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INSIGHT
Trial Exam Paper

2011

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	8	8	64
			Total 84

- 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 17 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**Question 1**

Which of the following oxides of nitrogen contains the highest percentage by mass of nitrogen?

- A. NO
- B. NO₂
- C. N₂O₄
- D. N₂O₅

Question 2

Which of the following molecules will have the highest boiling point?

- A. propane
- B. propanol
- C. butane
- D. pentane

Question 3

Element Z forms a compound Z₂(SO₄)₃. When Z reacts with bromine to form a compound, the likely formula will be

- A. ZBr
- B. ZBr₂
- C. ZBr₃
- D. Z₂Br₃

Question 4

In Rutherford's famous experiment, he bombarded a thin layer of gold foil with positive alpha particles. Most of the alpha particles passed through the foil easily, with only a small amount of deflection. The occasional particle rebounded drastically back in the direction it was fired from. Which of the following conclusions can be drawn from this experiment?

- I Many atoms have isotopes.
- II An atom is mostly space.
- III An atom has a small positive nucleus.
- IV The negative particles in an atom are clumped together.

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

Question 5

Formic acid is the old name for an organic molecule present in the fluid of ants. The percentage composition of the atoms in it is

26.09% C, 4.35% H, 69.56% O

The IUPAC name for formic acid is

- A. methanoic acid.
- B. methanol.
- C. ethanoic acid.
- D. propanoic acid.

Question 6

Which of the following contains the greatest mass of oxygen?

- A. 1 mole of oxygen gas, O₂
- B. 1.8 mole of oxygen atoms
- C. 30 g of oxygen gas
- D. 3.01×10^{24} atoms of oxygen

Question 7

Which of the following ground state configurations represents a transition series metal?

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

Question 8

Several elements are arranged from lowest to highest in regard to the trend in one of their properties.

Lowest	Na	Mg	Al	Si	P	S	Highest

This property is

- A. melting point.
- B. electronegativity.
- C. metallic nature.
- D. atomic radius.

Question 9

It was not until 1895 that the first sample of helium was isolated by Scottish chemist William Ramsay. In fact, none of the noble gases were isolated before 1890. The noble gases were not identified earlier because

- A. they are relatively scarce.
- B. they are unreactive.
- C. they are colourless.
- D. all of the above.

SECTION A – continued
TURN OVER

Questions 10 and 11 refer to the following list of chemicals.

Cu, CuCl₂, H₂O, Al, polyethene, Hg, CH₄

Question 10

The substances on this list that conduct electricity as solids are

- A. Cu, Al.
- B. Cu, Al, Hg.
- C. Cu, CuCl₂, Al, Hg.
- D. Cu, CuCl₂, H₂O, Al, polyethene, Hg, CH₄.

Question 11

The substances on this list that conduct electricity as liquids are

- A. Cu, Al.
- B. Cu, Al, Hg.
- C. Cu, CuCl₂, Al, Hg.
- D. Cu, CuCl₂, H₂O, Al, polyethene, Hg, CH₄.

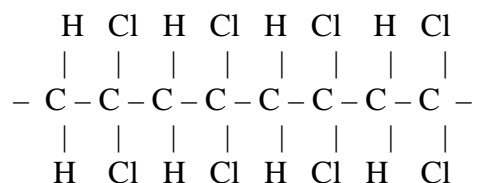
Question 12

The number of hydrogen atoms in 2-pentene is

- A. 5
- B. 9
- C. 10
- D. 12

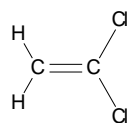
Question 13

Vinylidene chloride is a specialist polymer used to make solar tinting for windows. A segment of its structure is drawn below.

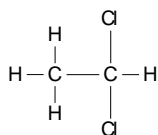


The monomer required to manufacture this polymer is

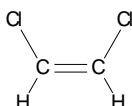
A.



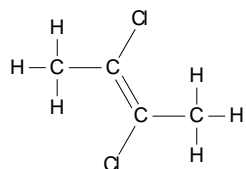
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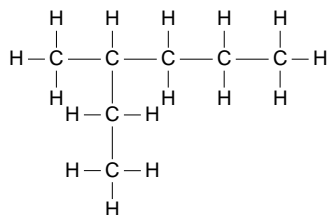
C.



D.

**Question 14**

The correct IUPAC name for the molecule shown is



- A. 3-methylhexane.
- B. 2-ethylpentane.
- C. 3-methylpentane.
- D. 3-methylheptane.

Question 15

A quantity of 7 moles of copper sulfate, CuSO_4 , contains

- A. 7 moles of atoms.
- B. 7 moles of oxygen atoms.
- C. 28 moles of oxygen atoms.
- D. $7 \times 6.02 \times 10^{23}$ atoms.

Question 16

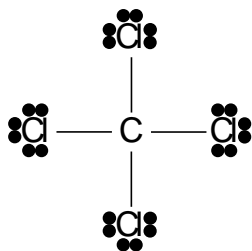
H_2O , AlCl_3 , SO_2 , NH_3 , Cu , NaBr , Li_2O , Cl_2

From the list above, the substances that are covalent molecular substances are

- A. AlCl_3 , NaBr , Li_2O .
- B. H_2O , SO_2 , NH_3 , AlCl_3 .
- C. H_2O , SO_2 , NH_3 , Cl_2 .
- D. H_2O , AlCl_3 , SO_2 , NH_3 , Cu , NaBr , Li_2O , Cl_2 .

Question 17

A diagram of the dry-cleaning fluid carbon tetrachloride, CCl_4 , is shown below.



This molecule will

- A. form a giant lattice.
- B. conduct electricity due to the outer shell electrons.
- C. be polar because of the high electronegativity of chlorine.
- D. contain bond dipoles but will be non polar.

Question 18

The properties of a particular element are listed as

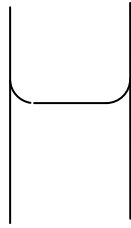
Melting point	961°C
Density	10.5 g mL^{-1}
Electrical conductivity	60 MS m^{-1}

The element is most likely to be

- A. silver.
- B. carbon.
- C. chlorine.
- D. aluminium.

Question 19

A student measuring the volume in a glass measuring cylinder notices that the water surface is not completely horizontal, as shown in the diagram below. The reason for this effect is that



- A. there are significant forces of attraction between the water molecules and the glass.
- B. water particles attract each other more than they attract to glass.
- C. water particles repel each other, pushing each other up the glass.
- D. water contains nanoparticles that are affected by gravity.

Question 20

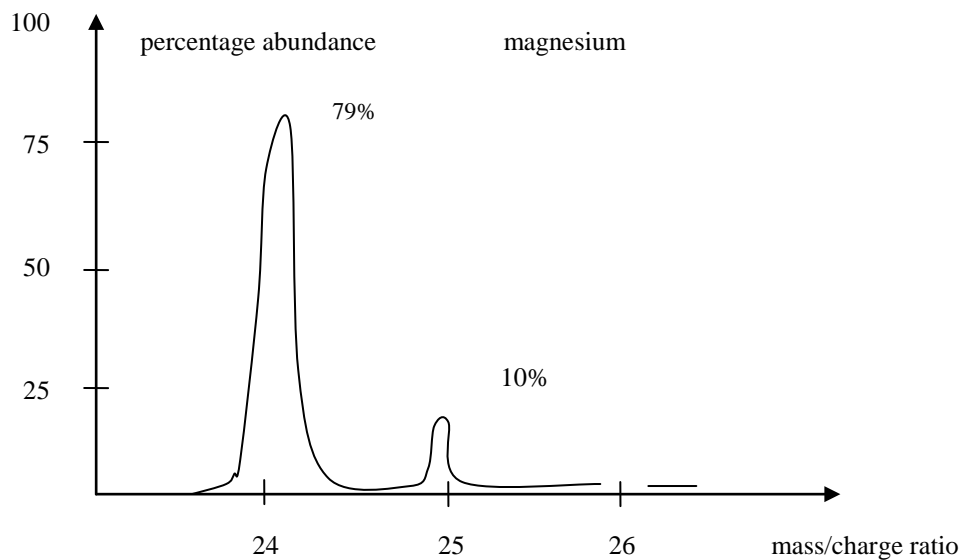
The width of a particular carbon nanotube is 23 nm. In metres, this corresponds to a width of

- A. 2.3×10^{-9}
- B. 2.3×10^{-8}
- C. 2.3×10^8
- D. 2.3×10^{10}

SECTION B – Short-answer questions

Question 1

Every element can be passed through a mass spectrometer. The number of isotopes of the element, and the exact mass of each isotope, is read from the spectrum obtained. A simplified mass spectrum for magnesium is drawn below. Note that a third peak has not been drawn in.



a. Draw in the third peak on the spectrum provided, indicating the height of the peak. 1 mark

b. Write the formula of each isotope in the form ${}^A_Z\text{X}$

3 marks

c. i. Write the ground state electron configuration of magnesium.

ii. What is the likely charge on a magnesium ion?

1 + 1 = 2 marks
Total 1 + 3 + 2 = 6 marks

Question 2

An electron dot diagram of two imaginary elements, A and B, is drawn below.



- a.** A pure sample of element A exists as a solid with a high melting point.
- i.** What category of material is element A?

- ii.** Will element A conduct electricity as a solid? Explain your answer.

1 + 2 = 3 marks

- b.** A pure sample of element B exists as a diatomic gas.
- i.** List two properties that a sample of element B will exhibit.

- ii.** Use a diagram to show the bonding that will exist in a sample of the gaseous element B.

- iii.** Name the type of bonding present in this sample of element B.

1 + 1 + 1 = 3 marks

c. A compound forms between the two elements A and B.

i. Give a chemical formula for the compound formed.

ii. Describe what happens to the electrons when the compound forms.

iii. List three properties that the compound will exhibit.

1 + 2 + 1 = 4 marks
Total 3 + 3 + 4 = 10 marks

Question 3

The charges on some particular ions are shown in the table below.

Oxidation number	Elements or ions
+3	Al, Fe
+2	Mg, Ca, Ba
+1	Li, Na, K, NH ₄
-1	F, Cl, NO ₃
-2	S, SO ₄
-3	PO ₄

Use the charges provided to answer the following questions.

a. Write the names of the following compounds.

i. NaNO₃ _____

ii. MgCl₂ _____

2 marks

b. Write balanced chemical formulas for each of the following compounds.

i. calcium fluoride _____

ii. lithium phosphate _____

iii. aluminium sulfate _____

3 marks

c. Determine the electrovalency of the anion (i.e. the negative ion) in each of the following.

i. K_2CO_3 _____

ii. $Al(OH)_3$ _____

2 marks

Total 2 + 3 + 2 = 7 marks

Question 4

Sodium carbonate is an ionic substance with a formula of Na_2CO_3 . A student heats a sample of sodium carbonate to ensure that it contains no moisture and then weighs the sample. The mass is 40.26 g.

a. Determine the relative formula mass of Na_2CO_3 .

1 mark

b. Determine the molar mass of Na_2CO_3 .

1 mark

c. Determine, in the sample weighed by the student, the

i. number of mole of Na_2CO_3 .

ii. number of mole of oxygen atoms.

iii. number of mole of atoms.

iv. number of atoms of oxygen.

1 + 1 + 1 + 1 = 4 marks

d. Calculate the mass of oxygen contained in the sample weighed.

2 marks

Total 1 + 1 + 4 + 2 = 8 marks

Question 5

The structure of organic molecules can be shown in several different formats. There are advantages and disadvantages of each style. This question uses the alkane molecule hexane, to test if you can use each formatting style competently.

a. Use the second column of the table provided to represent hexane in each of the requested formatting styles.

Formatting style	
molecular formula	
empirical formula	
semi-structural	
structural	

4 marks

b. i. Hexane has several isomers. Draw structural diagrams of two of these isomers.

ii. Name the isomers that you drew in part **b. i.**

2 + 2 = 4 marks

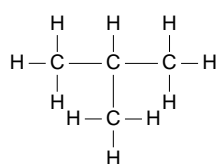
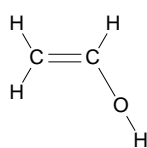
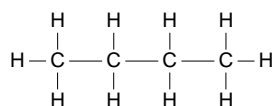
c. Hexane is a fuel. It burns in air to produce carbon dioxide and water.
Write a balanced equation for the combustion of hexane.

1 mark

Total 4 + 4 + 1 = 9 marks

Question 6

Polymers are very long molecules formed from a repeating unit called a monomer. One of the molecules drawn below can act as a monomer in an addition polymerisation reaction.



a. Select the molecule that is the most suitable monomer to form an addition polymer and draw the structure of the polymer that is formed from it.

2 marks

b. The polymer formed is described as a *thermoplastic* material.

i. Explain the term *thermoplastic*.

ii. Explain how the thermoplastic nature of a polymer is related to its ability to be recycled.

2 + 1 = 3 marks

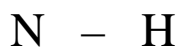
c. Some polymers can be extruded (i.e. elongated/shaped) into pipes or tubing. Explain how the thermoplastic nature of a polymer is related to its ability to be extruded.

2 marks

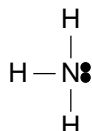
Total 2 + 3 + 2 = 7 marks

Question 7

- a. The electronegativity values for hydrogen and nitrogen are 2.1 and 3.0 respectively.
- i. Use the single bond shown below to draw in the bond dipole that will exist when nitrogen and hydrogen form a single covalent bond.



- ii. Ammonia is a compound formed when nitrogen bonds to three hydrogen atoms. The electron dot diagram of ammonia is drawn below. What will be the shape of the ammonia molecule?



- iii. Will this molecule be polar or non polar? Explain your answer.

1 + 1 + 2 = 4 marks

- b. Many covalent compounds have low melting points. Carbon, however, has a very high melting point whether it is present as diamond, graphite or nanotubes.
- i. Explain why diamond has a high melting point but methane, which also has covalent bonds, has a low melting point.

-
-
-
- ii. Compare the bonding of diamond with that of graphite and explain how they are very different even though they are both made from carbon.
-
-
-

2 + 2 = 4 marks

c. i. Draw the structure of 2-butene.

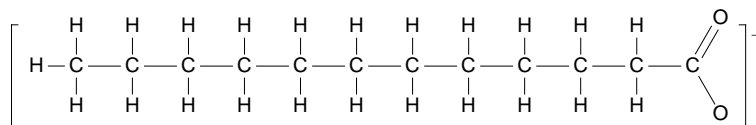
ii. Draw the structure of 2,2-dimethylpropane.

iii. Why is propene not written as 1-propene?

1 + 1 + 1 = 3 marks
Total 4 + 4 + 3 = 11 marks

Question 8

- a. A detergent molecule has a polar segment and a non-polar segment. An example is drawn below.



- i. Explain how a detergent molecule can have a polar segment and a non-polar segment.

- ii. Explain how the detergent molecule will orient itself when it meets a drop of oil on a greasy plate.

2 + 1 = 3 marks

- b. Carbon nanotubes are an example of a new technology that is expected to be important in the future.

- i. What does *nanotechnology* mean?

- ii. List two potential uses for carbon nanotubes.

1 + 2 = 3 marks

Total 3 + 3 = 6 marks