



INSIGHT
Year 11 Trial Exam Paper

2012

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	8	8	66
			Total 86

- 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 19 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 chosen for any question.

Question 1

The elements of the periodic table were not discovered all at once. In fact, their discovery has spanned many centuries. Which of the elements listed below was isolated first?

- A. carbon
- B. helium
- C. sodium
- D. uranium

Question 2

S Ar Ca Al K

An ion with the electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^6$ is formed from one of the elements listed above. The element could only have been

- A. Ar
- B. Ar, Ca or K
- C. S, K or Ca
- D. S, K, Ar or Al

Question 3

What is the chemical formula of the likely compound formed from the elements with the following electronic configurations?

X $1s^2 2s^2 2p^6 3s^2 3p^1$ Y $1s^2 2s^2 2p^4$

- A. XY
- B. XY_3
- C. X_2Y
- D. X_2Y_3

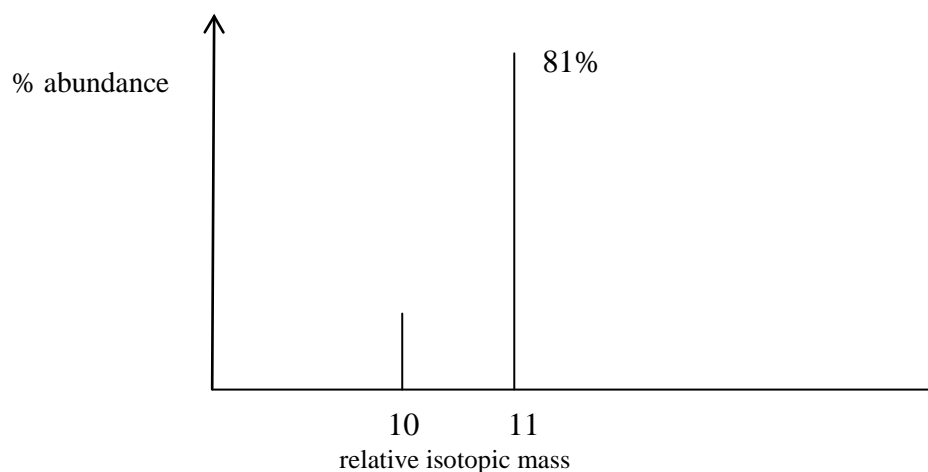
Question 4

Which of the following represents the greatest number of hydrogen atoms?

- A. 10 g of H atoms
- B. 9 g of H_2 molecules
- C. 15 g of water, H_2O
- D. 15 g of methane, CH_4

Questions 5 and 6 refer to the following information.

The mass spectrum for boron is shown.



Question 5

From the mass spectrum for boron it can be concluded that boron

- A. has two isomers
- B. has two isotopes, the second with one more proton than the first
- C. has two isotopes, the second with one more neutron than the first
- D. can form ions with two different oxidation numbers

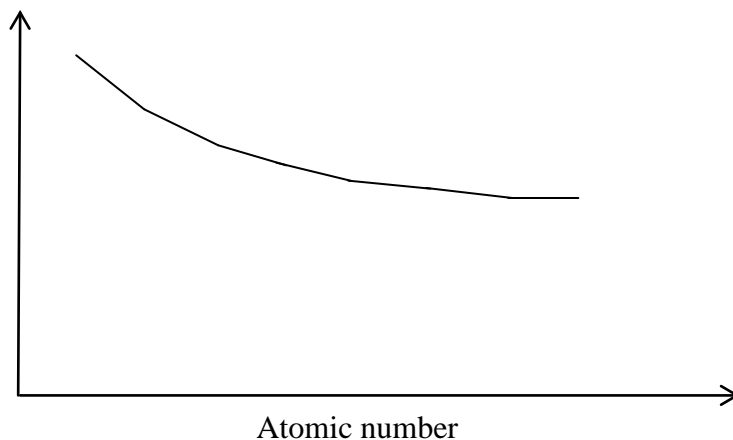
Question 6

The relative atomic mass of boron will be

- A. 10.00
- B. 10.19
- C. 10.50
- D. 10.81

Question 7

The graph below shows how a particular property changes as you move across period 3 of the periodic table.



From the shape of this curve, the property being measured might be

- A. atomic radius
- B. melting point
- C. electronegativity
- D. density

Question 8

Nitrogen forms many different compounds when it reacts with oxygen. A 5.00 g sample of one particular oxide of nitrogen is found to contain 1.52 g of nitrogen. The empirical formula of the oxide is

- A. NO
- B. NO₂
- C. N₂O
- D. NO₃

Question 9

The properties of a particular substance are

Melting point	896°C
Electrical conductivity (solid)	low
Electrical conductivity (liquid)	high
Solubility in water	high
Brittle	

The compound is most likely to be

- A. NaCl
- B. CO
- C. Mg
- D. diamond

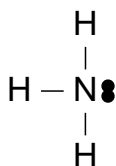
Question 10

Which list contains only organic compounds that are saturated?

- A. propane, CH_4 , $\text{CH}_3\text{CHCHCH}_2\text{CH}_3$
- B. butane, C_3H_8 , $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- C. butane, C_3H_6 , CH_2CHCH_3
- D. pentane, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$, C_4H_8

Question 11

The molecule shown is ammonia.



The nitrogen atom in an ammonia molecule has

- A. six electrons in the outer shell
- B. one lone pair of electrons and three shared electrons
- C. one lone pair of electrons and three pairs of bonding electrons
- D. eight bonding electrons in the outer shell

Question 12

The molecule carbon tetrafluoride has the formula CF_4 . Carbon tetrafluoride will contain

- A. no dipoles and be non-polar
- B. dipoles but be non-polar
- C. dipoles and be polar
- D. ionic bonds

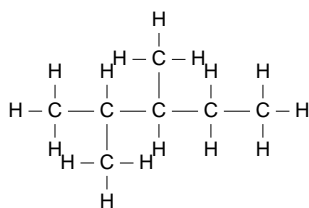
Question 13

Most of the alkane molecules are fuels. When they burn in excess air, the reaction is called a combustion reaction. The products of combustion reactions will be

- A. carbon and hydrogen
- B. carbon dioxide and water
- C. carbon and water
- D. carbon dioxide and hydrogen

Question 14

The correct IUPAC name for this compound is



- A. 2,3-dimethylpentane
- B. 2,3-methylpentane
- C. 2,3-dimethylheptane
- D. heptane

Question 15

An alkene has a molar mass of 70 g mol^{-1} . The alkene is

- A. ethene
- B. butane
- C. pentane
- D. pentene

Question 16

NaCl H₂O Pb N₂ diamond CH₄

The likely order of melting points, from lowest to highest, for the list of substances above will be

- A. N₂, CH₄, H₂O, Pb, diamond, NaCl
- B. N₂, Pb, CH₄, H₂O, NaCl, diamond
- C. N₂, NaCl, H₂O, CH₄, Pb, diamond
- D. N₂, CH₄, H₂O, Pb, NaCl, diamond

Question 17

Diamond is an allotrope of carbon. It does not melt to a liquid, rather it sublimates at very high temperatures. The reason for the high sublimation temperature is that

- A. the molecules in diamond are very long
- B. it is a giant covalent lattice with no discrete molecules
- C. it has a sea of electrons as metals do
- D. the molecules in diamond have some cross-links

Question 18

The structure of a polymer can be modified in many ways. Some of these possibilities are listed.

- I Increase the length of the molecules.
- II Replace a hydrogen atom in the monomer with a chlorine atom.
- III Add branches to the chains.
- IV Add cross-links to the polymer.

Which of the above changes will lead to an increase in the melting point of the polymer?

- A. IV only
- B. I and II only
- C. I, II and IV only
- D. I, II, III and IV

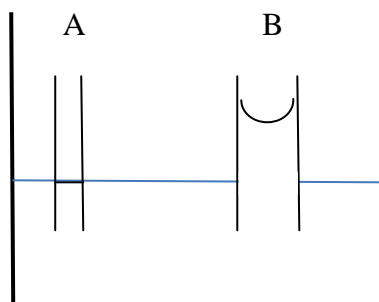
Question 19

A thermoplastic polymer has

- A. very long molecules held together with dispersion forces and/or dipoles
- B. very long molecules held together by covalent cross-links
- C. a network of molecules set into a giant array
- D. a giant network of covalent bonds

Question 20

The diagram shows two capillary tubes sitting in the same beaker of water.



From the diagram, and from your knowledge of capillary action, it can be concluded that

- A. water does not rise as far in narrow glass tubing
- B. tubing A might be made from plastic and tubing B from glass
- C. tubing B has been left in the liquid a lot longer than tubing A
- D. tubing A might be made from glass and tubing B from plastic

END OF SECTION A

**END OF SECTION A
TURN OVER**

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

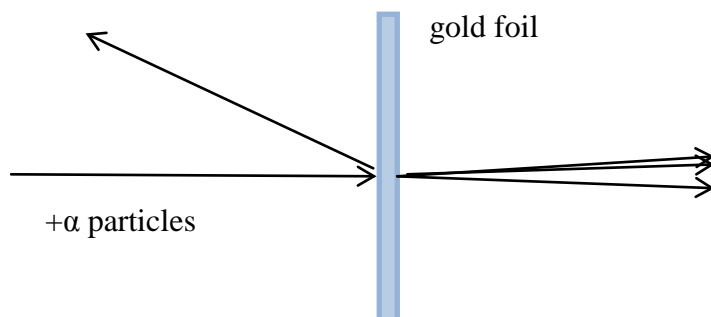
- give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks.
- show all working in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of 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

The discovery of radiation provided a new tool for scientists to use in their investigation of the atom. One scientist to make an important contribution was New Zealander Ernest Rutherford. Rutherford's team directed a beam of positively charged alpha particles at a very thin sheet of gold foil. The research team noticed that:

- most of the alpha particles passed through the foil with only a slight deviation in their path
- a small number of particles were deflected significantly, some even rebounding back towards the source of the particles.

These observations led to some surprising conclusions.



- a. What conclusion did Rutherford draw from the fact that most alpha particles passed through the gold foil?

1 mark

- b. Give two conclusions Rutherford made from the observation that a small percentage of alpha particles rebounded from the gold foil.

2 marks

- c. Danish scientist Niels Bohr communicated frequently with Rutherford. In 1913, he proposed a modification to the picture of the atom developed by Rutherford. Explain what Bohr proposed.

1 mark

- d. In 1932, English scientist James Chadwick identified a further particle in the atom.

i. What was the name of this particle?

ii. Give one reason why the discovery of this particle did not come until several years after Rutherford's experiment.

1 + 1 = 2 marks

Total 6 marks

SECTION B – continued
TURN OVER

Question 2

Aluminium and chlorine both belong to period 3 on the periodic table.

a. Describe how each of the following properties will change as you move across the elements of period 3.

i. electronegativity

ii. metallic character

iii. atomic radius

1 + 1 + 1 = 3 marks

Aluminium and chlorine can react to form a compound. (Use full subshell notation for all electron configurations asked for in this question.)

b. i. Write the electronic configuration of aluminium.

ii. Write the electronic configuration of the likely ion that aluminium will form.

1 + 1 = 2 marks

c. i. Write the electronic configuration of chlorine.

ii. Write the electronic configuration of the likely ion that chlorine will form.

1 + 1 = 2 marks

- d. i. What is the name, and chemical formula, of the compound formed between aluminium and chlorine?

Name: _____ Chemical formula: _____

- ii. List three properties of this compound.

1. _____

2. _____

3. _____

2 + 3 = 5 marks

Total 12 marks

Question 3

Complete the following table.

Name of compound	Formula of compound
potassium oxide	
iron(III) fluoride	
calcium nitride	
	Mg(OH) ₂
	Al ₂ (SO ₄) ₃

5 marks

SECTION B – continued
TURN OVER

Question 4

Glucose is one of the most important carbohydrate molecules. Its molecular formula is $C_6H_{12}O_6$.

- a. i.** What is the relative molecular mass of glucose?

- ii.** What is the molar mass of glucose?

1 + 1 = 2 marks

- b.** Calculate the percentage mass of oxygen in glucose.

2 marks

- c.** In a 600 g sample of glucose, calculate the

- i.** amount, in moles, of glucose

- ii.** amount, in moles, of carbon atoms

- iii.** number of carbon atoms

1 + 1 + 1 = 3 marks

d. A sample of a white powder is thought to be pure glucose. The mass of carbon in the sample is determined to be 4.8 g.

i. Calculate the mass of hydrogen that must be present for the sample to be glucose.

ii. Calculate the mass of oxygen that must be present for the sample to be glucose.

3 + 2 = 5 marks

Total 12 marks

SECTION B – continued
TURN OVER

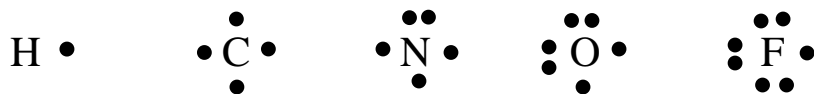
- d. i. What is the molecular formula of 2-butene? _____
- ii. What is the empirical formula of 2-butene? _____

1 + 1 = 2 marks

Total 8 marks

Question 6

Electron dot diagrams of some common non-metals are provided below. Electron dot diagrams are helpful when determining the formulas and structures of compounds formed between these elements.



Use these electron dot diagrams to complete the table below. For each pair of elements, draw a valence diagram (electron dot diagram) of the most likely compound to form when they bond. Use the valence diagram to predict the shape of the molecule.

	Valence diagram	Molecular formula	Shape
carbon and hydrogen			
hydrogen and oxygen			
nitrogen and hydrogen			
carbon and fluorine			

6 marks

SECTION B – continued
TURN OVER

Question 7

CH₄ SiO₂ polyethene MgCl₂ Li C₆H₁₄

- a. Use the list of compounds above to complete the table below. A substance may be used more than once or not at all.

A substance that conducts electricity as a liquid but not a solid	
A substance with covalent bonds and a very high melting point	
A molecular substance with a relatively high melting point	
A substance that conducts electricity as a solid and as a liquid	
A substance that is a gas at room temperature	

5 marks

- b. The bonding between two nitrogen atoms in an N₂ molecule is considered very strong. The boiling point of nitrogen gas, however, is very low, -196°C. Explain this apparent contradiction.

2 marks

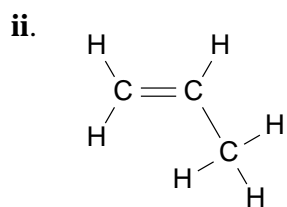
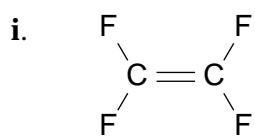
- c. A drop of water sits on a plastic plate in a ball shape. A similar drop of water on a glass plate spreads out to cover the glass. Explain the difference in the behaviour of water on the two surfaces.

2 marks

Total 9 marks

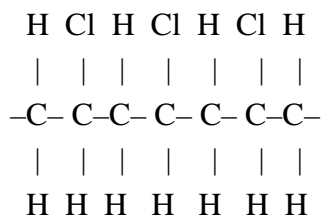
Question 8

a. Draw the likely polymer formed from each monomer.



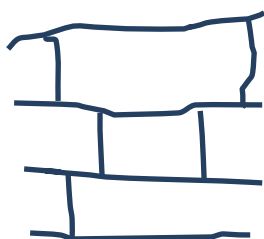
1 + 1 = 2 marks

- b. A segment of a polymer is shown in the diagram. Draw the monomer that was used to form this polymer.

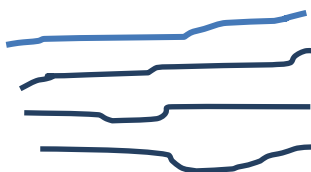


1 mark

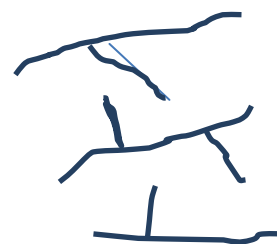
- c. There are many possible types of structures in polymers. Three of these types are modelled below.



A



B



C

- i. Which of these models represents a polymer that cannot be recycled? Explain your answer.

- ii. Which of these models is most likely to be that of LDPE, low density polyethene? Explain your answer.

2 + 2 = 4 marks

d. Which of the following items is likely to be made from a thermoset polymer?

saucepan handle ice-cream container detergent bottle frying pan handle

1 mark

Total 8 marks

END OF QUESTION AND ANSWER BOOK