BINDURA UNIVERSITY OF SCIENCE EDUCATION

SCIENCE AND MATHEMATICS EDUCATION DEPARTMENT

DIPLOMA IN SCIENCE EDUCATION

NOV 2023

COURSE: DCH003 Chemistry Practicals

2 Hours November 2023

WRITE YOUR REGISTRATION NUMBER IN THE SPACE PROVIDED BELOW

REG NO.

Answer ALL questions in the spaces provided on the question paper. You are advised to SHOW WORKING IN ALL calculations.

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CS1 is aqueous hydrochloric acid (HCl).
CS2 is 0.25 mol.dm^{-3} aqueous sodium hydroxide, (NaOH).

You are required to determine the concentration of aqueous hydrochloric acid, **CS1**.
Pipette 25.00 cm^3 **CS1** into a conical flask. Add 2-3 drops of phenolphthalein indicator and titrate with **CS2** from the burette until a faint pink color is observed.

Repeat the titration as many times as you think necessary to obtain accurate results.

Titration of **CS1** with **CS2**

Final burette reading /cm^3			
Initial burette reading /cm^3			
Volume of **CS2** used /cm^3			

[4+5 marks]

Summary

.....cm^3 of **CS1** required .....cm^3 of **CS2** for complete reaction.

[2 marks]

Show which results you used to obtain this value of the volume of **CS2** by placing a tick under the readings used.

(a) (i) Write a balanced equation for the reaction that took place inside the flask.

[2 marks]

(ii) Write an ionic equation for the reaction (excluding spectator ions).

[2 marks]

(iii) Calculate the number of moles of **CS2** run from the burette.

[2 marks]

(iv) Calculate the number of moles of **CS1** that reacted with **CS2**.

[2 marks]

(v) Calculate the concentration of **CS1** in $mol.dm^{-3}$.

[3 marks]

(b) Assuming that **CS1** was sulphuric acid, H_2SO_4, write:

(i) A balanced equation of the reaction that would have taken place inside the flask.

[2 marks]

(ii) An ionic equation of the above reaction.

[2 marks]

(c) What would have been;

(i) the number of moles of HCl?

[2 marks]

(ii) the concentration of the acid?

[2 marks]
[Total: 30 marks]

2. You are required to obtain values for the enthalpy change associated with the chemical reaction between sodium carbonate (Na_2CO_3) and sulphuric, acid (H_2SO_4).

By using a measuring cylinder, place 25.00 cm^3 of **CS3**, 1.5 $mol.dm^{-3}$ Na_2CO_3 in the plastic cup and record its temperature in the table below.

By using a second measuring cylinder, add 25.00cm^3 of **CS4**, 1$mol.dm^{-3}$ H_2SO_4 to the plastic cup. Stir the mixture with the thermometer and record the lowest temperature reached.

Temperature after mixing **CS3** and **CS4**	/^{0}C	
Initial temperature of **CS3**	/^{0}C	
Temperature change	/^{0}C	

[8 marks]

(i) Assuming that 4.35 J are required to raise the temperature of 1.0 cm^3 of solution by 1.0 ^{0}C, use the formula below to calculate the amount of heat evolved in this experiment.

$$\boldsymbol{Heat\ change = mc\Delta T}$$

[2 marks]

(ii) How many moles of Na_2CO_3 were in the plastic cup?

[2 marks]

(iii) How many moles of H_2SO_4 were placed in the plastic cup?

[2 marks]

(iv) Write a balanced equation for the reaction that took place.

[2 marks]

(v) In the above reaction, which chemical was the limiting reagent?

[1 marks]

(vi) Use the following formula to calculate the standard enthalpy change for the reaction

$$\Delta H^{o} = \frac{Heat\ Change}{number\ of\ moles\ of\ limiting\ substance}$$

[3 marks]

[Total 20 marks]

END OF PAPER