

Specimen Paper Answers – Paper 1  
**Cambridge IGCSE™ / IGCSE (9–1)**  
**Chemistry 0620 / 0971**

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 IGCSE / IGCSE (9-1) Chemistry 0620 / 0971, and to show examples of very good answers.

In this booklet, we have provided answers for all questions with examiner comments. This paper requires candidates to answer multiple choice questions. Candidates are awarded a 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)

## Assessment at a glance

The syllabus for Cambridge IGCSE Chemistry 0620 is available at [www.cambridgeinternational.org](http://www.cambridgeinternational.org)

All candidates take three papers. Candidates who have studied the Core syllabus content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G.

Candidates who have studied the Extended syllabus content (Core and Supplement), and who are expected to achieve a grade C or above, should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A\* to G.

### Core assessment

Core candidates take Paper 1 and Paper 3. The questions are based on the Core subject content only:

Paper 1: Multiple Choice (Core)	
45 minutes	
40 marks	30%
40 four-option multiple-choice questions	
Externally assessed	

Paper 3: Theory (Core)	
1 hour 15 minutes	
80 marks	50%
Short-answer and structured questions	
Externally assessed	

### Extended assessment

Extended candidates take Paper 2 and Paper 4. The questions are based on the Core and Supplement subject content:

Paper 2: Multiple Choice (Extended)	
45 minutes	
40 marks	30%
40 four-option multiple-choice questions	
Externally assessed	

Paper 4: Theory (Extended)	
1 hour 15 minutes	
80 marks	50%
Short-answer and structured questions	
Externally assessed	

### Practical assessment

All candidates take one practical paper from a choice of two:

Paper 5: Practical Test	
1 hour 15 minutes	
40 marks	20%
Questions will be based on the experimental skills in Section 4 of the syllabus	
Externally assessed	

Paper 6: Alternative to Practical	
1 hour	
40 marks	20%
Questions will be based on the experimental skills in Section 4 of the syllabus	
Externally assessed	

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## Specimen answers

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### Question 1

- 1 Which statement about liquids and gases is correct?
- A  $1\text{ cm}^3$  of gas contains more particles than  $1\text{ cm}^3$  of liquid.
  - B A given mass of liquid has a fixed volume at room temperature.
  - C Particles in a liquid can easily be forced closer together.
  - D Particles in a liquid have fixed positions.

**Candidate answer: B**

**Mark awarded = 1**

#### Examiner comment

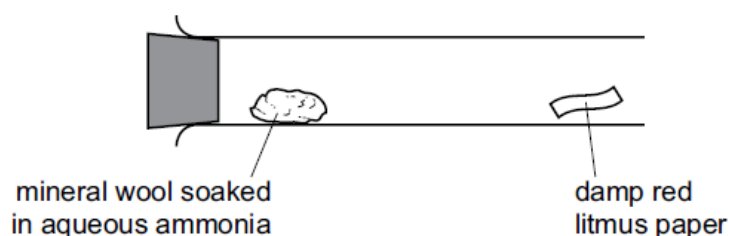
The particles in a gas are spread further apart than the particles in a liquid so option A must be incorrect. Liquids cannot be compressed so option C must be correct. Liquids take on the shape of the container they are in so option D must be incorrect, as the particles can move over one another.

#### Common mistakes

Candidates generally know that solids cannot be compressed but many incorrectly think that liquids can be compressed. Only gases can be compressed.

### Question 2

- 2 Mineral wool soaked in aqueous ammonia is placed in the apparatus shown.



After five minutes, the damp red litmus paper turns blue.

Which process led to this change?

- A condensation
- B crystallisation
- C diffusion
- D distillation

**Candidate answer: C**

**Mark awarded = 1**

### Examiner comment

For the damp red litmus paper to turn blue, particles from the ammonia must have moved from the mineral wool to the litmus paper. Only option C, diffusion, can be correct because it is the only option that describes the movement of particles.

### Common mistakes

Sometimes candidates lack confidence with questions that are set in unfamiliar contexts. Candidates should study the information carefully and work out what is happening as that will lead them to the correct answer.

### Question 3

3 Which pair of atoms contains the same number of neutrons?

- A  ${}_{27}^{59}\text{Co}$  and  ${}_{28}^{59}\text{Ni}$
- B  ${}_{29}^{64}\text{Cu}$  and  ${}_{29}^{65}\text{Cu}$
- C  ${}_{29}^{64}\text{Cu}$  and  ${}_{30}^{65}\text{Zn}$
- D  ${}_{29}^{65}\text{Cu}$  and  ${}_{30}^{65}\text{Zn}$

**Candidate answer: C**

**Mark awarded = 1**

### Examiner comment

The number of neutrons in an atom is determined by subtracting the proton number from the mass number. Only option C has two atoms with the same number of neutrons: Cu  $64 - 29 = 35$  and Zn  $65 - 30 = 35$ .

### Common mistakes

Candidates often confuse atomic number, proton number, mass number and nucleon number.

Atomic number and proton number are alternative terms for the number of protons in the nucleus of an atom, they also equal to the number of electrons in the atom.

Mass number and nucleon number are alternative terms for the number of nucleons (protons and neutrons) in the nucleus of an atom.

### Question 4

4 Which statement describes the bonding in sodium chloride?

- A A shared pair of electrons between two atoms leading to a noble gas configuration.
- B A strong force of attraction between oppositely charged ions.
- C A strong force of attraction between two molecules.
- D A weak force of attraction between oppositely charged ions.

**Candidate answer: B**

**Mark awarded = 1**

### Examiner comment

Sodium is a metal and chlorine is a non-metal so the bonding in sodium chloride will be ionic. Ionic bonding is the strong force of attraction between ions so option B is correct.

### Common mistakes

Some candidates recall that ionic bonding is a strong force of attraction but confuse attraction between ions and molecules and select option C.

### Question 5

- 5 A covalent molecule M contains a total of four shared electrons.

What is M?

- A ammonia,  $\text{NH}_3$
- B hydrogen chloride,  $\text{HCl}$
- C methane,  $\text{CH}_4$
- D water,  $\text{H}_2\text{O}$

**Candidate answer: D**

**Mark awarded = 1**

### Examiner comment

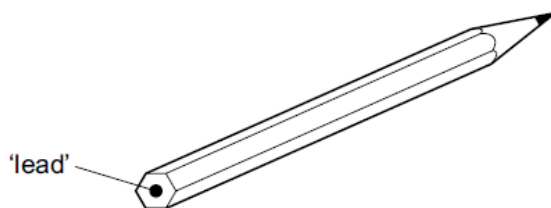
To determine the answer, the number of shared electrons in each of the molecules has to be worked out.  $\text{NH}_3$  has 3 shared pairs of electrons, so 6 shared electrons;  $\text{HCl}$  has one shared pair of electrons, so 2 shared electrons;  $\text{CH}_4$  has 4 shared pairs of electrons, so 8 shared electrons;  $\text{H}_2\text{O}$  has 2 shared pairs of electrons so 4 shared electrons. Therefore, option D is correct.

### Common mistakes

Some candidates select option C because methane has four covalent bonds. Each single covalent bond consists of a pair of electrons, so two individual electrons. Therefore, methane has 8 individual electrons.

### Question 6

- 6 The 'lead' in a pencil is made of a mixture of graphite and clay.



When the percentage of graphite is increased, the pencil moves across the paper more easily.

Which statement explains this observation?

- A Graphite has a high melting point.
- B Graphite is a form of carbon.
- C Graphite is a lubricant.
- D Graphite is a non-metal.



**Candidate answer: C**

**Mark awarded = 1**

### Examiner comment

All the statements about graphite are correct, but only C explains the observations in the question.

### Common mistakes

Candidates often recognise a statement as being true and automatically think that it must be the correct answer. All four options are correct but only option C answers the specific question being asked.

## Question 7

7 A compound with the formula  $XO_2$  has a relative formula mass of 64.

What is X?

- A cadmium
- B copper
- C gadolinium
- D sulfur

**Candidate answer: D**

**Mark awarded = 1**

### Examiner comment

To determine the answer, the relative formula mass for each compound, based on the formula  $XO_2$ , has to be calculated. The correct option will have a RFM of 64.

cadmium  $CdO_2 = 144$

copper  $CuO_2 = 96$

gadolinium  $GdO_2 = 189$

sulfur  $SO_2 = 64$ .

### Common mistakes

Candidates often recall the method for calculating the relative formula mass but add the atomic numbers rather than the mass numbers.

## Question 8

8 When molten lead(II) bromide is electrolysed using platinum electrodes, what is observed at each electrode?

	negative electrode	positive electrode
<b>A</b>	bubbles of a colourless gas	bubbles of a brown gas
<b>B</b>	bubbles of a colourless gas	bubbles of a colourless gas
<b>C</b>	shiny grey liquid	bubbles of a brown gas
<b>D</b>	shiny grey liquid	bubbles of a colourless gas

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

When electrolysing molten binary compounds, the positive metal ion will be attracted to the negative electrode and the negative non-metal ion will be attracted to the positive electrode. Lead is a grey metal so only options C and D can be correct. Bromine gas is a brown colour so option C must be correct.

**Common mistakes**

Candidates often confuse the directions ions move during electrolysis. The simplest fact to remember is that 'opposites attract', and therefore, positive ions are attracted to the negative electrode and *vice versa*.

**Question 9**

- 9 Aqueous nickel(II) sulfate is used as the electrolyte to electroplate a piece of steel with nickel.

Which materials are used as the negative electrode and positive electrode?

	negative electrode	positive electrode
<b>A</b>	carbon	steel
<b>B</b>	nickel	steel
<b>C</b>	platinum	nickel
<b>D</b>	steel	nickel

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

If steel is to be electroplated with nickel, the negative electrode must be steel so that it attracts the positive nickel ions. Therefore, only option D can be correct.

**Question 10**

- 10 Which row shows the waste products released from the exhaust of a vehicle powered using a hydrogen–oxygen fuel cell?

	carbon dioxide	oxides of nitrogen	water
<b>A</b>	✓	✓	✓
<b>B</b>	×	✓	✓
<b>C</b>	✓	×	×
<b>D</b>	×	×	✓

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

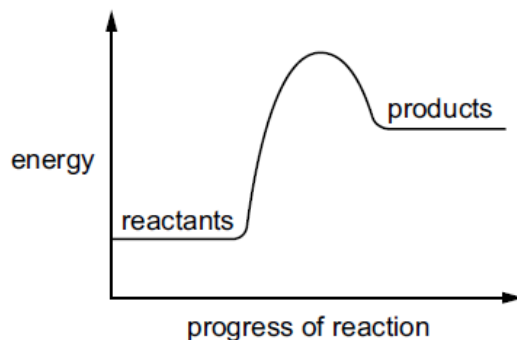
One of the main advantages of hydrogen–oxygen fuel cells is that they do not release carbon dioxide or oxides of nitrogen. The only waste product from hydrogen–oxygen fuel cells is water.

### Common mistakes

Many candidates spot the word 'fuel' and recall the fact that the combustion of some fuels produces carbon dioxide. Therefore, they select option C.

### Question 11

11 A reaction pathway diagram is shown.



Which statement about the reaction is correct?

- A Heat is released.
- B It is a combustion reaction.
- C It is an endothermic reaction.
- D The temperature increases.

**Candidate answer: C**

**Mark awarded = 1**

### Examiner comment

As the energy for the reactants is lower than the energy for the products, the reaction must have taken in energy from the surroundings. This is a characteristic of an endothermic reaction so option C is correct.

### Common mistakes

Many candidates confuse endothermic and exothermic reactions. Endothermic reactions have products with more energy than the reactants and take in energy from their surroundings. Exothermic reactions have products with less energy than the reactants and give out energy to their surroundings.

### Question 12

12 Which changes are physical changes?

- 1 melting ice to form water
- 2 burning hydrogen to form water
- 3 adding sodium to water
- 4 boiling water to form steam

- A** 1 and 2      **B** 1 and 4      **C** 2 and 3      **D** 3 and 4

**Candidate answer: B**

**Mark awarded = 1**

**Examiner comment**

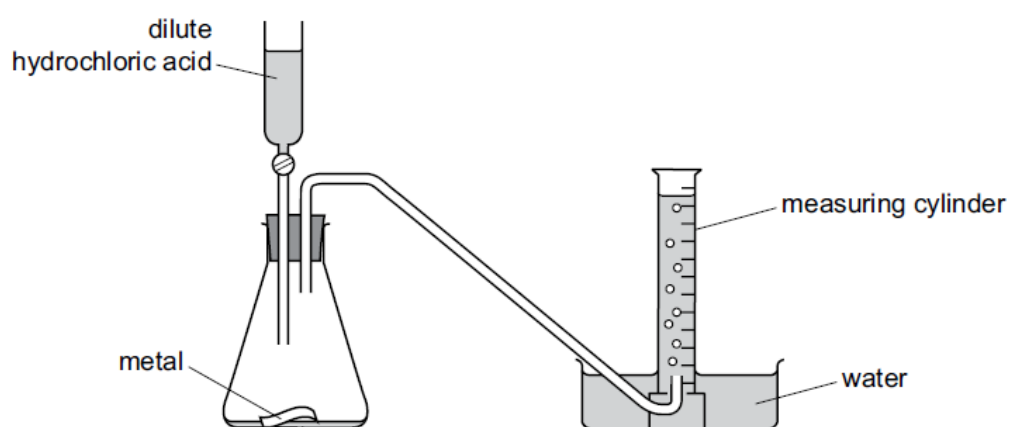
Physical changes can be reversed, whereas chemical changes cannot. Melting ice and boiling water are both reversible processes so are physical changes. Therefore, option B is correct.

**Common mistakes**

Candidates sometimes confuse physical and chemical changes. If a change can be reversed, it will be a physical change.

**Question 13**

13 The diagram shows an experiment to measure the rate of a chemical reaction.



Which change decreases the rate of reaction?

- A adding water to the flask
- B heating the flask during the reaction
- C using more concentrated acid
- D using powdered metal

**Candidate answer: A**

**Mark awarded = 1**

**Examiner comment**

Adding water to the flask results in a lower concentration of hydrochloric acid, which decreases the rate of the reaction.

**Common mistakes**

Candidates are familiar with questions about increasing the rate of reaction so they quickly select option B, C or D. This question asks about decreasing the rate of reaction – highlighting the importance of reading the question carefully.

## Question 14

- 14 Which row correctly matches the experiment and observations to the identity of the underlined substance?

	experiment and observations	identity of the underlined substance
<b>A</b>	<u>Blue crystals</u> are heated. The crystals turn white and steam is given off.	hydrated cobalt(II) chloride
<b>B</b>	<u>Pink crystals</u> are heated. The crystals turn blue and steam is given off.	anhydrous cobalt(II) chloride
<b>C</b>	Water is added to a <u>blue solid</u> . The blue solid turns pink.	hydrated copper(II) sulfate
<b>D</b>	Water is added to a <u>white solid</u> . The white solid turns blue.	anhydrous copper(II) sulfate

Candidate answer: D

Mark awarded = 1

## Examiner comment

Successful candidates recall that anhydrous copper(II) sulfate is white and that it turns blue when water is added.

## Common mistakes

Candidates often confuse the colour of anhydrous and hydrated cobalt(II) chloride and copper(II) sulfate.

## Question 15

- 15 Which equation shows an oxidation reaction?

- A**  $C + O_2 \rightarrow CO_2$   
**B**  $CaCO_3 \rightarrow CaO + CO_2$   
**C**  $CaO + 2HCl \rightarrow CaCl_2 + H_2O$   
**D**  $N_2O_4 \rightarrow 2NO_2$

Candidate answer: A

Mark awarded = 1

## Examiner comment

Oxidation can be defined as the gain of oxygen. Only option A involves a species gaining oxygen.

## Common mistakes

Candidates often see unfamiliar reactions, like option D, and become concerned that they don't know the reaction. Applying the simple fact that oxygen is the gain of oxygen, allows option A to be selected.

## Question 16

- 16 Farmers spread calcium hydroxide on their fields to neutralise soils that are too acidic for crops to grow well.

Which ion neutralises the acid in the soil?

- A  $\text{Ca}^{2+}$       B  $\text{H}^+$       C  $\text{O}^{2-}$       D  $\text{OH}^-$

**Candidate answer: D**

**Mark awarded = 1**

## Examiner comment

A characteristic of aqueous solutions of acids is that they contain  $\text{H}^+$  ions. Aqueous solutions of alkalis contain  $\text{OH}^-$  ions and can neutralise acids. Therefore, the ion in calcium hydroxide that neutralises acid in soils is  $\text{OH}^-$ , option D.

## Common mistakes

If candidates don't read the question carefully, they see 'acid', recall that acids contain  $\text{H}^+$  ions and immediately select option B.

## Question 17

- 17 Four different solutions, J, K, L and M, are tested with universal indicator.

solution	J	K	L	M
colour with universal indicator	green	red	purple	orange

Which solutions are acidic?

- A J and M      B K and M      C K only      D L only

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

Most candidates recall that acidic solutions turn universal indicator red so solution K must be acidic. Therefore, only options B and C can be correct. Acids with a lower hydrogen ion concentration turn universal indicator orange so solution M must also be acidic. Option B must therefore be correct.

## Question 18

18 Period 3 of the Periodic Table is shown.

Na	Mg	Al	Si	P	S	Cl	Ar
----	----	----	----	---	---	----	----

What increases from Na to Ar across Period 3?

- A density
- B melting point
- C non-metallic character
- D the number of electron shells

**Candidate answer: C**

**Mark awarded = 1**

## Examiner comment

Many candidates recall that elements change from metallic to non-metallic character across a period and can therefore select option C.

## Common mistakes

If a candidate cannot recall the answer, a methodical approach may allow them to deduce the answer from facts they do know. Sodium is a metal whereas argon is a gas, so density cannot increase, therefore option A is incorrect. As argon is a gas it must have a lower melting point than sodium so option B is incorrect. The elements in a period all have the same number of electron shells so option D is incorrect.

## Question 19

19 Sodium and rubidium are elements in Group I of the Periodic Table.

Which statement is correct?

- A Sodium atoms have more electrons than rubidium atoms.
- B Sodium has a lower density than rubidium.
- C Sodium has a lower melting point than rubidium.
- D Sodium is more reactive than rubidium.

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

Checking the Periodic Table shows that option A is incorrect because sodium atoms have less electrons than rubidium atoms. Many candidates recall that reactivity increases down Group I so option D is incorrect. Melting point decreases down Group I so option C must also be incorrect.

## Common mistakes

If the trends in Group I cannot be recalled, this question could be challenging. However, most candidates know that reactivity increases down the group and checking the Periodic Table gives the numbers of electrons so options A and D can be eliminated. This allows candidates to focus on options B and C which gives a better chance of success when choosing the final answer.

## Question 20

20 Chlorine, bromine and iodine are elements in Group VII of the Periodic Table.

Which statement about these elements is correct?

- A The colour gets lighter down the group.
- B The density decreases down the group.
- C They are all gases at room temperature and pressure.
- D They are all non-metals.

**Candidate answer: D**

**Mark awarded = 1**

## Examiner comment

Most candidates recall that Group VII are all non-metals.

## Common mistakes

Chlorine is perhaps the best-known Group VII element and most candidates know that is a pale yellow-green gas. Many also know that iodine is a solid. These basic facts allow options A, B and C to be eliminated.

## Question 21

21 Which row describes the properties of a typical transition element?

	melting point	forms coloured compounds	can act as a catalyst
<b>A</b>	high	no	no
<b>B</b>	high	yes	yes
<b>C</b>	low	no	yes
<b>D</b>	low	yes	no

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

Transition elements have high melting points so options C and D must be incorrect. A key characteristic of transition elements is that they often act as catalysts so option B must be correct.

## Common mistakes

If the answer cannot be recalled, candidates should use all the columns in a table as they may be able to use one column to eliminate an option or even answer the question.



**Question 22**

22 Which statement about the noble gases is correct?

- A Noble gases are diatomic molecules.
- B Noble gases are reactive gases.
- C Noble gases have full outer electron shells.
- D The noble gases are found on the left-hand side of the Periodic Table.

**Candidate answer: C**

**Mark awarded = 1**

**Examiner comment**

Most candidates recall that noble gases have full outer electron shells which explains their lack of reactivity.

**Question 23**

23 What is a property of **all** metals?

- A conducts electricity
- B hard
- C low melting point
- D reacts with water

**Candidate answer: A**

**Mark awarded = 1**

**Examiner comment**

The question has **all** in bold which highlights its importance. Only option A is a characteristic of **all** metals.

**Common mistakes**

Candidates are often familiar with the characteristics of metals but forget that these are general characteristics and there are exceptions. Candidates should remember that mercury and Group I metals show exceptions to these general characteristics.

**Question 24**

24 Which statement explains why aluminium is used in the manufacture of aircraft?

- A It conducts heat well.
- B It has a low density.
- C It is a good insulator.
- D It is easy to recycle.

**Candidate answer: B**

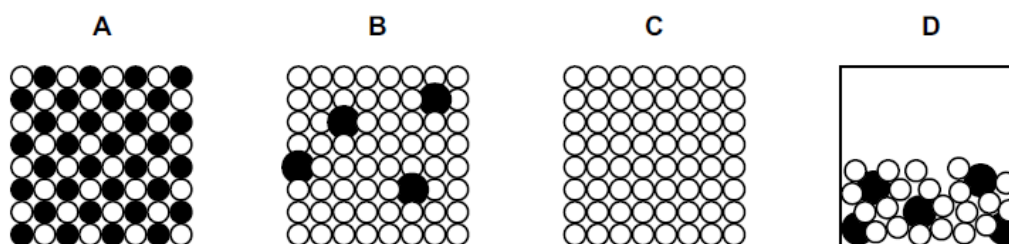
**Mark awarded = 1**

**Examiner comment**

Most candidates recall that aluminium has a low density which is why it is used in the manufacture of aircraft.

## Question 25

25 Which diagram represents a solid alloy?



Candidate answer: B

Mark awarded = 1

## Examiner comment

The regular arrangement of particles indicates that options A, B and C represent solids. The different sized atoms in option B show that the material is an alloy.

## Common mistakes

Some candidates realised that option D was an alloy but missed the fact that it was a liquid, not a solid.

## Question 26

26 Metals W, X, Y and Z are reacted with dilute hydrochloric acid.

The oxides of metals W, X, Y and Z are heated with carbon.

The results are shown.

reaction	W	X	Y	Z
metal + dilute hydrochloric acid	fizzing	fizzing	violent fizzing	no reaction
metal oxide + carbon and heat	no reaction	metal produced	no reaction	metal produced

What is the order of reactivity of the metals?

	most reactive	→			least reactive
A	Y	W	X	Z	
B	Y	X	W	Z	
C	Z	W	X	Y	
D	Z	X	W	Y	

Candidate answer: A

Mark awarded = 1

## Examiner comment

From the reactions of the metals with dilute hydrochloric acid, it is possible to determine the order as:

Y → \_ → \_ → Z.

Using the reactions of the metal oxides with carbon and heat, it is possible to determine that W is more reactive than X because the 'no reaction' shows that W is more reactive than carbon.

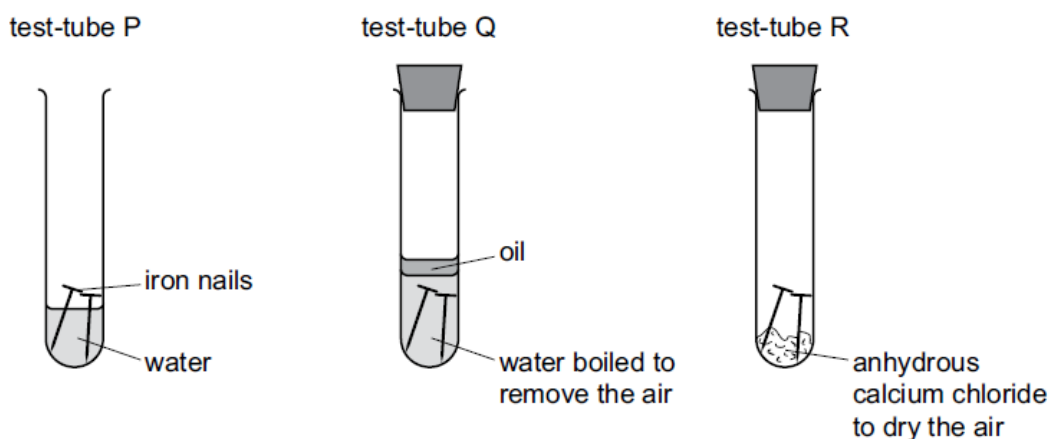
### Common mistakes

A common error is to reverse the order from least to most reactive and therefore select option D.

A common incorrect interpretation is that X is more reactive than W, as a reaction occurs. However, the observations show that X is below carbon in the reactivity series and W is above carbon. Therefore, W is more reactive than X.

### Question 27

27 The diagrams show experiments involving the rusting of iron.



A student predicted the following results.

- 1 In test-tube P, the iron nails rust.
- 2 In test-tube Q, the iron nails do not rust.
- 3 In test-tube R, the iron nails do not rust.

Which predictions are correct?

- 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

For rusting to occur, water and oxygen must be present. In test-tube P, both water and oxygen are present so the prediction is correct. In test-tube Q, only water is present because the oil prevents air (oxygen) coming into contact with the nail, therefore the prediction is correct. In test-tube R, only air (oxygen) is present as the anhydrous calcium chloride removes water from the air, therefore the prediction is correct. Option A is the correct answer as all three predictions are correct.

### Common mistakes

Some candidates can be confused by the large amount of information in the question. However, if they recall that rusting requires oxygen (air) and water, the correct answer can easily be determined.

### Question 28

28 Which statement about the extraction of iron in a blast furnace is correct?

- A Calcium oxide reacts with basic impurities.
- B Carbon is burnt to provide heat.
- C Iron(III) oxide is reduced to iron by carbon dioxide.
- D The raw materials are bauxite, limestone and coke.

**Candidate answer: B**

**Mark awarded = 1**

#### Examiner comment

The impurities in the blast furnace are acidic, not basic, so option A is incorrect. Option C is incorrect because carbon and carbon monoxide, not carbon dioxide, reduce the iron(III) oxide. The raw materials for the extraction of iron do not include bauxite so option D is incorrect.

#### Common mistakes

Many candidates recall that limestone and coke are needed to extract iron and therefore select option D. However, bauxite is used to extract aluminium, not iron.

### Question 29

29 Which process is used to convert calcium carbonate into calcium oxide?

- A electrolysis
- B fractional distillation
- C incomplete combustion
- D thermal decomposition

**Candidate answer: D**

**Mark awarded = 1**

#### Examiner comment

Most candidates recall that calcium carbonate thermally decomposes into calcium oxide as the reaction is an important part of iron extraction in the blast furnace.

### Question 30

30 Which substance is beneficial to aquatic life?

- A dissolved oxygen
- B phosphates
- C plastics
- D sewage

**Candidate answer: A**

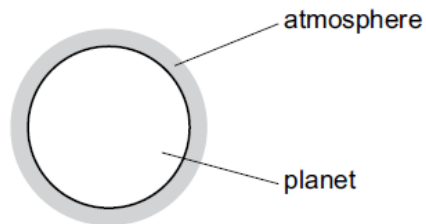
**Mark awarded = 1**

### Examiner comment

Options B, C and D are all common water pollutants and can therefore be harmful to aquatic life. Many aquatic organisms require dissolved oxygen for respiration.

### Question 31

31 A new planet has been discovered and its atmosphere has been analysed.



The table shows the composition of its atmosphere.

gas	percentage by volume
carbon dioxide	4
nitrogen	72
oxygen	24

Which gases are present in the atmosphere of the planet in a higher percentage than they are in the Earth's atmosphere?

- A carbon dioxide and oxygen
- B carbon dioxide only
- C nitrogen and oxygen
- D nitrogen only

**Candidate answer: A**

**Mark awarded = 1**

### Examiner comment

Candidates need to recall that the percentage of gases in the clean, dry air of the Earth's atmosphere are: 78% N<sub>2</sub>, 21% O<sub>2</sub> and the remainder as a mixture of noble gases and CO<sub>2</sub>. Applying these facts gives option A as the correct answer.

### Common mistakes

Some candidates interpret the question the wrong way around and select option D, nitrogen, as the only gas present at a lower concentration than the Earth's atmosphere.

### Question 32

32 Which statement is correct?

- A Atmospheric carbon dioxide is not a cause of climate change.
- B Atmospheric methane is produced by respiration.
- C Burning natural gas decreases the level of carbon dioxide in the atmosphere.
- D Decomposition of vegetation causes an increase in atmospheric methane.

**Candidate answer: D**

**Mark awarded = 1**

#### Examiner comment

Many candidates recall that the decomposition of vegetation causes an increase in atmospheric methane and therefore option D is correct. If the pertinent fact cannot be recalled, some incorrect options can be eliminated. Carbon dioxide is a well-known atmospheric pollutant so option A is incorrect. Carbon dioxide, not carbon monoxide, is produced by complete combustion so option B is incorrect. Burning natural gas increases, not decreases, the level of carbon dioxide in the atmosphere so option C is incorrect.

#### Common mistakes

Climate change is an area of confusion because the causes are extremely complex, it involves a multitude of gases and has terminology that is commonly used incorrectly.

### Question 33

33 A plastic combusts to form sulfur dioxide,  $\text{SO}_2$ , and hydrogen chloride,  $\text{HCl}$ .

How could both gases be removed from the air?

- A Pass the gases over solid anhydrous cobalt(II) chloride.
- B Pass the gases over solid damp calcium oxide.
- C Pass the gases through a catalytic converter.
- D Pass the gases through filter paper.

**Candidate answer: B**

**Mark awarded = 1**

#### Examiner comment

Sulfur dioxide and hydrogen chloride are both acidic and will therefore react with a base such as calcium oxide.

#### Common mistakes

Candidates often select option C because they are aware that catalytic converters reduce atmospheric pollutants. However, they will not remove these two pollutants.

## Question 34

34 Limestone fizzes and dissolves in dilute hydrochloric acid.

What is the word equation for this reaction?

- A calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide
- B calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide
- C calcium hydroxide + hydrochloric acid → calcium chloride + hydrogen
- D calcium oxide + hydrochloric acid → calcium chloride + water

**Candidate answer: B**

**Mark awarded = 1**

## Examiner comment

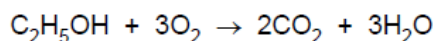
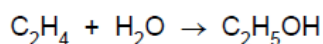
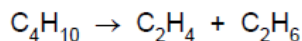
Limestone is mainly composed of calcium carbonate so only options A and B can be correct. When carbonates react with an acid, they form a salt, water and carbon dioxide so option B is correct.

## Common mistakes

Many candidates select option A because they recall that carbonates form a salt and carbon dioxide but forget about water.

## Question 35

35 Three equations involving organic compounds are shown.



How many different homologous series are shown in these equations?

- A 1
- B 2
- C 3
- D 4

**Candidate answer: C**

**Mark awarded = 1**

## Examiner comment

Candidates need to recall the general formulae of the homologous series and deduce that  $\text{C}_2\text{H}_6$  and  $\text{C}_4\text{H}_{10}$  are alkanes,  $\text{C}_2\text{H}_4$  is an alkene and  $\text{C}_2\text{H}_5\text{OH}$  is an alcohol. Therefore, there are three homologous series, option C.

## Common mistakes

Some candidates select option D, thinking that  $\text{CO}_2$  must be part of a homologous series because it contains carbon.

## Question 36

36 Petroleum is a mixture of different hydrocarbons.

Which process is used to separate the petroleum into groups of similar hydrocarbons?

- A combustion
- B cracking
- C fractional distillation
- D reduction

**Candidate answer: C**

**Mark awarded = 1**

## Examiner comment

Most candidates recall that petroleum is separated into fractions using fractional distillation.

## Common mistakes

Some candidates select option B because they recall a link between cracking and hydrocarbons. Cracking is used to make useful hydrocarbons, not to separate petroleum.

## Question 37

37 Ethene is a hydrocarbon.

Which row shows the type of covalent bond between the carbon atoms in ethene and the effect of ethene on aqueous bromine?

	type of covalent bond	effect of ethene on aqueous bromine
A	single bond	colour changes from brown to colourless
B	single bond	colour changes from colourless to brown
C	double bond	colour changes from brown to colourless
D	double bond	colour changes from colourless to brown

**Candidate answer: C**

**Mark awarded = 1**

## Examiner comment

Candidates have to recall that ethene is an alkene and therefore it contains a carbon–carbon double bond. All alkenes are unsaturated hydrocarbons, so it turns aqueous bromine from brown to colourless.

## Common mistakes

Some candidates confuse alkanes with alkenes. Organic compounds ending in -ane are alkanes and those ending in -ene are alkenes.



## Question 38

38 Which statements about ethanoic acid are correct?

- 1 It turns universal indicator purple.
- 2 It reacts with magnesium to form hydrogen gas.
- 3 It reacts with calcium carbonate to form carbon dioxide gas.
- 4 It decolourises aqueous bromine.

A 1, 2 and 3    B 1 and 2 only    C 2, 3 and 4    D 2 and 3 only

**Candidate answer: D**

**Mark awarded = 1**

## Examiner comment

Ethanoic acid is a weak acid so statement 1 must be incorrect as it would turn universal indicator orange. Therefore, only options C and D can be correct. As it is an acid, ethanoic acid would react with magnesium to form hydrogen gas so statement 2 is correct. An acid would react with a carbonate to form carbon dioxide gas so statement 3 is correct. Ethanoic acid will not react with aqueous bromine as it does not contain a carbon–carbon double bond so statement 4 is incorrect. Therefore, option D is correct.

## Common mistakes

Many candidates determine that statements 2 and 3 are correct but are uncertain if ethanoic acid will decolorise aqueous bromine. Only the reaction with the carbon–carbon double bond in alkenes will decolorise aqueous bromine.

## Question 39

39 Five steps in an acid–base titration are shown.

- 1 Slowly add the acid from a burette into a conical flask until the indicator becomes colourless.
- 2 Add thymolphthalein.
- 3 Use a volumetric pipette to add a fixed volume of alkali to a conical flask.
- 4 Read and record the initial volume of acid in the burette.
- 5 Read and record the final volume of acid in the burette.

What is the correct order of these steps to complete an acid–base titration?

- A 2 → 4 → 1 → 5 → 3  
 B 3 → 2 → 4 → 1 → 5  
 C 3 → 4 → 1 → 5 → 2  
 D 4 → 3 → 1 → 2 → 5

**Candidate answer: B**

**Mark awarded = 1**

**Examiner comment**

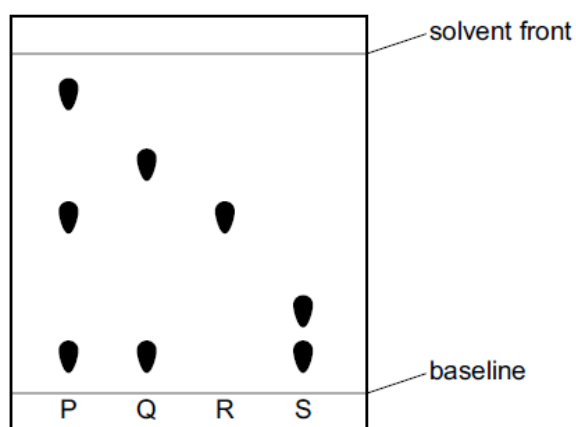
Candidates that have performed titrations will be able to apply this experience to determine that option B lists the correct order of steps for an acid-base titration.

**Common mistakes**

Some candidates realise that the last step must be number 5, to record the final volume, and therefore only options B and D can be correct. Option D must be incorrect because the indicator, thymolphthalein, is added after step 1.

**Question 40**

40 The chromatogram obtained from four mixtures of dyes, P, Q, R and S, is shown.



What is the total number of different dyes identified in the four mixtures?

- A 3                      B 4                      C 5                      D 8

**Candidate answer: C**

**Mark awarded = 1**

**Examiner comment**

Candidates that have performed chromatography will be able to apply this experience to determine that option C is correct. Mixture P has 3 different spots which means it contains three different dyes. Mixture Q has two different spots but one of these is common with mixture P so it only adds one dye to the total. Mixture R has one spot but it is common with P so it doesn't add any dyes to the total. Mixture S has two spots, one of which is common with P and Q, so it adds one dye to the total. Therefore, there are a total of 5 different dyes (spots).

**Common mistakes**

Some candidates select option D by simply adding up the total number of spots. However, this does not take into account the fact that mixtures P, Q and S each contain some of the same dyes.

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