Beatty Secondary School
Science Department (Chemistry Unit)
Chemistry 6092

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Name: _____ ( ) Date: _____

Class: 4E___

Practical 3: E1 – O level 6092 Chemistry Paper 3 Nov 2018 Q1

1 The reaction of zinc with aqueous copper(II) ions is exothermic.

You are going to investigate the temperature change when an excess of zinc is added to aqueous solutions containing different amounts of copper(II) sulfate.

Read all the instructions below carefully before starting the experiments in Question 1.

Instructions

You are going to do five experiments. **P** is 0.50 mol/dm^3 copper(II) sulfate.
You are provided with five samples of zinc powder each weighing between 0.5 and 0.6 g.

(a) *Experiment 1*

Using a 10 cm^3 measuring cylinder, pour 10 cm^3 of **P** into a boiling tube.
Measure the initial temperature of **P** in the boiling tube and record the value in the table.

Transfer the zinc powder from one of the five containers, labelled zinc powder, to **P** in the boiling tube. Stir the mixture gently with the thermometer.

Measure the highest temperature reached and record it in the table. Wash the thermometer and boiling tube with water.

Experiments 2 to 5

Repeat Experiment 1, using the different volumes of **P** and water given in the table. For example, in Experiment 2 measure 8 cm^3 of P into the measuring cylinder and then add water to **P** until the total volume in the measuring cylinder is 10 cm^3.

Complete the table by calculating the change in temperature for each experiment.

experiment	volume of **P** / cm^3	volume of water / cm^3	initial temperature / °C	highest temperature / °C	change in temperature / °C
1	10	0			
2	8	2			
3	6	4			
4	4	6			
5	2	8			

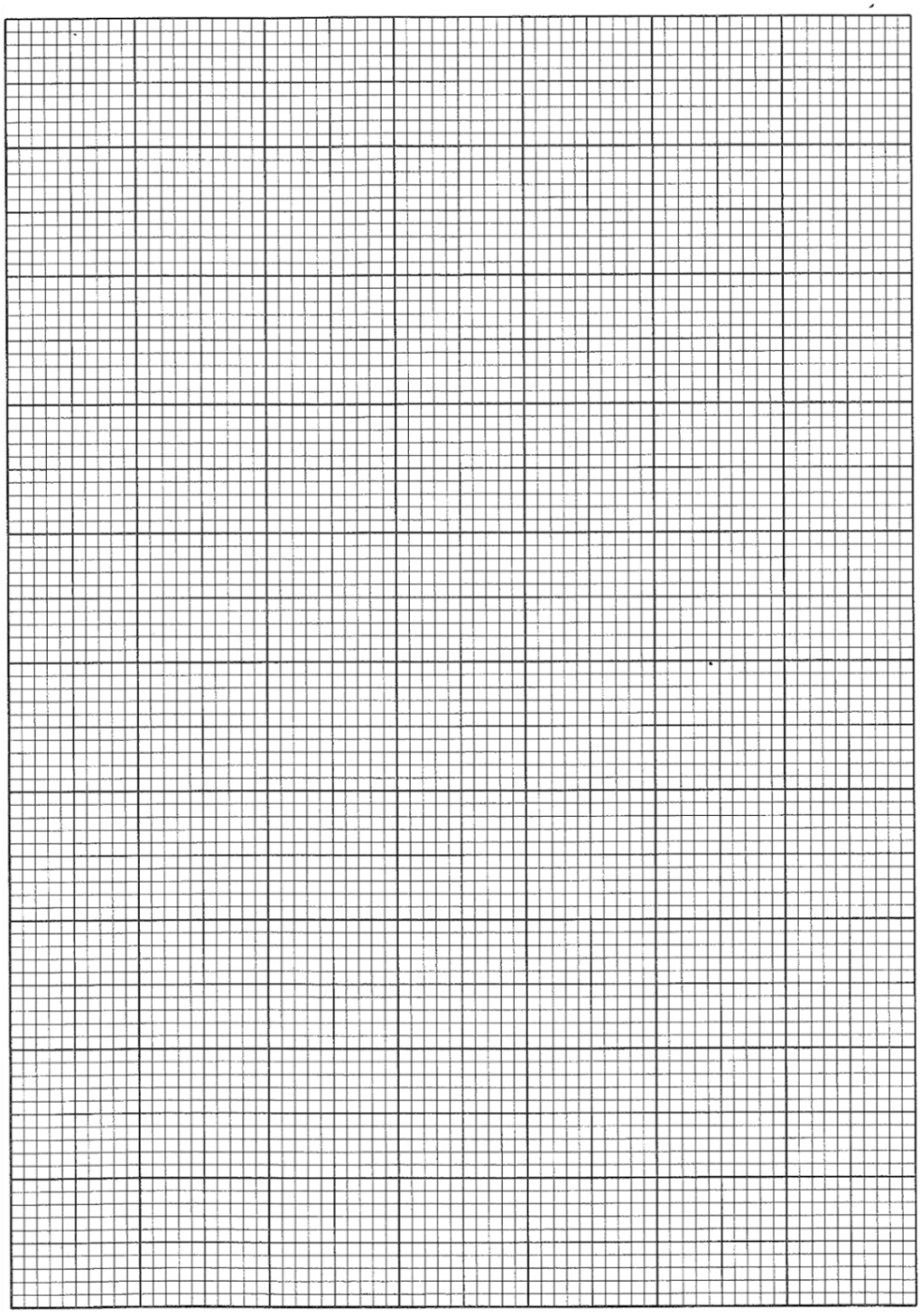
[4]

(b) Give an observation made when zinc reacts with aqueous copper(II) sulfate and explain the observation.

observation **Reddish-brown solid is formed / Blue solution fades away / turns lighter blue / colourless**

explanation **Zinc is more reactive than copper, hence zinc displaces copper from copper(II) sulfate solution to form zinc sulfate solution and copper solid.**

(c) Use the results you have obtained to plot a suitable graph on the grid below. Draw a straight line of best fit. [4]



(d) Describe and explain the trend shown by your graph in **(c)**.

The larger the volume of P ($CuSO_4$) used, the greater the temperature change observed / The increase in the volume of P used is directly proportional to the increase in temperature change observed [1]. Since $CuSO_4$ is the limiting reactant, an increase in $CuSO_4$ would lead to a greater number of moles of $CuSO_4$ to react with zinc, to produce more heat energy, resulting in a greater change in temperature observed [1].

(e) Determine the expected change in temperature if the experiment was repeated with 0.0035 mol of copper(II) sulfate in the 10 cm^3 of solution.

Show clearly **on the graph** how you obtained your answer.

Volume of P used = 0.0035 ÷ 0.5
= 0.007 dm^3
= 7 cm^3

Extrapolation with dotted lines shown on graph at 7 cm^3 [1]
Value obtained from graph [1]

(f) Predict the change in temperature if an excess of zinc powder was added to 10 cm^3 of 1.00 mol/dm^3 copper(II) sulfate.

Experiment 1 "change in temperature × 2" / reading from graph "change in temperature × 2"

(g) The temperature change obtained in Experiment 2 is lower than the value given in a chemistry data book. The main source of error is likely to be heat loss.

(i) Suggest a reason, **other than heat loss**, why your result is different from the data book value.

The volumes of P and water used may not be accurate.

(ii) Suggest an improvement you could make to the experiment in order to reduce this source of error.

Use a more accurate and precise instrument, burette instead of a measuring cylinder to measure the volume of solutions.

(h) If the same experiments were repeated using an excess iron powder instead of zinc powder, predict the effect on the changes in temperature.

Explain your answer.

The changes in temperature would be lower than expected [1]. This is because iron is less reactive than zinc and the difference in reactivity between iron and copper is smaller than the difference in reactivity between zinc and copper. As such, lesser heat energy would be released when iron powder is used, resulting in a lower change in temperature observed [1].

[Total: 19]