KIGUMO CLUSTER TERM 2 2021

PAPER III MARKING SCHEME

You are provided with

- Magnesium powder

-2M Hydrochloric acid solution R

-0.2M sodium hydroxide solution S

You are required to determine the

a) Mass of Magnesium that reacted

b) Molar enthalpy of reaction between magnesium and Hydrochloric acid

**Procedure I**

Using a measuring cylinder, transfer 100.0cm3 of the acid into a 200ml plastic beaker. Stir the acid with the thermometer. Take its initial temperature and record it in the table below at time =0 seconds. Add all the magnesium at once and start your stop watch immediately. Stir well and take the temperature after every thirty seconds up to the 5th minute.

Table 1

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (seconds) | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 |
| temperature | 19 | 30 | 37 | 40 | 40 | 39 | 38 | 37 | 36 | 34 | 33 |

(4mk)

Complete table- 1mk

Decimal point consistency -mk1

Accuracy -1mk

Trend -1mk

a) On the grid provided, plot a graph of temperature (Y-axis) against time (3mk)



b) On your graph show the highest temperature change ∆T (1mk)

(on the graph)

c) Calculate the heat change for the reaction (1mk)

100×4.2× correct Ans in (b) above

**Procedure 2**

Transfer the content of the plastic beaker into a 250 ml volumetric flask. Rinse the beaker and place the rinsing water into the volumetric flask. Top up the solution to the 250ml mark using distilled water and label it solution D.

Fill the burette with sodium hydroxide solution S

Using a pipette, transfer 25.0cm3 of solution D into a conical flask. Add 2 drops of phenolphthalein indicator and carry out titration .Record your results in the table 2 below. Repeat the procedure two more times and complete table 2 below.

**Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
| titration | 1 | 2 | 3 |
| Final burette reading (cm3) | 25.0 | 25.0 | 25.0 |
| Initial burette reading (cm3) | 0.0 | 0.0 | 0.0 |
| Volume of solution S used (cm3) | 25.0 | 25.0 | 25.0 |

.(4mks)

b) Determine

**I** average titre volume of solution S used (1mk)

= 25

**II** moles of NaOH in the average titre volume (1mk)

=0.005

**III** moles of hydrochloric acid in solution D that reacted with NaOH (1mk)

Mole ratio HCl:NaOH

1:1

=0.005

**IV** moles of HCl in 250cm3 of solution D (1mk)

Correct Ans in (III) above × 10

**V** moles of HCl in 100cm3 of solution R (1mk)

=0.1

**VI** moles of HCl that reacted with Mg (1mk)

Correct Ans in (v Above-Correct Ans in Iv above

**VII** moles of Mg that reacted (1mk)

Mole ratio HCl:Mg

2:1

=correct Ans in (VI) above×1/2

**VIII)** Molar enthalpy of reaction between Magnesium and HCl (2mk)

Correct Ans in C Ans in (VII)

? 1mole

= -Correct Ans in Joules/mole

2. You are provided with solid Z. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Place all solid Z in a boiling tube. Add 10cm3 of distilled water and shake. Filter the mixture. Divide the filtrate into two and preserve the residue.

|  |  |
| --- | --- |
| observations | inferences |
| Colourless filtrate  White residue | Cu2+,Fe2+,Fe3+ absent  Z is partially soluble |

b) To the first portion of filtrate add dilute sodium hydroxide and warm gently. Test the gas produced if any using moist blue and red litmus papers

|  |  |
| --- | --- |
| observations | inferences |
| Red litmus paper turns blue  Blue litmus paper remains blue | NH4+ |

c) To the second portion add 2 drops of lead (II) nitrate and warm

|  |  |
| --- | --- |
| observations | inferences |
| White ppt soluble on warming | Cl- |

d) Place the residue in a test tube. Add dilute nitric (V) acid until reaction is complete and test the gas produced using a glass rod dipped in lime water. Divide the solution formed into two

|  |  |
| --- | --- |
| observations | inferences |
| Effervescence  White ppt/solid formed  1mk | CO32-  1mk |

e) To the first portion add sodium hydroxide drop wise till in excess

|  |  |
| --- | --- |
| observations | inferences |
| White ppt soluble in excess  1mk | Zn2+,Al3+,Pb2+  2mk |

f) To the second portion add ammonia solution drop wise till in excess

|  |  |
| --- | --- |
| observations | inferences |
| White ppt soluble in excess | Zn2+ |

3. You are provided with liquid L. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Place 2 drops of liquid L on a watch glass and ignite using a wooden splint

|  |  |
| --- | --- |
| observations | inferences |
| Burns with a blue flame | =C=C=, -C≡C- absent |

b) To 2cm3 of liquid L in a test tube add 2 drops of acidified KMnO4

|  |  |
| --- | --- |
| observations | inferences |
| purple colour of acidified KMnO4 turns colourless | =C=C=,-C≡C- and R-OH absent |

c) To 2cm3 of liquid L in a test tube add 2drops of acidified potassium dichromate (VI) and warm

|  |  |
| --- | --- |
| observations | inferences |
| Orange colour of acidified K2Cr2O7 turns green | R-OH |

d) Use the remaining liquid L to determine the pH of the liquid using universal indicator paper provided. Use the guide provided

|  |  |  |
| --- | --- | --- |
| procedure | observation | inferences |
| -Place a universal indicator paper into the liquid  -match the colour of the paper to ones in the chart  -read the pH  11/2mk | pH 7  1/2mk | Neutral  1mk |