



# Cambridge IGCSE™

## CHEMISTRY

Paper 1 Multiple Choice (Core)

0620/11

May/June 2021

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

## INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

## INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.



1 Which row describes the arrangement and movement of particles in a liquid?

	arrangement of particles	movement of particles
<b>A</b>	touching and regular	vibrating
<b>B</b>	touching and random	moving around each other
<b>C</b>	touching and regular	moving around each other
<b>D</b>	touching and random	moving very fast

#### Answer

To describe the arrangement and movement of particles in a liquid, let's analyze the options:

A: Touching and regular; vibrating:

This describes a solid more than a liquid. In solids, particles are closely packed in a regular arrangement and primarily vibrate in place.

B: Touching and random; moving around each other:

Correct. In a liquid, particles are closely packed (touching) but arranged randomly. They have the freedom to move around each other, allowing liquids to flow.

C: Touching and regular; moving around each other:

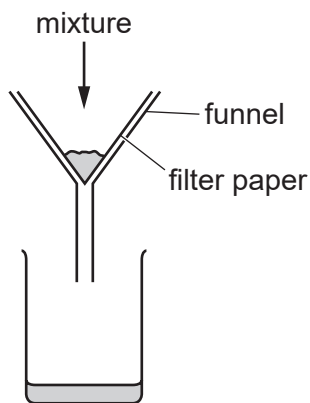
This combination is not typical for liquids. Regular arrangements are characteristic of solids, not liquids.

D: Touching and random; moving very fast:

While particles in a liquid are touching and random, the description "moving very fast" is more characteristic of gases, where particles move quickly and are spaced far apart.

**Therefore, the correct description for the arrangement and movement of particles in a liquid is B: Touching and random; moving around each other.**

- 2 A mixture is separated using the apparatus shown.



What is the mixture?

- A aqueous copper(II) sulfate and aqueous sodium chloride
- B aqueous copper(II) sulfate and copper
- C copper and sulfur
- D ethanol and ethanoic acid

Answer

The apparatus shown is a filtration setup, which separates a solid from a liquid.

Let's evaluate the options:

A. Aqueous copper(II) sulfate and aqueous sodium chloride: Both are solutions, so they won't be separated by filtration.

B. Aqueous copper(II) sulfate and copper: Copper is a solid that can be separated by filtration from the liquid copper(II) sulfate solution.

C. Copper and sulfur: Both are solids, and filtration isn't used to separate solids from solids.

D. Ethanol and ethanoic acid: Both are liquids, and filtration won't separate them.

**The correct answer is B: Aqueous copper(II) sulfate and copper.**

3 Which statement about paper chromatography is correct?

- A A solvent is needed to dissolve the paper.
- B Paper chromatography separates mixtures of solvents.
- C The solvent should cover the baseline.
- D The baseline should be drawn in pencil.

Answer

Let's evaluate each statement about polymers to determine which is correct:

A. All synthetic polymers rapidly break down in landfill sites.

This statement is incorrect. Most synthetic polymers are not biodegradable and do not rapidly break down in landfill sites. They can persist in the environment for many years.

B. Nylon is a natural polymer.

This statement is incorrect. Nylon is a synthetic polymer, not a natural one. It is man-made through chemical processes and does not occur naturally.

C. Proteins are non-biodegradable natural polymers.

This statement is incorrect. Proteins are natural polymers made of amino acids, and they are biodegradable. They can be broken down by biological processes in the environment.

D. Synthetic polymers are harmful to marine life.

This statement is correct. Synthetic polymers, such as plastics, can be harmful to marine life. They can cause physical harm when ingested by marine animals and can also release toxic substances as they break down.

**Therefore, the correct answer is D. Synthetic polymers are harmful to marine life. This statement accurately reflects the environmental impact of synthetic polymers on marine ecosystems.**

4 Element X has 7 protons.

Element Y has 8 more protons than X.

Which statement about element Y is correct?

- A Y has more electron shells than X.
- B Y has more electrons in its outer shell than X.
- C Y is in a different group of the Periodic Table from X.
- D Y is in the same period of the Periodic Table as X.

Answer

To determine which statement about element Y is correct, let's first identify elements X and Y based on their proton numbers:

Element X has 7 protons: This means element X is nitrogen (N), which is in Group 15 and Period 2 of the Periodic Table.

Element Y has 8 more protons than X: So, element Y has  $7+8=15$  protons. This means element Y is phosphorus (P), which is in Group 15 and Period 3 of the Periodic Table.

Now, let's evaluate each statement:

Option A: Y has more electron shells than X.

This is correct. Phosphorus (Y) is in Period 3, while nitrogen (X) is in Period 2, indicating that phosphorus has more electron shells.

Option B: Y has more electrons in its outer shell than X.

This is incorrect. Both nitrogen and phosphorus are in Group 15, meaning they both have the same number of valence electrons (5) in their outer shell.

Option C: Y is in a different group of the Periodic Table from X.

This is incorrect. Both nitrogen and phosphorus are in Group 15 of the Periodic Table.

Option D: Y is in the same period of the Periodic Table as X.

This is incorrect. Nitrogen is in Period 2, while phosphorus is in Period 3.

**Based on this analysis, the correct answer is Option A: Y has more electron shells than X.**

5 A covalent molecule Q contains only six shared electrons.

What is Q?

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

Answer

To determine which covalent molecule contains only six shared electrons, let's analyze each option:

A: Ammonia ( $\text{NH}_3$ ):

Ammonia consists of one nitrogen atom bonded to three hydrogen atoms. Each N-H bond shares two electrons, so there are a total of  $3 \times 2 = 6$  shared electrons.

B: Chlorine ( $\text{Cl}_2$ ):

A chlorine molecule consists of two chlorine atoms sharing a single pair of electrons, so it has only 2 shared electrons.

C: Methane ( $\text{CH}_4$ ):

Methane consists of one carbon atom bonded to four hydrogen atoms. Each C-H bond shares two electrons, so there are  $4 \times 2 = 8$  shared electrons.

D: Water ( $\text{H}_2\text{O}$ ):

Water consists of one oxygen atom bonded to two hydrogen atoms. Each O-H bond shares two electrons, so there are  $2 \times 2 = 4$  shared electrons.

Therefore, the covalent molecule that contains only six shared electrons is A: ammonia ( $\text{NH}_3$ ).

6 Which row describes how an ionic bond forms between a sodium atom and a chlorine atom?

	sodium atom	chlorine atom
<b>A</b>	two electrons are lost	two electrons are gained
<b>B</b>	one electron is gained	one electron is lost
<b>C</b>	two electrons are gained	two electrons are lost
<b>D</b>	one electron is lost	one electron is gained

**Answer**

To determine how an ionic bond forms between a sodium atom and a chlorine atom, let's consider the process:

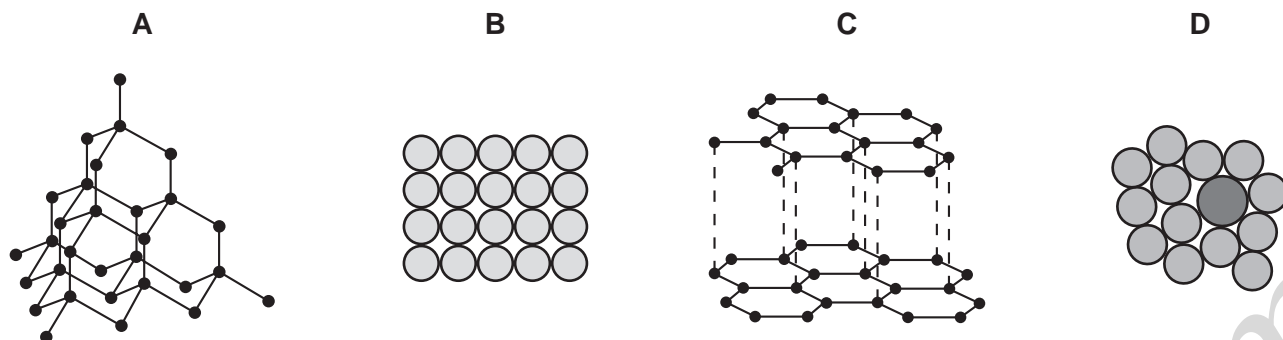
A sodium atom (Na) has one electron in its outer shell. To achieve a stable electron configuration, it tends to lose this one electron, forming a positively charged sodium ion ( $\text{Na}^+$ ).

A chlorine atom (Cl) has seven electrons in its outer shell and needs one more electron to complete its octet and become stable. It tends to gain one electron, forming a negatively charged chloride ion ( $\text{Cl}^-$ ).

When sodium loses one electron and chlorine gains one electron, an ionic bond forms between the oppositely charged ions ( $\text{Na}^+$  and  $\text{Cl}^-$ ), resulting in the formation of sodium chloride ( $\text{NaCl}$ ). Based on this process, the correct description is:

**D. Sodium atom: one electron is lost; Chlorine atom: one electron is gained.**  
This accurately describes the transfer of electrons during the formation of an ionic bond between sodium and chlorine.

7 Which diagram shows the structure of an alloy?



#### Answer

An alloy consists of a mixture of two or more elements, usually metals, that have been melted and fused together, forming a uniform structure with atoms of different types.

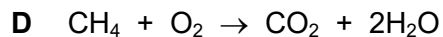
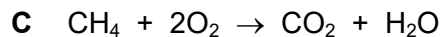
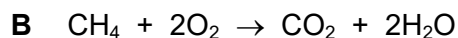
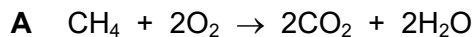
Diagram D shows a structure with different types of atoms (shown as different shades), indicating a mixed arrangement typical of alloys, where foreign atoms are incorporated into the metallic lattice.

Therefore, the correct answer is D.



8 Methane burns in oxygen to produce carbon dioxide and water.

What is the balanced equation for this reaction?



Answer

To find the balanced equation for the combustion of methane in oxygen, let's go through the stoichiometry of the reaction:

Combustion Reaction:

Methane ( $\text{CH}_4$ ) burns in oxygen ( $\text{O}_2$ ) to produce carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ).

To balance the chemical equation, ensure that the number of atoms of each element is the same on both sides of the equation:

Carbon Atoms:

Methane has 1 carbon atom, and the product side should also have 1 carbon atom. This is satisfied by having 1 molecule of  $\text{CO}_2$ .

Hydrogen Atoms:

Methane has 4 hydrogen atoms, so we need 2 molecules of water to provide 4 hydrogen atoms on the product side.

Oxygen Atoms:

On the product side, there are 2 oxygen atoms in  $\text{CO}_2$  and 2 oxygen atoms in 2 molecules of  $\text{H}_2\text{O}$ , making a total of 4 oxygen atoms. Therefore, we need 2 molecules of  $\text{O}_2$  to provide 4 oxygen atoms.

**The balanced equation is:**

**Option B:  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$**

This equation correctly balances all the atoms on both sides of the reaction.

9 What is the relative formula mass of magnesium nitrate,  $\text{Mg}(\text{NO}_3)_2$ ?

A 74

B 86

C 134

D 148

Answer

To determine the relative formula mass of magnesium nitrate,  $\text{Mg}(\text{NO}_3)_2$ , we need to calculate the mass based on the atomic masses of each element in the compound:

Magnesium (Mg):

Atomic mass = 24

Nitrogen (N):

Atomic mass = 14

There are 2 nitrogen atoms in  $\text{Mg}(\text{NO}_3)_2$ , so total mass for nitrogen =  $2 \times 14 = 28$

Oxygen (O):

Atomic mass = 16

There are 6 oxygen atoms (since each nitrate group,  $\text{NO}_3$ , has 3 oxygen atoms and there are 2 nitrate groups), so total mass for oxygen =  $6 \times 16 = 96$

Now, add these together to find the relative formula mass of magnesium nitrate:

Total mass = 24 (Mg) + 28 (N) + 96 (O) = 148

Therefore, the relative formula mass of magnesium nitrate,  $\text{Mg}(\text{NO}_3)_2$ , is D: 148.

- 10 In separate experiments, electricity was passed through concentrated aqueous sodium chloride and molten lead(II) bromide.

What would happen in **both** experiments?

- A A halogen would be formed at the anode.
- B A metal would be formed at the cathode.
- C Hydrogen would be formed at the anode.
- D Hydrogen would be formed at the cathode.

Answer

To determine what would happen in both experiments, let's analyze the electrolysis of concentrated aqueous sodium chloride and molten lead(II) bromide:

Concentrated Aqueous Sodium Chloride (NaCl):

At the anode: Chloride ions ( $\text{Cl}^-$ ) are oxidized to form chlorine gas ( $\text{Cl}_2$ ), a halogen.

At the cathode: Hydrogen ions ( $\text{H}^+$ ) from water are reduced to form hydrogen gas ( $\text{H}_2$ ).

Molten Lead(II) Bromide ( $\text{PbBr}_2$ ):

At the anode: Bromide ions ( $\text{Br}^-$ ) are oxidized to form bromine gas ( $\text{Br}_2$ ), a halogen.

At the cathode: Lead ions ( $\text{Pb}^{2+}$ ) are reduced to form lead metal (Pb).

Based on this analysis:

A. A halogen would be formed at the anode. This is correct, as both chlorine and bromine, which are halogens, form at the anode in the respective electrolysis experiments.

B. A metal would be formed at the cathode. This is correct for molten lead(II) bromide, where lead metal forms at the cathode, but not for aqueous sodium chloride.

C. Hydrogen would be formed at the anode. This is incorrect, as hydrogen forms at the cathode, not the anode.

D. Hydrogen would be formed at the cathode. This is correct for aqueous sodium chloride, but not for molten lead(II) bromide.

**Therefore, the correct answer is A. A halogen would be formed at the anode. This occurs in both experiments, as chlorine and bromine are formed at the anode during electrolysis.**