11: What is the maximum volume of butane which will completely burn in 130 cm^3 of oxygen?

$$C_4H_{10} + 6.5O_2 \rightarrow 4CO_2 + 5H_2O$$

- ☒ **A** 10 cm^3
- ☒ **B** 15 cm^3
- ☒ **C** 20 cm^3
- ☒ **D** 40 cm^3

(Total for Question 11 = 1 mark)

14 Which hazard warning symbol would be found on a bottle of hexane?

- ☒ **A** 
- ☒ **B** 
- ☒ **C** 
- ☒ **D** 

(Total for Question 14 = 1 mark)

15 Which statement about poly(ethene) is **not** correct?

- ☒ **A** it is an addition polymer
- ☒ **B** it decolourises bromine water
- ☒ **C** it is non-biodegradable
- ☒ **D** it has the empirical formula CH_2

(Total for Question 15 = 1 mark)

6: Which is the correct order for the processes in a mass spectrometer?

☒ **A**	deflection	detection	ionisation	vaporisation
☒ **B**	vaporisation	ionisation	deflection	detection
☒ **C**	ionisation	vaporisation	deflection	detection
☒ **D**	vaporisation	deflection	ionisation	detection

(Total for Question 6 = 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)

14: (a) Hairdressers use solutions of hydrogen peroxide that have these hazards:

- can cause serious eye damage
- is harmful if swallowed
- is an oxidising agent

Which hazard symbols should be on containers of this solution?

(1)

☒ **A**



☒ **B**



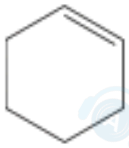
☒ **C**



☒ **D**



15 This question is about cyclohexene, a cyclic alkene.



(a) What is the general formula of cyclic alkenes such as cyclohexene?

(1)

- ☒ **A** C_nH_{2n-4}
- ☒ **B** C_nH_{2n-2}
- ☒ **C** C_nH_{2n}
- ☒ **D** C_nH_{2n+2}

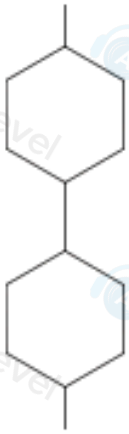
(b) Cyclohexene can form an addition polymer.

Which diagram shows two repeat units of this addition polymer?

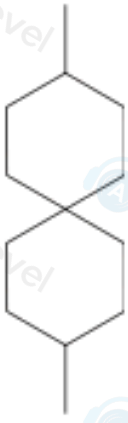
(1)



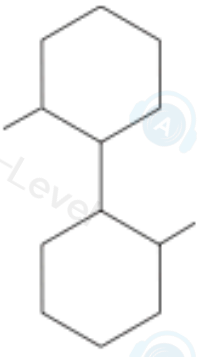
☒ **A**



☒ **B**



☒ **C**



☒ **D**

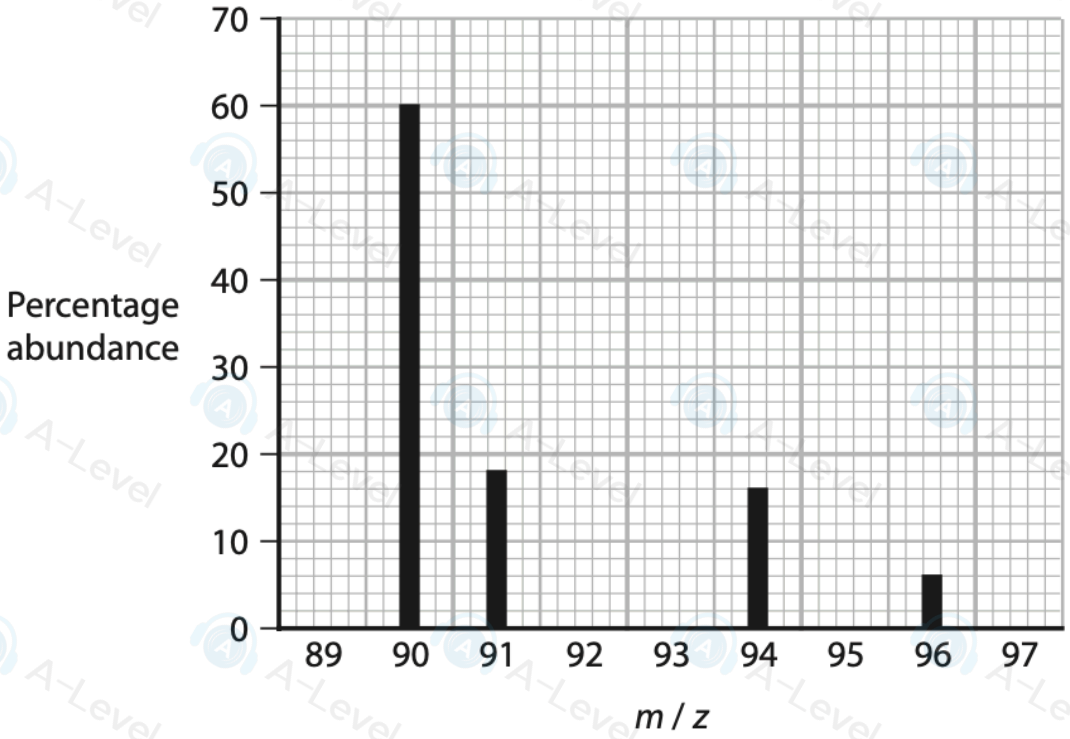
17 The substances formed from the combustion of petrol in car engines include

- ☒ **A** water, carbon dioxide and hydrogen
- ☒ **B** water, carbon monoxide and hydrogen chloride
- ☒ **C** water, carbon dioxide and sulfur dioxide
- ☒ **D** water, carbon particulates and hydrogen

(Total for Question 17 = 1 mark)

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7 The mass spectrum of an element is shown.

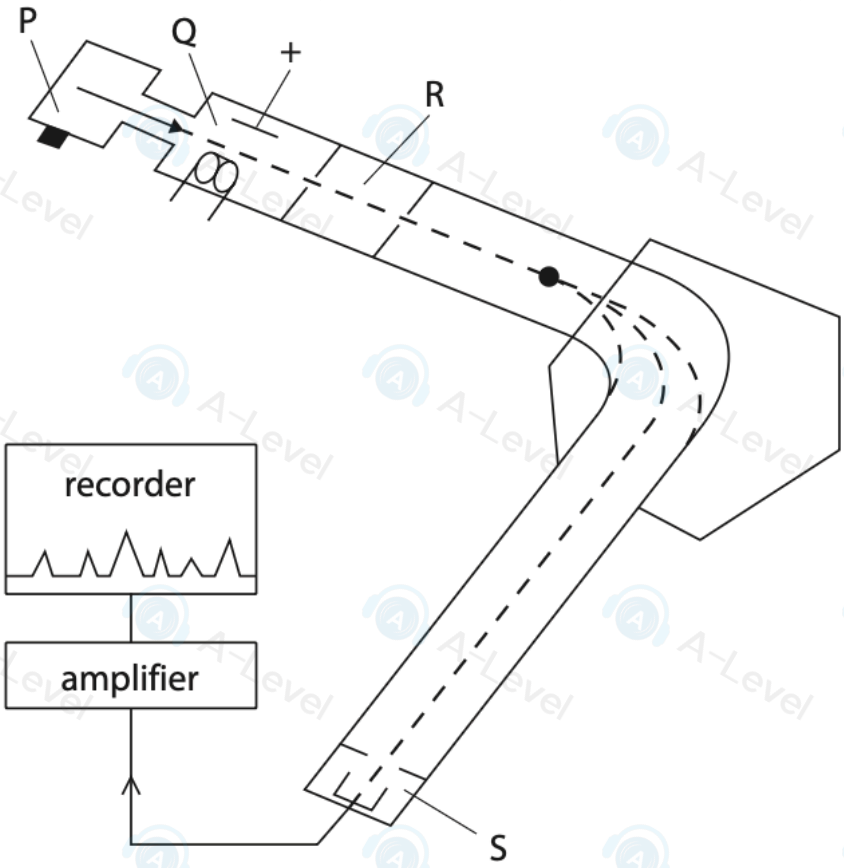


What is the relative atomic mass of this element?

- ☒ **A** 90.0
- ☒ **B** 90.9
- ☒ **C** 91.2
- ☒ **D** 92.8

(Total for Question 7 = 1 mark)

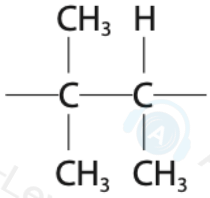
8 In which region of a mass spectrometer are particles ionised?



- ☒ **A** region P
- ☒ **B** region Q
- ☒ **C** region R
- ☒ **D** region S

(Total for Question 8 = 1 mark)

16 The repeat unit of a polymer is shown.

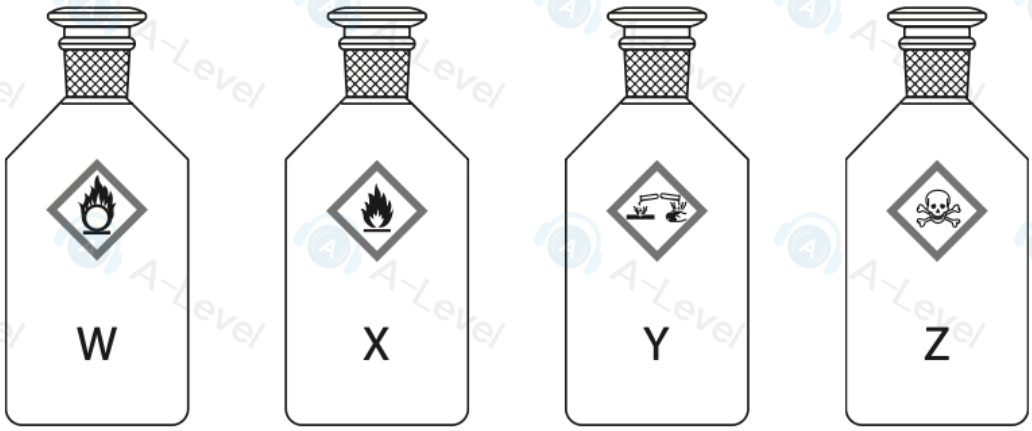


Which is the name of the monomer that forms this polymer?

- ☒ **A** 1,1,2-trimethylethene
- ☒ **B** 1,1-dimethylpropene
- ☒ **C** 2-methylbut-2-ene
- ☒ **D** 3-methylbut-2-ene

(Total for Question 16 = 1 mark)

17 A technician is asked to store four reagent bottles safely. The only information about each substance is the hazard label on the bottle.



Based on the hazard labels alone, which two bottles should **never** be stored together?

- ☒ **A** W and Z
- ☒ **B** Y and Z
- ☒ **C** W and X
- ☒ **D** Y and X

(Total for Question 17 = 1 mark)

13: Which type of reaction occurs when an alkane is cracked?

- ☒ **A** combustion
- ☒ **B** hydrolysis
- ☒ **C** neutralisation
- ☒ **D** thermal decomposition

(Total for Question 13 = 1 mark)

---

9 A sample of the element chlorine, Cl_2, was analysed in a mass spectrometer. Chlorine has **two** isotopes.

What is the **total** number of peaks, due to ions with a single positive charge, which could be seen in the mass spectrum?

- ☒ **A** two
- ☒ **B** four
- ☒ **C** five
- ☒ **D** six

(Total for Question 9 = 1 mark)

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18 Which of these formulae are correct for the compound 1,4-diethylcyclohexene?



(i)
skeletal formula

$C_{10}H_{18}$

(ii)
molecular formula

C_5H_9

(iii)
empirical formula

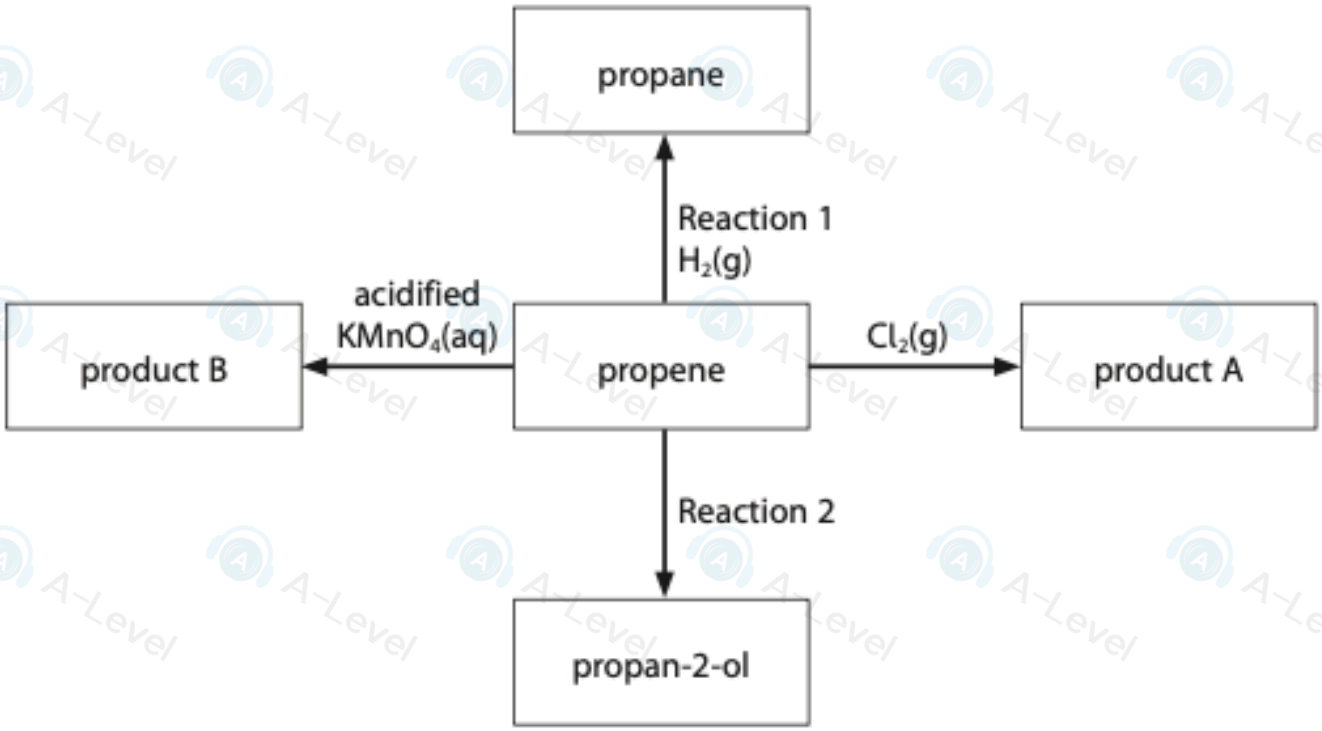
- ☒ **A** none of the three
- ☒ **B** (i) only
- ☒ **C** (ii) and (iii) only
- ☒ **D** (i), (ii) and (iii)

(Total for Question 18 = 1 mark)

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22 This question is about propene and some related compounds.

(a) Some reactions of propene are shown.



(i) Identify, by name or formula, the catalyst needed for Reaction 1.

(1)

.....

(ii) Name product A.

(1)

.....

(iii) Identify, by name or formula, the substances needed for Reaction 2.

(2)

.....

.....

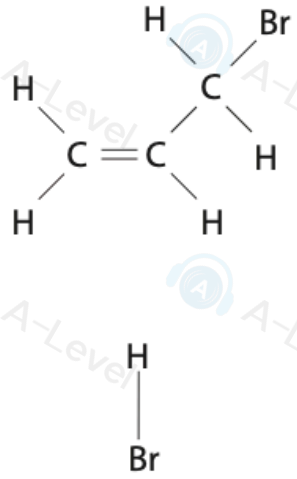
(iv) Draw the **displayed** formula of product B.

(1)

(c) Hydrogen bromide reacts with 3-bromopropene to form 1,2-dibromopropane as the major product.

(i) Complete the mechanism to show this reaction.
Include curly arrows, and any relevant lone pairs and dipoles.

(4)



(ii) Explain why 1,2-dibromopropane is the major product instead of 1,3-dibromopropane.

(2)

19 This question is about mass spectrometry and the shapes of molecules.

(a) In a mass spectrometer vaporised atoms are ionised, and the ions formed are accelerated, deflected and detected.

(i) State how atoms are ionised in the mass spectrometer.

(1)

(ii) State how the ions formed are accelerated.

(1)

(iii) Explain why isotopes of an element have the same chemical reactions but their ions are deflected differently in a mass spectrometer.

(2)

(b) Data from mass spectra may be used to determine the relative atomic masses of elements.

(i) State what is meant by relative atomic mass.

(2)

(ii) Show that the relative peak heights given in the table are consistent with the isotopic ratio of ^{35}Cl to ^{37}Cl being 3 : 1.

(2)

.....

.....

.....

(d) (i) Draw a dot-and-cross diagram of a PCl_3 molecule.
Show outer electrons only.

(2)

(ii) Explain the shape of a PCl_3 molecule.

(3)

23 Samples of germanium consist of five isotopes, four of which are stable.
The fifth isotope, germanium-76, is radioactive but with a very long half-life.

This means that the isotopic composition is almost constant.
The table shows data for four of the isotopes.

Atom	^{70}Ge	^{73}Ge	^{74}Ge	^{76}Ge
Mass number	70	73	74	76
Abundance / %	20.5	7.8	36.5	7.8

(a) (i) Calculate the mass number of the fifth isotope of germanium.
The relative atomic mass of germanium is 72.6.

You must show your working.

(3)

(ii) Give the main reason why the answer in (a)(i) should not be quoted to more than 2 significant figures.

(1)

.....

.....

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