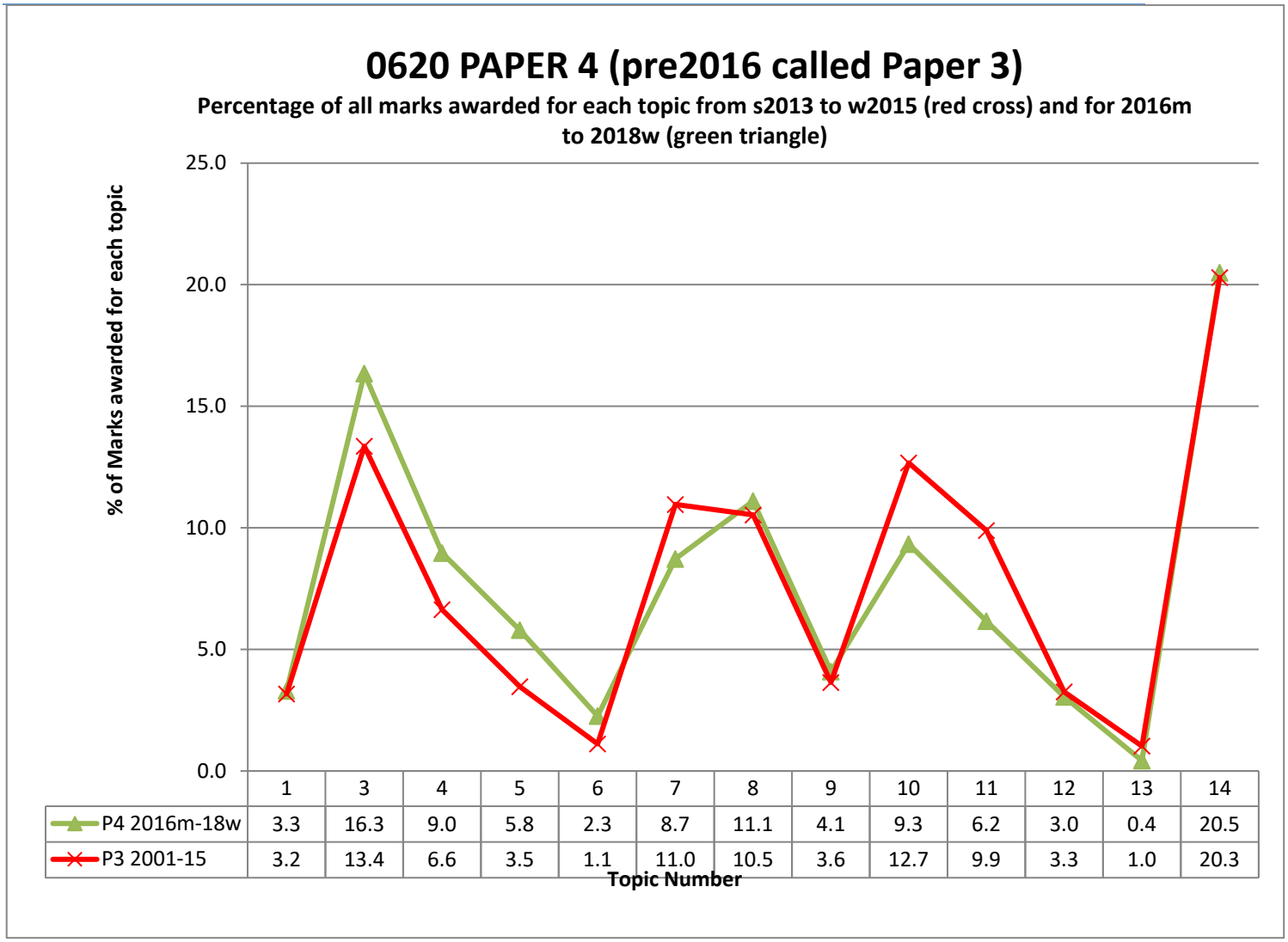
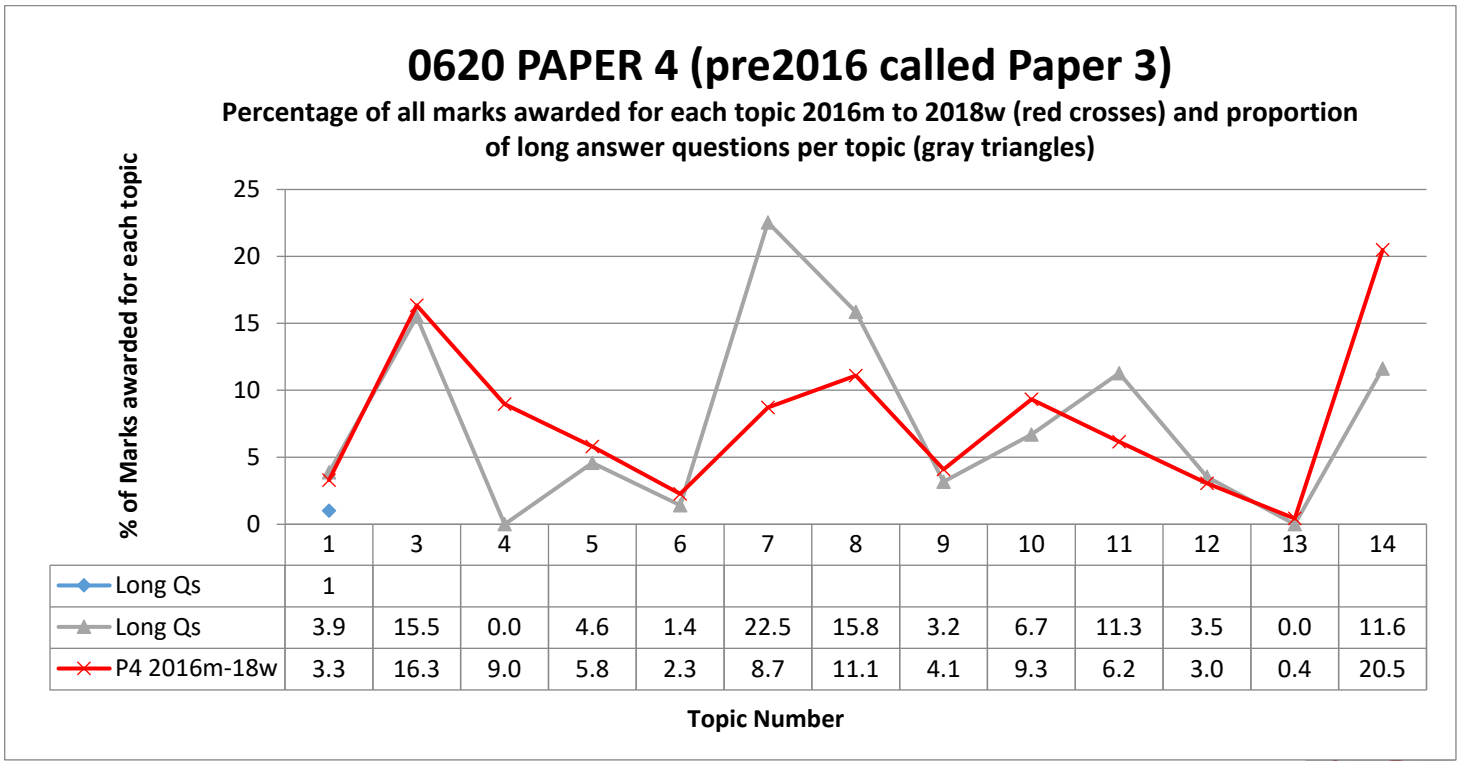
iG Chem ALL EQ P4 FINAL Master NEW 16m to 18w Multi-mark Long Answer Questions Only 290marks



	1	3	4	5	6	7	8	9	10	11	12	13	14
P4 2016m-18w	3.3	16.3	9.0	5.8	2.3	8.7	11.1	4.1	9.3	6.2	3.0	0.4	20.5
P3 2001-15	3.2	13.4	6.6	3.5	1.1	11.0	10.5	3.6	12.7	9.9	3.3	1.0	20.3



	1	3	4	5	6	7	8	9	10	11	12	13	14
Long Qs	1												
Long Qs	3.9	15.5	0.0	4.6	1.4	22.5	15.8	3.2	6.7	11.3	3.5	0.0	11.6
P4 2016m-18w	3.3	16.3	9.0	5.8	2.3	8.7	11.1	4.1	9.3	6.2	3.0	0.4	20.5

	Total	Topic												
		1	3	4	5	6	7	8	9	10	11	12	13	14
Total Marks	284	11	44	0	13	4	64	45	9	19	32	10	0	33
% of Marks		3.9	15.5	0.0	4.6	1.4	22.5	15.8	3.2	6.7	11.3	3.5	0.0	11.6

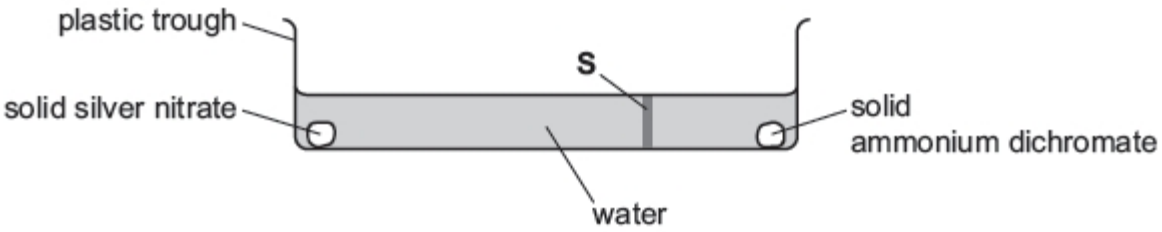
Topic Chem 1 **Q# 1/** IGCSE Chemistry/2017/m/Paper 42/

2 Silver dichromate, $Ag_2Cr_2O_7$, is a red insoluble salt.

Silver dichromate can be made by reacting silver nitrate solution with ammonium dichromate solution. The chemical equation for the reaction is shown.

$$2AgNO_3(aq) + (NH_4)_2Cr_2O_7(aq) \rightarrow 2NH_4NO_3(aq) + Ag_2Cr_2O_7(s)$$

(d) The apparatus shown was set up.



After five minutes, a red solid appeared along the line marked **S** on the diagram.

(i) Explain why a red solid appeared along the line marked **S**.

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(ii) The experiment was repeated at a higher temperature.

What effect, if any, would this have on the time taken for the red solid to appear? Explain your answer.

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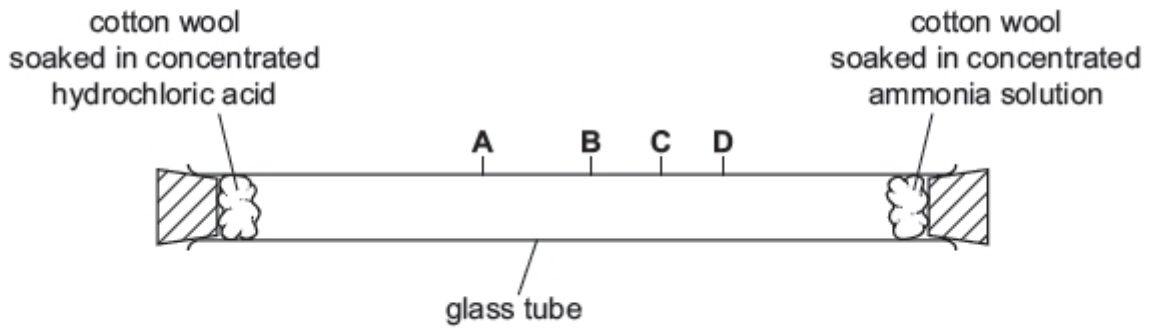
Topic Chem 1 **Q# 2/** IGCSE Chemistry/2016/s/Paper 43/

6 Concentrated ammonia solution gives off ammonia gas. Concentrated hydrochloric acid gives off hydrogen chloride gas. Ammonia, NH_3, and hydrogen chloride, HCl, are both colourless gases. Ammonia reacts with hydrogen chloride to make the white solid ammonium chloride.

Apparatus is set up as shown.



After ten minutes a white solid forms in the tube where the gases meet.

(a)

(iii) At which point, **A**, **B**, **C** or **D**, does the white solid form? Explain why the white solid forms at that point.

the solid forms at .....

explanation .....

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[3]

(iv) The experiment was repeated at a higher temperature.

Predict how the results of the experiment would be different. Explain your answer.

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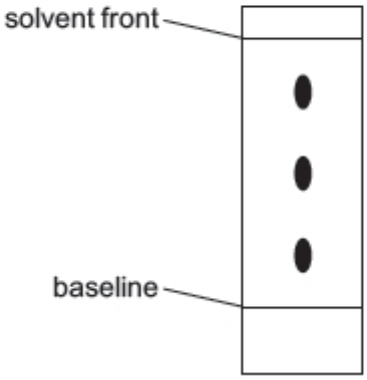
Topic Chem 2 **Q# 3/** IGCSE Chemistry/2016/w/Paper 42/Q7

(c) A colourless mixture of amino acids was separated by chromatography.
Amino acid **X** has an R_f value of 0.8.
The chromatogram of the mixture after treatment with a locating agent is shown.



(iii) Describe how you would perform a chromatography experiment to produce the chromatogram shown in **(c)**. Assume you have been given the mixture of amino acids and a suitable locating agent. You are provided with common laboratory apparatus.

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Topic Chem 2 **Q# 4/** IGCSE Chemistry/2016/w/Paper 41/

1 The table gives some information about five substances.

substance	melting point /°C	boiling point /°C	solubility in water	electrical conductivity when molten	electrical conductivity when solid
F	–97	65	very soluble	does not conduct	does not conduct
G	1600	2230	insoluble	does not conduct	does not conduct
H	801	1413	soluble	conducts	does not conduct
I	–57	126	insoluble	does not conduct	does not conduct
J	1085	2562	insoluble	conducts	conducts

(e) Describe how you could obtain a solid sample of substance **H** from a mixture of substance **H** and substance **G**.

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Topic Chem 3 **Q# 5/** IGCSE Chemistry/2018/s/Paper 42/

4 Potassium reacts with bromine at room temperature to form potassium bromide.

(b) Potassium bromide exists as an ionic lattice.
Potassium bromide does **not** conduct electricity when solid but does conduct electricity when molten.

(i) What is meant by the term *ionic lattice*?

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..... [2]

(ii) Explain why potassium bromide does **not** conduct electricity when solid but does conduct electricity when molten.

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(e) Potassium bromide has a melting point of 734 °C.
Iodine monochloride has a melting point of 27 °C.

In terms of attractive forces, explain why there is a large difference between these melting points.

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Topic Chem 3 **Q# 6/** IGCSE Chemistry/2017/w/Paper 43/Q3

(c) (i) Describe the bonding in iron. Include a diagram in your answer.

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(ii) Use your diagram in **(c)(i)** to explain why iron is malleable.

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Topic Chem 3 **Q# 7/** IGCSE Chemistry/2017/w/Paper 42/

(e) In terms of attractive forces, explain why LiC*l* has a higher melting point than SCl_2.

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Topic Chem 3 **Q# 8/** IGCSE Chemistry/2017/s/Paper 43/Q

(c) The boiling point of bromine is 59 °C and the boiling point of iodine is 184 °C.

Explain why iodine has a higher boiling point than bromine.

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Topic Chem 3 **Q# 9/** IGCSE Chemistry/2017/s/Paper 43/

3 Magnesium is a metal.

(a) Describe the structure and bonding in magnesium.

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..... [3]

(b) Why can magnesium conduct electricity when solid?

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..... [2]

(c) Why is magnesium malleable?

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..... [2]

(d)

(ii) Ionic compounds, such as magnesium sulfide, do **not** conduct electricity when solid.
Magnesium sulfide does **not** dissolve in water.
Magnesium sulfide **does** conduct electricity under certain conditions.

State the conditions needed for magnesium sulfide to conduct electricity. Explain why magnesium sulfide conducts electricity under these conditions.

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Topic Chem 3 **Q# 10/** IGCSE Chemistry/2017/s/Paper 42/

(e) Carbon dioxide, CO_2, is a gas at room temperature and pressure, whereas silicon(IV) oxide, SiO_2, is a solid.

(ii) Use your knowledge of structure and bonding to explain why carbon dioxide is a gas at room temperature and pressure, whereas silicon(IV) oxide is a solid.

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Topic Chem 3 **Q# 11/** IGCSE Chemistry/2016/w/Paper 43/

(c) **(i)** Describe the bonding in a metallic element such as beryllium.
Include a labelled diagram and any appropriate charges in your answer.

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Topic Chem 3 **Q# 12/** IGCSE Chemistry/2016/w/Paper 43/

(d) Solid sodium chloride does not conduct electricity. However, it conducts electricity when molten.

Explain why solid sodium chloride does **not** conduct electricity, whereas molten sodium chloride does conduct electricity.

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Topic Chem 3 **Q# 13/** IGCSE Chemistry/2016/s/Paper 43/

4 **(a)** Potassium iodide is an ionic compound.

(i) Describe what happens, in terms of electron loss and gain, when a potassium atom reacts with an iodine atom.

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(ii) Describe the structure of solid potassium iodide. You may draw a diagram.

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(iii) Explain why potassium iodide has a high melting point.

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Topic Chem 3 **Q# 14/** IGCSE Chemistry/2016/s/Paper 42/

3 Gallium is a metallic element in Group III. It has similar properties to aluminium.

(a) (i) Describe the structure and bonding in a metallic element.
You should include a labelled diagram in your answer.

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Topic Chem 5 **Q# 15/** IGCSE Chemistry/2018/s/Paper 42/Q4

(c) Concentrated aqueous potassium bromide is an electrolyte.

(i) What is meant by the term *electrolyte*?

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(ii) Describe the electrolysis of concentrated aqueous potassium bromide.

Include:
- an ionic half-equation for the reaction at the cathode
- the name of the product at the anode
- the name of the potassium compound formed.

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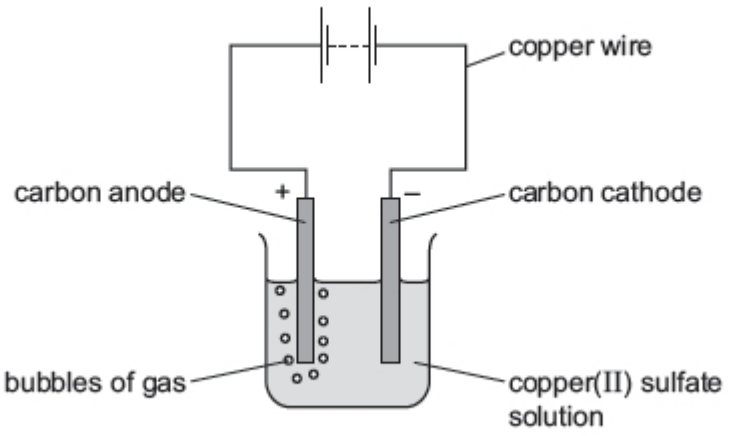
Topic Chem 5 **Q# 16/** IGCSE Chemistry/2016/w/Paper 41/

5 Copper(II) sulfate solution was electrolysed using the apparatus shown.



(a) A gas was formed at the anode.

(b) During electrolysis, electricity passes through the copper(II) sulfate solution.

Solid copper(II) sulfate does not conduct electricity.

Explain **both** of these statements.

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(c) The electrolysis was repeated using copper electrodes in place of carbon electrodes. The ionic half-equations for the reactions at the two electrodes are shown.

anode $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$

cathode $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

(ii) The masses of the copper electrodes changed during the electrolysis.

State how **and** explain why the masses of the **two** copper electrodes changed.
Use the ionic half-equations to help you.

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(iii) Explain why, during the electrolysis, the colour of the copper(II) sulfate solution does **not** change.

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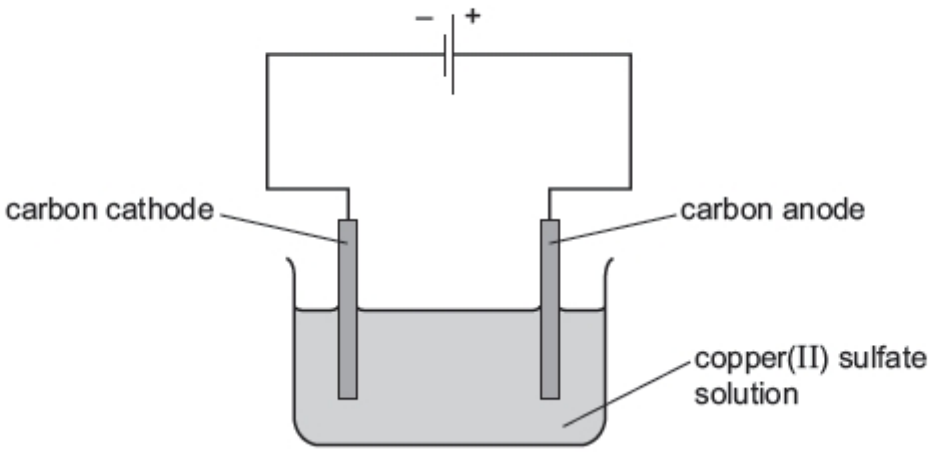
Topic Chem 6 **Q# 17/** IGCSE Chemistry/2017/m/Paper 42/

4 Copper(II) sulfate solution was electrolysed using the apparatus shown.



(c) The electrolysis was repeated using copper electrodes in place of carbon electrodes.

State and explain what happens to the masses of the anode and the cathode during this electrolysis.

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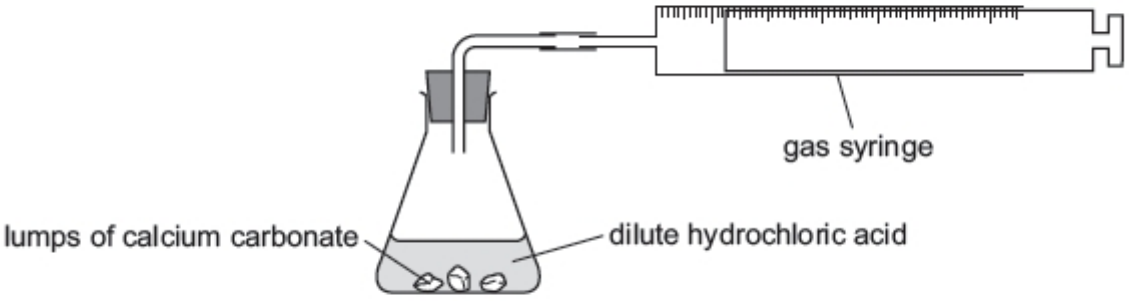
Topic Chem 7 **Q# 18/** IGCSE Chemistry/2018/w/Paper 43/Q5

5 A student investigates the rate of reaction between lumps of calcium carbonate and dilute hydrochloric acid using the apparatus shown.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

The calcium carbonate was in excess.



(a) Which measurements should the student make during the reaction to determine the rate of reaction?

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(b) What happens to the rate of reaction as the reaction proceeds? Explain your answer.

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(c) The student repeated the experiment at a higher temperature. All other conditions were kept the same. The student found that the rate of reaction increased.

Explain, in terms of collisions, why the rate of reaction increased.

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Topic Chem 7 **Q# 19/** IGCSE Chemistry/2018/w/Paper 42/Q4

(c) The original experiment was repeated at a higher temperature. All other conditions were kept the same.

Describe and explain, in terms of collisions between particles, the effect of using a higher temperature on the time taken for the reaction to finish.

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Topic Chem 7 **Q# 20/** IGCSE Chemistry/2018/w/Paper 41/Q5

(d) A mixture of hydrogen gas and iodine gas is allowed to reach equilibrium.

(i) Increasing the pressure of a gas increases its concentration.

State and explain the effect of increasing the pressure on the **rate** of the forward reaction.

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(ii) State and explain the effect of increasing the temperature on the **rate** of the reverse reaction.

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Topic Chem 7 **Q# 21/** IGCSE Chemistry/2018/s/Paper 43/Q3

(d) Cobalt reacts with dilute hydrochloric acid to make the salt cobalt(II) chloride. Bubbles of hydrogen gas are produced.

(iii) Use collision theory to explain how heating the dilute hydrochloric acid makes the rate of reaction faster.

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Topic Chem 7 **Q# 22/** IGCSE Chemistry/2017/w/Paper 43/

(b) The chemical equation shows the equilibrium between dinitrogen tetroxide (N_2O_4, a colourless gas) and nitrogen dioxide (NO_2, a brown gas).

$$\underset{\text{colourless}}{N_2O_4(g)} \rightleftharpoons \underset{\text{brown}}{2NO_2(g)}$$

A mixture of dinitrogen tetroxide and nitrogen dioxide is allowed to reach equilibrium in a closed gas syringe.

(i) In chemistry, what is meant by the term *equilibrium*?

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(ii) If the equilibrium mixture is heated at constant pressure, a darker brown colour is seen inside the gas syringe.

What does this information indicate about the decomposition of dinitrogen tetroxide?
Explain your answer in terms of the position of the equilibrium.

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..... [2]

(iii) Suggest what you would see if the pressure on the equilibrium mixture were increased at constant temperature.
Explain your answer in terms of the position of the equilibrium.

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..... [2]

Topic Chem 7 **Q# 23/** IGCSE Chemistry/2017/w/Paper 42/

5 Some chemical reactions are reversible.

(a) Aqueous potassium chromate(VI), K_2CrO_4, is a yellow solution.

Aqueous potassium dichromate(VI), $K_2Cr_2O_7$, is an orange solution.

The two compounds interconvert when the pH of the solution changes.

$$\underset{\text{yellow}}{2K_2CrO_4} + H_2SO_4 \rightleftharpoons \underset{\text{orange}}{K_2Cr_2O_7} + K_2SO_4 + H_2O$$

Solution **Y** is a mixture of aqueous potassium chromate(VI) and aqueous potassium dichromate(VI) at equilibrium.

- Explain, in terms of the position of the equilibrium, what you would **see** if sulfuric acid were added to solution **Y**.

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- Explain, in terms of the position of the equilibrium, what you would **see** if sodium hydroxide were added to solution **Y**.

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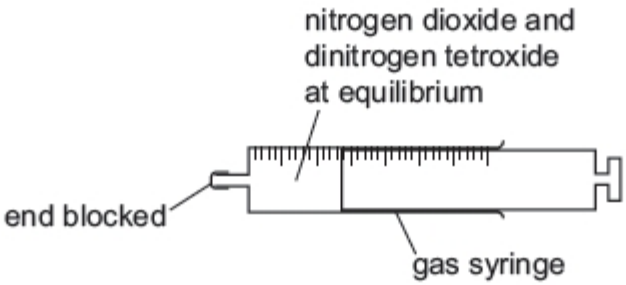
(c) Nitrogen dioxide, NO_2, exists in equilibrium with dinitrogen tetroxide, N_2O_4.
Nitrogen dioxide is brown and dinitrogen tetroxide is colourless.

$$2NO_2(g) \rightleftharpoons N_2O_4(g)$$
brown — colourless

(i) A sample of nitrogen dioxide and dinitrogen tetroxide at equilibrium was placed in a closed gas syringe.
The syringe plunger was pushed in. This increased the pressure in the gas syringe. The temperature was kept constant.



State how the colour of the gas in the syringe changed. Explain your answer in terms of the position of the equilibrium.

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(ii) A sealed tube containing nitrogen dioxide and dinitrogen tetroxide at equilibrium was cooled in an ice bath at constant pressure. The contents of the tube became paler.

Suggest an explanation for this observation in terms of the position of the equilibrium.

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..... [2]

7 Copper(II) oxide reacts with dilute hydrochloric acid.

$$CuO(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l)$$

6.00 g of copper(II) oxide were added to 50.0 cm^3 of 1.00 mol / dm^3 hydrochloric acid. This was an excess of copper(II) oxide.

(a) The rate of the reaction can be increased by increasing the concentration of the hydrochloric acid or by heating it.

(i) In terms of collisions, explain why increasing the concentration of the hydrochloric acid increases the rate of the reaction.

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(ii) In terms of collisions, explain why heating the hydrochloric acid increases the rate of the reaction.

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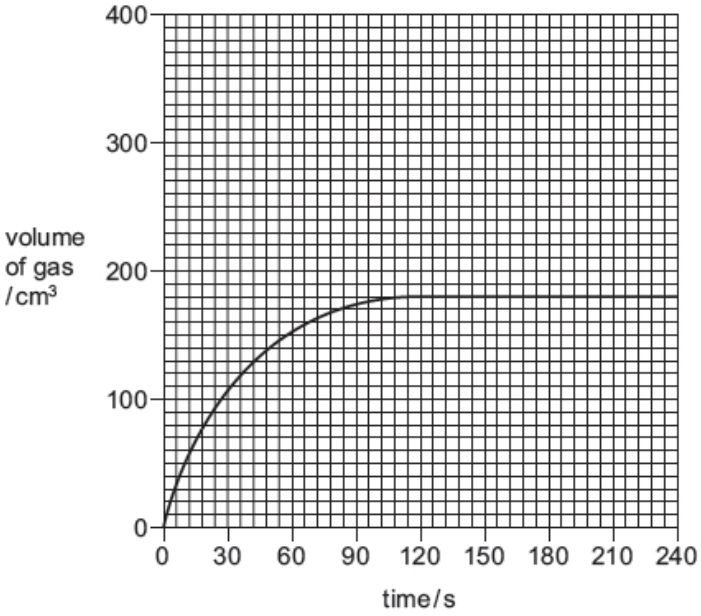
(e) The original graph has been drawn again.

On the grid, draw the graph expected if the concentration of dilute hydrochloric acid is changed from 0.1 mol / dm^3 to 0.2 mol / dm^3. All other conditions are the same as in the original experiment.

Explain, in terms of particles, why your graph is different from the original graph.



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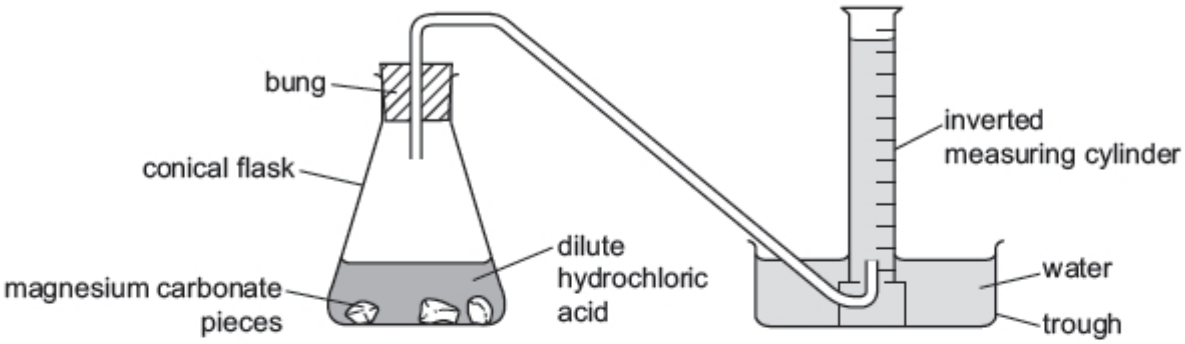
Topic Chem 7 **Q# 27/** IGCSE Chemistry/2016/w/Paper 41/

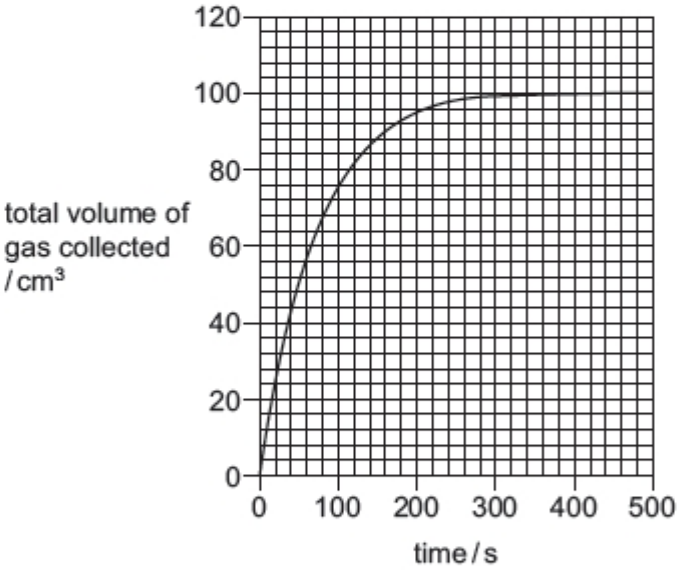
8 Magnesium carbonate reacts with dilute hydrochloric acid.

$$MgCO_3(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l) + CO_2(g)$$

An excess of magnesium carbonate pieces was added to dilute hydrochloric acid. The apparatus in the diagram was used to measure the volume of gas produced. The total volume of gas collected was recorded every 20 seconds.



(a) The results obtained are shown on the graph.



(i) Describe how the rate of this reaction changed during the reaction. Explain why the rate changed in this way.

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(ii) The experiment was repeated using the same mass of **powdered** magnesium carbonate with the same volume and concentration of dilute hydrochloric acid.

Explain how the initial rate of reaction and total volume of gas collected would compare to the first experiment.

initial rate of reaction .....

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total volume of gas .....

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[4]

(b) A piece of magnesium ribbon was cleaned. The experiment was repeated using this clean magnesium ribbon instead of magnesium carbonate.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

This reaction is exothermic.
The rate of the reaction gradually increased over the first 2 minutes.

Explain why the rate of the reaction increased.

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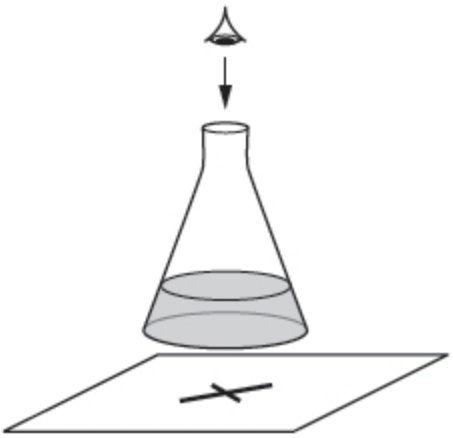
3 When aqueous sodium thiosulfate and dilute hydrochloric acid are mixed, a precipitate of insoluble sulfur is produced. This makes the mixture difficult to see through.

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow S(s) + 2NaCl(aq) + H_2O(l) + SO_2(g)$$

The time taken for the cross to disappear from view is measured.



A student adds the following volumes of aqueous sodium thiosulfate, dilute hydrochloric acid and distilled water to the conical flask.

The time taken for the formation of the precipitate of sulfur to make the cross disappear from view is recorded.

experiment number	volume of sodium thiosulfate / cm^3	volume of hydrochloric acid / cm^3	volume of distilled water / cm^3	time taken for cross to disappear from view / s
1	10	10	40	56
2	20	10	30	28
3				

(ii) Use collision theory to explain why increasing the concentration of sodium thiosulfate would change the rate of reaction.

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(c) The student repeated experiment 1 at a higher temperature.

Use collision theory to explain why the rate of reaction would increase.

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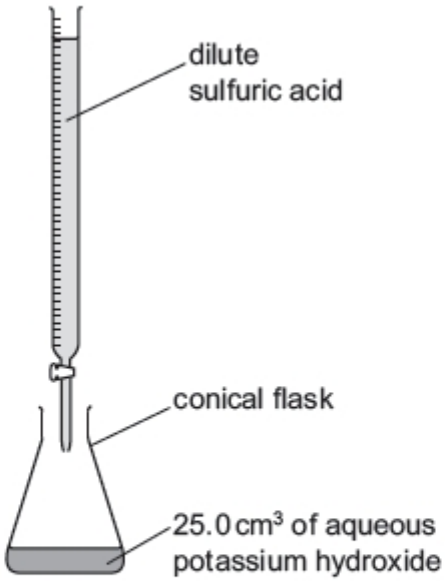
Topic Chem 8 **Q# 29/** IGCSE Chemistry/2018/w/Paper 43/Q4

4 **(a)** Dilute sulfuric acid and aqueous potassium hydroxide can be used to make potassium sulfate crystals using a method that includes titration.



A student titrated 25.0 cm^3 of 0.0500 mol/dm^3 aqueous potassium hydroxide with dilute sulfuric acid in the presence of an indicator. The volume of dilute sulfuric acid needed to neutralise the aqueous potassium hydroxide was 20.0 cm^3.

The equation for the reaction is shown.

$$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$$

(b) After the titration has been completed, the conical flask contains an aqueous solution of potassium sulfate and some of the dissolved indicator.

Describe how to prepare a **pure**, dry sample of potassium sulfate crystals from new solutions of dilute sulfuric acid and aqueous potassium hydroxide of the same concentrations as used in the titration. Include a series of key steps in your answer.

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Topic Chem 8 **Q# 30/** IGCSE Chemistry/2018/s/Paper 43/Q4

(f) Ethanoic acid, CH_3COOH, is a weak acid. It reacts with copper(II) carbonate to form the salt copper(II) ethanoate, $Cu(CH_3COO)_2$.

(ii) Describe how a crystalline sample of copper(II) ethanoate can be prepared starting with ethanoic acid and copper(II) carbonate.

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Topic Chem 8 **Q# 31/** IGCSE Chemistry/2018/s/Paper 42/

6 **(a)** All sodium salts are soluble in water. All nitrates are soluble in water. Barium carbonate is insoluble in water.

Describe how you would make a pure, dry sample of barium carbonate by precipitation.
Include:

- the names of the starting materials
- full practical details
- a chemical equation.

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Topic Chem 8 **Q# 32/** IGCSE Chemistry/2017/w/Paper 41/Q5

(b) Copper(II) carbonate reacts with dilute nitric acid. One of the products of the reaction is a solution of copper(II) nitrate.

(i) Describe tests for copper(II) ions and nitrate ions. Include the results of the tests.

copper(II) ions .....

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nitrate ions .....

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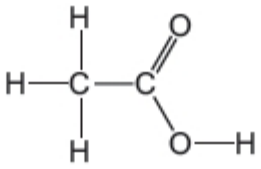
[4]

Topic Chem 8 **Q# 33/** IGCSE Chemistry/2017/w/Paper 41/

4 **(a)** Ethanol, C_2H_5OH, can be made by fermentation.

(ii) A molecule of ethanoic acid has the structure shown.



(ii) Describe how you could show that ethanoic acid is a weaker acid than hydrochloric acid.

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Topic Chem 8 **Q# 34/** IGCSE Chemistry/2017/s/Paper 42/Q4

(b) Copper(II) oxide is a basic oxide but zinc oxide is an amphoteric oxide. Both oxides are insoluble in water.

You are provided with a mixture of solid copper(II) oxide and solid zinc oxide. Describe how you would obtain a sample of copper(II) oxide from this mixture.

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Topic Chem 8 **Q# 35/** IGCSE Chemistry/2017/s/Paper 42/Q3

(d) Describe how you would prepare a pure dry sample of copper(II) nitrate crystals in the laboratory using dilute nitric acid and solid copper(II) carbonate.
Include a series of key steps in your answer.
You should include a chemical equation for the reaction.

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..... [6]

Topic Chem 8 **Q# 36/** IGCSE Chemistry/2017/s/Paper 41/

(c) Lead(II) sulfate, $PbSO_4$, is insoluble.

Describe how you would prepare a pure dry sample of lead(II) sulfate crystals starting from solutions of lead(II) nitrate and sodium sulfate.
Include a series of key steps in your answer.

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..... [4]

Topic Chem 8 **Q# 37/** IGCSE Chemistry/2017/m/Paper 42/

2 Silver dichromate, $Ag_2Cr_2O_7$, is a red insoluble salt.

Silver dichromate can be made by reacting silver nitrate solution with ammonium dichromate solution. The chemical equation for the reaction is shown.

$$2AgNO_3(aq) + (NH_4)_2Cr_2O_7(aq) \rightarrow 2NH_4NO_3(aq) + Ag_2Cr_2O_7(s)$$

(a) Describe how you could obtain pure dry solid silver dichromate after mixing silver nitrate solution and ammonium dichromate solution.

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..... [3]

(c) Dilute aqueous sodium hydroxide was added to the ammonium nitrate solution made in the reaction. The mixture was then warmed and damp Universal Indicator paper was held above the mixture.

State and explain what would happen to the Universal Indicator paper.

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.....

..... [2]

Topic Chem 8 **Q# 38/** IGCSE Chemistry/2016/s/Paper 43/Q4

(b) Potassium iodide and lead nitrate are both soluble. Lead iodide is insoluble.

(i) Describe how a pure dry sample of lead iodide could be made from solid potassium iodide and solid lead nitrate.

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..... [4]

Topic Chem 8 **Q# 39/** IGCSE Chemistry/2016/s/Paper 41/Q2

(c) Aluminium oxide is amphoteric. It is insoluble in water.

Describe experiments to show that aluminium oxide is amphoteric.

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..... [3]

Topic Chem 9 **Q# 40/** IGCSE Chemistry/2018/w/Paper 41/Q3

(d) A sample of copper(II) nitrate was dissolved in water to form an aqueous solution.

The aqueous solution was split into three portions. A separate test was done on each portion as shown.

test	reagent added	result
1	aqueous sodium hydroxide	light blue precipitate forms
2	zinc powder	solution changes from blue to colourless and a brown solid forms
3		ammonia gas is produced

(ii) Explain the changes seen in **test 2**.

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..... [3]

Topic Chem 9 **Q# 41/** IGCSE Chemistry/2017/s/Paper 42/

4 Nickel, copper and zinc are three consecutive elements in the Periodic Table.

(a) Nickel and copper are transition elements.

State **three** chemical properties of transition elements.

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..... [3]

Topic Chem 9 **Q# 42/** IGCSE Chemistry/2016/s/Paper 41/Q4

(c) Copper, nickel and silver are transition elements.
Typical physical properties of transition elements are a high density and a high melting point.

Give **three** different properties of transition metals which are not typical of other metals.

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..... [3]

Topic Chem 10 **Q# 43/** IGCSE Chemistry/2018/s/Paper 41/

(b) A series of reactions occurs in a blast furnace during the extraction of iron from hematite.

Describe these reactions.
Include:

- **one** chemical equation for the reduction of hematite
- **one** chemical equation for the formation of slag.

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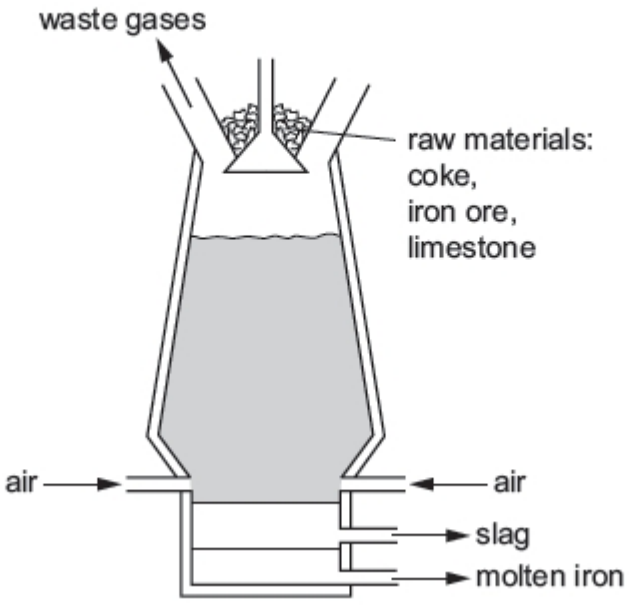
..... [5]

Topic Chem 10 **Q# 44/** IGCSE Chemistry/2017/w/Paper 43/

3 Iron is extracted from its ore using coke in a blast furnace.



(b) Describe the reactions occurring in the blast furnace.

In your answer, include

- **two** reasons for using coke in the blast furnace,
- a chemical equation for the reduction of iron(III) oxide,
- an explanation for using limestone in the blast furnace.

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..... [6]

Topic Chem 10 **Q# 45/** IGCSE Chemistry/2016/w/Paper 42/

6 Aluminium is a very important metal.

Aluminium is extracted from its ore, bauxite, by electrolysis. Bauxite is an impure form of aluminium oxide, Al_2O_3.

(a) Describe how aluminium is extracted from **bauxite**. Include an ionic half-equation for the reaction at each electrode.

description .....

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ionic half-equation for the anode reaction .....

ionic half-equation for the cathode reaction.....

[5]

Topic Chem 10 **Q# 46/** IGCSE Chemistry/2016/s/Paper 42/

(b) Zinc oxide is converted into zinc. Zinc oxide and coke are fed into a furnace. Hot air is blown into the bottom of the furnace.

Zinc has a melting point of 420 °C and a boiling point of 907 °C. The temperature inside the furnace is over 1000 °C.

(i) Explain how zinc oxide is converted into zinc. Your answer should include details of how the heat is produced and equations for all the reactions you describe.

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..... [3]

Topic Chem 11 **Q# 47/** IGCSE Chemistry/2018/w/Paper 43/Q3

(g) Iron does not rust when it is completely coated with zinc. When the zinc is scratched, the iron still does not rust.

(ii) Explain why the iron still does **not** rust when the zinc is scratched.

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..... [3]

Topic Chem 11 **Q# 48/** IGCSE Chemistry/2018/m/Paper 42/

1 This question is about gases.

(iii) Describe the steps in the industrial process which enables nitrogen and oxygen to be separated from clean dry air.

Use scientific terms in your answer.

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..... [3]

Topic Chem 11 **Q# 49/** IGCSE Chemistry/2017/s/Paper 43/Q4

(c) Car engines produce carbon monoxide and oxides of nitrogen.

(iv) Describe and explain how catalytic converters remove oxides of nitrogen from car engine exhaust fumes. You are advised to include a chemical equation in your answer.

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..... [3]

Topic Chem 11 **Q# 50/** IGCSE Chemistry/2016/w/Paper 42/

(b) Oxides of nitrogen are atmospheric pollutants which can cause acid rain.

Describe the formation of oxides of nitrogen and suggest how they can cause acid rain.

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..... [3]

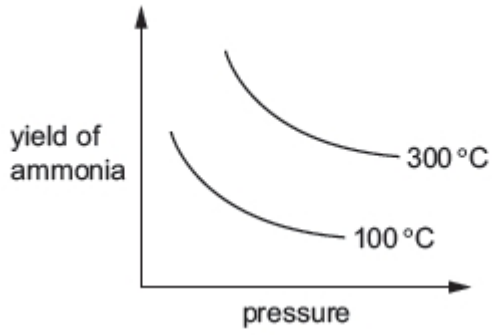
Topic Chem 11 **Q# 51/** IGCSE Chemistry/2016/w/Paper 41/

(b) Ammonia is also made when ammonium carbonate decomposes.

$$(NH_4)_2CO_3(s) \rightleftharpoons 2NH_3(g) + H_2O(g) + CO_2(g)$$

The reaction is reversible and can reach a position of equilibrium.

The graph shows how the yield of ammonia at equilibrium changes with temperature and pressure.



(i) What is meant by the term *equilibrium* for a reversible reaction?

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..... [2]

(iii) State and explain the effect of increasing the pressure on the yield of ammonia in this reaction.

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..... [3]

Topic Chem 11 **Q# 52/** IGCSE Chemistry/2016/s/Paper 43/

(b) Air often contains pollutants.

Identify **three** common gaseous pollutants in air and state how each of these pollutants are produced.

pollutant gas 1 .....

how it is produced .....

.....

pollutant gas 2 .....

how it is produced .....

.....

pollutant gas 3 .....

how it is produced .....

.....

[6]

Topic Chem 11 **Q# 53/** IGCSE Chemistry/2016/s/Paper 42/

(c) Rusting of steel can be prevented by coating the steel with a layer of zinc.

Explain, in terms of electron transfer, why steel does **not** rust even if the layer of zinc is scratched so that the steel is exposed to air and water.

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..... [4]

Topic Chem 11 **Q# 54/** IGCSE Chemistry/2016/m/Paper 42/

5 This question is about compounds of nitrogen.

(a) (i) Describe the Haber Process giving reaction conditions and a chemical equation. Reference to rate and yield is not required.

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..... [5]

Topic Chem 12 **Q# 55/** IGCSE Chemistry/2018/w/Paper 41/Q4

4 **(a)** Sulfuric acid is made industrially by a four-step process.

step 1 Sulfur is burned in air to produce sulfur dioxide.

step 2 Sulfur dioxide is converted into sulfur trioxide.

step 3 Sulfur trioxide is reacted with concentrated sulfuric acid to produce oleum.

step 4 Oleum is reacted with water to produce concentrated sulfuric acid.

(iii) Describe the conversion of sulfur dioxide into sulfur trioxide in **step 2**.

In your answer, include:

- a chemical equation for the reaction
- the essential reaction conditions.

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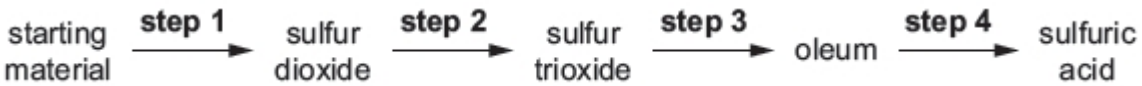
..... [5]

Topic Chem 12 **Q# 56/** IGCSE Chemistry/2016/s/Paper 41/

5 Sulfuric acid is produced by the Contact process. The steps of the Contact process are shown.



(b) Describe **step 2**, giving reaction conditions and a chemical equation. Reference to reaction rate and yield is not required.

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..... [5]

Topic Chem 14 **Q# 57/** IGCSE Chemistry/2018/w/Paper 43/Q6

6 **(a)** Ethanol can be manufactured by fermentation and by hydration.

(i) Describe these **two** processes of ethanol manufacture.

In each case you should:
- identify the reactants
- give the reaction conditions
- write a chemical equation for the reaction which produces ethanol.

fermentation .....

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.....

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hydration .....

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.....

[6]

Topic Chem 14 **Q# 58/** IGCSE Chemistry/2018/s/Paper 42/Q7

(f) Ethanol can be produced from long-chain alkanes as shown.

$$\text{long-chain alkane} \xrightarrow{\textbf{step 1}} \text{ethene} \xrightarrow{\textbf{step 2}} \text{ethanol}$$

Describe the **two-stage** manufacture of ethanol from the long-chain alkane octane, C_8H_{18}.
Include:

- the names of the types of chemical reactions that occur
- reaction equations
- reaction conditions.

step 1 .....

.....

.....

.....

step 2 .....

.....

.....

..... [5]

Topic Chem 14 **Q# 59/** IGCSE Chemistry/2017/s/Paper 43/

(b) One of the compounds in gasoline is heptane, C_7H_{16}. Heptane is a saturated hydrocarbon.

(i) What is meant by the term *saturated hydrocarbon*?

saturated .....

.....

hydrocarbon .....

.....

[3]

(ii) What is meant by the term *structural isomers*?

.....

.....

..... [2]

Topic Chem 14 **Q# 60/** IGCSE Chemistry/2017/s/Paper 41/

(f) Describe how a student could prepare the ester methyl ethanoate in a school laboratory.
In your description give

- the names of the **two** starting organic chemicals,
- the essential reaction conditions needed,
- a chemical equation for the reaction.

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..... [5]

Topic Chem 14 **Q# 61/** IGCSE Chemistry/2016/w/Paper 43/

6 Synthetic polyamides are made by condensation polymerisation.

(a) (i) What is meant by the term *condensation polymerisation*?

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..... [3]

(ii) Starting with a sample of protein, describe how to produce, separate, detect and identify the monomers which make it up.

Your answer should include

- the name of the process used to break down the protein into its monomers,
- the name of the process used to separate the monomers,
- the method used to detect the monomers after they have been separated,
- the method used to identify the monomers after they have been separated.

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..... [4]

Topic Chem 14 **Q# 62/** IGCSE Chemistry/2016/w/Paper 42/

7 Proteins are a major constituent of food.

Proteins are polymers.

(a) What is a polymer?

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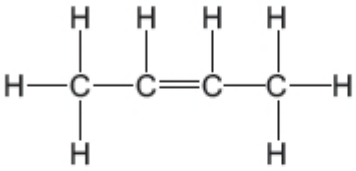
..... [2]

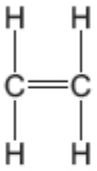
Topic Chem 14 **Q# 63/** IGCSE Chemistry/2016/s/Paper 43/

2 The structures of six organic compounds are shown.

A



B



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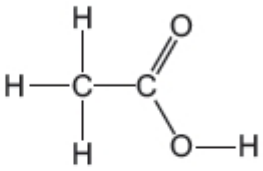
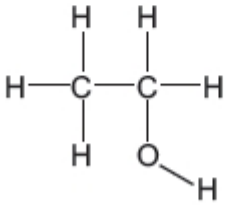
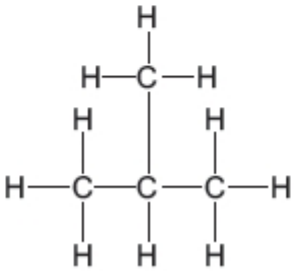


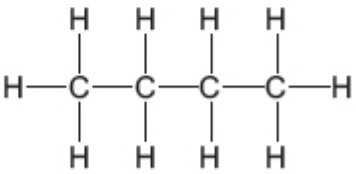
D



E



F



(e) Describe how **D** is manufactured from **B**. Give a chemical equation for the reaction.

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..... [3]

Mark Scheme

Q# 1/ IGCSE Chemistry/2017/m/Paper 42/

2(d)(i)	**M1** dichromate ions / particles are heavier (than silver ions)	1
	M2 so dichromate ions diffuse / move more slowly **ORA**	1
	M3 (where they meet they react and) silver dichromate is made	1
2(d)(ii)	**M1** red solid forms in less than five minutes **or** red solid forms faster / sooner	1
	M2 particles / ions move faster	1

Q# 2/ IGCSE Chemistry/2016/s/Paper 43/

6(a)(iii)	solid forms at: A; explanation: ammonia molecules/ particles have a smaller mass; (and so) move/ diffuse faster;	3 1 2
6(a)(iv)	**M1** solid forms in less time/faster/ quicker; **M2** particles/molecules have more energy; **M3** (and so) move faster/diffuse faster;	3 1 1 1

Q# 3/ IGCSE Chemistry/2016/w/Paper 42/

7(c)(iii)	mixture of amino acids is placed as a spot onto a (pencil) baseline placed into a (suitable) solvent/water a locating agent is added to the (finished) chromatogram (to reveal spots)	

Q# 4/ IGCSE Chemistry/2016/w/Paper 41/

1(e)	add/mix/stir/dissolve/shake/heat with water filter/decant heat (filtrate) or (leave filtrate to) evaporate	1 1 1

Q# 5/ IGCSE Chemistry/2018/s/Paper 42/

4(b)(i)	(ionic): made of, positive and negative ions / anions and cations / oppositely charged ions / unlike charged ions / different charged ions	1
	(lattice): regular / sequence / pattern / alternating / repeated / framework / ordered / organised / network / uniform	1
4(b)(ii)	(in solid) ions don't move	1
	(when molten) ions move / ions mobile	1

4(e)	(potassium bromide): ionic bonds / attraction between ions	1
	(iodine monochloride): intermolecular forces / forces between molecules / named intermolecular forces, e.g. van der Waals / London forces / dispersion forces / dipole- dipole	1
	bonds in KBr are stronger / need more energy to break bonds / ORA	1

Q# 6/ IGCSE Chemistry/2017/w/Paper 43/

3(c)(i)	positive ions / cations	1
	sea of electrons / mobile electrons / delocalised electrons / moving electrons / flowing electrons	1
	attraction between positive ions and electrons	1
3(c)(ii)	layers / rows / sheets of ions	1
	slide / slip / shift (over each other or past each other)	1

Q# 7/ IGCSE Chemistry/2017/w/Paper 42/

2(e)	SCl_2 has intermolecular forces (of attraction)	1
	LiCl has (electrostatic) forces (of attraction) between ions	1
	intermolecular forces are weaker / less energy is needed to break intermolecular forces	1

Q# 8/ IGCSE Chemistry/2017/s/Paper 43/

2(c)	(attractive) forces between molecules	1
	(forces of attraction) are stronger in iodine	1

Q# 9/ IGCSE Chemistry/2017/s/Paper 43/

3(a)	regular arrangement / lattice of positive ions / magnesium ions / Mg^{2+} ions	1
	sea of electrons OR delocalised electrons	1
	attraction between (positive) ions and (delocalised / sea of) electrons	1
3(b)	electrons	1
	move / flow (throughout / through the structure)	1
3(c)	layers (of atoms or ions)	1
	layers / atoms / ions can slide / slip / glide (over each other) (without breaking the metallic bonds)	1
3(d)(i)	magnesium shown as (2, 8) using crosses	1
	sulfide shown as (2, 8, 8), with the two gained electrons in the outer shell of sulfur shown as crosses and all other electrons on sulfur shown as dots	1
	magnesium ion charge as 2^+ **AND** sulfide charge as 2^-	1
3(d)(ii)	melt / fused	1
	ions can move OR are mobile	1

Q# 10/ IGCSE Chemistry/2017/s/Paper 42/

2(e)(ii)	carbon dioxide: **weak (force of) attraction** between molecules / **weak** intermolecular forces / **weak** van der Waals' forces / **weak** dispersion forces / **weak** London forces	1
	silicon(IV) dioxide: covalent bonds are **strong** / force of attraction between atoms is **strong** / no **weak** bonds (are present) / **all** bonds are **strong**	1
	(weak) forces of attraction in carbon dioxide need small amounts of **energy** or heat to break / **less energy** or heat needed to break **forces of attraction** in carbon dioxide OR **(strong) bonds** in silicon(IV) dioxide need large amounts of **energy** or heat to break / **more energy** or heat needed to break **bonds** in silicon(IV) dioxide	1

Q# 11/ IGCSE Chemistry/2016/w/Paper 43/

2(c)(i)	positive ions / cations labelled or named in text electrons labelled or named in text attraction between positive ions and negative electrons	1 1 1

Q# 12/ IGCSE Chemistry/2016/w/Paper 43/

4(d)	(sodium chloride contains) ions / is ionic in the solid ions are not moving / they are in fixed positions ions can move when molten	1 1 1

Q# 13/ IGCSE Chemistry/2016/s/Paper 43/

Question	Answer	Marks
4(a)(i)	**M1** movement of electron(s) from potassium to iodine; **M2** one electron transferred;	2 1 1
4(a)(ii)	**M1** regular arrangement / (giant) lattice of alternating; **M2** positive potassium ions / K^+ **and** negative iodide ions / I^-;	2 1 1
4(a)(iii)	**M1** strong (forces of) attraction (between oppositely charged ions) / ionic bonds are strong; **M2** which require lots of energy to overcome / break;	2 1 1

Q# 14/ IGCSE Chemistry/2016/s/Paper 42/

3(a)(i)	**M1** positive ions / cations (labelled or named in text); **M2** electrons (labelled or named in text); **M3** attraction between positive and negative;	3 1 1 1

Q# 15/ IGCSE Chemistry/2018/s/Paper 42/

4(c)(i)	substance that conducts electricity / (undergoes) electrolysis	1
	decomposed / chemically changed **OR** molten or liquid or solution or aqueous **AND** containing ions/or ionic	1
4(c)(ii)	$2H^+ + 2e(^-) \rightarrow H_2$ 1 mark for $H^+ + e(^-)$ as the only species on the left 1 mark for equation fully correct 1 mark for bromine at the anode 1 mark for potassium hydroxide	4

Q# 16/ IGCSE Chemistry/2016/w/Paper 41/

5(b)	reference to ions / ionic ions cannot move in solid OR are in fixed positions in solid ions can move when in solution	1 1 1
5(c)(i)	copper ions / Cu^{2+} gain of electrons / oxidation number decreases	1 1
5(c)(ii)	any 3 from: anode decreases (in mass) copper removed (from anode) / solid (copper from anode) becomes aqueous cathode increases (in mass) copper deposited / added / Cu^{2+} deposited as Cu (on cathode)	3
5(c)(iii)	copper is both added and removed (at same rate) OR the concentration (of copper ions) does not change	1

Q# 17/ IGCSE Chemistry/2017/m/Paper 42/

4(c)	**M1** anode mass decreases	1
	M2 copper lost as ions **OR** copper (atoms) becomes ions **OR** $Cu \rightarrow Cu^{2+} + 2e^-$	1
	M3 cathode mass increases	1
	M4 copper deposited / layer of copper forms / copper collected at cathode **OR** $Cu^{2+} + 2e^- \rightarrow Cu$	1

Q# 18/ IGCSE Chemistry/2018/w/Paper 43/

5(a)	**M1** volume of gas **M2** time	2
5(b)	**M1** rate decreases / reaction gets slower **M2** concentration of acid decreases **M3** fewer collisions per unit time	3
5(c)	**M1** particles have **more** kinetic energy **M2** particles move faster **M3 more** collisions **per unit time** **M4 more** of the particles have energy greater than or equal to activation energy / **more** of the collisions have energy greater than or equal to activation energy **OR** **more** of the particles have sufficient energy to react / **more** of the collisions have sufficient energy to react **OR** A greater percentage or greater proportion or greater fraction of collisions are successful	4

Q# 19/ IGCSE Chemistry/2018/w/Paper 42/

4(c)	M1 **Time** taken is less M2 (particles) have more energy M3 (particles) move faster M4 More collisions (of particles) occur per second / per unit time M5 More (of the) particles / collisions have energy greater than activation energy **or** More (of the) particles / collisions have sufficient energy to react **or** A greater percentage / proportion / fraction of collisions (of particles) are successful	**5**

Q# 20/ IGCSE Chemistry/2018/w/Paper 41/

5(d)(i)	**M1** Faster **and** More particles per unit volume / dm^3 / cm^3 **M2** More collisions per second / unit time or greater collision rate	**2**
5(d)(ii)	Reaction faster **and** (particles) have more energy **or** (particles) move faster	**1**
	more collisions per second **or** greater collision rate	**1**
	more (of the) particles / collisions have energy greater than the activation energy **or** more particles / collisions have sufficient energy to react **or** a greater percentage / proportion / fraction of collisions are successful	**1**

Q# 21/ IGCSE Chemistry/2018/s/Paper 43/

3(d)(iii)	(particles) have more energy / (particles) move faster	**1**
	more collisions per second / greater collision rate	**1**
	more of the colliding molecules have sufficient energy (activation energy) to react	**1**

Q# 22/ IGCSE Chemistry/2017/w/Paper 43/

5(b)(i)	reversible reaction in which the rate of the forward reaction **equals** the rate of the backward reaction	**1**
	concentration of all reactants and products becomes constant / does not change	**1**
5(b)(ii)	forward reaction is endothermic	**1**
	(increased temperature) causes equilibrium to shift to the right / to shift in the endothermic direction / to form more nitrogen dioxide / to form more product(s)	**1**
5(b)(iii)	less brown / lighter / paler / colour fades	**1**
	more molecules / moles / volume on the right ORA OR equilibrium shifts in the direction of **fewer** molecules / moles / lower volume	**1**

Q# 23/ IGCSE Chemistry/2017/w/Paper 42/

5(a)	both colours referred to correctly as observations in both parts of the answer	**1**
	(if sulfuric acid is added to solution Y,) equilibrium moves to the right-hand side	**1**
	because the concentration of acid has increased	**1**
	(if sodium hydroxide is added to solution Y,) equilibrium moves to the left-hand side	**1**
	because sodium hydroxide reacts with / neutralises sulfuric acid	**1**
5(b)(ii)	fewer moles / molecules / particles (of gas) on the left-hand side	**1**
5(b)(iii)	endothermic	**1**
5(b)(iv)	increases rate (of reaction)	**1**

Q# 24/ IGCSE Chemistry/2017/w/Paper 41/Q5

5(c)(i)	becomes paler	1
	equilibrium moves right	1
	(because) fewer moles (of gas) on right	1
5(c)(ii)	equilibrium moved right / more N_2O_4 / less NO_2	1
	(forward) reaction exothermic	1

Q# 25/ IGCSE Chemistry/2017/w/Paper 41/

7(a)(i)	more particles (of acid) in a given volume / dm^3 / cm^3	1
	more collisions per second / unit time OR greater collision rate	1
7(a)(ii)	particles have more energy / particles move faster / more collisions per second / more collisions per unit time / greater collision rate	1
	more (of the) particles / collisions have energy greater than the activation energy / more particles have sufficient energy to react / more collisions have sufficient energy to react / a greater percentage of collisions are successful	1

Q# 26/ IGCSE Chemistry/2017/s/Paper 41/

5(d)	curve starts from (0,0) and has a lower gradient than the original curve	1
	because lumps have a lower surface area	1

5(d)	curve starts from (0,0) and has a lower gradient than the original curve	1
	because lumps have a lower surface area	1

Q# 27/ IGCSE Chemistry/2016/w/Paper 41/

8(a)(i)	any 4 from: slowed down acid became less concentrated OR fewer particles per unit volume fewer collisions per second OR lower collision rate (then the reaction) stopped all the hydrochloric acid reacted	4
8(a)(ii)	any 4 from: faster (reaction) (powder has) larger surface area more collisions per second OR higher collision rate same volume of gas amount / moles hydrochloric acid is not changed	4
8(b)	any 5 from: temperature increased particles have more energy (particles) move faster more collisions per second OR higher collision rate more particles have sufficient energy to react / activation energy more of the collisions are successful	5

Q# 28/ IGCSE Chemistry/2016/s/Paper 41/

3(b)(ii)	**M1** more particles per unit volume/particles are closer together; **M2** increases the rate of collisions/there are more collisions per unit time;	2 1 1
3(c)	**M1** particles gain more energy **and** move faster; **M2** increasing rate of collisions/more collisions per unit time; **M3** higher proportion of particles have sufficient energy to react/collisions have sufficient energy to react/are above the activation energy;	3 1 1 1

Q# 29/ IGCSE Chemistry/2018/w/Paper 43/

4(b)	**SUMMARY** **M1** repeat **M2** heat (liquid or solution should be implied) **M3** when to stop heating **M4** what to do after heating **M5** method of drying crystals (crystals or solid should be implied) **M1** repeat without indicator using same volumes **M2** evaporate / heat / warm / boil / leave in sun **M3** until most of the water is gone / some water left / saturation(point) / crystallisation point / evaporate **some** of the water **M4** leave / (allow to) cool / allow to crystallise **M5** details of drying	**5**

Q# 30/ IGCSE Chemistry/2018/s/Paper 43/

4(f)(ii)	add excess copper(II) carbonate to ethanoic acid	**1**
	filter	**1**
	heat to point of crystallisation **AND** leave (to cool)	**1**

Q# 31/ IGCSE Chemistry/2018/s/Paper 42/

6(a)	(mix) sodium carbonate **AND** barium nitrate / barium chloride	**1**
	in solution / aqueous / dissolved (in water)	**1**
	filter / centrifuge (barium carbonate)	**1**
	wash (residue) **AND** dry / description of washing and drying	**1**
	$Ba(NO_3)_2 + Na_2CO_3 \rightarrow BaCO_3 + 2NaNO_3$ / $Ba^{2+} + CO_3^{2-} \rightarrow BaCO_3$ **OR** $BaCl_2 + Na_2CO_3 \rightarrow BaCO_3 + 2NaCl$	**1**

Q# 32/ IGCSE Chemistry/2017/w/Paper 41/Q5

5(b)(i)	*(copper(II) ions)* add sodium hydroxide (solution)	**1**
	(copper(II) ions) blue ppt.	**1**
	(nitrate ions) add aluminium **AND** aqueous sodium hydroxide **AND** warm	**1**
	ammonia given off / gas turns damp (red) litmus blue	**1**

Q# 33/ IGCSE Chemistry/2017/w/Paper 41/

4(d)(ii)	**M1** (acids) have same concentration	**1**
	M2: measure pH OR describe how to measure pH (such as use Universal Indicator) **M3**: lower pH corresponds to the stronger acid / hydrochloric acid OR **M2**: add calcium / magnesium / zinc / iron **M3**: faster rate of forming bubbles corresponds to the stronger acid / hydrochloric acid OR **M2**: rate of reaction with (metal) carbonate **M3**: faster rate of forming bubbles corresponds to the stronger acid / hydrochloric acid OR **M2**: rate of reaction with (named) metal oxide **M3**: dissolves faster means that reaction is with the stronger acid / hydrochloric acid OR **M2**: electrical conductivity **M3**: greater conductivity corresponds to the stronger acid / hydrochloric acid OR **M2**: add sodium hydroxide (or other named alkali) **M3**: greater temperature change corresponds to the stronger acid / hydrochloric acid	**2**

Q# 34/ IGCSE Chemistry/2017/s/Paper 42/

4(b)	add sodium hydroxide (solution) / NaOH / potassium hydroxide (solution) / KOH	**1**
	zinc oxide dissolves / reacts OR copper(II) oxide does not dissolve / react	**1**
	filter / decant / centrifuge (copper(II) oxide)	**1**

Q# 35/ IGCSE Chemistry/2017/s/Paper 42/

3(d)	add copper(II) carbonate (to acid) until it stops dissolving or no more effervescence / bubbling / fizzing	1
	filter (to remove copper(II) carbonate)	1
	evaporate / heat / warm / boil / leave in sun **AND** until most of the water has gone / some water is left / evaporate some of the water / until it is concentrated / saturation (point) / crystallisation point / crystals form on glass rod or microscope slide / crystals start to form	1
	(for any solution) leave / allow to cool / allow to crystallise **OR** (for any crystals) filter / wash / dry with filter paper / dry in warm place / dry in a (low) oven / leave to dry	1
	formula of $Cu(NO_3)_2$	1
	equation: $CuCO_3 + 2HNO_3 \rightarrow Cu(NO_3)_2 + CO_2 + H_2O$	1

Q# 36/ IGCSE Chemistry/2017/s/Paper 41/

3(c)	mix and stir the two solutions	1
	filter (to obtain residue)	1
	wash (the residue) using water	1
	dry the residue between filter papers / in a warm place	1
3(d)	$Pb^{2+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s)$ **M1** correct species **M2** correct state symbols	2

Q# 37/ IGCSE Chemistry/2017/m/Paper 42/

2(a)	**M1** filter	1
	M2 wash (the residue) using water	1
	M3 dry the residue between filter papers / in a warm place	1
2(c)	**M1** Universal Indicator turns blue	1
	M2 ammonia / NH_3 (is made)	1

Q# 38/ IGCSE Chemistry/2016/s/Paper 43/

4(b)(i)		4
	M1 dissolve solids (in water) and mix / combine / add;	1
	M2 filter;	1
	M3 wash the residue (with water);	1
	M4 leave to dry / place in oven / dry between filter papers;	1

Q# 39/ IGCSE Chemistry/2016/s/Paper 41/

2(c)		3
	M1 add a *named* acid, e.g. HC*l* **and** a named alkali, e.g. NaOH;	1
	M2 Al_2O_3 will react with / neutralises both reagents;	1
	M3 and so it will dissolve into the reagent / form a solution;	1

Q# 40/ IGCSE Chemistry/2018/w/Paper 41/

3(d)(ii)	Any three from: **1** zinc more reactive than copper **2** displacement / redox reaction **OR** zinc displaces copper **OR** zinc reacts with copper **ions** **3** copper is solid / copper is brown **4** zinc nitrate is colourless (solution) **OR** blue colour disappears because Cu^{2+} ions removed (from solution)	**max 3**

Q# 41/ IGCSE Chemistry/2017/s/Paper 42/

4(a)	any 3 from: • catalyst • more than one / variable oxidation state / oxidation number / valency • form coloured **compounds** / coloured **ions** • forms complex ions / complexes	3

Q# 42/ IGCSE Chemistry/2016/s/Paper 41/

4(c)			3
	(good) catalysts; variable oxidation numbers; form coloured compounds / coloured ions;	1 1 1	

Q# 43/ IGCSE Chemistry/2018/s/Paper 41/

3(b)	coke is burned (to form carbon dioxide) **OR** $C + O_2 \rightarrow CO_2$	**1**
	carbon dioxide is reduced by (more) coke to form **carbon monoxide** or **CO** **OR** $C + CO_2 \rightarrow 2CO$	**1**
	$3CO + Fe_2O_3 \rightarrow 2Fe + 3CO_2$	**1**
	limestone (decomposes to) form lime / CaO / calcium oxide (and carbon dioxide) **OR** $CaCO_3 \rightarrow CaO + CO_2$	**1**
	$CaO + SiO_2 \rightarrow CaSiO_3$	**1**

Q# 44/ IGCSE Chemistry/2017/w/Paper 43/

3(b)	(coke reacts with oxygen / air) to produce heat / increase temperature / exothermically	1
	coke is reducing agent / produces reducing agent / produces carbon monoxide OR coke **reduces** Fe_2O_3 / (iron) ore / hematite (producing iron)	1
	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ OR $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$ OR $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ **M1** species correct **M2** balanced	2
	limestone (decomposes to calcium oxide which) reacts with / removes **acidic impurities** / SiO_2 / sand / silica / silicon(IV) oxide / silicon dioxide	1
	limestone / calcium oxide / lime is involved in the production of slag / calcium silicate	1

Q# 45/ IGCSE Chemistry/2016/w/Paper 42/

6(a)	bauxite/Alumina is dissolved in <u>molten</u> cryolite cryolite lowers the melting temperature molten aluminium forms *anode reaction:* $2O^{2-} \rightarrow O_2 + 4e^-$ *cathode reaction:* $Al^{3+} + 3e^- \rightarrow Al$	5

Q# 46/ IGCSE Chemistry/2016/s/Paper 42/

6(b)(i)			3
	M1 heat produced by carbon / coke (burning in) oxygen / air; **OR** $C + O_2 \rightarrow CO_2$ produces heat / exothermic; **OR** $2C + O_2 \rightarrow 2CO$ produces heat / exothermic (scores **M1** and **M2**);	1	
	M2 $C + CO_2 \rightarrow 2CO$; **OR** $2C + O_2 \rightarrow 2CO$;	1	
	M3 $ZnO + CO \rightarrow Zn + CO_2$; **OR** $ZnO + C \rightarrow Zn + CO$; **OR** $2ZnO + C \rightarrow 2Zn + CO_2$;	1	

Q# 47/ IGCSE Chemistry/2018/w/Paper 43/

3(g)(ii)	**SUMMARY** **M1** comparison of reactivity **M2** zinc loses **electrons** **M3** where **electrons** move to **OR** iron does not lose electrons **M1** zinc is **more** reactive than iron / steel **ORA** **M2** zinc loses electrons / zinc is oxidised **M3** electrons are transferred to iron / iron is not oxidised / iron does not lose electrons	3

Q# 48/ IGCSE Chemistry/2018/m/Paper 42/

1(c)(iii)	fractional distillation of liquid air M1 air is made into a liquid M2 (allow air to) boil or evaporate M3 condense the vapours / collect the vapours in order (of evaporation) fractional distillation gets M2 and M3	3

Q# 49/ IGCSE Chemistry/2017/s/Paper 43/

4(c)(iv)	any 3 from: • oxides of nitrogen are reduced / lose oxygen (to form nitrogen) • oxides of nitrogen form nitrogen • (oxides of nitrogen) react with carbon monoxide • gases (adsorb / stick) on the catalyst's surface	3

Q# 50/ IGCSE Chemistry/2016/w/Paper 42/

3(b)	nitrogen **AND** oxygen (from the air) react (in the) high temperatures of a car engine NO_x / oxides of nitrogen react with or dissolve in water (to form an acid)	3

Q# 51/ IGCSE Chemistry/2016/w/Paper 41/

4(b)(i)	**M1** forward and reverse reactions (occur) **M2** amounts / moles / concentrations (of reagents and products) constant OR **M2** rate of forward and reverse reactions equal	1 1
4(b)(ii)	endothermic **AND** yield increases as temperature increases	1
4(b)(iii)	**M1** yield decreases (as pressure increases) **M2** because more moles / molecules (of gas) on the right **M3** so position of equilibrium moves left	1 1 1

Q# 52/ IGCSE Chemistry/2016/s/Paper 43/

3(b)	any 6 from: carbon monoxide; from incomplete combustion (of carbon-containing fuel); sulfur dioxide; from burning fossil fuels / roasting ores which contain sulphur / volcanoes; oxides of nitrogen; nitrogen reacting with oxygen in car engines / lightning; methane; from anaerobic decomposition / anaerobic decay;	6

Q# 53/ IGCSE Chemistry/2016/s/Paper 42/

6(c)	**M1** zinc is more reactive than iron / zinc is higher in the reactivity series than iron ora; **M2** zinc loses electrons; **M3** iron / steel / oxygen / air / water gains electrons **OR** electrons move to iron / steel / oxygen / air / water; **M4** (therefore) iron does not lose electrons / get oxidised / form iron(II) / form iron(III);	4 1 1 1 1

Q# 54/ IGCSE Chemistry/2016/m/Paper 42/

5(a)(i)	pressure in range 150–300 atmospheres/ atm; temperature in range 370–470 °C; iron (catalyst); balanced equation: $N_2 + 3H_2 \rightarrow 2NH_3$; equilibrium/ reversible;	5

Q# 55/ IGCSE Chemistry/2018/w/Paper 41/

4(a)(iii)	**M1** vanadium pentoxide **or** vanadium(V) oxide **or** V_2O_5 (catalyst);	1
	M2 1–5 atmospheres; (Units required)	1
	M3 450°C; units required	1
	M4 $2SO_2 + O_2 \rightarrow 2SO_3$;	1
	M5 equilibrium / reversible reaction in equation or text	1

Q# 56/ IGCSE Chemistry/2016/s/Paper 41/

5(b)		5
	M1 vanadium pentoxide /vanadium(V) oxide/V_2O_5 (catalyst); **M2** 1–5 atmospheres (units required); **M3** 450°C (units required); **M4** $2SO_2 + O_2 \rightarrow 2SO_3$; **M5** equilibrium/reversible reaction;	1 1 1 1 1

Q# 57/ IGCSE Chemistry/2018/w/Paper 43/

6(a)(i)	**SUMMARY** **M1 and M4** reactants **M2 and M5** conditions **M3 and M6** equation **FERMENTATION:** **M1** glucose / sucrose / starch / other named carbohydrate can score in equation as correct formula **M2** Zymase / Yeast / 37□C **M3** $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ **HYDRATION:** **M4** Ethene and steam or water can score in equation as correct formulae **M5** H_3PO_4 (catalyst) / 300□C / 60 atm **M6** $C_2H_4 + H_2O \rightarrow C_2H_5OH$	6

Q# 58/ IGCSE Chemistry/2018/s/Paper 42/

7(f)	(step 1) crack / cracking (of octane)	1
	(step 1) equation with only C_8H_{18} on left hand side and C_2H_4 + other correct product(s) on right hand side e.g. $C_8H_{18} \rightarrow C_2H_4 + C_6H_{14}$	1
	(step 2) hydration / addition	1
	(step 2) one correct condition for **either** process required (cracking): 450 (□) C to 800 (□) C / zeolites / aluminosilicates / silica / SiO_2 / aluminium oxide / Al_2O_3 / alumina / china / broken pot / chromium oxide / Cr_2O_3 / up to 70 atmospheres (hydration): phosphoric acid / H_3PO_4 / 300 (□)C / 60 atmospheres	1
	$C_2H_4 + H_2O \rightarrow C_2H_5OH$ / CH_3CH_2OH	1

Q# 59/ IGCSE Chemistry/2017/s/Paper 43/

4(b)(i)	*saturated:* only single bonds OR no double / multiple bonds (between carbon atoms)	1
	hydrocarbon: (compound that) contains carbon and hydrogen	1
	hydrocarbon: and no other elements / only	1
4(d)(ii)	(molecules with) the same molecular formula	1
	different structural formula / different displayed formula	1

Q# 60/ IGCSE Chemistry/2017/s/Paper 41/

6(f)	methanol	1
	ethanoic acid	1
	catalyst	1
	heat	1
	$CH_3COOH + CH_3OH \rightarrow CH_3COOCH_3 + H_2O$	1

Q# 61/ IGCSE Chemistry/2016/w/Paper 43/

6(a)(i)	*condensation:* **M1** (two) molecules / monomers joining **M2** with the removal of a (small) molecule *polymerisation:* **M3** (to form) a large molecule / a long chain	3
6(c)(ii)	hydrolysis chromatography (spray with) locating agent / UV determine R_f values / compare with standards	1 1 1 1

Q# 62/ IGCSE Chemistry/2016/w/Paper 42/

7(a)	large / big molecule made from (many) monomers (joined together)	2

Q# 63/ IGCSE Chemistry/2016/s/Paper 43/

2(e)	$C_2H_4 + H_2O \rightarrow C_2H_5OH$;	1	3
	any 2 from: high temperature / 220 °C–350 °C; high pressure / 60 atm–70 atm; phosphoric acid catalyst;	2	