iG Chem ALL EQ 17w to 16m Improving experiments and safety in the lab questions 57marks

Things to know:

These kinds of questions are in every single Paper 6 exam and on average there will b 4.1 marks per exam from this category of question.

- Although they look very confusing, they are in fact extremely repetitive in the answers they want
- Anything involving temperature changes the answers usually require some mention of using more insulation or using a lid to prevent heat moving between the experiment and the surroundings making the experiment more ACCURATE.
- Measuring cylinders allow you to add a liquid really fast, but they are less PRECISE than a burette, which are less precise than volumetric pipettes. When you are more precise your **ACCURACY** improves.
- Repeating an experiment and then taking average values improves RELIABILITY.

Topic **Chem 6 Q# 1/** iGCSE Chemistry/Paper 6/2017/w/ Time Zone 3/

2 A student investigated what happened to the temperature when two different solids, **W** and **X**, dissolved in water.

Two experiments were carried out.

Experiment 1

- Using a measuring cylinder, 30 cm^3 of distilled water were poured into a polystyrene cup. The initial temperature of the water was measured at time = 0 seconds.
- Solid **W** was added to the water, a timer was started and the solution was stirred with a thermometer.
- The temperature of the solution was measured every 10 seconds for 90 seconds.

Experiment 2

- The polystyrene cup was emptied and rinsed with water.
- Experiment 1 was repeated using solid **X**.
- The temperature of the solution was measured every 10 seconds for 90 seconds.

(g) State **two** sources of error in these experiments. Give **one** improvement to reduce each of these sources of error.

source of error 1 .....

improvement 1 .....

source of error 2 .....

improvement 2 .....

[4]

(h) When carrying out the experiments, what would be a disadvantage of taking the temperature readings only every 30 seconds?

.....

..... [1]

Topic **Chem 6 Q# 2/** iGCSE Chemistry/Paper 6/2017/w/ Time Zone 2/

2 A student investigated what happened when two different solids, **S** and **T**, dissolved in water.

Two experiments were carried out.

Experiment 1

- Using a measuring cylinder, 30 cm^3 of distilled water were poured into a polystyrene cup. The initial temperature of the water was measured.
- 2.0 g of solid **S** were added to the polystyrene cup and the solution was stirred with a thermometer.
- The **maximum** temperature of the solution was measured.
- The solution was poured away and the polystyrene cup was rinsed out with distilled water.

- The procedure was repeated using 3.0 g of solid **S**.
- The procedure was repeated using 5.0 g of solid **S**.

Experiment 2

- Experiment 1 was repeated using 2.0 g, 3.0 g, 4.0 g and 6.0 g of solid **T**. The **minimum** temperature of the solution was measured in each case.

(f) Suggest **one** change you could make to the experiments to obtain more accurate results. Explain how this change would make the results more accurate.

change .....

explanation .....

.....

[2]

(g) Suggest how the reliability of the results could be checked.

..... [1]

Topic **Chem 6 Q# 3/** iGCSE Chemistry/Paper 6/2016/w/ Time Zone 3/

2 A student investigated what happened when two different metals, iron and magnesium, reacted with aqueous copper(II) sulfate.
Two experiments were carried out.

(a) *Experiment 1*

A measuring cylinder was used to pour 25 cm^3 of aqueous copper(II) sulfate into a polystyrene cup. The initial temperature of the solution was measured, then again at 30 seconds and at 60 seconds.
At 60 seconds, the iron was added to the aqueous copper(II) sulfate and the mixture stirred continuously with a thermometer.
The temperature of the mixture was measured every 30 seconds for 300 seconds (5 minutes).

(b) *Experiment 2*

Experiment 1 was repeated using magnesium instead of iron.

(f) Suggest an advantage of taking the temperature readings every 15 seconds.

.....

..... [2]

(g) Explain why a polystyrene cup is used in the experiments and **not** a copper can.

.....

..... [2]

Topic **Chem 6 Q# 4/** iGCSE Chemistry/Paper 6/2016/s/ Time Zone 3/

2 A student investigated what happens when dilute hydrochloric acid and copper(II) sulfate solution react with different metals.

Five experiments were carried out.

(a) *Experiment 1*

A measuring cylinder was used to pour 10 cm^3 of dilute hydrochloric acid into a boiling tube.
The temperature of the hydrochloric acid was measured.
1 g of zinc was added to the boiling tube and the mixture stirred with a thermometer.
The maximum temperature reached by the mixture was measured.

Experiment 2

Experiment 1 was repeated using 1 g of iron instead of zinc.

Experiment 3

Experiment 1 was repeated using 1 g of magnesium instead of zinc.

(c) *Experiment 4*

A measuring cylinder was used to pour 10 cm^3 of copper(II) sulfate solution into a boiling tube.
The temperature of the solution was measured.
1 g of magnesium was added to the boiling tube and the mixture stirred with a thermometer.
The maximum temperature reached by the mixture was measured.

Experiment 5

Experiment 4 was repeated using 1 g of iron instead of magnesium.
The observation was recorded below.

The solution turned colourless and a brown deposit formed.

(h) Give **one** advantage of using a measuring cylinder to add the hydrochloric acid to the boiling tube.

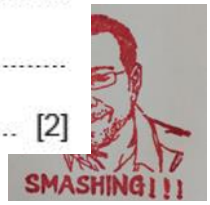
..... [1]

(i) Suggest and explain **one** improvement to increase the accuracy of these experiments.

.....

.....

..... [2]



Topic **Chem 6 Q# 5/** iGCSE Chemistry/Paper 6/2016/s/ Time Zone 1/

2 A student investigated the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid, **A** and **B**.
The reaction is:

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$$

Three experiments were carried out.

(a) *Experiment 1*

Using a measuring cylinder, 25 cm^3 of aqueous sodium carbonate were poured into a conical flask.
Thymolphthalein indicator was added to the conical flask.
A burette was filled up to the 0.0 cm^3 mark with solution **A** of dilute hydrochloric acid. **A** was added to the flask, until the solution just changed colour.

Experiment 2

Experiment 1 was repeated using methyl orange indicator instead of thymolphthalein.
Methyl orange is red-orange in acidic solutions and yellow in alkaline solutions.

(f) What would be a more accurate method of measuring the volume of the aqueous sodium carbonate?

..... [1]

(g) What would be the effect on the results, if any, if the solutions of sodium carbonate were warmed before adding the hydrochloric acid? Give a reason for your answer.

effect on results .....

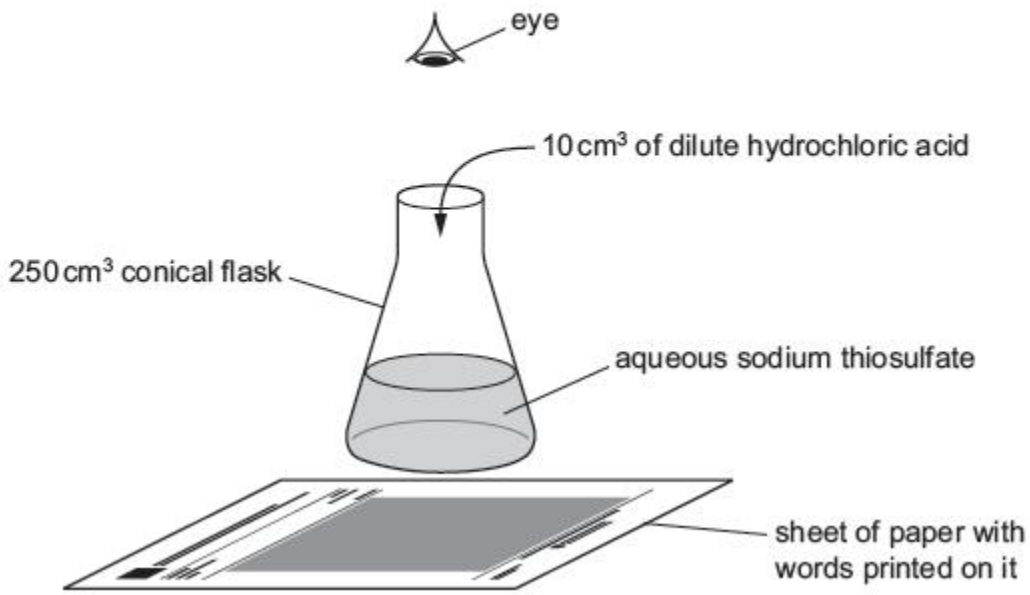
reason .....

[2]

Topic **Chem 7 Q# 6/** iGCSE Chemistry/Paper 6/2017/w/ Time Zone 1/

2 A student investigated the rate of reaction between dilute hydrochloric acid and aqueous sodium thiosulfate. When these chemicals react they form a precipitate which makes the solution go cloudy. The formation of this precipitate can be used to show how fast the reaction proceeds.

Five experiments were carried out using the apparatus shown.



Experiment 1

- Using a measuring cylinder, 50 cm^3 of aqueous sodium thiosulfate were poured into a conical flask. The initial temperature of the solution was measured. The conical flask was placed on a sheet of paper with words printed on it.
- Using a measuring cylinder, 10 cm^3 of dilute hydrochloric acid were added to the solution in the conical flask and a stopclock was started.
- The time taken for the printed words to disappear from view was measured.
- The final temperature of the mixture was measured.

Experiment 2

- Using a measuring cylinder, 50 cm^3 of aqueous sodium thiosulfate were poured into a conical flask. The solution was heated to about **30 °C** and the temperature was measured. The conical flask was placed on a sheet of paper with words printed on it.
- Using a measuring cylinder, 10 cm^3 of dilute hydrochloric acid were added to the solution in the conical flask and a stopclock was started.
- The time taken for the printed words to disappear from view was measured.
- The final temperature of the mixture was measured.

Experiment 3

- Experiment 2 was repeated but the 50 cm^3 of aqueous sodium thiosulfate were heated to about **40 °C** before adding the dilute hydrochloric acid.

Experiment 4

- Experiment 2 was repeated but the 50 cm^3 of aqueous sodium thiosulfate were heated to about **50 °C** before adding the dilute hydrochloric acid.

Experiment 5

- Experiment 2 was repeated but the 50 cm^3 of aqueous sodium thiosulfate were heated to about **60 °C** before adding the dilute hydrochloric acid.

(f) Suggest and explain the effect on the results of using

(i) a burette to measure the volumes,

.....

.....

..... [2]

(ii) a 100 cm^3 conical flask instead of a 250 cm^3 conical flask.

.....

.....

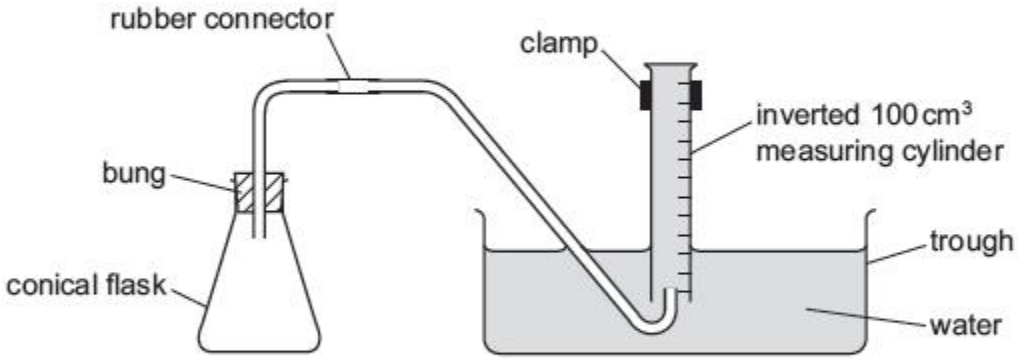
..... [2]

2 A student investigated the rate of reaction between magnesium ribbon and two different solutions of dilute sulfuric acid, solution **G** and solution **H**. The acid was in excess in both experiments.

Two experiments were carried out.

Experiment 1

- The apparatus was set up as shown in the diagram.



- Using a measuring cylinder, 50 cm^3 of solution **G** were poured into the conical flask. A piece of magnesium ribbon was added to the conical flask and the bung replaced.
- The timer was started immediately and the total volume of gas collected in the measuring cylinder was measured every 20 seconds for 180 seconds (3 minutes).

Experiment 2

- Experiment 1 was repeated using 50 cm^3 of solution **H** instead of solution **G**.

(g) Give **one** advantage and **one** disadvantage of using a measuring cylinder to measure the volumes of solution **G** and solution **H**.

advantage .....

disadvantage .....

[2]

(h) Suggest **one** improvement to these experiments.

.....

..... [1]

2 A student investigated the reaction between aqueous potassium manganate(VII), solution **A**, and two solutions of iron(II) sulfate, solution **B** and solution **C**, of different concentrations.

Two experiments were carried out.

Experiment 1

- A burette was filled with solution **A** to the 0.0 cm^3 mark.
- A measuring cylinder was used to pour 25 cm^3 of solution **B** into a conical flask.
- Solution **A** was added to the flask, while the flask was swirled, until the mixture just turned permanently pink. The burette reading was recorded.

Experiment 2

- Experiment 1 was repeated using 25 cm^3 of solution **C** instead of solution **B**. In Experiment 2 the burette was not filled to the 0.0 cm^3 mark.

(e) (i) If Experiment 2 were repeated using 50 cm^3 of solution **C**, what volume of solution **A** would be needed? Explain your answer.

.....

..... [2]

(ii) Suggest a practical problem that using 50 cm^3 of solution **C** in this investigation would cause. Suggest a practical solution to the problem.

problem .....

solution .....

[2]

(f) Give **one** advantage and **one** disadvantage of using a measuring cylinder instead of a 25 cm^3 pipette for solution **B**.

advantage .....

disadvantage .....

[2]

(g) How would the results be improved by taking repeated measurements?

.....

..... [1]

Topic **Chem 7 Q# 9/** iGCSE Chemistry/Paper 6/2017/s/ Time Zone 1/

2 A student investigated the reaction between aqueous sodium thiosulfate and two different aqueous solutions of potassium iodate labelled solution **C** and solution **D**.

Two experiments were carried out.

Experiment 1

- A burette was filled with aqueous sodium thiosulfate. The initial burette reading was recorded.
- Using a measuring cylinder, 20 cm^3 of solution **C** were poured into a conical flask. 10 cm^3 of dilute sulfuric acid and 1 g of potassium iodide were added to the flask to form a solution of iodine. The flask was swirled to mix the contents.
- Aqueous sodium thiosulfate was slowly added from the burette to the flask and swirled to mix thoroughly.
- When the contents of the flask turned pale yellow, starch solution was added and the solution turned blue-black.
- More aqueous sodium thiosulfate was then added slowly to the flask until the solution just turned colourless. The final burette reading was recorded.

Experiment 2

- The conical flask was emptied and rinsed with distilled water.
- Experiment 1 was repeated using solution **D** instead of solution **C**.

(e) (i) State **two** sources of error in the experiments.

1. .....

2. .....

[2]

(ii) Suggest **two** improvements to reduce the sources of error in **(e)(i)**.

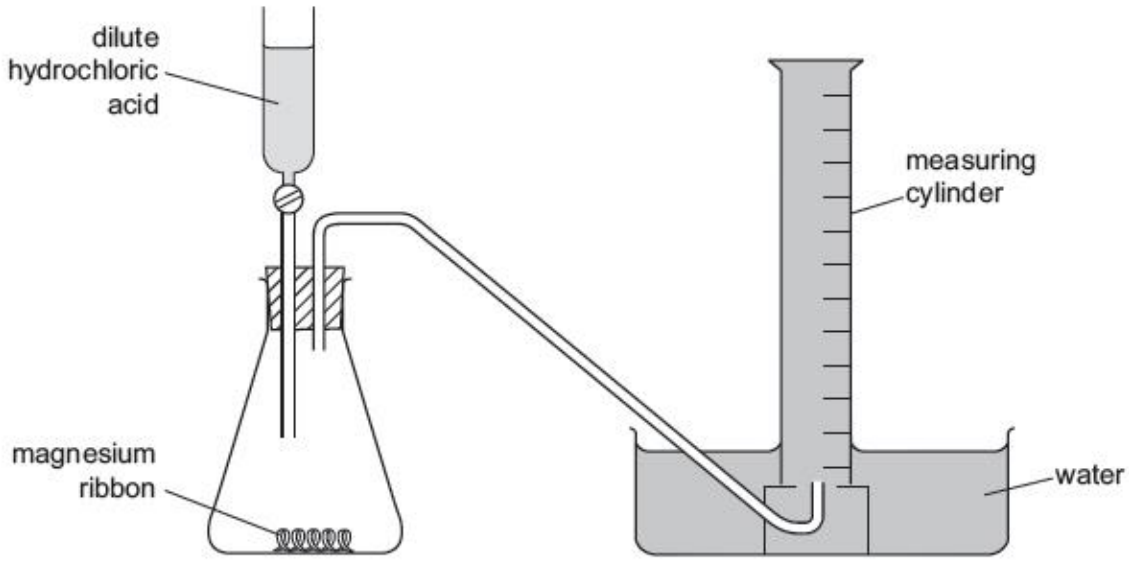
1. .....

2. .....

[2]

Topic **Chem 7 Q# 10/** iGCSE Chemistry/Paper 6/2016/w/ Time Zone 2/

2 A student investigated the rate of reaction between dilute hydrochloric acid and excess magnesium at room temperature.
The apparatus was set up as shown in the diagram.



30 cm^3 of dilute hydrochloric acid were added to the conical flask containing magnesium ribbon. The timer was then started and the volume of gas collected in the measuring cylinder was measured every 20 seconds for 180 seconds (3 minutes).

(ii) Suggest a possible reason for this anomalous result.

..... [1]

(g) Suggest why the reading on the measuring cylinder was 30 cm^3 after the acid had been added and before the timer had been started.

.....

..... [1]

(h) Suggest and explain **one** improvement to this experiment.

.....

.....

..... [2]

Topic **Chem 7 Q# 11/** iGCSE Chemistry/Paper 6/2016/s/ Time Zone 2/

2 A student investigated the rate of reaction between hydrogen peroxide and aqueous potassium iodide. When these chemicals react they form iodine. Sodium thiosulfate solution reacts with iodine and can be used to show how fast the reaction proceeds.

(a) A burette was filled up to the 0.0 cm^3 mark with sodium thiosulfate solution.
Using a large measuring cylinder, 100 cm^3 of distilled water were poured into a conical flask.
Using a small measuring cylinder, 6 cm^3 of sulfuric acid, 1 cm^3 of starch solution and 4 cm^3 of aqueous potassium iodide were added to the flask.
0.5 cm^3 of sodium thiosulfate solution was added from the burette to the mixture in the flask and swirled to mix.
The reaction was then started by adding 3 cm^3 of hydrogen peroxide solution to the mixture, and the timer started.
The time taken for a blue colour to appear was noted.
A further 0.5 cm^3 of sodium thiosulfate solution was added to the mixture in the conical flask, swirled and the blue colour disappeared. The time when the blue colour reappeared was noted.
The experiment continued by adding further 0.5 cm^3 portions of sodium thiosulfate solution until a total of 3.0 cm^3 of sodium thiosulfate solution had been added, noting the times at which the blue colour reappeared.

(d) Suggest the purpose of the starch solution.

..... [1]

(e) **(i)** Suggest **one** advantage of using a pipette to measure the volume of the hydrogen peroxide.

..... [1]

(ii) Suggest and explain **one** disadvantage of using a pipette to measure the volume of the hydrogen peroxide.

.....

..... [2]

(f) Explain **one** disadvantage of using a beaker instead of a conical flask.

.....

..... [1]

Topic **Chem 7 Q# 12/** iGCSE Chemistry/Paper 6/2016/m/ Time Zone 2/

2 A teacher investigated the rate of a reaction between two solutions, **J** and **K**, and sulfuric acid at different temperatures.

Four experiments were carried out.

(a) *Experiment 1*

A large measuring cylinder was used to pour 50 cm^3 of distilled water and 40 cm^3 of sulfuric acid into a 250 cm^3 conical flask.
A small measuring cylinder was used to add 2 cm^3 of methyl orange and 5 cm^3 of solution **J** to the mixture in the conical flask. The temperature of the mixture was measured.
The reaction was started by adding 5 cm^3 of solution **K** to the conical flask, immediately starting the timer and swirling the mixture.
The time taken for the mixture to turn pale yellow was measured. The final temperature of the mixture was measured.

Experiment 2

Experiment 1 was repeated but the mixture in the conical flask was heated to about 30 °C **before** adding the solution **K**. The temperature of the mixture was measured.
5 cm^3 of solution **K** was added to the conical flask. The timer was started and the mixture swirled.
The time taken for the mixture to turn pale yellow was measured. The final temperature of the mixture was measured.

Experiment 3

Experiment 1 was repeated but the mixture in the conical flask was heated to about 40 °C before adding the solution **K** to the flask. The same measurements were taken.

Experiment 4

Experiment 1 was repeated but the mixture in the conical flask was heated to about 50 °C before adding the solution **K** to the flask. The same measurements were taken.

(e) (i) Suggest and explain the effect **on the results** of using a burette to measure the volume of solution **J**.

.....

..... [2]

(ii) Suggest and explain one **other** improvement to these experiments.

.....

..... [2]

Topic **Chem 8 Q# 13/** iGCSE Chemistry/Paper 6/2017/s/ Time Zone 1/

3 Two solids, **E** and **F**, were analysed. Solid **F** was potassium iodide. Tests were carried out on each solid. Some of the observations on solid **E** are shown.

tests on solid **E**	observations
Appearance of solid **E**.	green solid
test 1 Solid **E** was heated gently then strongly.	the solid turned black

(a) Test 1 states that the solid should be heated gently then strongly.

In terms of safety, explain why it is necessary to heat gently at first.

.....

..... [1]

Topic **Chem 8 Q# 14/** iGCSE Chemistry/Paper 6/2017/m/ Time Zone 2/

2 A student investigated the reaction between dilute hydrochloric acid and two different aqueous solutions of sodium hydroxide labelled solution **O** and solution **P**.

Two experiments were carried out.

Experiment 1

- A burette was filled with dilute hydrochloric acid. The initial burette reading was recorded.
- Using a measuring cylinder, 20 cm^3 of solution **O** were poured into a conical flask.
- Thymolphthalein indicator was added to the conical flask.
- The dilute hydrochloric acid was added from the burette, while swirling the flask, until the solution just changed colour. The final burette reading was recorded.

Experiment 2

- The conical flask was emptied and rinsed with distilled water.
- Experiment 1 was repeated using solution **P** instead of solution **O**.

(g) (i) What would be a more accurate method of measuring the volume of the aqueous sodium hydroxide solution?

..... [1]

(ii) Suggest how the reliability of the results could be checked.

..... [1]

Topic **Chem 8 Q# 15/** iGCSE Chemistry/Paper 6/2016/w/ Time Zone 1/

2 A student investigated what happened when dilute nitric acid reacted with aqueous solutions of two different alkalis, solution **N** and solution **O**.

Two experiments were carried out.

(a) *Experiment 1*

A measuring cylinder was used to pour 50 cm^3 of solution **N** into a polystyrene cup. The initial temperature of the solution was measured.
A burette was filled with nitric acid to the 0.0 cm^3 mark.
5.0 cm^3 of nitric acid were added to solution **N** in the polystyrene cup and the solution stirred. The maximum temperature of the solution was measured.
A further 5.0 cm^3 of nitric acid were added to the polystyrene cup and the solution stirred. The maximum temperature of the solution was measured.
The student continued to add 5.0 cm^3 portions of nitric acid to the polystyrene cup, until a total volume of 40 cm^3 of nitric acid had been added. After each addition, the solution was stirred and the maximum temperature measured.

(b) *Experiment 2*

Experiment 1 was repeated using solution **O** instead of solution **N**.
Use the thermometer diagrams to record the maximum temperatures in the table.

(e) Name a suitable indicator that could be used in Experiment 1.

..... [1]

(h) Suggest why a polystyrene cup was used in these experiments and **not** a copper can.

..... [1]

(i) State **one** source of error in the experiments. Suggest an improvement to reduce this source of error.

source of error .....

improvement .....

[2]

Topic **Chem 8 Q# 16/** iGCSE Chemistry/Paper 6/2016/s/ Time Zone 1/Q3

(d) Chromium(III) can be converted to chromium(VI). Chromium(VI) is hazardous.

Suggest **one** safety precaution when using chromium(VI).

..... [1]

Mark Scheme

Q# 1/ iGCSE Chemistry/Paper 6/2017/w/ Time Zone 3/

2(g)	<table><tr><th>source of error</th><th>improvement</th></tr><tr><td>heat losses</td><td>use a lid / lag the apparatus</td></tr><tr><td>use of a measuring cylinder</td><td>use a pipette/burette</td></tr><tr><td>wet cup in the second experiment</td><td>use new/another cup **OR** dry the cup</td></tr><tr><td>the solid absorbs water from the air</td><td>store in a sealed container / airtight container / desiccator</td></tr><tr><td>only done once</td><td>repeat **and** average</td></tr><tr><td>different masses of solids used / masses of solids not measured</td><td>use same mass of solid / weigh the solids</td></tr></table>	4
2(h)	fewer data / less detail / fewer readings / graph not as good / not enough readings whilst the solid is reacting	1

Q# 2/ iGCSE Chemistry/Paper 6/2017/w/ Time Zone 2/

2(f)	*change to the experiments* use burette / pipette use insulation / lid use a new cup / dry the cup	1
	explanation (to match change) more accurate (than measuring cylinder) reduce heat losses remove water left from the previous experiment	1
2(g)	repeat experiments	1

Q# 3/ iGCSE Chemistry/Paper 6/2016/w/ Time Zone 3/

2(f)	more readings / points / data smoother curve / better or more accurate graph	1 1
2(g)	polystyrene is an insulator / copper is a (good) conductor reduced heat losses	1 1

Q# 4/ iGCSE Chemistry/Paper 6/2016/s/ Time Zone 3/

2(h)	quick / easy to use;	1
2(i)	insulate / lag tube / use a lid; 1 to reduce heat losses; 1 **OR** use a pipette / burette; 1 instead of measuring cylinder / more accurate; 1	2

Q# 5/ iGCSE Chemistry/Paper 6/2016/s/ Time Zone 1/

2(f)	use a pipette / burette;	1
2(g)	effect on results: none owtte; 1 reason: no change in concentration owtte; 1	2

Q# 6/ iGCSE Chemistry/Paper 6/2017/w/ Time Zone 1/

2(f)(i)	more accurate	1
	comparison to measuring cylinder	1
2(f)(ii)	time shorter / cross disappears faster	1
	depth greater	1

Q# 7/ iGCSE Chemistry/Paper 6/2017/s/ Time Zone 3/

2(g)	advantage: easy to use / quick	1
	disadvantage: not accurate	1
2(h)	use of burette / pipette / gas syringe / weighed amount of magnesium / repeat experiment (and average) / clean the magnesium / remove oxide layer	1

Q# 8/ iGCSE Chemistry/Paper 6/2017/s/ Time Zone 2/

2(d)(ii)	3 × as concentrated	1
2(e)(i)	double the volume of solution **C** was used / double the volume of solution **A** was needed	1
	78 cm^3	1
2(e)(ii)	problem: volume of potassium manganate(VII) solution added would be greater than 50 cm^3	1
	solution: use more than one burette / refill burette	1
2(f)	advantage: easy (to use) / quick	1
	disadvantage: not accurate	1
2(g)	can take average or mean / can spot anomalies / more reliable	1

Q# 9/ iGCSE Chemistry/Paper 6/2017/s/ Time Zone 1/

2(a)	initial and final readings completed correctly: 4.1, 38.3	1
	difference completed correctly: 34.2	1
2(b)	initial and final readings completed correctly: 3.7, 20.8	1
	difference completed correctly: 17.1	1
2(c)(i)	solution **C** is more concentrated	1
	a greater volume of thiosulfate was needed	1
2(c)(ii)	2 × as concentrated	1

Q# 10/ iGCSE Chemistry/Paper 6/2016/w/ Time Zone 2/

2(c)(ii)	misread measuring cylinder / read too early	1
2(g)	air is displaced (when the acid is added)	1
2(h)	improvement explanation use a burette / graduated pipette / gas syringe improves accuracy **OR** use cotton thread to hold a test-tube (containing the acid) in the flask no air is collected **OR** repeat the experiment take average / more frequent readings	1 1

Q# 11/ iGCSE Chemistry/Paper 6/2016/s/ Time Zone 2/

2(d)	as an indicator;	1
2(e)(i)	(more) accurate;	1
2(e)(ii)	solution slow to run out of pipette; difficult to know when to start timer / reaction does not start at once / inaccurate time measurement owtte;	2 1 1
2(f)	difficulty in swirling / mixing / shaking;	1

Q# 12/ iGCSE Chemistry/Paper 6/2016/m/ Time Zone 2/

2(e)(i)	more accurate; than a measuring cylinder;	2

2(e)(ii)	insulation / use a lid; to reduce heat losses; OR repeats; average results; OR measure water or sulphuric acid or methyl orange using a burette / use a 2 d.p. stopwatch / digital thermometer; reference to accuracy;	2

Q# 13/ iGCSE Chemistry/Paper 6/2017/s/ Time Zone 1/

3(a)	solid spits out of the tube / the tube might crack	1

Q# 14/ iGCSE Chemistry/Paper 6/2017/m/ Time Zone 2/

2(g)(i)	use a pipette / burette	1
2(g)(ii)	repeat experiments (and compare / average)	1

Q# 15/ iGCSE Chemistry/Paper 6/2016/w/ Time Zone 1/

2(e)	phenolphthalein / litmus / suitable named indicator	1

2(h)	polystyrene is an insulator / copper is a (good) conductor	1
2(i)	source of error: heat losses / using a measuring cylinder improvement: lag or insulate / use burette	1 1

Q# 16/ iGCSE Chemistry/Paper 6/2016/s/ Time Zone 1/

3(d)	fume cupboard / protective clothing, e.g. gloves or goggles;	1