollution (C.21)
1	Name the 3 greenhouse gases	Water, Methane, carbon dioxide
2	Name the greenhouse gas produced 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:	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:	Polymerisation (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
	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: 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_nH_{2n+2}
14	What is the general formula for an alkene?	C_nH_{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.  <ol style="list-style-type: none"> 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>

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>	<ul style="list-style-type: none"> *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 	<ol style="list-style-type: none"> 1) Test each sample of water with universal indicator and record the pH 2) Weigh the evaporating basin. 3) Pour 10cm³ of the sample into an evaporating basin and heat using the equipment set up below. 4) Weigh the cooled evaporating basin and then calculate the mass of solids in the basin.  <p>To gain pure water:</p> <ol style="list-style-type: none"> 1) Set up  <ol style="list-style-type: none"> 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>All water will have some dissolved substances in it unless it has been distilled.</p>	
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Physics

Mastery Matrix

Unit	Topic	Learning statement	Tier	Course	Revision Guide (double)	1	2	3
Energy and Waves	Elastic Objects & potential energy	Describe elastic and inelastic deformation	F	A	160			
Energy and Waves	Elastic Objects & potential energy	Explain the effect of forces on elastic objects	F	A	160			
Energy and Waves	Elastic Objects & potential energy	Describe Hooke's Law qualitatively and using the equation $F = ke$	F	A	161			
Energy and Waves	Elastic Objects & potential energy	Explain 'word done' when applied to stretching or compressing a spring	F	A	161			
Energy and Waves	Elastic Objects & potential energy	Explain the difference between a linear and a non-linear relationship	F	A	160			
Energy and Waves	Elastic Objects & potential energy	Interpret data from a force extension investigation	F	A	160			
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			
Energy and Waves	Waves	Describe what is meant by 'a wave'	F	A	182			
Energy and Waves	Waves	Describe the difference between longitudinal and transverse waves giving examples for both	F	A	182			
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			
Energy and Waves	Waves	Use and rearrange $T = 1/f$	F	A	183			
Energy and Waves	Waves	Use and rearrange $v = f \lambda$	F	A	183			
Energy and Waves	Waves	Identify amplitude and wavelength from diagrams of a wave	F	A	182			
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			
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			
Energy and Waves	Electromagnetic Waves	Describe what 'electromagnetic waves' are	F	A	184			
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			
Energy and Waves	Electromagnetic Waves	Explain how EM waves are generated and absorbed	F	A	186			
Energy and Waves	Electromagnetic Waves	Explain the hazardous effects of UV, X-rays and Gamma rays	F	A	187			
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			
Forces and Motion	Forces introduction	Define scalar and vector quantities	F	A	158			
Forces and Motion	Forces introduction	Use arrows to represent vector quantities	F	A	158			
Forces and Motion	Forces introduction	Define contact and non-contact forces giving examples of each	F	A	158			
Forces and Motion	Forces introduction	Define weight and gravity	F	A	158			
Forces and Motion	Forces introduction	Use $W = m \times g$	F	A	159			
Forces and Motion	Forces introduction	Describe what the centre of mass is	F	A	158			
Forces and Motion	Forces introduction	Explain how to measure weight using a calibrated spring balance (i.e. a Newton meter)	F	A	159			
Forces and Motion	Resultant forces	Calculate and define resultant forces	F	A	159			
Forces and Motion	Resultant forces	Use free body diagrams to show forces	F	A	159			
Forces and Motion	Speed and velocity	Explain the difference between distance and displacement	F	A	162			
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			
Forces and Motion	Speed and velocity	Recall typical speeds for different types of transportation (TBC – bus, train, car, aeroplane!) using - correctly.	F	A	162			
Forces and Motion	Speed and velocity	Recall the speed of sound in air	F	A	162			

Forces and Motion	Speed and velocity	State that most moving objects have varying speed including sound, wind, travelling people	F	A	162			
Forces and Motion	Speed and velocity	Use and rearrange $s = v t$ (speed = d/t equation!)	F	A	162			
Forces and Motion	Speed and velocity	Calculate average speed for non-uniform motion	F	A	162			
Forces and Motion	Speed and velocity	Define 'velocity'	F	A	162			
Forces and Motion	Distance time and velocity time graphs	Draw and interpret distance time graphs and use these to determine speed	F	A	163			
Forces and Motion	Distance time and velocity time graphs	Use and rearrange the equation $a = \Delta v / t$ (calculating acceleration)	F	A	164			
Forces and Motion	Distance time and velocity time graphs	Estimate the magnitude of every day acceleration	F	A	164			
Forces and Motion	Distance time and velocity time graphs	Draw and interpret velocity time graphs in order to calculate acceleration	F	A	164			
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			
Forces and Motion	Falling objects	Recall the value for acceleration due to gravity ($9.8m/s^2$)	F	A	166			
Forces and Motion	Falling objects	Explain the acceleration of objects through fluids (terminal velocity) – making reference to parachutes travelling through air	F	A	166			
Forces and Motion	Falling objects	Draw and interpret velocity time graphs for objects that reach terminal velocity	F	A	166			
Forces and Motion	Newton's Laws	Describe and explain Newton's first law	F	A	163			
Forces and Motion	Newton's Laws	Describe and explain Newton's second law using $F = m a$	F	A	165			
Forces and Motion	Newton's Laws	Estimate the forces involved in large accelerations for every day road transport using - correctly.	F	A	164			
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			
Forces and Motion	Stopping Distances	Define 'stopping distance', 'thinking distance' and 'braking distance'	F	A	168			
Forces and Motion	Stopping Distances	Recall typical values for reaction times (0.2-0.9 seconds)	F	A	168			
Forces and Motion	Stopping Distances	Describe factors that effect a drivers reaction time	F	A	168			
Forces and Motion	Stopping Distances	Explain methods used to measure human's reaction times	F	A	168			
Forces and Motion	Stopping Distances	Describe factors affecting 'braking distance'	F	A	169			
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			
Forces and Motion	Stopping Distances	Explain the energy transfers when a vehicle brakes	F	A	169			
Forces and Motion	Stopping Distances	Link braking force, deceleration and stopping distances	F	A	169			
Forces and Motion	Stopping Distances	Explain the dangers caused by large decelerations	F	A	169			
Forces and Motion	Moments	Describe and explain Newton's third law	F	A	166			
Applying forces and energy	Magnetism	Describe the polarity of magnets and list 4 magnetic materials	F	A	206			
Applying forces and energy	Magnetism	Explain the difference between a permanent and induced magnet	F	A	206			
Applying forces and energy	Magnetism	Describe the force between a magnet and a magnetic material	F	A	206			
Applying forces and energy	Magnetism	Describe the direction and strength of a magnetic field around a magnet	F	A	206			
Applying forces and energy	Magnetism	Explain how compasses work	F	A	206			
Applying forces and energy	Magnetism	Describe how to make an electromagnet and how to increase its strength	F	A	207			
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			

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)
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
	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:	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)

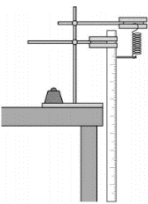
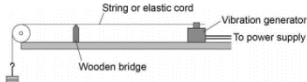
1	State the axes in a distance time graph	X axis = time, Y axis = distance
2	Describe what is meant by a flat horizontal line (—) on a distance-time graph?	The object is stationary
3	Describe what is meant by a straight diagonal line (/) away from the x-axis on a distance-time graph?	Object is moving 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
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 \uparrow , 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
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
14	Define "inertial mass"	The ratio of force over acceleration
15	What does this symbol mean? "~"	Approximately
	Topic:	Gas and fluid pressure (paper 2) (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
	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
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)
	Topic:	Generator effect (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
	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:	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

Required Practicals

<p>P6 – Hooke's Law</p>	<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>
<p>P7 – Forces, mass and acceleration</p>	<p>Big Question 1: How does force affect acceleration when a constant mass is used?</p> <p>IV – Force DV - Acceleration CV - Mass</p> <p>Big Question 2: How does mass affect acceleration when a constant force is used?</p> <p>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 style="writing-mode: vertical-rl; transform: rotate(180deg);">P10 – Radiation and Absorption</p>	<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	$v = f\lambda$