



Iona Presentation College

Year 12 Chemistry

Semester Two Examination, 1999

Student Name : _____

TIME ALLOWED FOR THIS PAPER

Reading time before commencing work : Ten minutes

Working time for paper : Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

To be Provided by the Supervisor

This Question Paper/ Answer Booklet
Separate Multiple Choice Answer Sheet
Chemistry/Data Sheet (inside front cover of this Question/ Answer Booklet)

To be Provided by the Candidate

Standard Items: Pens, pencils, eraser or correction fluid, ruler.

Special Items: Calculators satisfying the conditions set by the Curriculum Council and a 2B, B or HB pencil for the separate Multiple Choice Answer Sheet.

IMPORTANT NOTE TO CANDIDATES

No other items may be taken into the examination room.

It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor BEFORE reading any further.

Part	Format	No. of Questions Set	No. of Questions to be Attempted	Marks Allocated	Recommended Time (Approx) /Minutes
1.	Multiple choice	30	ALL	60 (30%)	55
2.	Short answers	14	ALL	70 (35%)	60
3.	Calculations	5	ALL	50 (25%)	45
4.	Extended answers	3	1	20 (10%)	20

Total marks for paper = 200 (100%)

INSTRUCTIONS TO CANDIDATES

Reading Time: The examiners recommend that candidates spend the reading time mainly reading the Instructions to Candidates and Parts 2, 3 and 4.

Part 1 — Multiple Choice

Use a 2B, B or HB pencil to answer on the separate Multiple Choice Answer Sheet. **Do not** use a ballpoint or ink pen.

If you consider that two or more of the alternative responses are correct, choose the one you think is best. If you think you know an answer, mark it even if you are not certain you are correct. Marks will **not** be deducted for incorrect answers.

FEEL FREE TO WRITE OR DO WORKING ON THE QUESTION PAPER; many students who score high marks in the Multiple Choice Section do this.

Parts 2, 3 and 4

Use a ballpoint or ink pen. **Do not** answer in pencil. Write your answers in this Question/Answer Booklet.

At the end of the examination make sure that your Student Number is on your Question/Answer booklet and on your separate Multiple Choice Answer Sheet.

Questions containing specific instructions to show working should be answered with a complete, logical, clear sequence of reasoning showing how the final answer was arrived at; correct answers which do not show working will not be awarded full marks.

CHEMICAL EQUATIONS

For full marks, chemical equations should refer only to those species consumed in the reaction and the new species produced. These species may be **ions** [for example $\text{Ag}^+(\text{aq})$], **molecules** [for example $\text{NH}_3(\text{g})$, $\text{NH}_3(\text{aq})$, $\text{CH}_3\text{COOH}(\text{l})$, $\text{CH}_3\text{COOH}(\text{aq})$] or **solids** [for example $\text{BaSO}_4(\text{s})$, $\text{Cu}(\text{s})$, $\text{Na}_2\text{CO}_3(\text{s})$].

Answer ALL questions in Part 1 on the Separate Multiple Choice Answer Sheet provided, using a 2B pencil. This part carries 60 marks (30% of the total — 2 marks for each question).

1. Which of the following elements is the most electronegative?
 - (a) Na
 - (b) S
 - (c) Cl
 - (d) Br

2. Element X has the electron configuration $1s^2 2s^2 2p^2$ and element Y has the electron configuration $1s^2 2s^2 2p^5$. What is the most likely formula of a compound formed between X and Y?
 - (a) X_2Y_5
 - (b) X_5Y_2
 - (c) X_4Y
 - (d) XY_4

3. Substance Z is a white crystalline solid that melts at 81°C . Z does not conduct electricity in either the solid or the liquid state.

Which of the following is most likely to be the structure of Z?

 - (a) Ionic.
 - (b) Covalent network.
 - (c) Covalent molecular.
 - (d) Metallic.

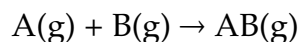
4. Which one of the following substances has linear molecules?
 - (a) H_2O
 - (b) NH_3
 - (c) CO_2
 - (d) SO_2

5. The first four successive ionisation energies for element X are $0.637 \text{ MJ mol}^{-1}$ 1.24 MJ mol^{-1} 2.40 MJ mol^{-1} 7.10 MJ mol^{-1}

Which of the following formulae is most likely for the chloride of element X?

 - (a) XCl
 - (b) XCl_2
 - (c) XCl_3
 - (d) X_2Cl_3

6. Which of the following statements best describes why metals conduct electricity?
- (a) A metal atom has only one electron in its valence shell and this is easily removed.
 - (b) Metal atoms are not tightly bonded one to another.
 - (c) The nuclei of metal atoms are arranged in a three dimensional network.
 - (d) The valence electrons in metals are delocalised.
7. Which of the following best explains the polarity of carbon dioxide?
- (a) The CO₂ molecule is non-polar because, although the carbon/oxygen bond is polar, the molecule is linear.
 - (b) The CO₂ molecule is non-polar because the valence electrons in the molecule are distributed evenly over the volume of the molecule.
 - (c) The CO₂ molecule is polar because O is more electronegative than C.
 - (d) The CO₂ molecule is polar because the molecule is bent (or V-shaped).
8. Below is the potential energy diagram for the reaction:

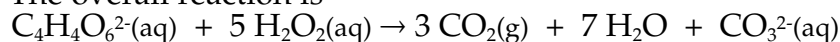


Which one of the following statements is **TRUE**?

- (a) ΔH for this reaction is 20 kJ.
- (b) ΔH for this reaction is -20 kJ.
- (c) ΔH for this reaction is -30 kJ.
- (d) The activation energy for this reaction is 20 kJ.

9. Which one of the following substances would yield a ketone when treated with a solution containing sodium dichromate and sulfuric acid?
- 1-Propanol
 - 2-Propanol
 - 2-Methyl-2-Propanol
 - Propanal
10. Which one of the following at 25°C is a good conductor of electricity?
- 1,2-dichloroethane (ethylene Dichloride), $\text{ClCH}_2\text{CH}_2\text{Cl}_{(l)}$
 - sodium trichloroethanoate (sodium trichloroacetate), $\text{CCl}_3\text{CO}_2\text{Na}_{(s)}$
 - a water solution of sodium trichloroethanoate
 - tellurium(II) chloride, $\text{TeCl}_{2(s)}$
11. A white crystalline solid dissolves in both dilute hydrochloric acid and dilute sodium hydroxide solution. Which one of the following could it be?
- calcium carbonate
 - hydrogen chloride
 - aluminium oxide
 - copper (II) oxide.
12. Which of the following **best** describes a condition which is necessary for the following reaction to be at equilibrium?
- $$\text{CH}_4(g) + \text{H}_2\text{O}(g) \rightleftharpoons \text{CO}(g) + 3 \text{H}_2(g)$$
- All species are present in equal concentrations.
 - The concentrations of $\text{CH}_4(g)$, $\text{H}_2\text{O}(g)$ and $\text{CO}(g)$ are equal.
 - The pressure in the reaction vessel remains constant.
 - The ratio is equal to 1.
13. In the laboratory under the heading 'Effect of catalysts on reaction rate' you may have carried out the following experiment.
- Some hydrogen peroxide solution is added to sodium potassium tartrate solution: there is no evidence of reaction.
 - The mixture is then heated to 65°C: there is still no evidence of reaction.
 - A few drops of cobalt chloride solution are then added: the red colour of the cobalt changes to blue; the reaction mixture bubbles violently and the temperature rises rapidly; and after a few seconds the bubbles stop forming and the red colour returns.

The overall reaction is



Which one of the following reaction profiles is consistent with the experiment?

14. In 50.0 mL of solution, silver metal and mercury(II) ion have reacted and established equilibrium according to the equation



At equilibrium, the concentration of mercury(II) ion is $0.00020 \text{ mol L}^{-1}$ and the concentration of silver ion is 0.10 mol L^{-1} . [Solid silver and liquid mercury are also present.] Water is added to the solution so that the volume increases to 100.0 mL, and the mixture is then shaken. What is the new equilibrium concentration of mercury(II) ion?

- (a) less than $0.00010 \text{ mol L}^{-1}$
- (b) $0.00010 \text{ mol L}^{-1}$
- (c) between 0.00010 and $0.00020 \text{ mol L}^{-1}$
- (d) $0.00020 \text{ mol L}^{-1}$

CHEMISTRY

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15. What is the pH of $1.0 \times 10^{-3} \text{ mol L}^{-1}$ acetic acid (ethanoic acid)?
- (a) below 3
 - (b) Exactly 3
 - (c) Between 3 and 7
 - (d) Exactly 7
16. Which one of the following conversions does **not** involve oxidation **or** reduction?
- (a) $\text{K}_2\text{Cr}_2\text{O}_7 \rightarrow \text{K}_2\text{CrO}_4$
 - (b) $\text{K}_2\text{S}_2\text{O}_8 \rightarrow \text{K}_2\text{SO}_4$
 - (c) $\text{K}_4\text{Fe}(\text{CN})_6 \rightarrow \text{K}_3\text{Fe}(\text{CN})_6$
 - (d) $\text{K}_2\text{C}_2\text{O}_4 \rightarrow \text{K}_2\text{CO}_3$
17. In which one of the following can geometric (*cis/trans*) isomerism occur?
18. A drop of water is added to a litre of pure liquid acetic acid (ethanoic acid) and the mixture shaken. Which of the following statements **best** describes the resulting solution?
- (a) It is a concentrated solution of a strong acid.
 - (b) It is a dilute solution of a strong acid.
 - (c) It is a concentrated solution of a weak acid.
 - (d) It is a dilute solution of a weak acid.
19. In which one of the following processes is water acting as a base?
- (a) $\text{HNO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{NO}_3^-$
 - (b) $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{g})$
 - (c) $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{NH}_4^+ + \text{OH}^-$
 - (d) $\text{NaCl}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$

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20. A dilute solution of lead nitrate is to be stored in a metal container. Which one of the following metals could be used?
- (a) aluminium
 - (b) copper
 - (c) iron
 - (d) nickel
21. A solution containing both copper(II) chloride and zinc chloride is made so that the concentration of each salt is 1 mol L^{-1} . What is the first product formed at the cathode when the solution is electrolysed using platinum electrodes?
- (a) chlorine
 - (b) copper
 - (c) hydrogen
 - (d) oxygen
22. Which one of the following statements is true about this sequence of oxides of period three elements?
- $\text{Na}_2\text{O} \quad \text{Al}_2\text{O}_3 \quad \text{SO}_3$
- (a) The boiling points increase.
 - (b) The colour intensifies.
 - (c) The oxides become increasingly acidic.
 - (d) The molecular weights increase.
23. A colourless liquid is known to be one of the following: a primary alcohol, a secondary alcohol, a tertiary alcohol, a ketone, or a carboxylic acid. When a sample of the liquid is shaken with a water-solution containing both potassium dichromate and sulfuric acid the orange colour of the solution changes to green. What can be concluded about the liquid?
- (a) It could be a primary alcohol or a secondary alcohol.
 - (b) It could be a tertiary alcohol only.
 - (c) It could be a tertiary alcohol or a ketone.
 - (d) It could be a tertiary alcohol, a ketone or a carboxylic acid.

24. What is the systematic name for the following?

- (a) 3-methylpentanoic acid
- (b) 3-ethylbutanoic acid
- (c) 2-ethylhexanoic acid
- (d) 3-ethylhexanoic acid

25. Examine this section of the structure of an addition polymer.

Which one of the following compounds could polymerise to form this chain?

26. Which one of the following is a soap?

27. Which one of the following slows down the corrosion of a small strip of iron?
- (a) Placing the iron under stress.
 - (b) Attaching a length of zinc to the iron.
 - (c) Attaching a length of copper to the iron.
 - (d) Attaching a length of tin to the iron.
28. You should always take any exhausted dry cells (Leclanché cells) out of an appliance because of the risk that the cells will leak. Why are these dry cells likely to leak?
- (a) The ammonia reaction product formed during the operation of the dry cell is a gas which raises the pressure inside the zinc casing and causes it to burst.
 - (b) The ammonium ion in the electrolyte of the dry cell is a weak acid and eventually dissolves the zinc casing of the cell.
 - (c) The ammonium ion in the electrolyte of the dry cell is a weak acid which reacts with the zinc to produce hydrogen gas which raises the pressure inside the casing and causes it to burst.
 - (d) The manganese dioxide oxidising agent in the dry cell will eventually come in contact with the zinc casing and corrode it.
29. Sodium carbonate can be prepared industrially by the following sequence of steps.
- Limestone is heated: $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
- The CO_2 is passed into a solution of ammonia and concentrated sodium chloride:
- $$\text{CO}_2 + \text{H}_2\text{O} + \text{NH}_3 + \text{Na}^+ \rightarrow \text{NH}_4^+ + \text{NaHCO}_3$$
- The washed, filtered and dried NaHCO_3 is heated:
- $$2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$$
- In a single run, how much sodium carbonate can be prepared from a sample of limestone containing 1 mol of calcium carbonate?
- (a) $\frac{1}{2}$ mol
 - (b) 1 mol
 - (c) $1\frac{1}{2}$ mol
 - (d) 2 mol
30. Which of the following best conducts electricity at 25°C?
- (a) $\text{H}_2\text{O}(l)$
 - (b) A water solution of NaCl
 - (c) $\text{NaCl}(s)$
 - (d) A water solution of $\text{CH}_3\text{CH}_2\text{OH}$

END OF PART 1

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- A 5.00 L sample of this waste water is evaporated to about 200 mL and sufficient barium nitrate solution is added to precipitate all the sulfate ion. The precipitate is washed with distilled water, filtered and dried. The mass of the precipitate is found to be 1.70 g.

- (a) Determine the concentration in mg L^{-1} of magnesium sulfate in the waste water. [4 marks]
- (b) What mass of washing soda, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, would need to be added to 100.0 L of the waste water to precipitate all the magnesium ion? [4 marks]

[illegible]