Insert school header here

Year 12 Semester Two Examination, 2008

Question/Answer Booklet

CHEMISTRY

Student Name/Number:	

Part	**Mark**
1	/60
2	/70
3	/50
4	/20
Total	/200
	%

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 Paper
Separate Multiple Choice Answer Sheet
Chemistry Data Sheet

To be provided by the candidate

Standard Items: Pens, pencils, eraser or correction fluid, ruler, highlighter
Special Items: A blue or black pen or a B or 2B or HB pencil for the separate Multiple Choice Answer Sheet and Calculators satisfying the conditions set by the Curriculum Council for this subject.

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.

SEE NEXT PAGE

Structure of this paper

Part	Number of questions available	Number of questions to be attempted	Suggested working time (minutes)	Marks available
1 Multiple-Choice	30	30	55	60
2 Short Answers	10	10	60	70
3 Calculations	5	5	45	50
4 Extended Answers	1	1	20	20
			Total marks	200

Instructions to candidates

1. Answer the questions according to the following instructions:

   Part 1 Answer **all** questions on the separate Multiple-Choice Answer Sheet. Use a blue or black pen 2B or B pencil.

   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.

   Parts 2, 3 and 4 Write your answers in the spaces provided in this Question/Answer Booklet. A blue or black ball point or ink pen should be used.

   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.

2. It is recommended that you spend your reading time mainly reading the Instructions to candidates and Parts 2, 3 and 4.

3. At the end of the examination make sure that your name is on your Question/Answer Booklet and on your separate Multiple-Choice Answer Sheet.

4. **Chemical Equations**
   For full marks, chemical equations should refer only to those specific 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)*, CH_3COOH*(ℓ)*, CH_3COOH*(aq)*] or **solids** [for example $BaSO_4$*(s)*, Cu*(s)*, Na_2CO_3*(s)*].

PART 1 (60 marks)

Answer ALL questions in Part 1 on the separate Multiple Choice Answer Sheet provided, using a blue or black pen or a 2B or B pencil. Each question in this part is worth 2 marks.

---

1. Which of the following species does not contain any atoms with a full outer shell of eight electrons?

   (a) O_2

   (b) $BeCl_2$

   (c) BH_3

   (d) Ne

2. What type of compound is the molecule $CH_3CHOHCH_2CH_3$?

   (a) Tertiary alcohol

   (b) Secondary alcohol

   (c) Ketone

   (d) Ester

3. Which of the following substances does not demonstrate geometric (*cis/trans*) isomerism?

   (a) 2-butene

   (b) 2-pentene

   (c) 1,3-dichloropropene

   (d) 1-chloro-2-methylpropene

4. The $[Au(CN)_2]^-$ ion is produced during the extraction of gold. What is the oxidation number of gold in this ion?

   (a) +1

   (b) +2

   (c) +3

   (d) –1

SEE NEXT PAGE

5. Potassium dichromate can be used to detect alcohol vapour in the breath of someone who has been drinking. The reaction occurring can be represented as shown below.

$3\ CH_3CH_2OH + 2\ Cr_2O_7^{2-} + 16\ H^+ \rightarrow 4\ Cr^{3+} + 11\ H_2O + 3\ CH_3COOH$

Which of the following statements about this reaction is false?

(a) The observed colour change would be orange to green.

(b) The oxidation state of chromium decreases by 3.

(c) The hydrogen is being reduced in the process.

(d) The reaction would occur more quickly in the presence of dilute acid.

6. Which of the following can be oxidised by acidified potassium permanganate, but not by dilute nitric acid?

(a) Cl_2

(b) Pt

(c) Cu

(d) H_2O

7. Which of the following correctly describes the substances produced at the electrodes during the electrolysis of 1.0 mol L^{-1} sulfuric acid using platinum electrodes?

	Anode	**Cathode**
(a)	oxygen gas	platinum metal
(b)	hydrogen gas	sulfur dioxide gas
(c)	sulfur dioxide gas	oxygen gas
(d)	oxygen gas	hydrogen gas

8. Which of the following 1.0 mol L^{-1} solutions will be most likely to have a pH of 7?

(a) Ammonium ethanoate

(b) Ammonium chloride

(c) Sodium hydrogencarbonate

(d) Aluminium chloride

Questions 9 - 12 relate the following information:

The initial reactions occurring during the corrosion of iron can be considered as an electrochemical cell. The two reactions that occur in the process are given below:

Cathode reaction: $O_2(g) + 2\,H_2O(\ell) + 4e^- \rightarrow 4\,OH^-(aq)$

Anode reaction: $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

9. The overall redox reaction for the process is best shown as:

(a) $O_2(g) + 2\,H_2O(\ell) + Fe(s) \rightarrow 4\,OH^-(aq) + Fe^{2+}(aq)$

(b) $O_2(g) + 2\,H_2O(\ell) + 4\,Fe(s) \rightarrow 4\,OH^-(aq) + 4\,Fe^{2+}(aq)$

(c) $O_2(g) + 2\,H_2O(\ell) + 2\,Fe(s) \rightarrow 2\,Fe(OH)_2(s)$

(d) $O_2(g) + 2\,H_2O(\ell) + 2\,Fe(s) \rightarrow 2\,OH^-(aq) + 2\,Fe^{2+}(aq)$

10. Which of the following statements about the above process is false?

(a) Electrons will flow through the iron to the cathodic regions.

(b) Oxygen is being reduced.

(c) Water is acting as a catalyst in the process.

(d) Hydroxide ions will flow through the water to the anodic regions.

11. The corrosion process can be slowed by applying an external voltage to the iron. Assuming standard conditions, what would be the minimum voltage required to stop the above reactions occurring.

(a) 0.44 V

(b) 0.84 V

(c) 0.04 V

(d) 0.40 V

12. Which of the following metals could be used as a sacrificial anode to reduce the corrosion of the iron?

(a) Copper

(b) Nickel

(c) Zinc

(d) Silver

SEE NEXT PAGE

13. The enthalpy changes for two processes is shown below.

A $H_2O(\ell) \rightarrow H_2O(g)$ $\Delta H = 44 \text{ kJ mol}^{-1}$

B $H_2O(\ell) \rightarrow H_2(g) + \frac{1}{2} O_2(g)$ $\Delta H = 286 \text{ kJ mol}^{-1}$

Which of the following is the best explanation for the differences in the values for the enthalpy changes?

(a) In **B**, double bonds are being formed as oxygen gas is produced.

(b) The hydrogen bonds between water molecules are much weaker than the covalent bonds between oxygen and hydrogen.

(c) In **B**, hydrogen bonds are being broken but in **A**, only dispersion forces have to be overcome to separate the molecules.

(d) There are no attractions between the molecules in **A,** so they can be separated easily.

14. Which of the following is the conjugate acid of the hydrogensulfate ion?

(a) HSO_4^{2-}

(b) HSO_3^-

(c) SO_4^{2-}

(d) H_2SO_4

15. Which of these is the electron configuration of a magnesium **ion**?

(a) $1s^2 2p^6$

(b) $1s^2 2s^2 2p^6$

(c) $1s^2 2s^2 2p^6 3s^2$

(d) $1s^2 2s^2 2p^2$

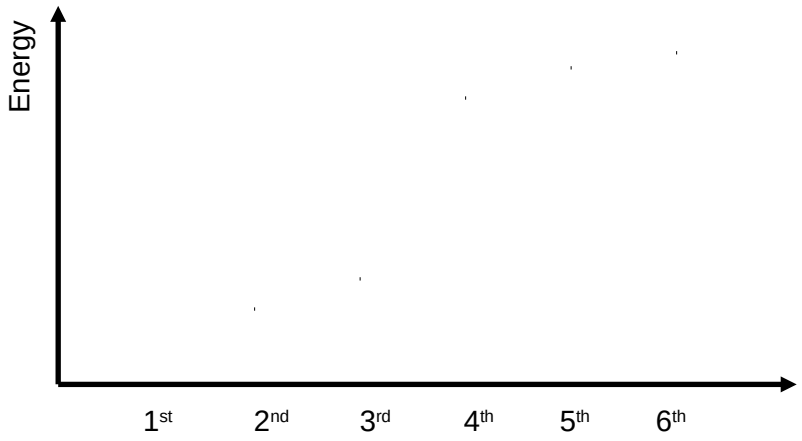
16. What type of bonding will be present in dry ice (solid carbon dioxide)?

(a) Non-polar covalent bonds and dispersion forces.
(b) Polar covalent bonds and dispersion forces.

(c) Polar covalent bonds and dipole-dipole forces.

(d) Covalent bonds within a molecular network.

17. The following graph shows the change in the first six ionisation energies of an element.



The element is most likely to

(a) Al

(b) B

(c) Ca

(d) Si

18. Which of the following molecules is not an isomer of the others?

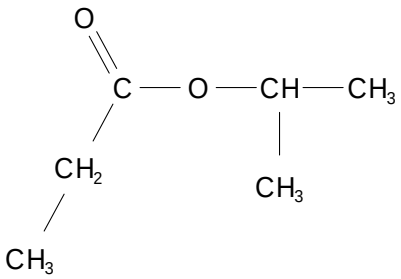
(a) 2-methyl-3-hexene

(b) 1,3-dimethylcyclopentane

(c) 3-ethylpentane

(d) 2,3-dimethyl-1-pentene

19. Which of the pairs of compounds below could be used to make the following molecule?



(a) Propanoic acid and 2-propanol

(b) Propanoic acid and 2-methylpropanol

(c) Ethanoic acid and 2-propanol

(d) Ethanoic acid and 1-propanol

SEE NEXT PAGE

20. What is the concentration, in parts per million of a solution of 1.00×10^{-3} mol L^{-1} NaCl*(aq)*? [M(NaCl) = 58.44 g mol^{-1} and density of solution = 1.00 g mL^{-1}]

(a) 58.4 ppm

(b) 5.84×10^{-2} ppm

(c) 5.84×10^{4} ppm

(d) 0.171 ppm

21. Which of the following species has a different shape to the rest?

(a) SO_3

(b) PCl_3

(c) NH_3

(d) H_3O^+

22. Which of the following correctly explains why silica (SiO_2) is a very hard substance?

(a) Silicon atoms are able to form strong covalent bonds with other silicon atoms.

(b) Silica contains double covalent bonds.

(c) Bonds between silicon atoms and oxygen atoms are highly polar.

(d) Silica has a continuous network structure.

23. Which of the following will have the lowest 1st ionisation energy?

(a) K

(b) C

(c) Li

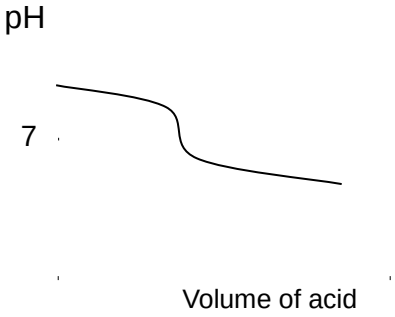
(d) F

Questions 24 - 26 relate the following information:

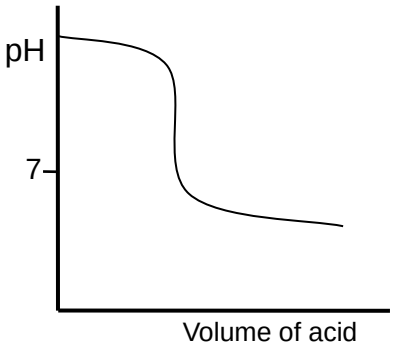
A student was asked to accurately calculate the concentration of a solution of ethanoic acid that had a concentration of approximately 0.4 mol L^{-1}. She placed 20.00 mL of a 0.500 mol L^{-1} solution of sodium hydroxide in a flask and titrated the ethanoic acid against this sodium hydroxide solution, using phenolphthalein as the indicator.

24. If the ethanoic acid was added until in excess, which of the graphs below would show the variation of pH during the titration.

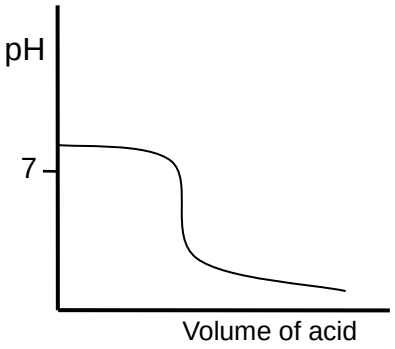
(a)



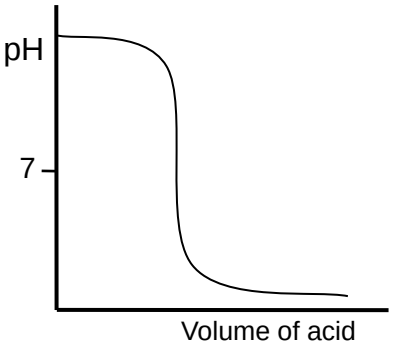
(b)



(c)



(d)



25. What would be the pH in the flask at the start of the titration?

(a) 13.7

(b) 12.7

(c) 14.0

(d) 0.40

26. What approximate volume of ethanoic acid would she expect to have added at the end point of the titration?

(a) 20 mL

(b) 25 mL

(c) 30 mL

SEE NEXT PAGE

(d) 35 mL

Questions 27 - 28 relate the following information:

The overall redox reaction occurring in a dry cell (Leclanché cell) is shown below.

$$Zn(s) + 2\,NH_4^+(aq) + 2\,MnO_2(s) \rightarrow Zn^{2+}(aq) + Mn_2O_3(s) + H_2O(\ell) + 2NH_3(aq)$$

27. Which of the following statements regarding the dry cell are correct?

I The zinc is acting as the anode.
II The oxidation state of manganese drops from +4 to +3.
III Ammonium chloride acts as an electrolyte for the cell.

(a) **I** and **III** only

(b) **I** and **II** only

(c) **II** and **III** only

(d) I, II and **III**

28. Which of the following will not increase the rate of the redox reaction?

(a) Increasing the concentration of ammonium ions.

(b) Grinding up the MnO_2 into a finer powder.

(c) Using more zinc.

(d) Warming up the cell.

29. Sodium hydrogencarbonate decomposes on heating as shown:

$$2\,NaHCO_3(s) \rightleftarrows 2\,Na^+(aq) + CO_3^{2-}(aq) + CO_2(g) + H_2O(\ell)$$

What would be the equilibrium constant (K) expression for the reaction?

(a) $K = \dfrac{[Na^+]^2[CO_3^{2-}][CO_2][H_2O]}{[NaHCO_3]^2}$

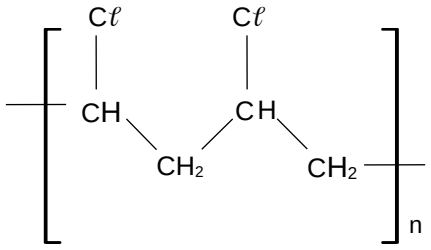
(b) $K = \dfrac{[Na^+][CO_3^{2-}][CO_2]}{[NaHCO_3]}$

(c) $K = [Na^+]^2[CO_3^{2-}][CO_2]$

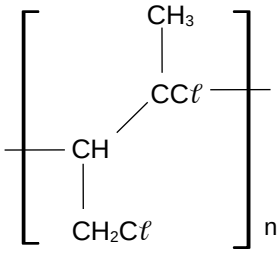
(d) $K = [Na^+]^2[CO_3^{2-}][CO_2][H_2O]$

30. Which one of the following would be made from the polymerisation of 1,3-dichloro-2-butene?

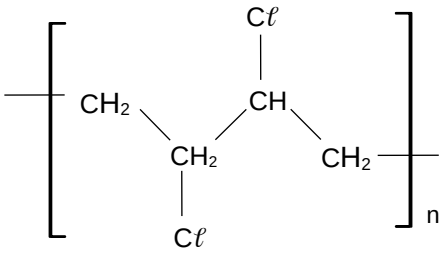
(a)



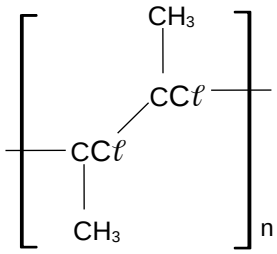
(b)



(c)



(d)



END OF PART 1

PART 2 (70 marks)

Answer ALL questions in Part 2 in the spaces provided.

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1. Write the equation for the reaction that occurs in each of the following procedures. If no reaction occurs write "no reaction".

   Following this, describe **in full** what you would observe in each case, 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) Concentrated sodium hydroxide solution is added to aluminium metal.

   Equation _____

   Observation _____

   _____

   [3 marks]

   (b) Dilute hydrochloric acid is added to solid nickel(II) carbonate.

   Equation _____

   Observation _____

   _____

   [3 marks]

   (c) Liquid bromine is added to a solution of potassium chloride.

   Equation _____

   Observation _____

   _____

   [3 marks]

   (d) Sodium metal is added to 1-propanol.

   Equation _____

   Observation _____

   _____

   [3 marks]

2. For the species listed in the table below, draw the structural formula, representing **all** valence shell electron pairs as **:** or as **–** . Indicate the shape of the species by either a sketch or a name.

Species	Structural formula	Shape
Ethyne, C_2H_2		
Dichloromethane, $CH_2C\ell_2$		
Nitrate ion, NO_3^-		

[6 marks]

3. An open beaker, initially containing 50.0 mL of 1.00 mol L^{-1} hydrochloric acid was left on a desk at all day. If 20.0 mL of the solution evaporated during this time, what would be pH of this solution at the end of the day, assuming the temperature is 25 °C?

[2 marks]

4. From the following list of elements, chose **two** that fit the description below.
You are allowed to use each element more than once.

C Cu O_2 Al Zn N_2 Fe F_2 Br_2 Ar Ag

Description	Formulae	
Two metals that will dissolve in both sodium hydroxide and dilute sulfuric acid.		
Two metals that will react with dilute nitric acid, but not dilute hydrochloric acid.		
Two non-metals that will combine with silicon to form covalent network compounds.		
Two elements that are used as the electrodes during the extraction of aluminium.		
Two elements that are unreactive gases.		
The two elements that have the highest electronegativities out of those listed.		

[7 marks]

5. Draw a labelled sketch to represent the structure and bonding within graphite.

[2 marks]

Draw a labelled diagram to represent the structure and bonding within zinc.

[2 marks]

By reference to your diagrams, explain why both substances can conduct electricity in the solid state.

[2 marks]

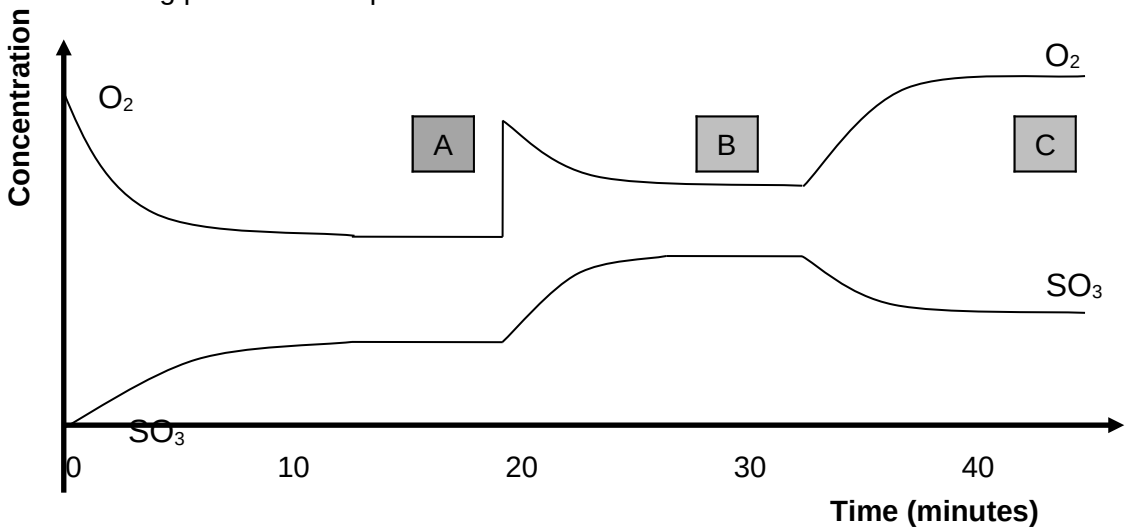
In a dry cell (Leclanché cell), Explain why zinc is chosen as the anode and graphite chosen as the cathode.

[2 marks]

6. The contact process is part of the production of sulfuric acid. Sulfur trioxide is produced by the reaction shown here. This can then be converted into sulfuric acid in the next step of the process.

$$2\ SO_2(g) + O_2(g) \rightleftarrows 2\ SO_3(g) + \text{HEAT}$$

A chemical engineer monitored the reaction, with the concentrations of oxygen and sulfur trioxide being plotted over a period of time. The results are shown here:



Write the equation for the equilibrium constant (K) for this reaction.

[1 mark]

More oxygen is added to the system after 20 minutes. Explain the shape of the graph over the next 5 minutes.

[2 marks]

The temperature of the system was increased after 33 minutes. At what point would the equilibrium constant be the lowest; A, B or C?

[1 mark]

Explain the reasons behind your answer given above.

_____

_____

_____

_____

_____

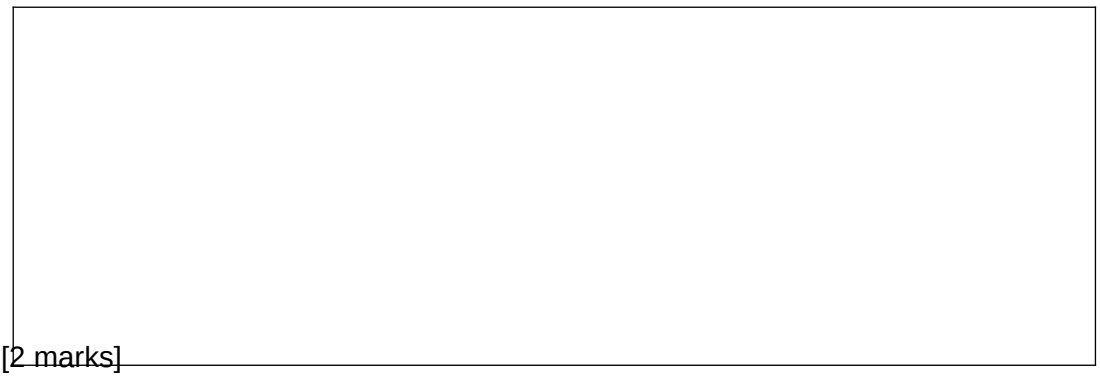
[2 marks]

7. Draw and name two geometric (*cis/trans*) isomers of the alkene $C_5H_{10.}$

Structure	Structure
Name:	Name:

[4 marks]

8. Prove that methyl propanoate is an isomer of butanoic acid.



[2 marks]

Explain why butanoic acid is a solid at room temperature whereas methyl propanoate is a liquid. (Diagrams are not required)

_____

_____

_____

_____

_____

[2 marks]

Write a balanced equation for a reaction that would enable butanoic acid to be prepared from 1-butanol and potassium permanganate.

_____

[2 marks]

Explain why dilute sulfuric acid is used in this reaction.

_____

_____

_____

[1 mark]

Describe the colour change that would occur during this reaction

_____

[1 mark]

Write a balanced equation for a reaction that would enable methyl propanoate to be prepared from propanoic acid.

_____

[1 mark]

Explain why concentrated sulfuric acid is used in this reaction.

_____

_____

[1 mark]

Describe the smell of the product in this reaction.

_____

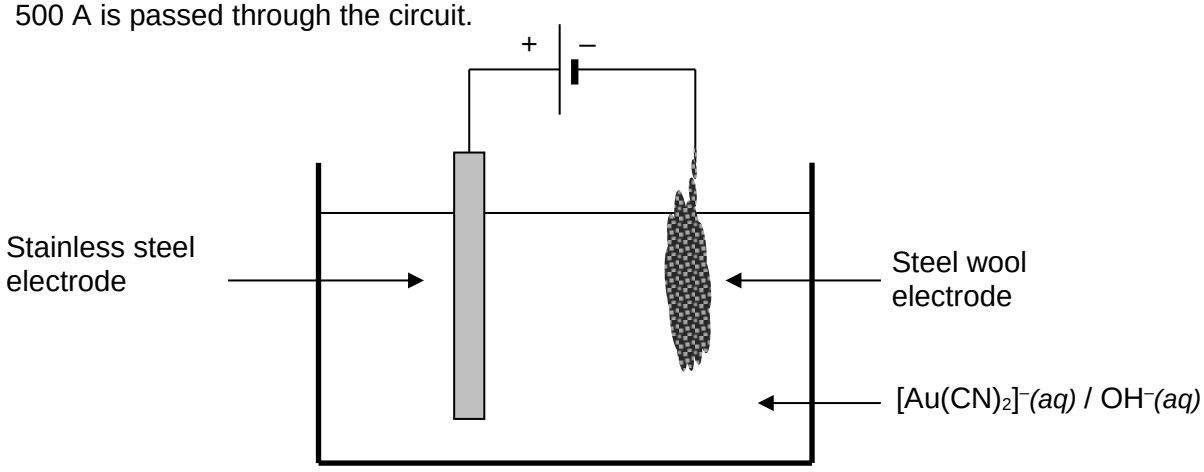
[1 mark]

9. A student places the following substances in jars in the laboratory: sodium carbonate, calcium carbonate, barium hydroxide, zinc hydroxide and sodium hydroxide.

Unfortunately he forgets to label the jars, and as they are all white solids, he does not know which one is which. Describe how you could carry out tests to distinguish between them. Write equations for any reactions that would occur in the tests. You are allowed to use normal laboratory reagents.

[7 marks]

10. Below is a representation of an electrolysis cell used in the production of gold. A current of 500 A is passed through the circuit.



Give the half equations for the reactions occurring at the anode and at the cathode. Then write an overall redox equation for the reaction occurring in the cell.

Anode half-equation:
Cathode half-equation:
Overall equation:

[3 marks]

How long would it take to deposit 10.0 g of gold using this cell? [M(Au) = 197.0 g mol^{-1}]

[3 marks]

Show the direction of flow of electrons in the external circuit by means of an arrow on the above diagram.

[1 mark]

Explain how the gold is removed from the electrode once the electrolysis process is completed.

_____

_____

[1 mark]

END OF PART 2

SEE NEXT PAGE

PART 3 (50 marks)

Answer ALL questions in Part 3. The calculations are to be set out in detail in this Question/Answer Booklet. Marks will be allocated for correct answers and clear setting out, even if you cannot complete the problem. When questions are divided into sections, clearly distinguish each section using (a), (b) and so on. Express your final numerical answers to three (3) significant figures where appropriate, and provide units where applicable. Information which may be necessary for solving the problems is located on the separate Chemistry Data Sheet. Show clear reasoning; if you don't, you will lose marks.

---

1. An experiment was carried out to determine the amount of calcium present in a sample of sea shells collected on City Beach in Perth. 15.65 g of the shells were crushed and then added to excess 2.00 mol L^{-1} hydrochloric acid. The resulting solution was filtered. Approximately 350 mL of 1.0 mol L^{-1} oxalic acid was added to the filtrate, which resulted in a precipitate of calcium oxalate (CaC_2O_4). When dried, this precipitate had a mass of 9.65 g.

   (a) Calculate the % (by mass) of calcium carbonate present in the seashells.

   (b) Calculate the minimum volume (in mL) of the hydrochloric acid required in the first stage of the process.

   [7 marks]

SEE NEXT PAGE

2. The final stage in the extraction of zinc metal is the electrolysis of zinc oxide dissolved in dilute sulphuric acid. The electrode reactions are shown below:

Anode reaction: $2\ H_2O(l) \rightarrow O_2(g) + 4\ H^+(aq) + 4e^-$

Cathode reaction: $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$

The zinc oxide used in the process is produced by roasting zinc sulphide (ZnS) in oxygen, with sulfur dioxide being the other product. The zinc sulfide used in the process has a purity of 93.0%.

(a) Calculate the current required in a cell which would be able to produce 2.00 kg of zinc metal in one hour.

(b) Calculate the mass (in kg) of the original impure zinc sulphide required to produce this 2.00 kg of zinc metal.

(c) Calculate the volume of oxygen, at 400°C and 1.00 atm pressure that would be required during the roasting process.

(d) Calculate the volume of oxygen, at 25°C and 1.00 atm pressure that would be produced during the electrolysis process when 2.00 kg of zinc is produced.

(e) Assuming the concentration of $H^+(aq)$ in the cell is 1.0 mol L^{-1}, what would be the minimum voltage required in the electrolysis cell for this reaction to proceed?

(f) According to the reduction potential values on the data sheet, the reaction occurring at the cathode should be the reduction of hydrogen ions.

$$2\ H^+(aq) + 2e^- \rightarrow H_2(g)$$

Suggest a reason why this reaction does not occur as predicted.

[14 marks]

SEE NEXT PAGE

SEE NEXT PAGE

3. Amino acids contain one or more amine groups and one or more carboxylic acid groups. The diprotic amino acid, glutamic acid, which contains carbon, hydrogen, oxygen and nitrogen, underwent analysis to determine its formula. When a 5.00 g sample of glutamic acid was combusted in oxygen, 7.48 g of carbon dioxide and 2.77 g of water was produced. A separate 3.00 g sample produced 0.938 g of nitrogen dioxide when burnt in oxygen.

4.56 g of glutamic acid was dissolved in 100.0 mL of water. 20.0 mL of this solution required 24.8 mL of 0.500 mol L^{-1} sodium hydroxide for complete neutralisation.

(a) Calculate the molecular mass of glutamic acid.

(b) Calculate the empirical formula of glutamic acid.

[11 marks]

SEE NEXT PAGE

4. An experiment was carried out to determine the percentage purity of a sample of iron(II) sulfate heptahydrate. ($FeSO^4.7H^2O$)

A solution of approximately 0.02 mol L^{-1} potassium permanganate was standardised against a solution of oxalic acid that was made by dissolving 3.451 g of hydrated oxalic acid ($C_2H_2O_4.2H_2O$) in 500.0 mL of distilled water. 19.75 mL of the potassium permanganate solution was found to react with 20.00 mL of the standard solution of oxalic acid.

4.57 g of the impure iron(II) sulfate heptahydrate was then dissolved into water in a volumetric flask and the solution was made up to 250.0 mL. Then 25.00 mL aliquots of this solution were titrated against the standardised potassium permanganate and the results are shown below.

	Burette readings (mL)		
	1	**2**	**3**
Final volume	14.40	28.55	42.70
Initial volume	0.00	14.40	28.55
Titre			

The relative half equations are:

$$C_2H_2O_4(aq) \rightarrow 2\ CO_2(g) + 2\ H^+(aq) + 2e^-$$

$$MnO_4^-(aq) + 8\ H^+(aq) + 5\ e^- \rightarrow Mn^{2+}(aq) + 4\ H_2O(\ell)$$

$$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e^-$$

(a) Calculate the actual concentration of the potassium permanganate solution.

(b) Calculate the % purity of the iron(II) sulfate heptahydrate.

[9 marks]

SEE NEXT PAGE

SEE NEXT PAGE

5. Alka-Seltzer is a water soluble drug that can treat acid indigestion in two ways; by neutralising stomach acid using sodium hydrogencarbonate and treating the associated pain by using aspirin ($C_9H_8O_4$). When it was developed in the early part of the twentieth century, it was found that the solubility of the active ingredients were improved if a reaction that gives off a gas took place when the tablet was added to water. Therefore solid citric acid ($C_6H_8O_7$) was added to the mixture to react with some of the sodium hydrogencarbonate.

The reaction causing the effervescence is:

$$3\ NaHCO^{3}(s)\ +\ C^{6}H^{8}O^{7}(aq)\ \rightarrow\ Na^{3}C^{6}H^{5}O^{7}(aq)\ +\ 3\ H^{2}O(\ell)\ +\ 3\ CO^{2}(s)$$

The normal composition of one tablet of Alka-Seltzer is:

sodium hydrogencarbonate	1700 mg
aspirin	325 mg
citric acid	300 mg

(a) When one tablet of Alka-Seltzer is completely dissolved in a glass containing 270 mL of water, and all the bubbling has stopped, calculate the final concentration (in mol L^{-1}) of:

(i) sodium hydrogencarbonate.

(ii) aspirin.

(b) In the stomach, the normal concentration of hydrochloric acid is 0.160 mol L^{-1}. The volume of the acid in the stomach can be assumed to be 0.650 litres. A stressed student, studying for her TEE chemistry exam eats a whole packet of Tim Tams, causing the concentration of the acid in her stomach to rise to 0.200 mol L^{-1}. Calculate how many Alka-Seltzer tablets she would need to take to reduce the level of acid back to normal.

[9 marks]

SEE NEXT PAGE

SEE NEXT PAGE

END OF PART 3

SEE NEXT PAGE

PART 4 (20 marks)

Answer the following question. Marks are awarded principally for the relevant chemical content of your answer, and also for coherence and clarity of expression. Where applicable use equations, diagrams and illustrative examples of the chemistry you are describing.

Your answer should be presented in about 1½ – 2 pages. Begin your essay on the lined paper following the end of the questions.

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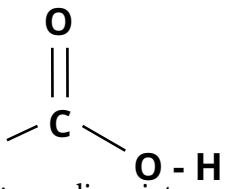
1. Whilst carrying out research into organic functional groups, a student found the following article posted on an internet encyclopaedia site.

Carboxylic Acids

Carboxylic acids are acids that contain the functional group $-CO_2H$, which has the structure as shown here:



- When this group dissociates, a carboxylate ion is formed as the acid donates the hydrogen atom.
- Carboxylic acids can be represented as R-COOH, where R always represents an alkyl group.
- Some carboxylic acids contain more than one carboxylic acid group.
- The reactions and behaviour of carboxylic acids can depend on what other atoms may be attached to this functional group.

Properties of carboxylic acids

- They will be soluble in water.
- Substances containing the group are weak acids.
- The carboxylic acid functional group is planar.
- They will form esters when reacted with alcohol in the presence of concentrated acid.
- Carboxylic acids may possess surfactant properties, and therefore can be used as soaps.
- Some carboxylic acids are able to undergo polymerisation reactions.

The article was not properly referenced and the student was not sure how valid the information was.

Rewrite this posting, adding explanations and examples which clarify the main points. Correct any misleading information, but do not add any further information about carboxylic acids that is not referred to in the original article.

END OF QUESTIONS

SEE NEXT PAGE

Write your response to Part 4 below.

SEE NEXT PAGE

SEE NEXT PAGE

SEE NEXT PAGE