PENCILTUTOR SCHOOL (PTE) LTD.
Co. Reg. No. 200601708E
Blk 102, #02-135
Yishun Avenue 5
Singapore 760102

Penciltutor®

Answers to 2018 O level Chemistry practical 6092/ Paper 3

The 2018 O level Chemistry practical paper had 3 questions. The first question was based on an exothermic reaction, the second on titration and the third question was based on cockle shells.

Question 1

a) Candidates were asked to add varying concentrations of $CuSO_4$ solution to 0.5 – 0.6g of zinc powder and asked to record the increase in temperature.

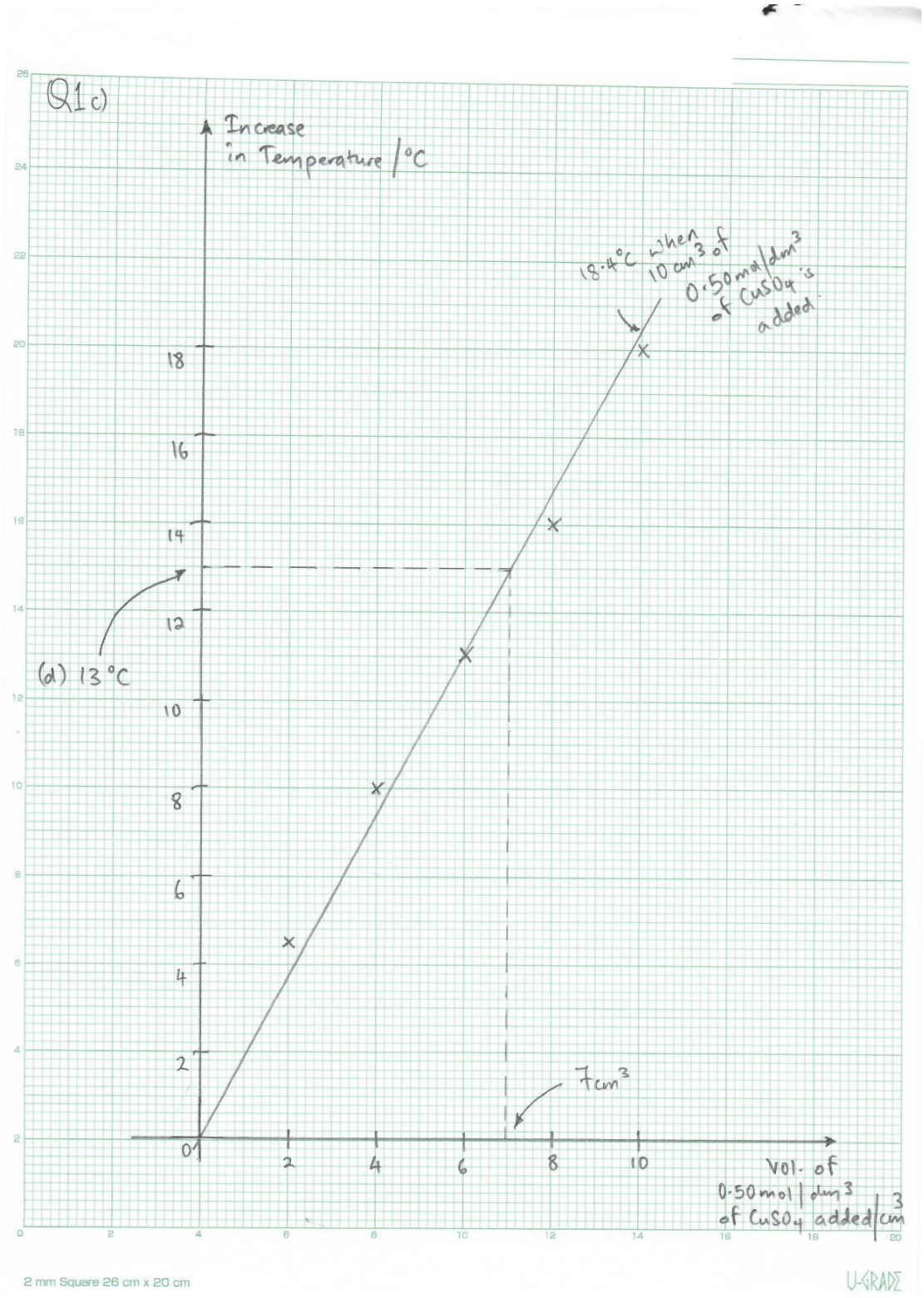
Volume of 0.50 mol/dm^3 $CuSO_4$ added/ cm^3	Volume of distilled water added/ cm^3	Increase in temperature/ °C
10	0	**18.0**
8	2	**14.0**
6	4	**11.0**
4	6	**8.0**
2	8	**4.5**

b) Candidates were asked to comment on observations made after zinc powder was added to $CuSO_4$ solution and to give an explanation for the observation.

OBSERVATION: Blue colour of $CuSO_4$ solution fades to become a colourless/pale blue solution. Grey zinc solid at the bottom of the boiling tube gets a brown coating.

EXPLANATION: Since zinc is more reactive than copper, zinc displaces copper from its solution.

c) Candidates were asked to plot the results from the above table and comment on the trend of the graph.



The increase in temperature is directly proportional to the volume of 0.50mol/dm^3 $CuSO_4$ added to zinc powder.

d) Using the graph, candidates were asked to predict the increase in temperature if $10cm^3$ of 0.0035 mol of $CuSO_4$ was added to an excess of zinc powder.

Concentration of $10cm^3$ of 0.0035 mol of $CuSO_4$ $= \frac{0.0035\ mol}{(10/1000)dm^3}$

$= 0.35\ mol/dm^3$

$0.35\ mol/dm^3$ is 70% of $0.50\ mol/dm^3$ and as such it is equivalent to adding $7cm^3$ of $CuSO_4$ to $3cm^3$ of distilled water.

From the graph, we get a temperature increase of 13°C.

e) Candidates were asked to predict the increase in temperature if $10cm^3$ of 1.00 mol of $CuSO_4$ was added to an excess of zinc powder.

Doubling the concentration of $CuSO_4$ will double the rate of reaction and double the gradient of the above graph. As such, the increase in temperature should be approximately 18.4 x 2 = 36.8°C.

f) Candidates were asked to comment on the sources of error in the experiment and to suggest for improvements.

Powdered zinc metal sticks to the side of the boiling tube when it is transferred from the plastic container into the boiling tube and as such amount added is not accurate. <u>IMPROVEMENT</u>: Use a spatula to add the zinc metal to the bottom of the boiling tube before adding $CuSO_4$ solution.

Part of the heat given off by the reaction is absorbed by the boiling tube and also dissipated to the surrounding. As such, temperature increase recorded by the thermometer is not accurate. <u>IMPROVEMENT</u>: Use a polystyrene cup instead of a boiling tube.

PENCILTUTOR SCHOOL (PTE) LTD.
Co. Reg. No. 200601708E
Blk 102, #02-135
Yishun Avenue 5
Singapore 760102

Question 2

This question mentions that some medical pills contain iron and that the amount of iron present can be determined via titration. 9 pills were dissolved to make a 250cm^3 solution containing iron (II) ions.

a) Candidates were asked to titrate 25.0 cm^3 of this iron (II) ion solution against $KMnO_4$ solution.

End point was reached with 20.00 cm^3 of $KMnO_4$ solution.

b) Given that the concentration of the $KMnO_4$ solution was 0.0105 mol/dm^3, candidates were asked to calculate the number of moles of $KMnO_4$ in 20.00 cm^3 of solution.

Number of moles of $KMnO_4$ in 20 cm^3 **= 0.0105 mol/dm^3** $\times \frac{20}{1000} dm^3$
= $\underline{2.1 \times 10^{-4} \text{ mol}}$

c) Given that 5 moles of Fe^{2+} reacts with 1 mole of $KMnO_4$, candidates were asked to calculate the number of moles of Fe^{2+} in 25.0cm^3.

Number of moles of Fe^{2+} in 25 cm^3 **= 5 × (2.1 × 10^{-4} mol)**
= $\underline{1.05 \times 10^{-3} \text{ mol}}$

d) From the value calculated in part (c), candidates were asked to calculate the number of moles of Fe^{2+} in the initial 250cm^3 solution.

Number of moles of Fe^{2+} in 250 cm^3 **= 10 × (1.05 × 10^{-3} mol)**
= $\underline{0.0105 \text{ mol}}$

e) From the value calculated in part (d), candidates were asked to calculate the mass of Fe^{2+} in one pill.

Number of moles of Fe^{2+} in 9 pills **=** **0.0105 mol**

Number of moles of Fe^{2+} in 1 pill **=** **1.167 × 10^{-3} mol**

Mass of Fe^{2+} in 1 pill **=** **(1.167 × 10^{-3} mol) × 56 g/mol^{-1}**

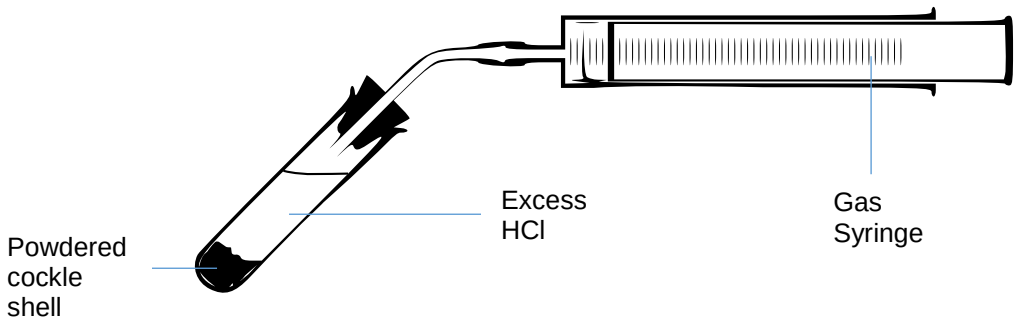
= **$\underline{0.0653}$g**

PENCILTUTOR SCHOOL (PTE) LTD.
Co. Reg. No. 200601708E
Blk 102, #02-135
Yishun Avenue 5
Singapore 760102

Question 3

This was a planning question where candidates were told that the shell of cockles were made up of about 60% CO_3^{2-}.

Candidates were then asked to plan an experiment to determine the percentage by mass of CO_3^{2-} in 1g of cockle shell. They were also asked to state any assumptions that they would make.



1. **<u>Apparatus & Chemicals</u>: Mortar & Pestle, Boiling tube with a rubber bung attached to a delivery tube, gas syringe held horizontally by a retort stand, an excess of aqueous HCl.**

2. **<u>Procedure</u>:**
   - **(i) Use a mortar and pestle to crush the cockle shell into smaller pieces or a powder.**
   - **(ii) Transfer the powdered cockle shell into the boiling tube.**
   - **(iii) Connect the free end of the delivery tube to the horizontally held gas syringe.**
   - **(iv) Add an excess of aqueous HCl to the boiling tube and quickly stopper the boiling tube with the rubber bung attached to a delivery tube as shown in the above figure.**
   - **(v) Record the volume of gas collected in the gas syringe. Calculate the mole of gas collected (1 mole of any gas occupies 24,000cm^3 of volume).**
   - **(vi) Repeat the 5 steps above with other 1g cockle shells and get an average value to minimize random errors.**

3. **From $2H^+(aq) + CO_3^{2-}(aq) \rightarrow H_2O(l) + CO_2(g)$, 1 mole of CO_3^{2-} produces 1 mole of CO_2 gas. Use the answer from 2(v) and the formula $mole = \frac{mass}{Mr\ of CO_3^{2-}}$ to calculate the percentage mass of CO_3^{2-} present in 1g of cockle shell.**

4. **<u>Assumption</u>: The same species of cockle shells are used to repeat the experiment in 2(vi) as different species of cockle shells may have different percentage of carbonate content.**

5. **Wear goggles when handling acids to protect the eye.**