INSIGHT
Trial Exam Paper

insight

2009
YEAR 11 CHEMISTRY
Written examination 2

STUDENT NAME:

QUESTION AND ANSWER BOOK

Reading time: 15 minutes

Writing time: 1 hour 30 minutes

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	7	7	58
			Total 78

- 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 15 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.

This page is blank

SECTION A – Multiple-choice questions

<div style="border:1px solid black">

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.

</div>

Question 1

Water expands on freezing. This is because

A.   water molecules are polar and all polar molecules expand on freezing.

B.   the intramolecular bonds of each water molecule lengthen as water cools.

C.   water self-ionises more as it cools and the ions formed are larger than water molecules.

D.   each water molecule forms bonds with four other water molecules when in the solid state.

Question 2

Which of the equations below best represents sodium nitrate dissolving in water?

A. $NaNO_3(s) + H_2O(l) \rightarrow NaNO_3(aq)$

B. $NaNO_3(s) \xrightarrow{H_2O(l)} NaNO_3(l)$

C. $NaNO_3(s) \xrightarrow{H_2O(l)} Na^+(aq) + NO_3^-(aq)$

D. $2NaNO_3(s) + H_2O(l) \rightarrow 2Na^+(aq) + 2HNO_3(aq)$

Question 3

Which of the following steps is **not** part of the usual treatment of rainwater in preparation for human consumption?

A.   flocculation

B.   distillation

C.   chlorination

D.   filtration

Question 4

Which of the following 1.0 M solutions would have the lowest pH?

A.   sulfuric acid

B.   sodium hydroxide

C.   ethanoic acid

D.   hydrochloric acid

Question 5

Which of the following substances is both diprotic and amphiprotic?

A. H_2SO_4

B. $H_2PO_4^-$

C. HCO_3^-

D. CH_3COO^-

Question 6

The mass of anhydrous $CuSO_4$, in g, required to be dissolved in water to make 750 mL of 0.250 M solution is closest to

A. 0.188

B. 21.0

C. 30.0

D. 53.2

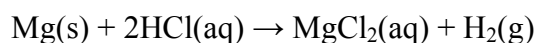**Question 7**

The pH of a 0.100 M solution of $Ca(OH)_2$ is closest to

A. 0.699

B. 1.00

C. 13.0

D. 13.3

Question 8

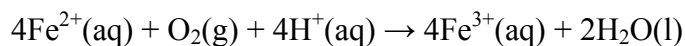An amount of 1.78 g of Mg reacts with 100 mL of 1.0 M HCl according to the equation

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

The mass of H_2 gas formed, in grams, is closest to

A. 0.100

B. 0.147

C. 0.200

D. 0.400

Question 9

Which species is acting as the reductant in the reaction represented by the equation below?

$$4Fe^{2+}(aq) + O_2(g) + 4H^+(aq) \rightarrow 4Fe^{3+}(aq) + 2H_2O(l)$$

A. Fe^{2+}

B. O_2

C. H^+

D. Fe^{3+}

Question 10

Which of the following is most likely to oxidise $Br^-(aq)$?

A. $Ag^+(aq)$

B. $Au^+(aq)$

C. $Fe^{3+}(aq)$

D. $I^-(aq)$

Question 11

Which one of the following is an effect of ozone depletion?

A.   increased ultraviolet light reaching the Earth

B.   increased acid rain

C.   increased photochemical smog

D.   increased global warming

Question 12

In the process of denitrification in the nitrogen cycle

A.   plants return nitrogen to the atmosphere.

B.   bacteria in the soil convert nitrogen in the atmosphere to soluble ions.

C.   soluble ions are converted to proteins in plants.

D.   bacteria in the soil return nitrogen to the atmosphere.

Question 13

Which of the following statements about kinetic molecular theory best explains why an inflated tractor tyre remains inflated over time?

A.   Collisions between particles are elastic.

B.   Most of the volume of a gas is empty space.

C.   Forces between gas particles are extremely weak.

D.   Gas particles move in random straight-line motion.

Question 14

A container of oxygen has a volume of 35.0 mL and a pressure of 5.00 atm. If the pressure of the oxygen gas is reduced to 2.00 atm and the temperature is kept constant, the new volume of the oxygen gas, in mL, will be

A.   14.0

B.   35.0

C.   87.5

D.   105

Question 15

A balloon has a volume of 2.80 L on a day when the temperature is 32.0°C. If the temperature at night falls to 15.0°C, the volume of the balloon at night, in L, if the pressure remains constant will be

A.   1.31

B.   2.64

C.   2.80

D.   2.97

Question 16

A sample of oxygen gas collected over water, when the atmospheric pressure was 1.02 atm and the room temperature 25.5°C, occupies 105.8 mL. What would be the volume of this dry gas, in mL, at STP?

A.   4.23

B.   98.7

C.   108

D.   118

Question 17

At what pressure, in kPa, would 15.0 g of nitrogen gas at 18.0°C occupy 12.5 L?

A. 9.64×10^{-3}

B.   6.41

C.   104

D.   208

Question 18

Which of the following gases will occupy the biggest volume at SLC?

A. 5.0 g of CO_2

B. 5.0 g of NO_2

C. 5.0 g of SO_2

D. 5.0 g of O_2

Question 19

Which of the following gases is **not** a contributor to photochemical smog?

A. carbon dioxide

B. nitrogen oxides

C. hydrocarbons

D. oxygen

Question 20

What volume, in mL, of 0.150 M sulfuric acid is required to react completely with 15.0 mL of 0.100 M sodium hydroxide?

A. 5.00

B. 10.0

C. 15.0

D. 20.0

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, $H_2(g)$; $NaCl(s)$

Question 1

Water is an abundant chemical in the environment where it supports life in many ways.

a. i. Draw the structure of a water molecule in the space below, demonstrating the correct shape and including all non-bonding electrons.

ii. On your diagram above, clearly label and name the intramolecular bond present.

$1 + 1 = 2$ marks

b. Briefly explain why water is a polar molecule.

_____

_____

_____

_____

2 marks

c. What is the name of the strongest type of bonding that occurs between different water molecules?

_____

1 mark

d. Give a brief explanation of each of the following properties of water.

    i. Water has a relatively high boiling temperature.

_____

_____

_____

    ii. Water is a poor conductor of electricity**.**

_____

_____

_____

1 + 1 = 2 marks
Total 2 + 2 + 1 + 2 = 7 marks

Question 2

A small mass of potassium chloride is dissolved in water.

a. Name the type of bonds that need to be broken in the solute during this process.

_____

1 mark

b. Name the type of bonds that are formed between the solute and water during this process.

_____

1 mark

c. Describe the way in which this dissolving process occurs.

_____

_____

_____

_____

2 marks

d. Draw a diagram to show the different arrangement of water molecules around dissolved potassium and chloride ions.

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

Question 3

a. Give a definition and example of a strong base.

_____

_____

_____

3 marks

b. Give a definition and an example of a weak acid.

_____

_____

_____

2 marks

c. Calculate the pH of a 500 mL solution in which 0.846 g of gaseous hydrogen chloride is dissolved.

_____

_____

_____

_____

_____

_____

3 marks

SECTION B – continued

d. A 7.43 g sample of copper sulfide is added to an excess amount of 1.50 M hydrochloric acid. The reaction that occurs is represented by the equation

$$CuS(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2S(g)$$
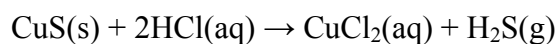
   i. Calculate the volume, in L, of HCl required to react with all of the CuS.

_____

_____

_____

_____

_____

3 marks

   ii. If a student carried out this experiment on a balance, what would be the total loss of mass observed by the student at the end of the experiment compared with the beginning?

_____

_____

_____

_____

_____

2 marks

Total $3 + 2 + 3 + 5 = 13$ marks

Question 4

Write balanced chemical equations to represent each of the following chemical reactions. Remember to include states in your equations.

a. A small volume of liquid ethanol, C_2H_5OH, is dissolved in water.

_____

_____

1 mark

b. A small sample of gaseous hydrogen chloride is dissolved in water.

_____

_____

2 marks

SECTION B – continued
TURN OVER

c. A precipitate forms when aqueous silver nitrate is added to aqueous sodium chloride.

_____

_____

2 marks

d. Aqueous hydrochloric acid and sodium carbonate are mixed and bubbles are observed.

_____

_____

2 marks

e. Silver ions are reduced by nickel metal.

_____

_____

2 marks

f. Respiration by plants returns carbon dioxide to the atmosphere.

_____

_____

1 mark
Total 1 + 2 + 2 + 2 + 2 + 1 = 10 marks

Question 5

During your studies of Unit 2 Chemistry, you will have examined the laboratory and industrial preparation of one gas of significance to the quality of the atmosphere. Write the name of the gas you studied here. _____

a. List two properties of this gas.

_____

_____

_____

_____

2 marks

b. Describe the laboratory preparation of this gas. Include an appropriate equation in your answer.

_____

_____

_____

2 marks

c. A reduction in the quality of the atmosphere can have significant consequences for the occupants of Earth. The enhanced greenhouse effect is one such problem.

    i. Describe the enhanced greenhouse effect.

_____

_____

_____

_____

    ii. List two human activities that have contributed to the enhanced greenhouse effect.

_____

_____

_____

_____

$1 + 2 = 3$ marks

d. Acid rain is another serious problem resulting from a decrease in the quality of the atmosphere. Use an equation to describe the production of acid rain from a gas in the atmosphere and outline one of the effects of acid rain on plants or animals.

_____

_____

_____

_____

2 marks
Total $2 + 2 + 3 + 2 = 9$ marks

Question 6

Use kinetic molecular theory to explain the following observations.

a.   A sample of methane that is released on one side of a large room is soon smelled by a student standing on the other side of the room.

_____

_____

1 mark

b.   An aerosol can that is heated too strongly may explode.

_____

_____

_____

_____

2 marks

c.   The gas-filled tyres of modern motor vehicles provide a much smoother ride than the solid wagon wheels on the early horse and carts.

_____

_____

_____

_____

2 marks
Total 1 + 2 + 2 = 5 marks

Question 7

a. The Hazelwood power station in the Latrobe Valley uses about 36 000 tonnes of coal each day (1 tonne = 10^6 g). The coal used in the power station contains about 25.0% carbon. Calculate the volume of carbon dioxide, in L, released each day by the power station at STP that is due to the burning of coal.

_____

_____

_____

_____

_____

_____

4 marks

b. In 1766, Cavendish prepared hydrogen gas by passing steam through a red-hot gun barrel. The reaction can be represented by the equation

$$4H_2O(g) + 3Fe(s) \rightarrow Fe_3O_4(s) + 4H_2(g)$$
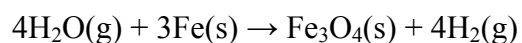
Calculate the volume of hydrogen at a pressure of 780 mmHg and a temperature of 27°C that can be prepared from the reaction of 20.0 g of water.

_____

_____

_____

_____

_____

_____

4 marks
Total 4 + 4 = 8 marks

END OF QUESTION AND ANSWER BOOK