

Examiners' report

AS LEVEL

CHEMISTRY B (SALTERS)

**OCR Level 3 Advanced Subsidiary GCE
in Chemistry B (Salters)**

H033

For first teaching in 2015

H033/01 Summer 2025 series

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate responses is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from [Teach Cambridge](#).

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Paper 1 series overview

This synoptic paper targets all three assessment objectives requiring candidates to:

- demonstrate and apply knowledge and understanding of scientific ideas, processes, techniques and procedures in theoretical and practical contexts
- handle qualitative and quantitative data
- analyse, interpret and evaluate scientific information to make judgements and reach conclusions
- show an ability to develop practical procedures.

To do well, candidates needed to demonstrate a broad knowledge and understanding of inorganic, organic and physical chemistry and be able to carry out multi-step calculations.

There were no indications that candidates needed more time to complete the paper, and most candidates attempted all questions. There was no evidence of candidates using the extra space to draft their answers to Question 21 (c) or 22 (b), which required longer structured answers, and candidates should be advised to do this.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• showed the steps in their calculations. • used a logical structure to questions requiring a detailed response. • ensured they read the question carefully and hence answered the question asked and where appropriate to the correct number of significant figures.	• we're not able to recall the steps in a recrystallisation procedure. • we're not able to carry out calculations which involved several steps. • had gaps in their knowledge of organic functional groups and their reactions.

Section A overview

There were very few instances of questions not being answered. Candidates who were most successful used the blank space next to the question to make notes or where appropriate, to carry out calculations.

Question 9

9 How can benzene be described?

- A A cycloalkene
- B An alkane
- C An alkene
- D An arene

Your answer

[1]

If a candidate did not score this mark, it was usually because they incorrectly described benzene as a cycloalkene.

Question 10

10 What is a **disadvantage** of using hydrogen rather than methane for burning in home gas boilers?

- A Hydrogen can be made by electrolysis of water using alternative energy sources.
- B Hydrogen gives no CO₂ when burned.
- C Hydrogen is less dense and more likely to leak out of pipes.
- D Hydrogen is renewable.

Your answer

[1]

Answered correctly by most candidates.

Question 11

11 1-bromopropane reacts with hydroxide ions:



What is correct?

- A 1-iodopropane undergoes a similar reaction but more slowly.
- B The missing product is HBr.
- C The OH^- ion is acting as a nucleophile.
- D This is an addition reaction.

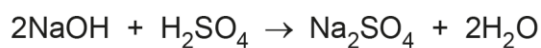
Your answer

[1]

Answered correctly by most candidates.

Question 12

12 Sodium hydroxide reacts with sulfuric acid:



What volume (in cm^3) of 0.1 mol dm^{-3} NaOH will neutralise 15 cm^3 of 0.2 mol dm^{-3} H_2SO_4 ?

- A 7.5
- B 15
- C 30
- D 60

Your answer

[1]

Most candidates who gave the correct response had shown a calculation.

Question 13

13 Ethene, C₂H₄, reacts with HBr:



What mass of HBr (in g) will react exactly with 120 cm³ of ethene at RTP?

- A 0.4
- B 0.8
- C 4
- D 8

Your answer

[1]

Most candidates who gave the correct response had shown a calculation.

Question 14

14 In which row does the compound have the correct systematic name?

	Compound	Systematic name
A	Cu ₂ O	Copper(II) oxide
B	NaClO	Sodium hypochlorite
C	FeSO ₄	Iron(II) sulfate(VI)
D	KMnO ₄	Potassium permanganate

Your answer

[1]

Candidates who did not give the correct response often chose response A

Question 15

15 Which molecule is most polar?

- A BF_3
- B CO_2
- C CH_3Cl
- D CH_3F

Your answer

[1]

The incorrect response of A was often given, suggesting the candidate had not recognised the symmetry of BF_3 .

Question 16

16 What is a reaction of methanol, CH_3OH ?

- A It can be dehydrated to an alkene.
- B It can be esterified using another alcohol.
- C It can be oxidised to a ketone.
- D It can be substituted using HBr .

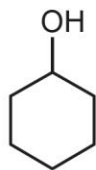
Your answer

[1]

Generally not answered well, showing a lack of understanding of simple organic reactions, with candidates answering A, B, C and D with a similar frequency.

Question 17

17 A compound has the formula:



What is a reaction of this compound?

- A It can be oxidised by acid dichromate(VI) to an aldehyde.
- B It gives a purple colour with FeCl_3 .
- C It reacts with $(\text{CH}_3\text{CO})_2\text{O}$.
- D It reacts with Na_2CO_3 .

Your answer

☐

[1]

Many candidates incorrectly answered B, suggesting they had identified the compound as a phenol.

Question 19

19 25 cm^3 of 0.10 mol dm^{-3} silver nitrate solution reacts with an excess of a sodium halide solution to form 0.59 g of silver halide precipitate.

Which halide is reacting?

- A fluoride
- B chloride
- C bromide
- D iodide

Your answer

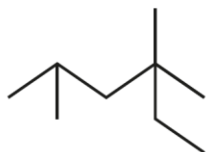
☐

[1]

Candidates who used an equation to describe the reaction, before attempting the calculation, were more likely to correctly answer D.

Question 20

20 A branched alkane has the formula:



What is the systematic name of the alkane?

- A 2,4,4-trimethylhexane
- B 2,4-dimethyl-2-ethylpentane
- C 2-ethyl-2,4,4-trimethylbutane
- D 3,3-dimethyl-5-methylhexane

Your answer

[1]

Generally, not answered well. Candidates who did not select the correct answer of D usually selected B, where they had not recognised that the ethyl branch was in fact part of the longest chain, hexane. Candidates should be reminded to look for the longest chain before naming attached groups.

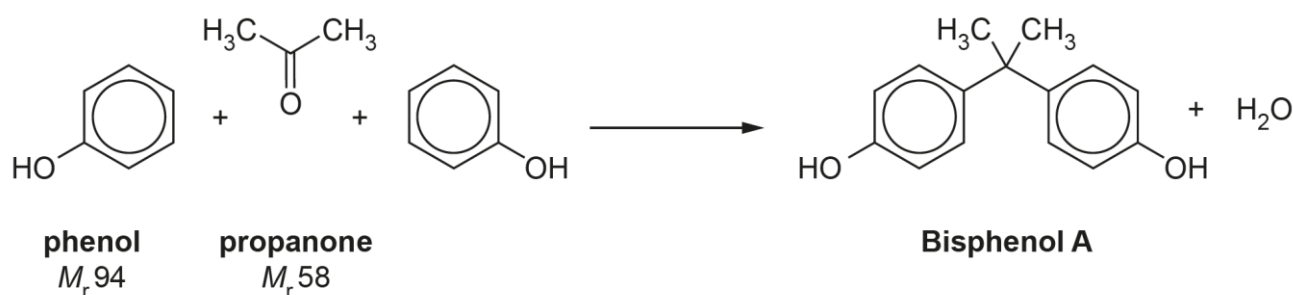
Section B overview

There were no indications that time was a problem, and most candidates provided answers to most questions. Many candidates' mis-understood what was being asked in Question 22 (a), and many did not score well in Questions 21 (b), 23 (c) (ii), 23 (d) (ii), 23 (e), 24 (b) (ii) and 24 (d) (i).

Question 21 (a)

21 Bisphenol A is a starting material for manufacturing plastics, particularly polycarbonate.

Bisphenol A is made by reacting phenol with propanone.



- (a) This process is regarded as 'green' because water is the only co-product and the reaction has a high atom economy.

Calculate the atom economy of the process.

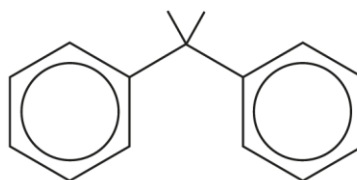
Atom economy = % **[2]**

Many candidates clearly understood the concept of product/reactant $\times 100$ but often incorrectly calculated the M_r of product or reactants and therefore only scored one mark.

Question 21 (b)

(b) An aromatic product is formed when bisphenol A reacts with ethanoic anhydride, $(\text{CH}_3\text{CO})_2\text{O}$.

Complete the **skeletal** formula of this aromatic product.



[2]

The structure of the ester groups formed were not well understood by candidates.

Question 21 (c)

(c) Bisphenol A can be purified by recrystallisation from dilute ethanoic acid.

Describe the steps in this procedure, stating where soluble and insoluble impurities are removed.

.....

.....

.....

.....

.....

..... [5]

This question on a practical procedure discriminated well. Common mistakes made included:

- not recognising that the solvent was ethanoic acid.
- using warm solvent instead of hot solvent
- steps in the wrong sequence
- evaporating to dryness to obtain crystals
- using techniques not appropriate for recrystallisation

Structuring the answer

There was no evidence that candidates were drafting their answer or using a flow chart to help them use the correct sequence of procedures and they should be encouraged to do this. This would also help to make sure they stated where the insoluble and soluble impurities were removed, as some candidates did not include this.

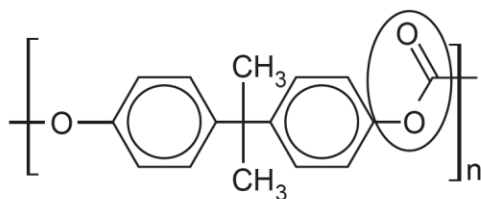
Exemplar 1

- ~~Heat~~ Add minimal amount of ^{warm} dilute ethanoic acid to dissolve Bisphenol A
 - Then perform hot filtration to remove ~~an~~ insoluble impurities
 - Then leave the filtrate to cool until you see crystals forming
 - Then perform vacuum filtration to get the crystals by itself removing soluble impurities
 - Then wash the crystals with cold solvent
 - Then leave the crystals to dry
- [5]

4 marks. Does not score MP1 as solvent is described as warm (needs to be hot). Otherwise, a clear, well-structured answer.

Question 21 (d)

(d) Bisphenol A can be converted to polycarbonate.



Polycarbonate

Name the functional group inside the oval ring.

..... [1]

Many candidates did not correctly identify the ester group.

Question 22 (a)

22 Chloroethane, $\text{C}_2\text{H}_5\text{Cl}$, has a boiling point of 12°C .

(a) $\text{C}_2\text{H}_5\text{Cl}$ can be made by reacting ethane with chlorine.

Complete the stages for this process:

Stage 1: **Initiation**

Chlorine radicals are formed from chlorine molecules.

The radiation that splits the chlorine molecules is

Stage 2: **Propagation**

Give the equations for the two propagation steps:

Step 1

Step 2

Stage 3: **Termination**

One termination reaction is $\text{Cl} + \text{Cl} \rightarrow \text{Cl}_2$

Give the equation of another termination reaction that occurs:

[3]

UV radiation was generally correctly identified. Many candidates incorrectly described propagation steps in terms of ozone depletion, which is required in part (b), therefore only scoring one mark.

Question 22 (b)

(b) $\text{C}_2\text{H}_5\text{Cl}$ was once used as an aerosol propellant in spray cans.

It is no longer used because it causes the breakdown of ozone in the stratosphere.

Describe how $\text{C}_2\text{H}_5\text{Cl}$ causes the breakdown of ozone and give **one** effect this ozone breakdown has on life on Earth.

.....

.....

.....

.....

.....

..... [4]

Candidates did not always identify the source of the chlorine radical or how it is generated. Most candidates who attempted to describe the catalytic breakdown of ozone using equations did so correctly. Candidates who scored well in this question often chose different ways of describing the effect of the loss of ozone, either stating its absence allows UV to reach Earth, or that the ozone absorbs the UV. Most candidates scored at least one mark for correctly stating one effect of ozone reaching Earth is that it can cause skin cancer.

Question 22 (c)

(c) The boiling point of bromoethane, $\text{C}_2\text{H}_5\text{Br}$, is higher than that of chloroethane, $\text{C}_2\text{H}_5\text{Cl}$.

This is because one type of intermolecular bonds are stronger for $\text{C}_2\text{H}_5\text{Br}$.

State which **type** of intermolecular bonds are stronger for $\text{C}_2\text{H}_5\text{Br}$.

Explain why they are stronger.

Type of Intermolecular bonds:

Explanation:

.....

.....

..... [2]

If the type of intermolecular force was correctly stated, then the correct explanation was usually given, but many candidates did not manage to identify the ID-ID bonds.

Question 22 (d)

(d) A scientist has 10.0 g of $\text{C}_2\text{H}_5\text{Cl}$ in a pressurised container.

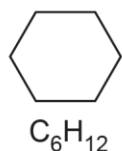
What volume of gas (in dm^3) would this give at 293 K and 101 000 Pa?

Volume = dm^3 [3]

Candidates who attempted this question usually clearly showed their working out. A common error was the incorrect conversion of Pa to kPa.

Question 23 (a)

23 Some students are given the hydrocarbon shown.



(a) Give the systematic name of the hydrocarbon.

..... [1]

Incorrect answers included benzene and cyclohexane but generally answered well.

Question 23 (b)

(b) Write the equation for the complete combustion of C_6H_{12} .

[1]

Answered well.

Question 23 (c) (i)

(c) The students look up the enthalpy change of combustion, $\Delta_c H$, of C_6H_{12} . They find it is negative.

(i) Which one-word term describes a reaction with a negative enthalpy change?

..... [1]

Answered well.

Question 23 (c) (ii)

(ii) Explain, in terms of bonds broken and made, why some enthalpy changes are negative.

.....
.....
.....
..... [1]

Incorrect responses included references to the number of bonds being broken/made.

Misconception

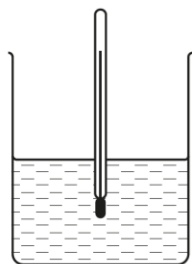


Many responses described bond breaking and bond forming as **both** requiring energy and had not understood that bond forming releases energy.

Question 23 (d) (i)

- (d) The students set up the apparatus shown below to measure the enthalpy change of combustion of C_6H_{12} .

They burn C_6H_{12} in a spirit burner and measure the rise in temperature of water in a beaker.



- (i) The students obtain the following results.

Mass of burner + C_6H_{12} at start	20.2 g
Mass of burner + C_6H_{12} at end	17.6 g
Mass of water in beaker	505 g
Temperature of water at start	20.0 °C
Temperature of water at end	65.5 °C

Use their results to calculate a value for the enthalpy change of combustion, $\Delta_c H$, of C_6H_{12} , in kJ mol^{-1} .

$\Delta_c H$ of C_6H_{12} = kJ mol^{-1} [3]

Most candidates who attempted the question and showed their 'working out' scored some marks, often with an ECF. The energy transferred was usually correctly calculated. Common mistakes which resulted in marks being lost included:

- Dividing by the mass of cyclohexane rather than the moles.
- Multiplying moles $\times$ the energy transferred, instead of dividing the energy transferred by the moles.
- Omitting the negative sign in the final response.

Question 23 (d) (ii)

(ii) The value in (i) is less negative than the Data Book value.

A student makes two statements:

- One reason for this is that some C_6H_{12} vapour might have evaporated during the process.
- Putting a cap on the lamp at the beginning of the experiment is more important to avoid evaporation than putting it on at the end.

Comment on the student's statements, giving reasons.

.....

.....

.....

.....

.....

..... [3]

Very few candidates were able to explain why the loss of cyclohexane due to evaporation gave a less negative enthalpy change. Candidates generally did not recognise the apparatus would be hotter at the end and therefore there would be more evaporation.

Exemplar 2

- 1st comment is correct in saying that C_6H_{12} evaporating will cause a decrease in enthalpy change however this is more due to evaporation ~~of it~~ ~~being~~ whilst the spirit burner is not in use
- disagree with the second statement it is more important at the end is the spirit burner will be hotter at the end so more evaporation would occur at the end. [3]

23(d)) These reason for why evaporated C_6H_{12} causes a decrease in enthalpy change is because it calculates a greater loss of mass so more moles of C_6H_{12} is said to be used which decrease enthalpy change per mol

This candidate response received 3 marks. The candidate has identified, at the start of their answer, that evaporation was the cause of the calculation error but has not explained sufficiently, at this stage, why this causes the reduced calculated enthalpy change. The candidate gained credit for marking points 2 and 3 and then explained in detail how a greater loss of mass (caused by evaporation) was used in the calculation, resulting in a lower enthalpy change per mole of cyclohexane.

Question 23 (e)

(e) The mass spectrum of C_6H_{12} has an $(M+1)^+$ peak at 85.

What causes this peak?

.....

..... [1]

Many candidates were able to identify the peak was due to the ^{13}C isotope but had not stated it was caused by one atom of this isotope.

Question 24 (a) (i)

24 A group of students are given some sodium iodide, NaI, to investigate.

- (a) The students electrolyse a solution of sodium iodide and collect the gaseous product at the cathode (negative electrode).
- (i) Draw a labelled diagram of an apparatus they could use.

[4]

Most candidates scored some marks for using electrodes in the solution. The wires connecting the battery to the electrodes were generally incorrectly attached to the top of the electrode, which meant if they had correctly placed an inverted boiling tube/measuring cylinder over the cathode, the wires passed through the glassware. Some candidates incorrectly used a gas syringe to collect the gas, not appreciating there would be insufficient pressure for this to work.

Question 24 (a) (ii)

- (ii) Write the half-equation for the reaction occurring at the cathode (negative electrode).

[2]

Very few candidates were able to do this. If a mark was scored it was usually for identifying that hydrogen was produced.

Question 24 (a) (iii)

- (iii) Name the substance formed at the **anode**.

..... [1]

Many candidates correctly stated iodine.

Question 24 (b) (i)

(b) The students react sodium iodide solution with chlorine solution.

(i) Write an **ionic** equation for the reaction that occurs.

[1]

Candidates who did not score this mark usually had incorrect species or had not balanced the equation correctly.

Question 24 (b) (ii)

(ii) Explain, in terms of electrons, why this reaction indicates that chlorine is more reactive than iodine.

.....
..... [1]

Many candidates had not identified the requirement in the question to explain in terms of electrons and instead described differences in electronegativity.

Question 24 (c)

(c) A student says that a pure sample of hydrogen iodide can be made by adding concentrated sulfuric acid to solid sodium iodide.

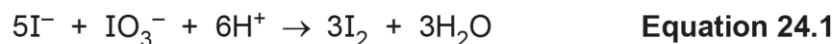
Comment on this statement, giving the correct chemistry where necessary.

.....
.....
.....
..... [2]

Only a few candidates stated phosphoric acid was needed and if marks were scored it was for identifying that H_2S or I_2 are formed.

Question 24 (d) (i)

(d) This reaction occurs in the manufacture of iodine by reacting NaI with NaIO₃.



(i) Give the systematic name for the IO₃⁻ ion.

..... [1]

Many candidates who recognised it was iodate omitted the oxidation state (iodate (V)).

Question 24 (d) (ii)

(ii) Identify the reducing agent in **Equation 24.1**.

Explain your answer in terms of the change in oxidation state of the reducing agent.

Reducing agent is:

Oxidation state of reducing agent changes from to [2]

Iodine was often given as the reducing agent. Oxidation states were usually given with negative sign correctly preceding the number.

Question 24 (d) (iii)

(iii) Calculate the volume (in cm³) of 0.24 mol dm⁻³ NaIO₃ solution that would react with 15 g of NaI in **Equation 24.1**.

Give your answer to an **appropriate** number of significant figures.

Volume of NaIO₃(aq) = cm³ [3]

Most candidates scored one mark for calculating the number of moles of sodium iodide. Marks were commonly lost when the factor of five was omitted or when the final response was given to too many significant figures.

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