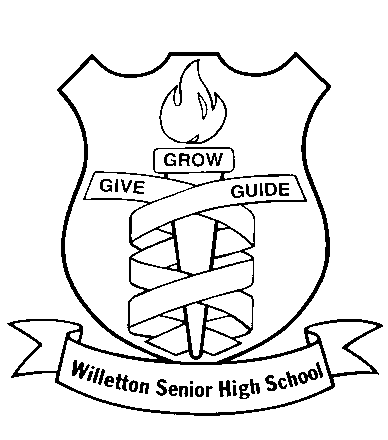
**CHEMISTRY 12 ATCHE**

**Total marks**

**/ 55**

**Organic Chemistry TEST**

**ANSWERS**

**PART ONE: MULTIPLE CHOICE QUESTIONS (10 MARKS)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **C** | **C** | **A** | **D** | **C** | **C** | **C** | **D** | **B** | **D** |

**PART TWO: SHORT ANSWER QUESTIONS (45 marks)**

**Question 11 ( 6 marks)**

Name and draw the structural formula for each of the following:

UNNECESSARY NUMBERS: DO NOT PENALISE eg 2-methylpropan-2-ol

1. An amine containing three carbon atoms per molecule.

**(2 marks)**

|  |
| --- |
| Structure:  1**-propanamine(1-aminopropane)**  Or **2-propanamine (2-aminopropane)**  CH3CH2CH2NH2  Or CH3CHCH3  NH2 |

1. A tertiary alcohol containing four carbon atoms per molecule.

**(2 marks)**

**methylpropanol**

|  |
| --- |
| Structure:  CH3  CH3CHCH3  OH |

1. The trans isomer of the alkene C3H4Cl2.

**trans-1,2-dichloropropene**

**(2 marks)**

|  |
| --- |
| Structure:  Cl CH3  C C  H Cl |

**Question 12 (3 marks)**

Complete the following table showing the structure and names of four organic compounds.

|  |  |
| --- | --- |
| **Structure** | **IUPAC Name** |
|  | **methyl propanoate** |
|  | **3-hexanone** |
|  | **1-amino-2-ethyl-2-methylbutane**  **or**  **2-ethyl-2methylbutan-1-amine** |

|  |  |
| --- | --- |
| **Description** | **Marks** |
| One mark for each correct structure / name | 1-3 |
| **Total** | **3** |

**Question 13 (6 marks)**

Complete the table by drawing the structure and giving the IUPAC name of the organic compounds that match each of the following descriptions.

|  |  |  |
| --- | --- | --- |
| **Description** | **Structure** | **IUPAC name** |
| A saturated secondary alcohol containing 10 hydrogen atoms |  | **Butan-2-ol (allow 2-butanol)** |
| An ester that is an isomer of pentanoic acid and can react with NaOH(aq) to form ethanol |  | **Ethyl propanoate** |
| A hydrocarbon that could be used to make 1,2-dichloromethylpropane via an addition reaction |  | **Methylpropene (allow 2-methylpropene)** |

|  |  |
| --- | --- |
| **Description** | **Marks** |
| One mark for each correct structure / name | 1-6 |
| **Total** | **6** |

**Question 14 (5 marks)**

Potassium peroxymonosulfate (KHSO5) is a powerful oxidising agent used as “Spa Shock” to oxidise organic wastes in spa baths and small swimming pools. The HSO5¯ ion reduces to HSO4¯

(a) Write a balanced half equation for the reduction of HSO5¯ to HSO4¯

**2H+ + HSO5¯ + 2 e‑ HSO4¯ + H2O**

(1 mark)

1. KHSO5 is a strong oxidant and can be used to oxidise propanol. Write the half equation for the complete oxidation of propanol:

**C3H7OH + H2O C2H5COOH + 4H+ + 4 e‑**

(1 mark propanoic acid, 1 mark equation)

1. Write the final overall redox equation for this reaction:

4H+ + 2HSO5¯ + H2O + C3H7OH 2HSO4¯ + 2H2O + C2H5COOH + 4H+

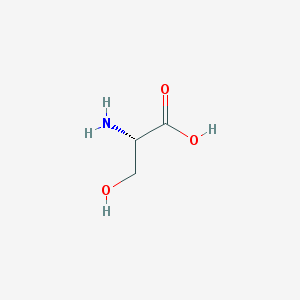
**2HSO5¯ + C3H7OH 2HSO4¯ + H2O + C2H5COOH** ( 2 marks all correct, 1 mark one error, follow through if propanal)

**Question 15 (3 marks)**

Serine, whose structure is shown below, is required for production of antibodies.

It contains three functional groups labelled A,B and C.

Name each of the three functional groups



**A : Amine**

**B : Alcohol (Hydroxyl is ok)**

**C**

**A**

**C : Carboxylic acid (Carboxyl ok, not**

**carbonyl)**

(1 mark each)

**B**

**Question 16 (4 marks)**

The following reaction sequence can be used to synthesise ethyl ethanoate.

Ethene

Acetic (Ethanoic) acid

Ethanol

Ethyl ethanoate

Steam

*Concentrated sulfuric acid*

*Phosphoric acid*

**STEP 1**

**STEP 2**

(a) Consider Step 1 and Step 2 in this reaction sequence.

(i) Write the equation for Step 1 and explain why it is described as an addition reaction. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| C2H4 + H2O → C2H5OH | 1 |
| two reactants and only one product / the water molecule ‘adds’ to the molecule across the double bond. | 1 |
| **Total** | **2** |

(ii) Write the equation for Step 2 and explain why it is described as a condensation reaction. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| C2H5OH + CH3COOH → C2H5OCOCH3 + H2O | 1 |
| a small molecule / water molecule is produced as a product | 1 |
| **Total** | **2** |

**Question 17 (7 marks)**

Consider the two molecules below.

**Molecule A Molecule B**

****

(a) Write the IUPAC name of the two molecules. (2 marks)

Molecule A

|  |  |
| --- | --- |
| **Description** | **Marks** |
| 2-methylpentan-2-ol *accept:*  2-methyl-2-pentanol |  |
| **Total** | **1** |

Molecule B

|  |  |
| --- | --- |
| **Description** | **Marks** |
| 2,2-dimethylbutan-1-ol *accept:*  2,2-dimethyl-1-butanol |  |
| **Total** | **1** |

(b) Describe a chemical test that could be used to distinguish between them. State the expected observations for both substances. (5 marks)

|  |  |  |
| --- | --- | --- |
| **Substance** | **Description of chemical test** | **Expected observations** |
| **Molecule A** | *either:*  **add a few drops / small amount of acidified (potassium) permanganate solution to both substances**  *or:*  **add a few drops / small amount acidified (potassium/sodium) dichromate solution to both substances** | **No colour change** |
| **Molecule B** | *either:*  **purple colour changes to colourless**  *or:*  **orange colour changes to green** |

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Correct description of test. Must include acidification and that the permanganate or dichromate are used in solution form for both marks | 1-2 |
| Molecule A – No reaction | 1 |
| Molecule B – initial colour | 1 |
| Molecule B – final colour | 1 |
| **Total** | **5** |

**Question 18 (11 marks)**

Dopamine is a primary amine that acts as a neurotransmitter, a chemical that send signals between nerve cells. Levels of dopamine in the brain have been linked to a number of medical conditions, including Parkinson’s disease and ADHD. Some additive drugs increase the production of dopamine. Dopamine contains carbon, nitrogen, hydrogen and oxygen. In this question you will work out the formula of dopamine.

Two samples of were analysed to determine its empirical formula.

A 12.1 g sample was combusted in oxygen and produced 27.6 g of carbon dioxide and

7.87 g of water.

A separate 17.2 g sample was found to contain 1.57 g of nitrogen.

(a) Determine the empirical formula of dopamine (6 marks)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | | | | | **Marks** |
| *Sample 1* | | | | | |
| m(C) = 27.6 × (12.01/44.01) = 7.53 g  %(C) = (7.53 / 12.1) × 100 = 62.2 % | | | | | 1 |
| m(H) = 7.87 × (2.016/18.016) = 0.881 g  %(H) = (0.881 / 12.1) × 100 = 7.28 % | | | | | 1 |
| *Sample 2* | | | | | |
| %(N) = (1.57/ 17.2) × 100 = 9.13 % | | | | | 1 |
| Oxygen | | | | | |
| %(O) = 100 – 62.2 – 7.28 – 9.13 = 21.4% | | | | | 1 |
|  | **C** | **H** | **N** | **O** |  |
| mass (%) | 62.2 | 7.28 | 9.13 | 21.4 |
| mole ratio | 62.2/12.01 | 7.28/1.008 | 9.13/14.01 | 21.4/16.00 |  |
|  | 5.187 | 7.222 | 0.6517 | 1.33 | 1 |
| divide by smallest | 5.187/0.6517 | 7.222/0.6517 | 0.6517/0.6517 | 1.33/0.6517 |  |
|  | 7.96 | 11.07 | 1.0 | 2.05 |  |
| round up | 8 | 11 | 1 | 2 |  |
| **Empirical Formula** | **C8H11NO2** | | | | 1 |
| **Total** | | | | | **6** |

(b) Dopamine is a weak monoprotic base (it can only accept one proton). 10.0 g of dopamine was dissolved in distilled water and the solution made up to 250.0 mL. When titrated against 0.250 mol L-1 hydrochloric acid, 25.00 mL of this solution required 26.1 mL of the acid for neutralisation.

From this data, calculate the molecular mass of dopamine, and hence determine the molecular formula of dopamine. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| n(HCℓ) = c × V = 0.250 × 0.0261 = 6.525 × 10-3 mol | 1 |
| n(dopamine)titration = (1/1) × n(HCℓ) = 6.525 × 10-3 mol | 1 |
| n(dopamine)total = (250.0/25.00) × n(dopamine)titration = 6.525 × 10-2 mol | 1 |
| n = m/M, M = m/n  M(dopamine)= 10.0 / 6.525 × 10-2  = 153.2 g mol-1 *(units not required)* | 1 |
| M(Empirical Formula) = M(C8H11NO2) = 153.18  153.2 / 153.18 = 1  Therefore Empirical Formula = molecular formula **= C8H11NO2** | 1 |
| **Total** | **5** |