15: One molecule of a hydrocarbon is cracked to form two molecules of ethene, two molecules of propene and one molecule of propane. What is the molecular formula of the hydrocarbon?

- ☒ **A** C_8H_{18}
- ☒ **B** $C_{10}H_{22}$
- ☒ **C** $C_{11}H_{24}$
- ☒ **D** $C_{13}H_{28}$

(Total for Question 15 = 1 mark)

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16 Which mixture could be formed when a **single** molecule of $C_{12}H_{26}$ is cracked?

- ☒ **A** butene, pentane and propene
- ☒ **B** hexane, butene and ethane
- ☒ **C** nonane and ethene
- ☒ **D** propene and decane

(Total for Question 16 = 1 mark)

15 Prop-2-en-1-ol is flammable, toxic and an environmental hazard.

Which hazard symbols should be shown on its container?

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question 15 = 1 mark)

5 Which molecule is polar?

- ☒ **A** $CO_2(g)$
- ☒ **B** $CCl_4(g)$
- ☒ **C** $BeCl_2(g)$
- ☒ **D** $NH_3(g)$

(Total for Question 5 = 1 mark)

13 The concentration of sulfur dioxide in a sample of polluted air is 0.4 ppm.

What is the percentage of sulfur dioxide molecules in this polluted air?

- ☒ **A** 0.4%
- ☒ **B** 0.004%
- ☒ **C** 0.00004%
- ☒ **D** 0.0000004%

(Total for Question 13 = 1 mark)

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8 Ethanoic acid can be produced by the oxidation of butane.

$$2C_4H_{10} + 5O_2 \rightarrow 4CH_3COOH + 2H_2O$$

The atom economy, by mass, for the production of ethanoic acid is

- ☒ **A** 13%
- ☒ **B** 67%
- ☒ **C** 77%
- ☒ **D** 87%

(Total for Question 8 = 1 mark)

24 A sample of a volatile liquid **X** was vaporised.
At 473 K and 110 000 Pa, 3.50 g of **X** occupies 1.79 dm^3.

(a) (i) Calculate the number of moles of **X** in the sample.

[$R = 8.31\ J\ mol^{-1}\ K^{-1}$]

Use $pV = nRT$

(4)

(ii) Deduce the relative molecular mass of **X**.

(1)

(iii) Compound **X** contains 85.7 % carbon and 14.3 % hydrogen by mass.

Calculate the empirical formula of **X**.

(2)

(iv) Deduce the molecular formula of **X**.

(1)

(b) A few drops of a purple solution of acidified potassium manganate(VII) were added to a sample of liquid **X** and shaken.
The solution remained purple.

State what can be deduced about the structure of **X** from this experiment.

(1)

.....

.....

.....

(c) Identify, by name or formula, **two** possible structural isomers of **X** using your answers to (a)(iv) and (b).

(2)

(Total for Question 24 = 11 marks)

22: This question is about alkanes and halogens.

Alkanes can react with halogens to form halogenoalkanes.

(a) Name the type and mechanism for the reaction between halogens and alkanes.

(1)

.....

.....

(b) Chlorine reacts with butane.

(i) Give the equation for the initiation step.

Include appropriate arrows and electrons.

(2)

(ii) Give an equation for each of the first two propagation steps.

(2)

First propagation step

.....

Second propagation step

.....

(iii) Give the equation for the termination step to form an alkane.

(1)

.....