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|  | |  |  | | --- | --- | | **Applied Science Chemistry Summer Work**  Applied Science Chemistry Summer Work |  | | Please note that you may see slight differences between this paper and the original.  Candidates answer on the Question paper.  **Supplied materials:** Additional resources may be supplied with this paper.  **Other materials required:** •   Pencil •   Ruler (cm/mm) |  | |  | | |  |

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| Candidate forename |  | Candidate surname |  |

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| Centre number |  |  |  |  |  | Candidate number |  |  |  |  |

## INSTRUCTIONS TO CANDIDATES

•   Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.  
•   Use black ink. HB pencil may be used for graphs and diagrams only.  
•   Answer **all** the questions, unless your teacher tells you otherwise.  
•   Read each question carefully. Make sure you know what you have to do before starting your answer.  
•   Where space is provided below the question, please write your answer there.  
•   You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number  
    and question number(s).

## INFORMATION FOR CANDIDATES

•   The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography   
    a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and  
    grammar and the use of specialist terminology* is assessed.  
•   The number of marks is given in brackets **[ ]** at the end of each question or part question.  
•   The total number of marks for this paper is **60**.  
•   The total number of marks may take into account some 'either/or' question choices.

Answer **all** the questions.

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **2.** | Which of these shows the balanced symbol equation for the reaction between potassium and chlorine to make potassium chloride?   1. C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p06_01_150.png 2. C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p06_02_150.png 3. C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p06_03_150.png 4. C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p06_04_150.png   Your answer C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p02_01_150.png  **[1]** | | |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **3(a).** | Look at the table. It shows information about some atoms and ions.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Particle** | **Atomic number** | **Mass number** | **Number of protons** | **Number of neutrons** | **Number of electrons** | **Electronic structure** | | **A** | 11 | 23 | 11 | .............. | 11 | 2.8.1 | | **B** | 9 | 19 | 9 | 10 | 9 | ............... | | **C** | ............. | 37 | 17 | ............. | 17 | 2.8.7 | | **D** | 13 | 27 | ............ | ............. | 10 | 2.8 |   **Complete** the table.  **[4]** | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(b).** | Particle **A** is a metal **atom**, particle **D** is an **ion**.  Explain why.      **[2]** | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(c).** | Particle **C** has the electronic structure 2.8.7.  What does this tell you about the position of particle **C** in the Periodic Table?  Explain your answer.        **[4]** | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **4.** | The diagrams show the structures of two forms of carbon.  C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p12_01_150.png  Graphite is a good conductor of electricity.  Diamond does not conduct electricity.  Use ideas about structure and bonding in diamond and graphite to explain these observations.      **[3]** | | |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **5(a).** | Irenka reacts an element, **X**, with oxygen, O2.  There is one product. It is the oxide of **X** i.e. **X** oxide.  4.86 g of **X** reacts with 3.20 g of oxygen to make 8.06 g of **X** oxide.   1. Calculate the number of moles of **X**, oxygen and **X** oxide involved in the reaction.  (The relative atomic mass of **X** is 24.3 and the relative formula mass of oxygen, O2, is 32.0 and of **X** oxide is 40.3.)    Number of moles of **X** = ...........................................................  Number of moles of O2 = ...........................................................  |  |  | | --- | --- | | Number of moles of **X** oxide = ........................................................... | **[3]** |  1. Use your answers to write the **balanced symbol** equation for the reaction between **X** and oxygen to make **X** oxide.   **[2]** | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(b).** | Look at the equation.  It shows the reaction between sodium hydroxide and dilute sulfuric acid.  C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p17_01_150.png  Calculate the mass of sodium hydroxide needed to make 30.0 g of sodium sulfate.  Give your answer to three significant figures.   |  |  | | --- | --- | | Mass of sodium hydroxide = ........................................................... g | **[3]** | | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **6.** | Zinc nitrate can be made by reacting zinc oxide with nitric acid, HNO3.  Write a **balanced symbol** equation for this reaction.  **[2]** | | |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **7.** | Magnesium has an atomic number of 12.  Calculate the mean mass of an atom of magnesium. Quote your answer to **three** significant figures.  (Avogadro constant = 6.022 × 1023 atoms per mole)   |  |  | | --- | --- | | Mean mass ........................................................... g | **[2]** | | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **8(a).** | Look at the diagrams.  They show the structures of two compounds.  C:\core\files\questions\1482242542\J248ChemistryAJ248-03NewSAM\img\p24_01_150.png  Sodium chloride has a melting point of 801oC.  Use the structure of sodium chloride to explain why.      **[2]** | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(b).** | Magnesium oxide has a similar structure to sodium chloride.  Draw ‘dot and cross’ diagrams to show the ionic bonding in magnesium oxide.  You should include the charges on the ions.  The electronic structure of magnesium is 2.8.2.  The electronic structure of oxygen is 2.6.  **[3]** | | |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **9(a).** | The Group 7 elements are known as the halogens.  The halogens have similar chemical properties.  Their physical properties vary with increasing atomic number.  Look at the table of information about the halogens.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Halogen** | **Atomic symbol** | **Atomic number** | **Molecular formula** | **Atomic radius in pm** | **Reaction of halogen with sodium iodide solution** | | fluorine | F | 9 | F2 | 64 | Makes iodine and sodium fluoride | | chlorine | C*l* | 17 | C*l*2 | 99 | Makes iodine and sodium chloride | | bromine | Br | 35 | Br2 | 114 | ..................................  .................................  ................................. | | iodine | I | 53 | I 2 | 133 | No reaction | | astatine | At | 85 | ................ | ................ | No reaction |  1. Predict the molecular formula and atomic radius of astatine.  Put your answers in the table.   **[2]**   1. Predict the reaction of bromine with sodium iodide solution.  Put your answer in the table.   **[1]**   1. Explain your answer to **(ii)** in terms of the reactivity of the halogens.     **[1]** | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(b).** | All halogens react with alkali metals to make a salt.   1. All halogens have similar chemical reactions.  Explain why in terms of electronic structure.     **[1]**   1. Sodium reacts with bromine to make sodium bromide, NaBr.  Construct the **balanced symbol** equation for this reaction.   **[2]**   1. What is the formula of the product of the reaction between astatine and potassium?   **[1]** | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **10.** | Look at the displayed formula of a molecule of glycerol.  C:\core\files\questions\1494566571\Codding_hodd637_1\img\p14_01a_150.png  What is the **molecular formula** of glycerol?  **[1]** | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **11.** | Fluorine reacts with chlorine to make a compound called chlorine fluoride, ClF.  ClF is a **covalent** compound.  The electronic structure of chlorine is 2.8.7.  The electronic structure of fluorine is 2.7.  Draw a ‘dot and cross’ diagram to show the covalent bonding in chlorine fluoride.  **[2]** | | |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **12.** | Jed is testing iron(III) chloride and some unknown compounds.  He does some tests.  These are the tests that Jed does on solutions of the compounds:   * adding sodium hydroxide solution * adding silver nitrate solution.   Look at his results.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | |  |  |  | | --- | --- | --- | | **Compound** | **Adding sodium hydroxide solution** | **Adding silver nitrate solution** | | iron(III) chloride | brown solid made | white solid made | | **A** | blue solid made | white solid made | | **B** | green solid made | cream solid made | |  |   Iron(III) chloride, FeC?3, reacts with silver nitrate, AgNO3, to make silver chloride, AgC?, and iron(III) nitrate, Fe(NO3)3.  Write a **balanced symbol** equation for this reaction.  Identify the unknown compounds **A** and **B** and explain your answers.  C:\core\files\questions\1493394068\J264ChemistryB742-022016Jun\img\p5_01a_150.png*The quality of written communication will be assessed in your answer to this question.*                          **[6]** | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **13.** | One scientist who helped to develop the Periodic Table was called Mendeleev.  Write about how Mendeleev helped in the development of the Periodic Table.        **[2]** | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **14(a).** | Zinc, Zn, reacts with hydrochloric acid, HCl .  Hydrogen gas, H2, and zinc chloride, ZnCl2, are made.  Construct the **balanced symbol** equation for this reaction.  **[1]** | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(b).** | Fatimah and Sam investigate the reaction between acid and metals.  They react dilute hydrochloric acid with zinc powder and with iron powder.  Look at the apparatus they use.  C:\core\files\questions\1493222298\J264ChemistryB741-022016Jun\img\p24-01a_150.png  Every 10 seconds they measure the volume of gas in the gas syringe.  Fatimah and Sam do three different experiments.   * 50 cm3 hydrochloric acid and 0.15 g of zinc * 50 cm3 hydrochloric acid and 0.15 g of iron * 50 cm3 hydrochloric acid and 0.075 g of iron mixed with 0.075 g of zinc.   Look at the graph of the results for the first two experiments.  C:\core\files\questions\1493222298\J264ChemistryB741-022016Jun\img\p25-01a_150.png   1. Calculate the rate of reaction of **iron** during the **first 30 seconds**.       rate of reaction = .............. cm3 / s  **[1]**   1. Predict the total volume of hydrogen formed when the **mixture** of zinc and iron powder is used.   ................................ cm3   **[1]** | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(c).** | Increasing the concentration of a reactant in solution will increase the rate of reaction.  Use the reacting particle model to explain why.        **[2]** | | |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **15.** | Sodium hydrogencarbonate decomposes when it is heated.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | sodium hydrogencarbonate | → | sodium carbonate | + | carbon dioxide | + | water | | 2NaHCO3 | → | Na2CO3 | + | CO2 | + | H2O |   The table shows the relative formula masses, Mr, of the substances in the equation.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | |  |  | | --- | --- | | **Substance** | **Relative formula mass** | | NaHCO3 | 84 | | Na2CO3 | 106 | | CO2 | 44 | | H2O | 18 | |  |   Zakia heats some sodium hydrogencarbonate.  Look at the apparatus she uses.  C:\core\files\questions\1493222298\J264ChemistryB741-022016Jun\img\p19-01a_150.png  Zakia heats 1.000 g of solid sodium hydrogencarbonate.  After heating for ten minutes the test tube contains 0.631 g of solid sodium carbonate.  Zakia does the experiment again.  This time she uses 2.500 g of solid sodium hydrogencarbonate.   1. Show that the predicted mass of solid sodium carbonate that she should make is 1.578 g.       **[1]**   1. Zakia actually makes 1.124 g of solid sodium carbonate.  Calculate the percentage yield.  Give your answer to **three significant figures**.        percentage yield =  ................................... %   **[2]** | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **16(a).** | 1. Iron rusts in damp air.  Rust is hydrated iron(III) oxide.  Write the **word** equation for the rusting of iron.   **[1]**   1. The rusting of iron is an **oxidation** reaction.  Explain why.   **[1]** | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | **(b).** | This question is about the corrosion of metals.  Look at the table. It shows how four metals corrode in different conditions.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | |  |  |  |  | | --- | --- | --- | --- | | **Metal** | **Does the metal corrode in** | | | | **damp air?** | **damp acidic air?** | **dry air?** | | **A** | no | quickly | no | | **B** | slowly | quickly | no | | **C** | very slowly | very slowly | no | | **D** | very quickly | very quickly | quickly | |  |   Metal **A** is aluminium.  Explain how you can tell from the information in the table.    **[1]** | | |

**END OF QUESTION paper**