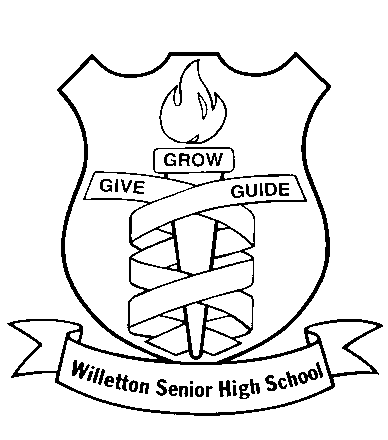
**CHEMISTRY 12 ATCHE**

**2021 Organic Chemistry TEST**

**ANSWERS /52**

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 2. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 3. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 4. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 5. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 6. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 7. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 8. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 9. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |
| 10. | a 🞏 | b 🞏 | c 🞏 | d 🞏 |

/10

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

**Question 11 (3 marks)**

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

|  |  |
| --- | --- |
| **Structure** | **IUPAC Name** |
|  | 3-methylpentan-2-one  Spaces not allowed between methyl and pentan if so, no mark |
|  | 5-methylhexan-3-amine |
|  | 2-methylpentan-3-one |

**Question 12 (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 tertiary alcohol containing 12 hydrogen atoms |  | 2-methylbutan-2-ol  No marks if spaces between methyl and butan.  The guide to whether there is a space is if there is enough room to fit a letter in there |
| An ester that is an isomer of hexanoic acid and made from ethanol |  | ethyl butanoate  also accept butyl ethanoate but only is structure matches |
| A hydrocarbon that could be used to make 1,2-difluoro-3-methylbutane via an addition reaction |  | 3-methylbut-1-ene |

**Question 13 10 marks**

A sample weighing 0.271g of a non-cyclic organic substance was burnt in a combustion chamber. Water (0.269g ) and carbon dioxide ( 0.662g ) were the only products formed. The chemist knew from its reaction with potassium permanganate, and its lack of reaction with bromine water, that the substance must either be an alcohol or an aldehyde, and therefore must contain oxygen. Use this information to calculate the compounds empirical formula. (8 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| Step | working | Answer | Mark |
| nC = | MCO2/FmassCO2 = 0.662/44.01 | = 0.015052 moles | (1 mark) |
| nH2O | MH2O/FmassH2O = 0.269/18.016 | = 0.029846 moles | (1 mark) |
| MC = | nC \* 12.01 = | 0.180776 g | (1 mark) |
| MH = | = nH \* 1.008 = | 0.030084 g | (1 mark) |
| MO= | by subtraction MT-MC-MO = 0.662g - 0.180776 - 0.030084 | 0.060139 g | (1 mark) |
| nO= | mO/MMO = 0.060139 g /16 | 0.003759 | (1 mark) |
| Divide by smallest moles to get ratio | O= 0.003759/0.003759 =1  C= 0.015052/0.003759 = 4.004592  H= 0.029846 / 0.003759 = 7.940367 |  | (1 mark for all 3, ½ if one mistake, nothing for any more) |
|  | Therefore Empirical formula = C4H8O |  | (1 mark) |

Was the compound an aldehyde, or an alcohol? Give a reason for your answer. (2 marks)

Aldehyde (1mark) . An unsaturated, non-cyclic 4 carbon alcohol would have 1 more hydrogen C4H9O (1 mark)

Similar reasoning which references the empirical formula ratios acceptable if they explain their answer.

**Question 14 (8 marks)**

The following synthetic pathway shows the formation of ethyl ethanoate from ethene.



Write out the reactions in equation form, making sure to show any reactants or products not mentioned in this synthesis diagram. (you may use molecular, full or condensed formula at your preference) (6 marks)

|  |
| --- |
| H3PO4   1. C2H4 + H2O -------🡪 C2H6O  C2H5OH 2 marks, only 1 if catalyst is missed or if trivial mistake in formula (1 mark off per mistake). States not required |

|  |
| --- |
| 1. 3CH3CH2OH + 2Cr2O72-  + 16H+ ---🡪 3CH3COOH + 4Cr3+ + 11H2O   2 marks, and boy have they earned them ! 1 mark for all correct species, and 1 mark for correct ratios. Note that this leniency is only on this Question, due to the work a student must put in to answer it. |

|  |
| --- |
| 1. CH3CH2OH + CH3COOH ---🡪 CH3CH2OOCH2CH3 + H2O   CH3COOCH2CH3  2 marks. 1 mark off if they forget water, and for each mistake. Note that this sequence is not a multistep eqn, but pay them marks if they have interpreted it as such |

Give three (3) considerations that chemists must take into account when deciding a synthesis pathway for a chemical (2 marks)

**yield, rate, cost, sustainability, safety**

**Must get 2 for 1 mark, 3 for 2 marks (1 is zero)**

**Question 15 (3 marks)** Complete the following table. Make sure that you use square brackets to indicate that the structure you have drawn is a polymer.

|  |  |
| --- | --- |
| Polymer | Monomer(s) structure |
|  | Note: cis/trans configuration not important. Name not needed, but for reference is 1-fluoro-prop-2-ene |
|  | and |
|  |  |

**Question 16 3 marks**

Describe, with the use of an appropriate equation, how the salt of a 16 carbon long saturated fatty acid can be prepared from a triacylglyceride.

Triacyl glycerides are esters that form between the triol glycerol and 3 fatty acids.

|  |
| --- |
| Such esters can be cleaved (accept hydrolysed, though not technically true) in the presence of hydroxide ions to form glycerol |
| And the fatty acid salt: |
| (C16H31O)3C3H5O3 + 3NaOH 🡪 3 C16H31O2Na + C3H8O3  C15H31COONa |

**Question 17 (6 marks)** Explain, with the use of a labelled diagram, how a salt such as that described in question 16 can be soluble in both polar and non-polar substances, and how this property makes it useful for cleaning oil off surfaces

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Micelle with outer polar and inner hydrophobic (1 mark)  Hydrogen bonding / ion-dipole bonding shown with water (1 mark)  Hydrophobic oil/dirt inside micelle (1 mark)  1 mark off if not labelled     |  |  | | --- | --- | | 1. Identify salt as containing polar and non-polar regions | 1/2 | | 1. Conclude from 1 that it can dissolve in polar and non-polar substances | 1/2 | | 1. Describe type of IMF for polar – ion-dipole with water (accept hydrogen, although that is looking at it from the waters perspective) | 1/2 | | 1. Describe imf in non-polar region – dispersion | 1/2 | | 1. Describe micelle structure that forms as a consequence | 1/2 | | 1. Concluding statement as to how this dissolves dirt | 1/2 | |

**Question 18 (3 marks)**

Describe the chemical composition of soap scum and give two ways in which soap manufacturers have tried to solve this problem (3 marks)

Soap scum is the insoluble calcium salts of long chain fatty acids (1)

Soap manufacturers solve the problem by

Including chelators (polyphosphates) in their soaps (1)

Using detergents such as alkyl benzylsulphonates (1)

Quaternary amine detergents (1)

Neutral detergents (polyalcohols) (1) **3 marks TOTAL**

**Which don’t form insoluble salts with hard water** (must have this link sentence or one similar to get the mark for alkyl benzylsulphonates, Quaternary amine, or Neutral detergents)

Etc. any 2 reasonable