

Student name

CHEMISTRY

Unit 2

Trial Examination

QUESTION AND ANSWER BOOK

Total writing time: 1 hour 30 minutes

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks	Suggested times (minutes)
A	20	20	20	24
B	8	8	56	66
Total			76	90

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, an approved graphics calculator (memory cleared) and/or one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied

- Question and answer book of 14 pages, with a detachable data sheet in the centrefold and a detachable answer sheet for multiple-choice questions inside the front cover.

Instructions

- Detach the data sheet from the centre of this book and the answer sheet for multiple-choice questions during reading time.
- Write your **name** in the space provided above on this page and on the answer sheet for multiple-choice questions.
- All written responses should be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

STAV Publishing

2003

CHEMISTRY

Unit 2 Trial Examination

MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME:	
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INSTRUCTIONS:**USE PENCIL ONLY**

- Write your name in the space provided above.
- Use a **PENCIL** for **ALL** entries.
- If you make a mistake, **ERASE** it – **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- Mark your answer by placing a **CROSS** through the letter of your choice.

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D
9.	A	B	C	D
10.	A	B	C	D

11.	A	B	C	D
12.	A	B	C	D
13.	A	B	C	D
14.	A	B	C	D
15.	A	B	C	D
16.	A	B	C	D
17.	A	B	C	D
18.	A	B	C	D
19.	A	B	C	D
20.	A	B	C	D

SECTION A

Specific instructions for Section A

Section A consists of 20 multiple choice questions. Section A is worth approximately 26 per cent of the marks available. You should spend approximately 24 minutes on Section A.

Choose the response that is **correct** or **best answers the question**, and mark your choice on the multiple choice answer sheet according to the instructions on that sheet.

A correct answer is worth 1 mark, an incorrect answer is worth no marks. No mark will be given if more than one answer is shown for any question. Marks will **not** be deducted for incorrect answers. You should attempt every question.

Question 1

Element X consists of two isotopes, ^{69}X and ^{71}X . If 60% of the mass of a sample of X is present as ^{69}X , the relative atomic mass of X would be

- A. 69.5
- B. 69.8
- C. 70.2
- D. 70.5

Question 2

The average mass, in gram, of **two** atoms of nitrogen would be closest to

- A. 1.16×10^{-23}
- B. 2.32×10^{-23}
- C. 4.66×10^{-23}
- D. 6.02×10^{-23}

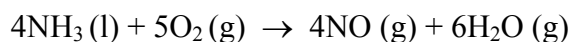
Question 3

An oxide of formula XO_2 was extracted from a sample of beach sand. If the oxide contains 40% by mass oxygen, the molar mass of X would be

- A. 24 g mol^{-1}
- B. 48 g mol^{-1}
- C. 60 g mol^{-1}
- D. 80 g mol^{-1}

Question 4

For the equation;

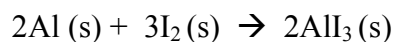


Which one of the following statements is **incorrect**?

- A. $2 \times n(\text{NO}) = 3 \times n(\text{H}_2\text{O})$
- B. $n(\text{H}_2\text{O}) = 1.5 \times n(\text{NH}_3)$
- C. $n(\text{NO}) = 0.8 \times n(\text{O}_2)$
- D. $n(\text{NH}_3) = n(\text{NO})$

The following information relates to questions 5 and 6

0.810 g of aluminium is heated with 7.62 g of solid iodine. A white solid, aluminium iodide forms according to the equation

**Question 5**

The chemical in excess and its mass would be closest to

- A. Iodine by 0.254 g
- B. Iodine by 1.905 g
- C. Aluminium by 0.270 g
- D. Aluminium by 0.540 g

Question 6

The maximum mass of aluminium iodide formed would be closest to

- A. 4.1 g
- B. 5.1 g
- C. 8.2 g
- D. 12.2 g

Question 7

What mass of aluminium fluoride, AlF_3 , would be required to make up 100 mL of a solution that has a fluoride ion concentration of 0.300 M?

- A. 0.57 g
- B. 0.84 g
- C. 2.52 g
- D. 7.56 g

Question 8

Which one of the following is true for **all** acids?

- A. They lower the hydroxide ion content of an aqueous solution.
- B. They accept protons during a chemical reaction.
- C. They cause universal indicator to turn orange.
- D. They react with a metal to produce a salt and hydrogen gas.

Question 9

When comparing equal volumes of 0.10 M HCl and 0.10 M CH_3COOH , the HCl solution would

- A. have a higher conductivity.
- B. neutralize a greater volume of 0.10 M NaOH solution.
- C. contain a lower concentration of hydronium ions.
- D. have a higher pH at 25 °C.

Question 10

Which of the following will **not** act as a base when dissolved in water?

- A. NaOH
- B. Na_2CO_3
- C. Na_2SO_4
- D. NaHCO_3

Question 11

The pH of a 0.0010 M solution of KOH is

- A. 1.0×10^{-11}
- B. 1.0×10^{-3}
- C. 3.0
- D. 11

Question 12

Which of the following is **not** true of carbon dioxide?

- A. It produces acidic solutions.
- B. It is essential for continuation of life on Earth.
- C. It is highly soluble in water.
- D. It is produced in respiration.

Question 13

Which of the following conditions would **both** cause a real gas to deviate from ideal behaviour?

- A. High temperature and low pressure.
- B. High temperature and high pressure.
- C. Low temperature and low pressure.
- D. Low temperature and high pressure.

Question 14

A sample of gas occupied 1.0 L at 101 kPa and 0 °C. The pressure was doubled to 202 kPa while keeping the volume constant. The new temperature for the sample of gas would be

- A. 273 K
- B. 273 °C
- C. 0 K
- D. 0 °C

Question 15

When 29.0 g of butane, C_4H_{10} , is completely burnt in air, the volume of carbon dioxide, produced at SLC, would be

- A. 24.5 L
- B. 49.0 L
- C. 73.5 L
- D. 98.0 L

Question 16

Which **one** of the following is correct about equal volumes of O_2 (g) and SO_2 (g) at 300 K and 2.0 atm?

- A. The SO_2 sample has the same mass as the O_2 sample.
- B. The average kinetic energy of the SO_2 molecules is half that of the O_2 molecules.
- C. The average velocity of the SO_2 molecules is half that of the O_2 molecules.
- D. The number of O_2 molecules and SO_2 molecules is the same.

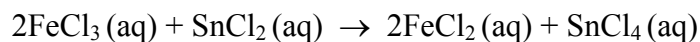
Question 17

Which of the following is **not** a redox reaction?

- A. $2HCl(aq) + Ca(s) \rightarrow CaCl_2(aq) + H_2(g)$
- B. $3Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$
- C. $H_2SO_4(aq) + Cu(s) \rightarrow CuSO_4(aq) + H_2(g)$
- D. $CuO(s) + 2HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + H_2O(l)$

Question 18

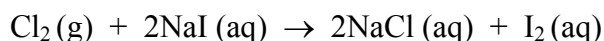
In the reaction represented by the equation



- A. Fe^{3+} ions lose electrons and are reduced.
- B. Fe^{2+} ions lose electrons and are oxidised.
- C. Sn^{2+} ions lose electrons and are oxidised.
- D. Cl^- ions lose electrons and are reduced.

Question 19

When chlorine gas is bubbled through a solution of sodium iodide, the following reaction occurs



In this reaction, the most accurate representation of the reductant is

- A. Cl_2
- B. NaCl
- C. I^-
- D. NaI

Question 20

Which of the following most correctly states the roles played by **tap** water, salt and air, in the rusting of iron?

- A. Only tap water and air are essential for rusting.
- B. Only de-aerated tap water is necessary for rusting.
- C. All three are required for rusting to occur.
- D. Rusting will occur if any two of the above chemicals is present.

END OF SECTION A

SECTION B

Specific instructions for Section B

Section B consists of eight short answer questions numbered 1 to 8; you must answer all of these questions. This section is worth 56 marks which is approximately 74 per cent of the total. You should spend approximately 66 minutes on this section.

The marks allotted to each question and the suggested times are shown at the end of each question.

Questions must be answered in the spaces provided in this book.

To obtain full marks for your response you should

- give simplified answers with an appropriate number of significant figures for 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 the working.
- make sure all 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) Show, by writing the respective equations for each acid, that hydrochloric acid (HCl) is a strong acid and ethanoic acid (CH_3COOH) is a weak acid.

- b) Define the term *conjugate acid/base pair* and use nitric acid to illustrate your answer.

- c) What is meant by the term **diprotic**? Use carbonic acid to support your definition.

- d) Explain why equal concentrations of hydrochloric acid and ethanoic acid will not have the same pH.

2 + 2 + 3 + 1 = 8 marks
(Suggested time: 9 minutes)

Question 2

Propane is the major component of bottled gas. When combusted in air it will produce carbon dioxide and water vapour.

- a) Write a balanced equation (including states) for the **complete** combustion of propane (C_3H_8) in air.

- b) Given that 0.66 kg of propane is combusted in excess air,

- (i) Calculate the amount, in mol, of propane used.

- (ii) Calculate the mass of carbon dioxide produced in this reaction.

- c) Calculate

- (i) the **number** of **molecules** of propane present in 0.66 kg of propane.

- (ii) the **number** of **atoms** of hydrogen present in 0.66 kg of propane.

2 + 4 + 2 = 8 marks
(Suggested time: 9 minutes)

Question 3

In the laboratory, a student is required to prepare 250 mL of 0.50 M HCl. The only available hydrochloric acid is a 10 M stock bottle.

- a) Calculate the amount of hydrochloric acid, in mol, in the diluted solution.

- b) Calculate the volume of stock hydrochloric, in mL, required to prepare the diluted acid.

- c) Explain how the diluted acid solution would be prepared.

- d) Calculate the pH of the 250 mL of 0.50 M HCl.

1 + 2 + 2 + 1 = 6 marks

(Suggested time: 7 minutes)

Question 4

Write the formula of the following chemicals

- a) phosphoric acid

- b) barium hydroxide

- c) iron(III) nitrate

- d) magnesium phosphate

1 + 1 + 1 + 1 = 4 marks

(Suggested time: 5 minutes)

Question 5

Some students were set the task of determining the concentration of a diluted ammonia solution in a 100 mL volumetric flask. The method they chose involved volumetric analysis using a standard solution of hydrochloric acid. An outline of the method they used is given below.

- A burette is filled with the standard hydrochloric acid solution.
- A pipette is used to transfer aliquots of the diluted ammonia to a conical flask.
- A suitable indicator is added and the diluted ammonia is titrated with the acid.
- Titrations were repeated until three concordant titres were obtained.

The equation for the reaction is $\text{HCl (aq)} + \text{NH}_3\text{(aq)} \rightarrow \text{NH}_4\text{Cl (aq)}$

- a) What is meant by a standard solution of hydrochloric acid?

- b) The data shown in one of the student's practical report was

Concentration of hydrochloric acid solution	=	0.1105 M
Volume of diluted ammonia in the volumetric flask	=	100.0 mL
Volume of diluted ammonia placed in each conical flask	=	20.00 mL
Average titre of concordant results	=	18.45 mL

- (i) Calculate the amount, in mol, of hydrochloric acid in the average titre.

- (ii) Calculate the amount, in mol, of ammonia in the 100.0 mL of diluted ammonia solution.

- (iii) Calculate the concentration, in mol L^{-1} , of the diluted ammonia.

1 + 4 = 5 marks
(Suggested time: 6 minutes)

Question 6

150 mL of 0.50 M hydrochloric acid solution is mixed with 250 mL of 0.40 M sodium carbonate solution and the following reaction occurs:



- a) Which reactant is in excess? Show all logic.

- b) What volume of carbon dioxide gas, in L, will be produced at 1.00 atmosphere and 15 °C?

- c) What will be the final molarity of NaCl if no change in solution volume occurs during the reaction?

3 + 3 + 2 = 8 marks

(Suggested time: 9 minutes)

Question 7

Write concise explanations or give descriptions for each of the following. Use a chemical equation where appropriate.

- a) A zinc block bolted onto an iron pipe will protect it from corrosion but a similar copper block will not.

- b) Oxygen and nitrogen have low solubilities in water.

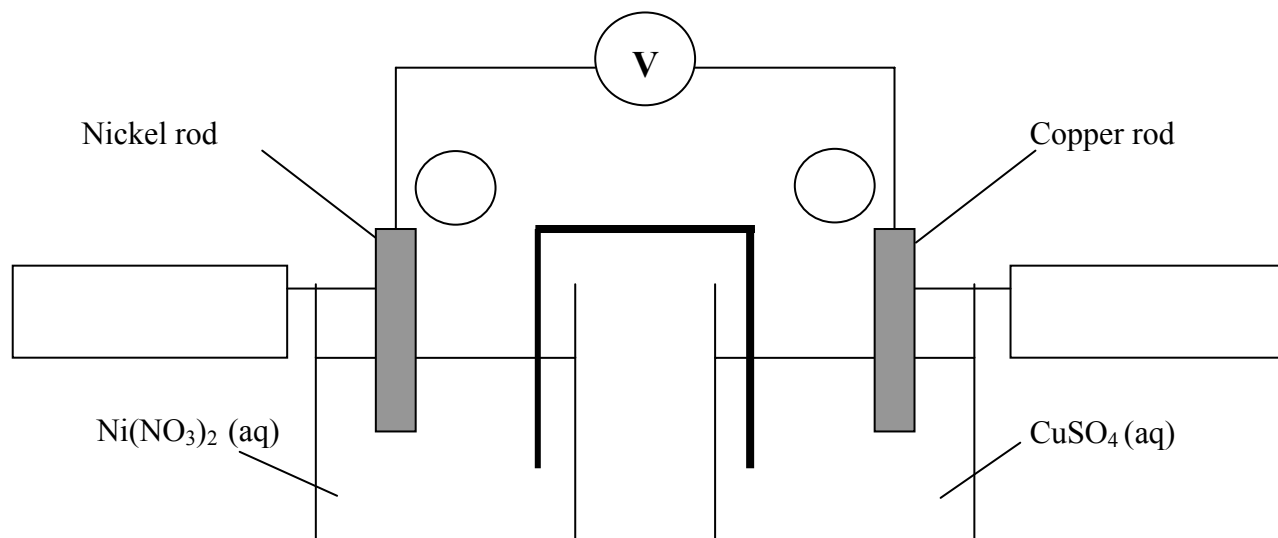
- c) Nitrogen fixation.

- d) Boyle's Law.

$3 + 2 + 2 + 2 = 9$ marks
(Suggested time: 12 minutes)

Question 8

A student was experimenting with galvanic cells. A nickel rod was dipped in a solution of 1 M $\text{Ni}(\text{NO}_3)_2$ (aq) in a beaker and a copper rod was dipped in a solution of 1 M CuSO_4 (aq) in another beaker. The two beakers were connected by placing a strip of absorbent paper that had been soaked in saturated sodium nitrate solution into both beakers. The metal strips were connected through a voltmeter. A diagram of the apparatus is illustrated below.



- a) **On the diagram**, clearly indicate the
- direction of the electron flow
 - cathode and the anode (use the boxes provided)
 - direction of movement of anions in the salt bridge
 - polarity of each electrode (use the circles)
- b) (i) Write a half equation to represent the reduction process.

- (ii) Write a half equation to represent the oxidation process.

- c) For this cell give the formula of the
- (i) oxidant _____ (ii) reductant _____

4 + 2 + 2 = 8 marks

(Suggested time: 9 minutes)

END OF EXAMINATION