**Unit 1: Organic chemistry solutions**

**Question 1**

*Answer:* B

*Explanation:*

The general formula for an alkene is CnH2n. Alternative B contains three alkenes whereas the other alternatives contain one alkane each.

**Question 2**

*Answer:* D

*Explanation:*

It is the forces between molecules that determine the boiling point of a molecule. The forces within the molecule are not relevant to boiling points.

**Question 3**

*Answer:* D

*Explanation:*

The correct names are respectively, ethanol, propanoic acid and but-2-ene. The functional groups used are listed on the study design.

**Question 4**

*Answer:* A

*Explanation:*

Esters are formed from reactions between alcohols and carboxylic acids. Both segments of the ester contain three carbon atoms so the two molecules are propan-1-ol and propanoic acid.

**Question 5**

*Answer:* A

*Explanation:*

The carbon chain contains 5 carbon atoms so is pentane. Numbering should start from the right hand end as the hydroxyl group has precedence. Correct answer is 3-chloropentan-1-ol

**Question 6**

*Answer:* B

*Explanation:*

The data needs to be used to determine the empirical formula.

 = 6.66:20 = 1:3

Empirical formula is CH3

This could be ethane which has a molecular formula of C2H6

**Question 7**

*Answer:* C

*Explanation:*

The molecule shown contains 5 carbon atoms and it is an alkane so the molecule is an isomer of pentane.

**Question 8**

*Answer:*

*Explanation:* C

A calculation could be done for ethane and ethene since Q6. already provides the percentage mass in ethane but it is not necessary. Each alkene has two less hydrogen atoms than the corresponding alkane so the percentage carbon in the alkene will be higher than the alkane.

**Question 9**

*Answer:* B

*Explanation:*

**Question 10**

*Answer:* D

*Explanation:*

Propan-1-ol will have the highest boiling point due to the hydrogen bonds that can form between its molecules.

**SECTION B: Short-answer questions**

**Question 1** (10 marks)

1. **i**. C8H18

 **ii**. C4H9

 **iii**.

**b. i**. Raw material: crude oil Compound: ethane 2 marks

 **ii**. Raw material: biomass Compound: ethanol 2 marks



c. 3 marks

pentane 2-chlorobutane 2,3-dimethylpropane

**Question** 2 (6 marks)

**a**. **i**. propan-2-ol 

 **ii**. methanoic acid 



 **iii**. 2-methylbutane 1 + 1 + 1 = 3 marks



**b**.

1. mark

**c. i**. 1-butanoic acid : the 1- is not correct as the carboxyl group cannot be anywhere else 1 mark

 **ii**. butene: a number is needed to indicate the position of the carbon-to-carbon double bond 1 mark

 where multiple positions are possible.

**Question 3** (10 marks)

**a. i**.

 **ii**. low boiling point, flammable, insoluble in water, colourless ( any two of these)

1 + 2 = 3 marks

**b**.

 but-2-ene methylpropene (no numbers needed)

4 marks

**c. i**. C4H8 = 56 gmol-1

 **ii**. %C =  \* = 85.7% \*

1 +2 = 3 marks

**Question 4** (4 marks)

**a**. propene but-1-ene (All alkenes have this empirical formula)

2 marks

**b.** propan-1-ol \* \*

2 marks

**Question 5** (10 marks)

**a**. **i**. 2-chloropentane 1 + 1 + 1 = 3 marks



  **ii**. pent-2-ene

 **iii**. propan-2-ol

**b**. The boiling point of chloroethane is higher than that of ethane. The dipole on the chlorine atom leads to dipole-to-dipole bonds between the molecules leading to an increased boiling point. 4 marks

Ethane has dispersion forces only.

**c**. 

 3 marks

 Propanoic acid pentanoic acid

 Pentanoic acid will have the higher boiling point as it is a longer molecule.