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| **C2a** | **The** **Structure of the Earth** |  | **C2a** | **The Structure of the Earth** |
| 1 | Describe the structure of the Earth |  | 1 | A sphere with a thin rocky crust, mantle and core. |
| 2 | What is the middle of the earth made of? |  | 2 | The core contains iron |
| 3 | What causes volcanoes and earthquakes? |  | 3 | The movement of the tectonic plates. |
| 4 | How fast do plates move? |  | 4 | About 2.5 cm a year. |
| 5 | What happens if you add up all the plate movements over millions of years? |  | 5 | You get continental drift; the continents move around very slowly, India was once part of Africa. |
| 6 | What theory is now used for plate movements? |  | 6 | Plate tectonics is now widely accepted by scientists. |
| 7 | Describe the outer layer of the Earth |  | 7 | Oceanic plates under oceans, continental plates under continents. |
| 8 | What is the lithosphere? |  | 8 | The cold hard bit at the surface, the crust and the top of the mantle. |
| 9 | Why do plates float? |  | 9 | These huge slabs of rock are less dense than the mantle so they float on it. |
| 10 | Why is studying the Earth’s structure difficult? |  | 10 | We can only drill so far in; the rest is based on seismology, the study of sound waves in the rock that are caused by explosions or earthquakes. |
| 11 | Why is plate tectonics now a widely accepted theory? |  | 11 | It explains a wide range of evidence; it has been discussed/ tested by a wide range of scientists. |
| **H12** | **Describe the mantle.** |  | **H12** | **The bit between the crust and the core, a semi-solid that is hotter and runnier at the bottom.** |
| **H13** | **What provides the energy for plate tectonics?** |  | **H13** | **Radioactive processes in the core give heat to the mantle. Convection currents then cause the plates to move slowly.** |
| **H14** | **When plates meet, what goes where?** |  | **H14** | **Oceanic plates are more dense than continental so in destructive collisions there is subduction and partial re-melting of the oceanic plates.** |
| **H15** | **At the ocean margins, what goes where?** |  | **H15** | **Plates are cooler at ocean margins and so they sink and pull plates down.** |
| **H16** | **How did the idea of plate tectonics begin?** |  | **H16** | **In 1914 Alfred Wegener proposed continental drift, that the continents were moving, based on evidence from maps and geology. Scientists did not accept this at first.** |
| **H17** | **What other evidence was found that provided evidence for plate tectonics?** |  | **H17** | **New evidence in 1960s, sea floor spreading. The theory of plate tectonics was slowly accepted by the scientific community as subsequent research has supported the theory.** |
| 18 | How does magma get to the surface? |  | 18 | Through cracks and weaknesses in rock. |
| 19 | Why does magma rise to the surface? |  | 19 | It is less dense than the rock around it. |
| 20 | How is igneous rock formed? |  | 20 | When molten rock cools. |
| 21 | What is magma anyway? |  | 21 | Molten rock under the earth |
| 22 | What is lava then? |  | 22 | Molten rock that escapes from volcanoes. |
| 23 | Are there different kinds of lava? |  | 23 | Yes, thick and explosive or quick and runny |
| 24 | What causes different sized crystals in igneous rock? |  | 24 | Different cooling times, fast cooling gives small crystals. Basalt cools quickly and has tiny crystals. Rhyolite/Granite cools slowly, larger crystals. Gabbro cools very slowly, huge crystals. |
| **H25** | **How does the type of lava affect the eruption?** |  | **H25** | **Iron-rich basalt lava is runny and fairly safe. Silicon-rich rhyolite is often explosive.** |
| 26 | Why do people live by volcanoes? |  | 26 | Rich soils, fertile soils. |
| 27 | Why do geologists study volcanoes? |  | 27 | To predict earthquakes, to study earth structure. |
| **H28** | **How accurate are eruption predictions? Why?** |  | **H28** | **Better but not 100% accurate. We have greater understanding and can make better analysis.** |
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| **C2b** | **Construction Materials** |  | **C2b** | **Construction Materials** |
| 1. | Name some construction materials |  | 1. | Aside from the four in Q2, concrete, plaster, rock |
|  | What are the following made from;   1. Aluminium and iron 2. Brick 3. Glass |  |  | Aluminium from Bauxite ore, iron from Haematite ore.  Brick is made from clay  Glass is made from sand |
| 2 | Name three rocks used in building. |  | 2 | Granite, Limestone, marble |
| 3 | What problems can quarrying rocks cause? |  | 3 | Destruction of the landscape  Use of lots of land  Increased noise, traffic and dust,  Reconstruction after quarrying |
| 4 | How do the limestone, marble and granite compare in hardness? |  | 4 | Granite is harder than Marble, which is harder than limestone. |
| **H5** | **Why is there such a difference in the hardness of the rocks from question 4?** |  | **H5** | **Granite is an igneous rock, marble is a crystallised sedimentary rock, and Limestone is sedimentary.** |
| 6 | What is the chemical name of limestone/Marble? |  | 6 | Calcium carbonate |
| 7 | 1. What happens when Limestone is heated above 1000’C? 2. What is the word equation for this reaction? 3. What type of reaction is this and why? |  | 7 | 1. It breaks up to form calcium oxide and carbon dioxide. 2. Calcium 🡪calcium oxide + carbon dioxide carbonate 3. Thermal decomposition, one substance is changed into two by heating |
| **H8** | **What is the balanced equation for the reaction in question 7?** |  | **H8** | **CaCO3 🡪 CaO + CO2** |
| 9 | How is concrete made? |  | 9 | Cement is mixed with gravel (aggregate), sand and water and allowed to set. |
| 10 | How is cement made? |  | 10 | By heating limestone and clay together |
| 11 | How is concrete reinforced? |  | 11 | Using a framework of steel bars/ supports |
| 12 | What type of material is reinforced concrete? |  | 12 | A composite material of steel and concrete |
| **H13** | **Why is reinforced concrete used in preference to concrete?** |  | **H13** | **Concrete has good compression strength, it is hard to squash. Concrete has low tensile strength, it doesn’t stretch. The steel supports help to strengthen it and stop it stretching.** |
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| **C2c** | **Metals and alloys** |  | **C2c** | **Metals and alloys** |
| 1a | How do you get copper from its ore? |  | 1a | Heat it with carbon, process is called smelting. |
| 1b | The copper is reduced, what does this mean? |  | 1b | It is the removal of oxygen from a substance |
| 2 | How do you purify impure copper? |  | 2 | Electrolysis |
| 3 | Which is cheaper, making or recycling copper? |  | 3 | Recycling saves resources, uses less energy. |
| 4 | What are the electrodes called in electrolysis? |  | 4 | Positive Anode, negative cathode |
| 5 | What is the liquid called? |  | 5 | The electrolyte, |
| 6a | What are the advantages of copper recycling? |  | 6a | Makes un-mined copper resources last longer, reduces costs of manufacture, reduces landfill, reduces environmental damage from copper mining, saves energy. |
| 6b | What are the disadvantages of copper recycling? |  | 6b | Copper is often stolen to sell for scrap, if cables are stolen this can cause problems with trains or electrical supply or motorway signalling. |
| **H7** | **In the purification of copper by electrolysis, what are the electrodes made of?** |  | **H7** | **Both are made of copper, the anode is impure copper but the cathode is pure copper** |
| **H8** | **What is the liquid/solution used?** |  | **H8** | **Copper (II) sulphate solution is the electrolyte.** |
| **H9** | **What happens at the anode?** |  | **H9** | **The Anode loses mass as copper atoms dissolve and become ions. Anode Slime forms.** |
| **H10** | **What happens at the cathode?** |  | **H10** | **The cathode gains mass as the copper ions are deposited as copper atoms** |
| **H11** | **Explain the changes at the anode** |  | **H11** | **Copper atoms lose 2 electrons to the external circuit and become copper 2+ ions**  **Cu(s) – 2e– 🡪Cu2+(aq)**  **Oxidation because electrons are lost. OIL** |
| **H12** | **Explain the changes at the cathode** |  | **H12** | **Copper 2+ ions gain 2 electrons from the external circuit and become copper atoms**  **Cu2+(aq) + 2e– 🡪Cu(s)**  **Reduction because electrons are gained. RIG** |
| **H13** | **What is Anode Slime?** |  | **H13** | **When the copper atoms leave the anode the impurities fall to the bottom of the cell. Impurities like gold, silver and platinum!** |
| 14 | What is an alloy? |  | 14 | A mixture of metals |
| 15 | Name five common alloys |  | 15 | Amalgam, Brass, Bronze, Solder, Steel. |
| 16 | Give one use and the main metals in each of the five alloys named in Q15. |  | 16a | Amalgam is used tooth fillings.  It contains mercury, Hg |
|  |  |  | b. | Brass is used in musical instruments, coins and door decorations e.g. door knockers. It is copper and Zinc, Cu/Zn. |
|  |  |  | c. | Bronze is used to make coins and bells. It is copper and tin, Cu/Sn. |
|  |  |  | d. | Steel is used to make cars, boats, trains, bridges and in construction. It is 99% Iron, Fe/C |
|  |  |  | e. | Solder is used to join electrical wires and in electronics. It is made from tin and lead, Sn/Pb |
| **H17** | **What are smart alloys** |  | **H17** | **Some have a shape memory, under the right conditions they form a particular shape,**  **e.g. nitinol- nickel and titanium** |
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| **C2d** | **Cars for Scrap** |  | **C2d** | **Cars for Scrap** |
| 1 | What is rust? |  | 1. | Rust needs iron, oxygen and water. The chemical name for rust is hydrated iron(III) oxide |
| 2 | Do all metals rust? |  | 2 | No, only iron and steel rust, other metals corrode |
| 3 | What makes rusting faster? |  | 3 | Salt water and acid rain |
| 4 | Why doesn’t aluminium corrode in moist air? |  | 4 | It has an impermeable oxide layer that stops it from reacting with oxygen. |
| 5 | What does rusting have to do with oxidation? |  | 5 | It is an oxidation reaction where iron reacts with oxygen, iron gains oxygen. |
| 6 | What is the word equation for rusting? |  | 6 | Iron + oxygen + water 🡪 hydrated  iron(III)oxide |
| 7 | How is iron different to aluminium physically? |  | 7 | Iron is denser, magnetic, it rusts easily aluminium is light, non-magnetic and doesn’t corrode |
| 8 | How are iron and aluminium similar? |  | 8 | both malleable and both good conductors |
| 9 | What is steel? |  | 9 | Steel is a mixture of 99% iron, 1% carbon |
| 10 | Why is steel more useful than iron? |  | 10 | Steel is harder and stronger than iron, it is slightly less likely to corrode. |
| 11 | What are the advantages of building cars from aluminium? |  | 11 | Aluminium cars are lighter and resistant to corrosion. **Better fuel economy, last longer.** |
| 12 | What are the disadvantages of building cars from aluminium? |  | 12 | Price, aluminium will be much more expensive. |
| 13 | What are the main materials in a car? |  | 13 | Steel, copper and aluminium. Glass, plastic and fibres (carpets). |
| 14 | Why recycle the materials in a car? |  | 14 | Saves natural resources, reduces disposal problems. |
| 15 | What advantages are there to using recycled materials in cars? |  | 15 | Reduces costs of disposal if parts and materials can be recycled. Tyres, wiring, etc. |
| 16 | How much of a car can be recycled? |  | 16 | Almost all of it, by law all liquids and metals from a car have to be recycled. |
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| **C2e** | **Making Ammonia, NH3** |  | **C2e** | **Making Ammonia, NH3** |
| 1 | In the Haber process, where do they get the nitrogen, N2 and the hydrogen, H2? |  | 1 | Nitrogen from the air. Hydrogen from the cracking of oil fractions or from natural gas. |
| 2 | Construct the word and the balanced symbol equation for the Haber process. |  | 2 | nitrogen + hydrogen <==> ammonia  N2 + 3H2 <==>2NH3 |
| 3 | Describe the conditions used when ammonia is made in the Haber process. |  | 3 | Iron catalyst, high pressure, temperature in the region of 450°C. |
| 4 | What happens to the un-reacted gases? |  | 4 | Un-reacted nitrogen and hydrogen are recycled. |
| **H5** | **Explain the pressure used in the Haber process.** |  | **H5** | **High pressure increases the percentage yield of ammonia.** |
| **H6** | **Explain the temperature used in the Haber process.** |  | **H6** | **High temperature decreases the percentage yield of ammonia but high temperature gives a high rate of reaction;**  **so 450°C is an optimum temperature to give a fast reaction with a sufficiently high percentage yield** |
| **H7** | **Explain the catalyst used in the Haber process.** |  | **H7** | **Iron catalyst increases the rate of reaction but does not change the percentage yield** |
| 8 | What five things affect the cost of making a new substance? |  | 8 | 1. Plant (equipment) 2. Labour costs (wages) 3. Energy costs (gas and electricity) 4. Materials (cost of starting or raw materials) 5. Speed, (cost of catalyst). |
| 9 | Describe how pressure affects the cost of making a new substance. |  | 9 | The higher the pressure the higher the plant cost |
| 10 | Describe how temperature affects the cost of making a new substance. |  | 10 | The higher temperature the higher the energy cost |
| 11 | Describe how catalysts affect the cost of making a new substance. |  | 11 | Catalysts reduce costs by speeding up the reaction which means less time using energy |
| 12 | Describe how recycling can affect the cost of making a new substance. |  | 12 | When un-reacted starting materials are recycled costs are reduced |
| 13 | How can you reduce staffing costs? |  | 13 | Automation reduces the wages bill |
| **H14** | **Explain how economic considerations determine the conditions used in the manufacture of chemicals:** |  | **H14** | 1. **rate must be high enough to give a sufficient daily yield of product** 2. **percentage yield must be high enough to give a sufficient daily yield of product** 3. **a low percentage yield can be accepted if the reaction can be repeated many times with**   **recycled started materials**   1. **Optimum conditions used that give the lowest cost rather than the fastest reaction or highest percentage yield.** |
| 15 | What symbol is used for a reversible reaction? |  | 15 | <==> |
| 16 | What is a reversible reaction? |  | 16 | A reversible reaction proceeds in both directions. |
| 17 | Give some of the uses of ammonia. |  | 17 | The manufacture of fertilisers and the manufacture of nitric acid. Household cleaners. |
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| **C2f** | **Acids and bases** |  | **C2f** | **Acids and bases** |
| 1 | Describe how universal indicator, UI, can be used to estimate the pH of a solution.  . |  | 1 | UI changes with pH 1-4 is red, 5&6 are orange and yellow, 7 is green, 8 & 9 are green-blue, 10&11 are purple. |
| 2 | Recall the colour changes with litmus |  | 2 | Litmus is red in acid, blue in alkali and purple in neutral solutions |
| 3 | What is an alkali? |  | 3 | An alkali is a soluble base. |
| 4 | Describe neutralisation. |  | 4 | an acid can be neutralised by a base or alkali, or vice versa, the other way around |
| 5 | What do indicators use colour change for? |  | 5 | Sudden or gradual changes of pH by using colour changes over different pH ranges |
| 6 | What is the equation for neutralisation? |  | 6 | acid + base 🡪 salt + water |
| 7 | Recall that in solution, all acids contain what? |  | 7 | All acids contain H+ ions. |
| 8 | What causes pH? |  | 8 | pH of an acid is determined by the concentration of H+ ions |
| **H9** | **Explain why an acid is neutralised by an alkali in terms of the ions present** |  | **H9** | **acids contain H+, alkalis contain OH–, neutralisation is**  **H+ + OH– <==> H2O** |
| 10 | Explain why metal oxides and metal hydroxides neutralise acids. |  | 10 | They react to form neutral salts and water. |
| 11 | Carbonates neutralise acids to give what? |  | 11 | Water, a salt and carbon dioxide. |
| 12 | Construct word equations to show the neutralisation of acids by bases |  | 12 | Acid + Base 🡪 Salt + Water |
| 13 | Construct word equations to show the neutralisation of acids by carbonates |  | 13 | Acid + Carbonate 🡪 Salt + Water + CO2 |
| 14 | Which salt is produced when magnesium oxide is neutralised by sulphuric acid? |  | 14 | Magnesium sulphate |
| 15 | Predict the name of the salt produced sodium carbonate is neutralised by nitric acid |  | 15 | Sodium carbonate |
| **H16** | **Construct a balanced symbol equation for the neutralisation of hydrochloric acid by potassium hydroxide.** |  | **H16** | **HCl + KOH 🡪 KCl + H2O** |
| **H17** | **Construct a balanced symbol equation for the neutralisation of sulphuric acid by sodium carbonate.** |  | **H17** | **Na2CO3 + H2SO4 🡪 Na2SO4 + H2O + CO2** |
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| **C2g** | **Fertilisers and crop yields** |  | **C2g** | **Fertilisers and crop yields** |
| 1 | What do fertilisers do? |  | 1 | fertilisers increase crop yield |
| 2 | How do plants absorb minerals? |  | 2 | Plants absorb minerals through their roots. |
| 3 | Describe fertilisers |  | 3 | chemicals that provide plants with essential chemical elements |
| 4 | Recall three essential elements needed for plant growth. |  | 4 | Nitrogen, phosphorus and potassium. NPK |
| 5 | What are the essential elements in (NH4)3PO4 |  | 5 | nitrogen, phosphorus |
| 6 | How can the use of fertilisers can be beneficial? |  | 6 | They increasing food supply |
| 7 | How can the use of fertilisers cause problems? |  | 7 | death of aquatic organisms (eutrophication) |
| 8 | Identify the apparatus needed to prepare a fertiliser by neutralisation. |  | 8 | Burette, measuring cylinder, filter funnel, conical flask |
| 9 | Recall the names of two nitrogenous fertilisers manufactured from ammonia |  | 9 | Ammonium nitrate, ammonium phosphate, ammonium sulphate, urea. |
| 10 | Explain why fertilisers are dissolved in water so they can be absorbed by plants. |  | 10 | plants absorb minerals through their roots as solutions |
| 11 | Identify arguments for and against the use of fertilisers. |  | 11 | world population is rising so we need to produce more food  Eutrophication and pollution of water supplies can result from excessive use of fertilisers  . |
| **H12** | **Explain how the use of fertilisers increases crop yield:** |  | **H12** | **a. replaces essential elements used by a previous crop or gives essential elements**  **b. more nitrogen gets incorporated into plant protein so increased growth.** |
| **H13** | **Explain the process of eutrophication:** |  | **H13** | 1. **run-off of fertiliser** 2. **more nitrate or phosphate in river** 3. **algal bloom** 4. **blocks off sunlight, other plants die** 5. **aerobic bacteria use up oxygen** 6. **most living organisms die.** |
| 14 | Predict the name of the acid and the alkali needed to make ammonium nitrate |  | 14 | Ammonia solution and nitric acid |
| **H15** | **Describe the preparation of ammonium nitrate in the lab.** |  | **H15** | **25cm3 of ammonia is neutralised by hydrochloric acid using a burette and indicator.**  **The same volumes of acid and ammonia are then mixed without the indicator.**  **The fertiliser is made by evaporation and crystallisation** |
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| **C2h** | **Chemicals from the sea:** |  | **C2h** | **the chemistry of sodium chloride** |
| **1** | Where can sodium chloride (salt) be obtained? |  | 1 | From the sea or from salt deposits |
| 2 | Describe how salt can also be mined. |  | 2 | It is mined as rock salt and by solution mining in Cheshire. |
| 3 | Explain how mining for salt can lead to subsidence. |  | 3 | Solution mining leaves huge holes in the rock which can subside. |
| 4 | The electrolysis of concentrated sodium chloride or brine produces what gases? |  | 4 | It gives chlorine and hydrogen. |
| 5 | Recall that the chemical test for chlorine |  | 5 | It bleaches moist litmus paper. |
| 6 | Recall the products of the electrolysis of concentrated sodium chloride solution (brine) |  | 6 | • hydrogen made at the cathode  • chlorine made at the anode  • sodium hydroxide is also made. |
| 7 | Explain why it is important to use inert electrodes in the electrolysis of sodium chloride solution. |  | 7 | The chlorine would react with the electrodes and destroy them. |
| **H8** | **What ions are there in the electrolysis of sodium chloride solution (brine)** |  | **H8** | **NaC*l*(aq) contains Na+, OH-, C*l*-, H+** |
| **H9** | **What happens at the cathode** |  | **H9** | **cathode 2H+ + 2e- 🡪 H2** |
| **H10** | **What happens at the anode** |  | **H10** | **anode 2C*l*- 🡪 C*l*2 + 2e-** |
| **H11** | **What is left in solution** |  | **H11** | **ions not discharged make sodium hydroxide.** |
| **H12** | **Why does the electrolysis of sodium chloride involve both reduction and oxidation?** |  | **H12** | **Oxidation is loss of electrons, reduction is gain of electrons. OIL RIG** |
| 13 | Recall the uses of sodium chloride |  | 13 | as a preservative and as a flavouring |
| 14 | Why is sodium chloride is an important raw material |  | 14 | It is used a lot in the chemical industry, including use as a source of chlorine and sodium hydroxide. |
| 15 | Name some household substances made from substances made from salt. |  | 15 | household bleach, pvc(plastics) and solvents |
| 16 | Give a use of chlorine |  | 16 | It is used to sterilise water and to make solvents, household bleach and plastics. |
| 17 | Give a use of hydrogen |  | 17 | It is used in the manufacture of margarine |
| 18 | Recall the uses of sodium hydroxide |  | 18 | It is used to make soap |
| 19 | How are sodium hydroxide and chlorine used to make household bleach. |  | 19 | Literally they are mixed together. |
| **H20** | **Explain the economic importance of the chlor-alkali industry.** |  | **H20** | **55% of GDP in the European Union is related to this industry.** |

**end**