**Core questions – Chemistry unit 1 - Atomic Structure and the Periodic Table**

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| **No.** | **Question** | **Answer** |
| 1 | Define atom | The smallest part of an element that can still be recognised as that element |
| 2 | Define element | A substance made of only one type of atom |
| 3 | Define compound | A substance made of two or more different atoms chemically bonded together |
| 4 | Define molecule | A substance made of more than one atom chemically bonded together (can be atoms of the same type!) |
| 5 | Define mixture | A substance made of more than one thing ***not*** chemically bonded together |
| 6 | Approximately how many elements are there? | 100 |
| 7 | How are elements represented on the periodic table? | Chemical symbols |
| 8 | How are chemical symbols written? | The first letter is always upper case. The second letter always lower case |
| 9 | Name four methods of separating mixtures | Crystallisation, filtration, distillation and chromatography |
| 10 | What is filtration used to separate? | An insoluble solid from a liquid |
| 11 | What is meant by the term filtrate? | A liquid which has passed through a filter |
| 12 | What is meant by the term residue? | A solid which has not passed through a filter |
| 13 | How is filtration used to separate a mixture? | A mixture of an insoluble solid and liquid is added to a funnel containing filter paper. The liquid will pass through the pores in the filter paper leaving behind the insoluble solid. |
| 14 | What is evaporation? | Evaporation is the change of state from a liquid to a gas |
| 15 | What is evaporation used to separate? | A soluble solid from a liquid it is dissolved in |
| 16 | How is evaporation used to separate a mixture? | The mixture of a soluble solid and liquid is heated until the liquid evaporates leaving behind a solid |
| 17 | What is crystallisation? | The formation of a soluble solid after a liquid has evaporated |
| 18 | What is distillation used for? | To separate liquids with different boiling points |
| 19 | What are the two changes of state involved with distillation? | Evaporation and condensation |
| 20 | How is distillation used to separate a mixture? | Heat a mixture of liquids, the liquid with the lowest boiling point evaporates then condenses first, leaving the second liquid behind |
| 21 | What is chromatography used for? | To separate mixtures of different chemicals |
| 22 | How does chromatography work to separate mixtures? | A spot of a mixture is placed near the bottom of a piece of chromatography paper and the paper is then placed upright in a suitable solvent. As the solvent soaks up the paper, it carries the mixture with it. Different components of the mixture will move at different rates and the mixture separates out |
| 23 | What did scientists think about atoms before the discovery of the electron? | They were tiny spheres that could not be broken up |
| 24 | Which sub-atomic particle did JJ Thomson discover? | Electrons |
| 25 | What model did JJ Thomson use, following the discovery of an electron, to describe the structure of an atom? | Plum pudding model |
| 26 | How did JJ Thomson describe an atom? | Spheres of positive charge with tiny negative electrons stuck in them |
| 27 | Which sub atomic particle was discovered by Rutherford and Marsden? | Protons |
| 28 | Describe the experiment Rutherford and Marsden did | Fired alpha particles at a thin piece of gold foil. |
| 29 | If the plum pudding model was correct what should have happened to the alpha particles when fired at the gold foil? | Pass straight through or be deflected only slightly |
| 30 | What did happen to the alpha particles when fired at the gold foil? | Most passed straight through, some were deflected more than expected and some were deflected backwards off the foil. |
| 31 | What new ideas about the atom were concluded from the gold foil experiment? | 1. Most of the mass was in the centre of atom in a tiny nucleus  2. The nucleus had a positive charge  3. Most of the atom is empty space |
| 32 | What name was given to the model of the atom following the gold foil experiment? | The nuclear model |
| 33 | How was the atom described in the first nuclear model? | A positively charged nucleus surrounded by a *cloud* of electrons |
| 34 | How did the work of Niels Bohr improve the nuclear model? | He suggested that electrons orbit the nucleus at specific distances |
| 35 | How did Bohr realise that his suggestions were correct? | His theoretical calculations agreed with experimental observations |
| 36 | What did later experiments show that led to the understanding of protons? | Scientists discovered that the positive charge of a nucleus can be divided into a whole number of smaller particles that each have the same positive charge. |
| 37 | Which sub-atomic particle was identified by James Chadwick? | The neutron |
| 38 | What is the current model of an atom? | There is a positively charged nucleus (made up of protons and neutrons), surrounded by negatively charged electrons. |
| 39 | In what order were the sub-atomic particles discovered? | Electrons, protons, neutrons |
| 40 | What are the three sub-atomic particles that make up an atom? | Protons, neutrons and electrons |
| 41 | What is the relative mass of a proton? | 1 |
| 42 | What is the relative mass of an electron? | Very small |
| 43 | What is the relative mass of a neutron? | 1 |
| 44 | What is the relative charge of a proton? | +1 |
| 45 | What is the relative charge of an electron? | -1 |
| 46 | What is the relative charge of a neutron? | 0 (neutral) |
| 47 | Why is the overall charge of an atom zero? | An atom has the same number of protons and electrons |
| 48 | What is ‘atomic number?’ | The number of protons in an atom |
| 49 | What is ‘atomic mass number?’ | The number of protons and neutrons added together |
| 50 | Where is most of the mass of the atom? | In the nucleus |
| 50 | What is the average radius of an atom | 1 X 10-10 m or 0.1nm (nanometres) |
| 51 | How big is the radius of the nucleus? | It is less than 1/10,000th of the radius of the atom. |
| 52 | What are energy levels? | The electrons are arranged at different distances from the nucleus in "energy levels" which are sometimes called "shells". |
| 53 | How many electrons can the first shell hold? | 2 |
| 54 | How many electrons can the second & third shell hold? | 8 |
| 55 | How can the electronic structure of an atom be represented? | Diagram or numbers |
| 56 | How are elements in the modern periodic table ordered? | By atomic number |
| 57 | What are groups in the periodic table? | The columns, numbered 1, 2, 3, 4, 5, 6, 7, 0 |
| 58 | How are elements in the **same group** similar to each other? | They all have similar chemical properties |
| 59 | What can the group tell you about the electrons in an atom? | How many electrons in the outer shell. E.g. carbon is in group 4 so has 4 electrons in the outer shell |
| 60 | What are periods in the periodic table? | The rows in the periodic table |
| 61 | What can the period tell you about the electrons in an atom? | How many shells an atom has. E.g. carbon is in the second period so has two shells |
| 62 | What is an isotope? | Atoms of the same element with a different number of neutrons |
| 63 | What is the relative atomic mass of an element? | The average value that takes account of the abundance of the isotopes of the element |
| 64 | Why is the relative atomic mass of chlorine 35.5? | 75% of chlorine has a mass of 35. 25% of chlorine has a mass of 37.  0.75 x 35 = 26.25  0.25 x 37 = 9.25  9.25 + 26.25 = 35.5 |
| 65 | How were elements arranged in the early periodic tables? | By atomic weight |
| 66 | What did Mendeleev do differently? | He still arranged them by weight, but left gaps where the properties didn’t quite fit |
| 67 | Why did Mendeleev put some elements in groups? | Because they had similar chemical properties (e.g. they reacted violently with water) |
| 68 | Why did Mendeleev leave gaps in his periodic table? | For elements that had not been discovered yet |
| 69 | What is an ion? | An atom that has lost or gained electrons |
| 70 | If an atom has gained electrons, what charge will it have? | Negative |
| 71 | If an atom has lost electrons, what charge will it have? | Positive (because they have lost a negative!) |
| 72 | Which elements react to form positive ions? | Metals |
| 73 | Which elements react to form negative ions? | Non-metals |
| 74 | Which side of the periodic table has the metals? | The left hand side |
| 75 | Define inert | Unreactive |
| 76 | What is a trend? | A pattern in properties |
| 77 | What group are the noble gases located? | Group 0 |
| 78 | Why are the noble gases inert? | Their outer electron shell is full, so do not need to lose or gain electrons |
| 79 | What is the trend in boiling points as you move **down** group 0? | They increase |
| 80 | In terms of electrons, what do group 1 elements have in common? | 1 electron in the outer shell |
| 81 | What are the group 1 metals called? | Alkali metals |
| 82 | Why are the group 1 metals called alkali metals? | They are metals that form alkalis when they react with water |
| 83 | How does the reactivity of alkali metals change as you move down the group? | They become more reactive |
| 84 | Why does the reactivity of alkali metals increase as you move down the group? | Their outer electron is easier to lose if it is further away from the nucleus, and if the atom has more shells |
| 85 | What is produced when group 1 metals react with water? | Metal hydroxide (alkali) and hydrogen gas |
| 86 | What is produced when group 1 metals react with chlorine? | Metal chloride |
| 87 | What is produced when group 1 metals react with oxygen? | Metal oxide |
| 88 | What is the common name for group 7 elements? | The halogens |
| 89 | In terms of electrons, what do group 7 elements have in common? | 7 electrons in the outer shell |
| 90 | What kind of ion will a halogen form? | A halide ion (X-) with a single negative charge |
| 91 | What is the trend in reactivity of group 7 elements as you move down the group? | They become less reactive |
| 92 | Why do group 7 elements become less reactive as you move down the group? | It is harder to attract an electron if the outer shell is further away from the nucleus (or if the atom has more shells) |
| 93 | What is the trend in melting points and boiling points as you move down group 7? | They increase |
| 94 | What is displacement? | A more reactive element replacing a less reactive element from an aqueous solution of its salt |
| 95 | Why is chlorine able to displace a bromine ion in sodium bromide? | Chlorine is more reactive than bromine |
| 96T | Where are transition metals found in the periodic table? **(Triple only)** | Middle section between group 2 & 3 |
| 97T | What is a transition metal? **(Triple only)** | Elements with similar properties to each, but different from those of the elements in group 1 |
| 98T | How are the properties of transition metals different from group 1? **(Triple only)** | Transition metals are: less reactive, more dense, stronger, higher melting and boiling points, harder |
| 99T | What unique properties do transition metals have? **(Triple only)** | They can form more than one ion  They are often coloured, meaning compounds that contain them are colourful  They make very good catalysts (e.g nickel) |

**Core questions – Chemistry unit 2 – Bonding and Structure**

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| **No.** | **Question** | **Answer** | |
| 1 | Where does ionic bonding occur? | In compounds formed from metals combined with non-metals | |
| 2 | Where does covalent bonding occur? | Non-metallic elements and in compounds of non-metals | |
| 3 | Where does metallic bonding occur? | In metallic elements and alloys | |
| 4 | What charge does an ion have when an atom has lost electrons? | Positive | |
| 5 | What charge does an ion have when an atom has gained electrons? | Negative | |
| 6 | Describe ionic bonding | The attraction between oppositely charged ions | |
| 7 | How are ionic compounds held together? | With strong electrostatic forces of attraction between the oppositely charged ions | |
| 8 | What does a dot cross diagram look like for sodium and chlorine reacting to form sodium chloride (only including the outer shell)? |  | |
| 9 | What does a ball and stick model of sodium chloride look like? |  | |
| 10 | What are the disadvantages of using a ball and stick model to represent ionic compounds? | The model doesn’t show the relative sizes of of the ions and it shows gaps between the ions, whereas in reality, there are no gaps between the ions | |
| 11 | How can you calculate the empirical formula from a 3D diagram of an ionic lattice? | STEP 1: Look at the diagram to work out what ions are in the compound (e.g potassium ions and oxide ions)  STEP 2: Work out what charges the ions will form  STEP 3: Balance the charges so the charge of the empirical formula is zero | Potassium is in group 1 so forms 1+ ions  Oxygen is in group 6 so forms 2- ions  A potassium ion only has a 1+ charge, so you’ll need two of them to balance out the 2- charge of an oxide ion.  The empirical formula is K2O |
| 12 | What charge do ions formed from group 1 elements have? | 1+ | |
| 13 | What charge do ions formed from group 2 elements have? | 2+ | |
| 14 | What charge do ions formed from group 6 elements have? | 2- | |
| 15 | What charge do ions formed from group 7 elements have? | 1- | |
| 16 | What is a covalent bond? | A shared pair of electrons | |
| 17 | Name 8 simple covalent molecules? | Hydrogen; chlorine; oxygen; nitrogen; hydrogen chloride; water; ammonia; methane | |
| 18 | What does a dot cross diagram for hydrogen look like? |  | |
| 19 | What does a dot cross diagram for chlorine look like? |  | |
| 20 | What does a dot cross diagram for oxygen look like? |  | |
| 21 | What does a dot cross diagram for nitrogen look like? | mage result for nitrogen gas dot and cross diagram | |
| 22 | What does a dot cross diagram for hydrogen chloride look like? |  | |
| 23 | What does a dot cross diagram for water look like? |  | |
| 24 | What does a dot cross diagram for ammonia look like? |  | |
| 25 | What does a dot cross diagram for methane look like? |  | |
| 26 | How else can simple covalent structures be represented other than dot and cross diagrams? | Displayed formula (e.g. )  3D structure (e.g ) | |
| 27 | What is a polymer? | Long chains of repeating units (monomers) | |
| 28 | How are the atoms in a polymer held together? | With covalent bonds | |
| 29 | How can polymers be represented? |  | |
| 30 | What is metallic bonding? | A lattice of positively charged metal ions surrounded by delocalised electrons | |
| 31 | How are atoms held together in metallic bonding? | Electrostatic attraction between the delocalised electrons and the positive metal ions | |
| 32 | Name the process of a solid turning into a liquid | Melting | |
| 33 | Name the process of a liquid turning into a solid | Freezing | |
| 34 | Name the process of a liquid turning into a gas | Boiling | |
| 35 | Name the process of a gas turning into a liquid | Condensing | |
| 36 | Name the process of a solid turning into a gas | Subliming | |
| 37 | How is the strength of the forces between particles and the melting and boiling point of a substance related? | The stronger the forces the higher the melting/boiling point | |
| 38 | What are the limitations of the particle model? | In the model there are no forces, particles are represented as spheres, the spheres are solid | |
| 39 | What does the state symbol (s) represent? | Solid | |
| 40 | What does the state symbol (l) represent? | Liquid | |
| 41 | What does the state symbol (g) represent? | Gas | |
| 42 | What does the state symbol (aq) represent? | Aqueous | |
| 43 | What does aqueous mean? | Dissolved in water | |
| 44 | What are the properties of ionic compounds? | High melting and boiling points; can conduct electricity when molten (or dissolved), but not as a solid | |
| 45 | Why do ionic compounds have high melting/boiling points? | Large amount of energy is needed to break the strong attractions between oppositely charged ions | |
| 46 | Why don't solid ionic compounds conduct electricity? | The ions are not free to move | |
| 47 | Why do aqueous and liquid ionic compounds conduct electricity? | The ions are free to move | |
| 48 | What are the properties of simple molecules? | Low melting and boiling points; do not conduct electricity | |
| 49 | Why are simple molecules usually gases or liquids at room temperature? | They have low melting and boiling points | |
| 50 | Why do simple molecules have low melting /boiling points? | The forces **between** the molecules are weak (intermolecular forces) and so require little energy to break | |
| 51 | What is broken when simple molecules are melted/boiled? | The forces **between** the molecules (the intermolecular forces) | |
| 52 | Why do larger molecules have higher melting points? | Larger molecules have stronger intermolecular forces | |
| 53 | Why don't simple molecules conduct electricity? | The molecules do not have an overall electric charge AND do not have free flowing electrons | |
| 54 | Why are polymers solid at room temperature? | Polymers are very large molecules and so have strong intermolecular forces | |
| 55 | What is a giant covalent structure? | One where all the atoms in the structure are covalently bonded to other atoms | |
| 56 | Name three giant covalent structures. | Diamond, graphite, silicon dioxide | |
| 57 | Why do giant covalent structures have high melting points? | Lots of energy is needed to break the covalent bonds between the atoms | |
| 58 | What are the properties of pure metals? | High melting and boiling points; easily bent and shaped | |
| 59 | Why do metals have high melting/boiling points? | The strong electrostatic attraction between the positive metal ions and the delocalised electrons needs lots of energy to be broken | |
| 60 | Why can pure metals be easily bent and shaped? | The atoms are arranged in layers, which allows the atoms to slide over each other easily | |
| 61 | What is an alloy? | A substance made of two or more elements, at least one of which is a metal | |
| 62 | Why are alloys harder than pure metals? | The layers of metal ions are distorted by the differing size of the other atoms, which prevents the layers from sliding over each other as easily | |
| 63 | Why are metals good conductors of electricity? | Because the delocalised electrons can carry electrical charge throughout the structure | |
| 64 | Why are metals good conductors of heat? | Because thermal energy can be transferred by the delocalised electrons | |
| 65 | Describe the structure of diamond. | Each carbon atom is covalently bonded to four others | |
| 66 | What are the properties of diamond? | High melting point, hard, doesn’t conduct electricity | |
| 67 | Why does diamond have a high melting point? | The strong covalent bonds between each atom takes a lot of energy to break | |
| 68 | Why is diamond hard? | Because each carbon atom forms four covalent bonds with other carbon atoms | |
| 69 | Why doesn't diamond conduct electricity? | Because it does not have free electrons that are able to move | |
| 70 | Describe the structure of graphite. | Each carbon atom is covalently bonded to three others to form layers of hexagonal rings | |
| 71 | How are the layers in graphite held together? | Intermolecular forces | |
| 72 | What are the properties of graphite? | High melting point; soft; can conduct thermal and electrical energy | |
| 73 | Why does graphite have a high melting point? | The strong covalent bonds between each atom takes a lot of energy to break | |
| 74 | Why can graphite conduct electricity? | One electron from each carbon atom is delocalised and can carry charge through the structure | |
| 75 | Why is graphite soft and slippery? | Because the layers are held by weak intermolecular forces, so are able to slide over each other easily | |
| 76 | What is graphene? | A single layer of graphite | |
| 77 | What are the properties of graphene? | Very light; very strong; can conduct electricity | |
| 78 | What real life applications can graphene be used for? | Composite materials and in electronic equipment | |
| 79 | Why can graphene be used in composite materials? | It makes materials very strong without adding too much weight | |
| 80 | Why can graphene be used in electronics? | It has delocalised electrons meaning it can conduct electricity | |
| 81 | What is a fullerene? | A molecule of carbon atoms with a hollow shape | |
| 82 | Describe the structure of a fullerene? | Mainly made of carbon atoms arranged in hexagons. They can also contain pentagon (5) or heptagon (7) rings | |
| 83 | What was the first fullerene to be discovered? | Buckminsterfullerene (C60) and forms a hollow sphere | |
| 84 | Give two uses of fullerenes? | They can be used to ‘cage’ other molecules, meaning they could be used to deliver drugs to inside the body  They have can be used as catalysts because they have huge surface areas | |
| 85 | What is a carbon nanotube? | Cylindrical fullerenes with very high length to diameter ratios | |
| 86 | What do the properties of carbon nanotubes makes them useful for? | Nanotechnology, electronics, materials | |
| 87T | What type of structures does Nano science refer to? **(Triple only)** | Structures that are 1-100 nm in size, of the order of a **few hundred atoms** | |
| 88T | What is the diameter of a fine particle (PM2.5)? **(Triple only)** | Between 100 and 2500 nm (1 x 10-7 m and 2.5 x 10-6 m) | |
| 89T | What is the diameter of a coarse particle (PM10)? **(Triple only)** | Between 2500 and 10 000 nm (1 x 10-5 m and 2.5 x 10-6 m) | |
| 90T | What are coarse particles more commonly referred to as? **(Triple only)** | Dust | |
| 91T | If the side of a cube decreases by a factor of 10, what does the surface area to volume ratio increase by? **(Triple only)** | 10 | |
| 92T | Why do nanoparticles have different properties than those for the same material in bulk (e.g. a big lump of gold compared to a gold nanoparticle) **(Triple only)** | They have very high surface area to volume ratios | |
| 93T | Why are nanoparticles being used in medicine? **(Triple only)** | To deliver drugs into the right cells in the body | |
| 94T | Why are nanoparticles being used in electronics? **(Triple only)** | Some nanoparticles conduct electricity so are used in tiny circuit boards | |
| 95T | Why are nanoparticles being used in cosmetics? **(Triple only)** | They can improve moisturisers without making them really oily | |
| 96T | Why are nanoparticles being used in deodorants? **(Triple only)** | Silver nanoparticles have antibacterial properties | |
| 97T | Why are nanoparticles being used as catalysts? **(Triple only)** | They have huge a huge surface area to volume ratio | |
| 98T | What are the possible risks associated with nanoparticles? **(Triple only)** | We don’t fully understand how they affect the body; they could damage the environment when washed away | |

**Core questions – Chemistry unit 3 – Quantitative chemistry**

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| **No.** | **Question** | **Answer** | |
| 1 | What is conservation of mass? | No atoms are lost or made during a chemical reaction - mass of the reactant = the mass of the products | |
| 2 | Why can it appear that mass is not conserved? | If an experiment is completed in an open system, then gases can either enter or leave the system | |
| 3 | Give an example of a reaction where mass may appear to increase | When a metal reacts with oxygen (gas) in an unsealed container, the mass of the container increases  Metal (s) + oxygen **(g)** 🡪 metal oxide (s) | |
| 4 | Give an example of a reaction where mass may appear to increase | When a metal carbonate thermally decomposes, carbon dioxide (gas) is given off  Metal carbonate (s) 🡪 metal oxide (s) + carbon dioxide **(g)** | |
| 5 | What is a word equation? | A way of using the names of substances to show what is happening during a chemical reaction | |
| 6 | What are the products in a chemical reaction? | The new substances formed in a chemical reaction | |
| 7 | What are the reactants in a chemical reaction? | The substances required for a chemical reaction | |
| 8 | Why must all symbol equations be balanced? | All atoms must be conserved | |
|  | What does a balanced symbol equation show? | The number of moles of each compound that takes part in a chemical reaction | |
| 9 | How do we know a symbol equation is balanced? | There is the same number of each atom on both sides of the arrow | |
| 10 | What do the big numbers before the molecules in a symbol equation represent? | The number of units (or moles) of that molecule | |
| 11 | Why must equations be balanced? | Because atoms cannot be created or destroyed | |
| 12 | What is relative formula mass? | The sum of the relative atomic masses of the atoms in the numbers shown in the formula (e.g. O2 = 16 +16 = 32) | |
| 13 | What is the symbol for relative formula mass? | Mr | |
| 14H | What is the definition molar mass? **(Higher tier only)** | The mass of one mole of a substance in grams | |
| 15H | What is the symbol for the unit mole? **(Higher tier only)** | Mol | |
| 16H | What is the definition of Avogadro’s constant? **(Higher tier only)** | The number of particles (atoms, molecules or ions) in one mole of a given substance | |
| 17H | What number is Avogadro’s constant? **(Higher tier only)** | 6.02 x 1023 per mole | |
| 18H | How many particles are there in 1 mole of any substance? **(Higher tier only)** | 6.02 x 1023 | |
| 19H | What is the formula for calculating the number of moles? **(Higher tier only)** | number of moles = actual mass (g)  Mr | |
| 20H | How can chemical equations be interpreted in terms of moles? **(Higher tier only)** E.g.  Mg + 2HCl 🡪 MgCl2 + H2 | This shows us that one mole of magnesium reacts with two moles of hydrochloric acid to produce one mole of magnesium chloride and one mole of hydrogen gas | |
| 21H | What is a limiting reactant? **(Higher tier only)** | If one reactant gets completely used up in a reaction before the rest, then the reaction will stop. This is the limiting reactant | |
| 22H | What does it mean when a reactant is in ‘excess’? **(Higher tier only)** | There is reactant left over (unreacted) at the end of the chemical reaction | |
| 23H | Why might we add reactants to ‘excess’? **(Higher tier only)** | To ensure that all of the other reactant is used up | |
| 24H | How can we calculate the masses of reactants and products from a balanced symbol equation? **(Higher tier only)**  e.g.  *If we have a solution containing 100g of sodium hydroxide (NaOH), how much chlorine gas (Cl2) should we pass through the solution to make bleach?* | STEP 1 : Balance the equation:  STEP 2 : Work out the Mr of the substances involved in the question:  STEP 3 : Calculate the number of moles of the mass in the question: (Moles = mass / Mr)  STEP 4: Look at the ratio of moles in the question:  STEP 5 : Calculate the mass of 1.25 moles of chlorine: | 2NaOH + Cl2 🡪 NaOCl + NaCl + H2O    NaOH = 40  Cl2 = 71    100g of sodium hydroxide is 100 ÷ 40 = **2.5 moles**  The chemical equation tells us that for every 2 moles of sodium hydroxide we need one mole of chlorine  So we need 2.5 ÷ 2 = 1.25 moles of chlorine  1.25 x 71g = **88.75g** of chlorine to react with 100g of sodium hydroxide |
| 25H | How can we balance equations using reacting masses? **(Higher tier only)**  e.g  *8.1g of zinc oxide (ZnO) reacts completely with 0.60g of carbon to form 2.2g of carbon dioxide and 6.5g of zinc. Write a balanced symbol equation for this reaction.*  *(C = 12), (O = 16), (Zn = 65)* | STEP 1 : Work out Mr for each of the substances in the reaction  STEP 2 : Divide the mass of each substance by its Mr to calculate how many moles of each substance reacted or were produced  STEP 3 : Divide by the smallest number of moles (0.050)  STEP 4 : The numbers are all the whole numbers, so you can use them to write the balanced symbol equation  Tip: if any of the number aren’t whole numbers, multiply all the numbers by the same amount so that they all become whole numbers | **ZnO:** 65 + 16 = 81, **C**: 12, **CO2**: 12 + (2 x 16) = 44, **Zn**: 65  ZnO: 8.1 / 81 = 0.10 mol, CO2: 2.2 / 44 = 0.050 mol  C: 0.60 / 12 = 0.050 mol, Zn: 6.5 / 65 = 0.10 mol  ZnO: 0.10 / 0.050 = 2.0, CO2: 0.050 / 0.050 = 1.0,  C: 0.050 / 0.050 = 1.0, Zn: 0.10 / 0.050 = 2.0  2ZnO + C 🡪 CO2 + 2Zn |
| 26 | What is a solvent? | A liquid that dissolves a solute | |
| 27 | What is a solute? | The solid that is being dissolved | |
| 28 | What is a solution? | A mixture of a solute dissolved in a solvent | |
| 29 | What is concentration? | The amount of substance in a certain volume of a solution | |
| 30 | What is the formula for calculating concentration (g/dm3)? | concentration (g/dm3) = mass of solute (g)  volume of solvent (dm3) | |
| 31T | What is percentage yield? **(Triple only)** | The percentage of theoretical yield actually obtained in a chemical reaction | |
| 32T | What is the formula for calculating percentage yield? **(Triple only)** | % Yield = Mass of product actually made (g) × 100  Maximum theoretical mass of product (g) | |
| 33T | Why is it not possible to obtain the calculated theoretical yield in a reaction? **(Triple only)** | * the reaction may not go to completion because it is reversible * some of the product may be lost when it is separated from the reaction mixture * some of the reactants may react in ways different to the expected reaction | |
| 34T | What is atom economy? **(Triple only)** | A measure of the amount of starting materials that end up as useful products. | |
| 35T | Why is it important for sustainable development and for economic reasons to use reactions with high atom economy? **(Triple only)** | * Less waste made that needs to be disposed of * Resources used up less quickly * More profitable | |
| 36T | What is the formula for calculating atom economy? **(Triple only)** | Atom economy = Relative formula mass of desired product × 100  relative formula mass of all reactants | |
| 37T | How do you calculate atom economy? **(Triple only)**  e.g.  calculate the atom economy of the following reaction **to produce hydrogen gas**  CH4(g) + H2O(g) 🡪 CO(g) + 3H2(g) | STEP 1: Identify the desired product  STEP 2: Work out the Mr of all the reactants  STEP 3: Work out the total Mr of the desired product  STEP 4: Use formula to calculate the atom economy | Hydrogen gas  **CH4**: 16, **H2O**: 18 **TOTAL Mr =** 34  **3H2** = 6  (6 ÷ 34) x 100 = **17.6%** |
| 38T | What is the formula for calculating concentration (mol/dm3)? **(Triple only)** | concentration (mol/dm3) = number of moles of solute (mol)  volume of solvent (dm3) | |
| 39T | How many cm3 are in 1 dm3? **(Triple only)** | 1 dm3 = 1000cm3 | |
| 40T | How can you convert cm3 into dm3? **(Triple only)** | Divide by 1000 | |
| 41T | What are the 6 steps for carrying out a titration? **(Triple only)** | 1. Use the pipette and pipette filler to add 25 cm3 of alkali (or acid) to a clean conical flask. 2. Add a few drops of indicator and put the conical flask on a white tile (so you can see the colour of the indicator more easily). 3. Fill the burette with acid (or alkali) and note the starting volume. 4. Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix. 5. Stop adding the acid when the end-point is reached (the appropriate colour change in the indicator happens). Note the final volume reading. 6. Repeat steps 1 to 5 until you get consistent readings | |
| 42T | If the volumes of two solutions that react completely are known and the concentration of one solution is known, how can the concentration of the other solution be calculated? **(Triple only)**  *e.g*  *A student started with 30.0cm3 of sulfuric acid (H2SO4) of unknown concentration in a flask. She found that it took an average of 25.0cm3 of 0.100 mol/dm3 sodium hydroxide (NaOH) to neutralise the sulfuric acid. Find the concentration of the acid in mol/dm3. The balanced symbol equation for the reaction is:*  *2NaOH + H2SO4 🡪 Na2SO4 + 2H2O* | **STEP 1: Convert all volumes to dm3**  **STEP 2:** Calculate the number of moles of the substance where the volume and concentration are known **(moles = conc. x volume)**  **STEP 3: Use the reaction equation to work out how many moles of the ‘unknown’ stuff you must have had**  **STEP 4: Work out the concentration of the ‘unknown’ stuff (conc. = moles** ÷ **volume)** | 30.0 cm3 = 30.0 ÷ 1000 = 0.030 dm3  25.0 cm3 = 25.0 ÷ 1000 = 0.025 dm3  0.100 mol/dm3 x 0.025 dm3 = 0.00250 moles of NaOH  Two moles of sodium hydroxide reacts with one mole of sulfuric acid. So 0.00250 moles of NaOH must have reacted with 0.00250 ÷ 2 = 0.00125 moles of H2SO4  0.00125 mol ÷ 0.030 dm3 = 0.04166666 mol/dm3  **= 0.0417 mol/dm3** |
| 43T | What is a meniscus? **(Triple only)** | The curved upper surface of a liquid in a tube | |
| 44T | What are concordant results? **(Triple only)** | The **volume** of three or more titres lie within 0.10cm3 of each other | |
| 45T | How do you calculate a mean? **(Triple only)** | Add up all the numbers, then divide by how many numbers there are | |
| 46T | What volume does one mole of any gas occupy at 20oC? **(Triple only)** | 24 dm3 (24000 cm3) | |
| 47T | At what temperature does one mole of any gas occupy 24 dm3? **(Triple only)** | 20oC | |
| 48T | What is the formula for calculating volume of gases? **(Triple only)** | Volume of gas (dm3) = mass of gas (g) x 24 dm3  Mr of gas | Volume of gas (dm3) = moles of gas x 24 dm3 |

**Core questions – Chemistry unit 4 – Chemical changes**

|  |  |  |
| --- | --- | --- |
| **No.** | **Question** | **Answer** |
| 1 | What is reduction in terms of electrons? | Gain of electrons |
| 2 | What is oxidation in terms of electrons? | Loss of electrons |
| 3 | What is reduction in terms of oxygen? | Loss of oxygen from a compound |
| 4 | What is oxidation in terms of oxygen? | Gain of oxygen in a compound |
| 5 | What is formed when a metal reacts with oxygen? | A metal oxide |
| 6 | How is the reactivity of a metal defined? | Its tendency to lose electrons to form positive ions |
| 7 | What is the order of reactivity of metals? | Potassium, sodium, lithium, calcium, magnesium, zinc, iron, copper |
| 8 | Which non-metals are often in included in the reactivity series? | Hydrogen & carbon |
| 9 | How can metal reactions with water and acid be used to determine the order of reactivity? | The more reactive the metal, the faster the reaction will go (e.g more bubbles, higher temperature change) |
| 10 | What is a displacement reaction? | A more reactive metal can displace a less reactive metal from a compound |
| 11 | Why is pure gold found naturally in the Earth? | Because it is not reactive enough to form a compound |
| 12 | How are metals that are less reactive than carbon extracted? | Their oxides are reduced using carbon (to form carbon dioxide and the pure metal) |
| 13 | What happens during the reaction of oxides, using carbon? | Oxygen is removed from the metal ore and carbon gains oxygen making carbon dioxide |
| 14 | What is formed when a metal reacts with an acid? | A salt and hydrogen |
| 15 | What sort of salt is formed when the acid used is hydrochloric acid? | Chloride salts (for example, sodium chloride) |
| 16 | What sort of salt is formed when the acid used is sulfuric acid? | Sulfate salts (for example, magnesium sulfate) |
| 17 | What sort of salt is formed when the acid used is nitric acid? | Nitrate salts (for example, ammonium nitrate) |
| 18 | What is the salt that is formed when magnesium reacts with hydrochloric acid? | Magnesium Chloride |
| 19 | What is the salt that is formed when zinc reacts with hydrochloric acid? | Zinc Chloride |
| 20 | What is the salt that is formed when iron reacts with hydrochloric acid? | Iron Chloride |
| 21 | What is the salt that is formed when magnesium reacts with sulfuric acid? | Magnesium Sulfate |
| 22 | What is the salt that is formed when zinc reacts with sulfuric acid? | Zinc Sulfate |
| 23 | What is the salt that is formed when iron reacts with sulfuric acid? | Iron Sulfate |
| 24 | What is formed when an acid is neutralised by an alkali? | Salt and water |
| 25 | What is formed when an acid is neutralised by a metal carbonate? | Salt, water and carbon dioxide |
| 26 | What does the particular salt produced in a reaction depend on? | The acid used & the positive ions in the base, alkali or carbonate |
| 27 | What is the formula of the chloride ion? | Cl- |
| 28 | What is the formula of the sulfate ion? | SO42- |
| 29 | What is the formula of the nitrate ions? | NO3- |
| 30 | What ion is present in acids? | Hydrogen ions (H+) |
| 31 | What ion is present in alkalis? | Hydroxide ions (OH-) |
| 32 | What is the pH scale? | A measure of the acidity or alkalinity of a solution |
| 33 | What does is the range of the pH scale? | From 0 to 14 |
| 34 | How can the pH of a substance be measured? | Using universal indicator or a pH probe |
| 35 | What pH is neutral? | Seven (7) |
| 36 | What pH values do acids have? | Less than 7 |
| 37 | What pH values do bases have? | More than 7 |
| 38 | What is a base? | A substance with a pH greater than 7 |
| 39 | Give two examples of bases? | Metal oxides and metal hydroxides |
| 40 | What is an alkali? | A base that will dissolve in water |
| 41 | How can neutralisation between acids and alkalis be represent in terms of H+ and OH- ions? | H+ + OH- 🡪 H2O |
| 42 | How can a soluble salt be prepared from an insoluble oxide or carbonate reacting with an acid? | 1. Warm the acid using a Bunsen burner 2. Add the insoluble base to the acid until no more reacts (add to **excess)** 3. **Filter** the excess solid to get the salt solution 4. Gently heat the solution to **evaporate** some water. Leave the rest for the salt to form (**crystallisation**) |
| 43T | How is a titration used to find out concentration? **(Triple only)** | 1. Add indicator to the acid or alkali 2. Add other reagent (acid or alkali) using a burette swirling each time 3. Go slower (drop by drop) near the end point 4. Stop when the indicator changes colour |
| 44T | What is a single indicator? **(Triple only)** | An indicator that is only one colour in acid and another colour in alkali, regardless of how strong |
| 45T | Give three examples of single indicators, and what are their colours in acids and alkalis? **(Triple only)** | Litmus paper (red in acid, blue in alkali),  Phenolphthalein (colourless in acids, pink in alkali),  Methyl orange (red in acids, yellow in alkalis) |
| 46T | Why are single indicator used for titrations? **(Triple only)** | You want to see a sudden colour change to make it easier to see the end point |
| 47H | What is a strong acid? **(HT only)** | An acid that is fully dissociated into its ions |
| 48H | What is a weak acid? **(HT only)** | An acid that is partially dissociated into its ions |
| 49H | Give examples of a strong acid. **(HT only)** | Hydrochloric acid, sulfuric acid, nitric acid |
| 50H | Give examples of a weak acid. **(HT only)** | Ethanoic acid, citric acid, carbonic acid |
| 51H | What is the concentration of an acid? **(HT only)** | A measure of the amount of hydrogen ions dissolved in per unit volume of solvent |
| 52H | What happens to the hydrogen ion concentration of a solution as the pH decreases by one unit? **(HT only)** | The hydrogen ion concentration of the solution increases by a factor of 10 |
| 53H | What is the difference between concentration and strength of an acid? **(HT only)** | Concentration describe the total number of dissolved acid molecules per unit volume  Strength is the number of molecules that are ionised to produce hydrogen ions |
| 54 | What is an electrolyte? | A liquid or solution that is able to conduct electricity due to the presence of ions |
| 55 | What is the cathode? | The negative electrode |
| 56 | What is the anode? | The positive electrode |
| 57 | What is electrolysis? | Splitting up a compound with electricity |
| 58 | What is attracted towards the cathode during electrolysis? | The positive ions (the cations) |
| 59 | What is attracted towards the anode during electrolysis? | The negative ions (the anions) |
| 60 | What happens to the ions at each electrode? | They turn back into atoms |
| 61 | What happens to the positive ions at the cathode? | They gain electrons |
| 62 | What happens to the negative ions at the anode? | They lose electrons |
| 63 | When is electrolysis used to extract metals? | When the metal is more reactive than carbon OR if the metal reacts with carbon |
| 64 | What is aluminium oxide dissolved in during the electrolysis of aluminium oxide? | Cryolite |
| 65 | Why is aluminium oxide dissolved in cryolite for its electrolysis? | Its lowers the melting point needed and therefore reduces the amount of energy required |
| 66 | What are the electrodes made of for the electrolysis of aluminium oxide? | Carbon |
| 67 | Why does the anode need replacing during the electrolysis of aluminium oxide? | It is made of carbon, and reacts with oxygen to produce carbon dioxide |
| 68 | Why would hydrogen be produced at the cathode during the electrolysis of an ionic compound in solution? | If the metal is more reactive than hydrogen |
| 69 | What is produced at the anode during the electrolysis of an ionic compound in solution when halide ions aren’t present? | Oxygen |

**Core questions – Chemistry unit 5 – Energy changes**

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| --- | --- | --- |
| **No.** | **Question** | **Answer** |
| 1 | What is an exothermic reaction? | One that transfers energy to the surroundings (energy is given out) |
| 2 | What happens to the temperature of the surroundings in an exothermic reaction? | It increases |
| 3 | What types of chemical reactions are exothermic? | Combustion, oxidation reactions, neutralisation |
| 4 | What is an endothermic reaction? | One that takes in energy from the surroundings |
| 5 | What happens to the temperature of the surroundings in an endothermic reaction? | It decreases |
| 6 | What types of chemical reactions are endothermic? | Thermal decompositions. The reaction of citric acid and sodium hydrogencarbonate |
| 7 | Give two uses of exothermic reactions. | Self-heating cans, hand warmers |
| 8 | Give a use of endothermic reactions | Instant cold pack for sports injuries |
| 9 | How can the energy transfer in a chemical reaction be measured? | Using a thermometer to measure the temperature change |
| 10 | How can we avoid energy being lost to the surroundings when measuring the temperature change of a chemical reaction? | Use insulation (like cotton wool) |
| 11 | What is the activation energy of a reaction? | The minimum amount of energy that particles must have when they collide in order to react |
| 12 | What does the energy level diagram look like for an exothermic reaction? | Image result for exothermic energy diagram |
| 13 | What does the energy level diagram look like for an endothermic reaction? | Image result for exothermic energy diagram |
| 14 | What happens to the activation energy when a catalyst is used? | It is lower |
| 15H | What is bond energy? **(HT only)** | The amount of energy that is needed to make or break a bond |
| 16H | What sort of process is bond breaking? **(HT only)** | Endothermic |
| 17H | What sort of process is bond making? **(HT only)** | Exothermic |
| 18H | When would a reaction be exothermic, in terms of bond breaking and making? **(HT only)** | The energy released from forming new bonds is greater than the energy needed to break existing bonds |
| 19H | Why would a reaction be endothermic, in terms of bond breaking and making? **(HT only)** | The energy needed to break existing bonds is greater than the energy released from forming new bonds |
| 20H | How can we calculate the overall energy change for a reaction? **(HT only)** | The sum of the energies needed to break bonds in the reactants minus the energy released when the new bond are formed in the products |
| 21T | What is an electrochemical cell? **(Triple only)** | A system made up of two different electrodes in contact with an electrolyte |
| 22T | What is a charge difference and how is it created in a cell? **(Triple only)** | A potential difference (voltage). Created by the chemical reactions between the electrodes and the electrolyte |
| 23T | What is the voltage produced by a cell dependent on? **(Triple only)** | The type of electrode and the electrolyte |
| 24T | What is an electrolyte? **(Triple only)** | A liquid that contains ions which react with the electrodes |
| 25T | What effect does the reactivity of the electrodes have on the voltage produced? **(Triple only)** | The bigger the difference in reactivity between the metals used as electrodes, the greater the voltage |
| 26T | What is a battery? **(Triple only)** | Two or more cells connected together in series to provide a greater voltage |
| 27T | Why do non-rechargeable cells stop working? **(Triple only)** | Because one of the reactants has been used up |
| 28T | What type of batteries are non-rechargeable? **(Triple only)** | Alkaline batteries |
| 29T | Why can rechargeable cells be recharged? **(Triple only)** | Because their reactions are reversible |
| 30T | How are the reactions reversed in a rechargeable battery? **(Triple only)** | By connecting it to an electric current |
| 31T | What is a fuel cell? **(Triple only)** | A cell where the chemical energy from a fuel is converted into electricity. The fuel is provided from an external source. |
| 32T | How is a potential difference produced in a fuel cell? **(Triple only)** | When the fuel is oxidised electrochemically with the fuel cell |
| 33T | What happens at the anode? **(Triple only)** | Hydrogen loses electrons to produce H+ ions (oxidation). H+ ions move to the cathode. |
| 34T | What is the half equation to show what happens at the anode? **(Triple only)** | 2H2 🡪 4H+ + 4e- |
| 35T | What happens at the cathode? **(Triple only)** | Oxygen gains electrons from the cathode and reacts with H+ ions to make water |
| 36T | What is the half equation to show what happens at the cathode? **(Triple only)** | O2 + 4H+ + 4e- 🡪 2H2O |
| 37T | What is the overall reaction in a hydrogen fuel cell? **(Triple only)** | Hydrogen + Oxygen 🡪 Water |
| 38T | What are the advantages of hydrogen fuel cells? **(Triple only)** | They have no moving parts to maintain, Very quiet in use, their only product is water |
| 39T | What are the disadvantages of hydrogen fuel cells? **(Triple only)** | Hydrogen is difficult to store (could be explosive!), there is not yet a network of filling stations |

**Core questions – Chemistry unit 6 – Rate and extent of chemical change**

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| --- | --- | --- |
| **No.** | **Question** | **Answer** |
| 1 | What is the rate of a chemical reaction? | The speed at which the reactants are changed into products |
| 2 | What equations can we use to calculate the rate of reaction? | *mean rate of reaction = quantity of reactant used*  *time taken*  *mean rate of reaction = quantity of product formed*  *time taken* |
| 3 | What units are used to measure the quantity of reactant or product? | Mass in grams (if it is a solid), or volume in cm3 (if it is a gas) |
| 4 | What units can be used to represent the rate of reaction? | Grams per second (g/s) or cubic centimetres per second (cm3/s) |
| 5 | What is ‘collision theory’? | Chemical reactions only occur when the reacting particles collide with each other a with sufficient energy |
| 6 | What is the ‘activation energy’? | The minimum amount of energy the particles need to collide with to react |
| 7 | What four factors can affect the rate of reaction? | Temperature, concentration or pressure, surface area, use of a catalyst |
| 8 | What happens to the rate of reaction if the temperature is increased? | Increases |
| 9 | Why does the rate of reaction increase if the temperature of the reactants is increased? | There are more **successful** collisions because the particles have more energy  There are more **frequent** collisions because they are moving faster |
| 10 | What happens to the rate of reaction if concentration or pressure is increased? | Increases |
| 11 | Why does the rate of reaction increase if the concentration or pressure of the reactants is increased? | There are more **frequent** collisions because there are more particles in the same space |
| 12 | What happens to the rate of reaction if the surface area of the reactant is increased? | Increases |
| 13 | How can you increase the surface area of a reactant? | Cut it into smaller pieces |
| 14 | Why does the rate of reaction increase if the surface area of the reactant is increased? | There are more **frequent** collisions because there is a higher surface area to volume ratio meaning there are more particles exposed |
| 15 | What is a catalyst? | A substance used to speed up a chemical reaction |
| 16 | Why does using a catalyst increase the rate of reaction? | They provide an alternative reaction pathway with a lower activation energy |
| 17 | What happens to a catalyst during a reaction? | Nothing, they are not used up |
| 18 | Draw a reaction profile for an exothermic reaction before and after a catalyst has been used? |  |
| 19 | What are three different ways we can measure the rate of a reaction? | Time how long it takes for the colour of a solution to change  Time how long it takes for a substance to lose mass (if a gas is given off)  Time how long it takes to collect gas in a gas syringe |
| 20 | Why might the colour of a solution change during a reaction? | If one of the products of the reaction is a precipitate (a solid) |
| 21 | What would be plotted on the axis of a graph if you were recording the volume of gas produced at regular time intervals? | Time on the x - axis, volume of gas on the y - axis |
| 22 | Draw a sketch graph of the volume of gas produced over time during a chemical reaction? | Image result for rate of reaction graph |
| 23 | How do we tell when the reaction has stopped on a rate of reaction graph? | The line becomes horizontal (the line is flat – no more gas is produced) |
| 24 | How can you calculate the rate of a chemical reaction at a certain point, from a graph? | The gradient of the graph at that point |
| 25 | What is a reversible reaction? | A reaction in which the products of the reaction react to produce the original reactants |
| 26 | What is the symbol for a reversible reaction? | ⇌ |
| 27 | How are reversible reactions represented? | *A* + *B* ⇌ *C* + *D* |
| 28 | When does a reversible reaction reach ‘equilibrium’? | When the forward and reverse reactions occur at exactly the same rate |
| 29 | What is needed for equilibrium to be achieved in a reaction? | A closed system – none of the reactants can escape, and nothing else can get in |
| 30 | What happens to the concentration of the products if the equilibrium of a reaction lies to the right? | The concentration of products is greater than that of the reactants |
| 31 | What happens to the concentration of the products if the equilibrium of a reaction lies to the left? | The concentration of the products is less than that of the reactants |
| 32 | What factors can change the position of equilibrium? | Temperature, pressure, changing the concentration of reactants or products |
| 33 | What sort of energy transfers take place in a reversible reaction? | If it is exothermic in one direction (gives out energy), it is endothermic in the opposite direction (takes in energy) |
| 34 | What happens to the total amount of energy in the forward and backward reaction in a reversible reaction? | It remains the same |
| 35 | What is Le Chatelier’s Principle? **(higher tier)** | If you change the conditions of a reversible reaction at equilibrium, the system will try to counteract that change |
| 36 | What happens to the reaction’s equilibrium if the temperature of the reaction is decreased? **(higher tier)** | It will move in the **exothermic direction** to produce more heat  You will get more products for the exothermic reaction |
| 37 | What happens to the reaction’s equilibrium if the temperature of the reaction is increased? **(higher tier)** | It will move in the **endothermic direction** to try to decrease the temperature.  You will get more products for the endothermic reaction |
| 38 | What happens to the reaction’s equilibrium if the pressure of the reaction is decreased? **(higher tier)** | It will move towards the side where there are **more** molecules of gas |
| 39 | What happens to the reaction’s equilibrium if the pressure of the reaction is increased? **(higher tier)** | It will move towards the side where there are **less** molecules of gas |
| 40 | What happens to the reaction’s equilibrium if the concentration of the reactants is increased? **(higher tier)** | The reaction makes more products |
| 41 | What happens to the reaction’s equilibrium if the concentration of the products is decreased? **(higher tier)** | More reactants will react (decreasing the number of reactants) |

**Core questions – Chemistry unit 7 - Organic chemistry**

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| **No.** | **Question** | **Answer** |
| 1 | What is an organic compound? | Something that contains carbon atoms |
| 2 | How did crude oil form? | From the remains of ancient biomass consisting mainly of plankton that was buried in mud |
| 3 | What is crude oil a mixture of? | Hydrocarbons |
| 4 | What is a hydrocarbon? | Molecules made up of hydrogen and carbon atoms only |
| 5 | What is an alkane? | A saturated hydrocarbon |
| 6 | What is the general formula for an alkane? | CnH2n+2 |
| 7 | What is a saturated hydrocarbon? | Contains only single covalent bonds between atoms |
| 8 | What is displayed formula? | Represents the covalent bonds present in a molecule as lines |
| 9 | How do we name alkanes? | Look at the carbon chain length, apply the right prefix and add ‘ane’ on the end |
| 10 | What is the prefix for 1 carbon? | Meth- |
| 11 | What is the prefix for 2 carbons? | Eth- |
| 12 | What is the prefix for 3 carbons? | Prop- |
| 13 | What is the prefix for 4 carbons? | But- |
| 14 | How are the hydrocarbons in crude oil separated? | Fractional distillation |
| 15 | What is a fractional distillation ‘fraction’? | Contains molecules with a similar number of carbon atoms |
| 16 | Describe temperature changes in the fractional distillation column? | Hotter at the bottom, colder at the top |
| 17 | Why do the different fractions condense at different temperatures? | Different chain lengths have different boiling points |
| 18 | What are the 2 physical changes involved in fractional distillation? | Evaporation and condensation |
| 19 | What can crude oil fractions be used for? | Fuels and as a raw material for the petrochemical industry |
| 20 | What different fuels come from crude oil? | Petrol, diesel, kerosene, heavy fuel oil, petroleum gases |
| 21 | What substances are made from crude oil, other than fuels? | Solvents, lubricants, polymers, detergents |
| 22 | What properties are affected by hydrocarbon chain length? | Boiling point, viscosity, flammability |
| 23 | How does hydrocarbon chain length affect boiling point? | The longer the chain, the higher the boiling point |
| 24 | What is flammability? | How easily a substance ignites or burns |
| 25 | How does hydrocarbon chain length affect the flammability? | The longer the chain, the less flammable it is |
| 26 | What is viscosity? | How thick a liquid is |
| 27 | How does hydrocarbon chain length affect viscosity? | The longer the chain length, the more viscous it is |
| 28 | Why do we burn hydrocarbon fuels? | To release energy |
| 29 | What type of reaction is combustion? | Oxidation |
| 30 | What are the two products when a hydrocarbon undergoes complete combustion? | Carbon dioxide, water |
| 31 | What is cracking? | Breaking down large hydrocarbons to smaller, more useful molecules |
| 32 | Why are smaller hydrocarbons more useful than larger molecules? | Make better fuels |
| 33 | What are the two types of cracking? | Catalytic cracking, steam cracking |
| 34 | What conditions are needed for catalytic cracking? | Vapour passed over a hot catalyst at high temperature |
| 35 | What conditions are needed for steam cracking? | Mix vapours with steam at high temperature |
| 36 | What are the products of cracking? | Alkane(s) and alkene(s) |
| 37 | What is an alkene? | An unsaturated hydrocarbon with a carbon-carbon double bond |
| 38 | What is the test for an alkene? | Turns bromine water from orange to colourless |
| 39 | What are alkenes used for? | Producing polymers and other chemicals |
| 40 | How do we name alkenes? **(Triple only)** | Look at the carbon chain length, apply the right prefix and add ‘ene’ on the end |
| 41 | What does the ‘functional group’ on a molecule determine? **(Triple only)** | How it reacts |
| 42 | What functional group do alkenes contain? **(Triple only)** | Carbon-carbon double bond (C=C) |
| 43 | What is a homologous series? **(Triple only)** | A series of compounds with the same functional group |
| 44 | What causes incomplete combustion? **(Triple only)** | A lack of oxygen |
| 45 | What are the products of incomplete combustion? **(Triple only)** | Carbon monoxide, soot, water |
| 46 | What is an addition reaction? **(Triple only)** | A reaction that add a molecule across the carbon-carbon double bond |
| 47 | What conditions are needed for the addition of hydrogen to alkenes? **(Triple only)** | A heated catalyst of nickel at 300oC |
| 48 | What is produced when an alkene reacts with hydrogen? **(Triple only)** | An alkane (a saturated hydrocarbon) |
| 49 | What conditions are needed for the addition of water to alkenes? **(Triple only)** | React with steam passed over a catalyst of hot phosphoric acid |
| 50 | What is the product when an alkene reacts with water? **(Triple only)** | Ethanol |
| 51 | What functional group do alcohols contain? **(Triple only)** | -OH |
| 52 | What are the main uses of alcohols? **(Triple only)** | Fuels and solvents, making alcoholic drinks and bread |
| 53 | How do we name alcohols? **(Triple only)** | Look at the carbon chain length and apply the right prefix and add ‘anol’ on the end |
| 54 | What are two ways alcohols can be produced? **(Triple only)** | Fermentation and hydration of ethene |
| 55 | What conditions are needed for the fermentation of sugar? **(Triple only)** | Add sugar to yeast at 25-40oC in anaerobic conditions |
| 56 | What are the products of the fermentation of glucose? **(Triple only)** | Ethanol and carbon dioxide |
| 57 | What is produced when an alcohol reacts with oxygen? **(Triple only)** | Carbon dioxide and water |
| 58 | What gas is produced when an alcohol reacts with sodium? **(Triple only)** | Hydrogen |
| 59 | What is formed when alcohols react with an oxidising agent? **(Triple only)** | A carboxylic acid and water |
| 60 | What is formed when alcohol is dissolved in water? **(Triple only)** | A neutral solution |
| 61 | What functional group do carboxylic acids contain? **(Triple only)** | -COOH |
| 62 | How do we name carboxylic acids? **(Triple only)** | Look at the carbon chain length and apply the right prefix and add ‘anoic’ on the end |
| 63 | What is formed when a carboxylic acid dissolves in water? **(Triple only)** | An acidic solution |
| 64 | Why do carboxylic acids form weak acids in solution? **(Triple only)** | They are only partially ionised in water |
| 65 | What is produced when a carboxylic acid reacts with a metal? **(Triple only)** | A salt and hydrogen |
| 66 | What is produced when carboxylic acids react with carbonates? **(Triple only)** | Salt, carbon dioxide, water |
| 67 | What is produced in a reaction between carboxylic and alcohols? **(Triple only)** | An ester and water |
| 68 | What ester is produced in the reaction between ethanoic acid and ethanol? **(Triple only)** | Ethyl ethanoate |
| 69 | What is a monomer? **(Triple only)** | A molecule that can be bonded to other identical molecules to form a polymer |
| 70 | What is a polymer? **(Triple only)** | A long chain molecule made from many monomers |
| 71 | What is addition polymerisation? **(Triple only)** | A reaction that joins many monomers together to form a polymer |
| 72 | Why can alkenes be used in addition polymerisation? **(Triple only)** | They contain a double bond |
| 73 | How are polymers represented? **(Triple only)** | The displayed formulae are written as repeating units with a square bracket at each end, with an n outside the bracket |
| 74 | What is condensation polymerisation? (HT) **(Triple only)** | When monomers with different functional groups react to produce a new functional group plus a small molecule |
| 75 | How is the polymer structure represented after a condensation reaction? **(Triple only)** | -[[X][Y]]- |
| 76 | What functional groups do amino acids contain? **(Triple only)** | H2N, COOH |
| 77 | What polymer is formed from amino acids? **(Triple only)** | Proteins |
| 78 | What is DNA? **(Triple only)** | A naturally occurring polymer essential for life |
| 79 | What is the function of DNA? **(Triple only)** | Encodes genetic instructions for the development and functioning of living organisms and viruses |
| 80 | What is the structure of DNA? **(Triple only)** | Two polymer chains, made from four different monomers called nucleotides, in a double helix |
| 81 | What are other examples of naturally occurring polymers? **(Triple only)** | Proteins, starch, cellulose |
| 82 | What polymers are formed from glucose monomers? **(Triple only)** | Starch and cellulose |

**Core questions – Chemistry Unit 8 - Chemical analysis**

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| **No.** | **Question** | **Answer** |
| 1 | What is a pure substance in everyday life? | A substance that has had nothing added to it |
| 2 | What is a chemically pure substance? | A single element or compound |
| 3 | What information can be used to determine purity? | Melting and boiling point |
| 4 | What is a formulation? | A mixture that has been designed as a useful product |
| 5 | What are 7 examples of formulations? | Fuels, cleaning agents, paints, medicines, alloys, fertilisers, foods |
| 6 | How are formulations made? | By mixing components in carefully measured quantities |
| 7 | What is chromatography used for? | Separation and identification of substances |
| 8 | What is the visible record that shows the results from chromatography called | Chromatogram |
| 9 | What is the stationary phase? | The solid or liquid that the mobile phase passes through. In paper chromatography, this is the paper. |
| 10 | What is the mobile phase? | The solvent that moves through the stationary phase. E.g water |
| 11 | What is the Rf value? | Retention factor – used to calculate how far different substances have travelled |
| 12 | How do you calculate retention factor? | Rf = Distance moved by substance  Distance moved by solvent |
| 13 | How are different substance identified using chromatography? | By visual comparison or comparing Rf values with known substances |
| 14 | How is a pure substance identified using chromatography? | Only a single spot is visible |
| 15 | What are the key features when carrying out paper chromatography? | Start line drawn in pencil, use a suitable solvent, start line has to be above solvent level |
| 16 | How is carbon dioxide tested for? | Bubble it through limewater |
| 17 | What is the positive result for presence of carbon dioxide? | Limewater turns cloudy |
| 18 | How is chlorine tested for? | Use litmus paper |
| 19 | What is the positive result for the presence of chlorine? | Litmus paper is bleached (turns white) |
| 20 | How is hydrogen tested for? | Burning splint is held at the open end of a test tube |
| 21 | What is the positive result for presence of hydrogen? | A squeaky pop |
| 22 | How is oxygen gas tested for? | Glowing splint inserted into a test tube |
| 23 | What is a positive result for the presence of oxygen? | Glowing splint re-ignited |
| 24 | How are flame tests carried out? **(Triple only)** | Use safety glasses, clean wire with hydrochloric acid, burn loop in flame, dip wire in substance to be tested, burn in blue flame to observe colour |
| 25 | What are flame tests used to identify? **(Triple only)** | Metal ions (cations) |
| 26 | What is a positive flame test for lithium? **(Triple only)** | Crimson flame |
| 27 | What is a positive flame test for sodium? **(Triple only)** | Yellow flame |
| 28 | What is a positive flame test for potassium? **(Triple only)** | Lilac flame |
| 29 | What is a positive flame test for calcium? **(Triple only)** | Orange-red flame |
| 30 | What is a positive flame test for copper? **(Triple only)** | Green flame |
| 31 | How is sodium hydroxide used to identify metal ions in a solution? **(Triple only)** | Add sodium hydroxide and observe of precipitate formed |
| 32 | What is a precipitate? **(Triple only)** | An insoluble solid produced in a reaction |
| 33 | What colour precipitate is observed when sodium hydroxide is added to a solution containing aluminium ions? **(Triple only)** | White |
| 34 | What colour precipitate is observed when sodium hydroxide is added to a solution containing calcium ions? **(Triple only)** | White |
| 35 | What colour precipitate is observed when sodium hydroxide is added to a solution containing magnesium ions? **(Triple only)** | White |
| 36 | What colour precipitate is observed when sodium hydroxide is added to a solution containing copper (II) ions? **(Triple only)** | Blue |
| 37 | What colour precipitate is observed when sodium hydroxide is added to a solution containing iron (II) ions? **(Triple only)** | Green |
| 38 | What colour precipitate is observed when sodium hydroxide is added to a solution containing iron (III) ions? **(Triple only)** | Brown |
| 39 | How are magnesium, calcium and aluminium precipitates distinguished apart? **(Triple only)** | Aluminium re-dissolves with more sodium hydroxide, calcium and magnesium should be flame tested |
| 40 | What is the test for a carbonate? **(Triple only)** | Reacts with dilute acid to form carbon dioxide |
| 41 | What is the test for halides in solution? **(Triple only)** | Add nitric acid and silver nitrate solution |
| 42 | What is a positive result for chloride ions? **(Triple only)** | White precipitate |
| 43 | What is a positive result for bromide ions? **(Triple only)** | Cream precipitate |
| 44 | What is a positive result for iodide ions? **(Triple only)** | Yellow precipitate |
| 45 | What is the test for sulfate ions in solution? **(Triple only)** | Add barium chloride and hydrochloric acid |
| 46 | What is a positive test for sulfate ions? **(Triple only)** | Forms a white precipitate |
| 47 | What are the advantages of using instrumental methods over chemical tests? **(Triple only)** | More accurate, sensitive and rapid |
| 48 | What is one example of an instrumental method of testing for metal ions in solution? **(Triple only)** | Flame emission spectroscopy |
| 49 | How are result from flame emission spectroscopy used to identify a substance? **(Triple only)** | By comparing lines from the spectra to known substances |
| 50 | How is flame emission spectroscopy carried out? **(Triple only)** | Sample is put into a flame and the light given out is passed through a spectroscope |

**Core questions – Chemistry – Unit 9 – Chemistry of the atmosphere**

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| **No.** | **Question** | **Answer** |
| 1 | What gases are present in today’s atmosphere on Earth? | Nitrogen, oxygen, carbon dioxide, water vapour |
| 2 | What are the proportions of the gases in the current atmosphere on Earth? | About 80% nitrogen  About 20% oxygen  Small amounts of carbon dioxide, water vapour and noble gases |
| 3 | How long have the proportions of different gases in the atmosphere been the same? | 200 million years |
| 4 | Why is the evidence about the Earth’s early atmosphere limited? | The time scale of 4.6 billion years |
| 5 | How the Earth’s early atmosphere was formed? | Intense volcanic activity that released gases |
| 6 | How were the oceans formed? | Water vapour that condensed |
| 7 | What was the main gas in the early atmosphere? | Carbon dioxide |
| 8 | What other gases were present in the early atmosphere? | Small amount of methane and ammonia |
| 9 | What was the Earth’s early atmosphere compared to? | Atmospheres of Mars and Venus today - mainly carbon dioxide with little or no oxygen gas |
| 10 | How did the amount of nitrogen in the atmosphere increase? | Volcanoes produced nitrogen |
| 11 | Where did the oxygen in the atmosphere come from? | Photosynthesis of algae and plants |
| 12 | How long ago did algae evolve? | 2.7 billion years ago |
| 13 | Why did the amount of carbon dioxide in the atmosphere decrease? | * Photosynthesis * Locked up in carbonate rocks (limestone) * Locked up in fossil fuels (oil, coal, gas) * Dissolved into the oceans |
| 14 | What are the greenhouse gases? | Water vapour, carbon dioxide, methane |
| 15 | What is the greenhouse effect? | Short wavelength radiation (light) passes through the atmosphere  Long wave radiation (thermal) is reflected back, buts gets trapped by greenhouse gases |
| 16 | Why are greenhouse gases important? | The maintain temperatures on Earth high enough to support life |
| 17 | What have humans done to increase the amount of carbon dioxide in the atmosphere? | Deforestation  Burning fossil fuels |
| 18 | What have humans done to increase the amount of methane in the atmosphere? | Agriculture – farm animals release methane  Landfill sites release methane and carbon dioxide |
| 19 | How are human activities affecting the temperature of the Earth’s atmosphere? | It is increasing, which increases the surface temperature |
| 20 | What does an increase in the surface temperature of the Earth cause? | Climate change |
| 21 | Why do scientists believe that climate change is happening? | It is based on **peer reviewed evidence** |
| 22 | Why is it hard to fully understand the Earth’s climate? | It is complex, and there are many variables, meaning it’s difficult to make models that aren’t over simplified |
| 23 | What are the consequences of climate change? | * Polar ice caps melting * Changes in rainfall patterns * More extreme weather events * Differences in the distributions of wildlife |
| 24 | What is the consequence of the polar ice caps melting? | It will cause a rise in sea levels, increased flooding and coastal erosion |
| 25 | What is the consequence of changes in rainfall patterns? | Some regions may get too much of too little water making it more difficult to make food |
| 26 | What is a carbon footprint? | The total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, service or event |
| 27 | What can be done to reduce the carbon footprint? | * Use renewable energy sources instead of fossil fuels * Avoid putting waste into landfill sites * Tax products, services or events that produce large amount of carbon dioxide * Use carbon capture and storage in power stations |
| 28 | Why is making reductions in the carbon footprint difficult? | * Lots more research needs to be done with renewable fuels * Governments are worried making changes will affect the economic growth of communities * Individuals don’t want to make changes to their lifestyles |
| 29 | What is a fossil fuel? | A substance that contains a mixture of hydrocarbons |
| 30 | What are the products when fossil fuels are burnt? | Carbon dioxide, water vapour, carbon monoxide, sulfur dioxide, oxides of nitrogen, particulates |
| 31 | What is the equation for complete combustion? | fuel + oxygen 🡪 carbon dioxide + water |
| 32 | What is the equation for incomplete combustion? | fuel + oxygen 🡪 carbon dioxide + carbon monoxide + water + carbon |
| 33 | What is carbon monoxide? | Carbon monoxide is a toxic gas. It is colourless and odourless |
| 34 | What are the consequences of sulfur dioxide and nitrous oxides being released into the atmosphere? | They can cause respiratory problems if breathed in and acid rain when mixed with clouds |
| 35 | What are particulates? | Solid particles of soot (carbon) |
| 36 | What health problems are associated with particulates? | If they are inhaled, they can cause respiratory problems |
| 37 | What environmental problems are associated with particulates? | They can reflect sunlight back into space, causing **global dimming** |

**Core questions – Chemistry – Unit 10 – Using resources**

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| **No.** | **Question** | **Answer** |
| 1 | What do human’s use the Earth’s resources for? | To provide warmth, shelter, food and transport |
| 2 | What is a natural resource? | Something that forms without human input |
| 3 | What is a synthetic product? | A man made product |
| 4 | Give an example of a natural product that can be replaced by a synthetic product? | Rubber can be replaced with polymers |
| 5 | How does agriculture play a role in human development? | It can provide conditions where natural resources can be enhanced for our needs |
| 6 | Give an example of how agriculture can enhance natural resources? | Fertilisers mean we can produce a higher yield of crops |
| 7 | What is a finite resource? | A resource that will run out |
| 8 | What is a renewable resource? | Reforms at a similar rate to, or faster than, we use them |
| 9 | What is sustainable development? | Development that meets the needs of current generations without compromising the ability of future generations to meet their own needs |
| 10 | What is potable water? | Water that is safe to drink |
| 11 | What is ‘safe’ water? | Water that doesn’t have high levels of dissolved salts or microbes |
| 12 | Why is potable water not chemically pure? | Because it contains a mixture of ions and other dissolved substances |
| 13 | What is ‘pure’ water? | Water that contains only H2O |
| 14 | How is potable water produced? | * Choosing an appropriate source of fresh water (rainwater in lakes, rivers and reservoirs) * Passing the water through filter beds – this removes big solids bits * Sterilising – to kill any harmful microbes |
| 15 | What methods are used to sterilise water? | Chlorine, ozone or ultraviolet light |
| 16 | How is potable water produced in dry countries? | Desalination of salty water or sea water |
| 17 | What methods are used to desalinate salty water? | Distillation or reverse osmosis |
| 18 | How is water distilled? | * Heat a flask of salty water * The water boils to produce steam, leaving dissolved salts in the flask * The steam then condenses back to liquid |
| 19 | Why is distillation and reverse osmosis expensive? | They require large amounts of energy |
| 20 | What is waste water? | Water that has been used in agriculture, industry or domestically and released into sewers |
| 21 | What needs to be removed from waste water? | Organic matter and harmful microbes and chemicals |
| 22 | What processes are involved in the treatment of sewage? | 1. Screening and grit removal 2. Sedimentations to produce sewage sludge and effluent 3. Anaerobic digestion of sewage sludge 4. Aerobic biological treatment of effluent |
| 23 | What is low-grade copper ore? **(HT only)** | Ores without much copper in it |
| 24 | What two ways are being used to extract copper from low grade copper ore? **(HT only)** | Phytomining, bioleaching |
| 25 | What is phytomining? **(HT only)** | Uses plants to absorb metal compounds. The plants are harvested and burned to produce ash that contains metal compounds |
| 26 | What is bioleaching? **(HT only)** | Uses bacteria to produce leachate solutions that contain metal compounds |
| 27 | How are the metal compounds processed once they have undergone phytomining or bioleaching? **(HT only)** | They undergo displacement using scrap iron, or electrolysis |
| 28 | Why are new ways of extracting copper better? **(HT only)** | * They can extract small amounts of copper from the Earth * It is less damaging to the environment because it reduces the amount of digging, moving and disposing of large amounts of rock |
| 29 | What is a life cycle assessment (LCA)? | It looks at every stage of a product’s life to assess the impact it would have on the environment |
| 30 | What stages are looked at during the life cycle assessment? | * Extracting and processing raw materials * Manufacturing and packaging * Use and operation during its lifetime * Disposal at the end of its useful life, including transport and distribution at each stage |
| 31 | What problems are there with life cycle assessments? | It’s difficult to allocate numerical values to the effect of some pollutants  LCAs can be biased, depending on who is doing the assessment  Selective LCAs can be used to only show some of the impacts of a product |
| 32 | How can the use of finite resources be reduced? | Using less, reuse products and recycling materials |
| 33 | Give examples of materials that are made from finite materials? | Metals, glass, building materials, clay ceramics, plastics |
| 34 | Why is recycling a product better than making it from scratch? | * Mining and extracting metals uses lots of energy whereas recycling uses less energy * Conserves finite resources |
| 35 | How are metals recycled? | By melting them and then casting them into the shape of the new product |
| 36 | How is glass recycled? | It is separated by colour and chemical composition then crushed and melted to make different glass products |
| 37 | What is corrosion? **(Triple only)** | The destruction of materials by chemical reaction with substances in the environment |
| 38 | Give an example of corrosion? **(Triple only)** | Rusting |
| 39 | What is rusting? **(Triple only)** | When iron reacts with oxygen and water to produce iron oxide |
| 40 | What is needed for iron to rust? **(Triple only)** | Oxygen AND water |
| 41 | How can corrosion be prevented? **(Triple only)** | By applying a coating that acts as a barrier such as greasing, painting or electroplating |
| 42 | How does painting stop rusting? **(Triple only)** | It acts as barrier to stop oxygen and water getting to the iron |
| 43 | What is electroplating? **(Triple only)** | It uses electrolysis to reduce metal ions onto an iron electrode, which coats the iron with a layer of a different metal that won’t be corroded away |
| 44 | When is oil or greasing used to prevent rusting? **(Triple only)** | When moving parts are involved e.g. a bike chain |
| 45 | What is the ‘sacrificial method’ of protecting iron? **(Triple only)** | A more reactive metal such as zinc or magnesium is placed on the iron. This metal then reacts instead of the iron |
| 46 | Why doesn’t aluminium corrode? **(Triple only)** | It reacts with oxygen to form aluminium oxide, which forms a protective layer over the aluminium |
| 47 | What is an alloy? **(Triple only)** | A mixture of different metals |
| 48 | What is bronze an alloy of? **(Triple only)** | Copper and tin |
| 49 | What is a use of bronze? **(Triple only)** | It’s used to make medals and statues |
| 50 | What is brass an alloy of? **(Triple only)** | Copper and zinc |
| 51 | What is a use of brass? **(Triple only)** | Used in water taps and door fitting |
| 52 | What is gold usually alloyed with in jewellery? **(Triple only)** | Silver, copper and zinc |
| 53 | How is the proportion of gold measured? **(Triple only)** | In carats |
| 54 | What is 24 carat gold? **(Triple only)** | 100% gold |
| 55 | What is 18 carat gold? **(Triple only)** | 75% gold |
| 56 | What is steel? **(Triple only)** | An alloy of iron, carbon and other metals |
| 57 | What are the properties of high carbon steel? **(Triple only)** | Strong, brittle |
| 58 | What is a use of high carbon steel? **(Triple only)** | Bridges |
| 59 | What are the properties of low carbon steel? **(Triple only)** | Softer and more easily shaped |
| 60 | What is a use of low carbon steel? **(Triple only)** | Car bodies |
| 61 | What are the properties of steels containing chromium and nickel? **(Triple only)** | Stainless steel – hard and resistant to corrosion |
| 62 | What is a use of stainless steels? **(Triple only)** | Cutlery |
| 63 | What are the properties of aluminium alloys? **(Triple only)** | Low density |
| 64 | What are aluminium alloys used for? **(Triple only)** | To make aircraft |
| 65 | What type of glass is used the most? **(Triple only)** | Soda lime glass |
| 66 | How is soda lime glass made? **(Triple only)** | By heating a mixture of sand, sodium carbonate and limestone until it melts. It dries as glass |
| 67 | How is borosilicate glass made? **(Triple only)** | From sand and boron trioxide |
| 68 | How is borosilicate glass different from soda lime glass? **(Triple only)** | Borosilicate glass melts at higher temperatures than soda lime glass |
| 69 | What are ceramics? **(Triple only)** | Non-metal solids with high melting points that aren’t made from carbon-based compounds |
| 70 | What are clay ceramics? **(Triple only)** | Ceramics made from clay, including pottery and bricks |
| 71 | How are clay ceramics made? **(Triple only)** | By shaping wet clay and then heating in a furnace |
| 72 | What is a polymer? **(Triple only)** | A chain of many of the same monomers |
| 73 | What do the properties of polymers depend on? **(Triple only)** | The monomers they are made from and the conditions under which they are made |
| 74 | What monomer are low density and high density poly(ethene) made from? **(Triple only)** | Ethene |
| 75 | What conditions are needed to make low density poly(ethene)? **(Triple only)** | A moderate temperature under high pressure with a catalyst |
| 76 | What are the properties of low density poly(ethene)? **(Triple only)** | Flexible |
| 77 | What is low density poly(ethene) used for? **(Triple only)** | Plastic bags and bottles |
| 78 | What conditions are needed to make high density poly(ethene)? **(Triple only)** | A low temperature and pressure with a catalyst |
| 79 | What are the properties of high density poly(ethene)? **(Triple only)** | It is rigid |
| 80 | What is low density poly(ethene) used for? **(Triple only)** | Water tanks and drainpipes |
| 81 | What is a thermosoftening polymer? **(Triple only)** | Contains individual polymer chains entwined together with weak forces between the chains |
| 82 | What are the properties of thermosoftening polymer? **(Triple only)** | They have low melting points and can be remoulded |
| 83 | What is a thermosetting polymer? **(Triple only)** | Contains monomers that can form cross-links between the polymer chains, holding the chains together in a solid structure |
| 84 | What are the properties of thermosetting polymers? **(Triple only)** | They don’t soften when heated. They are hard, strong and rigid |
| 85 | What is a composite? **(Triple only)** | Made of two materials, and a matrix or binder surrounding the fibres or fragments of other materials, binding them together |
| 86 | What are the fibres or fragments in a composite called? **(Triple only)** | Reinforcement |
| 87 | What examples are there of composites? **(Triple only)** | Fibreglass, carbon fibre, concrete, wood |
| 88 | What is fibreglass? **(Triple only)** | Consists of fibres of glass embedded in a matrix made of plastic |
| 89 | What is carbon fibre? **(Triple only)** | Long chains of carbon atoms or carbon nanotubes bonded together |
| 90 | What is concrete? **(Triple only)** | Aggregate (sand and gravel), embedded in cement |
| 91 | What is wood? **(Triple only)** | A natural composite of cellulose fibres held together by an organic polymer matrix |
| 92 | What is the Haber process? **(Triple only)** | A process used to manufacture ammonia |
| 93 | What is the chemical equation for the Haber process? **(Triple only)** | N2 + 3H2 ⇌ 2NH3 |
| 94 | What are the raw materials needs for the Haber process? **(Triple only)** | Nitrogen & hydrogen |
| 95 | Where does the nitrogen come from for the Haber process? **(Triple only)** | The air |
| 96 | Where does the hydrogen come from for the Haber process? **(Triple only)** | Reacting methane with steam |
| 97 | Describe the process of the Haber process? **(Triple only)** | Purified hydrogen and nitrogen are passed over a catalyst of iron at a high temperature (about 450oC) and a high pressure (about 200 atmospheres). The ammonia liquefies and is removed. |
| 98 | Why is a temperature of 450oC and a pressure of 200 atm used in the Haber process? **(Triple only)** | It’s a compromise between the speed of the reaction and how expensive it is to do |
| 99 | What is NPK fertiliser? **(Triple only)** | A fertiliser that contains nitrogen, phosphorous and potassium |
| 100 | How is NPK fertiliser made? **(Triple only)** | NPK is a **formulation** of various salts containing appropriate percentages of the elements |
| 101 | What is ammonia used for? **(Triple only)** | To manufacture ammonium salts and nitric acid |
| 102 | How is nitric acid made? **(Triple only)** | Reacting ammonia with oxygen and water |
| 103 | How is ammonium nitrate made? **(Triple only)** | Reacting ammonia with nitric acid |
| 104 | How is ammonium nitrate made in industry? **(Triple only)** | In giant vats at high concentrations making it very exothermic |
| 105 | How is ammonium nitrate made in the lab? **(Triple only)** | By titration and crystallisation resulting in a much slower and less exothermic reaction |
| 106 | How is potassium obtained? **(Triple only)** | By mining potassium chloride and potassium sulfate |
| 107 | How is phosphate rock treated to produce soluble salts? **(Triple only)** | With nitric acid or sulfuric acid |
| 108 | What is produced when phosphate rock is reacted with nitric acid? **(Triple only)** | Phosphoric acid and calcium nitrate |
| 109 | What is produced when phosphate rock is reacted with sulfuric acid? **(Triple only)** | Calcium sulfate and calcium phosphate |
| 110 | What is produced when phosphate rock is reacted with phosphoric acid? **(Triple only)** | Calcium phosphate |