Carmel School

Semester 1 Examination, 2013

Question/Answer Booklet

CHEMISTRY 3A

Student Name: _____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Answer Sheet
Chemistry Data Sheet

To be provided by the candidate

Standard items: pens, pencils, eraser, correction fluid, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set out by the Curriculum Council for this course

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.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Multiple-choice	25	25	50	50	25
Section Two: Short answer	12	12	60	70	35
Section Three: Extended answer	6	6	70	80	40
					100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the Student *Diary 2013.* Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Sections Two and Three: Write answers in this Question/Answer Booklet.

3. When calculating numerical answers, show your working or reasoning clearly unless instructed otherwise.

4. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

5. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Section One: Multiple-choice **25% (50 Marks)**

This section has **25** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time for this section is 50 minutes.

---

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 2, 4 and element Y has the electron configuration 2, 7. What is the most likely formula of a compound formed between X and Y?

   (a) X_2Y_5
   (b) X_4Y
   (c) XY_4
   (d) X_4Y_7

3. Substance Z is a white crystalline solid that melts at 81^{o}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) Metallic.
   (d) Covalent molecular.

4. Which one of the following substances has linear molecules?

   (a) H_2O
   (b) NH_3
   (c) CO_2
   (d) SO_2

5. Which of the following has the greatest solubility in water?

   (a) $BaSO_4$
   (b) CH_4
   (c) NH_3
   (d) $Ca(OH)_2$

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. An element Z has the following five successive ionization energies (in kJ Mol^{-1})

740 1500 7700 10500 13600

What would be the formula of the compound formed when Z reacts with oxygen?

(a) Z_2O
(b) ZO
(c) Z_2O_3
(d) ZO_2

8. The equation below shows carbon and hydrogen reacting to form methane.

$C(s) + 2H_2(g) \leftrightarrow CH_4(g) + 75\ kJ$

If the reaction has reached equilibrium, how could you increase the yield of methane?

(a) Decrease the temperature.
(b) Decrease the pressure.
(c) Add a suitable catalyst.
(d) Both (a) and (c) above.

9. Which one of the following is **not correct** about acids?

(a) Acids are proton donors.
(b) Acids contain H^+ (aq) and not OH^- (aq).
(c) Weak acids are only partially ionized.
(d) Acids conduct electricity.

10. The chemical properties of an atom are mainly influenced by which one of the following?

(a) mass of the nucleus
(b) number of electrons in the valence shell
(c) number of neutrons in the nucleus
(d) combined number of protons and electrons

11. Covalent bonds are most commonly found between which one of the following pairs of substances?

(a) gaseous and solid elements.
(b) two elements with low first ionization energies.
(c) two elements with a large difference in first ionization energies.
(d) two elements with similar but relatively high first ionization energies.

12. Which one of the following best explains the effect of a catalyst on a system at equilibrium?

(a) It speeds up the rate of the forward reaction only.
(b) It speeds up the rate of the reverse reaction only.
(c) It speeds up the rate of both the forward and the reverse reactions.
(d) It lowers the activation energy for the forward reaction but not for the reverse.

13. Which one of the following is a concentrated solution of a weak acid?

(a) 0.001 mol L^{-1} HCl
(b) 10 mol L^{-1} HCl
(c) 0.001 mol L^{-1} H_3PO_4
(d) 10 mol L^{-1} H_3PO_4

14. Which one of the following mixtures of salts could be made into a single water solution containing 0.01 mol L^{-1} of all three compounds?

(a) KCl, $Ba(NO_3)_2$, $AgNO_3$
(b) NaOH, $FeCl_3$, NH_4NO_3
(c) NH_4Cl, $FeSO_4$, $Cu(NO_3)_2$
(d) $BaCl_2$, $Fe(NO_3)_3$, $CuSO_4$

15. Which one of the following statements is true about a chemical system at equilibrium?

(a) There will be constant macroscopic properties
(b) The amount of the reactants will be equal to the amount of the products
(c) The concentration of the reactants will be equal to the concentration of the products
(d) Activity will cease at the molecular level

16. Sodium carbonate can be prepared industrially by the following sequence of steps.

Limestone is heated: $CaCO_3 \rightarrow CaO + CO_2$

The CO_2 is passed into a solution of ammonia and concentrated sodium chloride:

$$CO_2 + H_2O + NH_3 + NaCl \rightarrow NH_4Cl + NaHCO_3$$

The washed, filtered and dried $NaHCO_3$ is heated:

$$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$$

How much sodium carbonate can be prepared in a single run starting from 1 mol of limestone?

(a) 0.5 mol
(b) 1 mol
(c) 1.5 mol
(d) 2 mol

17. The equilibrium constant, k, for the reaction,

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$, is equal to 2×10^{81} at 25 ^oC.

This value suggests that

(a) this reaction favours the forward reaction slightly more than the reverse reaction.
(b) this reaction favours the reverse reaction slightly more than the forward reaction.
(c) this reaction virtually goes to completion with little reversal.
(d) this reaction virtually does not proceed forward and largely favours the reactants.

18. In an experiment, 2 g of magnesium shavings dissolve in 500 mL of 2 mol L^{-1} hydrochloric acid with the production of considerable quantities of heat. Which one of the following actions will **NOT** increase the initial rate of production of hydrogen?

(a) Using the same mass of magnesium but using larger pieces of the metal.
(b) Heating the reaction mixture.
(c) Using 500 mL of 5 mol L^{-1} acid instead of 500 mL of 2 mol L^{-1} acid.
(d) Using 10 g of the original magnesium shavings instead of 2 g.

19. For the reaction, $HF(aq) + H_2O(l) \rightarrow H_3O^+(aq) + F^-(aq)$, the conjugate base of HF is

(a) H_2O
(b) H_3O^+
(c) F^-
(d) OH^-

20. In which of the following is there no covalent bond?

(a) diamond
(b) sodium fluoride
(c) sodium sulphate
(d) sulfur dioxide

21. Which of the following **best** explains why water has a lower boiling point than sodium chloride?

(a) the bonding in water is weaker than the bonding in sodium chloride
(b) the covalent bonds in water are weaker than the ionic bonds in sodium chloride
(c) the intermolecular forces between water molecules are weaker than the ionic bonds in sodium chloride
(d) the molecular weight of water is lower than the molecular weight of sodium chloride

22. A stock solution contains 1.00 g L^{-1} copper (as Cu^{2+}). What volume of this solution must be diluted to 50.0 mL to give a solution containing 5.00 mg L^{-1} copper?

(a) 0.100 mL
(b) 0.250 mL
(c) 1.00 mL
(d) 2.50 mL

23. Which one of the following statements about trends in the elements of Periodic Group IV is **false**?

(a) bonding in the elements tends to change from covalent to metallic going down the group
(b) electrical conductivity in the elements tends to rise going down the group
(c) the melting point of the chlorides of the elements tends to fall going down the group
(d) the oxides of the elements tend to become more basic going down the group

24. Which one of the following species acts as an acid when ammonia gas is passed into a water solution of sodium chloride?

(a) Cl^-
(b) H_2O
(c) Na^+
(d) NH_3

25. At 500^0C sulfur vapour reacts with hydrogen gas as follows:

$$S_8(g) + 8\ H_2(g) \rightarrow 8\ H_2S(g)$$

When 1.0 L of sulfur vapour (at 500^0C and 100 k Pa) reacts with excess hydrogen gas what volume of hydrogen sulphide (measured at 500^0C and 100 k Pa) is produced?

(a) 1.0 L
(b) 8.0 L
(c) 9.0 L
(d) 17.0 L

End of Section One

Section Two: Short answer **35% (70 Marks)**

This section has **12** questions. Answer **all** questions. Write your answers in the space provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time for this section is 60 minutes.

Question 26 **(2 marks)**

Write the equilibrium constant expression for each of the following.

Equation	$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$
Equilibrium constant expression	

(1 mark)

Equation	$CO_2(g) + H_2O(l) \rightleftharpoons H^+(aq) + HCO_3^-(aq)$
Equilibrium constant expression	

(1 mark)

Question 27 **(4 marks)**

Write the equation for the reaction that occurs in each of the following procedures. If no reaction occurs, write 'no reaction'. 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 $Ag^+(aq)$], molecules [for example $NH_3(g)$, $NH_3(aq)$, $CH_3COOH(\ell)$] or solids [for example $BaSO_4(s)$, $Cu(s)$, $Na_2CO_3(s)$].

(a) Ammonia gas is bubbled through ethanoic acid solution. (2 marks)

Equation: _____

(b) Ammonium carbonate solution is added to potassium sulfate solution. (2 marks)

Equation: _____

Question 28 **(8 marks)**

Oxides of sulfur and nitrogen are major pollutants that contribute to the formation of acid rain in industrialised countries.

(a) State whether sulfur has a high, an intermediate, or a low electronegativity.

_____

(1 mark)

(b) Draw an electron dot diagram to show the bonding and shape of a molecule of SO_2.

(2 marks)

(c) On the diagram that you have drawn above, show the polarity of one bond, using the appropriate convention.

(1 mark)

(d) State why the bond between S and O is polar.

_____

_____

_____

_____

(2 marks)

(e) State why the molecule is polar.

_____

_____

_____

_____

(2 marks)

Question 29 **(10 marks)**

(a) Ancient coins often contain copper and silver, however, modern coins are made of many different metals including nickel and magnesium.

Write the electron configuration of magnesium.

_____

(1 mark)

Why would it be unlikely to find magnesium in ancient coins?

_____

_____

_____

_____

_____

(2 marks)

(b) Green spots on ancient coins contain the corrosion product copper(II) ethanoate.

Write the formula of copper(II) ethanoate.

_____

(1 mark)

(c) The ancient Romans discovered that copper coins dipped in molten silver chloride became coated with silver.

Write an equation for this reaction.

_____

(2 marks)

(d) The only cleaning agents recommended for use on ancient coins are soapy water or CF_3CCl_3 (1,1,1-Trichlorotrifluoroethane), which is a non-polar solvent.

Explain why CF_3CCl_3 would be used to remove grease from coins rather than plain water.

_____

_____

_____

_____

_____

_____

_____

(4 marks)

Question 30 **(10 marks)**

Chemical reactions can be used to provide portable sources of heat.

(a) A self-heating drink container has been designed so that the energy released by the reaction of solid CaO and water in one chamber of the container heats a drink in another chamber of the container.

State the name used to describe any reaction that causes an increase in temperature.

_____

(1 mark)

(b) Write an equation for the reaction of CaO and water.

_____

(2 marks)

Calcium oxide or quicklime as it is known has many other uses, for example making cement or plaster. It is made by the decomposition of calcium carbonate.

(c) Write a reaction for the production of quicklime from calcium carbonate.

_____

(2 marks)

Calcium oxide is also an important material in the manufacture of chemicals, for example calcium carbide, CaC_2.

$$2\ CaO(s) + 5\ C(s) \longrightarrow 2\ CaC_2(s) + CO_2(g)$$

Calcium carbide reacts with water, releasing acetylene, C_2H_2.

$$CaC_2(s) + 2\ H_2O(l) \longrightarrow C_2H_2(g) + Ca(OH)_2(aq)$$

Acetylene is an important fuel for welding and is also a starting material for a range of organic compounds, including vinyl chloride, neoprene, and acrylonitrile, all of which are raw materials for polymers.

(d) If 500 g of calcium oxide is used to make acetylene via the two equations shown above, what mass of acetylene will be produced if the process is only 85% efficient?

_____

_____

_____

_____

_____

_____

_____

_____

(5 marks)

Question 31 **(4 marks)**

Using the information in the table, identify the substances A, B, C, and D from the following list.

barium sulphate	candle wax	aluminium
potassium nitrate	sucrose	sulphur
carbon (graphite)	copper(II) oxide	wood

Sub-stance	Electrical conductivity			Solubility in water	Colour of solid	Name of substance
	Solid	Liquid	Water solution			
A	nil	nil	nil	insoluble	white	
B	conducts	conducts	-	insoluble	silver	
C	nil	conducts	-	insoluble	black	
D	nil	conducts	conducts	soluble	white	

Question 32 **(4 marks)**

Write observations for any reactions that occur in the following procedures. In each case describe in full what you would observe, including any

- colours
- odours
- precipitates (give the colour)
- gases evolved (give the colour or describe as colourless).

If no change is observed, you should state this.

(a) a piece of zinc is added to a solution of copper(II) sulfate. (2 marks)

Observation:_____

_____

_____

_____

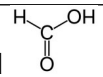
(b) a piece of magnesium is burned in air. (2 marks)

Observation:_____

_____

Question 33 **(8 marks)**

Complete the following table.

Molecule	Major type of intermolecular attraction	Boiling point ranking (1 = highest, 4 = lowest)
methanoic acid 		
methanol 		
methane		
fluoro-methane 		

Question 34 **(4 marks)**

Large amounts of atmospheric carbon dioxide, $CO_2(g)$, dissolve in the Earth's oceans and form $CO_2(aq)$, as shown in Equation 1 below:

Equation 1: $CO_2(g) + aq \leftrightarrow CO_2(aq)$

(i) State the effect that an increase in the concentration of $CO_2(g)$ has on the concentration of $CO_2(aq)$. Explain your answer with reference to Le Châtelier's principle.

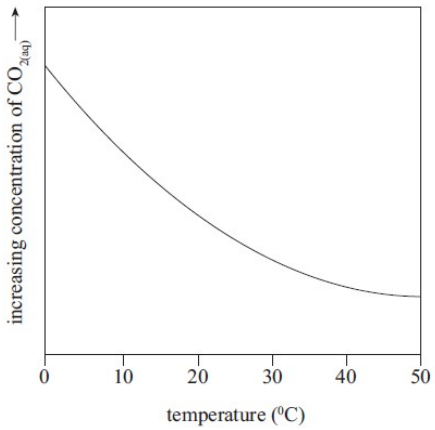
_____

_____

_____

(2 marks)

(ii) The effect of temperature on the concentration of $CO_2(aq)$ in sea water is shown in the graph below:



Using the graph above, state and explain whether the dissolving of carbon dioxide in water, as shown in Equation 1, is an exothermic reaction or an endothermic reaction.

_____

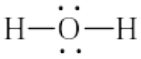
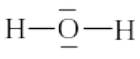
_____

_____

(2 marks)

Question 35 **(6 marks)**

For each species listed in the table below, draw the structural formula, representing all valence shell electron pairs either as **:** or as — **and** state or draw the shape of the molecule or ion.

(for example, water  or  or  bent

Species	Structural formula (showing all valence shell electrons)	Shape (sketch or name)	Polarity
Carbonate ion			
Methanol (CH_3OH)			

Question 36 **(4 marks)**

Use the Bronsted-Lowry theory to write equations to illustrate the following reactions in water:

a) HCO_3^- acting as a base

_____

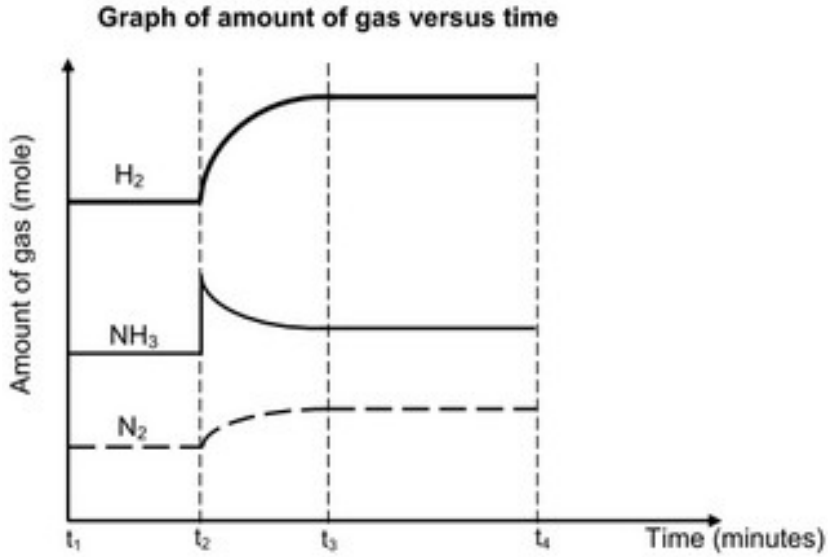
b) HSO_4^- acting as an acid

_____

Question 37 **(6 marks)**

Below is a graph showing the progress of the production of ammonia by the following reaction:

$$3\ H_2(g) + N_2(g) \longrightarrow 2\ NH_3(g) + \text{Heat}$$



(a) Describe the change that occurred at time t_2 on the graph and explain why you have come to this conclusion.

(2 marks)

(b) What has happened at time t_3?

(1 mark)

(c) At time t_4 hydrogen is removed from the system suddenly. On the graph show what will take place.

(3 marks)

End of Section Two

Section Three: Extended answer **40% (80 Marks)**

This section contains **six (6)** questions. You must answer **all** questions. Write your answers in the space provided.

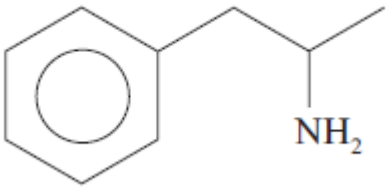
Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time for this section is 70 minutes.

Question 38 **(9 marks)**

Amphetamine is a chemical that stimulates the human nervous system. The structural formula of amphetamine is shown below:



(a) Amphetamine has a low solubility in water and is usually taken in the form of a salt.

(i) Using the structural formula above, explain why amphetamine has a low solubility in water.

(2 marks)

(i) Amphetamine is converted into a salt by reaction with an acid solution. With reference to the structural formula above, explain how amphetamine reacts with an acid solution

(2 marks)

(b) Lithium carbonate, Li_2CO_3, is commonly used in tablet form as a mood stabiliser. The tablets release Li^+ into the aqueous body fluid. One commonly prescribed tablet contains 0.25 g of Li_2CO_3.

(i) Calculate the number of moles of Li+ in one tablet.

(2 marks)

(ii) The volume of aqueous body fluid in an average adult is approximately 42 L. Calculate the average concentration of Li+, in mmol L-1, in the aqueous body fluid of an adult who has taken four tablets.

(3 marks)

Question 39 **(15 marks)**

The production of zinc occurs in the steps listed below:

Step 1 Roasting of the mineral zinc sulfide in air.

Step 2 Production of sulfuric acid.

Step 3 Conversion of zinc oxide into zinc sulfate solution.

Step 4 Purification of zinc sulfate solution.

Step 5 Reduction of zinc sulfate solution.

(a) In Step 1 the roasting of the mineral zinc sulfide in air produces zinc oxide and sulfur dioxide gas, SO_2.

Write an equation for this reaction.

(2 marks)

(b) If 2 tons (2000 kg) of zinc sulfide ore is roasted, what volume of sulfur dioxide gas is produced if the reaction occurs at 320 ^{o}C and 150 kPa.

(4 marks)

(c) In Step 2 the SO_2 produced is used to make sulfuric acid. The first stage in the production of sulfuric acid is shown by the equation below:

$$2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g) \quad \Delta H = -198 \text{ kJ}$$

(i) Write a *K* expression for this reaction.

(1 mark)

(ii) State whether the reaction is exothermic or endothermic.

(1 mark)

(iii) State and explain the effect on the value of *K* of increasing the temperature.

(3 marks)

(d) In Step 3 zinc oxide reacts with sulfuric acid to produce zinc sulfate solution. Write an equation for this reaction.

(2 marks)

(e) In Step 4 metal ions that contaminate the zinc sulfate solution are removed by the addition of zinc powder. Circle one ion, of those shown below, that will be removed by the addition of zinc powder.

Hg^{+} Pb^{2+} Mg^{2+}

(1 mark)

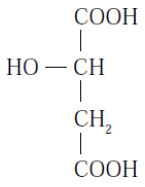
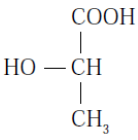
(f) In Step 5 zinc sulfate solution is reduced to zinc using electrolysis.

State how the use of electrolysis suggests that the production of zinc from zinc sulfate is a non-spontaneous reaction.

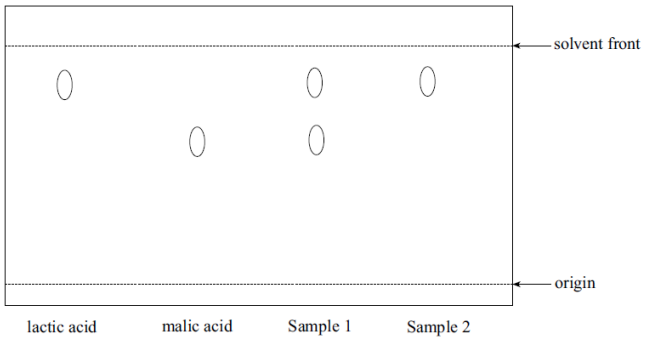
(1 mark)

Question 40 **(15 marks)**

Carboxylic acids contribute to the characteristic taste of wines. The structural formulae of two carboxylic acids found in wines are shown in the table below:

Malic acid	Lactic acid
	

A process known as malo-lactic fermentation occurs in some wines. During this process malic acid is converted into lactic acid.
The amount of malo-lactic fermentation in one wine over a period of time was analysed by Chromatography. The wine placed on the chromatography paper and a solvent is allowed to travel up the paper. The various constituents of the wine travel at different speeds, causing them to separate.
The following two samples of the wine were spotted onto the chromatography paper:
Sample 1 — no malo-lactic fermentation had occurred in the wine.
Sample 2 — malo-lactic fermentation had occurred.
Reference samples of lactic acid and malic acid were also spotted onto the paper.
The chromatography obtained is shown below:



(a) Suggest a reason why malic acid moved a shorter distance than lactic acid.

(1 mark)

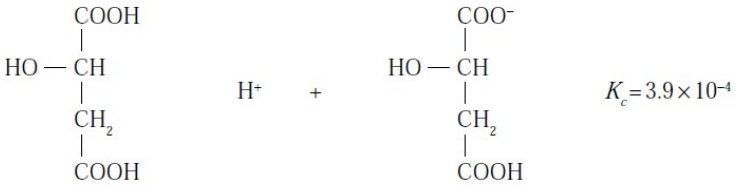
(b) Explain how the chromatogram indicates that malo-lactic fermentation has occurred in Sample 2.

(2 marks)

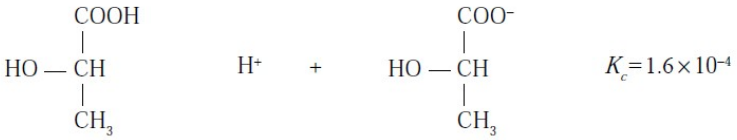
(c)What type of intermolecular forces is the solvent likely to have? Explain your answer fully.

(3 marks)

(d) Malic acid and lactic acid ionise in water, as shown in the equations below:



malic acid



lactic acid

State which is the stronger acid and use the information above, explain why malo-lactic fermentation causes wine to become less acidic.

(2 marks)

(e) Lactic acid is neutralised by addition of sodium hydroxide. Jaimie is trying to determine the amount of lactic acid in a sample of wine. If she has a solution of 500.0 mL containing an unknown amount of lactic acid and adds 20.0 mL of 0.01 mol L^{-1} NaOH which is an excess, she then has to add 3.78 mL of 0.01 mol L^{-1} HCl to neutralise the excess NaOH. What is the concentration of lactic acid present in the wine sample? (7 marks)

Question 41 **(16 marks)**

Hydrobromic acid is a strong acid made by the reaction of bromine and formic acid. Look at the table for a set of data from an experiment performed between bromine and formic acid in a research laboratory.

$$Br_2(aq)+HCOOH(aq) \rightarrow 2Br^-(aq)+2H^+(aq)+CO_2\ (g)$$

Reading	Concentration of bromine (mol L^{-1})	Time (s)
1	0.1	0
2	0.07	0.75
3	0.05	1.75
4	0.035	2.49
5	.02	3.48
6	0.01	5
7	0.005	6.2
8	0.001	7.5

a) Plot a graph of the concentration of bromine against time.

(4 marks)

(b) Name the independent and dependent variables in this experiment. (2 marks)

Independent _____

Dependent _____

(c) Name **two** variables that must be kept constant during this experiment. (2 marks)

(d) What is the relationship between the concentration of bromine and the reaction rate? (1 mark)

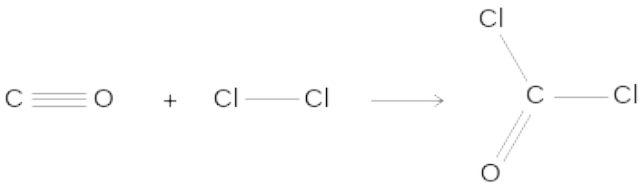
(e) Provide an explanation for your answer to question (d) (2 marks)

(f) “Hydrobromic acid is a strong acid.” Explain what this statement means. (2 marks)

(g) Name another factor that could cause an increase in the reaction rate. Explain your answer. (3 marks)

Question 42 **(12 marks)**

Chemical and biological weapons like sarin or anthrax are frequently in the news these days. Phosgene is a toxic gas that was used as a chemical weapon in World War I. It is used these days to make plastics and pesticides. The equation for its production is shown below:



Phosgene

(a) If 500 kg of phosgene is being produced, what volume of chlorine and carbon monoxide would be required if the temperature is 150^{o}C and the pressure is 108.6 kPa?

(4 marks)

(b) The poison phosgene ($COCl_2$) can be neutralized with sodium hydroxide (NaOH) to produce salt (NaCl), water and carbon dioxide by the reaction:

$COCl_2 + 2\ NaOH \rightarrow 2\ NaCl + H_2O + CO_2$

If 9.5 grams of phosgene and 9.5 grams of sodium hydroxide are reacted:

(i) will all of the phosgene be neutralized?
(ii) If so, how much sodium hydroxide remains? If not, how much phosgene remains?

(8 marks)

Question 43 **(13 marks)**

Explain the following data:

Boiling points (°C)

Group IV Hydrides		**Group VII Hydrides**	
CH_4	-162	HF	20
SiH_4	-111	HCℓ	-85
GeH_4	-88	HBr	-67
SnH_4	-52	HI	-35
PbH_4	-13		

Your answer should be approximately one to two pages in length.

End of questions

Additional working space