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| **%** | **I can …** | **Prove it!** |
| **80%+** | **Interpret graphs of reaction conditions versus rate (triple only)**  **Apply the principals of dynamic equilibrium to the Haber process (triple only)**  **Explain why oxygen levels increased and carbon dioxide levels decreased (linking to photosynthesis and sedimentation)**  **Explain why it is difficult to model global warming and how this has led to simplification, speculation and biased opinions in the media** | 1. Explain how this graph shows that the forwards reaction in the Haber process is exothermic.   Changing the pressure and temperature in an equilibrium reaction   1. Choose from the following words to explain what would happen in the Haber process in conditions a - e: exothermic, endothermic, temperature, pressure, catalyst, yield   a. high temperature  b. low temperature  c. high pressure  d. low pressure.  e. presence of a catalyst   1. Use data from the graph to **explain** the trend in oxygen levels.   Image result for oxygen levels on earth over time graph   1. Use the data in the pie chart to **explain** how carbon dioxide levels have changed over time.   Image result for early atmosphere pie chart   1. Imagine that you are a scientist and an oil company approaches you to carry out a piece of research to find out how the levels of carbon dioxide have affected the average global temperatures. Explain the problem with you carrying out this research on their behalf. 2. For each headline, explain the possible impact that these could have on public opinion and behaviour:   Image result for headlines on global warming Image result for headlines on global warming |
| **70%** | **Explain how peer review evidence have linked these activities to global climate change**  **Explain how phytomining and bioleaching and scrap iron and electrolysis can be used to extract copper from low grade ores**  **Discuss the scale, risks and environmental implication of global climate change**  **Explain how some natural products are being replaced by some agricultural and synthetic products**  **Use data to carry out LCA for shopping bags made from plastic and paper** | 1. Explain what is meant by the term ‘peer review’ and give three reasons why it is important that scientific research undergo this process. 2. Complete the following table:  |  |  |  |  | | --- | --- | --- | --- | | **Alternative methods of extracting metals** | | | | | Method | Product | Description | Advantages | | electrolysis |  |  |  | | phytomining |  |  |  | | bioleaching |  |  |  |  1. Create a mind map to show how each of the following effects of climate change could impact on the earth:  * a rise in sea level * more frequent and severe storms * increased number of heatwaves * more droughts * changes to the distribution of plants and animals * food shortages  1. Explain why a family in 1200 AC could survive on using only resources from their local forest, whereas a family in 2017 could not. 2. Use the data in this table to decide which bag is more sustainable:   Image result for life cycle assessment of plastic bags vs paper bags |

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| **60%** | **Explain why large amounts of waste water are produced (urban life styles and industrial processes)**  **Explain what needs to be removed from sewage and agricultural waste in comparison with industrial waste water**  **Explain that water resources, energy and waste production can be easily quantified whereas pollutant effects are hard to quantify**  **Explain how glass is produced**  **Explain how these conditions are manipulated to produce optimum quantities of the desired products (triple only)**  **Discuss the environmental impact of using metal, glass, building materials, clay ceramics and plastics linking to the use of these limited resources and the energy used to extract and process them.**  **Evaluate the methods to produce potable water (linking to location and potential water supply)**  **Explain how the ammonia is removed and the hydrogen and nitrogen are recycled (triple only)**  **Describe how simplified life cycle assessments can be used in a biased manner to support advertising claims in the media** | 1. Draw a flow chart to show how water is recycled from homes back to drinkable water again. Use these words: waste water, organic matter, microorganisms, toxic chemicals, screening, girt removal, sedimentation, anaerobic digestion, aerobic biological treatment. 2. Complete the table to show the difference between what substances need to be removed from sewage compared to agricultural waste:  |  |  | | --- | --- | | Sewage | Agricultural waste | |  |  |  1. Explain why it is difficult to quantify the effects of pollutants using an example to help illustrate your explanation. 2. Draw a flow chart to show how glass is produced. 3. Complete the table to show the chosen reaction conditions in the Haber process:  |  |  |  | | --- | --- | --- | | Factor | Condition | Reason | | temperature |  |  | | pressure |  |  | | catalyst |  |  |  1. Draw a mind map to show how each of the following impact on the environment: metal, glass, building materials, clay, ceramics, and plastics. Make sure you include information on what they are used for, how limited they are on earth and how much energy is used to extract them. 2. Write a paragraph evaluating both desalination and sterilisation of water. 3. Complete the following paragraph: **fractional distillation, liquefies, Haber, natural gas, nitrogen, nitrogen, ammonia, hydrogen**   In the \_\_\_\_\_\_ process, the raw materials are \_\_\_\_\_\_\_\_\_ and hydrogen and the product is \_\_\_\_\_\_\_\_\_\_\_. Purified nitrogen is obtained from the \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of air. Hydrogen is obtained from \_\_\_\_\_\_ \_\_\_\_ or steam. The reaction is reversible, which means that some of the ammonia will break back down into the reactants \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_. These are then recycled. The ammonia will cool down and turn back into a \_\_\_\_\_\_\_ and can be removed.   1. Image result for biased advert environmentally friendly This advert used a shortened version of the real LCA. Give one reason why a company would use this shortened version rather than the full one. |

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| **50%** | **Draw links between the early Earth’s atmosphere and that of other planets (Mars and Venus)**  **Evaluate different theories regarding the Earth’s early atmosphere**  **Explain how we can reduce our use of limited resources (reduce, reuse, recycle)**  **Explain how to produce clay ceramics**  **Compare low density and high density poly(ethane)**  **Compare and contrast thermosetting and thermosoftening polymers explaining the differences**  **Explain what ‘composites’ are and give some examples**  **Explain ways that we can reduce this environmental impact**  **Describe the ‘greenhouse effect’ linking to the wavelength of radiation**  **Describe actions to reduce our carbon footprint and explain why these actions may have limited impact**  **Describe the properties of potable water (is safe to drink) linking to purity, salt and microbe levels**  **Describe the different sources of drinking water in the UK and the process that it must undergo before it is potable**  **Describe the process of desalination (distillation or reverse osmosis)** | 1. Complete the Venn diagram to show the similarities and differences between Earth’s early atmosphere and that of Mars and Venus.   Image result for blank venn diagram   1. List examples of how we can carry out the following:  |  |  |  | | --- | --- | --- | | Reduce | Reuse | Recycle | |  |  |  |  1. Draw a flow chart to show the stages in making clay ceramics. 2. Complete the table to show the comparison between thermosetting and thermosoftening plastics.  |  |  |  | | --- | --- | --- | |  | Thermosoftening polymers | Thermosetting polymers | | Structure description |  |  | | Structure diagram |  |  | | Type of forces |  |  | | Properties |  |  |  1. Write a definition of a composite material and give two examples. 2. Complete the diagram to show how the greenhouse effect is created using these labels.   Image result for greenhouse effect diagram gcseA. Infrared radiation is reflected back from the Earth’s surface.  B. The Earth becomes hotter as a result  C. Infrared radiation from the Sun enters the Earth’s atmosphere  D. Infrared radiation is absorbed by greenhouse gases and as a result becomes trapped in the Earth’s atmosphere   1. There are many things we can do to reduce our carbon footprint. Write a description for each action:  |  |  | | --- | --- | | Action | Description | | Using alternative energy resources |  | | Wasting less energy |  | | Carbon Capture and Storage (CCS) |  | | Carbon taxes and licenses |  | | Carbon off-setting |  | | Carbon-neutral products |  |   8. Explain some of the problems with reducing our carbon footprint (6 marks)  9. Write a description of potable water and include information about its purity, salt levels and the number of microorganisms it contains.  10. Create cycle to show each of the following processes:  A. producing potable water  B. Desalination |

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| **40%** | **Describe the composition of the atmosphere and how long this has been the case**  **Describe the development from early atmosphere to present day**  **Describe the term ‘greenhouse gases’ and give three examples (water vapour, carbon dioxide and methane)**  **Describe the effect of human activities on the levels of greenhouse gases, recalling two that affect methane and two that affect carbon dioxide**  **Describe 4 potential effects of global climate change**  **Describe what is meant by the term ‘carbon footprint’**  **Describe combustion as a major source of atmospheric pollution**  **Name gases release when fuels such as coal are burnt (carbon dioxide, water vapour, carbon monoxide, sulphur dioxide and nitrogen oxides) and predict which of these would be produced from a given fuel composition**  **Describe ‘particulates’**  **Describe issues arising from carbon dioxide, sulphur dioxide, nitrogen oxides and particulates**  **Recalls that humans use the Earth’s resources to provide; warmth, shelter, food, transport (through timber, clothing, fuels/energy and other materials)**  **Define what is meant by the term ‘finite resource’**  **Define what is meant by the term ‘sustainable development’ and explain the role that chemistry plays in developing agricultural and industrial processes**  **Required practical 8: Analyse and purify water samples from different sources, including pH, dissolved solids and distillation**  **Describe the 4 steps of sewage treatment**  **Compare the relative ease of obtaining potable water from waste, the ground and salt water**  **Describe what is meant by the term ‘life cycle assessment’**  **Describe the 4 stages of a life cycle assessment**  **Describe what factors affect the properties of polymers**  **Compare the composition and melting points of soda-lime glass and borosilicate glass**  **State what is produced in the Haber process and explain how ammonia produced from this process is used (triple only)**  **List the raw materials for the Haber process and where they are sourced from (triple only)**  **Recall the conditions required for the Haber process to take place (triple only)**  **Recall the word and symbol equation for the Haber process (triple only)**  **Describe what NPK fertilisers are (triple only)**  **Describe how NPK fertilisers are produced industrially (triple only)**  **Describe how sources of NPK are produced/found (ammonium salts, nitric acid and potassium chloride and phosphate rock) (triple only)** | 1. Complete the diagram to show the stages in the evolution of the earth’s atmosphere:   Words to use:  **photosynthesis, Ozone, CO2,**  **condensed, nitrogen, oceans,**  **UV rays, oxygen**   1. Write a definition of a greenhouse gas and give three examples. 2. **Complete the table:**  |  |  |  | | --- | --- | --- | | Greenhouse gas | Human activity, which increases this gas. | Effects on the Earth | | Methane |  |  | | Methane |  | | Carbon dioxide |  | | Carbon dioxide |  |  1. Make a mind map to show four effects of global warming. 2. Complete the following sentence:   *‘Carbon footprint is. . . ‘*   1. Complete the word and symbol equations for combustion:   Complete combustion  word:  symbol:  Incomplete combustion  word:  symbol:  7. Complete the following:  Most fuels are made of \_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ (hydrocarbons) but many also contain \_\_\_\_\_\_\_. During \_\_\_\_\_\_\_\_\_ (burning) of hydrocarbons, both carbon and hydrogen are oxidised and \_\_\_\_\_\_ is released. Carbon dioxide and water \_\_\_\_\_\_\_\_ are released into the atmosphere. If there is not enough oxygen then \_\_\_\_\_\_\_\_\_\_\_ combustion takes place and carbon \_\_\_\_\_\_\_\_\_\_ and solid \_\_\_\_\_\_\_\_\_\_\_ are released. Carbon monoxide is a colourless and odourless gas, which is \_\_\_\_\_. Global \_\_\_\_\_\_\_\_\_\_ can be caused by solid particulates building up in the atmosphere. They can also damage our \_\_\_\_\_\_\_. \_\_\_\_\_\_\_\_\_\_\_ in the air can also react with oxygen to form nitrogen oxides. These gases can cause respiratory problems and react with rainwater to form \_\_\_\_\_\_\_\_\_. This can damage \_\_\_\_\_\_\_\_ and buildings. \_\_\_\_\_\_ can also be released from fuels and react with rainwater to produce acid rain.  Words: **nitrogen, combustion, incomplete, monoxide, plants, carbon, acid rain, hydrogen, sulphur, vapour, dimming, energy, toxic, lungs, sulphur, particulates**   1. Put each of these uses into the correct resource:  |  |  |  |  | | --- | --- | --- | --- | | Animals | Plants | Trees | Fossil fuels | |  |  |  |  |   clothing, food, warmth, energy, fuels, shelter   1. Write a definition for the term ‘finite resource’. 2. Complete the following sentence:   ‘Sustainable development is…..’   1. Describe one industrial process improved by our understanding of chemistry and explain your choice. 2. Put these stages in sewage treatment into the correct order:   A. Aerobic digestion of sewage sludge  B. Sedimentation to produce sewage sludge and effluent  C. Screening and grit removal  D. Aerobic biological treatment of effluent   1. a) What does the following acronym stand for: LCA?   b) Write a definition for what LCA means.  c) Write down the four stages of an LCA.   1. True or false:  * Thermosoftening polymers have strong intermolecular forces between polymer chains. * Thermosoftening polymers include poly(ethane). * Thermosetting polymers have strong intermolecular forces between polymer chains called cross-links. * Thermosetting polymers include melamine. * Thermosoftening polymers will soften on heating. * Thermosetting polymers will soften on heating.  1. Complete the following table to compare soda-lime and borosilicate:  |  |  |  |  | | --- | --- | --- | --- | |  | Made up of… | Melting point | Uses | | soda-lime glass |  |  |  | | borosilicate |  |  |  |  1. Write a word and symbol equation for the Haber process. 2. Give two uses of the ammonia produced in the Haber process. 3. Give the following conditions for the Haber process:   a) Temperature  b) Pressure  c) catalyst   1. What does NPK stand for and what are they used for? 2. Draw a flow chart to show how NPK fertilisers are made. 3. Describe how each of the following are produced/found.   a) ammonium salts  b) nitric acid  c) phosphorous rock  d) potassium chloride |

**Key Words:**

atmosphere, algae, locked up, limestone, sedimentary rocks, fossil fuels, crude oil, natural gas, coal, carbonates, infrared radiation, greenhouse gases, carbon dioxide, water vapour, methane (CH4), biased, climate change, greenhouse effect, carbon footprint, distillation, sewage, phytomining, bioleaching, CCS, sustainable development, agriculture, potable, desalination, ceramics, composites, borosilicate glass (Pyrex), soda-lime, LCA, Haber process, reversible reaction, catalyst, NPK fertilisers, phosphate rock