

Specimen Paper Answers

Paper 1: Multiple Choice

**Cambridge O Level Chemistry**

**5070**

For examination from 2023



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## Introduction

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The main aim of this booklet is to exemplify standards for those teaching Cambridge O Level Chemistry 5070, and to show examples of very good answers.

In this booklet, we have provided answers for all questions with examiner comments. These exercises require candidates to answer multiple choice questions and candidates are awarded maximum of 40 marks for this paper and the mark scheme provides the answers required to gain the marks.

Each question and answer is followed by an examiner comment on how each answer should be determined. Additionally, the examiner has set out a number of common mistakes that occur when candidates answer the questions. In this way, it is possible to understand what candidates have done to gain their marks and how they could avoid errors.

The mark schemes for the Specimen Papers are available to download from the School Support Hub at [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)

### 2023 Specimen Paper 1 Mark Scheme

Past exam resources and other teaching and learning resources are available on the School Support Hub [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)

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## Assessment at a glance

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The syllabus for Cambridge O Level Chemistry 5070 is available at [www.cambridgeinternational.org](http://www.cambridgeinternational.org)

All candidates take three papers. Candidates will be eligible for grades A\* to E.

Paper 1: Multiple Choice	
1 hour	
40 Marks	30%
40 four-option multiple-choice questions	
Externally assessed	

And

Paper 2: Theory	
1 hour 45 minutes	
80 Marks	50%
Short-answer and structured questions	
Externally assessed	

### Practical assessment

Paper 3: Practical Test	
1 hour 30 minutes	
40 Marks	20%
Questions will be based on the experimental skills in Section 4	
Externally assessed	

And

Paper 4: Alternative to Practical	
1 hour	
40 Marks	20%
Questions will be based on the experimental skills in Section 4	
Externally assessed	

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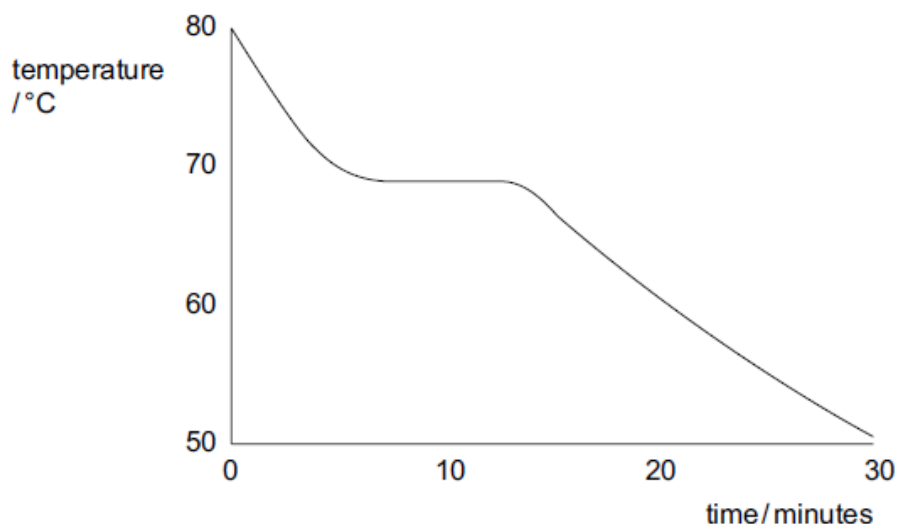
## Specimen answers

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### Question 1

1 Stearic acid has a melting point of  $69^{\circ}\text{C}$ .

A heated sample of pure stearic acid is cooled and the temperature is recorded every minute for 30 minutes. A graph of the results is shown.



Which process occurs between 8 and 12 minutes?

- A boiling
- B condensing
- C freezing
- D melting

**Candidate answer: C**

**Mark awarded = 1**

#### Examiner comment

This question requires candidates to apply their knowledge of cooling curves to stearic acid with a melting point of  $69^{\circ}\text{C}$ .

#### Common mistakes

- Option D (melting) – if the candidate has read the graph read backwards.
- Some candidates will miss the statement about the melting point of stearic acid at the beginning of the question, and not link it to the horizontal part of the graph at  $69^{\circ}\text{C}$ .

## Question 2

2 Which statements are correct?

- 1 The volume of a gas at constant pressure increases as the temperature increases.
- 2 When the pressure of a gas is increased the particles move closer together.
- 3 The pressure of a gas at constant volume decreases as the temperature increases.

A 1, 2 and 3    B 1 and 2 only    C 1 and 3 only    D 2 and 3 only

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

This question requires recall.

## Question 3

3 Which substance would diffuse most quickly?

- A carbon dioxide at 0 °C
- B carbon dioxide at 25 °C
- C neon at 0 °C
- D neon at 25 °C

**Candidate answer: D**

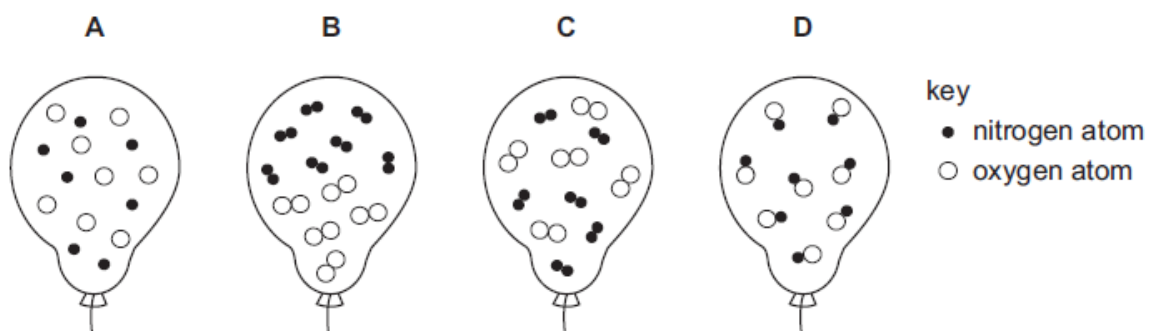
**Mark awarded = 1**

## Examiner comment

The answer is D because the substance with the smallest molecular mass ( $M_r$ ) at the higher temperature, would diffuse most quickly.

## Question 4

4 Which diagram shows the arrangement of particles inside a balloon containing a mixture of the gases nitrogen and oxygen?



**Candidate answer: C**

**Mark awarded = 1**

**Examiner comment**

Option C shows the correct particles, and they are dispersed randomly within the balloon.

**Common mistakes**

Option B – both particles are shown correctly, but they are not dispersed randomly; this suggests that the candidate has not understood diffusion.

**Question 5**

**5** The ion  $Q^{2+}$  has three complete shells of electrons.

What is Q?

- A** calcium
- B** magnesium
- C** oxygen
- D** sulfur

**Candidate answer: A**

**Mark awarded = 1**

**Examiner comment**

The answer requires an appreciation that calcium has lost its outer shell of electrons, and the use of the periodic table to count shells.

**Question 6**

**6** The symbols for two ions are shown.



Which statement is correct?

- A** The fluoride ion contains more electrons than the sodium ion.
- B** The sodium ion contains more neutrons than the fluoride ion.
- C** The two ions contain the same number of electrons as each other.
- D** The two ions contain the same number of protons as each other.

**Candidate answer: C**

**Mark awarded = 1**

**Examiner comment**

It cannot be A as both ions contain 10 electrons: fluoride (9 + 1) and sodium ion (11 – 1).

It cannot be B as both ions contain 10 neutrons: fluoride (19–9) and sodium ion (21–11).

It cannot be D as the proton number is different.



## Common mistakes

Option B – the candidate only considers mass number.

## Question 7

7 Two isotopes of chlorine are  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$ .

Using these isotopes, how many different relative molecular masses are possible for the compound with molecular formula  $\text{C}_2\text{H}_3\text{Cl}_3$ ?

- A 2                      B 3                      C 4                      D 5

**Candidate answer: C**

**Mark awarded = 1**

## Examiner comment

As there are three chlorine atoms in the compound, there are four possible combinations of  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$ :

$3 \times ^{35}\text{Cl}$

$3 \times ^{37}\text{Cl}$

$(2 \times ^{35}\text{Cl}) + (1 \times ^{37}\text{Cl})$

$(1 \times ^{35}\text{Cl}) + (2 \times ^{37}\text{Cl})$

## Common mistakes

- Option A – as there are two different isotopes, the candidate has considered that all three chlorine atoms in the compound are  $^{35}\text{Cl}$  or all  $^{37}\text{Cl}$  but not that it could contain a combination of the two isotopes.
- Option B – as the compound contains three chlorines.

## Question 8

8 What must happen to an atom of a Group II element in order to form a compound?

- A bond with two atoms of oxygen  
 B receive two electrons from an atom of oxygen  
 C share two electrons with an atom of oxygen  
 D transfer two electrons to an atom of oxygen

**Candidate answer: D**

**Mark awarded = 1**

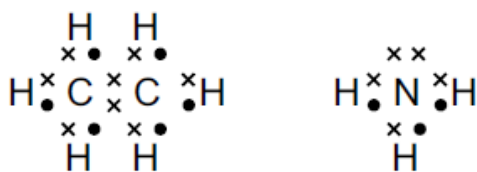
## Examiner comment

The candidate answers this question using recall. Alternatively, they could use the periodic table to see that the Group II element will lose two electrons and the Group VI element (oxygen) gains two electrons.

## Question 9

9 Ethane,  $C_2H_6$ , and ammonia,  $NH_3$ , are covalent compounds.

The dot-and-cross diagrams of these compounds are shown.



Which statements are correct?

- 1 A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
- 2 An unreacted nitrogen atom has five outer electrons.
- 3 In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each carbon atom.

A 1, 2 and 3    B 1 and 2 only    C 1 and 3 only    D 2 and 3 only

Candidate answer: A

Mark awarded = 1

## Examiner comment

The candidate can work out the answer by simply counting the atoms and electrons on the relevant species.

## Common mistakes

Option B – because the shared electrons are both crosses, candidates might think that statement 3 is incorrect.

## Question 10

10 A compound contains 70% by mass of iron and 30% by mass of oxygen.

What is its empirical formula? [ $A_r$ : O, 16; Fe, 56]

A FeO    B  $Fe_2O_3$     C  $Fe_3O_2$     D  $Fe_3O_4$

Candidate answer: B

Mark awarded = 1

### Examiner comment

The candidate needs to do a calculation:

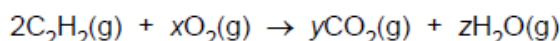
Fe	O	
$70 \div 56 = 1.25$	$30 \div 16 = 1.875$	Divide <i>percentage by mass</i> by <i>relative atomic mass</i>
$1.25 \div 1.25 = 1$	$1.875 \div 1.25 = 1.5$	Divide by smallest number
$1 \times 2 = 2$	$1.5 \times 2 = 3$	Convert to whole numbers
$\text{Fe}_2\text{O}_3$		Write the formula

### Common mistakes

- Option A – the candidate assumes  $\text{Fe}^{2+}$  rather than doing the calculation.
- Option C – the candidate does the calculation correctly but then reverses the ratio.
- Option D – the candidate divides the mass of oxygen by 32, rather than 16.

### Question 11

11 The equation for the reaction between ethyne,  $\text{C}_2\text{H}_2$ , and oxygen is shown.



When the equation is balanced, what is  $x$ ?

- A 2                      B 3                      C 4                      D 5

**Candidate answer: D**

**Mark awarded = 1**

### Examiner comment

The candidate has balanced the equation correctly.

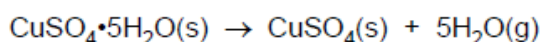
### Common mistakes

There are various ways of coming to the numbers given. Some of the more common might be:

- Option A – the candidate does not consider the 2 before  $\text{C}_2\text{H}_2$  and rounds down.
- Option B – the candidate does not consider the 2 before  $\text{C}_2\text{H}_2$  and rounds up, *OR*  
– the candidate counts six molecules on the right, forgetting that some are  $\text{O}_2$ .
- Option C – the candidate counts four molecules of  $\text{H}_2\text{O}$  rather than two.

### Question 12

12 25.0g of hydrated copper(II) sulfate crystals are heated to produce anhydrous copper(II) sulfate and water.



What is the mass of anhydrous copper(II) sulfate formed?

$[M_r: \text{CuSO}_4, 160; \text{H}_2\text{O}, 18]$

- A 9.0g                      B 16.0g                      C 22.5g                      D 25.0g

**Candidate answer: B****Mark awarded = 1****Examiner comment**

The candidate must do a calculation:

$$M_r \text{ CuSO}_4 \cdot 5\text{H}_2\text{O} = 160 + (5 \times 18) = 250$$

$$250 \text{ g CuSO}_4 \cdot 5\text{H}_2\text{O} \text{ gives } 160 \text{ g CuSO}_4$$

$$25 \text{ g CuSO}_4 \cdot 5\text{H}_2\text{O} \text{ forms } \mathbf{16 \text{ g CuSO}_4}$$

Calculate  $M_r$  of starting substanceSubstitute  $M_r$  values ( $M_r \text{ CuSO}_4 = 160$  given)Divide both sides by 10 ( $250 \text{ g} \div 10 = 25 \text{ g}$ )**Common mistakes**Option D – the candidate does not consider the  $M_r$  of the water when calculating the  $M_r$  of the crystals.**Question 13****13** The relative formula masses of four compounds are given.

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
<b>A</b>	$\text{Al}_2\text{O}_3$	102
<b>B</b>	$\text{CuO}$	80
<b>C</b>	$\text{H}_2\text{SO}_4$	98
<b>D</b>	$\text{HNO}_3$	63

**Candidate answer: D****Mark awarded = 1****Examiner comment**

The candidate must use the relationship, 'amount of substance (mol) = mass (g) / molar mass (g / mol)' to calculate the number of moles of oxygen in each option.

Option A:  $(1 \div 102) \times 3 = 0.0294$

Option B:  $(1 \div 80) \times 1 = 0.0125$

Option C:  $(1 \div 98) \times 4 = 0.0408$

Option D:  $(1 \div 63) \times 3 = 0.0476$

**Common mistakes**Option C – candidate assumes  $\text{H}_2\text{SO}_4$  as it contains the most oxygen atoms per molecule (4).

## Question 14

- 14 50.0 cm<sup>3</sup> of 0.10 mol/dm<sup>3</sup> silver nitrate, AgNO<sub>3</sub>, is added to 150.0 cm<sup>3</sup> of 0.05 mol/dm<sup>3</sup> sodium iodide, NaI, in a beaker.

After the reaction, solid silver iodide is present in the beaker.  
What else is present?

- A aqueous silver nitrate and aqueous sodium nitrate  
B aqueous sodium iodide and aqueous sodium nitrate  
C aqueous sodium iodide only  
D aqueous sodium nitrate only

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

The candidate needs to calculate the number of moles of each reagent in order to determine the ions that remain in solution.

The candidate must use the relationship, 'amount of substance (mol) = mass (g) / molar mass (g / mol)' to calculate the number of moles of each reagent.

Number of moles AgNO<sub>3</sub> = (50 × 0.1) ÷ 1000 = 5 × 10<sup>-3</sup> mol

Number of moles NaI = (150 × 0.05) ÷ 1000 = 7.5 × 10<sup>-3</sup> mol

All Ag<sup>+</sup> reacts with excess I<sup>-</sup> to form solid AgI

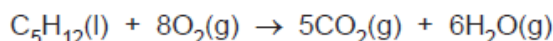
Left in solution is NO<sub>3</sub><sup>-</sup>, Na<sup>+</sup>, I<sup>-</sup>, i.e. solutions of sodium nitrate and sodium iodide.

## Common mistakes

- Option C – the candidate only considers that aqueous sodium iodide is in excess, forgetting that there are soluble nitrate ions left over from the silver nitrate after the Ag<sup>+</sup> react with excess I<sup>-</sup>
- Option D – the candidate does not calculate the number of moles of each reagent, and simply writes the equation as though the stoichiometric amounts are present.

## Question 15

- 15 When 0.1 mol of the hydrocarbon, C<sub>5</sub>H<sub>12</sub>, is completely combusted it produces carbon dioxide, CO<sub>2</sub>, and water, H<sub>2</sub>O.



What is the volume of carbon dioxide produced when measured at room temperature and pressure?

- A 0.5 dm<sup>3</sup>      B 2.4 dm<sup>3</sup>      C 5.0 dm<sup>3</sup>      D 12 dm<sup>3</sup>

**Candidate answer: D**

**Mark awarded = 1**

**Examiner comment**1 mole C<sub>5</sub>H<sub>12</sub> gives 5 moles of CO<sub>2</sub>

Using the given equation

0.1 mole C<sub>5</sub>H<sub>12</sub> gives 0.5 moles of CO<sub>2</sub>

Divide both sides by 10

0.5 moles has a volume of (0.5 × 24) = 12 dm<sup>3</sup>Using 'molar gas volume = 24 dm<sup>3</sup> at r.t.p'.**Common mistakes**Option B – the candidate forgets that there five times as many moles of CO<sub>2</sub> as C<sub>5</sub>H<sub>12</sub>.**Question 16****16** Carbon electrodes are used to electrolyse aqueous copper(II) sulfate.

Which observations are made?

	at the anode	electrolyte	at the cathode
<b>A</b>	colourless gas forms	blue colour fades	pink solid forms
<b>B</b>	colourless gas forms	blue colour fades	colourless gas forms
<b>C</b>	electrode increases in mass	blue colour fades	pink solid forms
<b>D</b>	electrode increases in mass	no change	pink solid forms

**Candidate answer: A****Mark awarded = 1****Examiner comment**

This question requires recall of the electrolysis of aqueous copper(II) sulfate using inert carbon electrodes.

**Common mistakes**

Option D – confusing partly with using copper electrodes, even though the anode has increased in mass.

**Question 17****17** Electrolysis is used to plate a metal coin with silver.

The coin is used as an electrode in a suitable electrolyte.

Which row is correct?

	coin	electrolyte
<b>A</b>	anode	AgCl(aq)
<b>B</b>	anode	AgNO <sub>3</sub> (aq)
<b>C</b>	cathode	AgCl(aq)
<b>D</b>	cathode	AgNO <sub>3</sub> (aq)

**Candidate answer: D**

Mark awarded = 1

### Examiner comment

This question requires recall of the process of electrolysis and how metals are electroplated:

$\text{Ag}^+$  is attracted to the cathode (negative electrode).

$\text{AgNO}_3$  is soluble but  $\text{AgCl}$  is not.

Therefore, the answer is option D.

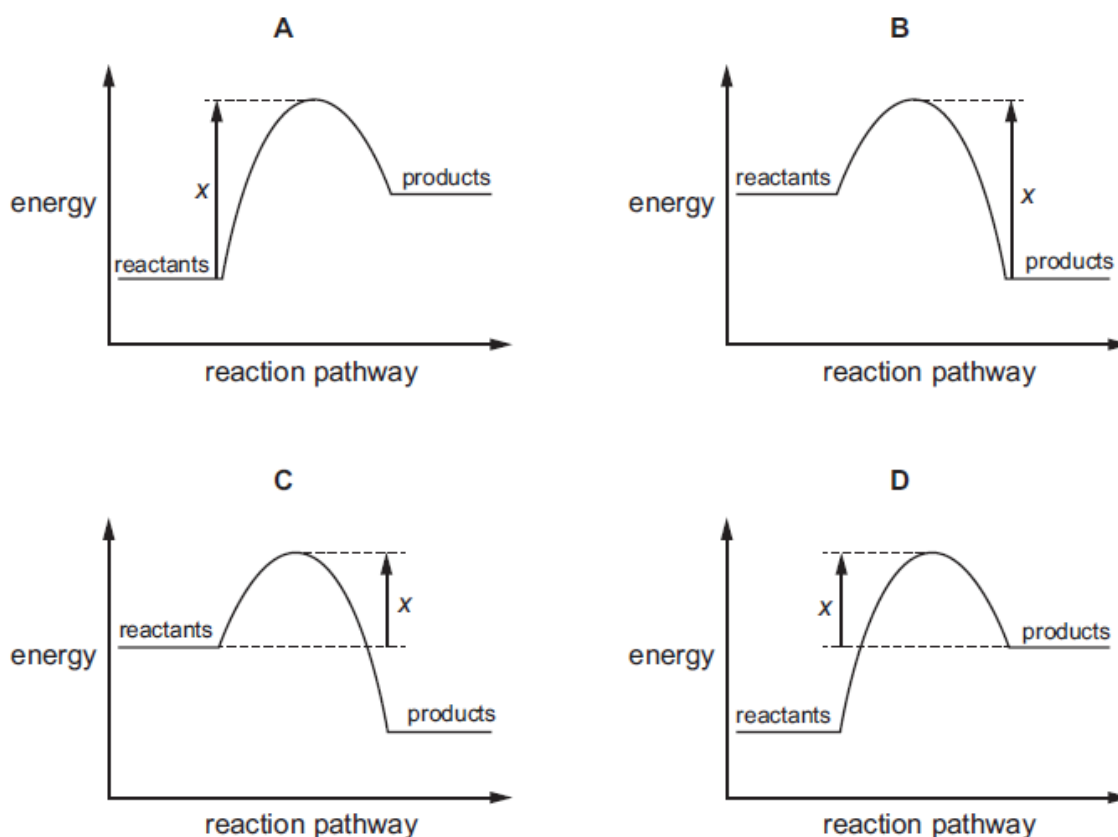
### Common mistakes

Option B – the candidate reverses the polarity of the cathode and the anode.

## Question 18

18 An endothermic reaction has an activation energy of  $x$ .

Which reaction pathway diagram is correct for this reaction?



Candidate answer: A

Mark awarded = 1

### Examiner comment

Endothermic has products at higher energy than reactants, therefore answer is option A or option D.

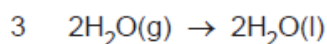
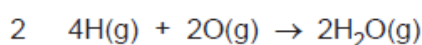
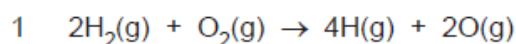
Activation energy,  $E_a$ , is energy from reactant to the top of the 'hump', therefore the answer is option A.

### Common mistakes

- Option D – candidates misunderstand activation energy,  $E_a$ .
- Option C – candidates misunderstand endothermic.

## Question 19

19 The formation of liquid water from hydrogen and oxygen may occur in three stages.



Which stages are endothermic?

- A 1, 2 and 3      B 1 only      C 1 and 3      D 2 only

Candidate answer: B

Mark awarded = 1

## Examiner comment

Bond breaking is endothermic, so stage 1 is endothermic.

Bond forming is exothermic, so stages 2 and 3 are exothermic, so answer is option B.

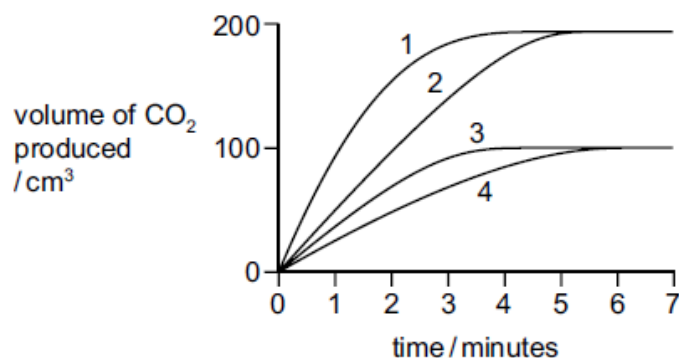
## Question 20

20 In four separate experiments, 1, 2, 3 and 4, nitric acid is added to an **excess** of marble pieces and the volume of carbon dioxide gas formed is measured.

In all four experiments the same volume of nitric acid is used.

The concentration, or temperature, or both concentration and temperature of the nitric acid, are changed.

The results of the experiments are shown on the graph.



Which statement is correct?

- A A lower concentration of acid is used in experiment 3 than in experiment 1.  
 B Experiment 4 is faster than experiment 3.  
 C The acid used in experiment 2 is of a lower concentration than in experiment 1.  
 D The temperature of the acid is the same in experiments 1 and 2.

Candidate answer: A



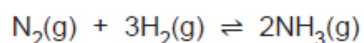
**Mark awarded = 1**

**Examiner comment**

A lower concentration of acid will form less carbon dioxide since there is an excess of marble pieces, therefore the answer is option A.

**Question 21**

**21** The equation shows the reaction for the manufacture of ammonia.



Which change will decrease the activation energy of the reaction?

- A adding a catalyst
- B decreasing the temperature
- C increasing the concentration
- D increasing the pressure

**Candidate answer: A**

**Mark awarded = 1**

**Examiner comment**

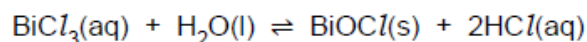
The candidate is correct.

**Common mistakes**

Option B – there is a common misconception that because a lower temperature lowers the kinetic energy of the particles, it must also lower the activation energy.

**Question 22**

**22** A reversible reaction is shown.



Which changes increase the mass of the precipitate formed?

- 1 adding more water
  - 2 adding aqueous sodium hydroxide
  - 3 adding dilute hydrochloric acid
- A** 1 and 2      **B** 1 and 3      **C** 1 only      **D** 2 and 3

**Candidate answer: A**

**Mark awarded = 1**

**Examiner comment**

In 1, the equilibrium moves to the right in order to remove the additional water and in the process forms more precipitate.

In 2, the equilibrium moves to the right in order to replace the hydrochloric acid that is removed by reacting with the sodium hydroxide, and increases the mass of precipitate in the process.

In 3, the equilibrium moves to the left in order to remove the additional hydrochloric acid.

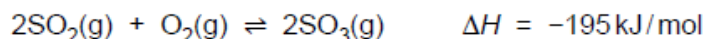
Hence, the answer is option A.

**Common mistakes**

Option C – candidates might miss that sodium hydroxide reacts with hydrochloric acid, hence removing it from the righthand side, which causes the equilibrium to move to the right.

**Question 23**

**23** Sulfur trioxide is produced by the reversible reaction shown.



Which change in conditions will produce a greater amount of  $\text{SO}_3$  at equilibrium?

- A adding a catalyst
- B increasing the pressure
- C increasing the temperature
- D removing some  $\text{SO}_2$  and  $\text{O}_2$

**Candidate answer: B**

**Mark awarded = 1**

**Examiner comment**

A catalyst does not change the position of equilibrium.

The reaction produces 2 moles of gas from 3 moles of gas, which requires an increase in pressure, therefore an increase in pressure will favour the forward reaction.

The enthalpy change of the reaction shows it is exothermic, so increasing the temperature will favour the reverse reaction.

Removing  $\text{SO}_2$  and  $\text{O}_2$  will favour the reverse reaction.

Hence, the answer is option B.

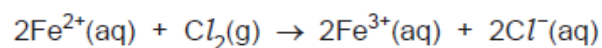
**Common mistakes**

Option C – there are two common misconceptions candidates often make:

- mistaking the meaning of the negative  $\Delta H$
- thinking that increasing the temperature increases yield of product as well as rate of reaction.

## Question 24

24 Iron(II) ions react with chlorine.



Which statement about this reaction is correct?

- A Chlorine is reduced by iron(II) ions.
- B Chlorine is the reducing agent.
- C Iron(II) ions are reduced by chlorine.
- D Iron(II) ions are the oxidising agent.

**Candidate answer: A**

**Mark awarded = 1**

**Examiner comment**

Reduction is a gain of electrons, so the answer is option A.

**Common mistakes**

Option B – candidates often confuse ‘reduction’ and ‘reducing agent’.

## Question 25

25 Which reactions involve oxidation and reduction?

- 1 chlorine gas reacting with aqueous potassium iodide
- 2 dilute sulfuric acid reacting with magnesium
- 3 dilute hydrochloric acid reacting with aqueous sodium hydroxide

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

**Candidate answer: B**

**Mark awarded = 1**

**Examiner comment**

The reaction needs to result in a change of oxidation number, so the answer cannot include reaction 3.

**Common mistakes**

Option A – candidate does not appreciate that there is no change in oxidation number in reaction 3.

## Question 26

- 26 Which statement about weak acids is correct?
- A They are partially dissociated in aqueous solution.
  - B They do not react with alkalis.
  - C They do not react with metals.
  - D They form solutions with pH values in the range 0 to 2.

**Candidate answer:** A

**Mark awarded = 1**

## Examiner comment

This question requires recall of the definition of a weak acid.

## Common mistakes

Options B and C – candidates misunderstand that weak acids do react similarly to strong acids, but less vigorously.

## Question 27

- 27 A colourless aqueous solution of pH 13 is tested separately with methyl orange indicator and thymolphthalein indicator.

Which row is correct?

	colour with methyl orange	colour with thymolphthalein
<b>A</b>	red	blue
<b>B</b>	red	colourless
<b>C</b>	yellow	blue
<b>D</b>	yellow	colourless

**Candidate answer:** C

**Mark awarded = 1**

## Examiner comment

This question requires candidates to recall the effects of alkali on the colour of the given indicators.

## Common mistakes

Option B – candidates reverse both colours due to incorrect recall or misunderstanding of pH 13.

**Question 28**

**28** Which pair of reagents is suitable for preparing a pure sample of copper(II) chloride crystals?

- A aqueous copper(II) nitrate and aqueous sodium chloride
- B copper and aqueous sodium chloride
- C copper and dilute hydrochloric acid
- D copper(II) oxide and dilute hydrochloric acid

**Candidate answer: D**

**Mark awarded = 1**

**Examiner comment**

The candidate needs to recall that copper is an unreactive metal so will not react with acid or salt solution, so the answer cannot be option B or C.

The product is soluble so cannot be formed from the reagents in option A.

The answer is therefore option D: metal oxide/base + acid.

**Common mistakes**

Option A – candidates often miss the fact that crystals are made, so the product is soluble in water.

**Question 29**

**29** Element X forms an oxide of formula  $X_2O_5$ .

In which group of the Periodic Table is X likely to be found?

- A Group II
- B Group III
- C Group V
- D Group VIII

**Candidate answer: C**

**Mark awarded = 1**

**Examiner comment**

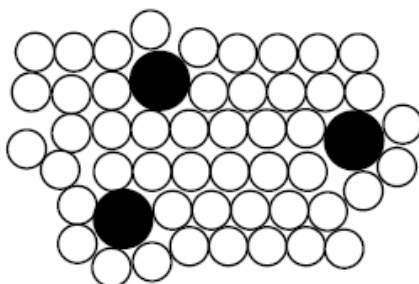
This question requires candidates to consider electrons used in bonding.

**Common mistakes**

Option A – candidates do not consider the stoichiometry.

## Question 30

30 The diagram shows the structure of an alloy.



Which statement about alloys is correct?

- A Alloys can only be formed by mixing copper or iron with other metals.
- B Carbon and iron are the only two elements in stainless steel.
- C In an alloy there is attraction between positive ions and a 'sea' of delocalised electrons.
- D The alloy brass has a chemical formula.

**Candidate answer: C**

**Mark awarded = 1**

## Examiner comment

This question requires recall of alloys and metallic bonding.

## Common mistakes

Option D – candidates often miss the fact that an alloy is a mixture of a metal with other elements.

## Question 31

31 Which compound has the lowest percentage by mass of nitrogen?

- A  $(\text{NH}_2)_2\text{CO}$  [ $M_r$ : 60]
- B  $(\text{NH}_4)_2\text{SO}_4$  [ $M_r$ : 132]
- C  $(\text{NH}_4)_3\text{PO}_4$  [ $M_r$ : 149]
- D  $\text{NH}_4\text{NO}_3$  [ $M_r$ : 80]

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

This question requires candidates to calculate the percentage composition by mass:

percentage composition by mass = (mass of element in compound /  $M_r$  of compound)  $\times$  100

A  $(28 \div 60) \times 100 = 47\%$  (atomic mass N = 14;  $2 \times 14 = 28$ )

B  $(28 \div 132) \times 100 = 21\%$

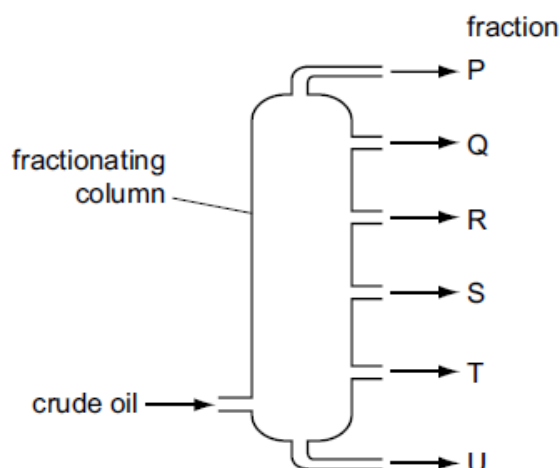
C  $(42 \div 149) \times 100 = 28\%$  ( $3 \times 14 = 42$ )

D  $(28 \div 80) \times 100 = 35\%$



## Question 33

33 The diagram shows a fractionating column used in the separation of petroleum.



Which row explains why fraction R is collected above fraction S?

	boiling point of R	average molecular mass of R
<b>A</b>	greater than S	greater than S
<b>B</b>	greater than S	smaller than S
<b>C</b>	smaller than S	greater than S
<b>D</b>	smaller than S	smaller than S

**Candidate answer: D**

**Mark awarded = 1**

## Examiner comment

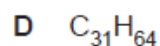
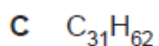
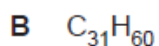
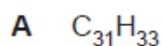
This question requires candidates to recall how the properties of fractions obtained from petroleum change from the bottom to the top of the fractionating column.

## Common mistakes

Option A – candidates often reverse the trends.

## Question 34

34 Which compound is an alkane?



**Candidate answer: D**

**Mark awarded = 1**

## Examiner comment

This question requires candidates to recall the general formulae of alkanes is  $C_nH_{2n+2}$ , and then to use it to determine which compound is an alkane.



Option A is a compound with general formula  $C_nH_{n+2}$

Option B is a compound with general formula  $C_nH_{2n-2}$

Option C is a compound with general formula  $C_nH_{2n}$

Option D is a compound with general formula  $C_nH_{2n+2}$

### Common mistakes

- Option C – candidates use the general formula of an alkene by mistake.
- Option A – candidates use the general formula  $C_nH_{n+2}$ .

### Question 35

35 Which row correctly describes alkenes?

	saturated or unsaturated	result when shaken with aqueous bromine
A	saturated	no change
B	saturated	the aqueous bromine is decolourised
C	unsaturated	no change
D	unsaturated	the aqueous bromine is decolourised

**Candidate answer: D**

**Mark awarded = 1**

### Examiner comment

This question requires candidates to recall that alkenes are unsaturated hydrocarbons, and to recall the properties of alkenes in terms of addition reactions with aqueous bromine.

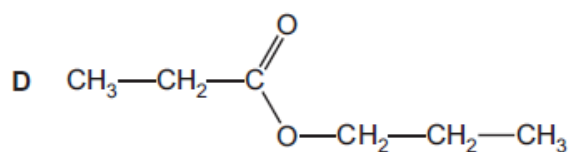
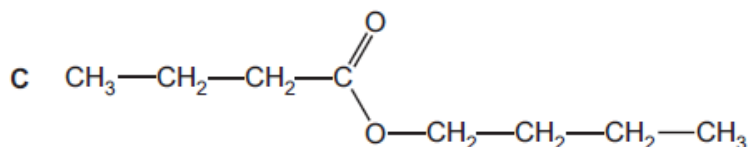
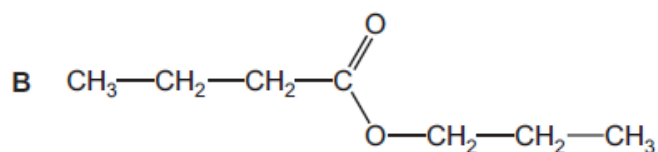
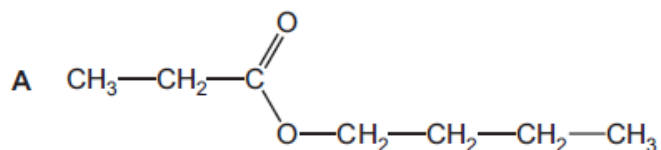
### Common mistakes

Option A – candidates often select this because they have confused alkenes with alkanes, which are saturated hydrocarbons, and there is no change when shaken with aqueous bromine.

## Question 36

- 36 A carboxylic acid with molecular formula  $C_4H_8O_2$  reacts with an alcohol with molecular formula  $C_3H_8O$  to form an ester.

What is the formula of the ester formed?



Candidate answer: B

Mark awarded = 1

## Examiner comment

The candidate needs to use what they know about the reaction of a carboxylic acid with an alcohol when using an acid catalyst to form an ester.

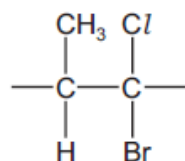
They would expect the resulting ester to contain 3C then COO then 3C, (as the carboxylic acid has four carbons and the alcohol has three carbons) so the answer is option B.

## Common mistakes

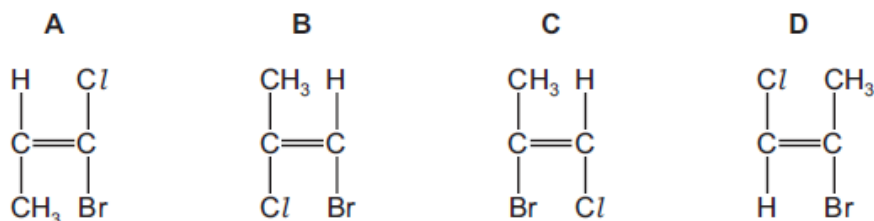
Option A – this option has the right number of carbons in total, but the linkage reversed.

## Question 37

37 The repeat unit of a polymer is shown.



Which monomer would produce this polymer?



**Candidate answer: A**

**Mark awarded = 1**

### Examiner comment

The candidate must use their understanding of addition polymers to identify the correct monomer. They should see that Cl and Br must be on one C, with H and CH<sub>3</sub> on the other, therefore the answer must be option A.

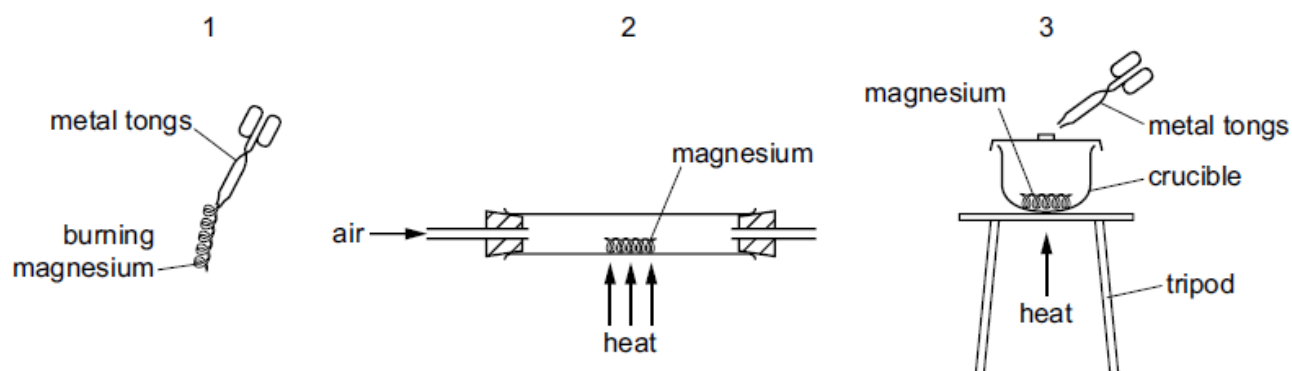
### Common mistakes

Option D – candidates see CH<sub>3</sub> and Cl on adjacent carbons (as is the case in the polymer) but miss that the Br is on the incorrect C.

## Question 38

38 When heated, magnesium reacts with oxygen in the air to form magnesium oxide, a white powder.

A student investigates the change in mass that occurs during this reaction. The student is given a balance and the three sets of apparatus shown.



Which sets of apparatus are suitable for this investigation?

- A 1, 2 and 3    B 1 and 3 only    C 2 and 3 only    D 2 only

**Candidate answer: C**

**Mark awarded = 1**

## Examiner comment

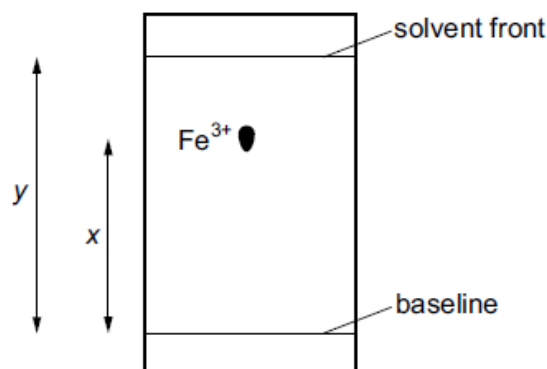
To investigate a change in mass, the student will need to measure the mass before and after the reaction; this in turn means that product cannot be lost. The set of apparatus in 1, will lose some of the product, while set ups 2 and 3 collect product. Therefore, the answer is option C.

## Common mistakes

Option A – as all experiments involve heating/burning magnesium.

## Question 39

39 A student uses paper chromatography to find an  $R_f$  value for  $\text{Fe}^{3+}(\text{aq})$ . The result is shown.



To make the spot containing  $\text{Fe}^{3+}(\text{aq})$  more visible, the paper is sprayed with aqueous sodium hydroxide so that a precipitate of iron(III) hydroxide forms.

Under the conditions of the experiment, the  $R_f$  value of  $\text{Fe}^{3+}(\text{aq})$  is given by .....1..... and the colour of the precipitate is .....2.....

Which row correctly completes gaps 1 and 2?

	gap 1	gap 2
<b>A</b>	$\frac{x}{y}$	green
<b>B</b>	$\frac{x}{y}$	red-brown
<b>C</b>	$\frac{y}{x}$	green
<b>D</b>	$\frac{y}{x}$	red-brown

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

This question requires candidates to recall tests using aqueous sodium hydroxide to identify aqueous cations.

$R_f$  should be less than one, so  $x/y$ .

Iron(III) hydroxide is red-brown with sodium hydroxide.

Therefore, the answer is option B.

## Common mistakes

- Option C – candidate inverts the  $R_f$ .
- Option A – candidate confuses the test for Fe(II) and Fe(III).

## Question 40

40 Tests on an aqueous solution of an unknown compound P are shown in the table.

test	observation
aqueous sodium hydroxide added	green precipitate, soluble in excess giving a green solution
dilute nitric acid added then aqueous barium nitrate	white precipitate
dilute nitric acid added then aqueous silver nitrate	no precipitate

Which ions are present in P?

- A  $\text{Cr}^{3+}$  and  $\text{Cl}^-$
- B  $\text{Cr}^{3+}$  and  $\text{SO}_4^{2-}$
- C  $\text{Fe}^{2+}$  and  $\text{Cl}^-$
- D  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$

**Candidate answer: B**

**Mark awarded = 1**

#### Examiner comment

This question requires candidates to recall tests used to identify anions, and the tests using aqueous sodium hydroxide to identify aqueous cations.

White precipitate is formed following the addition of aqueous barium nitrate, suggesting the compound contains a sulfate.

Green precipitate is formed when aqueous sodium hydroxide is added, suggesting the compound contains  $\text{Cr}^{3+}$  or  $\text{Fe}^{2+}$ ; but dissolving in excess sodium hydroxide suggests  $\text{Cr}^{3+}$ .

Therefore, answer is option B.

#### Common mistakes

Option D – candidates miss that the green precipitate is soluble in excess aqueous sodium hydroxide, and therefore cannot be  $\text{Fe}^{2+}$ , which although is a green precipitate, it is insoluble in aqueous sodium hydroxide.

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