**Mearns Castle High School**

**Chemistry Department**

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**Spring Revision Pack**

**55 Marks – Time allowed 1 hour 25**

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| **Question &****Key Area** |  | **Marks** |
| 1 – Rates | The following answer was taken from a student’s examination paper. The answer is **incorrect**. Give the correct explanation. | 1 |
| 2 – Period-icity | Lithium starts the second period of the Periodic Table. a) What is the trend in electronegativity values across this period from Li to F?  b) **Graph 1** shows the first four ionisation energies for aluminium. Why is the fourth ionisation energy of aluminium so much higher that the third ionisation energy? c) **Graph 2** shows the boiling points of the elements in Group 7 of the Periodic Table. Why do the boiling points increase down Group 7?  | 111 |

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| 3 aBonding3b Bond Enthalpy | a) The structures below show molecules that contain chlorine atoms The compounds shown above are not very soluble in water. Trichloromethane is around ten times more soluble in water than tetrachloromethane.**Explain clearly** why trichloromethane is more soluble in water thantetrachloromethane.Your answer should include the names of the intermolecular forces involved.b) Chloromethane can be produced by the reaction of methane with chlorine.CH4(g) + Cl2(g) 🡪 CH3Cl(g) + HCl(g)Using bond enthalpies from the data booklet, calculate the enthalpy change, in kJ mol−1, for this reaction. | 32 |
| 4aEssential oils4bAlcohols | Many molecules in perfumes are molecules consisting of joined isoprene units. 1. What name is given to molecules in perfume consisting of joined isoprene units?
2. Geraniol is one of the compounds found in perfume. It has the following structural formula and systematic name.

Linalool can also be present. Its structural formula is shown.1. State the systematic name for linalool.
2. Explain why linalool can be classified as a tertiary alcohol.
 | 111 |
| 5 a+bRedox and Skills5c(i)Bonding5cii)+iii)Free Radicals | Sodium hypochlorite, NaOCl, is a strong oxidising agent added to water inswimming pools.1. State the purpose of adding sodium hypochlorite to water in swimming pools.
2. The concentration of sodium hypochlorite in swimming pool water can be determined by redox titration.

**Step 1**A 100·0 cm3 sample from the swimming pool is first reacted with an excess ofacidified potassium iodide solution forming iodine.NaOCl(aq) + 2I−(aq) + 2H+(aq) → I2(aq) + NaCl(aq) + H2O(l)**Step 2**The iodine formed in step 1 is titrated using a standard solution of sodiumthiosulfate, concentration 0·00100 mol l−1. A small volume of starch solution is added towards the endpoint.I2(aq) + 2Na2S2O3(aq) → 2NaI(aq) + Na2S4O6(aq)(i) Describe in detail how the burette should be prepared and set up, readyto begin the titration.(ii) Write the ion-electron equation for the oxidation reaction occurring instep 1.(iii) Calculate the concentration, in mol l−1, of sodium hypochlorite inthe swimming pool water if an average volume of 12·4 cm3 of sodiumthiosulfate was required.c) The familiar chlorine smell of a swimming pool is not due to chlorinebut compounds called chloramines. Chloramines are produced when thehypochlorite ion reacts with compounds such as ammonia, produced by thehuman body.OCl−(aq) + NH3(aq) → NH2Cl(aq) + OH−(aq) MonochloramineOCl−(aq) + NH2Cl(aq) → NHCl2(aq) + OH−(aq) DichloramineOCl−(aq) + NHCl2(aq) → NCl3(aq) + OH−(aq) TrichloramineChloramines are less soluble in water than ammonia due to the polarities of the molecules, and so readily escape into the atmosphere, causing irritation to the eyes.(i) Explain the difference in polarities of ammonia and trichloraminemolecules.Chloramines can be removed from water using ultra-violet lighttreatment.One step in the process is the formation of free radicals. UVNH2Cl 🡪 •NH2 + •Clii) What are free radicals?iii) Another step in the process isNH2Cl + •Cl → •NHCl + HClState the name for this type of step in a free radical reaction. | 1313211 |
| 6Esters, Fats and Oils | Pentyl butanoate is responsible for some of the flavour in apricots andstrawberries. (a) Hydrolysis of pentyl butanoate using sodium hydroxide produces analcohol and the salt of the carboxylic acid.(i) Name the alcohol that would be formed when pentyl butanoate ishydrolysed.(ii) Draw a structural formula for the sodium salt of the carboxylic acidthat would be formed.(b) Fats and oils belong to the same class of compounds as pentyl butanoate.(i) Name this class of compounds.(ii) When a fat is hydrolysed using sodium hydroxide, sodium salts offatty acids are produced.State a use for sodium salts of fatty acids. | 1111 |
| 7aHess’ Law7b Equilibrium | Mobile phones are being developed that can be powered by methanol.Methanol can be made by a two-stage process.(*a*) In the first stage, methane is reacted with steam to produce a mixture ofcarbon monoxide and hydrogen.Use the data below to calculate the enthalpy change, in kJ mol–1, for theforward reaction.(*b*) In the second stage, the carbon monoxide and hydrogen react to producemethanol.Circle the correct words in the table to show the changes to temperature andpressure that would favour the production of methanol. | 21 |
| 8aFats and Oils8b Skills8c % Yield8dAtom Economy | In an experiment some oils were used to make soap. The oil, triolein, was reacted with sodium hydroxide.a) Name product X.b) 5·0 g of triolein was dissolved in ethanol and placed in a test tubewith excess sodium hydroxide. The mixture was heated to 80 ºC.State a suitable method for heating the reaction mixture.c) The experiment produced 1·28 g of sodium oleate. Calculate the percentage yield.d) Calculate the atom economy of this method of producing sodium oleate.  | 1122 |
| 9aMolar Volume9bProteins | Dishwasher tablets produce the bleach hydrogen peroxide, H2O2. Oneaction of this oxidising agent is to oxidise food.a) Hydrogen peroxide decomposes to form water and oxygen.A dishwasher tablet produces 0·051 g of hydrogen peroxide (mass ofone mole = 34 g).Calculate the volume of oxygen that would be produced when0·051 g of hydrogen peroxide decomposes.*Take the volume of 1 mole of oxygen gas to be 24 litres.*b) Enzymes are commonly added to dishwasher tablets. These are used to break down proteins.(i) The proteins are broken down into small, water-soluble molecules.Name the small, water-soluble molecules made when proteins arebroken down completely.ii)The structure of a section of protein chain found in egg white isshown.(A) Name the functional group circled.(B) Draw a structural formula for **one** of the molecules thatwould be made when this section of egg white protein chainis completely broken down.(iii) As part of the program in the dishwasher, the conditions in thedishwasher change so that the enzyme molecules no longer workbecause they change shape.(A) State the term used to describe the change in shape ofenzyme molecules.(B) Suggest a change in conditions which would cause theenzyme molecules to change shape. | 311111 |
| 10aEsters10bExcess10cCosting/Numeracy Q | Methyl benzoate is commonly added to perfumes as it has a pleasant smell.The chemical reaction involved in the production of methyl benzoate is shown.a) Name product X.b) In a laboratory experiment, a student used 5·0 g of benzoic acid and 2·5 g of methanol to produce methyl benzoate. Explain why benzoic acid is the limiting reactant. You must include calculations in your answer.c) The student produced 3·1 g of methyl benzoate from 5·0 g of benzoic acid. Benzoic acid costs £39·80 for 500 g. Calculate the cost, in £, of the benzoic acid needed to make 100 g of methyl benzoate using the student’s method. | 122 |
| 11 Enthalpy of Combustion | A student investigated the properties of methanol and ethanolThe student carried out experiments to determine the enthalpy of combustion of the alcohols.a) The student carried out the first experiment as shown, but was told to repeat the experiment as the thermometer had been placed in the wrong position. Suggest why the student’s placing of the thermometer was incorrect.b) The student always used 100 cm3 of water. State another variable that the student should have kept constant.c) The student burned 1·07 g of methanol and recorded a temperature rise of 23 ºC. Calculate the enthalpy of combustion, in kJ mol−1 , for methanol using the student’s results. | 113 |