**Paper 2 knowledge booklet**

**COMBINED HIGHER 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…**  Image result for green tick | **Instead…** Image result for green tick |
| 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. |

**200 to Great!**

**The Challenge:** Accumulate **50 HOURS** of science revision for your exam!

**How:** All you need to do is colour in a box each time that you spend 15 minutes self-quizzing with your flash cards, knowledge organiser or revision quiz.

**1 row= 1 merit!** (collect your merit from any Science teacher)

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| **Topic** | **15min** | **15min** | **15min** | **15min** | **15min** | **15min** | **15min** | **15min** | **15min** | **15min** |
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**Biology**

**Mastery Matrix:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Unit** | **Topic** | **Learning statement** | **Tier** | **Course** | **Revision Guide (trilogy)** | **Revision Guide (separate)** | **1** | **2** | **3** |
| Cell Biology | Sexual and asexual reproduction (meiosis) | Explain the process of sexual reproduction and link this to variation | F | A | 64 | B74 |  |  |  |
| Cell Biology | Sexual and asexual reproduction (meiosis) | Explain the process of meiosis which leads to the formation of gametes | F | A | 64 | B74 |  |  |  |
| Cell Biology | Sexual and asexual reproduction (meiosis) | Explain the process of asexual reproduction | F | A | 64 | B74 |  |  |  |
| Cell Biology | Sexual and asexual reproduction (meiosis) | Model the behaviour of chromosomes during meiosis | F | A | 64 | B74 |  |  |  |
| Cell Biology | The DNA code | Describe the structure of DNA | F | A | 65 | B76 |  |  |  |
| Cell Biology | The DNA code | Explain what the human genome is and the importance of mapping it | F | A | 65 | B76 |  |  |  |
| Cell Biology | The DNA code | Use genetic crosses to predict outcomes of a monohybrid cross | F | A | 66 | B79 |  |  |  |
| Communicable Diseases | Developing new medicines | Explain the issues with the development of new antibiotics in the race against antibiotic resistance and what we can do as a society to reduce the rate of development of antibiotic resistance bacteria (linking to medicine and agriculture) | F | A | 44 | B81 |  |  |  |
| Plant Biology | Introducing ecosystems | Define “ecosystem” | F | A | 74 | B86 |  |  |  |
| Plant Biology | Introducing ecosystems | Define ‘interdependence’ and explain what species depend on | F | A | 74 | B86 |  |  |  |
| Plant Biology | Introducing ecosystems | Describe what plants and animals ‘compete’ with each other for | F | A | 74 | B86 |  |  |  |
| Plant Biology | Introducing ecosystems | Describe structural, behavioural and functional adaptations of organisms | F | A | 75 | B87 |  |  |  |
| Plant Biology | Introducing ecosystems | Define extremophiles linking to the conditions that they inhabit (bacteria in deep sea vents) | F | A | 75 | B87 |  |  |  |
| Plant Biology | Interdependence | Interpret data from graphs and tables relating to predator and prey relationships predicting numbers of species based on changes in this data | F | A | 77 | B89 |  |  |  |
| Plant Biology | Interdependence | List biotic and abiotic factors and explain how changes in them would affect a given community | F | A | 74 | B86 |  |  |  |
| Plant Biology | Interdependence | Define primary, secondary and tertiary consumers | F | A | 77 | B89 |  |  |  |
| Plant Biology | Interdependence | Explain the role of producers in food chains | F | A | 77 | B89 |  |  |  |
| Plant Biology | Interdependence | Use a range of experimental methods to calculate the abundance and distribution of species in a given ecosystem | F | A | 75 | B87 |  |  |  |
| Plant Biology | Interdependence | **RP Field Invesitgations** (a - separate only): Measure the population size of a common species(b - trilogy & separate)Investigate the effects of a factor on the distribution of a species using sampling techniques | F | A | 75 | B87 |  |  |  |
| Plant Biology | Natural Recycling | Describe the carbon cycle and its importance | F | A | 76 | B88 |  |  |  |
| Plant Biology | Natural Recycling | Describe the water cycle and its importance | F | A | 76 | B88 |  |  |  |
| Plant Biology | Humans and the environment | Define biodiversity and explain its importance | F | A | 78 | B90 |  |  |  |
| Plant Biology | Humans and the environment | Explain in detail human impact on biodiversity (waste management, pollution, land use, deforestation, global warming) | F | A | 78 | B90 |  |  |  |
| Plant Biology | Humans and the environment | Describe and evaluate some of the programs used to reduce the negative effects of humans on ecosystems and biodiversity (breeding programs, protection/regeneration of rare habitats, reintroduction of field margins and hedgerows, reduction of deforestation, reduction of carbon emissions, increased recycling) | F | A | 78 | B90-92 |  |  |  |
| Evolving organisms | Classifying organisms | Describe the role of Carl Linnaeus in development of a classification system (kingdom, phylum, class, order, family, genus, species) | F | A | 72 | B84 |  |  |  |
| Evolving organisms | Classifying organisms | Explain the binomial naming system of organisms | F | A | 72 | B84 |  |  |  |
| Evolving organisms | Classifying organisms | Define ‘species’ (linking to future fertility and breeding) | F | A | 72 | B84 |  |  |  |
| Evolving organisms | Classifying organisms | Explain how classification models have developed over time due to improvements in microscopy and biochemistry) | F | A | 72 | B84 |  |  |  |
| Evolving organisms | Natural selection and evolution | Describe and explain the theory of ‘natural selection’ and ‘evolution’ | F | A | 68 | B80 |  |  |  |
| Evolving organisms | Natural selection and evolution | Describe the evidence for evolution including antibiotic resistant and the fossil record | F | A | 69 | B81 |  |  |  |
| Evolving organisms | Natural selection and evolution | Describe what a fossil is and explain how they form and explain why these cannot be used as evidence for how life began on Earth  | F | A | 69 | B81 |  |  |  |
| Evolving organisms | Natural selection and evolution | Interpret information from evolutionary trees  | F | A | 73 | B85 |  |  |  |
| Evolving organisms | Natural selection and evolution | Explain what extinction is and describe factors which may contribute to the extinction of a species | F | A | 72 | B84 |  |  |  |
| Evolving organisms | Selective breeding & genetic engineering | Describe selective breeding and explain the potential benefits and risks of this process (linking to disease resistance in crops, animals with more milk and meat, large or unusual flowers and domestic dogs with a gentle nature) | F | A | 70 | B82 |  |  |  |
| Evolving organisms | Selective breeding & genetic engineering | Define ‘genetic engineering’ | F | A | 70 | B82 |  |  |  |
| Evolving organisms | Selective breeding & genetic engineering | Describe the main steps in genetic engineering | HT | A | 71 | B82 |  |  |  |
| Evolving organisms | Selective breeding & genetic engineering | Give examples of genetic engineering (including crop resistance to diseases, insect attack and herbicides, crops with bigger, better fruits and bacterial cells used in the production of insulin) | F | A | 71 | B82 |  |  |  |
| Evolving organisms | Selective breeding & genetic engineering | Evaluate the use of genetic engineering and modification and describe the potential uses of this in the future | F | A | 71 | B83 |  |  |  |
| Evolving organisms | The Nervous System | Describe the structure of the nervous system | F | A | 51 | B48 |  |  |  |
| Evolving organisms | The Nervous System | Explain how it is adapted for its function and why it is important | F | A | 51 | B48 |  |  |  |
| Evolving organisms | The Nervous System | Describe the pathway of a message from stimulus to response | F | A | 51 | B48 |  |  |  |
| Evolving organisms | The Nervous System | Describe the design of a reflex arc and explain its purpose | F | A | 51 | B48 |  |  |  |
| Evolving organisms | The Nervous System | Use tables and graphs to extract information about reflex actions | F | A | 51 | B48 |  |  |  |
| Evolving organisms | The Nervous System | **RP Reaction Time:** Plan and carry out an investigation into the effect of a factor on human reaction time | F | A | 51 | B48 |  |  |  |
| Evolving organisms | Homeostasis | Define ‘homeostasis’ and explain why it is important | F | A | 50 | B46 |  |  |  |
| Evolving organisms | Homeostasis | List three factors controlled by homeostasis in the human body (blood glucose concentration, temperature, water levels) | F | A | 50 | B46 |  |  |  |
| Evolving organisms | Homeostasis | Explain how these automatic systems are controlled | F | A | 50 | B46 |  |  |  |
| Evolving organisms | The endocrine system | Describe the principals of hormonal coordination including what makes up the endocrine system | F | A | 52 | B50 |  |  |  |
| Evolving organisms | The endocrine system | Describe what hormones are and label six glands in the body | F | A | 52 | B50 |  |  |  |
| Evolving organisms | The endocrine system | Describe the role of the pituitary gland | F | A | 52 | B50 |  |  |  |
| Evolving organisms | The endocrine system | Explain the roles of thyroxine (produced by the thyroid gland) and adrenaline (produced by the adrenal gland) linking this to negative feedback loops (HT only) | HT | A | 52 | B50 |  |  |  |
| Evolving organisms | The endocrine system | Describe and explain how the body controls blood glucose concentration (making reference to glucose, glycogen, glucagon, negative feedback cycle, insulin and the pancreas) | F | A | 53 | B50 |  |  |  |
| Evolving organisms | Diabetes | Explain type 1 and type 2 diabetes and how they can be treated | F | A | 53 | B50 |  |  |  |
| Evolving organisms | Diabetes | Compare and contrast the two types of diabetes | F | A | 53 | B50 |  |  |  |
| Evolving organisms | Diabetes | Compare data (from graphs) regarding blood glucose levels in people with and without diabetes  | F | A | 53 | B50 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Describe the roles of FSH, LH, Oestrogen and progesterone in the menstrual cycle  | F | A | 54 | B52 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Describe the roles of oestrogen and progesterone in puberty | F | A | 54 | B52 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Interpret graphs relating to hormone levels in the menstrual cycle (HT only) | HT | A | 54 | B52 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Link hormone cycles to ovulation and menstruation | F | A | 54 | B52 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Evaluate hormonal and non-hormonal methods of contraception (oral, injection, implant, skin patch, condoms, diaphragms, intrauterine device, spermicidal agents, abstinence, sterilisation) | F | A | 55 | B53 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Explain why issues around contraception are not answered solely by the field of Science | F | A | 55 | B53 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Explain the process of embryo screening and evaluate based on ethical, social and economic perspectives | F | A | 55 | B53 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Explain the use of FSH and LH as a fertility drug (HT only) | F | T | 55 | B53 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Explain IVF (in vitro fertilisation) (HT only) | HT | A | 55 | B53 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Explain how developments in microscopy have enabled IVF treatments to be improved (HT only) | HT | A | 55 | B53 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Evaluate social and ethical issues and risks from the perspective of patients and doctors in IVF (HT only) | HT | A | 55 | B53 |  |  |  |
| Evolving organisms | Hormones in the reproductive system | Compare nervous system and hormonal responses | F | A | 54 | B52 |  |  |  |

**Knowledge organiser**:

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|  | **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)** |
|  | State the name of the genetic material found in the nucleus of a cell | DNA |
|  | Describe the structure of DNA | Double helix |
|  | State the name given to one molecule of DNA | Chromosome |
|  | State the name of a small section of DNA | A gene |
|  | What does a gene code for? | A sequence of amino acids which join to form a specific protein |
|  | Define the "human genome" | The sequence of the human DNA |
|  | State 3 reasons for mapping the human genome | 1) locating disease causing genes 2) treating inherited disorders 3) tracing human migration patterns |
|  | Define "homozygous" | two of same alleles e.g. BB |
|  | Define "heterozygous" | Two different alleles e.g. Bb |
|  | Define "dominant" | always expressed |
|  | Define "recessive" | Expressed only with 2 of this allele present |
|  | Define 'genotype' | The 2 alleles present e.g. Bb |
|  | Define 'phenotype' | The characteristic expressed e.g. brown eyes |
|  | Is cystic fibrosis caused by a dominant or recessive allele? | Recessive |
|  | Is Huntingdon's caused by a dominant or recessive allele? | Dominant |
|  | **Topic:** | **Introducing ecosystems and interdependence (B.20)** |
|  | State the name given to a habitat and all of the organisms living inside of it? | Ecosystem |
|  | What is the name for living factors that affect species? | Biotic |
|  | What is the name for non-living factors that affect an environment? | Abiotic |
|  | State the 3 types of adaptations that exist | 1) Structural 2) Behavioural 3) Functional |
|  | State 4 things that animals compete for | Water, mates, territory, food |
|  | State 4 things that plants compete for | Nutrients, Water, Space, Light |
|  | What is the scientific word for species relying on each other? | Interdependence |
|  | Similar organisms that can breed together to produce fertile offspring are known to be the same \_\_\_\_\_\_\_? | Species |
|  | 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) |
|  | Name 4 biotic factors | 1) food availability, 2) new predators, 3) new pathogens, 4) species outcompeting |
|  | What is the name given to an organism that lives in an extreme environment? | Extremophile |
|  | What is the name given to the TYPE of organism that absorbs sunlight and uses it to produce glucose? | Producer |
|  | What type of animal feeds off of the dead remains of other animals? | Scavenger |
|  | State two experimental techniques used to determine the abundance and distribution of a species | Transect (line across an environment) & quadrat (1m metal square) |
|  | What is the name given to the type of sampling that is done along a line? | Transect |
|  | **Topic:** | **Interdependence (B.22)** |
|  | Which organisms make up the tropic level 1? | Plants and algae (producers) |
|  | Which type of organisms make up trophic level 2? | Primary consumers/herbivores |
|  | Which type of organisms make up trophic level 3? | Secondary consumers/carnivores |
|  | Which type of organisms make up trophic level 4? | Tertiary consumers/carnivores |
|  | What is the name given to a carnivore that has no predators? | Apex predator |
|  | What is the name given to an organism that breaks down dead plant and animal matter? | Decomposer |
|  | How do decomposers break down dead plant and animal matter? | Secreting enzymes |
|  | How do decomposers absorb food molecules? | Diffusion |
|  | What is the name given to the diagram drawn to represent the amount of biomass found at each trophic level? | Pyramid of biomass |
|  | Which trophic level is always found at the bottom of a pyramid of biomass? | Trophic level 1 |
|  | What happens to the amount of biomass as you move up the food chain? | It decreases |
|  | Approximately what percentage of incident energy from light is transferred into plants during photosynthesis? | 0.01 |
|  | Approximately what percentage of biomass is transferred from each trophic level to the trophic level above? | 0.1 |
|  | Which is biomass lost between trophic levels? | 1) lost as faeces2) lost as CO2, water and urea3) used as glucose in respiration |
|  | 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)** |
|  | Define by "biodiversity" | variety of all the different species on earth/within an ecosystem |
|  | Why is increased biodiversity good? | Increases ecosystem stability |
|  | State three ways that humans can cause water pollution | Sewage, fertilisers, toxic chemicals |
|  | State three ways that humans can cause air pollution | Smoke, acidic gases |
|  | State three ways that humans can cause land pollution | Landfill sites, toxic chemicals |
|  | State 4 ways that humans are decreasing the land available for living organisms | building, quarrying, farming, dumping waste |
|  | State two uses of peat | Fuel & fertiliser |
|  | What is the name for 'cutting down trees' | Deforestation |
|  | State two reasons for deforestation occurring | Land for farming & growing biofuels |
|  | 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)** |
|  | Name the 7 classification levels proposed by Carl Linnaeus (in order) | Kingdom, Phylum, Class, Order, Family, Genus, Species |
|  | What does "binomial" literally mean? | Two names |
|  | What do the two parts of a binomial name tell us? | (i) Genus (ii) Species |
|  | Who introduced the 'domain' level to the classification system? | Carl Woese |
|  | 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 |
|  | State the meaning of the domain "archaea" | Primitive bacteria usually living in extreme environments (DNA is NOT contained in a nucleus) |
|  | State the meaning of the domain "bacteria" | DNA is NOT contained in a nucleus, don't live in extreme environments |
|  | State the meaning of the domain "eukaryote" | Their DNA is contained in a nucleus (protists, fungi, plant and animals) |
|  | Define "species" | organisms that can breed together to produce FERTILE offspring |
|  | List the 5 'classes' of classification | Mammals, reptiles, birds, fish, amphibians |
|  | List 4 ways a species can become extinct slowly | \*New predators\*New diseases\*Changes to the environment over time\*More successful competitors |
|  | State one way a species can become extinct rapidly | Catastrophic event e.g. volcanic eruption |
|  | State the purpose of an evolutionary tree | A diagram used to show how closely related we think organisms are to each other |
|  | State two pieces of evidence used to create an evolutionary tree | Fossil records and DNA samples |
|  | List the 5 kingdoms? | Prokaryote, Protoctista, Fungi, Animals, Plants |
|  | **Topic:** | **Natural selection and evolution (B.31)** |
|  | State three factors that can cause variation in a species | The environment, random mutations, sexual reproduction |
|  | Define 'evolution' | The gradual change in the inherited characteristics of a population over time |
|  | If enough variation occurs over time due to evolution, a new \_\_\_\_\_\_\_\_ is created | species |
|  | What was Charles Darwin's theory called? | Theory of evolution through natural selection |
|  | 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 |
|  | 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 |
|  | What is a fossil? | The remains of an organism from hundreds of thousands of years ago |
|  | 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 |
|  | Describe how scientists use fossils | As evidence of how organisms have changed over time (evolution |
|  | Explain why fossils can't be used to provide evidence of how life began on Earth | Fossil record is incomplete (there are gaps) |
|  | Explain why there are gaps in the fossil record | \*Early animals had soft bodies so decayed easily \*Geological activities destroyed fossils  |
|  | What is an antibiotic-resistant bacterium? | A bacteria that cannot be killed by an antibiotic |
|  | What was the name of Charles Darwin's book? | The origin of species 1859 |
|  | **Topic:** | **Selective breeding and genetic engineering (B.32)** |
|  | Describe the purpose of selective breeding | Humans breed plants & animals with particular desirable characteristics |
|  | State two reasons to use selective breeding | \*produce food crops \*produce domesticated animals |
|  | List 4 steps in selective breeding | 1) Choose parent with desired characteristic2) Breed them together3) Choose best offspring4) Continue over many generations |
|  | 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 |
|  | State one disadvantage of selective breeding in animals | Inbreeding -> health issues |
|  | State one disadvantage of selective breeding in crops | Crops have very similar DNA so disease can kill them all |
|  | Why was Mendel's work initially not accepted? | \*He was a monk \*He didn’t publish his work in a well know journal |
|  | Who discovered the structure of DNA? | Franklin, Watson & Crick |
|  | Describe "gene theory" | The idea that genes are "units" of inheritance |
|  | Define "genetic engineering" | Modifying (changing) the genome (genes) of an organism to give a desired characteristic |
|  | 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 |
|  | Describe the 4 stages of genetic engineering | 1) select desired characteristic 2) isolate gene 3) insert gene into vector 4) replicate |
|  | Define "vector" | A ring of DNA (plasmid) or an organism that carries a gene from one organism into another |
|  | 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)** |
|  | Define "CNS" | Central Nervous System (brain and spinal cord) |
|  | Define "PNS" | Peripheral Nervous System (neurones) |
|  | Define "stimulus" | A change in the environment detected by receptors e.g. light, temperature, pressure, smell |
|  | Define "receptor" | Specialised cells that detects the stimulus e.g. tongue, skin, nose, eye |
|  | Define "effector" | Muscle/gland that responds to the motor neurone to cause a change |
|  | Define "sensory neurone" | Neurone carrying electrical impulse FROM receptor to CNS |
|  | Define "motor neurone" | Neurone carrying electrical impulse FROM the CNS to effector |
|  | Define "relay neurone" | Neurone carrying electrical impulse from one part of the CNS to another |
|  | Define "reflex response" | Rapid response which does not use conscious part before response occurs |
|  | Describe how messages are sent through the nervous system | Through neurones (electrical) |
|  | Describe how messages are sent through the endocrine system | Through blood (chemical) |
|  | Which system (nervous or endocrine) transfers messages around the body quicker? | Nervous |
|  | Which system (nervous or endocrine) does the response last for longer? | Endocrine |
|  | Which gland is called the 'master gland'? | The pituitary gland |
|  | Define "synapse" | A gap or junction between two neurons |
|  | **Topic:** | **Homeostasis (B.34)** |
|  | Name the 6 glands/organs in the endocrine system | Thyroid gland, pituitary gland, pancreas, adrenal gland, testes, ovaries |
|  | 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) |
|  | State the hormone that is released from the thyroid gland and its effect on the body | Thyroxine - increases metabolism (chemical reactions) |
|  | State the hormones that is released from the pituitary gland and their effect on the body | FSH (egg development) & LH (ovulation) |
|  | State the hormone that is released from the testes and its effect on the body | Testosterone - puberty & sperm production (in boys) |
|  | State the hormones that is released from the ovaries and their effect on the body | Oestrogen - causes uterus lining to rebuildProgesterone - maintains uterus lining |
|  | Which two systems help to control homeostasis? | Nervous system and endocrine system |
|  | Which disease is linked to an inability to control your blood glucose levels? | Diabetes |
|  | Define "homeostasis" | Regulation of internal conditions of a cell or organism to maintain optimum conditions |
|  | 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) |
|  | State 4 things that are regulated in the body | Body temperature, blood glucose, water levels, ion levels |
|  | Which part of the body detects and controls body temperature | Thermoregulatory centre (in the brain) |
|  | 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 |
|  | 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 |
|  | 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)** |
|  | Which organ monitors and controls your blood glucose concentration? | The Pancreas |
|  | Which hormone is released if there is too much glucose in the blood? | Insulin |
|  | Which hormone is released if there is too little glucose in the blood? | Glucagon |
|  | Describe the effect of insulin have in the body? | (Soluble) glucose stored in the muscle & liver cells as (insoluble) glycogen |
|  | Describe the effect of glucagon have in the body? | (Insoluble) glycogen turned into (soluble) glucose and released from liver and muscle cells into blood |
|  | 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  |
|  | 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 |
|  | State the hormones that is released from the pancreas and it's effect on the body | Insulin - decreases blood glucose Glucagon - increases blood glucose |
|  | Define "gland" | An organ that releases a hormone into the blood |
|  | Define "hormone" | A chemical messenger that travels in the blood and targets organs |
|  | Define 'negative feedback' (higher tier only) | Our body's way of monitoring changes in internal conditions and then responding to these changes so that homeostasis is regained |
|  | Which type of diabetes is inherited? | Type one |
|  | Which type of diabetes is caused by lifestyle | Type two |
|  | How do glucagon & insulin travel around the body? | In blood |
|  | State a risk factor for type 2 diabetes | Obesity |
|  | **Topic:** | **Hormones in the reproductive system (B.36)** |
|  | State the function of FSH (follicle stimulating hormone) | Causes egg to mature |
|  | State where FSH is produced | Pituitary Gland |
|  | State the hormone that FSH stimulates the production of (HT only) | Oestrogen from ovaries |
|  | State the effect of oestrogen | Causes uterus lining to build up |
|  | Which hormone inhibits FSH release? (HT only) | Oestrogen |
|  | Which hormone does oestrogen stimulate? (HT only) | Luteinising hormone (LH) |
|  | State the effect of luteinising hormone (LH) on the body | Causes ovulation |
|  | Where is luteinising hormone produced? | Pituitary Gland |
|  | Where is progesterone produced? | The empty egg follicle (corpus luteum) |
|  | State the role of progesterone | Maintains uterus liningInhibits FSH & LH |
|  | Name 3 non-hormonal methods of contraception | Barrier method (diaphragm or condoms), abstinence, spermicide, sterilisation, some intrauterine devices |
|  | Name 3 hormonal methods of contraception | Oral contraceptive pill, implant, injection, some intrauterine devices |
|  | What does IVF stand for? | In Vitro Fertilisation (outside of the body) |
|  | What are the 4 stages of IVF? (higher tier only) | 1) Mother given FSH & LH to stimulate maturation of several eggs 2) eggs collected from mother and fertilised by sperm in lab 3) Fertilised eggs develop into embryos 4) Two embryos inserted into mothers uterus |
|  | 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)** |
|  | What is the independent variable? | Attempt number |
|  | What is the dependent variable? | Reaction time (s) |
|  | Name 3 control variables | 1) Same hand used2) Same person dropping ruler3) Hand placed in same position each time  |
|  | How is the reaction time measured? | A ruler is dropped and caught and the distance on the ruler is recorded |
|  | Name one source of error in the method | Measuring the distance from a different place on the ruler each time |
|  | Give two ways to improve the accuracy of the results | 1) Measure from above the thumb2) Use a computer programme |
|  | How do we turn the distance on the ruler to a reaction time? | Use a conversion chart to turn the distance into a time |
|  | Name the equipment | Metre rule, chair, table, partner |
|  | 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  |
|  | Describe where the ruler should start from | The bottom of the ruler at 0cm between the thumb and forefinger |
|  | Describe how the ruler should be dropped | Your partner drops the ruler without telling you |
|  | Describe how the ruler should be caught | As quickly as you an between thumb and forefinger |
|  | Name one risk in the investigation | Care should be taken to avoid injury from the falling ruler |
|  | What results should you see? | As the number of practice attempts increases, the reaction time decreases |
|  | What are possible variations on this method? | 1) Effect of sugary drinks2) Effect of caffeine3) Effect of age |
|  | **Topic:** | **RP: Field investigations (B9) (B.49)** |
|  | What is the first aim? | Investigating the population size of a plant species using random sampling |
|  | How do we prepare the area we are investigating? | Lay out two measuring tapes at right angles to each other |
|  | Name the equipment  | a 25 cm x 25cm quadrat, a 30 m tape measure, a clipboard, a pen, paper. |
|  | How do we ensure the sample is random? | Choose random co-ordinates and place the quadrat in these places |
|  | What are the steps in the method? | 1) Place the quadrat down and count the number of organisms inside.2) Repeat for 10 quadrats3) Calculate the mean |
|  | How do we work out an estimate for the whole area? | estimated population size = (area sampled /total area) x mean number of organisms counted |
|  | How can we improve the accuracy of the estimate? | increase the number of quadrat throws and calculate the mean |
|  | 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 |
|  | What is the second aim? | Investigating the effect of light intensity on plant distribution using a transect line. |
|  | How do we set up a transect line? | Place a tape measure from one part of the area to another |
|  | How do we measure the number of organisms? | Place a quadrat down and count the number of organisms inside |
|  | 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. |
|  | How do you measure the light intensity? | Use a light meter or light probe |
|  | How do you represent the data? | Plot a graph of light intensity against number of organisms |
|  | What are possible variations on this method? | 1) Effect of pH2) Effect of temperature3) Effect of carbon dioxide levels4) Distance from a factory/road |

**Required practicals**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Practical** | **Variables** | **Equipment** | **Method** | **Expected conclusion** | **Possible variations** |
| **B7 – Reaction Time** | **Big Question**: Investigate the effect of sugar on reaction time.**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  | \*Metre ruler\*Chair\*Table | 1. Person 1 & 2 drinks a non-sugary drink twenty minutes before the test (this is a control).
2. Person 1 sits on chair with arm on the table.
3. Person 2 holds the ruler vertically with the 0cm mark in between person 1’s finger and thumb.
4. Tell person 1 to prepare to catch the ruler.
5. Drop the ruler
6. Person 1 catches the ruler as quickly as they can and records the number just above the person’s thumb.
7. Repeat three times.
8. Repeat the test with person 1.
9. Person 1&2 drinks a sugar free drink twenty minutes before the next test.
10. Repeat the experiment steps 1-9.
 | Sugary drink leads to faster reaction times | Investigate how gender affects reaction timeInvestigate how caffeine affects reaction timeInvestigate the effect of age on reaction time |
| **B9 – Field Investigations** | **Big Question (1):** Estimate the number of daisies in this field. (RANDOM SAMPLING)**Big Question (2):** Describe how light intensity effects the distribution of grass.(QUADRAT SAMPLING)**Big Question 2:**IV – Light intensityDV – Grass coverageCV - area of quadrat, soil water content, temperature | Big question 1:\*1m2 quadrat\*2 x tape measures\*Bag of numbers for random selectionBig question 2:\*Light intensity meter\*Tape measure\*1m2 quadrat | **Big Question 1:**1. Get a 1m2 quadrat.
2. Mark the edge of the field with a tape measure
3. Mark the second edge (at a right angle) with a second tape measure.
4. Choose two numbers from a bag and use these as the co-ordinates to identify a random position in the field.
5. Place the quadrat here and count the number of daisies.
6. Repeat multiple times and then calculate an average.
7. Multiple this by the area of the field.

**Big Question 2:**1. Place a transect (a line) from inside a shady part of a forest into the bright light.
2. Place the quadrat at the start of the transect and record the approximate area covered in grass plants.
3. Measure the light intensity using a light intensity meter.
4. Repeat steps 2-3 at regular intervals along the transect.
 | Big Question 2:Increase in light intensity should cause an increase in grass plants. | Investigate how the number of lichens changes as you move further from the main road.Investigate the number of woodlice changes as you move further from a lake. |
| Practical | Variables | Equipment | Method | Expected conclusion | Possible variations |
| **B7 – Reaction Time** | **Big Question**: Investigate the effect of sugar on reaction time.**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  | \*Metre ruler\*Chair\*Table | 1. Person 1 & 2 drinks a non-sugary drink twenty minutes before the test (this is a control).
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7. Repeat three times.
8. Repeat the test with person 1.
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10. Repeat the experiment steps 1-9.
 | Sugary drink leads to faster reaction times | Investigate how gender affects reaction timeInvestigate how caffeine affects reaction timeInvestigate the effect of age on reaction time |

**Chemistry**

**Mastery Matrix:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Unit** | **Topic** | **Learning statement** | **Tier** | **Course** | **Revision Guide (trilogy)** | **Revision Guide** **(separate)** | **1** | **2** | **3** |
| Chemistry Fundamentals | Mixtures | Define ‘pure substances’ and explain the difference between its scientific and everyday meaning | F | A | 140 | C84 |  |  |  |
| Chemistry Fundamentals | Mixtures | Use melting and boiling point data to establish pure substances from mixtures | F | A | 140 | C84 |  |  |  |
| Chemistry Fundamentals | Mixtures | Describe what a ‘formulation’ is and give examples (Fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods) | F | A | 140 | C84 |  |  |  |
| Chemistry Fundamentals | Mixtures | Describe the two phases (stationary and mobile) of chromatography and its purpose | F | A | 140 | C84 |  |  |  |
| Chemistry Fundamentals | Mixtures | Calculate Rf values | F | A | 141 | C85 |  |  |  |
| Chemistry Fundamentals | Mixtures | Interpret chromatograms to decide whether a substance is pure of a mixture | F | A | 140 | C84 |  |  |  |
| Chemistry Fundamentals | Mixtures | **RP Chromatography**: Use paper chromatography to investigate the colours within different substances and calculate Rf values  | F | A | 140 | C84 |  |  |  |
| Chemistry Fundamentals | Mixtures | Explain the difference in difficulty of separating compounds compared to mixtures | F | A | 88+89 | C8+C9 |  |  |  |
| Reacting substances | Rates of reaction | Calculate the mean rate of reaction  | F | A | 124 | C60 |  |  |  |
| Reacting substances | Rates of reaction | Recall the units for mass (g), volume (cm3) and rate (g/s, cm3/s, mol/s) | F | A | 124 | C60 |  |  |  |
| Reacting substances | Rates of reaction | Draw tangents on curves in order to calculate rates of reaction | F | A | 125 | C61 |  |  |  |
| Reacting substances | Rates of reaction | Explain the collision theory and link to activation energy | F | A | 124 | C60 |  |  |  |
| Reacting substances | Rates of reaction | Describe and explain factors that affect rates of reaction (concentration, pressure, surface area, catalysts and temperature) | F | A | 124+125+126 | C60+C61+C62 |  |  |  |
| Reacting substances | Rates of reaction | Plot and interpret graphs showing rates of reaction | F | A | 125 | C61 |  |  |  |
| Reacting substances | Rates of reaction | Explain why one reactant is used in excess in a chemical reaction | F | A | 105 | C33 |  |  |  |
| Reacting substances | Rates of reaction | Describe what is meant by ‘a limiting reactant’ | F | A | 105 | C33 |  |  |  |
| Reacting substances | Rates of reaction | **RP Rates of Reaction:** Investigate how changes in concentration affect the rates of reactions by measuring volume of the gas and change of colour | F | A | 125 | C61 |  |  |  |
| Reacting substances | Rates of reaction | Give examples of catalysts  | F | A | 126 | C62 |  |  |  |
| Reacting substances | Rates of reaction | Draw a reaction profile for a catalysed reaction | F | A | 121 | C57 |  |  |  |
| Reacting substances | Reversible reactions | Use the appropriate symbol to denote a reversible reaction | F | A | 126 | C62 |  |  |  |
| Reacting substances | Reversible reactions | Explain energy changes in reversible reactions (ammonium chloride and hydrated copper sulphate) | F | A | 126 | C63 |  |  |  |
| Reacting substances | Reversible reactions | Explain what is meant by the term ‘equilibrium’ | F | A | 127 | C63 |  |  |  |
| Reacting substances | Reversible reactions | Explain and use Le Chatelier principle to make predictions about reactants and products (HT only) | HT | A | 127 | C63 |  |  |  |
| Reacting substances | Reversible reactions | Explain the effect of changing concentration, pressure and temperature on equilibrium (HT only) | HT | A | 127 | C63 |  |  |  |
| Humans and the Earth | The Earths Early Atmosphere | Describe the composition of the atmosphere and how long this has been the case | F | A | 143 | C89 |  |  |  |
| Humans and the Earth | The Earths Early Atmosphere | Describe the development from early atmosphere to present day | F | A | 142 | C88 |  |  |  |
| Humans and the Earth | The Earths Early Atmosphere | Draw links between the early Earth’s atmosphere and that of other planets (Mars and Venus) | F | A | 142 | C88 |  |  |  |
| Humans and the Earth | The Earths Early Atmosphere | Evaluate different theories regarding the Earth’s early atmosphere | F | A | 142 | C88 |  |  |  |
| Humans and the Earth | The Earths Early Atmosphere | Explain why oxygen levels increased and carbon dioxide levels decreased (linking to photosynthesis and sedimentation) | F | A | 143 | C89 |  |  |  |
| Humans and the Earth | Global Warming | Describe the term ‘greenhouse gases’ and give three examples (water vapour, carbon dioxide and methane) | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Global Warming | Describe the ‘greenhouse effect’ linking to the wavelength of radiation | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Global Warming | Describe the effect of human activities on the levels of greenhouse gases, recalling two that affect methane and two that affect carbon dioxide | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Global Warming | Explain how peer review evidence have linked these activities to global climate change | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Global Warming | Explain why it is difficult to model this and how this has led to simplification, speculation and biased opinions in the media | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Global Warming | Describe 4 potential effects of global climate change | F | A | 145 | C91 |  |  |  |
| Humans and the Earth | Global Warming | Discuss the scale, risks and environmental implication of global climate change | F | A | 145 | C91 |  |  |  |
| Humans and the Earth | Global Warming | Describe what is meant by the term ‘carbon footprint’ | F | A | 145 | C91 |  |  |  |
| Humans and the Earth | Global Warming | Describe actions to reduce our carbon footprint and explain why these actions may have limited impact | F | A | 145 | C91 |  |  |  |
| Humans and the Earth | Air pollution | Describe combustion as a major source of atmospheric pollution | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Air pollution | Name gases release when fuels such as coal are burnt (carbon dioxide, water vapour, carbon monoxide, sulphur dioxide and nitrogen oxides) and predict which of these would be produced from a given fuel composition | F | A | 143 | C89 |  |  |  |
| Humans and the Earth | Air pollution | Describe ‘particulates’  | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Air pollution | Describe issues arising from carbon dioxide, sulphur dioxide, nitrogen oxides and particulates | F | A | 144 | C90 |  |  |  |
| Humans and the Earth | Finite resources | Recalls that humans use the Earth’s resources to provide; warmth, shelter, food, transport (through timber, clothing, fuels/energy and other materials)  | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Finite resources | Define what is meant by the term ‘finite resource’ | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Finite resources | Define what is meant by the term ‘sustainable development’ and explain the role that chemistry plays in developing agricultural and industrial processes | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Finite resources | Explain how some natural products are being replaced by some agricultural and synthetic products | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Water and waste | Describe the properties of potable water (is safe to drink) linking to purity, salt and microbe levels | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Water and waste |  Describe the different sources of drinking water in the UK and the process that it must undergo before it is potable | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Water and waste | Describe the process of desalination (distillation or reverse osmosis) | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Water and waste | Evaluate the methods to produce potable water (linking to location and potential water supply) | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Water and waste | **RP Water Purification:** Analyse and purify water samples from different sources, including pH, dissolved solids and distillation | F | A | 147 | C93 |  |  |  |
| Humans and the Earth | Water and waste | Explain why large amounts of waste water are produced (urban life styles and industrial processes) | F | A | 147 | C93 |  |  |  |
| Humans and the Earth | Water and waste | Explain what needs to be removed from sewage and agricultural waste in comparison with industrial waste water  | F | A | 147 | C93 |  |  |  |
| Humans and the Earth | Water and waste | Describe the 4 steps of sewage treatment | F | A | 147 | C93 |  |  |  |
| Humans and the Earth | Water and waste | Compare the relative ease of obtaining potable water from waste, the ground and salt water | F | A | 146 | C92 |  |  |  |
| Humans and the Earth | Life Cycle Assessments | Explain how phytomining and bioleaching and scrap iron and electrolysis can be used to extract copper from low grade ores | HT | A | 147 | C93 |  |  |  |
| Humans and the Earth | Life Cycle Assessments | Describe what is meant by the term ‘life cycle assessment’ | F | A | 148 | C95 |  |  |  |
| Humans and the Earth | Life Cycle Assessments | Describe the 4 stages of a life cycle assessment | F | A | 148 | C95 |  |  |  |
| Humans and the Earth | Life Cycle Assessments | Explain that water resources, energy and waste production can be easily quantified whereas pollutant effects are hard to quantify | F | A | 148 | C95 |  |  |  |
| Humans and the Earth | Life Cycle Assessments | Describe how simplified life cycle assessments can be used in a biased manner to support advertising claims in the media | F | A | 148 | C95 |  |  |  |
| Humans and the Earth | Life Cycle Assessments | Use data to carry out LCA for shopping bags made from plastic and paper | F | A | 148 | C95 |  |  |  |
| Humans and the Earth | Life Cycle Assessments | Explain how we can reduce our use of limited resources (reduce, reuse, recycle) | F | A | 149 | C95 |  |  |  |
| Humans and the Earth | Making Materials | Describe what factors affect the properties of polymers | F | T |  | C70 |  |  |  |
| Humans and the Earth | Making Materials | Compare low density and high density poly(ethane) | F | T |  | C70 |  |  |  |
| Humans and the Earth | Making Materials | Compare and contrast thermosetting and thermosoftening polymers explaining the differences | F | T |  | C71 |  |  |  |
| Humans and the Earth | Making Materials | Explain what ‘composites’ are and give some examples | F | T |  | C95 |  |  |  |
| Humans and the Earth | Making Materials | Explain how glass is produced  | F | T |  | C94 |  |  |  |
| Humans and the Earth | Making Materials | Compare the composition and melting points of soda-lime glass and borosilicate glass | F | T |  | C94 |  |  |  |
| Humans and the Earth | Making Materials | Discuss the environmental impact of using metal, glass, building materials, clay ceramics and plastics linking to the use of these limited resources and the energy used to extract and process them. | F | T | 149 | C95 |  |  |  |
| Humans and the Earth | Making Materials | Explain ways that we can reduce this environmental impact | F | T | 149 | C95 |  |  |  |
| Organic Chemistry | Alkanes and Alkenes | Explain what crude oil is and how it is formed | F | A | 136 | C64 |  |  |  |
| Organic Chemistry | Alkanes and Alkenes | Define ‘alkanes’ and give the general formula | F | A | 136 | C64 |  |  |  |
| Organic Chemistry | Alkanes and Alkenes | Recall the formulae and structures for the first 4 alkanes (methane, ethane, propane and butane) | F | A | 137 | C65 |  |  |  |
| Organic Chemistry | Alkanes and Alkenes | Define ‘alkenes’ and give the general formula  | F | A | 138 | C66 |  |  |  |
| Organic Chemistry | Alkanes and Alkenes | Recall the formulae and structures for the first 4 alkenes (ethene, propene, butane, pentene) | F | A | 138 | C67 |  |  |  |
| Organic Chemistry | Alkanes and Alkenes | Define the terms ‘saturated’ and ‘unsaturated’ and link to alkanes and alkenes | F | A | 136 | C64+C66 |  |  |  |
| Organic Chemistry | Alkanes and Alkenes | Use the bromine test to identify whether there are alkanes or alkenes present | F | A | 139 | C67 |  |  |  |
| Organic Chemistry | Fractional Distillation | Explain the process of fractional distillation | F | A | 136 | C64 |  |  |  |
| Organic Chemistry | Fractional Distillation | Name and describe the uses (fuels and feedstock for the petrochemical industry e.g. solvents, lubricants, polymers and detergents) of each of the fractions produced (petrol, diesel, kerosene, heavy fuel oil and LPG) | F | A | 136 | C64 |  |  |  |
| Organic Chemistry | Fractional Distillation | Describe why carbon can form such a vast array of natural and synthetic compounds | F | A | 136 | C64 |  |  |  |
| Organic Chemistry | Fractional Distillation | Explain how the size of hydrocarbon is linked to their boiling point, viscosity and flammability  | F | A | 136 | C64 |  |  |  |
| Organic Chemistry | Fractional Distillation | Describe the combustion of hydrocarbons and write balanced symbol equations | F | A | 137 | C65 |  |  |  |
| Organic Chemistry | Cracking | Describe what is meant by ‘cracking’ | F | A | 138 | C66 |  |  |  |
| Organic Chemistry | Cracking | Describe why cracking is required | F | A | 138 | C66 |  |  |  |
| Organic Chemistry | Cracking | Describe the methods and conditions used for ‘catalytic cracking’ and ‘steam cracking’ | F | A | 138 | C66 |  |  |  |
| Organic Chemistry | Cracking | Recall the uses of alkenes produced during cracking (polymers) | F | A | 138 | C70 |  |  |  |
| Organic Chemistry | Cracking | Balance chemical equations for cracking | F | A | 138 | C66 |  |  |  |

**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 ⇌ ammonia + hydrogen chlorideHydrated copper sulphate (blue) ⇌ anhydrous copper sulphate (white) + water |
| 3 | Is ammonium chloride -> ammonia + hydrogen chloride an endothermic or exothermic reaction? | Endothermic |
| 4 | What is it called when the forward and reverse reactions occur at exactly the same rate? | Equilibrium |
| 5 | The effects of changing conditions on a system at equilibrium can be predicted using …? (HT only) | Le Chatelier's Principle |
| 6 | Which 3 factors affect the position of equilibrium? | Pressure (gases), temperature, concentration |
| 7 | When the pressure of a system is increased, equilibrium will shift towards which side? (HT only) | Least molecules |
| 8 | When the pressure of a system is decreased, equilibrium will shift towards which side? (HT only) | Most molecule |
| 9 | When the temperature of a system is increased, the equilibrium will shift towards which side? (HT only) | Endothermic reaction |
| 10 | When the temperature of a system is decreased, the equilibrium will shift towards which side? (HT only) | Exothermic reaction |
| 11 | If the concentration of the reactants are increased, which reaction will be favoured? (HT only) | The forwards reaction (to make more product) |
| 12 | If the concentration of the reactants are decreased, which reaction will be favoured? (HT only) | The backwards reaction (to make more reactants) |
| 13 | What is a closed system? | A reaction (system) where no reactants are added or products removed. |
| 14 | What is the symbol for a reversible reaction? |  ⇌  |
| 15 | What is the general equation for a reversible reaction? | A + B ⇌ 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 CO2 between the Early Atmosphere and today. | 1) Dissolved in seas2) Trapped in rocks3) Photosynthesis4) 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 (CH4) |
| 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 CO2 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 bed2) 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 materials2) Manufacturing and packing3) Use during its life4) Disposal |
|  |  |  |
|  | **Topic:** | **Alternative methods of extracting metals (HT only) (C.24)** |
| 1 | Define high-grade and low-grade ore. | High-grade ore is a rock containing lots of a metal, low-grade ore is a rock containing a small amount of a metal |
| 2 | State three reasons why copper is a useful metal (HT only) | 1) Good conductor, 2) Easily bent, 3) Unreactive with water |
| 3 | How can copper be extracted from copper-rich ores? (HT only) | Smelting = heating the copper ore with carbon in a furnace |
| 4 | How can copper be purified after smelting? (HT only) | Electrolysis |
| 5 | Name the method for extracting copper from a salt. (HT only) | Electrolysis |
| 6 | Where do copper ions move to during electrolysis? (HT only) | The cathode |
| 7 | Name the method used to extract copper using scrap iron. (HT only) | Displacement |
| 8 | Which metal is used in reduction of low grade copper extraction? (HT only) | Iron |
| 9 | Why are we running out of copper-rich ores? (HT only) | Because of extensive mining of copper in the past. |
| 10 | State two alternative methods of extracting copper rather than using copper-rich ores. (HT only) | Phytomining (using contaminated land), Bioleaching (using low-grade ores) |
| 11 | Why are phytomining and bioleaching more environmentally friendly? (HT only) | They don't involve digging up and moving large quantities of rock, or produce lots of waste. |
| 12 | State the 3 steps in phytomining (HT only) | 1) Grow plants on low grade ore, 2) Plants absorb and store copper, 3) Burn plants to produce ash |
| 13 | State the organism used in bioleaching and the solution produced (HT only) | Bacteria, Leachate |
| 14 | State the two steps in removing copper from the copper filled ash produced in phytomining (HT only) | 1) Dissolve in water, 2) displacement/electrolysis |
| 15 | State how copper is removed from the leachate produced in bioleaching (HT only) | Displacement or electrolysis |
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|  | **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 |
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|  | **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 |
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|  | **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 magnesium2)volume of acid3) 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 syringe2) 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 acid2)size/thickness of the cross3)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 temperature2) Effect of volume3) Effect of a catalyst |
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|  | **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 colour2) Size of the coloured dot3) Start point of the solvent |
| 5 | Name 3 sources of error | 1) Starting line drawn in ink2) Solvent above the starting line3) 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? | Rf value = distance moved by dye / 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. |
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|  | **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 basin2) Fill evaporating basin with water sample3) Heat gently using Bunsen burner4) 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? | CnH2n+2 |
| 14 | What is the general formula for an alkene? | CnH2n |
| 15 | Which type of hydrocarbon is saturated - alkanes or alkenes? | Alkanes |

**Required practicals**

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| **C5 – Rates of reaction** | **Big Question 1**: Investigate how concentration affects rate of reaction (using volume of gas produced)**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.**Big Question 2**: Investigate how concentration affects rate of reaction (using turbidity – aka cloudiness)**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. | **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**Big question 2:****(turbidity)**\*Sodium thiosulphate\*Distilled water\*1.0M HCl\*Conical flask\*Black cross\*Stopwatch | **Big Question 1: (volume of gas)**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.

**Alternative method of measuring volume of gas:**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. Image result for delivery tube, upside down measuring cylinder - name of methodAdd the magnesium strip to the HCl.
5. Add the bung, delivery tube to the top of the conical flask.
6. Start the stop watch immediately.
7. Record the volume of gas produced every 10 seconds for 100seconds.
8. Repeat using the 1.5M HCl instead.

**Big Question 2: (turbidity)**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.
 | As concentration increases, rate of reaction should increase. | Investigate how temperature affects rate of reaction.Investigate how addition of a catalyst affects rate of reaction.Investigate how volume of a reactant affects rate of reaction. |
| **C6 – Paper chromatography** | **Big Question:** Investigate the colours that are found within a mixture of food colourings**IV –** Ink colour**DV –** Rf value**CV -** Start point of the colour, size of the coloured dot, start point of the solvent | \*Beaker\*Wooden splint\*Chromatography paper\*4 food colourings ‘A’-‘D’\*mixture of food colourings ‘U’\*5 glass capillary tubes\*paper clip\*ruler\*pencil | 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 split with the spots at the bottom.
7. Carefully hang into the beaker.
8. Wait for the water to travel ¾ 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).
 | 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. | Investigate whether this pen is a pure colour or a mixture. |
| **C8 – Water purification** | **Big Question**: Analyse and purify a water sample to make sure it is safe to drink (potable!).**IV –** Water sample**DV –** Mass of solids dissolved in 10cm3 AND pH**CV -** Volume of water tested | \*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 | 1. Image result for simple evaporation equipmentTest 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.

To gain pure water:1. Set up simple distillation equipment as shown in the diagram.
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).
 | All water will have some dissolved substances in it unless it has been distilled. |  |

**Physics**

**Mastery Matrix**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Unit** | **Topic** | **Learning statement** | **Tier** | **Course** | **Revision Guide (trilogy)** | **Revision Guide (separate)** | **1** | **2** | **3** |
| Energy and Waves | Elastic Objects & potential energy | Describe elastic and inelastic deformation | F | A | 160 | P10 |  |  |  |
| Energy and Waves | Elastic Objects & potential energy | Explain the effect of forces on elastic objects | F | A | 160 | P10 |  |  |  |
| Energy and Waves | Elastic Objects & potential energy | Describe Hooke’s Law qualitatively and using the equation F = ke | F | A | 161 | P10 |  |  |  |
| Energy and Waves | Elastic Objects & potential energy | Explain ‘word done’ when applied to stretching or compressing a spring | F | A | 161 | P10 |  |  |  |
| Energy and Waves | Elastic Objects & potential energy | Explain the difference between a linear and a non-linear relationship | F | A | 160 | P10 |  |  |  |
| Energy and Waves | Elastic Objects & potential energy | Interpret data from a force extension investigation | F | A | 160 | P10 |  |  |  |
| Energy and Waves | Elastic Objects & potential energy | **RP Force and Extension:** Investigate the relationship between force and extension for spring (Hooke’s Law) | F | A | 161 | P11 |  |  |  |
| Energy and Waves | Waves | Describe what is meant by ‘a wave’ | F | A | 182 | P30 |  |  |  |
| Energy and Waves | Waves | Describe the difference between longitudinal and transverse waves giving examples for both | F | A | 182 | P30 |  |  |  |
| Energy and Waves | Waves | Describe amplitude, wavelength (λ), wave speed (v), frequency (f) and period of a wave (T) and give units for each | F | A | 182 | P30 |  |  |  |
| Energy and Waves | Waves | Use and rearrange T = 1/f | F | A | 183 | P30 |  |  |  |
| Energy and Waves | Waves | Use and rearrange v = f  λ | F | A | 183 | P31 |  |  |  |
| Energy and Waves | Waves | Identify amplitude and wavelength from diagrams of a wave | F | A | 182 | P30 |  |  |  |
| Energy and Waves | Waves | Describe the method to measure the speed of sound in air and the speed of ripples on the water surface | F | A | 183 | P31 |  |  |  |
| Energy and Waves | Waves | **RP Waves:** Make observations to identify the suitability of apparatus for measuring frequency, wavelength and speed of waves in a ripple tank and waves on a string or elastic cord. | F | A | 183 | P31 |  |  |  |
| Energy and Waves | Electromagnetic Waves | Describe what ‘electromagnetic waves’ are | F | A | 184 | P36 |  |  |  |
| Energy and Waves | Electromagnetic Waves | Recall the order of EM waves & recall their frequency and wavelength and give examples of the uses of these | F | A | 186 | P36 |  |  |  |
| Energy and Waves | Electromagnetic Waves | Explain how EM waves are generated and absorbed  | F | A | 186 | P36 |  |  |  |
| Energy and Waves | Electromagnetic Waves | Explain the hazardous effects of UV, X-rays and Gamma rays | F | A | 187 | P37 |  |  |  |
| Energy and Waves | Electromagnetic Waves | Link the properties of EM waves to their practical application (HT only) | HT | A |  | P36 |  |  |  |
| Energy and Waves | Electromagnetic Waves | Apply knowledge of reflection, refraction, transmission and absorption to EM waves (HT only) | HT | A |  | P32+P33 |  |  |  |
| Energy and Waves | Electromagnetic Waves | **RP Radiation and Absorption:** investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface | F | A | 186 | P37 |  |  |  |
| Energy and Waves | Electromagnetic Waves | Explain how radio a radio works using EM waves (HT only) | HT | A | 187 | P37 |  |  |  |
| Forces and Motion | Forces introduction | Define scalar and vector quantities | F | A | 158 | P8 |  |  |  |
| Forces and Motion | Forces introduction | Use arrows to represent vector quantities | F | A | 158 | P8 |  |  |  |
| Forces and Motion | Forces introduction | Define contact and non-contact forces giving examples of each | F | A | 158 | P8 |  |  |  |
| Forces and Motion | Forces introduction | Define weight and gravity | F | A | 158 | P8 |  |  |  |
| Forces and Motion | Forces introduction | Use W=m x g | F | A | 159 | P9 |  |  |  |
| Forces and Motion | Forces introduction | Describe what the centre of mass is | F | A | 158 | P8 |  |  |  |
| Forces and Motion | Forces introduction | Explain how to measure weight using a calibrated spring balance (i.e. a Newton meter) | F | A | 159 | P9 |  |  |  |
| Forces and Motion | Resultant forces | Calculate and define resultant forces | F | A | 159 | P9 |  |  |  |
| Forces and Motion | Resultant forces | Use free body diagrams to show forces | F | A | 159 | P9 |  |  |  |
| Forces and Motion | Resultant forces | Use vector diagrams to illustrate the resolution of forces and determine resultant forces (scale drawings) (HT only) | HT | A | 159 | P9 |  |  |  |
| Forces and Motion | Speed and velocity | Explain the difference between distance and displacement | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | Define ‘speed’ and explain factors that affect the speed a person walks, runs or cycles at (including average speeds for these activities) | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | Recall typical speeds for different types of transportation (TBC – bus, train, car, aeroplane!) using ̴ correctly. | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | Recall the speed of sound in air | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | State that most moving objects have varying speed including sound, wind, travelling people | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | Use and rearrange s = v t (speed = d/t equation!) | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | Calculate average speed for non-uniform motion | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | Define ‘velocity’ | F | A | 162 | P14 |  |  |  |
| Forces and Motion | Speed and velocity | Describe circular motion (HT only) | HT | A | 163 | P15 |  |  |  |
| Forces and Motion | Distance time and velocity time graphs | Draw and interpret distance time graphs and use these to determine speed | F | A | 163 | P15 |  |  |  |
| Forces and Motion | Distance time and velocity time graphs | Draw tangents on a distance time graph to determine speed of an accelerating object (HT only) | HT | A | 163 | P15 |  |  |  |
| Forces and Motion | Distance time and velocity time graphs | Use and rearrange the equation a = Δv / t (calculating acceleration) | F | A | 164 | P16 |  |  |  |
| Forces and Motion | Distance time and velocity time graphs | Estimate the magnitude of every day acceleration  | F | A | 164 | P16 |  |  |  |
| Forces and Motion | Distance time and velocity time graphs | Draw and interpret velocity time graphs in order to calculate acceleration | F | A | 164 | P16 |  |  |  |
| Forces and Motion | Distance time and velocity time graphs | Use velocity time graphs to calculate distance/displacement (HT only) | HT | A | 164 | P16 |  |  |  |
| Forces and Motion | Falling objects | Apply the equation v2-u2=2as (For moving and falling objects) [Newton’s equations of motion] | F | A | 164 | P16 |  |  |  |
| Forces and Motion | Falling objects | Recall the value for acceleration due to gravity (9.8m/s2) | F | A | 166 | P18 |  |  |  |
| Forces and Motion | Falling objects | Explain the acceleration of objects through fluids (terminal velocity) – making reference to parachutes travelling through air | F | A | 166 | P18 |  |  |  |
| Forces and Motion | Falling objects | Draw and interpret velocity time graphs for objects that reach terminal velocity | F | A | 166 | P18 |  |  |  |
| Forces and Motion | Newton’s Laws  | Describe and explain Newton’s first law | F | A | 163 | P15 |  |  |  |
| Forces and Motion | Newton’s Laws  | Explain the concept of inertia (HT only) | HT | A | 163 | P15 |  |  |  |
| Forces and Motion | Newton’s Laws  | Describe and explain Newton’s second law using F = m a | F | A | 165 | P17 |  |  |  |
| Forces and Motion | Newton’s Laws  | Defiine inertial mass (HT only) | HT | A | 165 | P17 |  |  |  |
| Forces and Motion | Newton’s Laws  | Estimate the forces involved in large accelerations for every day road transport using ̴ correctly. | F | A | 164 | P16 |  |  |  |
| Forces and Motion | Newton’s Laws  | **RP Acceleration:** Investigate the effects of varying force on the acceleration of an object with a constant mass and the effects of varying the mass on the acceleration produced by a constant force | F | A | 165 | P17 |  |  |  |
| Forces and Motion | Stopping Distances | Define ‘stopping distance’, ‘thinking distance’ and ‘braking distance’ | F | A | 168 | P20 |  |  |  |
| Forces and Motion | Stopping Distances | Recall typical values for reaction times (0.2-0.9 seconds) | F | A | 168 | P20 |  |  |  |
| Forces and Motion | Stopping Distances | Describe factors that effect a drivers reaction time | F | A | 168 | P20 |  |  |  |
| Forces and Motion | Stopping Distances | Explain methods used to measure human’s reaction times | F | A | 168 | P20 |  |  |  |
| Forces and Motion | Stopping Distances | Describe factors affecting ‘braking distance’ | F | A | 169 | P21 |  |  |  |
| Forces and Motion | Stopping Distances | Predict how the distance for a vehicle to make an emergency stop varies over a range of speeds | F | A | 169 | P21 |  |  |  |
| Forces and Motion | Stopping Distances | Explain the energy transfers when a vehicle brakes | F | A | 169 | P21 |  |  |  |
| Forces and Motion | Stopping Distances | Link braking force, deceleration and stopping distances | F | A | 169 | P21 |  |  |  |
| Forces and Motion | Stopping Distances | Explain the dangers caused by large decelerations | F | A | 169 | P21 |  |  |  |
| Forces and Motion | Stopping Distances | Estimate the forces involved in the deceleration of road vehicles (HT only) | HT | A | 169 | P21 |  |  |  |
| Forces and Motion | Momentum | Define ‘momentum’ using p = m v (HT only) | HT | A | 166 | P18 |  |  |  |
| Forces and Motion | Momentum | Explain conservation of ‘momentum’ (HT only) | HT | A | 167 | P19 |  |  |  |
| Forces and Motion | Moments | Describe and explain Newton’s third law | F | A | 166 | P18 |  |  |  |
| Applying forces and energy | Magnetism | Describe the polarity of magnets and list 4 magnetic materials | F | A | 206 | P66 |  |  |  |
| Applying forces and energy | Magnetism | Explain the difference between a permanent and induced magnet | F | A | 206 | P66 |  |  |  |
| Applying forces and energy | Magnetism | Describe the force between a magnet and a magnetic material | F | A | 206 | P66 |  |  |  |
| Applying forces and energy | Magnetism | Describe the direction and strength of a magnetic field around a magnet | F | A | 206 | P66 |  |  |  |
| Applying forces and energy | Magnetism | Explain how compasses work | F | A | 206 | P66 |  |  |  |
| Applying forces and energy | Magnetism | Describe how to make an electromagnet and how to increase its strength | F | A | 207 | P67 |  |  |  |
| Applying forces and energy | The motor effect and the generator effect | Describe the motor effect and use this to explain how electric motors work (HT only) | HT | A | 208 | P68 |  |  |  |
| Applying forces and energy | The motor effect and the generator effect | Explain and apply Fleming’s left hand rule (HT only) | HT | A | 209 | P68 |  |  |  |
| Applying forces and energy | The motor effect and the generator effect | Recall factors that affect the size of the force on a conductor (HT only) | F | A | 208 | P67 |  |  |  |
| Applying forces and energy | The motor effect and the generator effect | Use and rearrange the equation F = B I L (HT only) | HT | A | 208 | P68 |  |  |  |

**Knowledge organiser:**

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|  | **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/fPeriod (s) = 1/ frequency (Hz) |
| 11 | State the equation to calculate wave speed | v = f x λ wave speed (m/s) = frequency (Hz) x wavelength (m) |
| 12 | State the relationship between speed and wavelength | They are directly proportional  |
| 13 | In a transverse wave, oscillations are \_\_\_\_\_\_\_\_ to the direction of energy transfer  | perpendicular  |
| 14 | In a longitudinal wave, oscillations are \_\_\_\_\_\_\_\_\_\_\_ to the direction of energy transfer | parallel  |
| 15 | What do waves transfer? | Energy (not matter) |
|  |  |  |
|  | **Topic:** | **Electromagnetic waves 1 (P.5)** |
| 1 | What type of waves are electromagnetic waves? | Transverse |
| 2 | At what speed do all electromagnetic waves travel? | Speed of light (300,000,000m/s) |
| 3 | What do the different types of electromagnetic waves vary in? | Frequency  |
| 4 | List the electromagnetic waves in order of frequency from lowest to highest | Radio waves, microwaves, infrared waves, visible light, ultraviolet, X-Rays, gamma rays |
| 5 | Which sub-cellular structure is damaged by ionising radiation? | DNA |
| 6 | Which type of wave is the most ionising? | Gamma Rays |
| 7 | Which wave is used in medical imaging? | X-Rays |
| 8 | Which wave is used in telecommunications? | Radio waves and microwaves |
| 9 | Which wave has the longest wavelength? | Radio waves |
| 10 | State 3 properties shared by all electromagnetic waves | 1) All travel at the speed of light 2) All transverse 3) All travel through a vacuum |
| 11 | Which wave has the shortest wavelength? | Gamma rays  |
| 12 | State 1 risk associated with UV rays | Skin cancer |
| 13 | Which two types of waves are ionising radiation? | X-Rays and Gamma Rays |
| 14 | Which wave can be detected by the human eye? | Visible light  |
| 15 | Which 3 rays can have hazardous effects on the human body? | UV, X-Ray and Gamma rays  |
|  |  |  |
|  | **Topic:** | **Electromagnetic waves 2 (P.6)** |
| 1 |  What is produced by oscillations in electrical circuits? (HT only) | Radio waves |
| 2 | What happens when a radio wave is absorbed? (HT only) | Alternating current produced |
| 3 | What causes EM waves to be generated/absorbed? | Changes in atoms/nuclei of atoms |
| 4 | State two effects of UV waves | Cause skin to age prematurely, increase risk of skin cancer |
| 5 | State two effects of X-rays and gamma rays | 1) mutations of genes, 2) cancer |
| 6 | State two uses of radio waves | TV and radio |
| 7 | State 2 uses of microwaves | Satellite communication and cooking food |
| 8 | State 3 uses of infrared | Electrical heaters, cooking food, infrared cameras |
| 9 | State 1 use of visible light | Fibre optic communication |
| 10 | State 2 uses of UV waves | Energy efficient lamps and sun tanning |
| 11 | State two uses of X-rays and gamma rays | Medical imaging and treatments |
| 12 | Why are radio waves used in television and radio? (HT only) | Can be reflected from atmosphere due to wavelength |
| 13 | Why are microwaves used in cooking? (HT only) | Frequency matches frequency of water particles vibrating |
| 14 | Why are microwaves used in satellite communication?(HT only) | Frequency allows them to pass through atmosphere |
| 15 | Why are X-rays and gamma rays used in medical imaging? (HT only) | Highly ionising and penetrating |
|  |  |  |
|  | **Topic:** | **Sound and light waves introduction (P.7)** |
| 1 | What type of waves are sound waves? | Longitudinal |
| 2 | What type of waves are light waves? | Transverse |
| 3 | Light waves travel in \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ | Straight lines |
| 4 | Why can sound waves not travel in a vacuum | A vacuum has no particles |
| 5 | What happens to the speed of a light wave as it enters a more dense medium | The first part of the light wave slows down |
| 6 | Which state does a sound wave travel fastest in? | Solid |
| 7 | Which state does a sound wave travel slowest in? | Gas |
| 8 | What happens to the direction of a light wave as it enters a different medium? | The light wave changes direction towards the normal |
| 9 | What must sound waves travel through? | A medium |
| 10 | When light and sound waves reach a boundary between mediums (materials) what four things can happen to them? | Reflected, refracted, absorbed, transmitted |
| 11 | What happens to the loudness of a sound wave when it's amplitude increases? | The loudness increases |
| 12 | What happens to the pitch of a sound wave when it's frequency increases? | The pitch increases (gets higher) |
| 13 | Do light waves vary their speed? | No, they all travel at the same speed |
| 14 | What is the amplitude of a sound wave related to? | It's volume |
| 15 | What is the frequency and wavelength of a sound wave related to? | It's pitch |
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|  |  |  |
|  | **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 times (m) = v (m/s) x 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 (ΔY/ΔX) |
| 6 | If an object is not travelling at a constant speed, how will this motion be shown on a distance time graph? | A curve |
| 7 | How do you calculate the speed of an object using a distance time graph if the speed is not constant (the line is a curve!)? | Draw a tangent & calculate gradient |
| 8 | What does a steeper line on a distance-time graph represent? | An object moving faster |
| 9 | Describe the axes on a velocity-time graph | X-axis = time, Y-axis = velocity |
| 10 | Describe what is meant by a flat horizontal line (───) on a velocity-time graph? | The object is moving at a constant velocity |
| 11 | Describe what is meant by a straight diagonal line (/) away from the x-axis on a velocity-time graph? | Object is accelerating |
| 12 | Describe what is meant by a straight diagonal line (\) towards the x-axis on a velocity-time graph? | Object is decelerating |
| 13 | What do you calculate when you calculate the area under a velocity-time graph? (HT only) | Total distance travelled |
| 14 | How do you calculate acceleration (if it is constant - a straight line) from a velocity time graph? | Calculate gradient (ΔY/ΔX) |
| 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 | (final velocity)^2 - (initial velocity)^2 = 2 x acceleration x distancev2-u2=2as |
| 2 | What is the acceleration of an object free falling due to gravity close to the Earth? | 9.8m/s2 |
| 3 | What are the two forces acting upon a falling object? | Weight and air resistance |
| 4 | Describe the motion of an object as it begins to fall through a fluid | It accelerates (weight is bigger than air resistance) |
| 5 | As an object continues to fall through a fluid, the weight remains the same, describe what happens to the air resistance as the object gains speed? | Air resistance increases |
| 6 | What is the term that given to describe the motion of an object when it's weight and the air resistance acting upon it are equal? | Terminal velocity |
| 7 | Describe what happens to the forces acting upon a parachuter when they open their parachute | Air resistance ↑, weight stays constant |
| 8 | According to Newton's First Law, what will affect an object's velocity? | A resultant force |
| 9 | According to Newton's First Law, if the resultant force acting upon a stationary object is zero, what will happen? | The object remains stationary |
| 10 | According to Newton's First Law, if the resultant force acting upon a moving object is zero, what will happen? | Moves with at same velocity |
| 11 | What is the term given to the tendency of an object to continue in their state of rest or uniform motion? (HT only) | Inertia |
| 12 | Which objects have a large inertia? (HT only) | Objects with a large mass |
| 13 | According to Newton's 2nd Law state what is the relationship between acceleration and force? | Directly proportional |
| 14 | According to Newton's 2nd Law state what is the relationship between acceleration and mass? | Inversely proportional |
| 15 | Write Newton's Second Law as an equation | Resultant force (N) = mass (kg) x acceleration (m/s^2)F = ma |
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|  | **Topic:** | **Stopping distances (P.17)** |
| 1 | Define "stopping distance" | Thinking distance + braking distance |
| 2 | Define "thinking distance" | The distance travelled during the drive's reaction time |
| 3 | Define "braking distance" | The distance travelled under the braking force |
| 4 | What are the typical values for reaction time | 0.2-0.9 seconds |
| 5 | State 4 factors that effect a driver's reaction time | Tiredness, alcohol, drugs, distractions |
| 6 | State 3 factors that may affect braking distance | Adverse weather conditions (ice/snow/wet), worn tyres, worn brakes |
| 7 | What happens to a vehicles braking distance when a car is travelling faster? | Increases |
| 8 | Which force causes a car to slow down? | Friction (between brakes and wheels) |
| 9 | Describe the energy transfers that occur when a force is applied to a car's brakes | Kinetic energy of car -> thermal energy in the brakes |
| 10 | Why is a car travelling at high speed stopping suddenly dangerous? | Need larger braking force -> large deceleration  |
| 11 | State 2 dangers of large decelerations | Overheating brakes and skidding car |
| 12 | Define "adverse" | Bad |
| 13 | What is 'inertial mass' (HT only) | A measure of how hard it is to change an object's velocity |
| 14 | Define "inertial mass" | The ratio of force over acceleration |
| 15 | What does this symbol mean? "~" | Approximately |
|  |  |  |
|  | **Topic:** | **Momentum (HT only) and Moments (separate only) (P.18)** |
| 1 | Define "momentum" (HT only) | Momentum = mass x velocityp = m v (kg m/s) (kg) (m/s) |
| 2 | Define "conservation of momentum" (HT only) | Total momentum before an event = total momentum after event |
| 3 | State the equation to calculate change in momentum (HT only) | F = (m ∆v) / ∆t when (m ∆v) is ∆p |
| 4 | State the relationship between force and momentum (HT only) | Force equals rate of change of momentum |
| 5 | Describe how safety features including seat belts, gym crash mats and cycle helmets work (linking to momentum) (HT only) | Increase time -> decrease rate of change of momentum -> decrease force |
|  |  |  |
|  | **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 / areap = 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/m3 |
|  |  |  |
|  | **Topic:** | **Magnetism (P.38)** |
| 1 | Define "poles" on a magnet | The place where the magnetic force is the strongest |
| 2 | What do two magnets next to each other do? | Exert a force on each other |
| 3 | What is the effect of two like poles on each other? (e.g. N-N) | Repel |
| 4 | What is the effect of two different poles on each other? (e.g. N-S) | Attract |
| 5 | What type of force are attraction and repulsion? | Non-contact |
| 6 | Define "permanent" magnet | Produces its own magnetic field |
| 7 | Define "induced" magnet | A material that becomes a magnet when placed in a magnetic field |
| 8 | What happens to an induced magnet when it is removed from the magnetic field? | Loses all of its magnetism |
| 9 | What is the region around a magnet where magnetic force has an effect called? | Magnetic field |
| 10 | Name 4 magnetic materials | Iron, steel, cobalt, nickel |
| 11 | Describe the force between a magnet and a magnetic material | Attraction |
| 12 | State one factor that effects the strength of a magnetic field | Distance from magnet |
| 13 | What direction do the magnetic field lines go when drawn around a magnet? | North (seeking) pole to south (seeking) pole |
| 14 | How do you plot magnetic field lines around a magnet? | Use a compass to identify north and join dot to dot |
| 15 | How does a compass work for navigation? | The core of the Earth is magnetic! |
|  |  |  |
|  | **Topic:** | **Motor effect (P.39)** |
| 1 | What happens when a current flows through a wire? | A magnetic field is produced around wire |
| 2 | State two factors that affect the strength of the magnetic field around a wire | Current & distance from the wire |
| 3 | How do you determine the direction of the magnetic field around a wire? | Fleming’s right hand rule (thumb = current direction, fingers = magnetic field direction) |
| 4 | What is a solenoid? | A coil of wire |
| 5 | Describe the shape of the magnetic field around a solenoid | Same as a bar magnet |
| 6 | How can you increase the strength of a solenoid? | Increase current, increase number of coils, add iron core |
| 7 | Define an "electromagnet" | A solenoid (coil of wire) with an iron core |
| 8 | What is the term given to "the force exerted by a conductor and a permanent magnet on each other"? (HT only) | The motor effect |
| 9 | What does each part of Fleming's left-hand rule stand for? (HT only) | ThuMb - thrust (motion), First finger - Force, seCond finger - Current |
| 10 | What is the equation used to work out the force acting on a conductor? (HT only) | Force = magnetic flux density x current x lengthF = B I l  (N) (T) (A) (m)  |
| 11 | What tends to happen to a coil of wire when placed into a magnetic field? | It rotates |
| 12 | Name two pieces of equipment that use the motor effect  | Loudspeakers and headphones |
| 13 | Describe how a speaker works | Oscillations in electrical current -> vibrations of a speaker cone -> oscillations of air particles (sound waves) |
| 14 | 0 | 0 |
| 15 | 0 | 0 |
|  |  |  |
|  | **Topic:** | **Generator effect (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 magentic 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 bench2) 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 it's 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? | ∝ |
| 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 / wavelengthv = f / λ(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 |
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|  | **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 strengthW = 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 distanceW = 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 extensionF = ke(N) (N/m) (m) |
| 4 | How do you calculate distance when you know speed and time? | Distance = speed x times = vt(m) (m/s) (s) |
| 5 | How do you calculate acceleration when you know the change in velocity? | acceleration = change in velocity/time takena = Δv/t(m/s^2) (m/s) (t) |
| 6 | How do you calculate force when you know mass and acceleration? | Force = mass x accelerationF = ma(N) (kg) (m/s^2) |
| 7 | How do you calculate momentum? | Momentum = mass x velocity p = m x v(kg m/s) (kg) (m/s) |
| 8 | How do you calculate wave speed? | wave speed = frequency x wavelengthv = fλ(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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **P6 – Hooke’s Law** | **Big Question:** Investigate the relationship between force and extension and a springIV – Force (weight)DV – Extension of springCV - ruler is vertical, measuring from same point on the spring | \*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 | 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.
 | Force will be directly proportional to extension until the spring reaches its limit of proportionality. | Investigate a spring to find it’s limit of proportionality.Investigate the relationship between force and extension of a rubber band. |
| **P7 – Forces, mass and acceleration** | **Big Question 1:** How does force affect acceleration when a constant mass is used?**IV** – Force**DV** - Acceleration**CV** - Mass**Big Question 2**: How does mass affect acceleration when a constant force is used?**IV –** Mass**DV** – Acceleration**CV** – Force  | \*trolley\*metre ruler\*Pencil\*bench pulley\*string\*weight stack\*stopwatch\*blu-tac | **Big Question 1:**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.

**Big Question 2:**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.
 | As force increases, acceleration should increase (directly proportional).As mass increases, acceleration should decrease (inversely proportional) | Use light gates to investigate the effect of force on acceleration when mass is kept constant.Use light gates to investigate the effect of mass on acceleration when mass is kept constant. |
| **P8 – Waves** | **Big Question 1:** Investigate the properties of water wavesIV = Frequency of waveDV = WavelengthCV = Amplitude, weight on end of string**Big Question 2**: Investigate the properties of waves in solids | **Big Question 1:**\*ripple tank\*water\*lamp\*metre ruler**Big Question 2:**\*vibration generator\*power pack\*string\*set of 1N masses\*table\*pulley | **Big Question 1:**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.

**Big Question 2:**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.
 |  |  |
| **P10 – Radiation and Absorption** | **Big Question**: Investigate the amount of infrared radiation radiated from different surfaces.**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. | \*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 | 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.
 | Best emitter:Matt black |  |

**Equations for Physics:**

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

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| --- |
| **Paper 1** |
| kinetic energy = 0.5 x mass x (velocity)2 | Ek=1/2mv2 |
| gravitational potential energy = mass x gravitational field strength x height | Ep=mgh |
| power = energy transferredtime | P = Et |
| power = work donetime | P = Wt |
| efficiency = useful output energy transfertotal input energy transfer |  |
| efficiency = useful power outputtotal 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 = I2R |
| energy transferred = charge flow x potential difference | E=QV |
| density = massvolume | ρ = mv |
| pressure = force *(separate only)*surface area | p = FA |
| **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 = change in velocitytime taken | a = Δvt |
| resultant force = mass x acceleration | F = ma |
| momentum = mass x velocity | p = mv |
| wave speed = frequency x wavelength | v = fλ |