Name ……Teacher……..

Part 2 (70 marks = 35% of paper)

Answer all questions in part 2 in the spaces provided below

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1 Write reactions for any reactions that occur in the following procedures. If no reaction occurs write "no reaction" .

In each case describe **in full** what could be observed including any

- colours
- odours
- precipitates (state colours)
- gases evolved (state colour or describe as colourless)

If no change is observable, this should be stated

(a) Zinc carbonate is placed in a solution of dilute sulfuric acid

Equation _____

Observation _____

_____

(3marks)

(b) Concentrated nitric acid is added to pieces of copper

Equation___ _____

Observation _____

_____

(3 marks)

(c) A solution of 6 $molL^{-1}$ sodium hydroxide is added in excess to zinc nitrate solution

Equation___ _____

Observation _____

_____

(3 marks)

(d) Sodium sulfide solution is mixed with hydrochloric acid

Equation___ _____

Observation _____

_____

(3 marks)

(e) Aluminium sulfate solution is mixed with strontium nitrate solution

Equation _____

Observation _____

_____

(3 marks)

2 Write equations to show how the $C_5H_5N^+$ ion can act as either a Lowry- Bronsted acid or base:

As acid :
As base :

(4)

3 Write a name or formula to give an example of each of the following .

A polyatomic anion that will form a precipitate with calcium nitrate solution	
An organic liquid that will not react with sodium	
A reducing agent weaker than Fe^{2+}but stronger than.H_2	
A weak diprotic acid	
An oxidising agent that will react with sodium bromide solution	
A covalent molecular substance that forms a low % of ions in aqueous solution	

(6marks)

4 An equilibrium system is described by the following equation :

$Mg^{2+}_{(aq)} + H_2S_{(g)}$ ⟵⟶ $+ MgS_{(s)} + 2H^+_{(aq)} + 28\ kJ$

Complete the following table to describe

(i) the effect on concentration of Mg^{2+}present

(ii) the effect on forward and reverse reaction rates

as the following changes are made to the system until equilibrium is re established

Change to system	Effect on concentration of Mg^{2+}	Effect on reverse reaction rate
More solid MgS is added		
System is cooled		
KOH solution is added to the system		
Pressure on the system is increased		

(8)

5

Write the equilibrium constant expression for the following systems

(a) $Zn^{2+}_{(aq)} + 4OH^-_{(aq)}$ ⟵⟶ $[Zn(OH)_4]^{2-}_{(aq)}$

. (b) $Fe_2(CO_3)_{3(s)}$ ⟵⟶ $2Fe^{3+}_{(aq)} + 3CO_3^{2-}_{(aq)}$

(2)

6 The curves below describe the changes in concentration of the equilibrium system

$$56kJ + N_{2(g)} + 3Cl_{2(g)} \rightleftharpoons 2\,NCl_{3(g)}$$

(a) When was equilibrium first reached in the system

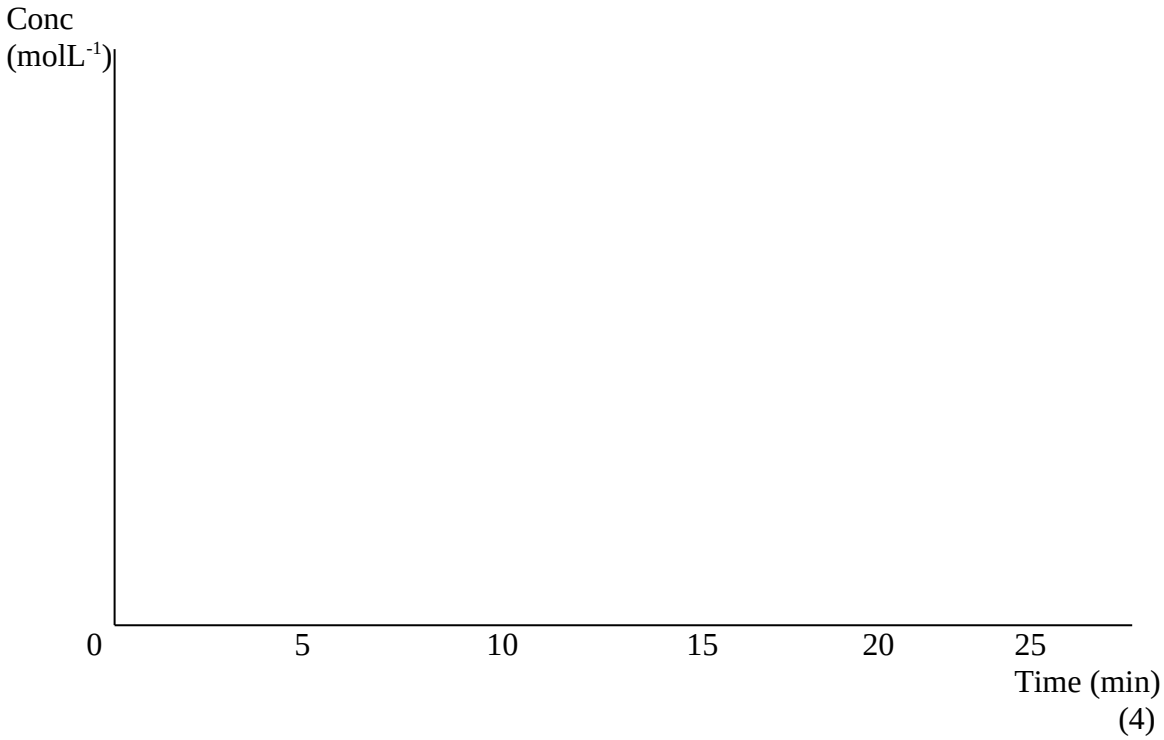
(1)

(b) Explain your answer to (a)

(1)

(c) Use the following information to complete the curves until t = 25 min

At t= 10min the system was heated and equilibrium was established again at t=15min (Use your knowledge of equilibrium principles to make any reasonable estimate of the new equilibrium concentrations of each gas)



(4)

7 For each of the following pairs of substances describe a chemical test that would distinguish between them. Describe the distinguishing observations , but no equations are required

	Chemical test (Describe fully)	Observation in each case
Hydrochloric and sulfuric acid acid		With hydrochloric acid
		With sulfuric acid
Copper nitrate and copper sulfate solutions		With copper nitrate
		With copper sulfate
Nickel and chromium		With nickel
		With chromium

(6 marks)

8 A hypochlorous acid solution (HClO), acidified with sulfuric acid, is added to solid AsO_2 and the hypochlorous acid ion oxidises the AsO_2 to AsO_4^{2-} ions .Write the oxidation, reduction and overall redox equation to describe this process.

Reduction half equation
Oxidation half equation
Redox equation

(4)

9 Explain , with the aid of relevant balanced equations , the following observations

(a) A solution of potassium hydrogen sulfate is acidic but a solution of potassium hydrogen phosphate is basic

(b) Hydrochloric acid should not be used to acidify potassium permanganate solutions.

(6)

10 Methyl orange is used as an indicator to titrate a solution of nitric acid against a standardised potassium carbonate solution

(a) Use an equation to help explain the value of pH at the equivalence point for this titration

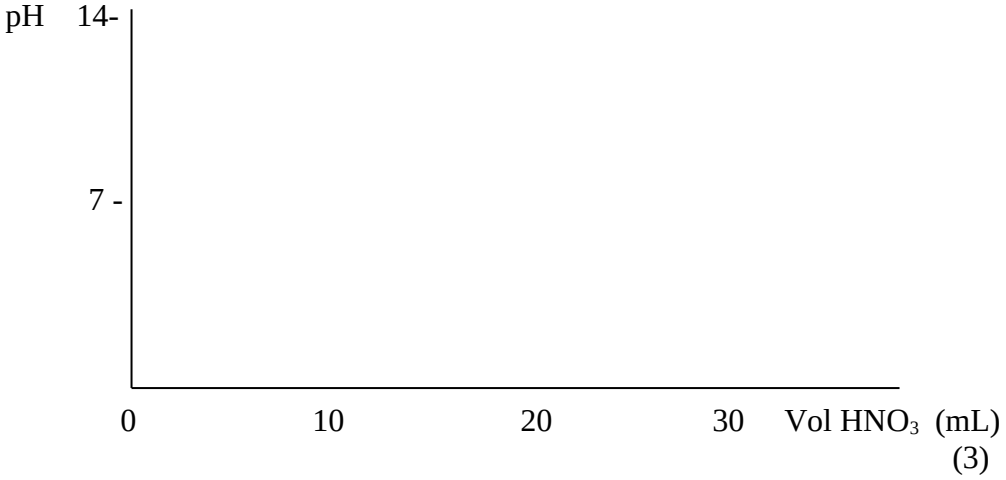
(2)

(b) Explain whether or not this indicator is appropriate for this titration

(2)

(c) A 20.00mL aliquot of sodium carbonate solution is placed in the conical flask, HNO_3 in the burette.

Sketch a pH curve to show how the pH changes as HNO_3 is delivered from the burette. Label the equivalence point on your curve. The titration volume is 13.70 mL



(3)

11 Consider 0.100 $molL^{-1}$ solutions of the following substances

chromium III nitrate; sodium ethanoate ; ethanol; zinc nitrate; phosphoric acid

(a) Which solution has the highest concentration of ions? Explain.

(b) Which solution has the highest pH? Explain

(c) Which solution has the lowest electrical conductivity? Explain

(6)

End of Section 2