

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

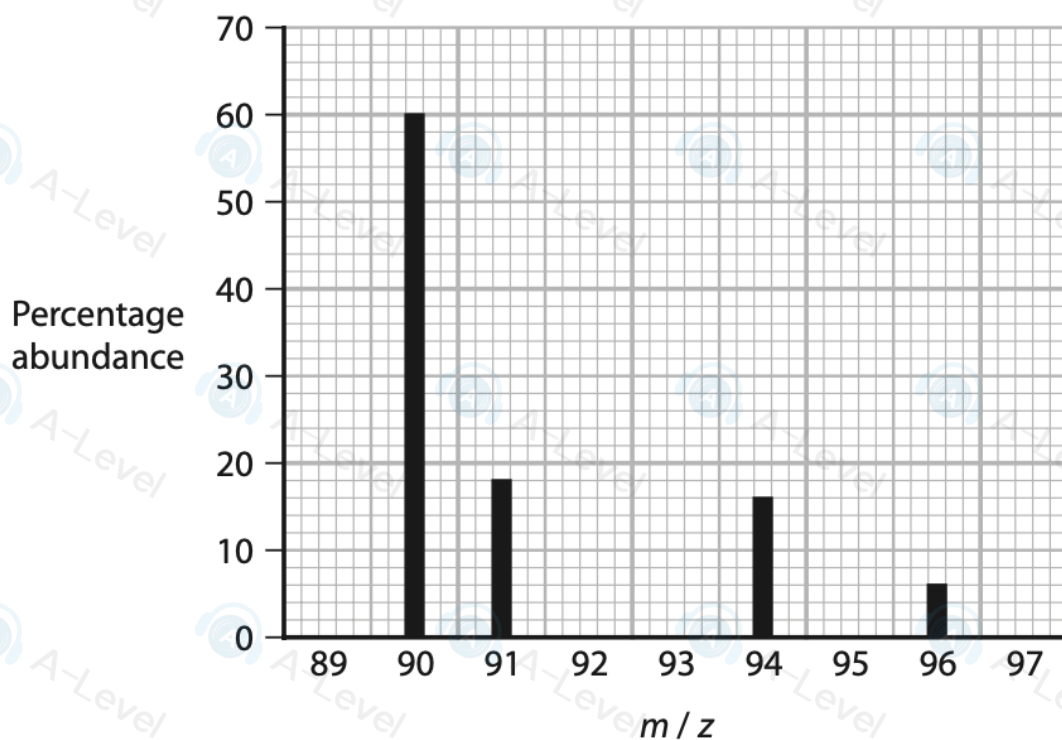
- can cause serious eye damage
- is harmful if swallowed
- is an oxidising agent

Which hazard symbols should be on containers of this solution?

(1)

☒	A			
☒	B			
☒	C			
☒	D			

7 The mass spectrum of an element is shown.

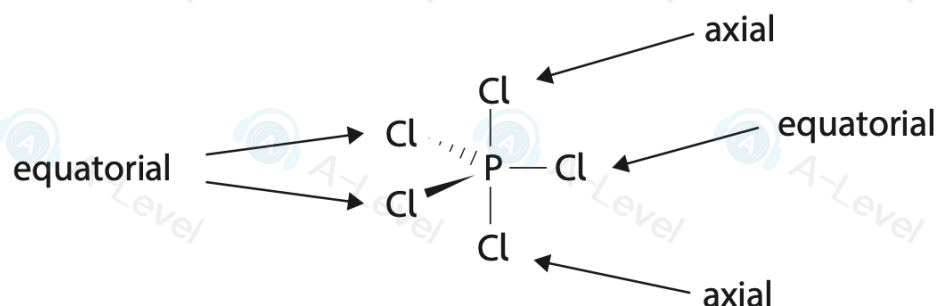


What is the relative atomic mass of this element?

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

(Total for Question 7 = 1 mark)

13 In the gas phase, PCl_5 exists as molecules. They are trigonal bipyramidal.



Each chlorine atom can be replaced one at a time by a fluorine atom.
The two axial chlorine atoms are replaced before the three equatorial atoms.

Which of the resulting molecules does **not** have a permanent dipole?

- ☒ **A** PCl_4F
- ☒ **B** PCl_3F_2
- ☒ **C** PCl_2F_3
- ☒ **D** PClF_4

(Total for Question 13 = 1 mark)

6 A solution contains 95 ppm of a solute.

What mass of the solute is dissolved in 1 kg of this solution?

- ☒ **A** 95 g
- ☒ **B** 0.95 g
- ☒ **C** 0.095 g
- ☒ **D** 0.000095 g

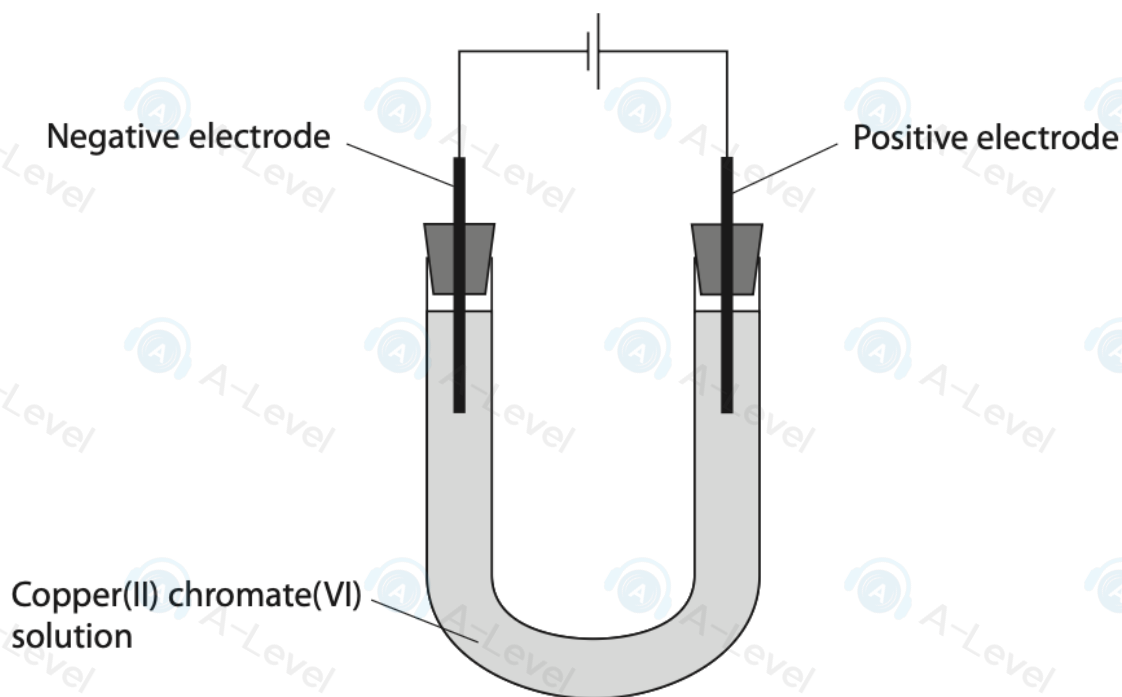
(Total for Question 6 = 1 mark)

13 Which molecule has the largest bond angle?

- ☒ **A** BF_3
- ☒ **B** CF_4
- ☒ **C** H_2O
- ☒ **D** NH_3

(Total for Question 13 = 1 mark)

- 7 A direct electrical current was passed through a green solution of copper(II) chromate(VI) in the apparatus shown.



Which colours would be seen at each electrode after several minutes?

	Negative electrode	Positive electrode
☒ A	blue	green
☒ B	green	blue
☒ C	blue	yellow
☒ D	yellow	blue

(Total for Question 7 = 1 mark)

- 13 Which solution contains chloride ions with a concentration of $0.0500 \text{ mol dm}^{-3}$?

[A_r values: Ca = 40.1 Cl = 35.5 Na = 23.0]

	Solute	Mass of solute / g	Volume of solution / cm^3
☒ A	calcium chloride	1.39	250
☒ B	calcium chloride	1.39	500
☒ C	sodium chloride	1.46	250
☒ D	sodium chloride	1.46	1000

(Total for Question 13 = 1 mark)

11 A piece of filter paper is soaked in water and attached to a microscope slide.
A few crystals of green copper(II) chromate(VI) are placed in the centre of the filter paper.

The filter paper is connected to a DC supply of 20V.

What colours are observed on the paper after a few minutes?

	positive electrode		negative electrode
☒ A	blue		yellow
☒ B	green		blue
☒ C	yellow		green
☒ D	yellow		blue

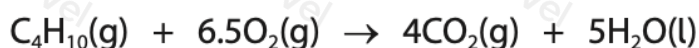
(Total for Question 11 = 1 mark)

12 Which is a use of graphene based on its electrical properties?

- ☒ **A** drill tips
- ☒ **B** pencils
- ☒ **C** touch screens
- ☒ **D** body armour

(Total for Question 12 = 1 mark)

2 What is the maximum volume of butane that can be completely burned in 39 cm^3 of oxygen at room temperature and pressure?



- ☒ **A** 6.0 cm^3
- ☒ **B** 12 cm^3
- ☒ **C** 24 cm^3
- ☒ **D** 45 cm^3

(Total for Question 2 = 1 mark)

11 Which row of the table shows properties consistent with the type of bonding shown?

	Bonding	Solubility in water	Melting temperature	Electrical conductivity of solid
☒ A	ionic	soluble	high	poor
☒ B	ionic	soluble	low	good
☒ C	metallic	soluble	low	good
☒ D	metallic	insoluble	high	poor

(Total for Question 11 = 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)

7 1 kg of seawater contains 64 mg of bromide ions.

[A_r of Br = 80 Avogadro constant, $L = 6.0 \times 10^{23} \text{ mol}^{-1}$]

(a) What is the concentration of bromide ions in parts per million (ppm) by mass?

(1)

- ☐ **A** 0.80
- ☐ **B** 64
- ☐ **C** 800
- ☐ **D** 64 000

(b) How many bromide ions are in 500 g of the sample?

(1)

- ☐ **A** 2.4×10^{20}
- ☐ **B** 4.8×10^{20}
- ☐ **C** 1.9×10^{22}
- ☐ **D** 3.8×10^{22}

(Total for Question 7 = 2 marks)

5 Which molecule is polar?

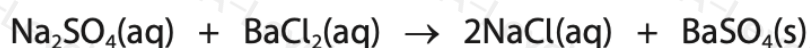
- ☐ **A** $\text{CO}_2(\text{g})$
- ☐ **B** $\text{CCl}_4(\text{g})$
- ☐ **C** $\text{BeCl}_2(\text{g})$
- ☐ **D** $\text{NH}_3(\text{g})$

(Total for Question 5 = 1 mark)

10 An excess of sodium sulfate solution is added to 50 cm³ of a 0.100 mol dm⁻³ solution of barium chloride.

What is the mass of barium sulfate formed?

[*M_r* value: BaSO₄ = 233.4]



- ☐ **A** 1.167 g
- ☐ **B** 2.334 g
- ☐ **C** 11.67 g
- ☐ **D** 23.34 g

(Total for Question 10 = 1 mark)

23: This question is about structure and bonding.

(a) Ionic bonding occurs between metals and non-metals.

(i) Describe ionic bonding.

(1)

(ii) Explain why the ionic bonding in magnesium fluoride might be expected to be stronger than the ionic bonding in sodium fluoride.

(2)

(iii) Sodium and oxygen react to form sodium oxide, which is also ionic.
Draw the dot-and-cross diagram showing the ions present in sodium oxide.

(2)

(iv) Draw the ionic lattice for sodium chloride.

You should show at least nine ions.

(2)

(b) Non-metal atoms join together using covalent bonds.

(i) Describe covalent bonding.

(1)

.....

.....

.....

.....

.....

.....

.....

(iii) The three molecules (methane, ammonia and water) each have a different shape. Complete the table below.

(3)

molecule	shape	bond angle
methane		
ammonia		
water		

(iv) Explain the differences between the molecular shapes and bond angles for ammonia and water.

(2)

.....

.....

.....

.....

.....

.....

(v) Ethene and poly(ethene) have different melting temperatures.

Molecule	Melting temperature (K)
ethene	104.1
poly(ethene)	400

Explain why their melting temperatures are different.

(2)

(c) Metals are held together by metallic bonding.

(i) Describe metallic bonding.

(1)

(ii) Metals conduct electricity when solid.

Explain, with the aid of a diagram, why copper conducts electricity.

(2)

(Total for Question 23 = 21 marks)

19 Many cars use fuels containing ethanol as well as hydrocarbons. The E numbers of these fuels show the percentage by volume of ethanol in the fuel. For example, an E5 fuel contains 5% ethanol and 95% hydrocarbons by volume.

(a) A brand of E10 fuel contains 92.2% hydrocarbons and 7.80% ethanol **by mass**.

The energy density is the amount of energy released per kg of a fuel burned.
The energy densities of the two components of this brand of fuel are shown.

$$\text{energy density of hydrocarbons} = 46.5 \text{ MJ kg}^{-1}$$

$$\text{energy density of ethanol} = 29.7 \text{ MJ kg}^{-1}$$

- (i) Calculate the **mean** energy density of this E10 fuel in MJ kg^{-1} .
Give your answer to an appropriate number of significant figures.

(2)

- (ii) The density of the E10 fuel is 0.729 g cm^{-3} .

Calculate the mass of 1500 cm^3 of the fuel.

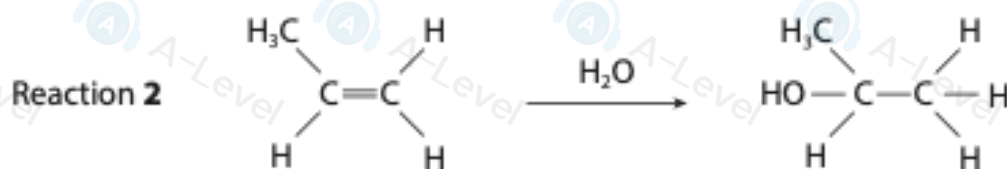
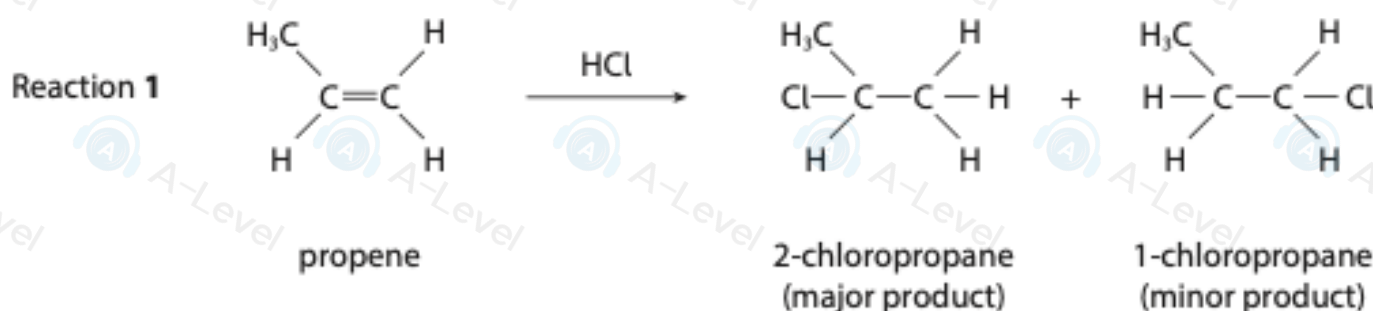
(1)

- (iii) Calculate the energy released when 1500 cm^3 of the E10 fuel is burned in excess oxygen, using your answers from (a)(i) and (a)(ii).

[If you did not calculate a value for the **mean** energy density of the E10 fuel in (a)(i), use a value of 38.1 MJ kg^{-1} . This is not the correct value.]

(1)

19 This question is about two reactions of propene.



(a) (i) Name the mechanism and type of reaction for Reaction 1.

(1)

(ii) Explain why the structures of the intermediates in Reaction 1 mean that 2-chloropropane is formed in greater yield than 1-chloropropane.

(3)