

INSIGHT

Trial Exam Paper

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, $(\text{NH}_4)_2\text{SO}_4$, 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

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, $\text{H}_2(\text{g})$; $\text{NaCl}(\text{s})$

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?

- 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 (CH_4) 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'.

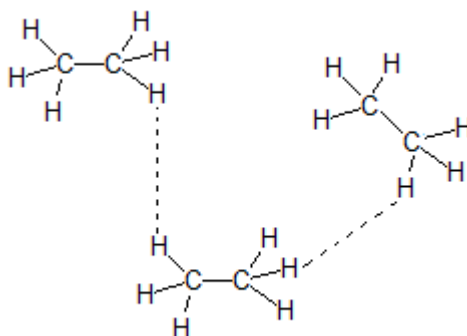
1 mark

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.



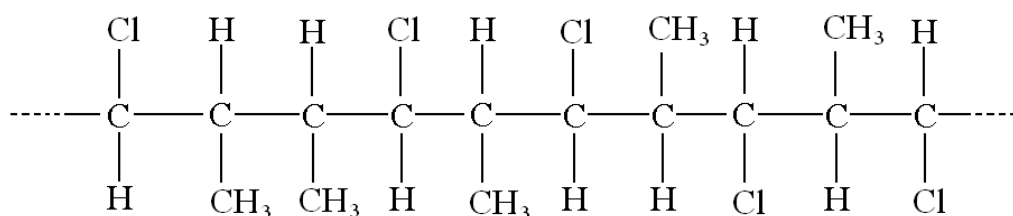
2 marks

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