**Paper 1 knowledge booklet**

**FOUNDATION**

**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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| --- | --- | --- | --- | --- |
| **Topic** | **Course** | **Tier** | **Revision Guide (double)** | **Learning statement** |
| Types of cell | A | F | 16+17 | Describe the structure of plant, animal and bacteria cells, classifying as prokaryotic and eukaryotic cells. |
| Types of cell | A | F | 16 | Identify and explain the functions of sub-cellular structures |
| Specialised cells | A | F | 20+24 | Describe the difference between ‘*cell differentiation’* and ‘*cell division’* |
| Specialised cells | A | F | 24 | Describe how cells are specialised and explain their roles (*animal cells: sperm cells, nerve cells, muscle cells. Plant cells: root hair, xylem and phloem*). |
| Specialised cells | A | F | 25 | Define ‘*tissue’, ‘organ’ and ‘organ system’* and explain how they work together to create a functioning ‘*organism’* |
| Microscopy | A | F | 18 | Compare and contrast electron and light microscopes |
| Microscopy | A | F | 18 | Define *‘magnification’* and ‘*resolution’* |
| Microscopy | A | F | 19 | Calculate magnification using a formula (magnification = size of image ÷ size of real object) |
| Microscopy | A | F | 18 | Explain how electron microscopy has improved our understanding of subcellular structures |
| Microscopy | A | F | 18 | Define and apply the prefixes ‘*centi’*, ‘*milli’*, ‘*micro’* and *‘nano’* |
| Microscopy | A | F | 19 | **RP Microscopy:** Use a light microscope to observe, draw and label a selection of plant and animal cells. A scale magnification must be included.  |
| Cell division (mitosis) | A | F | 20 | Define, locate and rank in terms of size, *‘Genes’, ‘Chromosomes’, ‘DNA’ and ‘nucleus’* |
| Cell division (mitosis) | A | F | 20 | Explain the process of *‘mitosis’* and the ‘*cell cycle’* (when, where, how and why) |
| Cell division (mitosis) | A | F | 21 | Describe what stem cells are, where they can be found and how the can be used |
| Cell division (mitosis) | A | F | 21 | Explain the process of *‘therapeutic cloning’*  |
| Cell division (mitosis) | A | F | 21 | Evaluate the risks and benefits, including the social and ethical implications, of using stem cells in treatments |
| Cell division (mitosis) | A | F | 21 | Explain how plants can be cloned from stem cells and the benefits of doing this |
| Introducing pathogens and types of disease | A | F | 30 | Define ‘*health*’ |
| Introducing pathogens and types of disease | A | F | 30 | List factors that affect mental and physical health |
| Introducing pathogens and types of disease | A | F | 30+40 | Define ‘*pathogens*’ and explain the difference between ‘*communicable’* and ‘*non-communicable’* diseases |
| Introducing pathogens and types of disease | A | F | 40+41 | Explain how ‘*viruses’*, ‘*bacteria’*, ‘*protists’* and ‘*fungi’* are spread in animals and plants |
| Introducing pathogens and types of disease | A | F | 40+41 | Describe the how bacteria and virus cause problems within the body |
| Introducing pathogens and types of disease | A | F | 40 | State 4 ways to reduce or prevent the spread of communicable diseases |
| Detailed disease case studies | A | F | 40 | Describe three viral diseases in details – the effects, how they are spread, how people are trying to reduce its impact (Measles, HIV and Tobacco Mosaic Virus) |
| Detailed disease case studies | A | F | 41 | Describe two bacterial diseases in detail – the effects, how they are spread, how people are trying to reduce its impact (Gonorrhoea and Salmonella) |
| Detailed disease case studies | A | F | 41 | Describe one fungal disease in detail – the effects, how it is spread, how people are trying to reduce its impact (Rose Black Spot) |
| Detailed disease case studies | A | F | 41 | Describe one protist disease in detail – the effects, how it is spread, how people are trying to reduce its impact (malaria) |
| Preventing pathogen  | A | F | 42 | Describe how the body prevents entry of pathogens into the body |
| Preventing pathogen  | A | F | 42 | Describe how the immune system tackles pathogens once they have made it into the body (phagocytosis, antibody production and antitoxin production) |
| Preventing pathogen  | A | F | 43 | Explain how vaccines work |
| Preventing pathogen  | A | F | 43 | Discuss the global use of vaccination in the prevention of disease |
| Preventing pathogen  | A | F | 44 | Explain the use of antibiotics and other medicines |
| Developing new medicines | A | F | 44 | Describe how bacteria have developed resistance to antibiotics – in particular MRSA (and use this as an example of evolution)  |
| Developing new medicines | A | F | 44 | Explain the issues with the development of new antibiotics in the race against antibiotic resistance and what we can do as a society to reduce the rate of development of antibiotic resistance bacteria (linking to medicine and agriculture) |
| Developing new medicines | A | F | 44+45 | Describe how many new drugs are still developed from plants and microorganisms (including digitalis and aspirin) |
| Developing new medicines | A | F | 45 | Explain how preclinical and clinical trials are used to test new drugs (including tests for safety, effectiveness, toxicity and dosage) |
| Developing new medicines | A | F | 44 | Compare and contrast painkillers and antibiotics |
| Developing new medicines | A | F | 44+45 | Explain the benefits and drawbacks of antibiotics and limitations of antivirals |
| Using and interpreting data | A | F | 30 | Describe situations where types of diseases interact (poor physical health, viruses causing cancer, pathogens -> allergic reactions, immune system defects -> more susceptible to infectious disease) |
| Using and interpreting data | A | F | 30 | Translate numerical information between tables and graphs |
| Using and interpreting data | A | F | 30 | Construct and interpret bar charts and histograms |
| Breathing and respiration | A | F | 48 | Describe the purpose of cellular respiration, recalling the word & symbol equation for aerobic respiration |
| Breathing and respiration | A | F | 49 | Explain how the body responds to exercise in terms of heart rate, breathing rate and breath volume |
| Breathing and respiration | A | F | 48 | Explain when anaerobic respiration occurs in humans and recall the word equation for this process |
| Breathing and respiration | A | F | 49 | Explain what is meant by the term ‘oxygen debt’ |
| Breathing and respiration | A | F | 48 | Explain anaerobic respiration in yeast, recalling the word equation for this process |
| Breathing and respiration | A | F | 48 | Describe how this process of anaerobic respiration (fermentation) is used by humans in the manufacturing industry |
| Breathing and respiration | A | F | 29 | Label the structure and describe the function of the human lungs (including how they are adapted for gaseous exchange) |
| Blood and the heart | A | F | 29 | Describe the structure and function of the human heart |
| Blood and the heart | A | F | 29 | Describe the roles of the four blood vessels associated with the heart |
| Blood and the heart | A | F | 28 | Describe the 3 different types of blood vessel in the body and their structure |
| Blood and the heart | A | F | 29 | Carry out rate calculations for blood flow |
| Blood and the heart | A | F | 29 | Describe how our body controls our natural resting heart rate |
| Blood and the heart | A | F | 28 | Describe the composition of blood and know the functions of each of the components |
| Blood and the heart | A | F | 28 | Draw blood cells from under a microscope and recognise different types of blood cells from a photo or diagram, explaining how they are adapted to their functions |
| Blood and the heart | A | F | 31 | Describe coronary heart disease |
| Blood and the heart | A | F | 31 | Describe what a ‘stent’, ‘statin’, ‘mechanical/biological valve replacement’, ‘pacemaker’ and ‘transplant’ are |
| Blood and the heart | A | F | 31 | Evaluate the advantages and disadvantages of treating cardiovascular diseases using drugs, mechanical devices or transplants |
| Blood and the heart | A | F | 31 | Evaluate risks associated with the use of blood products  |
| Interpreting disease data | A | F | 30 | Construct and interpret frequency tables and diagrams |
| Interpreting disease data | A | F | 30 | Apply the techniques of scientific sampling to disease incident information |
| Interpreting disease data | A | F | 30 | Discuss the human and financial cost of non-communicable diseases (individual, local community, national and global level) |
| Interpreting disease data | A | F | 30 | Describe the causal mechanisms of some risk factors for non-communicable diseases (causes of: cardiovascular disease, type 2 diabetes, brain and liver function, lung disease and lung cancer, cancers and foetal damage) including the effects of diet, alcohol and smoking |
| Interpreting disease data | A | F | 30 | Use a scatter diagram to identify a correlation between two variables (linking to disease incidence) |
| Digestion | A | F | 26 | Describe what the digestive system is |
| Digestion | A | F | 26 | Explain the role of enzymes in the digestive system making reference to ‘lock and key’ |
| Digestion | A | F | 27 | Explain how carbohydrates, proteins and lipids are synthesised, broken down and used, making reference to sugars, amino acids, fatty acids and glycerol |
| Digestion | A | F | 27 | Link carbohydrase (amylase), protease, lipase & bile to the breakdown of particular food groups, identifying where they are produced |
| Digestion | A | F | 26 | **RP Food Tests:** Use qualitative reagents to test for a range of carbohydrates, proteins and lipids |
| Digestion | A | F | 26 | Describe the effects of temperature and pH on the rate of enzyme reactions and investigate the effect of pH on the rate of reaction of amylase |
| Digestion | A | F | 27 | **RP Enzymes:** Investigate the effect of pH on the rate of reaction of amylase enzyme |
| Digestion | A | F | 49 | Define ‘metabolism’ |
| Digestion | A | F | 49 | Calculate the rate of given chemical reactions  |
| Digestion | A | F | 49 | Explain the 5 processes that contribute to our metabolism (starch formation, lipid formation, protein synthesis, respiration and protein breakdown) |
| Diffusion | A | F | 22 | Define ‘diffusion’ and give examples of diffusion in plants and animals (gas exchange and urea in the kidney) |
| Diffusion | A | F | 22 | Explain how different factors affect the rate of diffusion (concentration, surface area, temperature) |
| Diffusion | A | F | 22 | Calculate surface area: volume ratios |
| Diffusion | A | F | 22 | Explain how surface area: volume ratio of a single celled organism (amoeba) allows sufficient molecule transport |
| Diffusion | A | F | 22 | Explain adaptations for exchange materials in: small intestines, lungs, gills, roots and leaves |
| Photosynthesis  | A | F | 16+32 | Draw and label an unspecialised plant cell and a palisade, root hair, xylem and phloem specialised cell |
| Photosynthesis | A | F | 32 | Describe the 5 tissues and name the key organs in the plant |
| Photosynthesis | A | F | 32 | Label a transverse section of a leaf |
| Photosynthesis | A | F | 22 | Describe the process of osmosis |
| Photosynthesis | A | F | 33 | Calculate the rate of water uptake by a plant |
| Photosynthesis | A | F | 33 | Calculate the percentage change in mass following osmosis |
| Photosynthesis | A | F | 33 | Analyse and draw graphs relating to osmosis |
| Photosynthesis | A | F | 23 | **RP Osmosis:** Analyse the range of concentrations of solutions on the change in mass of plant tissue |
| Photosynthesis | A | F | 23 | Describe the process of active transport and explain why it is necessary |
| Photosynthesis | A | F | 23 | Compare diffusion, osmosis and active transport |
| Photosynthesis | A | F | 23 | Describe the process of active transport and how root hair cells are adapted to this  |
| Photosynthesis | A | F | 33 | Describe the process of transpiration and translocation (including the structure and function of stomata). |
| Photosynthesis | A | F | 33 | Explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration  |
| Photosynthesis | A | F | 33 | Calculate surface area, volume and mean in transpiration investigation |
| Photosynthesis | A | F | 33 | Analyse data from graphs and tables relating to transpiration experiments |
| Photosynthesis | A | F | 24 | Describe in detail the location, function and adaptations of xylem tissue, phloem tissue, stomata and guard cells |
| Photosynthesis | A | F | 46 | Describe the process of photosynthesis |
| Photosynthesis | A | F | 46 | Recall the word and symbol equation for photosynthesis |
| Photosynthesis | A | F | 46 | Explain the effects of temperature, light intensity, carbon dioxide intensity and the amount of chlorophyll on the rate of photosynthesis |
| Photosynthesis | A | F | 47 | Analyse data and calculate rates of photosynthesis and limiting factors from graphs and tables |
| Photosynthesis | A | F | 47 | Translate information between tabulated and graphical form (from tables to graphs) selecting the appropriate scale for axes |
| Photosynthesis | A | F | 47 | **RP Photosynthesis:** Investigate the effect of light intensity on the rate of photosynthesis on an aquatic plant  |
| Photosynthesis | A | F | 47 | Describe how glucose is used after photosynthesis  |
| Photosynthesis | A | F | 47 | Explain the use of nitrate ions within plants  |
| Photosynthesis | A | F | 47 | Use tests to identify starch, glucose and proteins |

**Knowledge organiser**:

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|  | **Paper:** | **B1** |
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| **Topic:** | **Types of cells (B.1)** |
| 1 | What is the main difference between a prokaryotic and eukaryotic cell? | Eukaryotic have their DNA contained within a nucleus |
| 2 | Give an example of a eukaryotic cell. | Animal and plant cells |
| 3 | Give an example of a prokaryotic cell. | Bacteria |
| 4 | Eukaryotic cells have which sub-cellular structures? | Cell membrane, cytoplasm and genetic material in a nucleus. |
| 5 | What is the function of cell wall? | Supports/ Strengthens the cell |
| 6 | What is the function of mitochondria? | Where respiration takes place |
| 7 | What is the function of the nucleus? | Controls the activities of the cell |
| 8 | What us the function of cell membrane? | Controls what enters/exits the cell |
| 9 | What is the function of the vacuole? | Store sugars and salts |
| 10 | What is the function of chloroplasts? | Absorb light for photosynthesis |
| 11 | What is the function of cytoplasm? | Where chemical reactions of the cell take place |
| 12 | What is the approximate size of a prokaryotic cell | 0.1-5.0 μm |
| 13 | What is the approximate size of a eukaryote cells | 10-100µm |
| 14 | Which is bigger? A prokaryotic or eukaryotic cell? | Eukaryotic |
| 15 | What is meant by "micro" | 1/1,000,000th (1 millionth) |
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|  | **Topic:** | **Specialised cells (B.2)** |
| 1 | Define "cell differentiation" | A cell becoming specialised to perform a particular function |
| 2 | Define "cell division" | The splitting of a cell into two genetically identical daughter cells |
| 3 | Name 3 specialised cells found in the animals and 3 in plants | Animals: Muscle cell, nerve cell, sperm cellPlants: Root hair cell, phloem, xylem |
| 4 | State the function of a muscle cell | Produce movement |
| 5 | State one adaptation of a muscle cell | Lots of mitochondria for releasing energy |
| 6 | State the function of a sperm cell | Fertilise the female egg |
| 7 | State three adaptations of a sperm cell | \*Tail for movement\*Lots of mitochondria to release energy\*Enzymes in its head to penetrate egg |
| 8 | State the function of a nerve cell | Carry information from one part of the body to another |
| 9 | State two adaptations of a nerve cell | \*Dendrites to connect to other neurones\*Long axon to cover large distances |
| 10 | State the function of a root hair cell | Absorb water and minerals from the soil |
| 11 | State two adaptations of a root hair cell | \*Large surface area\*Thin cell wall |
| 12 | State the function of a xylem cell | Carry water from roots to leaves |
| 13 | State two adaptations of a xylem cell | \*Lignin to strengthen cells\*End walls broken down to form hollow tubes |
| 14 | State the function of a phloem cell | Transport glucose within a plant |
| 15 | State two adaptations of a phloem cell | \*less sub-cellular structures\*end walls have sieve plates to allow glucose through |
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|  | **Topic:** | **Microscopy (B.3)** |
| 1 | How do you calculate the magnification? | magnification = size of image/size of object |
| 2 | Which microscope has the highest magnification? | electron microscopes |
| 3 | Which microscope has the lowest resolution? | Light microscope |
| 4 | Which microscope produces 3D images? | Scanning and transmission Electron microscope |
| 5 | Which microscope shows colours? | Light microscope |
| 6 | Which microscope allows to see inside an object? | Transmission Electron Microscope |
| 7 | Which microscope shows black and white images? | Scanning and transmission electron microscope |
| 8 | Which sub-cellular structures can you see with a higher resolution? | Mitochondria and ribosomes |
| 9 | Define "tissue" | A group of similar specialised cells working together to fulfil a function |
| 10 | Define "organ" | A group of different tissues working together to fulfil a function |
| 11 | Define "organ system" | A group of different organs working together to fulfil a function |
| 12 | Put into order of size (smallest to largest): cell, organism, nucleus, tissue, organ system, organ | nucleus, cell, tissue, organ, organ system, organism |
| 13 | What is meant by "centi"? | 1/100th (1 hundredth) |
| 14 | What is meant by "milli" | 1/1000th (1 thousandth) |
| 15 | What is meant by "nano" | 1/1,000,000,000th (1 billionth) |
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|  | **Topic:** | **Cell division (mitosis) (B.4)** |
| 1 | Put in order of size (smallest to largest): genes, chromosomes, DNA, cell, nucleus | DNA, gene, chromosome, nucleus, cell |
| 2 | Name the 3 stages of the cell cycle | Interphase, Mitosis, Cytokinesis |
| 3 | Describe the three things that happen during interphase | 1) The cell grows, 2) chromosomes are copied, 3) more mitochondria and ribosomes are made |
| 4 | Describe what happens during mitosis | Chromosomes pulled to opposite ends of the cell |
| 5 | Describe what happens during cytokinesis | Cell membrane and cytoplasm split in two |
| 6 | State why the cell cycle is important | More cells are made for growth and repair |
| 7 | State what is produced in the cell cycle | Two genetically identical daughter cells |
| 8 | Mitosis produces which type of cells? | Diploid cells |
| 9 | Define "stem cell" | An undifferentiated cell |
| 10 | Name 3 places where stem cells can be found in humans | Embryos, adult bone marrow, meristem |
| 11 | State two conditions that stem cells can be used to treat in humans | Paralysis and type 1 diabetes |
| 12 | State two uses of stem cells in plants | 1) Clone rare species 2) produce disease resistant crops |
| 13 | Describe what is meant by "therapeutic cloning) | Using clones of a patient’s own stem cells to treat them |
| 14 | Which cells are required for therapeutic cloning? | Egg cell and a normal body cell from patient |
| 15 | State two objections to using stem cells in treatment | Potential transfer of viral infections and ethical/religious objections |
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|  | **Topic:** | **Introducing pathogens and types of disease (B.7)** |
| 1 | Define "health" | State of physical and mental well being |
| 2 | What is the name for a disease that can be passed on from person to person? | Communicable (or infectious) |
| 3 | What is the name for a disease that can NOT be passed on from person to person? | Non-communicable |
| 4 | State three factors other than disease that can have an impact on health | Diet, stress, life events |
| 5 | State one consequence of long term physical ill health | Depression |
| 6 | What is the name given to a disease causing microorganism? | Pathogen |
| 7 | Define "risk factors" | Factors that are linked to an increased rate of disease |
| 8 | State three risk factors for cardiovascular disease | Diet, smoking and exercise |
| 9 | State one risk factor for type 2 diabetes | Obesity |
| 10 | Name 2 organs effected by drinking alcohol | Brain and Liver |
| 11 | Name 2 potential impacts of smoking | Lung disease and lung cancer |
| 12 | State a risk factor for cancer | Contact with carcinogens (including ionising radiation) |
| 13 | State two lifestyle factors that can impact an unborn baby’s development | Smoking and drinking alcohol |
| 14 | Why is a sample of people used when investigating risk factors for diseases? | Too time consuming/impractical to sample whole population |
|  | **Topic:** | **Detailed disease case studies (B.8)** |
| 1 | Name 4 types of pathogen | Virus, bacteria, fungi, protist |
| 2 | Name 3 viral diseases | Measles, HIV, TMV (tobacco mosaic virus) |
| 3 | Name 2 bacterial diseases | Salmonella & Gonorrhoea |
| 4 | Name 1 fungal disease | Rose black spot |
| 5 | Name 1 protist disease | Malaria |
| 6 | State 2 symptoms of measles | Fever. Red skin rash |
| 7 | State 2 symptoms of HIV | Flu-like symptoms. AIDS |
| 8 | State 1 symptom of TMV | Discolouration of leaves |
| 9 | State 2 symptoms of salmonella | Fever. Cramps. Vomitting . Diarrhoea |
| 10 | State 2 symptoms of gonorrhoea | Thick yellow/green discharge. Pain urinating |
| 11 | State 2 symptoms of rose black spot | Purple/black spots on leaves. Leaves turn yellow & drop off |
| 12 | How is measles spread & prevented? | Spread: Air Prevented: Vaccination |
| 13 | How is Gonorrhoea spread & prevented? | Spread: Sex Prevented: Condoms |
| 14 | How is Rose Black Spot spread & prevented? | Spread: Direct contact Prevented: Fungicide & destroying affected leaves |
| 15 | How is Salmonella spread & prevented? | Spread: Food Prevented: Cooking thoroughly & washing hands |
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|  | **Topic:** | **Preventing pathogens from making us unwell (B.9)** |
| 1 | State 3 ways that pathogens can be spread | Direct contact, water, air |
| 2 | How do bacteria make us feel unwell? | Produce toxins (poisons) that damage tissues |
| 3 | How do viruses make us feel unwell? | Live & reproduce in cells causing cell damage |
| 4 | Name 4 of the body's non-specific defence systems | Skin, nose, trachea, stomach |
| 5 | How does the skin prevent pathogens from making us unwell? | Prevent them from entering body |
| 6 | How does the nose prevent pathogens from making us unwell? | Mucus to trap dirt & pathogens, ciliated cells to sweep it out |
| 7 | How does the trachea prevent pathogens from making us unwell? | Mucus to trap dirt & pathogens, ciliated cells to sweep it out |
| 8 | How does the stomach prevent pathogens from making us unwell? | Stomach acid to kill pathogens |
| 9 | State three ways that white blood cells can help to defend us against pathogens | Phagocytosis, antibody production, antitoxin production |
| 10 | Which type of white blood cell carries out phagocytosis? | Phagocytes |
| 11 | Which type of white blood cell carries out antibody and antitoxin production? | Lymphocytes |
| 12 | State one thing that can trigger cancers to form | Viruses in cells |
| 13 | What causes tumours to form? | Changes in cells that lead to uncontrolled growth and division |
| 14 | Define "benign tumour" | Growth of abnormal cells contained in ONE area in a membrane |
| 15 | Define "malignant tumour" | Growth of abnormal cells that SPREAD to other parts of the body in blood and INVADE other tissues. |
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|  | **Topic:** | **Developing new medicines (B.10)** |
| 1 | State three ways that drugs can be produced | Extracted from plants, microorganisms & synthesised |
| 2 | Where does the heart drug digitalis originate from? | Foxgloves (plant) |
| 3 | Where does the pain killer aspirin originate from? | Willow trees |
| 4 | Where does the antibiotic penicillin originate from? | Penicillium mould |
| 5 | State three things that drugs are tested and trialled for before use | 1) Toxicity (safe), 2) efficacy (does it work), 3) dose (quantity) |
| 6 | What is used to test drugs during preclinical testing? | Cells, tissues & live animals |
| 7 | Who are medicines tested on in stage 1 of clinical trials? | Healthy volunteers (low doses - test for toxicity) |
| 8 | Who are medicines tested on in stage 2 of clinical trials? | Patient volunteers (low doses - test for efficacy & dose) |
| 9 | What is a double blind trial? | Neither experimenter or patient knows if they are taking medicine or placebo |
| 10 | What is a placebo? | A substance that contains no medicine (a control) |
| 11 | What is the name for the injection given to patients to prevent them from catching an infectious disease? | Vaccination |
| 12 | Describe step 1 of vaccinations | 1) small quantity of dead/inactive pathogen |
| 13 | Describe step 2 of vaccinations | 2) white blood cells produce correct antibody (slowly) |
| 14 | Describe step 3 of vaccinations | 3) pathogen enters body & WBC produce correct antibodies (quickly) |
| 15 | State two benefits of vaccination | Prevent illness in an individual & prevent spread to others |
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|  | **Topic:** | **Breathing and respiration (B.14)** |
| 1 | What is the name of respiration with oxygen? | Aerobic |
| 2 | What is the name of respiration that occurs without oxygen? | Anaerobic |
| 3 | What is the word equation for aerobic respiration | Oxygen + glucose -> carbon dioxide + water |
| 4 | What is the balanced symbol equation for aerobic respiration | C6H12O6 + 6O2 -> 6CO2 + 6H2O |
| 5 | What is the word equation for anaerobic respiration in animals | Glucose -> Lactic acid |
| 6 | What is the balanced symbol equation for anaerobic respiration in animals | C6H12O6 -> 2C3H6O3 |
| 7 | What is the word equation for anaerobic respiration in yeast and plant cells | Glucose -> Ethanol + carbon dioxide |
| 8 | What is anaerobic respiration in yeast cells called? | Fermentation |
| 9 | What happens to your breathing and heart rate when you exercise? | Increase |
| 10 | What is the name of the main organ in the respiratory system? | Lungs |
| 11 | What is the name of the sheet of muscle beneath the lungs? | Diaphragm |
| 12 | What is the scientific name for the windpipe? | Trachea |
| 13 | What is the scientific name for the air sac? | Alveoli |
| 14 | The windpipe divides into two tubes when it reaches the lungs. What are these tubes called? | Bronchi/bronchus |
| 15 | State three uses of energy in organisms | 1) Chemical reactions to build larger molecules, 2) movement, 3) keeping warm |
|  | **Topic:** | **The Heart (B.15)** |
| 1 | Which type of vessel leaves the heart? | Arteries |
| 2 | Which type of vessel enters the heart? | Veins |
| 3 | What is the name of the 4 chambers of the heart? | Top: Left/right AtriumBottom: Left/right ventricle |
| 4 | Where is the body's natural pacemaker (cells that control the bodies resting heart rate)? | Right atrium |
| 5 | What is the name of the blood vessel that enters the heart from the body? | Vena Cava |
| 6 | What is the name of the blood vessel that enters the heart from the lungs? | Pulmonary vein |
| 7 | What is the name of the blood vessel that goes to the lungs from the heart? | Pulmonary artery |
| 8 | What is the name of the blood vessel that goes from the heart to the rest of your body? | Aorta |
| 9 | Which side of the heart is thicker? | Left |
| 10 | Which side of the heart pumps oxygenated blood out of it and which side pumps deoxygenated? | Oxygenated = LeftDeoxygenated = Right |
| 11 | What is the name for removing a heart from one person and placing it into another person? | Transplant |
| 12 | What is the name of the drug that reduces that amount of cholesterol in a person’s body? | Statins |
| 13 | Which organ does a statin effect? | Liver |
| 14 | State 3 adaptations of a red blood cell | \*no nucleus, \*biconcave shape, \*small |
| 15 | State 2 adaptations of a white blood cell | Cytoplasm contains enzymes, flexible cell membrane |
|  |  |  |
|  | **Topic:** | **The Blood (B.16)** |
| 1 | Which type of blood vessel has thin walls but a large lumen? | Vein |
| 2 | Which type of blood vessel has thick walls but a small lumen? | Artery |
| 3 | Which type of blood vessel has valves? | Veins |
| 4 | Which type of blood vessel has a pulse? | Artery |
| 5 | Give one non-surgical intervention that can reduce the changes of heart disease/a heart attack | Exercise/diet |
| 6 | What is the name of the specialised cell that is designed to carry oxygen? | Red Blood Cell |
| 7 | What is the name of the specialised cell that is designed to fight pathogens? | White Blood Cell |
| 8 | What is the name of the specialised cell that helps to clot our blood? | Platelets |
| 9 | What is the name of the liquid part of blood that carries dissolved substances? | Plasma |
| 10 | Give one substance that is carried in the plasma of blood | Carbon dioxide/urea/glucose |
| 11 | What is the name of the substance that can block arteries? | Cholesterol |
| 12 | What is the name of a disease that occurs when the blood vessels in the muscle of the heart get blocked? | Coronary Heart Disease |
| 13 | What are the blood vessels that provide the heart with oxygen called? | Coronary arteries |
| 14 | What is the name of the piece of wire mesh put inside a blood vessel to keep it open? | Stent |
| 15 | State the equation to calculate blood flow rate calculations | Cardiac output = heart rate x stroke volume(cm3/min) (beats/min) (cm3) |
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|  | **Topic:** | **Digestion (B.17)** |
| 1 | Which enzyme breaks down lipids, carbohydrates and proteins? | Lipids = lipasecarbohydrates = amylaseProteins = protease |
| 2 | Which enzyme is produced by the salivary glands? | Amylase |
| 3 | What is the name of the leaf shaped organ that produces enzymes? | Pancreas |
| 4 | What is the name of the organ that produces bile? | Liver |
| 5 | What is the name of the organ that stores bile? | Gall bladder |
| 6 | Is bile acidic or alkaline? | Alkaline |
| 7 | What is added to the stomach to kills pathogens? | Hydrochloric acid |
| 8 | What is the name of the process that breaks down large globules of fat into smaller ones? | Emulsification |
| 9 | Write the word equation for the digestion of carbohydrates | Starch -> glucose |
| 10 | Write the word equation for the digestion of proteins | Proteins -> amino acids |
| 11 | Write the word equation for the digestion of fats | lipids -> fatty acids + glycerol |
| 12 | Which part of the digestive system are nutrients and water absorbed into the blood from? | Nutrients = small intestineWater = large intestine |
| 13 | What is the scientific name for the food pipe? | Oesophagus |
| 14 | What is the name of the process where food is pushed down the food pipe? | Peristalsis |
| 15 | Name the food group that cannot be digested in the body | Fibre |
|  |  |  |
|  | **Topic:** | **Transport in cells (diffusion, active transport and osmosis) (B.19)** |
| 1 | Substances moving from a high concentration to a low concentration is called… | Diffusion |
| 2 | Two examples of diffusion in humans are: | CO2 + O2 in gas exchange, urea from cells to blood |
| 3 | Three factors that affect the rate of diffusion are: | Concentration gradient, temperature, surface area of the membrane |
| 4 | How are single celled organisms adapted for diffusion? | Large surface area: volume ratio |
| 5 | How is the small intestine adapted for exchanging materials? | \*Villi for large S.A. \*villi one cell thick \*good blood supply |
| 6 | How is the lungs adapted for exchanging materials? | \*Alveoli large surface area: volume ratio, surface is moist, good blood supply |
| 7 | How is the gills adapted for exchanging materials? | \*large S.A. \*moist \*good blood flow to maintain concentration gradient |
| 8 | How is the roots adapted for exchanging materials? | \*Large SA to volume ratio \*lots of mitochondria for respiration -> energy for active transport |
| 9 | How is the leaves adapted for exchanging materials? | \*Stomata \*thin so that distance for diffusion is smaller |
| 10 | Four ways that to increase the rate of transport | \*Large surface area, thin membrane, efficient blood supply (in animals), well ventilated (in animals) |
| 11 | Water moves from a dilute to concentrated solution across a partially permeable membrane via... | Diffusion |
| 12 | Pure water will move into a potato because | Of osmosis |
| 13 | (RP) How can you tell the concentration of sugar in a piece of potato? | 1) Place into different concentrations of sugar solution. 2) Plot graph 3) Find concentration where mass doesn’t change |
| 14 | When a substance moves against the concentration gradient, it is called. | Active transport |
| 15 | Active transport requires \_\_\_\_\_\_\_\_ from \_\_\_\_\_\_\_\_\_. | energy respiration |
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|  | **Topic:** | **Structure of a plant (B.21)** |
| 1 | What is the name of the plant tissue where new cells are made? | Meristem |
| 2 | What is the name of the specialised plant cell adapted to absorb water & nutrients from the soil? | Root Hair Cell |
| 3 | What is the name of the specialised plant cell adapted to open and close the stomata of a plant? | Guard Cell |
| 4 | Which word describes a guard cell (a) filled with water? (b) that has very little water | (a) filled = Turgid(b) lacking water = flaccid |
| 5 | What is the name of the specialised cell that is adapted to absorb lots of light energy in the leaf? | Palisade cell |
| 6 | What is the chemical in chloroplasts that allow plant cells to absorb lots of light energy? | Chlorophyll |
| 7 | Which type of plant tissue is made up of sieve cells and companion cells? | Phloem |
| 8 | What is the name for the hole in a leaf that allows gases in and water out? | Stoma/Stomata |
| 9 | What is the name of the plant tissue that is made up of a hollow tube of dead cells? | Xylem |
| 10 | Which tissue in a plant transports water? | Xylem |
| 11 | Which tissue in a plant transports glucose? | Phloem |
| 12 | In which plant organ is glucose made? | Leaf |
| 13 | What is the name for the process that converts water and carbon dioxide into glucose and oxygen? | Photosynthesis |
| 14 | Which organ of a plant is designed to absorb water? | Root |
| 15 | Which organ of a plant is designed to transport substances from the roots to the leaves and vice versa? | Stem |
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|  | **Topic:** | **Transport in plants (B.23)** |
| 1 | Define the term "osmosis" | Movement of water from a dilute solution to a concentrated solution through a semi permeable membrane |
| 2 | How do you calculate rate of water uptake by a plant? | volume of water absorbed ÷ time taken |
| 3 | How do you calculate percentage change in mass following osmosis? | Change in mass/initial mass x 100 |
| 4 | When looking at an osmosis graph (change in mass of unknown substance vs concentration of known sucrose solution) - how can you identify the concentration of the unknown substance? | When the line of best fix crosses the X axis |
| 5 | Which piece of equipment is used to cut a cylindrical piece of potato? | A cork borer |
| 6 | What is the name given to a semi permeable piece of tubing? | Visking tube |
| 7 | Which substance moves into a plant by osmosis? | Water |
| 8 | How are root hair cells adapted for osmosis? | Large surface area and large vacuole |
| 9 | Define 'active transport' | Movement of substances from a dilute to a concentrated solution against the concentration gradient. Requires energy |
| 10 | Name a substance that is moved into plants by active transport | Mineral ions |
| 11 | How are root hair cells adapted for active transport? | Lots of mitochondria for respiration |
| 12 | Define "diffusion" | Movement of particles from an area of high concentration to an area of low concentration |
| 13 | Name one substance that moves into a leaf by diffusion | Carbon dioxide  |
| 14 | Name two substance that moves out of a leaf by diffusion | Oxygen and water |
| 15 | Which cells open and close to control the diffusion of substances from a leaf? | Guard cells |
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|  | **Topic:** | **Transpiration and translocation (B.24)** |
| 1 | Name the process by which glucose is moved from a leaf to other parts of the cell | Translocation |
| 2 | What is the scientific name given to the evaporation of water from a leaf? | Transpiration |
| 3 | On which side of the leaf are there more stomata? | Underside/lower |
| 4 | What is covering the top layer of the leaf to reduce the loss of water? | Waxy Cuticle |
| 5 | Which organ in a plant does water enter through? | Root |
| 6 | Do guard cells become flaccid or turgid when it is very sunny? | Turgid |
| 7 | Do stomata open or close when it is night time? | Close |
| 8 | Describe the structure of xylem | Hollow tubes strengthened with lignin |
| 9 | Describe the structure of phloem | Elongated cells with a sieve plate and companion cell |
| 10 | How do you calculate surface area of a cuboid? | Sum of all the 2D faces |
| 11 | State four factors that increases the rate of transpiration | 1) High wind intensity 2) high light intensity 3) arid (dry)4) high temperature |
| 12 | Why does high wind intensity increase transpiration? | Increases concentration gradient |
| 13 | Why does high light intensity increase transpiration? | Causes stomata to open |
| 14 | Why does arid conditions increase the rate of transpiration? | Increases concentration gradient |
| 15 | Why does high temperature increase the rate of transpiration? | Water particles have more kinetic energy |
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|  | **Topic:** | **Photosynthesis (B.25)** |
| 1 | Name the two reactants in photosynthesis | Carbon Dioxide and water |
| 2 | Name the two products formed in photosynthesis | Oxygen and glucose |
| 3 | Write the word equation for photosynthesis | Carbon dioxide + water -> oxygen and glucose |
| 4 | Write the symbol equation for photosynthesis | CO2 + H2O 🡪 O2 + C6H12O6 |
| 5 | Describe what happens to the rate of photosynthesis as temperature increases | Rate increases and then decreases |
| 6 | Describe what happens to the rate of photosynthesis as light intensity increases | Rate increases and then remains constant |
| 7 | Describe what happens to the rate of photosynthesis as carbon dioxide increases | Rate increases and then remains constant |
| 8 | Define limiting factor | A factor that directly affects the rate of photosynthesis on its own, regardless of the level of the other factors. |
| 9 | Name the plant used to investigate the effect of different factors on rate of photosynthesis | Elodea (pondweed) |
| 10 | How can you calculate the rate of photosynthesis of an aquatic plant? | Count the number of O2 bubbles produced in a minute |
| 11 | How can you more accurately calculate the rate of photosynthesis of an aquatic plant? | Record volume of gas produced (using a gas syringe) |
| 12 | Which cells are adapted for increased photosynthesis? | Palisade cells |
| 13 | How are palisade cells adapted for increased rates of photosynthesis? | Lots of chloroplasts (and chlorophyll) |
| 14 | State three limiting factors for photosynthesis | 1) Carbon dioxide concentration, 2) Temperature, 3) Light intensity |
| 15 | In a variegated leaf, why do some parts appear white? | There is no chlorophyll |
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|  | **Topic:** | **The products of photosynthesis (B.26)** |
| 1 | State 5 uses of glucose produced during photosynthesis | 1) respiration, 2) stored as insoluble starch, 3) stored as fats/oils 4) making cellulose, 5) making amino acids |
| 2 | State two substances required for making proteins in plants | Nitrate ions and glucose |
| 3 | Which substance is used to test for the presence of starch? | Iodine solution |
| 4 | What colour will iodine solution turn in the presence of starch? | Blue/black |
| 5 | What colour will iodine solution turn if no starch is present? | Remains orange |
| 6 | Which substance is used to test for the presence of sugar? | Benedict's solution |
| 7 | What colour will benedict's solution turn in the presence of sugar? | Red (lots of sugar), orange (some sugar), green (small amount of sugar) |
| 8 | What colour will benedict's solution turn if no glucose is present? | Remains blue |
| 9 | Which substance is used to test for the presence of protein? | Biuret's solution |
| 10 | What colour will biuret solution turn in the presence of protein? | Purple |
| 11 | What colour will biuret solution turn if no protein is present? | Remains blue |
| 12 | Which substance is used to test for the presence of lipids (fats)? | Ethanol |
| 13 | What colour will ethanol solution turn in the presence of fats? | Creamy white |
| 14 | What colour will ethanol solution turn if no fat is present? | Remains colourless |
| 15 | Describe the relationship between a light's distance from a plant and rate of photosynthesis (HT only) | power ÷ distance squared (inverse square law) |
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|  | **Topic:** | **Exercise and metabolism (B.40)** |
| 1 | What is the effect of exercise on heart rate during exercise? | Increase |
| 2 | What is the effect of exercise on breathing rate and breathing volume during exercise? | Increases |
| 3 | Why does heart rate, breathing rate and breathing volume increase during exercise  | Supply muscles with more oxygenated blood |
| 4 | Which type of respiration occurs if there is insufficient oxygen available? | Anaerobic respiration |
| 5 | State two effects of long periods of anaerobic respiration | Build-up of lactic acid and oxygen debt |
| 6 | Where is lactic acid broken down? (HT only) | The liver |
| 7 | How is lactic acid broken down? | Reacts with oxygen to convert to glucose |
| 8 | Define "oxygen debt" | Amount of O2 required to break down lactic acid |
| 9 | How would the lung capacity of an athlete compare to a non-athlete | Larger |
| 10 | How would the resting heart rate of an athlete compare to a non-athlete? | Lower |
| 11 | Define "metabolism" | Sum of all reactions in a cell/body |
| 12 | During metabolism, glucose is converted into which three substances? | 1) Starch, 2) glycogen, 3) cellulose |
| 13 | During metabolism, lipids are formed from which molecules? | 1 molecule glycerol, 3 molecules fatty acids |
| 14 | During metabolism, which substances are used for form amino acids? | Glucose and nitrate ions |
| 15 | State two ongoing processes that are part of metabolism | Respiration and deamination |
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|  | **Topic:** | **RP: Microscopy (B1) (B.41)** |
| 1 | What is the aim of the investigation? | To investigate and view the sub-cellular structures of plant and animal cells using a microscope. |
| 2 | What type of microscope is used to view the cells? | Light microscope |
| 3 | What type of tissue is used? | A thin layer of onion skin |
| 4 | How is the slide prepared? | 1) Drop of water added to glass slide2) Thin layer of onion skin placed onto glass slide3) Drop of iodine added onto the onion skin4) Cover slip placed on top |
| 5 | What do we need to ensure is not present on the slide? | Air bubbles |
| 6 | Why is iodine used to prepare the slides? | To dye the sub-cellular structures and make them easier to see |
| 7 | Which magnification is used to first view the cells? | x10 |
| 8 | How do you first find the cells under the microscope? | By turning the coarse-focusing wheel |
| 9 | How do you see the cell sin more detail? | By turning the fine-focusing wheel |
| 10 | Which sub-cellular structures should you be able to identify? | nucleus, cell wall, vacuole, cell membrane and cytoplasm |
| 11 | Which structures cannot be seen with a light microscope? | ribosomes, mitochondria |
| 12 | What type of microscope would you need to use to improve the resolution of the image? | electron microscope |
| 13 | What is the formula to calculate the magnification? | magnification = size of image / size of real object |
| 14 | How do you rearrange the formula to find the size of the real object? | size of real object = size of image / magnification |
| 15 | How do you convert from mm to µm? | x by 1000 |
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|  | **Topic:** | **RP: Osmosis (B3) (B.43)** |
| 1 | What is the independent variable? | The concentration of the solution |
| 2 | What is the dependent variable? | The percentage change in mass |
| 3 | Name 5 control variables | 1)Length of potato2) Diameter of potato3) Volume of solution4) Time potato is left for5) Temperature of solution |
| 4 | Give 3 ways to make the results accurate | 1) Read the volume of the solution from the meniscus2) Dab the potatoes dry before measuring the mass3) Use a digital top pan balance |
| 5 | Name one risk and precaution | Risk = cutting yourself with the potato borerPrecaution = push the borer down towards the desk not upwards |
| 6 | What is the purpose of the distilled water? | To act as a control to compare your results to |
| 7 | How is the concentration inside the tissue estimated? | Plot a graph of concentration against % change in mass and find where the line of best fit crosses 0% |
| 8 | How is the percentage change in mass calculated? | % change in mass = change in mass / initial mass |
| 9 | What is percentage change calculated rather than just the change? | The potato may be slightly different sizes and shapes to begin with |
| 10 | Why does the tissue increase in mass? | Water has entered the tissue by osmosis in more dilute solutions |
| 11 | How can you tell if there has been an increase in mass? | The % change in mass is +ve |
| 12 | Why does the tissue decrease in mass? | Water has left the tissue by osmosis in more concentrated solutions |
| 13 | How can you tell if there has been a decrease in mass? | The % change in mass is -ve |
| 14 | What does no change in mass mean? | The concentration of the solution is the same as the concentration inside the tissue |
| 15 | What are possible variations on this method? | 1) Using any other vegetable/plant tissue2) Using any other food substance 3) Using a salt solution |
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|  | **Topic:** | **RP: Food tests (B4) (B.44)** |
| 1 | How are the food samples prepared? | Mash up using a pestle and mortar, add distilled water, filter to make a solution. |
| 2 | What reagent is used to test for starch? | Iodine |
| 3 | What is the negative result for starch (no starch)? | orange/brown |
| 4 | What is the positive result for starch (starch is present)? | blue/black |
| 5 | What is the reagent used to test for sugars? | Benedict's |
| 6 | What conditions are needed for Benedict's? | Water bath at 80⁰C for 5 min |
| 7 | What is the negative result for sugars (no sugars present)? | blue |
| 8 | What is the positive result for sugars (sugars are present)? | green --> orange –-> red |
| 9 | What reagent is used to test for lipids? | Ethanol followed by distilled water |
| 10 | What must be done to the solution when ethanol is added? | Shaken |
| 11 | What is a negative result for lipids (no lipids present)? | No white emulsion forms |
| 12 | What is a positive result for lipids (lipids present)? | A white emulsion forms |
| 13 | What reagent is used to test for proteins? | Biuret solution (copper sulphate + sodium hydroxide) |
| 14 | What is a negative result for proteins (no proteins present)? | blue |
| 15 | What is a positive result for proteins (proteins present)? | purple |
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|  | **Topic:** | **RP: Enzymes (B5) (B.45)** |
| 1 | What is the independent variable? | pH of buffer solution |
| 2 | What is the dependent variable? | time taken for starch to break down into simple sugars (iodine solution to turn from black to brown) |
| 3 | Name 5 control variables | 1) Volume of starch solution2) Temperature of solution3) How the mixture is stirred4) Volume of amylase solution5) Time intervals  |
| 4 | What piece of equipment is used to place the test solution in? | Spotting tile |
| 5 | How is the temperature controlled? | Using a water bath |
| 6 | Name one risk and precaution | Iodine is an irritant so avoid contact with skin |
| 7 | How do you know when all of the starch is broken down? | Samples of solution in the spotting tiles turn back to orange/brown |
| 8 | How can accuracy of the measurements be improved? | 1) Remove the first drop of solution as soon as the amylase is added2) Use a pipette to measure each drop accurately3) Start the timer immediately |
| 9 | Why must the solution be constantly mixed? | To ensure that all of the amylase and starch bind to each other |
| 10 | Name one random error | Different sizes of drops of solution added to the spotting tile |
| 11 | What has happened to amylase below pH6 and above pH 7? | Amylase has denatured |
| 12 | How can the rate of reaction be calculated? | rate = 1 / time |
| 13 | How will the results be displayed? | Plotting a graph of pH against rate |
| 14 | What results should you see? | A curve with the rate reaching an optimum at approximately pH7 |
| 15 | What are possible variations on this method? | 1) Investigating the effect of pH on any other enzyme2) Investigating the effect of temperature on any enzyme |
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|  | **Topic:** | **RP: Photosynthesis (B6) (B.46)** |
| 1 | What is the independent variable? | Distance from the light source (light intensity) |
| 2 | What is the dependent variable? | Number of bubbles per minute |
| 3 | Name 3 control variables | 1) Temperature of the water2) Carbon dioxide concentration 3) Colour of the light |
| 4 | How is the rate of photosynthesis measured? | rate = total O2 produced / time |
| 5 | How is the volume of oxygen measured? | Counting the number of bubbles per minute |
| 6 | How is the light intensity changed? | Changing the distance of the beaker from the light |
| 7 | Name one random error | Counting the bubbles incorrectly  |
| 8 | Give one way to make the results more accurate | Increase the amount of time you count the bubbles for |
| 9 | How is the concentration of carbon dioxide controlled? | Adding sodium hydrogen carbonate to the solution |
| 10 | Give an alternative way to measure the volume of gas produced? | Volume of water displaced from a measuring cylinder |
| 11 | Name one risk and precaution | The lamp may be hot so do not touch it |
| 12 | How is the temperature controlled? | Water bath |
| 13 | How is the pondweed controlled? | Same species, same age and same length |
| 14 | What results should you see? | As the light intensity increases, the rate photosynthesis increases |
| 15 | What are possible variations on this method? | 1) Investigate the effect of different coloured lights 2) Investigate the effect of temperature 3) Investigate the effect of CO2 concentration |

**Required practicals**

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| --- | --- | --- | --- | --- | --- |
| **Name** | **Variables** | **Equipment** | **Method** | **Expected conclusion** | **Possible variations** |
| **B1 - Microscopy** | **Big Question**: Investigate the structure of plant and animal cells using a microscope. | \*A microscope\*Slides of animal cells\*Slides of plant cells | 1. Put the slide on the stage
2. Turn the nose piece to the lowest power objective lens
3. Move the stage until it is almost touching the objective lens
4. Look through the eyepiece and turn the coarse adjustment knob so that the stage moves down. Do this until the cells come into focus.
5. Use the fine adjustment knob to bring the cells into clear focus.
6. Switch the nose piece to a higher power lens.
7. Use the fine adjustment knob to bring the cells back into focus.
8. Draw and label some of the cells.
9. Write your magnification underneath the drawing
10. Multiply the objective magnification by the eyepiece magnification.
 | You should be able to identify the nucleus, cell wall, vacuole, cell membrane, chloroplasts and the cytoplasm. | Given an image and asked to work out magnification or real size |
| **B3 – Osmosis** | **Big Question:** Investigate the effect of a range of concentrations of salt or sugar on the mass of plant tissue**IV** – Concentration of sugar solution**DV** – Percentage change in mass of potato**CV** – Length of potato, diameter of potato, volume of sucrose solution, duration potato is left for | \*A potato\*A cork borer\*A ruler\*A 10cm3 measuring cylinder\*Labels\*5 boiling tubes\*A test tube rack\*Paper towels\*A scalpel\*A white tile\*A range of sugar solutions (of different concentrations)\*Distilled water\*A top pan balance (accurate to 0.01g). | 1. Use the cork borer to cut five potato cylinders of the same diameter
2. Use the scalpel to trim the potato cylinders to the 3cm long.
3. Measure the mass of each potato cylinder using a top pan balance and record in a results table.
4. Record the mass of each cylinder
5. Measure 10cm3 of each concentration of sugar solution into 4 of the boiling tube.
6. Measure 10cm3 of distilled water and add into the fifth boiling tube
7. Add one potato cylinder into each boiling tube
8. Leave the potato cylinders in the solution for 48 hours.
9. Remove the potato cylinders using the forceps and blot them dry with paper towel.
10. Measure the new mass of each potato cylinder and record in the results table.
11. Calculate the percentage change in mass of each potato cylinder and plot a graph against concentration.
 | When the potato cylinder doesn’t change mass, the concentration of sugar in the solution is the same as the concentration of sugar in the potato | Investigate the effect of a range of salt concentrations on a potato cylinderInvestigate the effect of a range of concentrations on sugar on the size of a visking tube/raisin |
| **B4 – Food tests** | **Big Question**: Use qualitative reagents to test for carbohydrates (starch and sugars), lipids, proteins | **For all:**\*Food sample\*Test tube\*Pipettes**Benedict’s test for sugars**\*Benedict’s solution\*Water bath\*Thermometer**Iodine test for starch**\*Iodine solution**Lipids – ethanol**\*Ethanol\*Distilled water**Biuret test for protein:**\*Biuret solution A (Copper sulphate)\*Biuret solution B (sodium hydroxide) | **Benedict’s test for sugar**1. Set up a waterbath.
2. Put some of the food sample into a test tube.
3. Add a few drops of Benedict’s solution to the sample
4. Put the test tube in the waterbath at 80⁰C for 5 minutes.
5. Note down any colour changes in your results table.

**Iodine test for starch**1. Put the food sample in the test tube
2. Add a few drops of iodine solution
3. Record colour changes

**Ethanol test for lipids:**1. Put a food sample into the test tube
2. Add a few drops of distilled water
3. Shake gently
4. Record any observations

**Biuret test for protein**1. Put a food sample into the test tube.
2. Add 1cm3 of bieuret solution A (copper sulphate). Add 1 cm3 of Biuret solution B (sodium hyudroxide).
3. Shake to mix
4. Record colour changes.
 | **Benedict’s test:**No sugar: BlueSugar: green/orange/red (most sugar!)**Iodine test:**No starch: orange/brownStarch: blue/black**Ethanol test:**If lipids present, a white milky layer of oil should form on top of the mixture**Biuret test:**No protein: BlueProtein: Purple | May also reference Sudan (III) for fats – forms a red layer on top of the mixture |
| **B5 – Enzymes** | **Big Question:** Investigate the effect of pH on the rate of reaction of amylase**IV** – pH of buffer solution**DV** – time taken for starch to break down into simple sugars (iodine solution to turn from black to brown)**CV** – Volume of starch solution, temperature of solution, whether the mixture is stirred | **Big question:**\*10 test tubes\*Test tube rack\*Water bath\*Thermometer\*Spotting tile\*5cm3 measuring cylinder\*Pipettes\*Glass rod\*Stop clock\*Starch solution\*Amylase solution\*Iodine solution\*Buffer solutions (range of pH values) | 1. Heat the water bath to 35⁰C.
2. Add 2cm3 of each buffer solution into individual test tubes. Label each.
3. Add 20cm3 of starch solution into test tube labelled “starch”.
4. Put a thermometer in the starch to monitor the temperature.
5. Add 10cm3 of Amylase solution to another test tube. Label “amylase”.
6. Put all test tubes into the water bath.
7. Allow the solutions to reach 35⁰C.
8. Add one drop of iodine into each depression on the spotting tile.
9. When all solutions reach 35⁰C, take one test tube of buffer solution, add the 2cm3 of starch and 2cm3 of amylase solution. Stir mixture with a glass rod.
10. Start a stop clock.
11. After 10 seconds use a pipette to add 2cm3 of the solution to one depression on the tile.
12. Continue to do every 10 seconds until the iodine solution turns from black to orange (showing the starch has been broken down into glucose).
 | As pH increases, rate of reaction should increase and then begin to decrease again as enzymes become denatured. | Investigate the effect of temperature/volume of amylase on rate of reaction of amylaseInvestigate the effect of temperature on the rate of reaction of protease/lipase (hint: Think about the indicator you would need to use!!) |
| **B6 – Photosynthesis** | **Big Question:** Investigate the effect of light intensity on the rate of photosynthesis of pondweed.**IV:** distance from light source to pondweed**DV:** volume of O2 produced**CV:** temperature of the water, carbon dioxide concentration, colour of the light | \*A beaker\*A filter funnel\*Plastercine\*A measuring cylinder\*A 10cm piece of pondweed\*A light source\*A metre rule\*A stop clock | 1. Put your 10cm piece of pond weed into a beaker of water.
2. Cover the pondweed with an inverted (upside down) filter funnel – raised off the bottom of the beaker with plastercine.
3. Fill the measuring cylinder with water and gently position as in the diagram.
4. Use the ruler to position the beaker and pondweed 100cm away from the light source.
5. Start the stop clock.
6. Count the number of bubbles released in three minutes.
7. Record the volume of gas collected in the measuring cylinder in the same three minutes.
8. Repeat with the light source at 80cm, 60cm, 40cm, 20cm away.
9. Calculate rate of CO2 production by doing: Total CO2 produced

 Time | The closer the light source, the more gas (O2) will be produced in the three minutes. | Investigate the effect of different coloured lights on rate of photosynthesisInvestigate the effect of temperature on photosynthesisInvestigate the effect of CO2 tablets on photosynthesis |

**Chemistry**

**Mastery Matrix:**

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| --- | --- | --- | --- | --- |
| **Topic** | **Course** | **Tier** | **Revision Guide (double)** | **Learning statement** |
| Elements & Compounds | A | F | 94 | Describe and draw a model of the three states of matter |
| Elements & Compounds | A | F | 94 | Use the particle model to explain melting, boiling, freezing and condensing |
| Elements & Compounds | A | F | 95 | Identify a substance’s state using its melting and boiling point |
| Elements & Compounds | A | F | 88 | Classify a substance as an element or compound |
| Elements & Compounds | A | F | 88 | Identify the symbol for the first 20 elements |
| Elements & Compounds | A | F | 88 | Name common compounds from their formula |
| Mixtures | A | F | 89 | Use key terms (soluble, insoluble, solute, solvent and solution) correctly to describe a substance dissolving |
| Mixtures | A | F | 89 | Explain how to separate given mixtures (filtration, crystallisation, simple distillation, fractional distillation, chromatography) |
| Structure of an atom | A | F | 90 | Describe the plum pudding model of the atom |
| Structure of an atom | A | F | 90 | Describe the current (nuclear) model of the atom giving the relative charge and mass of the subatomic particles |
| Structure of an atom | A | F | 90 | Recall the radius of an atom and its nucleus |
| Structure of an atom | A | F | 91 | Calculate protons, neutrons and electrons for an atom linking to mass and atomic number |
| Structure of an atom | A | F | 91 | Draw the electronic structure and work out the electronic configuration for a given atom |
| Structure of an atom | A | F | 91 | Define an ‘isotope’ |
| Structure of an atom | A | F | 212 | Link isotopes to relative atomic mass to explain why this is an average |
| Structure of an atom | A | F | 212 | Calculate the relative atomic mass of an element given the percentage abundance of its isotopes |
| Structure of an atom | A | F | 103 | Calculate the relative formula mass of a substance |
| Metals in the periodic table | A | F | 92 | Describe how Mendeleev has arranged the periodic table |
| Metals in the periodic table | A | F | 101 | Explain why something is classified as a metal or non-metal |
| Metals in the periodic table | A | F | 101 | Describe the uses of metals |
| Metals in the periodic table | A | F | 88 | Define a ‘chemical reaction’ and given examples |
| Metals in the periodic table | A | F | 101 | Explain what an alloy is and how it’s properties differ from a pure metal |
| Groups in the periodic table | A | F | 92+93 | Describe the key properties (state, easy to cut, appearance) of group 1 |
| Groups in the periodic table | A | F | 92 | Describe and explain how the reactivity changes as you move down group 1 (oxygen, chlorine, water) |
| Groups in the periodic table | A | F | 93 | Describe the key properties (molecular mass, boiling and melting point) of group 7 |
| Groups in the periodic table | A | F | 93 | Describe and explain how the reactivity changes as you move down group 7  |
| Groups in the periodic table | A | F | 92 | Describe the key properties (boiling point, density, reactivity) of group 0 |
| Groups in the periodic table | A | F | 92 | Describe and explain how the reactivity changes as you move down group 0 |
| Types of bonding | A | F | 97 | Describe the structure and properties of giant ionic structures |
| Types of bonding | A | F | 97 | Link the structure of giant ionic structures to its properties |
| Types of bonding | A | F | 98 | Describe the structure and properties of simple covalent structures |
| Types of bonding | A | F | 99 | Describe the structure and properties of giant covalent structures (including diamond, graphite and silica) |
| Types of bonding | A | F | 99+100 | Compare and contrast giant carbon structures (diamond, graphite, graphene and fullerene – Buckminster fullerenes and nanotubes as examples) |
| Types of bonding | T | F |  | Describe two uses of nanotechnology |
| Types of bonding | A | F | 101 | Describe how a substance bonds metallically |
| Types of bonding | A | F | 101 | Link the structure of giant metallic structures to their properties  |
| Describing chemical reactions | A | F | 88 | Write a word equation for a given reaction |
| Describing chemical reactions | A | F | 88 | Write a balanced symbol equation for a given reaction |
| Describing chemical reactions | A | F | 95 | Include appropriate state symbols in an equation  |
| Describing chemical reactions | A | F | 102 | Compare the mass of reactants and products when looking at a word equation, linking this to the theory of ‘conservation of mass’ (metal and oxygen, thermal decomposition of metal carbonates) |
| Describing chemical reactions | A | F |  | Calculate ‘uncertainty’ for a given set of measurements |
| Reactions of metals | A | F | 114 | Describe the reaction of given metals with oxygen  |
| Reactions of metals | A | F | 92 | Describe the reaction of given metals with water |
| Reactions of metals | A | F | 116 | Describe the reactions of given metals with acids (magnesium, zinc and iron with hydrochloric and sulphuric acid) |
| Reactions of metals | A | F | 114+116 | Predict products from given reactants |
| Acids & alkalis | A | F | 116 | Identify the ions produced by different acids and alkalis |
| Acids & alkalis | A | F | 116 | Describe the pH scale and how to test pH using universal indicator or a pH probe |
| Acids & alkalis | A | F | 116 | Describe neutralisation reactions (alkalis and bases, metal carbonates and acid) |
| Acids & alkalis | A | F | 117 | Deduce the formulae of salts from their given ions |
| Acids & alkalis | A | F | 117 | Explain the method for producing soluble salts |
| Acids & alkalis | A | F | 117 | **RP Making Salts:** Prepare a pure dry sample of a soluble salt from an insoluble oxide or carbonate |
| Acids & alkalis | A | F | 116 | Recall the ionic equation for neutralisation |
| Acids & alkalis | A | F | 116 | Explain how to use a titration to measure the volume of an acid or an alkali |
| Reactivity of metals | A | F | 114 | Use evidence to rank metals in order of reactivity |
| Reactivity of metals | A | F | 114 | Predict what would happen in a displacement reaction between two substances |
| Electrolysis | A | F | 115 | Link reactivity to how metals are extract from their ore |
| Electrolysis | A | F |  | Describe how electrolysis is carried out |
| Electrolysis | A | F |  | Explain the electrolysis of molten compounds e.g. Lead bromide |
| Electrolysis | A | F |  | Predict what is produced at each electrode |
| Electrolysis | A | F |  | Explain how electrolysis can be used to extract metals from their ores |
| Electrolysis | A | F |  | Explain how electrolysis can be used to determine the presence of hydrogen in an aqueous solution |
| Electrolysis | A | F | 119 | **RP Electrolysis:** Investigate what happens when aqueous solutions are electrolysed (including the development of a hypothesis) |
| Exothermic and Endothermic reactions | A | F | 120 | Explain how energy is conserved in reactions |
| Exothermic and Endothermic reactions | A | F | 120 | Define and give examples and uses of exothermic and endothermic reactions |
| Exothermic and Endothermic reactions | A | F | 120 | Evaluate data to decide whether a reaction is exothermic or endothermic |
| Exothermic and Endothermic reactions | A | F | 120 | **RP Temperature Changes:** Investigate the variables that affect temperature changes in reacting solutions |
| Exothermic and Endothermic reactions | A | F | 121 | Define activation energy |
| Exothermic and Endothermic reactions | A | F | 121 | Use reaction profiles to show energies of reactants and products and link to exothermic and endothermic and draw simple reaction profiles for endothermic and exothermic reactions. |
| Exothermic and Endothermic reactions | A | F | 122 | Explain whether energy is supplied or released when bonds are broken and made (HT only) |
| Exothermic and Endothermic reactions | A | F | 123 | Calculate the overall energy change in a reaction using bond energies and use this to decide if a reaction is endothermic or exothermic (HT only) |
| Chemical calculations | D | F | 103 | Calculate the relative formula mass of a substance (double only) |
| Volumes and concentrations | A | F | 105 | Calculate the mass of solute in a given volume of solution |
| Volumes and concentrations | A | F | 105 | Explain how the mass of a solute and the volume of a solution is related to the concentration (HT only) |
| Types of bonding | D | F | 96 | Name the three types of bonds that can form (double only recap) |
| Types of bonding | D | F | 96 | Explain how atoms bond ionically (double only recap) |
| Types of bonding | D | F | 96 | Use different models to represent the ions in an ionic compound (double only recap) |
| Types of bonding | D | F | 96 | Evaluate the use of different models of representation (double only recap) |
| Types of bonding | D | F | 96 | Work out the empirical formula for different ionic compounds (double only recap) |
| Types of bonding | D | F | 97 | Describe and explain the properties of ionic compounds (double only recap) |
| Types of bonding | D | F | 98 | Explain how atoms bond covalently (double only recap) |
| Types of bonding | D | F | 98 | Use different models to represent the atoms in a covalent compound (hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia, methane) (double only recap) |
| Types of bonding | D | F | 99+100 | Describe the structure of diamond, graphite, graphene and fullerenes (double only recap) |
| Types of bonding | D | F | 99+100 | Explain the properties of simple and giant covalent compounds (double only recap) |
| Types of bonding | D | F | 139 | Describe the structure of a polymer (double only recap) |
| Types of bonding | D | F | 98 | Work out the molecular formula of a substance given a model or diagram of its structure (double only recap) |
| Types of bonding | D | F | 101 | Explain how atoms bond metallically (double only recap) |
| Types of bonding | D | F | 101 | Describe and explain the properties of giant metallic structures (double only recap) |

**Knowledge organiser:**

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|  | **Paper:** | **C1** |
| **Topic:** | **The Three States (C.1)** |
| 1 | In which state do atoms have strong bonds between them? | Solid |
| 2 | Describe motion of particles in a solid, liquid and gas | S = Vibrating, L = Sliding, G = quick & random |
| 3 | In which state can diffusion NOT happen? | Solid |
| 4 | In which states, can particles not be compressed? | Solid & liquid |
| 5 | Which state is the least dense? | Gas |
| 6 | Which state is the densest? | Solid |
| 7 | In which state are there weaker forces between particles? | Gases |
| 8 | In which state do particles remain in a fixed position? | Solid |
| 9 | What is the name for the change of state when a solid change to a liquid? | Melted |
| 10 | What is the name for the change of state when a liquid changes to a gas? | Evaporation |
| 11 | What is the name for the change of state when a gas changes to a liquid? | Condensation |
| 12 | What is the name for the change of state when a liquid changes to a solid? | Freezing/solidifying |
| 13 | What is the name for the temperature where a liquid turns into a gas? | Boiling point |
| 14 | What is the name for the temperature where a solid turns into a liquid? | Melting point |
| 15 | Why is there no overall temperature change when a substance is changing state? | The particles are absorbing thermal energy to overcome the forces between them.The particles are absorbing thermal energy to overcome the forces between them.Particles are absorbing the thermal energy to overcome the forces between them. |
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|  | **Topic:** | **Elements, compounds (C.2)** |
| 1 | What is the name for substances made of only ONE type of atom? | Elements |
| 2 | What is the name for substances made of two or more types of atoms NOT chemically bonded together? | Mixtures |
| 3 | What is the name for substances made of two or more types of atoms chemically BONDED together? | Compounds |
| 4 | What is the formula for water? | H2O |
| 5 | What is the formula for Methane? | CH4 |
| 6 | Define "alloy" | A mixture of a metal and at least one other element |
| 7 | Why are alloys harder than pure metals? | Different sized atoms distort the regular rows so that the layers can't slide over each other |
| 8 | What is the word for an element that always exists as two atoms bonded together? | Diatomic |
| 9 | Is an alloy an element, compound or mixture? | Mixture |
| 10 | What is the formula for glucose? | C6H12O6 |
| 11 | Which elements exist diatomically? | N2, H2, O2 and all of group 7 |
| 12 | How many electrons can be held in the first shell and then second and third shell of an atom? | First shell is TWO, all other shells EIGHT |
| 13 | What is the different between Ar (relative atomic mass) and Mr (relative molecular mass) | Ar = for an element Mr = for a compound |
| 14 | Define "ion"? | An electrically charged atom that has gained or lost electrons |
| 15 | How do you calculate Ar of an element | It is it's mass number |
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|  | **Topic:** | **Mixtures (C.3)** |
| 1 | Define "pure" substance | A single element or compound |
| 2 | What temperature is the melting point of water? | 0⁰C |
| 3 | What temperature is the boiling point of water? | 100⁰C |
| 4 | Define "formulation" | A mixture designed as a useful product |
| 5 | Give three examples of a formulation | Fuel, paint, alloys |
| 6 | Define "soluble" | Can dissolve |
| 7 | Define "insoluble" | Cannot dissolve |
| 8 | Define "solute" | A solid which can dissolve |
| 9 | Define "solvent" | A liquid in which a solid will dissolve |
| 10 | Define "solution" | A mixture of a dissolved solute and solvent |
| 11 | What is filtration used to separate? | An insoluble solid and a liquid |
| 12 | What is crystallisation used to separate? | A soluble solid and a solvent (collect solid) |
| 13 | What is simple distillation used to separate? | A soluble solid and a solvent (collect liquid) |
| 14 | What is fractional distillation used to separate? | Liquids with different boiling points |
| 15 | What is chromatography used to separate? | Different colours of ink or dye |
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|  | **Topic:** | **Chromatography (C.4)** |
| 1 | What are the two "phases" in chromatography? | Mobile and stationary phase |
| 2 | What is the "mobile phase" in chromatography | The solvent (that travels up the paper) |
| 3 | What is the "stationary phase" in chromatography | The paper |
| 4 | Why should the start line be drawn in pencil? | Because pencil will not dissolve and affect the results. |
| 5 | Why should the start line sit above the solvent? | So that the dots of ink or dye do not wash off the paper |
| 6 | Why do the dots of ink or dye need to be the same size? | To make it a fair test |
| 7 | How is the Rf value calculated? | Rf = distance by dye / distance by solvent |
| 8 | What does a high Rf value tell us? | The substance is more soluble and travelled further |
| 9 | What does a low Rf value tell us? | The substance is less soluble and travelled less distance |
| 10 | What should the Rf value always be? | A number between 0 - 1 |
| 11 | What solvents are used in chromatography? | Water, alcohol, acetone |
| 12 | Where should the distance moved by the dye be measured from? | The same place each time (top, bottom or middle) |
| 13 | What is chromatography used for? | To separate different coloured compounds (dyes or inks) |
| 14 | How will temperature affect the rate of chromatography? | The higher the temperature, the faster the rate |
| 15 | How can chromatography be used to identify an unknown substance? | Compare with a known substance |
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|  | **Topic:** | **Structure of an atom (C.5)** |
| 1 | What is the charge, relative size and location of a proton? | Charge: 1+, Size = 1, Location = Nucleus |
| 2 | What is the charge, relative size and location of a neutron? | Charge: 0, Size = 1, Location = Nucleus |
| 3 | What is the charge, relative size and location of an electron? | Charge: -1, Size = 1/2000, Location = Shells |
| 4 | What is the radius of an atom?  | 0.1 nm (1 x 10 -10m) |
| 5 | What is the radius of a nucleus? | 1 x 10 -14m |
| 6 | Define "atomic number" | No. of protons in an atom |
| 7 | Define "atomic mass number" | Sum of protons and neutrons in an atom |
| 8 | Define isotope? | Atoms of the same element that have the same number of protons but different numbers of neutrons |
| 9 | What was the Dalton model of the atom? | Atoms = tiny spheres |
| 10 | Describe Thompson's 'Plum Pudding' model of an atom. | Ball of positive charge with electrons embedded throughout |
| 11 | Describe Rutherford's model of the atom | Dense, positive mass in the centre (the nucleus) |
| 12 | Describe the Neil's Bohr model of the atom | Positive nucleus orbited by negative electrons |
| 13 | Describe Chadwick's 'Nuclear Model' of an atom | Neutrons & protons in a +ve nucleus, -ve electrons in shells |
| 14 | What is the name for the current model of the atom? | Nuclear model |
| 15 | What 3 things did the alpha scattering experiment prove? | 1) Nucleus = positive (deflected & reflected +ve α particles) 2) Nucleus = dense mass in centre of atom, 3) Rest = empty space |
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|  | **Topic:** | **The periodic table (C.6)** |
| 1 | How are elements arranged in the periodic table? | In order of atomic number (lowest to highest) |
| 2 | What does the column (group) in the periodic table tells us? | Number of electrons in the outer shell |
| 3 | What are the rows of the periodic table called? | Periods |
| 4 | What did Mendeleev do when creating the modern periodic table? | Left gaps to make the pattern fit |
| 5 | Where are alkali metals found in the periodic table? | Group 1 |
| 6 | Where are non-metals found in the periodic table? | Right |
| 7 | Name the groups in the periodic table (1, 7, 0) | 1 = Alkali metals, 7 = Halogens, 0 = Noble gases |
| 8 | State 3 properties of group 7 | Non-metal, highly reactive, diatomic |
| 9 | What happens to reactivity as you move down group 7? | They become less reactive - it is harder to gain an electron |
| 10 | What is the name of the elements found in the middle of the periodic table that are not part of a group? | Transition metals |
| 11 | Give 4 properties of metals | 1) High melting point, 2) Good thermal and electrical conductors, 3) Ductile, 4) Malleable |
| 12 | Give 3 properties of non-metals | 1) Low melting point, 2) Poor thermal and electrical conductors, 3) Brittle |
| 13 | Give 5 properties of the alkali metals | 1) Highly reactive, 2) Low melting and boiling points, 3) Low density, 4) Shiny when cut, 5) Soft |
| 14 | What is formed when alkali metals react with water? | Alkaline metal hydroxide |
| 15 | What happens to reactivity as you move down group 1? | They become more reactive - it is easier to lose their outer electron. |
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|  | **Topic:** | **Types of bonding (C.7)** |
| 1 | Which type of bonding occurs between metals and non-metals? | Ionic |
| 2 | Which type of bonding occurs between non-metals? | Covalent |
| 3 | Which type of bonding occurs between metals? | Metallic |
| 4 | When electrons leave the shells of an atom, they are said to be ……? | Delocalised |
| 5 | Which type of ions are formed by metals? | Positive ions |
| 6 | Which type of ions are formed by non-metals? | Negative ions |
| 7 | What is graphene? | A single layer of graphite |
| 8 | What is a fullerene? | Hollow carbon structures |
| 9 | What is Buckminster Fullerene? | Spherical carbon shape with 60 carbon atoms |
| 10 | What is an allotrope? | Two or more different physical arrangements of the same atom e.g. diamond, graphite, graphene |
| 11 | What is a carbon nanotube? | A cylindrical fullerene with a very high length to diameter ratio |
| 12 | Describe what happens in ionic bonding | Electrons are transferred from a metal atom to a non-metal atom = strong electrostatic attraction between oppositely charged ions |
| 13 | Describe what happens in covalent bonding | Electrons are shared between atoms = strong electrostatic attraction between electrons and nucleus |
| 14 | Describe what happens in metallic bonding | Electrons become delocalised creating a sea of negative charge = strong electrostatic attraction with positive metal ions& sea of delocalised electrons |
| 15 | Why do noble gases not form compounds? | Because they already have a full outer shell of electrons |
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|  | **Topic:** | **Properties of materials (C.8)** |
| 1 | State two properties of simple covalent molecules | 1) Low melting & boiling point, 2) Poor conductor of thermal & electrical energy |
| 2 | State three properties of diamond | 1) Hard, 2) Poor electrical conductor, 3) Good thermal conductor |
| 3 | State two properties of graphite | 1) Soft & slippery, 2) Conducts electricity |
| 4 | State two properties of silicon dioxide | 1) Hard, 2) Doesn't conduct electricity |
| 5 | Why do metals and graphite conduct electricity? | Delocalised electrons can move through structure carrying electrical charge |
| 6 | Why do ionic compounds, metallic compounds and giant covalent compounds have high melting and boiling points? | Strong INTRAmolecular bonds/forces = difficult to move apart |
| 7 | Why do simple compounds have low melting and boiling points? | Weak INTERmolecular bonds/forces = easy to move apart |
| 8 | Why do ionic compounds conduct electricity when molten/aqueous? | Ions are free to move carrying charge |
| 9 | Name the structure that ionic bonding forms | Giant ionic lattice |
| 10 | State three examples of giant covalent structures | Diamond, graphite, silicon dioxide |
| 11 | Name the two types of structure that can be formed from covalent bonding | Simple covalent molecules, giant covalent structures |
| 12 | How are unreactive metals (e.g. gold) removed from their ore? | They are native (unreactive so don't form an ore) |
| 13 | How are metals LESS reactive than carbon removed from their ore? | They are reduced (reacted with) by carbon |
| 14 | How are metals MORE reactive than carbon removed from their ore? | Electrolysis |
| 15 | What is reduction & oxidation (in terms of electrons)? (HT only) | Oxidation = Is Loss of electrons, Reduction = Is Gain electrons, (OIL RIG) |
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|  | **Topic:** | **Describing chemical reactions, reactions of metals and gas tests (C.9)** |
| 1 | metal + oxygen -> | metal oxide |
| 2 | metal + water -> | metal hydroxide + hydrogen gas |
| 3 | metal + acid -> | metal salt + hydrogen gas |
| 4 | Define oxidation (in terms of oxygen) | Addition of oxygen to an element |
| 5 | Define reduction (in terms of oxygen) | Removal of oxygen from a compound |
| 6 | What is the law of conservation of mass? | No atoms are lost or made during a reaction (mass of reactants = mass of products) |
| 7 | acid + alkali (or base) -> | salt + water |
| 8 | If sulphuric acid reacts with a metal, what will the salt end in? | \_\_\_\_\_\_ sulphate |
| 9 | If nitric acid reacts with a metal, what will the salt end in? | \_\_\_\_\_\_\_\_ nitrate |
| 10 | metal carbonate + acid ->  | metal salt + water + carbon dioxide  |
| 11 | If hydrochloric acid reacts with a metal, what will the salt end in? | \_\_\_\_\_\_\_ chloride |
| 12 | What is the test for hydrogen gas? | A burning splint will make a squeaky pop |
| 13 | What is the test for carbon dioxide gas? | Limewater will turn cloudy |
| 14 | What is the test for oxygen gas? | A glowing splint will relight |
| 15 | What is the test for chlorine gas? | Damp litmus paper will be bleached and turned white |
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|  | **Topic:** | **Acids and Alkalis (C.10)** |
| 1 | Which ions make a solution alkaline? | OH- (hydroxide) |
| 2 | Which ions make a solution acidic? | H+ |
| 3 | Give 3 ways to measure the pH of a substance | Litmus paper, universal indicator, pH probe |
| 4 | What pH and colour is universal indicator in a strongly ACIDIC solution? | pH 1 - 3 (red) |
| 5 | What pH and colour is universal indicator in a strongly ALKALINE solution? | pH10-14 (purple) |
| 6 | What pH and colour is universal indicator in a weak ACID? | pH 4-6 (orange/yellow) |
| 7 | What pH and colour is universal indicator in a weak ALKALI? | pH8-9 (blue) |
| 8 | What colour is methyl orange in acid and alkali? | Red (acid), orange (alkali) |
| 9 | What colour is phenolphthalein in acids and alkali? | Colourless (acid), pink (alkali) |
| 10 | What is the difference between the solubility of alkalis and bases? | Alkalis are soluble and bases are insoluble |
| 11 | What is the definition of a) strong acid and b) weak acid? | a) Strong acid completely ionises (breaks down into its ions) in water, b) Weak acid partially ionises in water |
| 12 | Give 3 examples of a strong acid (H only) | Hydrochloric acid, sulphuric acid, nitric acid |
| 13 | List the steps in making a soluble salt | 1) Add solid to heated acid until no more reacts (in excess), 2) Filter excess solid, 3) Leave for 24hrs for water to evaporate (crystallisation), 4) Dab dry |
| 14 | State three examples of weak acids (H only) | Ethanoic acid, citric acid and carbonic acid |
| 15 | What does a decrease in pH by one-unit mean? (HT only) | The hydrogen ion concentration increases by a factor of 10 |
|  | **Topic:** | **Electrolysis (C.12)** |
| 1 | Define 'electrolysis' | A substance is decomposed (broken down) using electricity |
| 2 | Why can electrolysis only occur if an ionic substance is molten or aqueous? | The ions are free to move |
| 3 | What is the name of the negative and positive electrode? | Negative: CathodePositive: Anode |
| 4 | Which ions are attracted to the anode and which to the cathode? | Anode = negativeCathode = positive |
| 5 | Define "electrolyte" | Ions in a solution that are free to move and can conduct electricity |
| 6 | What happens when ions get to an electrode? | Gain or lose electrons becoming neutral atoms again |
| 7 | What happens at the anode? | Electrons transferred from the ion to the anode and the non-metal forms |
| 8 | What happens at the cathode? | Electrons transferred from the cathode to the ion and a metal is formed |
| 9 | When is hydrogen formed from an aqueous solution? | If the metal is MORE reactive than hydrogen |
| 10 | When is a metal (not hydrogen) formed from an aqueous solution? | If the metal is LESS reactive than hydrogen |
| 11 | State one use of electrolysis | Extracting a reactive metal from its ore |
| 12 | Which useful product could be removed from the solution left after electrolysis of dilute sodium chloride solution? | Sodium hydroxide (bleach) |
| 13 | What would be formed at the anode in electrolysis of dilute sodium chloride solution? | Chlorine gas |
| 14 | What would be formed at the cathode in electrolysis of dilute sodium chloride solution? | Hydrogen |
| 15 | When will oxygen be produced at the anode? | When the solution does NOT contain HALIDE ions. Otherwise the halogen is produced. |
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|  | **Topic:** | **Endothermic and exothermic reactions (C.14)** |
| 1 | Which type of reaction releases energy into the surroundings? | Exothermic |
| 2 | Which type of reaction absorbs energy from the surroundings? | Endothermic |
| 3 | In an exothermic reaction, what has more energy in it? The products or the reactants? | Reactants |
| 4 | In an endothermic reaction, what has more energy in it? The products or the reactants? | Products |
| 5 | Define "activation energy" | Minimum amount of energy that particles must collide with to react |
| 6 | Is energy released when bonds are broken or bonds are made? (HT only) | Made |
| 7 | Is energy absorbed when bonds are broken or bonds are made? (HT only) | Broken |
| 8 | What would happen to the temperature of the surroundings in an exothermic reaction? | Increase |
| 9 | What would happen to the temperature of the surroundings in an endothermic reaction? | Decrease |
| 10 | Give three examples of endothermic reactions | Thermal decomposition reactionsCitric acid + sodium hydrogen carbonate Sports injury packs |
| 11 | Give two examples of exothermic reactions | Self-heating cansHand warmers |
| 12 | What is the other name for an energy level diagram? | Reaction profile |
| 13 | What is the substance called that reduces the activation energy required by a reaction? | Catalyst |
| 14 | Do Exothermic or endothermic reactions require a bigger activation energy? | Endothermic |
| 15 | What is the unit for temperature? | Degrees Celsius |
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|  | **Topic:** | **Rates of reaction (C.17)** |
| 1 | What are the two equations for calculating mean rate of reaction? | mean ROR = quantity of reactant used/time take or quantity of product formed/time taken |
| 2 | If the mass of the product or reactant is given in grams, which unit should you use for the rate? | g/s |
| 3 | If the volume of the product or reactant is given in cm3, which unit should you use for the rate? | cm3/s |
| 4 | If the amount of the product or reactant is given in moles, which unit should you use for the rate? (HT only) | 0 |
| 5 | What does a steep gradient on a graph tell us about the rate of a reaction? | The rate of reaction is fast |
| 6 | What does a flat line (0 gradient) on a graph tell us about the rate of a reaction? | The reaction has stopped |
| 7 | What has a higher surface area? A powder or lumps of a substance | Powder because more particles are exposed and able to successfully collide |
| 8 | How does increasing concentration increase rate of reaction? | More particles -> more frequent successful collisions |
| 9 | How does increasing temperature increase rate of reaction? | Particles have more kinetic energy -> more collisions with activation energy |
| 10 | How does increasing pressure increase rate of reaction? | Particles closer together -> more frequent successful collisions |
| 11 | How does a catalyst increase rate of reaction? | Provides an alternative pathway for the reaction with a lower activation energy |
| 12 | What is activation energy? | The minimum amount of energy that particles must have to react |
| 13 | State 4 factors that affect rate of reaction | Pressure (in gases), concentration, temperature, a catalyst |
| 14 | How can you measure volume of gas produced? | Gas syringe |
| 15 | How can you use turbidity (cloudiness) to measure rate of reaction? | Record time for a cross to disappear |
|  |  |  |
|  | **Topic:** | **Chemical calculations, volumes and concentrations (C.19)** |
| 1 | State the 'law of conservation of mass' | No atoms are lost or made during a chemical reaction |
| 2 | The sum of the Mr of the reactants must equal | The sum of the Mr of the products |
| 3 | State one example of when a reaction may APPEAR to lose mass | When a gas is produced and escapes |
| 4 | State the value of Avogadro's constant (HT only) | 6.02 x 10 23  |
| 5 | State the equation to calculate moles from mass and Mr (HT only) | Moles (mol) = mass (g) /Mr |
| 6 | State how to calculate Mr (relative formula mass) | The sum of the Ar (atomic masses) of each atom |
| 14 | When a symbol equation is balanced, what is shown by the large numbers in front of a formula e.g. 2HCl? | The ratio of moles of each substance |
| 15 | What is the volume of 1 mole of any gas at room temperature and pressure? | 24dm3 |
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|  | **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 |
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**Required practicals**

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| --- | --- | --- | --- | --- | --- |
| **C1 – Making Salts** | **Big Question:** How do you prepare a pure, dry sample of a soluble salt from an insoluble salt?  | \*Dilute sulphuric acid\*Measuring cylinder\*Copper oxide powder\*Spatula\*Glass rod\*100cm3 beaker\*250cm3 beaker\*Bunsen burner\*Tripod\*Gauze\*Heatproof mat\*Filter funnel and paper\*Small conical flask\*Evaporating basin | 1. Measure 40cm3 of sulphuric acid and add to a beaker.
2. Heat the acid gently. Turn off the Bunsen burner.
3. Add copper oxide power to the acid until it stops reacting. Stir continuously.
4. Filter the solution to remove excess insoluble copper oxide
5. Pour the filtrate into an evaporating basin and heat gently over a water bath.
6. As soon as crystals start to form, leave the evaporating dish for 24 hours.
7. Pat the crystals dry between two pieces of filter paper.

Note: Evaporation is the changing of water from a liquid to a gas, crystallisation is the formatino of crystals from a concentrated subsance.Note: \*Carbonates tend to be insoluble \*Sulphates, nitrates, chlorides tend to be soluble | You will remove the insoluble black copper oxide from the mixture by filtering.You will remove the water through evaporation.Blue crystals of copper sulphate will form – the slower the cool, the larger they will be. These are TOXIC, do not ingest (eat). | Explain have lithium sulphate can be produced from lithium carbonate and sulphuric acid.Explain how to prepare an insoluble salt from a soluble salt - (react two soluble salts and a precipitate will form, filter, wash with water, then dry in an oven). |
| **C3 - Electrolysis** | **Big Question**: Investigate the products formed during electrolysis of an aqueous solution. | \*copper chloride solution\*sodium chloride solution\*100cm3 beaker\*Petri dish lid\*2 carbon electrodes\*2 crocodile clips\*low voltage power supply\*blue litmus paper\*forceps | 1. Pour approximately 50cm3 copper (II) chloride solution into the beaker.
2. Add the petri dish lid and insert the carbon rods through the holes. The rods must not touch each other.
3. Attach crocodile leads to the rods. Connect the rods to the dc terminals of a low voltage power supply.
4. Select 4 V on the power supply and switch on.
5. Look at both electrodes and record your observations.
6. Use forceps to hold a piece of blue litmus paper in the solution next to the anode. Record your observation.
7. Rinse the electrochemical cell apparatus and collect a new set of electrodes.
8. Repeat steps 1‒8 using the other solution sodium chloride.
 | CuCl2 solution will form copper at the cathode (-ve electrode) and chlorine at the anode (+ve electrode). This will bleach the litmus paper.NaCl will form hydrogen at the cathode (because it the metal is more reactive than hydrogen) and chlorine at the anode (positive electrode). | Investigate the products formed during electrolysis of aqueous copper sulphate.Describe how you would carry out electrolysis of molten zinc chloride. |
| **C4 – Temperature Changes** | **Big Question 1:** Investigate the variables that affect temperature changes in reacting solutions.IV: Volume of NaOHDV: Temperature changeCV: Volume of HCl | \*dilute hydrochloric acid\*dilute sodium hydroxide solution \*a polystyrene cup and lid\*250 cm3 beaker \*10 cm3 measuring cylinder\*50 cm3 measuring cylinder \*a thermometer | 1. Measure 30cm3 of dilute HCl and add it to the polystyrene cup.
2. Stand the cup inside the beaker
3. Use the thermometer to measure the temperature of the acid and record in a results table.
4. Add 5cm3 of NaOH solution, add the lid and stir gently.
5. When the temperature stops rising, record the temperature on the thermometer.
6. Repeat steps 4-5 adding a further 5cm3 each time until 40cm3 of NaOH has been added.
7. Wash out the equipment and repeat the experiment two more times so that you can remove anomalies and calculate an accurate mean.
 | Temperature should increase until the point where the same volumes of acid and alkali are added and then should decrease slightly as you are adding more cold alkali but not producing any more reactions (acid becomes the limiting reactant). | Investigate the temperature changes involved in the reaction between water and calcium chloride (exothermic).Investigate the temperature changes involved in the reaction between ethanoic acid and sodium carbonate (endothermic). |

**Physics**

**Mastery Matrix**

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| --- | --- | --- | --- | --- |
|  | **Course** | **Tier** | **Revision Guide (double)** | **Learning statement** |
| Energy Types | A | F | 172 | Describe ways in which energy can be transferred within a system |
| Energy Types | A | F | 170 | Describe ways to store energy |
| Energy Types | A | F | 170 | Describe the law of conservation of energy |
| Energy Types | A | F | 170 | Describe concepts of open and closed systems |
| Energy Types | A | F | 172 | Describe ways to reduce unwanted energy transfers |
| Energy Types | A | F | 172 | Link energy loss to insulation and thermal conductivity |
| Energy Types | A | F | 173 | Define renewable and non-renewable energy resources |
| Energy Types | A | F | 173 | Compare & contrast energy resources in terms of reliability, cost and political, environmental & social factors |
| Work, power and efficiency | A | F | 160 | Define and calculate work done using E=Pt and E=fd |
| Work, power and efficiency | A | F | 193 | Define and calculate power using P=VI and E = Pt |
| Work, power and efficiency | A | F | 193 | Describe examples of applications of power in everyday life |
| Work, power and efficiency | A | F | 195 | Use and rearrange both equations for calculating efficiency |
| Elastic Objects & potential energy | A | F | 160 | Describe elastic and inelastic deformation |
| Elastic Objects & potential energy | A | F | 160 | Explain the effect of forces on elastic objects |
| Elastic Objects & potential energy | A | F | 161 | Describe Hooke’s Law qualitatively and using the equation F = ke |
| Elastic Objects & potential energy | A | F | 161 | Explain ‘word done’ when applied to stretching or compressing a spring |
| Elastic Objects & potential energy | A | F | 160 | Explain the difference between a linear and a non-linear relationship |
| Elastic Objects & potential energy | A | F | 160 | Interpret data from a force extension investigation |
| Elastic Objects & potential energy | A | F | 161 | **RP Force and Extension:** Investigate the relationship between force and extension for spring (Hooke’s Law) |
| Elastic Objects & potential energy | A | F | 170 | Use the elastic potential energy equation (Ee=1/2ke2) |
| Elastic Objects & potential energy | A | F | 170 | Use and rearrange the equation for kinetic energy (Ek=1/2mv2) |
| Elastic Objects & potential energy | A | F | 170 | Use and rearrange the equation for gravitational potential energy (Eg=mgh) |
| Nuclear Physics  | A | F | 212 | Describe the structure and size of an atom |
| Nuclear Physics  | A | F | 212 | Calculate the number of protons, neutrons and electrons in an atom |
| Nuclear Physics  | A | F | 212 | Describe how electrons can change energy level |
| Nuclear Physics  | A | F | 212 | Describe isotopes |
| Nuclear Physics  | A | F | 212 | Describe what an ion is |
| Nuclear Physics  | A | F | 213 | Describe the development of the model of the atom (Plum-pudding, Rutherford, Neils Bohr and Chadwick). |
| Radioactive decay and Radiation | A | F | 214 | Describe what radioactive decay is |
| Radioactive decay and Radiation | A | F | 214 | Recall the definition and units for activity and count rate |
| Radioactive decay and Radiation | A | F | 215 | Describe what makes up alpha, beta, gamma and neutron radiation |
| Radioactive decay and Radiation | A | F | 214 | Describe the properties of each type of radiation |
| Radioactive decay and Radiation | A | F | 217 | Use nuclear equations to represent radioactive decay |
| Radioactive decay and Radiation | A | F | 216 | Define half-life |
| Radioactive decay and Radiation | A | F | 216 | Complete half-life calculations from graphs or other data |
| Radioactive decay and Radiation | A | F | 215 | Describe the impact and precautions for radioactive contamination |
| Radioactive decay and Radiation | A | F | 215 | Analyse data about the effects of radiation on people |
| Density | A | F | 210 | Use and rearrange ρ =m/v |
| Density | A | F | 210 | Draw simple diagrams to model the difference between solids, liquids and gases |
| Density | A | F | 210 | Link the arrangement of atoms and molecules to different densities of the states |
| Density | A | F | 210 | **RP Density:** Determine the densities of regular and irregular solid objects and liquids |
| Changes of state and latent heat | A | F | 210 | Describe how mass is conserved during changes of state |
| Changes of state and latent heat | A | F | 211 | Explain why changes of state are physical changes |
| Changes of state and latent heat | A | F | 170 | Define internal energy  |
| Changes of state and latent heat | A | F | 171 | Explain the effect of heating on the energy within a system and calculate energy change during a state change.  |
| Changes of state and latent heat | A | F | 211 | Describe ‘latent heat’ of a material including specific latent heat of fusion and specific latent heat of vaporisation |
| Changes of state and latent heat | A | F | 211 | Explain and calculate ‘specific latent heat’ using the E=mL |
| Changes of state and latent heat | A | F | 211 | Interpret heating and cooling graphs that include changes of state |
| Specific Heat Capacity | A | F | 211 | Explain the differences between ‘heat’ and ‘temperature’  |
| Specific Heat Capacity | A | F | 171 | Define and calculate specific heat capacity  |
| Specific Heat Capacity | A | F | 171 | Use and rearrange equations for calculating specific heat capacity |
| Specific Heat Capacity | A | F | 171 | **RP Specific Heat Capacity:** Investigate the specific heat capacity of materials |
| Specific Heat Capacity | A | F | 171+211 | Distinguish between specific heat capacity and specific latent heat |
| Gas Pressure and Fluid Pressure | A | F | 210 | Describe the motion of particles in a gas and relate this to pressure, kinetic energy and temperature |
| Gas Pressure and Fluid Pressure | A | F | 210 | Explain the relationship between temperature and pressure of a gas at constant volume |
| Electricity Introduction | A | F | 188 | Identify the key circuit symbols. |
| Electricity Introduction | A | F | 188 | Define current, charge and potential difference. |
| Electricity Introduction | A | F | 188 | Use and rearrange equations for calculating current. |
| Electricity Introduction | A | F | 188 | Predict the current at given points within a series and parallel circuit. |
| Electricity Introduction | A | F | 189 | Predict the potential difference (voltage) at given points within a series and parallel circuit. |
| Electricity Introduction | A | F | 189 | Describe the relationship between current, potential difference and resistance. |
| Electricity Introduction | A | F | 189 | Use and rearrange equations for calculating current, potential difference and resistance. |
| Electricity Introduction | A | F | 189 | Recall units for current, potential difference and resistance. |
| Series and Parallel Circuits | A | F | 192 | Compare and contrast series and parallel circuits in terms of current and potential difference. |
| Series and Parallel Circuits | A | F | 192 | Calculate resistance in series circuits and describe resistance in parallel circuits.  |
| Series and Parallel Circuits | A | F | 189 | **RP Resistance:** Use circuit diagrams to set up circuits to investigate the factors affecting resistance (length of a wire at constant temperature and combinations of resistors in series and parallel.) |
| Ohmic/Non-ohmic and types of resistors | A | F | 191 | Describe the relationship between current and potential difference in ohmic conductors.  |
| Ohmic/Non-ohmic and types of resistors | A | F | 191 | Explain how resistances change in thermistors and LDRs.  |
| Ohmic/Non-ohmic and types of resistors | A | F | 191 | List the applications of thermistors and LDRs.  |
| Ohmic/Non-ohmic and types of resistors | A | F | 191 | Interpret graphs to determine whether relationships are linear or non-linear.  |
| Ohmic/Non-ohmic and types of resistors | A | F | 190 | **RP I-V Characteristics:** Investigate V-I characteristics using circuits.  |
| Mains electricity | A | F | 194 | Describe the properties of mains electricity in the UK (A.C., Frequency and Voltage) |
| Mains electricity | A | F | 194 | Explain the difference between direct and alternating potential difference |
| Mains electricity | A | F | 194 | Describe the three core cables and the wires that they are made up of and the dangers of these |
| Energy and Power of Electricity | A | F | 193 | Use and rearrange the P=IV equation (electrical power) |
| Energy and Power of Electricity | A | F | 193 | Use and rearrange the P=I2R equation (electrical power) |
| Energy and Power of Electricity | A | F | 196 | Describe energy transfers in electrical appliances |
| Energy and Power of Electricity | A | F | 195 | Use and rearrange E=Pt |
| Energy and Power of Electricity | A | F | 196 | Use and rearrange E=QV |
| Energy and Power of Electricity | A | F | 193 | Explain how the power of a circuit is related to potential difference, current and energy |
| The National Grid | A | F | 197 | Describe the components of the national grid |
| The National Grid | A | F | 197 | Explain the role of step up and step down transformers in the national grid and use this to explain why it is an efficient system for transferring energy |

**Knowledge organiser:**

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|  | **Paper:** | **P1** |
|  |  |
| **Topic:** | **Energy Types (P.1)** |
| 1 | What type of energy do all moving objects have? | Kinetic energy |
| 2 | The law of conservation of energy states what three things that can happen to energy | Transferred usefully, stored or dissipated |
| 3 | Which word means 'wasted into the surroundings'? | Dissipated |
| 4 | When energy is wasted, it is usually which energy types? | Thermal and sound |
| 5 | The law of conservation of energy states that which two things cannot happen to energy? | Created or destroyed |
| 6 | What can be done to moving parts in a system to reduce heat loss by friction? | Lubrication (adding oil/grease) |
| 7 | What name is given to a material which does not conduct thermal energy well? | Thermal insulator |
| 8 | What name is given to a material which allows thermal energy to pass through it easily? | Thermal conductor |
| 9 | What is the unit for energy? | Joules (J) |
| 10 | What type of heat transfer travels through solids? | Conduction |
| 11 | What type of heat transfer happens only in fluids (gas and liquids)? | Convection |
| 12 | Which is the only type of thermal energy transfer can occur in a vacuum? | Radiation |
| 13 | Which dissipates less thermal energy? Thin walls or thick walls?  | Thick |
| 14 | Which dissipates less thermal energy? Walls with large or small area | Small |
| 15 | Which dissipates less thermal energy? Large or small temperature difference | Small |
|  |  |  |
|  | **Topic:** | **Work power and efficiency (P.2)** |
| 1 | Equation for work done. | Work done =Force x distance |
| 2 | Units for work done. | Joules (J) |
| 3 | What is work done? | Energy transferred. |
| 4 | Units for power. | Watts (W) |
| 5 | Equation for power. | Power = Energy transferred/time |
| 6 | Units for time.  | seconds (s) |
| 7 | Define power. | Rate at which energy is transferred. |
| 8 | One watt is the same as… | 1 joule per second. |
| 9 | Equation for efficiency in terms of energy | efficiency = useful output energy transfer/total input energy transfer |
| 10 | Equation for efficiency in terms of power | efficiency = useful output power/total input power |
| 11 | Units for efficiency | No units  |
| 12 | Units for force | Newtons (N) |
| 13 | One Joule is the same as… | one Newton-metre |
| 14 | The minimum value of efficiency | 0 |
| 15 | The maximum value of efficiency | 1 |
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|  | **Topic:** | **Elastic objects and potential Energy (P.3)** |
| 1 | What is the equation for elastic potential energy? | Ee=1/2ke2Elastic potential energy (J) = 1/2 x spring constant (N/m) x extension (m) |
| 2 | What is the equation for kinetic energy? | Ek = 1/2 mv2Kinetic energy (J) = 1/2 x mass (Kg) x velocity2 (m/s) |
| 3 | What is the equation for gravitational potential energy? | Eg=mghGravitational potential energy (J) = mass (kg) x gravitational field strength (N/kg) x height (m) |
| 4 | Which equation describes Hooke's Law? | F = keForce (N) = spring constant (N/m) x extension (m) |
| 5 | What type of energy is stored in a stretched elastic band? | Elastic potential energy |
| 6 | What type of energy is stored in a squashed up tennis ball? | Elastic potential energy |
| 7 | What needs to be applied for an object to change shape? | A force |
| 8 | Define the term for an object returning to its original shape after being stretched | Elastic deformation |
| 9 | Define the term for an object not returning to its original shape after being stretched | Inelastic deformation |
| 10 | Identify the Law: "The extension of a spring is directly proportional to the force applied to it." | Hooke's Law |
| 11 | What sort of energy is stored in a bungee cord? | Elastic potential energy |
| 12 | What do you call the point at which Hooke's Law no longer applies? | The limit of proportionality |
| 13 | In a graph of Hooke's Law, what happens at the limit of proportionality? | Line no longer straight, it will curve  |
| 14 | What is the equation for "gravitational potential energy"? | Eg = mgh |
| 15 | What is the equation for Kinetic Energy? | Ek=1/2mv2 |
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|  | **Topic:** | **Nuclear physics (P.21)** |
| 1 | What is the size of the atom? | 1 x 10-10m |
| 2 | Which two sub atomic particles are found in the nucleus? | Protons and neutrons |
| 3 | What is the radius of nucleus compared to radius of atom?  | 1/10000 of the size (one ten thousandth of the size) |
| 4 | Electrons go up an energy level when… (HT only) | They absorb electromagnetic radiation.  |
| 5 | Electrons move down an energy level when… (HT only) | They emit electromagnetic radiation.  |
| 6 | Are atoms positive, negative or neutral? | Neutral |
| 7 | What is the atomic number? | Number of protons |
| 8 | What is the mass number? | Number of protons AND neutrons.  |
| 9 | What is an "ion"? | A charged atom (lost or gained electrons) |
| 10 | What are isotopes? | Atoms of the same element with the SAME number of protons but a DIFFERENT number of neutrons. |
| 11 | Describe the plum pudding model | The atom is a ball of positive charge with negative electrons embedded in it |
| 12 | What is the name of the current model of the atom?  | Nuclear model |
| 13 | State two conclusions from the alpha scattering experiment | 1) mass of an atom is concentrated in a nucleus in the centre2) nucleus is positive |
| 14 | State the conclusion provided by Niels Bohr | Electrons orbit the nucleus |
| 15 | State the conclusion provided by James Chadwick | Discovered neutrons |
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|  | **Topic:** | **Radioactive decay and radiation (P.22)** |
| 1 | What two words can we use to describe the process of radioactive decay? | Random and unpredictable |
| 2 | What is the word to describe the rate at which a source of unstable nuclei decays | Activity |
| 3 | What is the word to describe the number of decays recorded each second by a detector | Count rate |
| 4 | What is the equipment for measuring radiation?  | Geiger-Muller tube |
| 5 | Name the four types of nuclear radiation | alpha particle, beta particle, gamma ray, neutron |
| 6 | Describe the structure of an alpha particle | 2 neutrons & 2 protons (helium nucleus) |
| 7 | What is a beta particle? | A negative electron |
| 8 | What is a gamma ray? | An electromagnetic wave |
| 9 | Three main types of radiation in order of high to low ionising power.  | alpha, beta, gamma |
| 10 | Three main types of radiation in order of high to low penetrating power.  | gamma, beta, alpha |
| 11 | Which materials are able to stop each type of radiation? | Alpha = paper, beta = aluminium, gamma = nothing, thick lead absorbs some of it |
| 12 | Distances alpha, beta and gamma can go in air. | Alpha: 3-5cm, Beta: 15cm, Gamma: several metres.  |
| 13 | Define "irradiation" | Exposing an object to nuclear radiation. The irradiated object does not become radioactive. |
| 14 | Define "half-life" | The time it takes for the number of unstable nuclei of the isotope in a sample to halve |
| 15 | Define "radioactive contamination" | The unwanted presence of radioactive atoms on other materials |
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|  | **Topic:** | **Background decay and radiation (P.23)** |
| 1 | State two natural sources of background radiation | Rocks and cosmic rays |
| 2 | State two man made sources of background radiation | Fallout from nuclear weapons testing, nuclear accidents |
| 3 | Define 'background radiation' | Radiation around us all the time.  |
| 4 | Define 'radiation dose' | The amount of radiation that is absorbed by a person (Sv) |
| 5 | Would a long or short half-life radioactive material be more dangerous in the long term? | Long half-life material.  |
| 6 | State 2 medical uses of nuclear radiation | Exploring internal organs, control/destruction of unwanted tissue. |
| 7 | Why is using nuclear radiation to treat a tumour a risk? | The radiation might cause a tumour |
| 8 | Give an example of an internal organ that would be explored with radiation | Intestines - to look for blockages.  |
| 9 | Would you use a short or long half-life material for using a tracer in the intestine? | Short - an hour or so - you don't want to leave the hospital if you are still give out high levels of radiation.  |
| 10 | What kind of radiation is used to look at internal organs? | Beta |
| 11 | Why can't alpha be used to look at internal organs? | Stopped by skin |
| 12 | What kind of radiation is used to destroy tumours? | Gamma rays (sometimes beta) |
| 13 | Why is gamma used to destroy tumours? | Most ionising & can penetrate the skin and bones  |
| 14 | Why is a long half-life material high risk? | It will still be giving out radiation in years to come |
| 15 | State 2 factors that affect the amount of background radiation people are exposed to  | Occupation (job) & location |
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|  | **Topic:** | **Nuclear fission and fusion (P.24)** |
| 1 | Define 'Nuclear fission' | Splitting a large & unstable nucleus.  |
| 2 | State 2 examples of elements that undergo fission.  | Uranium & plutonium |
| 3 | Spontaneous fission is rare. What usually causes fission? | An unstable nucleus absorbs a neutron |
| 4 | State the 3 products of nuclear fission | 2 smaller nuclei, 2 or 3 neutrons, gamma rays |
| 5 | In what form is energy released in a fission reaction? | Gamma rays |
| 6 | How do the sizes of the two nuclei produced in a fission reaction compare? | Roughly the same size.  |
| 7 | The nuclei and neutrons produced have after a fission reaction have \_\_\_\_\_\_\_\_\_\_\_\_\_? | Kinetic energy |
| 8 | What is a chain reaction?  | Neutrons from a fission reaction are absorbed by another nucleus & start another fission reaction |
| 9 | How is a fission reaction in a nuclear power station controlled? | Control rods absorb neutrons (slow down the chain reaction) |
| 10 | In a nuclear weapon, is the chain reaction controlled or uncontrolled? | Uncontrolled.  |
| 11 | Define 'nuclear fusion' | The joining of two light nuclei to form a heavier nucleus with some mass converted to energy.  |
| 12 | Where does nuclear fusion happen? | In stars e.g. the sun.  |
| 13 | Why does nuclear fusion happen in the sun? | High temperature & pressure |
| 14 | Why does fusion need a high temperature and pressure? | To overcome the repulsion force between the 2 positive nuclei |
| 15 | State two elements that undergo nuclear fusion | Hydrogen and helium |
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|  | **Topic:** | **Density (P.25)** |
| 1 | State the equation for density |  ρ =m/vDensity (kg/m3) = mass (kg) / volume (m3) |
| 2 | State the units for density | Kilograms per metre cubed (kg/m3) |
| 3 | State the units for volume | Meters cubed, (m3) |
| 4 | How do you calculate the volume of a cube? | V = lxlxl or l3Volume (m3) = length (m) x length (m) x length (m) |
| 5 | How do you calculate the volume of a cuboid? | V = l x w x hVolume (m3) = length (m) x width (m) x height (m) |
| 6 | State two drawbacks of the particle model | 1) assumes particles are all small solid spheres 2) doesn't show bonds between atoms |
| 7 | Describe the particle model of solids | Particles all touching (bonded) in rows |
| 8 | Describe the particle model of liquids | Particles randomly placed, almost all particles touching. |
| 9 | Describe the particle model of gases | Particles placed randomly, none or very few touching.  |
| 10 | Name the five changes of state | Sublimation, condensing, boiling, freezing and melting |
| 11 | Describe the state change in sublimation | Solid to gas |
| 12 | How do the particles move in a solid? | Vibrate in a fixed position |
| 13 | How do you calculate the density of an irregular shape? | Submerge in water to calculate the volume, use a balance to measure the mass. |
| 14 | How do you calculate the density of a regular shape? | Calculate the volume using l x b x h, use a balance to measure the mass |
| 15 | How do the particles move in a gas? | Randomly, in all directions |
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|  | **Topic:** | **Changes of state, latent heat and specific heat capacity (P.26)** |
| 1 | Define 'conservation of mass' | Total mass is the same before and after a reaction |
| 2 | Why does temperature not change during a state change? | Energy used to make/break bonds increasing the internal energy not temperature |
| 3 | Define "internal energy" | Energy stored inside a system by the particles |
| 4 | How do we calculate internal energy? | Sum kinetic and potential energy of all particles |
| 5 | How does heating affect the internal energy of a system? | It increases it |
| 6 | State the equation for change in thermal energy | ∆ E = m c ∆ θChange in energy (J) = mass (kg) x specific heat capacity (J/Kg°C) x change in temperature (°C) |
| 7 | State the units for specific heat capacity | Joules per kilogram per degree Celsius, J/kg °C |
| 8 | Define "specific heat capacity" | Amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius. |
| 9 | Define "latent heat"  | The energy needed for a substance to change state |
| 10 | Define "specific latent heat of vaporisation"  | The amount of energy required to boil one kilogram of the substance with no change in temperature |
| 11 | Define "specific latent heat of fusion" | The amount of energy required to freeze one kilogram of the substance with no change in temperature |
| 12 | Equation for specific latent heat.  | E = m LEnergy (J) = mass (kg) x specific latent heat (J/kg) |
| 13 | State the units for specific latent heat | Joules per kilogram, J/kg |
| 14 | Describe the key property of a substance with a high specific heat capacity  | Will store a lot of energy per kilogram |
| 15 | What does a flat section on a heating and cooling graph represent? | Changes of state |
|  | **Topic:** | **Gas and fluid pressure (paper 1) (P.27)** |
| 1 | Describe the motion of particles in a gas. | Random movement |
| 2 | How do we determine the temperature of a gas? | Average kinetic energy of the molecules |
| 3 | State two factors that will influence gas pressure | 1) temperature, 2) volume |
| 4 | If a gas is held at a constant volume, describe the relationship between temperature and pressure | Directly proportional |
| 5 | Why does increasing temperature increase the pressure of a gas (if held at a constant volume)? | Particles collide with the side of the container: (a) more frequently and (b) with more energy |
| 13 | Gas pressure causes a force at \_\_\_degrees to the container wall.  | 90 |
| 14 | State 2 factors that increase when work is done on a gas | Internal energy and temperature |
| 15 | State a situation where doing work on a gas increases the temperature | Bicycle pump |
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|  | **Topic:** | **Electricity introduction (P.29)** |
| 1 | What does LED stand for? | Light emitting diode. |
| 2 | What does LDR stand for?  | Light dependent resistor. |
| 3 | State the equation for charge flow | Q=ItCharge flow © = current (A) x time (S) |
| 4 | State the units for charge flow | Coulombs (C) |
| 5 | Define 'electrical current' | Flow of electrical charge |
| 6 | What do the symbols I, t and Q represent? | I - current, t - time, Q - charge flow.  |
| 7 | State the units for resistance | Ohms (Ω) |
| 8 | How does resistance affect current? | The higher the resistance, the lower the current (inversely proportional) |
| 9 | What is an ohmic conductor? | Electrical component where current and voltage are DIRECTLY PROPORTIONAL |
| 10 | What is a non-ohmic conductor? | Electrical component where current and voltage are NOT directly proportional |
| 11 | Write Ohm's law as an equation | V=IR |
| 12 | Units for potential difference. | Volts (V) |
| 13 | State the units for current. | Amperes (A) |
| 14 | Which piece of equipment is used to measure current in a circuit? | Ammeter |
| 15 | Which piece of equipment is used to measure voltage in a circuit? | Voltmeter |
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|  | **Topic:** | **Series and parallel circuits (P.30)** |
| 1 | Do series circuits have one loop or multiple loops? | 1 loop |
| 2 | Do parallel circuits have one loop or multiple loops? | Multiple loops |
| 3 | Describe the distribution of current in a series circuit | It is the same everywhere |
| 4 | Describe the distribution of potential difference in a series circuit | Split between components |
| 5 | Describe the distribution of current in a parallel circuit | Split up in the different loops |
| 6 | Describe the distribution of potential difference in a parallel circuit | The same in each loop |
| 7 | Name the component used to measure current  | Ammeter |
| 8 | Name the component used to measure voltage  | Voltmeter |
| 9 | Are voltmeters connected in series or parallel? | in parallel |
| 10 | Are ammeters connected in series or parallel? | In series |
| 11 | State the equation for calculating resistance in a series circuit | Rtotal = R1 +R2 |
| 12 | How do you calculate total resistance in a series circuit? | Sum the resistance of each component |
| 13 | What affect does adding resistors have in a series circuit on the resistance? | Increases the total resistance |
| 14 | What affect does adding resistors have in a parallel circuit on the resistance? | Decreases the total resistance |
| 15 | Equation for resistance in a parallel circuit: | 1/Rtotal = 1/R1 + 1/R2 |
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|  | **Topic:** | **Ohmic/non-ohmic types of resistors (P.31)** |
| 1 | In ohmic components, which two variables are directly proportional? | Current and potential difference |
| 2 | If current and potential difference are directly proportional, what does this tell us about the resistance? | It is constant (gradient on IV graph).  |
| 3 | Sketch an IV graph for an ohmic conductor  | Image result for properties of a filament lamp |
| 4 | Sketch a graph an IV for a filament bulb.  | Image result for filament bulb iv graph |
| 5 | Sketch a graph an IV graph for a diode.  | Image result for graph of a diode |
| 6 | Name 4 non-ohmic conductors | Filament bulb, diodes, thermistors, LDRs |
| 7 | Why are filament light bulbs non-ohmic? | Current ↑, temperature ↑, resistance ↑ |
| 8 | Describe the relationship between current and potential difference for a diode.  | Current only flows in one direction (has a very high resistance in the other direction) |
| 9 | Describe the relationship between temperature and resistance in a thermistor. | Temperature ↑, resistance ↓ |
| 10 | State one use of a thermistor | Thermostat |
| 11 | Describe the relationship between light intensity and resistance in an LDR | Light intensity ↑, resistance ↓ |
| 12 | State a use of an LDR | Switching lights on when it gets dark e.g. street lamps.  |
| 13 | Draw the symbol of a resistor.  | See the source image |
| 14 | Symbol of a variable resistor.  | https://upload.wikimedia.org/wikipedia/commons/thumb/7/76/Variable_resistor_symbol_Europe.svg/2000px-Variable_resistor_symbol_Europe.svg.png |
| 15 | Symbol of LDR | http://classconnection.s3.amazonaws.com/599/flashcards/1562599/png/screen_shot_2013-05-16_at_115849-13EAD00F21C1055791A.png |
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|  | **Topic:** | **Mains electricity (P.32)** |
| 1 | Is mains electricity AC or DC? | AC |
| 2 | What do AC and DC mean? | Alternating currentDirect current.  |
| 3 | State the frequency of UK mains supply | 50Hz |
| 4 | State the potential difference of UK mains supply  | 230V |
| 5 | What are the names of the three wires in a three core cable | Live, neutral, earth.  |
| 6 | State the colour of a)earth wire, b)live wire, c) neutral wire | a)Green and yellow stripes, b)brown, c)blue |
| 7 | State the function of the live wire. | Carries alternating potential difference from the supply |
| 8 | State the function of the neutral wire.  | Completes the circuit |
| 9 | Function of the earth wire.  | Safety wire to remove excess potential difference (to stop the appliance becoming live) |
| 10 | State the potential difference between the live wire and earth wire.  | 230V |
| 11 | State the potential difference of the neutral wire.  | At or close to 0V |
| 12 | State the potential difference of the earth wire.  | 0V unless there is a fault.  |
| 13 | State the equation for electrical power (that uses potential difference) | P= IV |
| 14 | State two things that affect the amount of energy an appliance transfers | Power and time(E=Pt) |
| 15 | State the equation we use to calculate the energy transferred by a device that uses charge flow | E = QV |
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|  | **Topic:** | **Energy and power of electricity and the National Grid (P.33)** |
| 1 | State the equation that links current, potential difference and power | P = IVpower (W) = current (I) x potential difference (V) |
| 2 | State the equation that links current, power and resistance | P = I2RPower (W) = current2 (A) x resistance (Ω) |
| 3 | State the two most commonly wasted forms of energy | Thermal and sound |
| 4 | When energy is wasted, what happens to it? | It is dissipated into the environment |
| 5 | State the equation that links time, energy and power | E=Ptenergy (J) = power (W) x time (s) |
| 6 | State the equation that links energy, potential difference and charge flow | E = QVenergy (J) = charge flow (C) x potential difference (V) |
| 7 | What is the national grid composed of? | Cables and transformers linking power stations to consumers.  |
| 8 | What is the national grid used for? | Supplying electrify to houses |
| 9 | State the effect of step up transformers on potential difference | Increases p.d. |
| 10 | State the effect of step down transformers on potential difference | Decreases p.d. |
| 11 | State the effect of step up transformers on current. | Decreases current.  |
| 12 | State the effect of step down transformers on current. | Increases current.  |
| 13 | Why are step up transformers used? | To reduce energy loss from cables (thermal) |
| 14 | Why are step down transformers used? | To reduce the potential difference to make it safe for domestic use.  |
| 15 | Why is the national grid efficient? | Transformers reduces heat loss from wires when electricity travels long distances |
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| **P1 – Specific Heat Capacity** | **Big Question 1:** Determine the specific heat capacity of a materialIV: MaterialDV: Temperature changeCV: Energy input, time, mass of the block | \*3 metal blocks (copper, iron, aluminium)\*a thermometer\*a pipette to put water in the thermometer hole\*a 12 V immersion heater\*a 12 V power supply \*an ammeter and a voltmeter\*five connecting leads \*a stop clock\*a balance. | 1. Measure the mass of the copper block using the top pan balance.
2. Wrap insulation around the block.
3. Place the heater in the larger hole in the block
4. Connect the ammeter and power pack and heater in series and the voltmeter in parallel across the heater.
5. Use a pipette to add a small amount of water to the other hole and put the thermometer in this hole.
6. Set the power pack to 12V and turn it on.
7. Record the ammeter and voltmeter readings
8. Measure the temperature of the copper block and start the stop clock.
9. Record the temperature every minute for 10 minutes.
10. Record your results and use this to calculate the specific heat capacity of the copper block.
11. Repeat with the iron and aluminium blocks.
 | Aluminium has the highest SHC and copper the lowest. *The energy required to raise 1kg of a substance by 1 degree Celsius. Substances with high specific heat capacity take a long time to heat up but also a long time to cool down.*  | You will be required to calculate power and then use this to work out energy.You will also need to work out the gradient from a graph of work done vs temperature change. |
| **P3 - Resistance** | **Big Question 1**: Investigate the effect of the length of a wire on resistanceIV: Length of wireDV: ResistanceCV: Thickness of the wire**Big Question 2**: Investigate the effect of different combinations of resistors in series and in parallel. | **Big Question 1:**\*a power supply\*ammeter \*voltmeter \*crocodile clips \*resistance wire \*metre rule \*connecting leads \*a battery or suitable power supply \*a switch \*ammeter \*voltmeter \*crocodile clips \*two 10 Ω resistors \*connecting leads | **Big Question 1:**1. Set up the circuit as shown in the diagram below.
2. Place the crocodile clips A and B 10cm apart on the wire.
3. Turn on the power pack and measure the readings for the voltmeter and ammeter at this distance.
4. Turn off the power pack so that the wire does not overheat.
5. Move the crocodile clips so that they are 20cm, 30cm, 40cm and 50cm apart and repeat steps 3 & 4.
6. Calculate resistance for each length of wire.
7. Repeat the experiment three times and remove any anomalies so that you can calculate an accurate mean.

**Big Question 2:**1. Set up the circuit as shown below.
2. Switch on and record the readings on the ammeter and the voltmeter.
3. Calculate the total resistance of the series circuit.
4. Set up the circuit for two resistors in parallel.
5. Calculate the total resistance of the parallel circuit.
 | **Big Question 1:**As length of wire increases, resistance should increase in a directly proportional relationship. This is because there are more ions for the electrons to collide with.**Big Question 2:**Total resistance in the series circuit should be approximately 20Ω.Total resistance in the series circuit should be less than 10Ω. | Investigate the relationship between thickness of a wire and resistance.Investigate the resistance of individual resistors in a series and parallel circuit. |
| **P4 – IV characteristics & Ohms’ Law** | **Big Question:** Use circuits to investigate the I-V characteristics of a filament lamp, diode and a resistor. | **Filament light bulb/resistor:**\*ammeter \*voltmeter \*wires \*filament lamp\*variable power pack\*resistor**Diode:**\*Milliammeter \*voltmeter \*wires \*diode\*variable power pack\*resistor labelled P | **A filament light bulb/resistor:**1. Use the circuit diagram to set up your circuit.
2. Record the readings on the ammeter and voltmeter.
3. Adjust the voltage on the power pack.
4. Repeat the reading on the ammeter and voltmeter.
5. Switch the wires around on the power pack so that the current is flowing in the opposite direction.

1. Continue to vary the voltage and record the readings on the ammeter and voltmeter.
2. Repeat the experiment but swapping the filament light bulb for a resistor.

**A diode:**1. Lower the potential difference to less than 5V.
2. Set up the circuit as shown to the right.
3. Record the readings on the milliammeter and voltmeter.
4. Adjust the potential difference several times to collect several pairs of readings.
5. Swap the wires so that the current flows in the opposite direction and take 4 more pairs of readings.
 | Use the results to draw a graph to show the characteristics of each component.**Filament Bulb:**Image result for filament bulb iv graph**Resistor:**Image result for properties of a filament lamp**Diode**:Image result for graph of a diode |  |
| **P5 – Density** | **Big Question:** Determine the density of regular and irregularly shaped objects. | **Regular objects:**\*various regular shaped objects \*30cm ruler\*digital balance**Irregular objects:**\*a digital balance \* a displacement can \* various measuring cylinders\*beaker of water and an extra empty beaker \*paper towels \*a selection of irregularly shaped objects.**A liquid**\*a digital balance\*a 100cm3 measuring cylinder\*sugar solution of unknown concentration | **Regular objects:** 1. Calculate the volume of the object using length x width x height.
2. Record the mass of the object using the top pan balance
3. Calculate the density by dividing mass by volume.

**Irregular objects:**1. Measure the mass of the irregular shaped object using a top pan balance.
2. Put the displacement can on a wooden block with the spout above an empty beaker.
3. Fill the can with water until the water drips from the spout.
4. Replace the beaker with the measuring cylinder which will give the most accurate reading.
5. Place the object into the displacement can until it is completely submerged.
6. Collect the water and this will give you the volume of the object.
7. Divide this by the object’s mass to give the density.

**A liquid:**1. Measure the mass of an empty measuring cylinder.
2. Add 100cm3 of sugar solution into it and record the mass.
3. Use this to calculate the mass of the liquid (total mass – mass of measuring cylinder).
4. Then calculate the liquid’s density by doing mass/volume.
 | Solids should be denser than liquids/porous objects. | You may be asked to identify an object by calculating its density and then looking it up on a density table. |