

YEAR 11 CHEMISTRY

Written examination 1

STUDENT NAME:

QUESTION AND ANSWER BOOK

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	6	6	47
			Total 67

- Students are permitted to bring the following items into the examination: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring sheets of paper or white out liquid/tape into the examination.

Materials provided

- The question and answer book of 13 pages, with a removable data sheet.
- An answer sheet for multiple-choice questions.

Instructions

- Remove the data sheet from this book during reading time.
- Write your **name** in the box provided.
- You must answer the questions in English.

At the end of the examination

- Place the multiple-choice answer sheet inside the front cover of this question and answer book.

Students are NOT permitted to bring mobile phones or any other electronic devices into the examination.

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SECTION A – Multiple-choice questions**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for the multiple-choice questions. Choose the response that is **correct** or that **best answers** the questions.

1 mark will be awarded for a correct answer; no marks will be awarded for an incorrect answer.

Marks are **not** deducted for incorrect answers

No marks will be awarded if more than one answer is complete for any question.

Question 1

An ion that contains 8 protons, 9 neutrons and 10 electrons will have a mass number and charge corresponding to

	Mass number	Charge
A.	9	-2
B.	9	+2
C.	17	-2
D.	17	+2

Question 2

The ground state electronic configuration for ${}_{16}\text{S}^{2-}$ is

- A. $1s^2 2s^2 2p^6 3s^2 3p^4 4s^2$
- B. $1s^2 2s^2 2p^6 3s^2 3p^2$
- C. $1s^2 2s^2 2p^6 3s^2 3p^4$
- D. $1s^2 2s^2 2p^6 3s^2 3p^6$

Question 3

The characteristic that is used as a basis for placing elements into **periods** on the Periodic Table is

- A. atomic number
- B. mass number
- C. number of electrons in the outer shell
- D. number of occupied electron shells

Question 4

The 3d subshell has

- A. 3 orbitals and can hold up to 6 electrons
- B. 5 orbitals and can hold up to 10 electrons
- C. 3 orbitals and can hold up to 9 electrons
- D. 5 orbitals and can hold up to 15 electrons

Question 5

The element that is chemically most similar to the element with atomic number 17 is

- A. S
- B. Ar
- C. Br
- D. P

Question 6

The total number of atoms in 5.00 g of propane (C_3H_8) is

- A. 0.114
- B. 6.84×10^{22}
- C. 1.25
- D. 7.53×10^{23}

Question 7

Ammonium sulfate, $(NH_4)_2SO_4$, is often used as a source of soluble nitrogen for plants. The mass of nitrogen in 300 kg of ammonium sulfate, in kilograms, is

- A. 10.6
- B. 21.2
- C. 38.8
- D. 63.6

Question 8

The mass of one molecule of water (H_2O), in grams, is

- A. $\frac{18.0}{6.02 \times 10^{23}}$
- B. 18.0
- C. $\frac{6.02 \times 10^{23}}{18.0}$
- D. $6.02 \times 10^{23} \times 18.0$

Question 9

16.0 g of nitrogen is converted completely into an oxide of nitrogen. The mass of the oxide formed is 52.6 g.

The empirical formula of the oxide would be

- A. NO
- B. NO₂
- C. NO₃
- D. N₂O₅

Question 10

Which of the following lists contains only empirical formulas?

- A. HCl, C₂H₆, CO₂, NaNO₃
- B. AlCl₃, CH₄, CO, C₆H₁₂O₆
- C. CH₃COOH, NaCl, MgNO₃, H₂O
- D. MgCl₂, C₃H₈, SO₃, Cu₂O

Question 11

Which of the following substances **does not** contain charged particles arranged in a lattice structure when in solid form?

- A. diamond
- B. potassium chloride
- C. iron
- D. sodium nitrate

Question 12

The correct formula of aluminium oxide is

- A. AlO
- B. AlO₃
- C. Al₂O₃
- D. Al₃O₂

Question 13

Which of the following models of bonding contains both cations and anions?

- A. metallic lattices
- B. ionic lattices
- C. covalent molecules
- D. covalent layer lattices

Question 14

Atom X has 6 electrons in its outer shell. Atom Y has 7 electrons in its outer shell. When they react, the type of bonding involved and the most likely formula for the compound is

	Bonding type	Formula
A.	ionic	X_2Y
B.	ionic	XY_2
C.	covalent	X_2Y
D.	covalent	XY_2

Question 15

Polyethene is an addition polymer that can exist in both high-density and low-density forms. Compared to the low-density form, the high-density form is

- A.** highly branched with a high melting temperature.
- B.** highly branched with a low melting temperature.
- C.** unbranched with a high melting temperature.
- D.** unbranched with a low melting temperature.

Question 16

The name of a molecule with the formula C_4H_8 could be

- A.** 1-butene
- B.** butane
- C.** 1-propene
- D.** propane

Question 17

Which of the following groups only contains molecules that have a linear shape?

- A.** HCl , H_2O , N_2
- B.** NH_3 , O_2 , CO_2
- C.** CO_2 , H_2 , HF
- D.** HCl , HF , CH_4

Question 18

A new material has been discovered. Experimental tests determine that it has a melting temperature of $750^\circ C$, can conduct electricity when molten and is brittle when hit with a hammer. The strongest bonding type present in the material is most likely to be

- A.** ionic
- B.** covalent
- C.** metallic
- D.** hydrogen

SECTION A – continued
TURN OVER

Question 19

Which of the following groups contains only polar molecules?

- A. HCl, H₂O, N₂, CO₂
- B. H₂O, CO₂, NH₃, HF
- C. HF, H₂O, NH₃, CH₄
- D. HCl, HF, H₂O, NH₃

Question 20

Particles at the surface of a material often behave very differently to the particles that are part of the bulk of the material. The best explanation of this is that particles at the surface of a material

- A. react with water in the atmosphere, which changes their properties.
- B. do not bond to as many surrounding particles as those in the bulk of the material.
- C. bond more strongly to their surrounding particles than those in the bulk of the material.
- D. can break away easily from their surrounding materials.

END OF SECTION A

SECTION B – Short-answer questions**Instructions for Section B**

Answer **all** questions in the spaces provided.

To obtain **full marks** for your responses you should

- give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks.
- show all working in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of working.
- make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example, H₂(g); NaCl(s)

Question 1

a. The current model of the atom has developed historically through the contributions of a number of individuals.

i. Give the name of one individual who has contributed to the historical development of the model of the atom.

ii. Describe the contribution made by this individual.

1 + 1 = 2 marks

b. Argon has three naturally occurring isotopes. Their relative abundances and masses are shown in the table below.

	Relative isotopic mass	Percentage abundance
³⁶ Ar	35.968	0.3365
³⁸ Ar	37.963	0.0632
⁴⁰ Ar	39.962	99.6003

i. What is the name of the instrument that is commonly used to experimentally obtain abundance and relative isotopic mass data?

SECTION B – continued
TURN OVER

- ii. Using the information in the table, determine the relative atomic mass of argon. Show your working and give your answer to the appropriate number of significant figures.

1 + 2 = 3 marks

- c. The atomic number of potassium is 19.

- i. Write the electron configuration, in terms of shells and subshells, for the potassium atom in its ground state.

- ii. Write the electron configuration, in terms of shells and subshells, for the K^+ ion.

1 + 1 = 2 marks

Total 2 + 3 + 2 = 7 marks

Question 2

The Periodic Table is an extremely useful framework for displaying the known elements and information about their properties.

- a. i. Give the name of an individual who has made a contribution to the modern Periodic Table.

- ii. Describe the contribution made by this individual.

2 marks

- b.** Use the Periodic Table to write the symbol for each of the following elements:
- i.** The element that is in Group 2 and Period III. _____
 - ii.** An element from Period V that is located in the s block. _____
 - iii.** An element that is in Period IV and is a transition metal. _____
 - iv.** A noble gas with 6 occupied shells. _____
 - v.** The element from Period III with the largest atomic radius. _____
 - vi.** The element that has 4 occupied shells and 2 electrons in its outer shell. _____

6 marks

- c. i.** State whether the trend in metallic character of elements increases or decreases from left to right across the Periodic Table. _____
- ii.** Give a brief explanation for this trend.

1 + 2 = 3 marks

Total 2 + 6 + 3 = 11 marks

Question 3

A sample of sodium carbonate (Na_2CO_3) has a mass of 16.6 g.

- a.** Calculate the amount, in mol, of sodium carbonate present.

2 marks

- b.** Calculate the amount, in mol, of sodium atoms present.

1 mark

SECTION B – continued
TURN OVER

- c. Calculate the total number of atoms present.

2 marks

- d. Determine the percentage, by mass, of oxygen in sodium carbonate.

2 marks

Total 2 + 1 + 2 + 2 = 7 marks

Question 4

Give concise explanations for each of the following:

- a. Metallic substances are good conductors of electricity.

1 mark

- b. Ionic substances cannot conduct electricity when solid but can when molten or aqueous.

2 marks

- c. A methane (CH₄) molecule has a tetrahedral shape.

2 marks

Total 1 + 2 + 2 = 5 marks

SECTION B – continued

Question 5

- a. Write the name and molecular formula of an alkane that has 3 carbon atoms.

1 mark

- b. Draw the structure of 2-pentene.

1 mark

- c. Draw the structures and give the names of all of the structural isomers of C_4H_{10} .

4 marks

- d. Alkanes and alkenes are both examples of a homologous series. Give a definition of the term 'homologous series'.

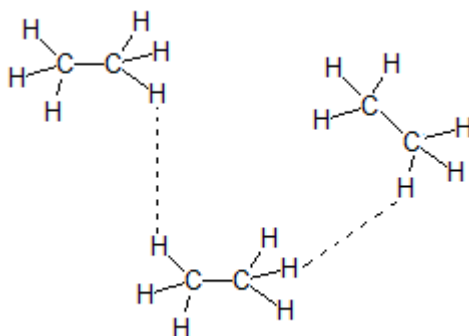
1 mark

SECTION B – continued
TURN OVER

- e. Explain why alkanes are non-polar molecules.

1 mark

- f. Consider the diagram below, which represents a number of ethane molecules. Clearly label and name the different types of bonding present.



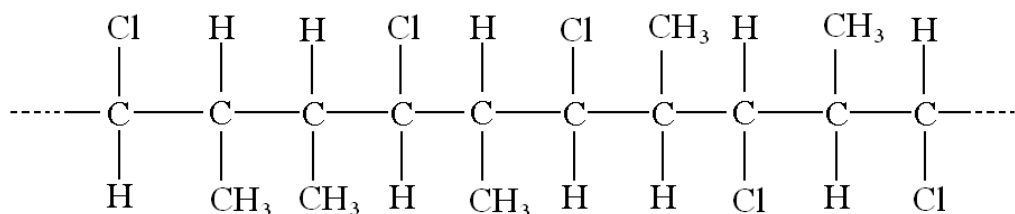
2 marks

Total 1 + 1 + 4 + 1 + 1 + 2 = 10 marks

Question 6

Polymers are very large covalent molecular substances.

- a. Below is a representation of an addition polymer.



Draw the structure of the monomer from which this polymer was formed.

1 mark

- b.** Describe a simple experiment you could perform to determine if a particular polymer was thermosetting or thermoplastic. Describe the results you would expect for both types of polymer.

3 marks

- c.** Describe the main structural difference between thermosetting and thermoplastic polymers.

2 marks

- d.** Customised polymers are polymers designed and produced for a particular task. Give **one** way in which a customised polymer can be produced.

1 mark

Total 1 + 3 + 2 + 1 = 7 marks