



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY

0620/11

Paper 1 Multiple Choice (Core)

May/June 2017

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

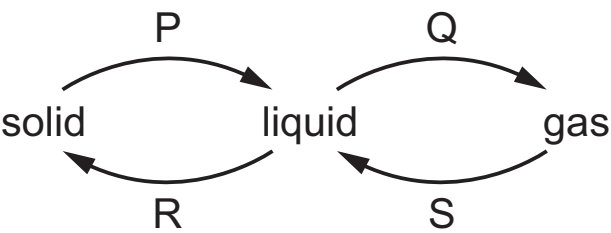
Electronic calculators may be used.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level1/Level 2 Certificate.

This document consists of **14** printed pages and **2** blank pages.



1 The diagram shows some changes of state.



Which words describe the changes of state, P, Q, R and S?

	P	Q	R	S
A	freezing	boiling	melting	evaporation
B	melting	evaporation	freezing	condensation
C	melting	sublimation	freezing	evaporation
D	sublimation	evaporation	melting	condensation

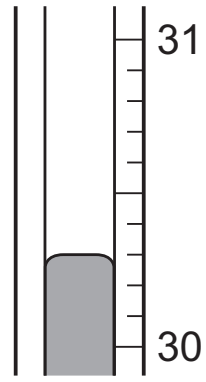
Answer

To identify the processes P, Q, R, and S, we analyze each state change:

- P (Solid to Liquid): This is melting.
- Q (Liquid to Gas): This is evaporation.
- R (Liquid to Solid): This is freezing.
- S (Gas to Liquid): This is condensation.

The correct answer is B: Melting, Evaporation, Freezing, Condensation.

2 The diagram shows part of a thermometer.



What is the reading on the thermometer?

- A** 30.2 **B** 30.3 **C** 31.7 **D** 31.8

Answer

Upon closely analyzing the thermometer diagram, we can see the marking on the thermometer where the liquid level is positioned. The thermometer has markings between 30 and 31, and each small division represents an increment of 0.1 degrees. Upon inspection, the liquid in the thermometer is slightly above the third division mark past 30, which corresponds to 30.3.

Therefore, the correct reading on the thermometer is B: 30.3.

- 3 Pure water has a boiling point of 100°C and a freezing point of 0°C .

What is the boiling point and freezing point of a sample of aqueous sodium chloride?

	boiling point/ $^{\circ}\text{C}$	freezing point/ $^{\circ}\text{C}$
A	98	-2
B	98	2
C	102	-2
D	102	2

Answer

To determine the boiling point and freezing point of an aqueous sodium chloride solution, we need to understand how solutes like sodium chloride affect these points in water.

Boiling Point Elevation:

The boiling point of a solution is higher than that of the pure solvent due to the presence of a solute. This phenomenon is known as boiling point elevation. Sodium chloride, when dissolved in water, will cause the boiling point to increase.

Therefore, the boiling point of the solution will be higher than 100°C .

Freezing Point Depression:

Conversely, the freezing point of a solution is lower than that of the pure solvent. This is known as freezing point depression. Sodium chloride in water will cause the freezing point to decrease.

Therefore, the freezing point of the solution will be lower than 0°C .

Now, let's examine each option:

Option A:

Boiling point: 98°C - This is lower than pure water's boiling point.

Freezing point: -2°C - This is lower than pure water's freezing point.

Option B:

Boiling point: 98°C - This is lower than pure water's boiling point.

Freezing point: 2°C - This is higher than pure water's freezing point.

Option C:

Boiling point: 102°C - This is higher than pure water's boiling point.

Freezing point: -2°C - This is lower than pure water's freezing point.

Option D:

Boiling point: 102°C - This is higher than pure water's boiling point.

Freezing point: 2°C - This is higher than pure water's freezing point.

Based on the principles of boiling point elevation and freezing point depression, the correct choice is Option C:

Boiling point is increased to 102°C .

Freezing point is decreased to -2°C .

- 4 Pure copper(II) sulfate crystals can be made by adding copper(II) oxide to hot dilute sulfuric acid.

The copper(II) oxide is added until it1..... .

The solution is2..... and then3..... to obtain the pure crystals.

Which words complete gaps 1, 2 and 3?

	1	2	3
A	is in excess	cooled	filtered
B	is in excess	filtered	cooled
C	changes colour	cooled	filtered
D	changes colour	filtered	cooled

Answer

Let's reevaluate the process of making pure copper(II) sulfate crystals to see why Option B might be considered correct:

Addition of Copper(II) Oxide:

Copper(II) oxide is added until it is in excess, ensuring all sulfuric acid reacts.

The Solution is Filtered:

After the reaction, filtering is necessary to remove the excess unreacted copper(II) oxide. This step separates the solid impurities from the copper(II) sulfate solution.

The Solution is Cooled:

Once the solution is free of solid impurities, it is cooled to allow the copper(II) sulfate to crystallize.

Given this sequence, Option B makes sense:

- 1: "is in excess" (Copper(II) oxide is added until it is in excess)
- 2: "filtered" (The solution is filtered to remove excess solid)
- 3: "cooled" (The solution is cooled to crystallize the copper(II) sulfate)

Therefore, the correct choice is indeed Option B.

5 Which part of an atom has a relative mass of 1 and a relative charge of 0?

- A electron
- B neutron
- C nucleus
- D proton

Answer

To determine which part of an atom has a relative mass of 1 and a relative charge of 0, let's examine each option:

Electron:

Relative Mass: Approximately $1/1836$ (very small compared to protons and neutrons).

Relative Charge: -1 .

Conclusion: Does not fit the criteria.

Neutron:

Relative Mass: 1.

Relative Charge: 0.

Conclusion: Fits the criteria of having a relative mass of 1 and a relative charge of 0.

Nucleus:

The nucleus is not a single particle but a collection of protons and neutrons. While it contains particles with a relative mass of 1 (protons and neutrons), it does not have a relative charge of 0 as a whole because it also contains protons (which are positively charged).

Conclusion: Does not fit the criteria as a single part of an atom.

Proton:

Relative Mass: 1.

Relative Charge: $+1$.

Conclusion: Does not fit the criteria of having a relative charge of 0.

Based on this analysis, the correct answer is B: Neutron, as it has a relative mass of 1 and a relative charge of 0.

6 Which molecule contains exactly two single covalent bonds?

A Cl_2

B CH_4

C H_2O

D HCl

Answer

To determine which molecule contains exactly two single covalent bonds, let's analyze each option:

Cl_2 :

This molecule consists of two chlorine atoms bonded together by a single covalent bond.
Conclusion: Contains one single covalent bond.

CH_4 (Methane):

This molecule consists of one carbon atom bonded to four hydrogen atoms, resulting in four single covalent bonds.
Conclusion: Contains four single covalent bonds.

H_2O (Water):

This molecule consists of one oxygen atom bonded to two hydrogen atoms, resulting in two single covalent bonds.
Conclusion: Contains exactly two single covalent bonds.

HCl (Hydrochloric acid):

This molecule consists of one hydrogen atom bonded to one chlorine atom by a single covalent bond.
Conclusion: Contains one single covalent bond.

Based on this analysis, the correct answer is C: H_2O , as it contains exactly two single covalent bonds.

7 Sodium reacts with chlorine to form sodium chloride.

Which statements describe what happens to the sodium atoms in this reaction?

- 1 Sodium atoms form positive ions.
- 2 Sodium atoms form negative ions.
- 3 Sodium atoms gain electrons.
- 4 Sodium atoms lose electrons.

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

Answer

To determine what happens to sodium atoms when they react with chlorine to form sodium chloride, let's analyze the behavior of sodium in this reaction:

Sodium Atoms Form Positive Ions:

Sodium atoms lose one electron to achieve a stable electron configuration, forming Na^+ ions.

Conclusion: This statement is correct.

Sodium Atoms Form Negative Ions:

Sodium atoms do not gain electrons; they lose electrons, so they do not form negative ions.

Conclusion: This statement is incorrect.

Sodium Atoms Gain Electrons:

Sodium atoms lose electrons to form positive ions, not gain them.

Conclusion: This statement is incorrect.

Sodium Atoms Lose Electrons:

Sodium atoms lose one electron to form a positive ion.

Conclusion: This statement is correct.

Based on this analysis, the correct answer is B: 1 and 4.

8 Diamond is extremely hard and does not conduct electricity.

Which statement explains these properties?

- A It has a lattice of positive carbon ions in a 'sea of electrons'.
- B It has delocalised electrons and each carbon atom forms three covalent bonds with other carbon atoms.
- C It has no delocalised electrons and each carbon atom forms four covalent bonds with other carbon atoms.
- D It has strong ionic bonds between each carbon atom.

Answer

To explain the properties of diamond, we need to consider its structure:

Diamond's Hardness:

Diamond is extremely hard due to its strong covalent bonding and rigid tetrahedral structure. Each carbon atom is bonded to four other carbon atoms, forming a very strong and interlocking lattice.

Electrical Conductivity:

Diamond does not conduct electricity because it has no free or delocalized electrons. All electrons are involved in bonding.

Now, let's evaluate each option:

Option A:

"It has a lattice of positive carbon ions in a 'sea of electrons'."

This is a description more typical of metallic bonding, not covalent bonding as in diamond.

Conclusion: Incorrect.

Option B:

"It has delocalised electrons and each carbon atom forms three covalent bonds with other carbon atoms."

This description fits graphite, not diamond. Graphite has delocalized electrons and three covalent bonds per carbon atom.

Conclusion: Incorrect.

Option C:

"It has no delocalised electrons and each carbon atom forms four covalent bonds with other carbon atoms."

This description accurately reflects the structure of diamond: a strong covalent network with no free electrons.

Conclusion: Correct.

Option D:

"It has strong ionic bonds between each carbon atom."

Diamond consists of covalent, not ionic, bonds.

Conclusion: Incorrect.

Based on this analysis, the correct answer is C: It has no delocalised electrons and each carbon atom forms four covalent bonds with other carbon atoms.

9 What is the relative formula mass of ammonium nitrate, NH_4NO_3 ?

A 80

B 108

C 122

D 150

Answer

To calculate the relative formula mass of ammonium nitrate (NH_4NO_3), we need to add up the atomic masses of all the atoms in the molecule.

Atomic Masses:

Nitrogen (N): 14

Hydrogen (H): 1

Oxygen (O): 16

Composition of Ammonium Nitrate (NH_4NO_3):

NH_4 : 1 nitrogen and 4 hydrogen atoms

NO_3 : 1 nitrogen and 3 oxygen atoms

Calculation:

Total for NH_4 :

$$(1 \times 14) + (4 \times 1) = 14 + 4 = 18$$

Total for NO_3 :

$$(1 \times 14) + (3 \times 16) = 14 + 48 = 62$$

Total relative formula mass of NH_4NO_3 :

$$18 + 62 = 80$$

Based on this calculation, the correct answer is A: 80.

10 Concentrated aqueous sodium chloride is electrolysed.

What is the main product formed at the positive electrode (anode)?

- A** chlorine
- B** hydrogen
- C** oxygen
- D** sodium

Answer

When concentrated aqueous sodium chloride (brine) is electrolyzed, different products are formed at the electrodes:

At the Positive Electrode (Anode):

The anode is where oxidation occurs. In the electrolysis of brine, chloride ions (Cl^-) are oxidized to form chlorine gas (Cl_2).

At the Negative Electrode (Cathode):

The cathode is where reduction occurs, and typically hydrogen ions (H^+) are reduced to form hydrogen gas (H_2).

Now, let's evaluate the options:

A: Chlorine

Chlorine gas is the main product formed at the anode.

Conclusion: Correct.

B: Hydrogen

Hydrogen gas is typically formed at the cathode, not the anode.

Conclusion: Incorrect.

C: Oxygen

Oxygen is not typically produced in the electrolysis of concentrated sodium chloride solution.

Conclusion: Incorrect.

D: Sodium

Sodium metal is not formed in this aqueous electrolysis process.

Conclusion: Incorrect.

Based on this analysis, the correct answer is A: Chlorine.