



IGCSE Chemistry

ACIDS, BASES & SALTS

THEORY

2026 EDITION

Q1

0620/41/O/N/23/Q6(c)(i)

Easy

(c) The catalyst in method 2 is phosphoric acid, H_3PO_4 . Dilute phosphoric acid is a weak acid which contains phosphate ions, PO_4^{3-} .

(i) State what is meant by the term acid.

..... [1]

Q2

0620/43/O/N/24/Q4(e)(i)

Easy



(e) Potassium hydrogen sulfate, KHSO_4 , dissolves in water to form solution **X**.

Solution **X** contains K^+ , H^+ and SO_4^{2-} ions.

(i) Name the **type** of solution that contains H^+ ions.

..... [1]

Q3

0620/42/O/N/25/Q4(a)(i)-(ii)

Hard



4 Nitric acid, HNO_3 , and sulfuric acid, H_2SO_4 , are strong acids. Ethanoic acid, CH_3COOH , is a weak acid.

(a) One mole of each acid is added separately to 1000cm^3 of distilled water to form a dilute solution. All three acids dissociate in distilled water.

(i) State the formula of the common cation produced when each of the three acids dissociates in water.

..... [1]

(ii) Explain, in terms of dissociation, why:

- nitric acid is described as a strong acid

.....

- ethanoic acid is described as a weak acid.

.....

[2]

Q4

0620/42/M/J/23/Q4(f)(ii)-(iii)

Hard

(ii) Suggest the pH of dilute ethanoic acid.

..... [1]

(iii) Complete the symbol equation to show the dissociation of ethanoic acid.

CH_3COOH [3]

Q5

0620/41/O/N/23/Q6(c)(ii)

Easy

(c) The catalyst in method 2 is phosphoric acid, H_3PO_4 . Dilute phosphoric acid is a weak acid which contains phosphate ions, PO_4^{3-} .

(ii) State the meaning of weak in the term weak acid.

..... [1]

Q6

0620/42/O/N/25/Q4(b)(i)-(ii)

Easy

(b) Aluminium nitrate, $Al(NO_3)_3$, is made when dilute nitric acid reacts with aluminium hydroxide, $Al(OH)_3$.

(i) $Al(OH)_3$ acts as a base in this reaction.

Define the term base.

..... [1]

(ii) $Al(OH)_3$ is **not** an alkali.

State what this tells you about the solubility of $Al(OH)_3$.

..... [1]

Q7

0620/42/M/J/21/Q5(e)(i)

Easy

(e) Ammonia is a base which forms a weakly alkaline solution when dissolved in water.

(i) Define the term *base*.

..... [1]

Q8

0620/41/O/N/22/Q2(c)(ii)

Easy

(ii) The solution formed is potassium hydroxide, a strong alkali.

State the formula of the ion responsible for alkalinity in a solution.

..... [1]

Q9

0620/42/O/N/22/Q2(c)(i)

Easy

(c) Sodium reacts vigorously with water to form aqueous sodium hydroxide, NaOH, which is a strong base.

(i) Explain in terms of proton transfer what is meant by a base.

..... [1]

Q10

0620/42/F/M/23/Q2(b)(ii)-(iii)

Easy

(ii) Suggest the pH of a solution of a strong alkali.

pH = ... [1]

(iii) Name a substance which can be used to confirm the pH of a solution of a strong alkali.

..... [1]

Q11

0620/42/M/J/22/Q2(b)(i)-(ii)

Easy

(b) When calcium hydroxide dissolves in water, it dissociates into ions and forms a weakly alkaline solution.

(i) Suggest the pH of aqueous calcium hydroxide.

..... [1]

(ii) Give the formula of the ion responsible for making the solution alkaline.

..... [1]

Q12

0620/41/M/J/20/Q4/b

Easy

(ii) Aqueous ammonia is described as a weak base.

Suggest the pH of aqueous ammonia.

pH = ... [1]

(iii) Describe what is seen when aqueous ammonia is added to aqueous copper(II) sulfate, until no further change is seen.

.....

.....

..... [3]

Q12

0620/41/M/J/20/Q4/C,D

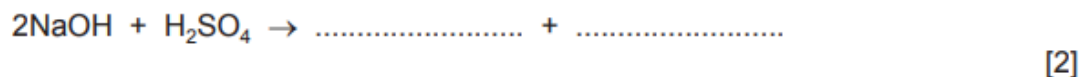
Easy

(c) Aqueous sodium hydroxide, NaOH(aq), is a strong alkali that reacts with dilute sulfuric acid exothermically.

(i) What type of reaction is this?

..... [1]

(ii) Complete the equation for the reaction between aqueous sodium hydroxide and dilute sulfuric acid.



(d) A student wanted to find the concentration of some dilute sulfuric acid by titration. The student found that 25.0 cm³ of 0.0400 mol/dm³ NaOH(aq) reacted exactly with 20.0 cm³ of H₂SO₄(aq).

(i) Name a suitable indicator to use in this titration.

..... [1]

Q13

0620/42/M/J/21/Q5(e)(ii)

Easy

(e) Ammonia is a base which forms a weakly alkaline solution when dissolved in water.

(ii) Suggest the pH of aqueous ammonia.

..... [1]

Q14

0620/42/O/N/21/Q5(d)(iv)

Easy

(iv) Predict the pH of the colourless solution formed when potassium reacts with water.

..... [1]

Q15

0620/42/O/N/22/Q2(c)(ii)

Easy

(c) Sodium reacts vigorously with water to form aqueous sodium hydroxide, NaOH, which is a strong base.

(ii) State a pH number that indicates the presence of a strong alkali.

..... [1]

Q16

0620/42/F/M/24/Q3(c)

Easy

(c) Thymolphthalein is an indicator.

State the colour of thymolphthalein in:

- NaOH(aq)
 - CH₃COOH(aq).
- [2]

Q17

0620/41/O/N/25/Q3(f)

Easy

- 3 A student makes crystals of the salt sodium sulfate, Na₂SO₄. The student reacts 0.200 mol/dm³ dilute sulfuric acid, H₂SO₄(aq), with aqueous sodium hydroxide, NaOH(aq).

The student uses the following steps.

- step 1** The student places 40.0 cm³ of NaOH(aq) into a conical flask. This volume contains 0.0100 moles of NaOH.
- step 2** The student adds a few drops of methyl orange indicator to the NaOH(aq) in the conical flask.
- step 3** The student adds 0.200 mol/dm³ H₂SO₄(aq) to the flask until the end-point is reached.
- step 4** The student transfers the mixture from the conical flask to an evaporating basin and obtains dry crystals.

(f) State the colour change observed in **step 3**.

from to [2]

Q18

0620/41/O/N/22/Q2(c)(iii)

Easy

(iii) State the colour of litmus in a strong alkali.

..... [1]

Q19

0620/42/O/N/22/Q2(c)(iii)

Easy

(c) Sodium reacts vigorously with water to form aqueous sodium hydroxide, NaOH, which is a strong base.

(iii) State the colour of methyl orange in aqueous sodium hydroxide.

..... [1]

Q20

0620/41/O/N/23/Q6(f)

Easy

(f) Ethanoic acid reacts with calcium to form a salt and one other product.

(i) Name the salt.

..... [1]

(ii) Write the formula of the salt.

..... [1]

(iii) Identify the other product.

r11

Q21

0620/43/M/J/22/Q5

Hard

- (c) The formula for crystals of hydrated copper(II) sulfate is $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

Hydrated copper(II) sulfate is made by reacting copper(II) oxide with dilute sulfuric acid.

The overall equation is shown.



The crystals are made using the following steps:

- step 1** 50.0 cm³ of 0.200 mol/dm³ dilute sulfuric acid is heated in a beaker. Powdered copper(II) oxide is added until the copper(II) oxide is in excess. Aqueous copper(II) sulfate is formed.
- step 2** The excess copper(II) oxide is separated from the aqueous copper(II) sulfate.
- step 3** The aqueous copper(II) sulfate is heated until a saturated solution is formed.
- step 4** The saturated solution is allowed to cool and crystallise.
- step 5** The crystals are removed and dried.

- (d) State **one** observation that indicates the copper(II) oxide is in excess in **step 1**.

..... [1]

Q22

0620/42/M/J/24/Q5(c)

Easy

(c) An acid containing sulfur reacts with sodium hydroxide, NaOH, to form a salt and water. The salt has the formula Na_2SO_3 .

(i) Deduce the formula of this acid.

..... [1]

(ii) Deduce the formula of the anion in Na_2SO_3 .

..... [1]

Q23

0620/41/O/N/24/Q1(a)

Easy



1 A list of chemical and physical processes, **A** to **H**, is shown.

- A** combustion
- B** diffusion
- C** melting
- D** neutralisation
- E** photosynthesis
- F** reversible reaction
- G** roasting
- H** thermal decomposition

Answer the following questions about processes **A** to **H**.
Each letter may be used once, more than once or not at all.

State which of the processes **A** to **H**:

(a) happens when an acid reacts with an alkali

..... [1]

Q24

0620/43/O/N/22/Q5(d)(ii)

Easy

- (d) Aqueous potassium hydrogensulfate, $\text{KHSO}_4(\text{aq})$, contains the ions $\text{K}^+(\text{aq})$, $\text{H}^+(\text{aq})$ and $\text{SO}_4^{2-}(\text{aq})$.

Describe the observations in the following tests.

- (i) A flame test is carried out on aqueous potassium hydrogensulfate.

..... [1]

- (ii) Solid copper(II) carbonate is added to aqueous potassium hydrogensulfate.

.....
..... [2]

- (iii) An acidic solution containing aqueous barium ions, $\text{Ba}^{2+}(\text{aq})$, is added to aqueous potassium hydrogensulfate.

..... [1]

Q25

0620/42/F/M/21/Q3(b)

Easy

..... [3]

(b) Ammonia reacts with sulfuric acid to make a compound which is used as a fertiliser.

Write the chemical equation for the reaction between ammonia and sulfuric acid.

..... [2]

[Total: 12]

Q26

0620/41/M/J/23/Q6(c)

Easy

(c) When sulfuric acid reacts with ammonia the salt produced is ammonium sulfate.

Write the symbol equation for this reaction.

..... [2]

Q27

0620/41/M/J/21/Q5(a)

Hard

(a) Salts that are insoluble in water are made by precipitation.

- Lead(II) iodide, PbI_2 , is insoluble in water.
- All nitrates are soluble in water.
- All sodium salts are soluble in water.

You are provided with solid lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2$, and solid sodium iodide, NaI .

Describe how you would make a pure sample of lead(II) iodide by precipitation.

Your answer should include:

- practical details
- a chemical equation for the precipitation reaction.

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.....

..... [5]

Q28

0620/41/O/N/25/Q3(g)-(h)

Hard

- 3 A student makes crystals of the salt sodium sulfate, Na_2SO_4 . The student reacts 0.200 mol/dm^3 dilute sulfuric acid, $\text{H}_2\text{SO}_4(\text{aq})$, with aqueous sodium hydroxide, $\text{NaOH}(\text{aq})$.

The student uses the following steps.

step 1 The student places 40.0 cm^3 of $\text{NaOH}(\text{aq})$ into a conical flask. This volume contains 0.0100 moles of NaOH .

step 2 The student adds a few drops of methyl orange indicator to the $\text{NaOH}(\text{aq})$ in the conical flask.

step 3 The student adds 0.200 mol/dm^3 $\text{H}_2\text{SO}_4(\text{aq})$ to the flask until the end-point is reached.

step 4 The student transfers the mixture from the conical flask to an evaporating basin and obtains dry crystals.

- (g) The dry crystals formed in **step 4** are coloured and **not** white. This is because the student should do an additional step between **step 3** and **step 4**.

Suggest what the student should do in this additional step to produce white crystals.

.....
..... [1]

- (h) In **step 4**, the student gently heats the solution in the evaporating basin until the solution is saturated. The student then stops heating and leaves the hot solution to cool. Crystals start to appear.

- (i) Explain the term saturated solution.

.....
.....
..... [2]

- (ii) Explain why crystals start to appear as the hot solution cools.

.....
..... [1]

- (iii) Suggest the effect, if any, on the mass of crystals collected in **step 4** if the solution in the evaporating basin is allowed to dry without gentle heating.

..... [1]

Q29

0620/43/M/J/24/Q5(b)

Easy

(b) Soluble salts are made from dilute acids.

Name the dilute acid and one other substance that react together to make copper(II) sulfate.

dilute acid

other substance

[2]

Q30

0620/43/M/J/21/Q5(a)

Hard

(a) Salts that are soluble in water can be made by the reaction between insoluble carbonates and dilute acids. Zinc sulfate is soluble in water.

You are provided with solid zinc carbonate, ZnCO_3 , and dilute sulfuric acid, H_2SO_4 .

Describe how you would make a pure sample of zinc sulfate crystals.

Your answer should include:

- practical details
- how you would make sure that all the dilute sulfuric acid has reacted
- a chemical equation for the reaction.

.....

.....

.....

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.....

.....

..... [5]

Q31

0620/41/M/J/22/Q6(b)(i)-(ii)

Hard

(b) Zinc sulfate crystals, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, are hydrated.

Zinc sulfate crystals are made by reacting zinc carbonate with dilute sulfuric acid.

The equation for the overall process is shown.



- step 1** Large pieces of solid zinc carbonate are added to dilute sulfuric acid until the zinc carbonate is in excess. This forms aqueous zinc sulfate.
- step 2** The excess zinc carbonate is separated from the aqueous zinc sulfate.
- step 3** The aqueous zinc sulfate is heated until a saturated solution is formed.
- step 4** The saturated solution is allowed to cool and crystallise.
- step 5** The crystals are removed and dried.

(i) In **step 1**, zinc carbonate is in excess when no more zinc carbonate dissolves.

State one **other** observation that indicates the zinc carbonate is in excess in **step 1**.

..... [1]

(ii) Name a different substance, other than zinc carbonate, that can be added to dilute sulfuric acid to produce aqueous zinc sulfate in **step 1**.

..... [1]

Q32

0620/43/M/J/23/Q6(c)(i)-(iii)

Hard

(c) A student makes aqueous copper(II) nitrate by adding an excess of solid copper(II) carbonate to dilute nitric acid.

(i) Write the symbol equation for this reaction.

..... [2]

(ii) State **two** observations that indicate the copper(II) carbonate is in excess.

1

2 [2]

(iii) Name **one** compound, other than copper(II) carbonate, that can be added to dilute nitric acid to produce aqueous copper(II) nitrate.

..... [1]

Q33

0620/41/M/J/25/Q3(c)(i)-(vii)

Hard

- (c) Copper(II) sulfate crystals are made by the reaction between copper(II) carbonate and dilute sulfuric acid, using the following steps.

The sulfuric acid has a concentration of 0.100 mol/dm^3 .

step 1 Powdered copper(II) carbonate is added to dilute sulfuric acid. The mixture is stirred. A reaction occurs.

step 2 More copper(II) carbonate is added, with stirring, until the reaction stops.

step 3 Unreacted copper(II) carbonate is separated from aqueous copper(II) sulfate by filtration.

step 4 Aqueous copper(II) sulfate is heated until some of the water evaporates.

step 5 The remaining solution is allowed to cool and crystallise.

step 6 The crystals are removed and dried.

- (i) Give **two** observations in **step 1**.

1

2

[2]

Q33 (continued)

0620/41/M/J/25/Q3(c)(i)-(vii)

Hard



(ii) State why the reaction stops in **step 2**.

..... [1]

(iii) Name the residue in **step 3**.

..... [1]

(iv) Name a substance, other than copper(II) carbonate, that can be added to dilute sulfuric acid to produce aqueous copper(II) sulfate.

..... [1]

(v) The solution at the end of **step 4** contains the maximum amount of copper(II) sulfate that will dissolve at that temperature.

State the term used to describe this type of solution.

..... [1]

(vii) Copper(II) sulfate crystals have the formula $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

State the term used to describe a substance that is chemically combined with water.

..... [1]

Q34

0620/43/M/J/25/Q3(c)(i)-(v)

Hard

- (c) Zinc sulfate crystals are made by the reaction between zinc carbonate and dilute sulfuric acid, using the following steps.

step 1 An excess of powdered zinc carbonate is added to dilute sulfuric acid.

step 2 Excess zinc carbonate is separated from aqueous zinc sulfate by filtration.

step 3 Aqueous zinc sulfate is heated until a saturated solution is formed.

step 4 The saturated solution is allowed to cool and crystallise.

step 5 The crystals are removed and dried.

- (i) Give **two** observations which show that the zinc carbonate is in excess in **step 1**.

1

2 [2]

- (ii) Name the filtrate in **step 2**.

..... [1]

Q34 (continued)

0620/43/M/J/25/Q3(c)(i)-(v)

Hard



- (iii) Name a compound, other than zinc carbonate, that can be added to dilute sulfuric acid to produce aqueous zinc sulfate in **step 1**.

..... [1]

- (iv) State what is meant by the term saturated solution.

.....
..... [2]

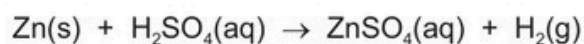
Q35

0620/43/O/N/23/Q4(a)(i)-(iii)

Hard

- (a) Zinc reacts with dilute sulfuric acid. Aqueous zinc sulfate is one of the products.

Powdered zinc is added to dilute sulfuric acid. The mixture is stirred. More zinc is added, with stirring, until the zinc is in excess.



The mixture is then filtered.

- (i) Name the limiting reactant.

..... [1]

- (ii) State two **observations** that indicate the zinc is in excess.

1

2 [2]

- (iii) Name the filtrate.

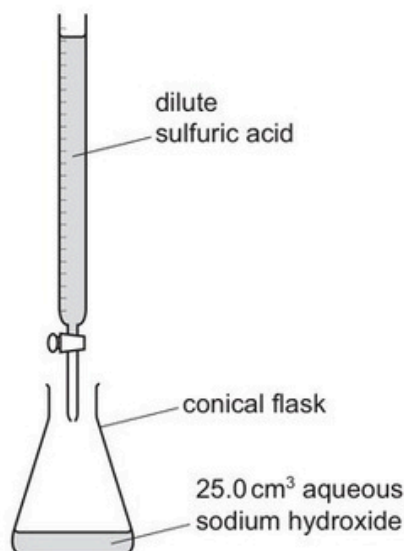
..... [1]

Q36

0620/43/O/N/21/Q5(a)-(b)

Hard

- 5 (a) Dilute sulfuric acid and aqueous sodium hydroxide can be used to prepare sodium sulfate crystals using a method that involves titration.



- (i) Suggest why universal indicator is **not** suitable for this titration.

..... [1]

- (ii) Name an indicator that can be used in this titration.

..... [1]

20.0 cm³ of dilute sulfuric acid neutralises 25.0 cm³ of 1.00 mol/dm³ aqueous sodium hydroxide. At the end of the titration the conical flask contains aqueous sodium sulfate with the dissolved indicator as an impurity.

- (b) Describe how to prepare a **pure** sample of sodium sulfate crystals from the original solutions of dilute sulfuric acid and aqueous sodium hydroxide of the same concentrations.

You are not required to give details of how to carry out the titration.

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.....
.....
.....
.....
.....
.....
.....
.....
..... [5]

Q37

0620/43/O/N/24/Q4(a)

Hard

- (a) Dilute sulfuric acid and aqueous sodium hydroxide can be used to prepare sodium sulfate crystals using a method that involves titration.

The apparatus for titration is shown in Fig. 4.1.

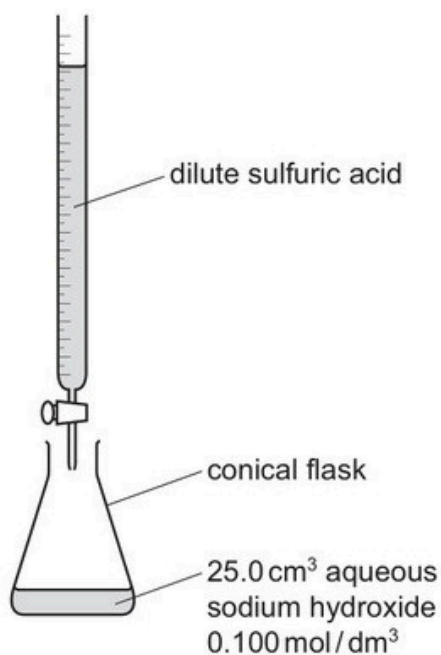


Fig. 4.1

Thymolphthalein is used as an indicator for this titration.

- (i) State the colour change of thymolphthalein at the end-point of this titration.

from to [2]

- (ii) Suggest why universal indicator is **not** used for this titration.

.....

Q38

0620/41/O/N/25/Q3(a)-(b)

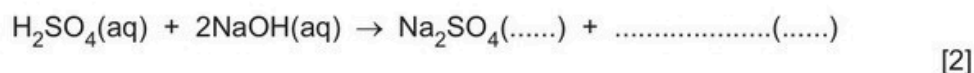
Easy

- 3 A student makes crystals of the salt sodium sulfate, Na_2SO_4 . The student reacts 0.200 mol/dm^3 dilute sulfuric acid, $\text{H}_2\text{SO}_4(\text{aq})$, with aqueous sodium hydroxide, $\text{NaOH}(\text{aq})$.

The student uses the following steps.

- step 1** The student places 40.0 cm^3 of $\text{NaOH}(\text{aq})$ into a conical flask. This volume contains 0.0100 moles of NaOH .
- step 2** The student adds a few drops of methyl orange indicator to the $\text{NaOH}(\text{aq})$ in the conical flask.
- step 3** The student adds 0.200 mol/dm^3 $\text{H}_2\text{SO}_4(\text{aq})$ to the flask until the end-point is reached.
- step 4** The student transfers the mixture from the conical flask to an evaporating basin and obtains dry crystals.

- (a) Complete the symbol equation for the reaction. Include state symbols.



- (b) State the type of exothermic reaction taking place.

..... [1]

Q39

0620/41/O/N/22/Q2(d)

Easy

- (d) Aqueous potassium hydroxide reacts with a dilute acid to produce aqueous potassium chloride, $\text{KCl}(\text{aq})$, which is a salt.

- (i) Name the dilute acid used.

..... [1]

- (ii) State the type of reaction taking place.

..... [1]

- (iii) Name the experimental technique used when salts are made by reacting a dilute acid with an aqueous alkali.

..... [1]

Q40

0620/41/M/J/23/Q6(d)

Hard

(d) Lead(II) sulfate is an insoluble salt.

Lead(II) sulfate can be made from aqueous ammonium sulfate using a precipitation reaction.

(i) Name a solution that can be added to aqueous ammonium sulfate to produce a precipitate of lead(II) sulfate.

..... [1]

(ii) Write an ionic equation for this precipitation reaction. Include state symbols.

..... [3]

(iii) The precipitate of lead(II) sulfate forms in an aqueous solution.

Describe how pure lead(II) sulfate can be obtained from the mixture.

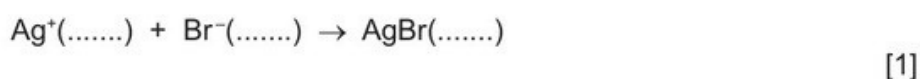
.....
.....
..... [3]

Q41

0620/42/O/N/24/Q4(a)-(b)

Easy

(a) Complete the ionic equation for the reaction by adding the missing state symbols.



(b) Name a different aqueous silver salt which could be used in **step 1**.

..... [1]

Q42

0620/43/O/N/25/Q5(a)

Hard

- (a) Insoluble metal salts, such as lead(II) sulfate, are made by precipitation.

When aqueous lead(II) ions react with aqueous sulfate ions, a precipitate of lead(II) sulfate forms.

A sample of pure lead(II) sulfate can be obtained from the precipitate formed.

- (i) Write an ionic equation for this precipitation reaction. Include state symbols.

..... [3]

- (ii) State the name of an aqueous solution containing lead(II) ions.

..... [1]

- (iii) State the name of an aqueous solution containing sulfate ions.

..... [1]

- (iv) The lead(II) sulfate precipitate is separated from the rest of the reaction mixture by filtration. The impure lead(II) sulfate remains on the filter paper.

State the general term given to an insoluble substance that remains on the filter paper during filtration.

..... [1]

- (v) Describe how the lead(II) sulfate is purified after filtration.

.....

..... [2]

Q43

0620/41/M/J/24/Q5(a)

Hard

5 (a) Lead(II) bromide, PbBr_2 , is an insoluble salt and is made by precipitation.

(i) Name **two** aqueous solutions that produce a precipitate of lead(II) bromide when they are mixed.

1

2

[2]

(ii) Describe how to produce a pure sample of lead(II) bromide from the mixture of aqueous solutions in (a)(i).

.....

..... [2]

(iii) Write an ionic equation for the precipitation reaction which produces lead(II) bromide. Include state symbols.

..... [3]

Q44

0620/43/M/J/24/Q5(a)

Hard

5 (a) Barium sulfate, BaSO_4 , is an insoluble salt and is made by precipitation.

(i) Name **two** aqueous solutions that produce a precipitate of barium sulfate when they are mixed.

1

2

[2]

(ii) Describe how to produce a pure sample of barium sulfate from the mixture of aqueous solutions in (a)(i).

.....

..... [2]

(iii) Write an ionic equation for the precipitation reaction which produces barium sulfate. Include state symbols.

..... [3]

Q45

0620/41/O/N/22/Q2(e)

Easy

(e) When aqueous silver nitrate, $\text{AgNO}_3(\text{aq})$, is added to aqueous potassium chloride, a precipitate is formed.

(i) State the colour of the precipitate formed.

..... [1]

(ii) Name the precipitate formed.

..... [1]

(iii) Write the ionic equation for the reaction. Include state symbols.

..... [3]

Q46

0620/43/O/N/22/Q5(d)(iii)-(e)

Hard

(d) Aqueous potassium hydrogensulfate, $\text{KHSO}_4(\text{aq})$, contains the ions $\text{K}^+(\text{aq})$, $\text{H}^+(\text{aq})$ and $\text{SO}_4^{2-}(\text{aq})$.

Describe the observations in the following tests.

(i) A flame test is carried out on aqueous potassium hydrogensulfate.

..... [1]

(ii) Solid copper(II) carbonate is added to aqueous potassium hydrogensulfate.

.....
..... [2]

(iii) An acidic solution containing aqueous barium ions, $\text{Ba}^{2+}(\text{aq})$, is added to aqueous potassium hydrogensulfate.

..... [1]

(e) Write the ionic equation for the reaction in (d)(iii).

Include state symbols.

..... [3]

Q47

0620/42/O/N/23/Q4(a)

Hard

(a) A student prepares a sample of insoluble lead(II) chloride, PbCl_2 , by mixing aqueous solutions of **two** salts in a beaker.

(i) Identify **two** soluble salts suitable for making lead(II) chloride when mixed together.

.....
..... [2]

(ii) Write the ionic equation for the formation of lead(II) chloride by mixing aqueous solutions.
Include state symbols.

..... [3]

(iii) List the steps the student should take in preparing a pure sample of lead(II) chloride from the mixture in the beaker.

.....
.....
..... [3]

Q48

0620/62/F/M/21/Q3

Hard

- 3 Two solids, solid **C** and solid **D**, were analysed. Tests were done on each solid.

tests on solid C

Tests were carried out and the following observations were made.

tests	observations
test 1 A flame test was carried out on solid C .	a red flame was seen
Solid C was dissolved in distilled water to produce solution C . test 2 About 5 cm ³ of aqueous sodium hydroxide was added to solution C .	no change
test 3 A piece of aluminium foil was added to the mixture formed in test 2 . The mixture was warmed gently and any gas produced was tested.	effervescence was seen; damp red litmus paper turned blue

- (a) Name the gas that turned the damp red litmus paper blue in **test 3**.

..... [1]

- (b) Identify solid **C**.

.....

..... [2]

Q48 (continued)

0620/62/F/M/21/Q3

Hard

tests on solid D

Solid **D** was aluminium sulfate.

Complete the expected observations.

Solid **D** was dissolved in water to form solution **D**. Solution **D** was divided into four approximately equal portions in four test-tubes.

- (c) Aqueous sodium hydroxide was added dropwise and then in excess to the first portion of solution **D**.

observations
..... [2]

- (d) Aqueous ammonia was added dropwise and then in excess to the second portion of solution **D**.

observations
..... [2]

- (e) About 1 cm³ of dilute nitric acid and a few drops of aqueous silver nitrate were added to the third portion of solution **D**.

observations [1]

- (f) About 1 cm³ of dilute nitric acid and a few drops of aqueous barium nitrate were added to the fourth portion of solution **D**.

observations [1]

[Total: 9]

Q49

0620/62/F/M/22/Q3

Hard

- 3 Solution **A** and solid **B** were analysed. Solution **A** was aqueous copper(II) bromide. Tests were done on each substance.

Complete the expected observations.

tests on solution A

Solution **A** was divided into three approximately equal portions in three test-tubes.

- (a) The end of a piece of wire was dipped into the first portion of solution **A**. The end of the wire was then placed at the edge of a roaring Bunsen burner flame.

observations [1]

- (b) To the second portion of solution **A** aqueous ammonia was added dropwise until in excess.

observations

.....
..... [3]

- (c) To the third portion of solution **A** about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added.

observations

..... [1]

Q49 (continued)

0620/62/F/M/22/Q3

Hard

tests on solid B

tests	observations
Solid B was added to 15 cm³ of water in a boiling tube. A bung was placed in the boiling tube and it was shaken to dissolve solid B and form solution B. Solution B was divided into three approximately equal portions in three test-tubes. test 1 The first portion of solution B was tested using universal indicator paper.	the universal indicator paper turned blue
test 2 To the second portion of solution B aqueous sodium hydroxide was added dropwise and then in excess.	a white precipitate formed which remained when excess aqueous sodium hydroxide was added
test 3 To the third portion of solution B aqueous ammonia was added dropwise and then in excess.	the solution remained colourless

(d) Deduce the pH of solution **B**.

pH = ... [1]

(e) Identify solid **B**.

.....

..... [2]

[Total: 8]

Q50

0620/62/F/M/23/Q3

Hard

- 3 A student tests two solutions: solution **C** and solution **D**.

Tests on solution C

Solution **C** is aqueous calcium nitrate.

Complete the expected observations.

The student divides solution **C** into three portions.

- (a) The student carries out a flame test on the first portion of solution **C**.

observations [1]

- (b) To the second portion of solution **C**, the student adds aqueous sodium hydroxide dropwise until it is in excess.

observations adding dropwise

observations in excess [2]

- (c) To the product from (b), the student adds a piece of aluminium foil and warms the mixture gently. Any gas produced is tested.

observations

..... [1]

- (d) To the third portion of solution **C**, the student adds about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.

observations

..... [1]

Q50 (continued)

0620/62/F/M/23/Q3

Hard

tests on solution D

Table 3.1 shows the tests and the student's observations for solution **D**. The student divides solution **D** into four portions.

Table 3.1

tests	observations
test 1 Use a glass rod to transfer one drop of the first portion of solution D onto a piece of universal indicator paper.	the universal indicator paper turns red
test 2 To the second portion of solution D , add solid sodium carbonate. Test any gas produced.	the solid sodium carbonate disappears and there is effervescence the gas turns limewater milky
test 3 To the third portion of solution D , add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.	no change
test 4 To the fourth portion of solution D , add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.	white precipitate

(e) Deduce the pH of solution **D**.

pH = ... [1]

(f) Identify the gas made when sodium carbonate is added to solution **D**.

..... [1]

(g) Identify the **two** ions in solution **D**.

.....

..... [2]

[Total: 9]

Q51

0620/62/F/M/24/Q3

Hard

- 3 A student tests two substances: solid **C** and solid **D**.

Tests on solid C

Solid **C** is ammonium iodide.

The student dissolves solid **C** in water to form solution **C**. The student divides solution **C** into three approximately equal portions.

Complete the expected observations.

- (a) To the first portion of solution **C**, the student adds about 1 cm³ of dilute nitric acid followed by a few drops of aqueous barium nitrate.

observations
..... [1]

- (b) To the second portion of solution **C**, the student adds about 1 cm³ of dilute nitric acid followed by a few drops of aqueous silver nitrate.

observations
..... [1]

- (c) (i) To the third portion of solution **C**, the student adds an excess of aqueous sodium hydroxide.

observations
..... [1]

- (ii) The student warms the product from (c)(i) and tests any gas given off.

observations
..... [1]

Q51 (continued)

0620/62/F/M/24/Q3

Hard

Tests on solid DTable 3.1 shows the tests and the student's observations for solid **D**.**Table 3.1**

tests	observations
test 1 Do a flame test on solid D .	yellow coloured flame
test 2 Gently heat about half of the remaining solid D . Hold a strip of anhydrous cobalt(II) chloride paper at the mouth of the boiling tube.	steam is given off and condensation forms at the top of the boiling tube the anhydrous cobalt(II) chloride paper changes colour
test 3 Dissolve the remaining solid D in water to form solution D . Divide solution D into three portions. To the first portion of solution D , add aqueous ammonia dropwise until in excess.	green precipitate which is insoluble in excess
test 4 To the second portion of solution D , add a piece of aluminium foil and about 5 cm ³ of aqueous sodium hydroxide. Heat the mixture formed and hold damp red litmus paper at the mouth of the boiling tube.	green precipitate the red litmus paper remains red
test 5 To the third portion of solution D , add about 5 cm ³ of dilute nitric acid. Bubble any gas formed through limewater.	effervescence the limewater becomes milky

(d) State the final colour of the cobalt(II) chloride paper in **test 2**.

..... [1]

(e) State what ion the observations in **test 4** show is **not** present.

..... [1]

Q51 (continued)

0620/62/F/M/24/Q3

Hard

(f) Identify the gas produced in **test 5**.

..... [1]

(g) Identify the **three** ions in solid **D**.

.....

.....

..... [3]

[Total: 10]

Q52

0620/62/F/M/25/Q3

Hard



- 3 A student tests two substances: solution **A** and solid **B**.

Tests on solution A

Solution **A** is aqueous chromium(III) chloride.

The student divides solution **A** into three approximately equal portions.

Complete the expected observations.

- (a) To the first portion of solution **A**, the student adds aqueous sodium hydroxide dropwise until it is in excess.

observations
.....
..... [2]

- (b) To the second portion of solution **A**, the student adds about 1 cm³ of dilute nitric acid followed by a few drops of aqueous barium nitrate.

observations
..... [1]

- (c) To the third portion of solution **A**, the student adds about 1 cm³ of dilute nitric acid followed by a few drops of aqueous silver nitrate.

observations
..... [1]

Q52 (continued)

0620/62/F/M/25/Q3

Hard

■ ■

Tests on solid B

Table 3.1 shows the tests and the student's observations for solid **B**.

Table 3.1

tests	observations
test 1 Carry out a flame test on solid B .	red coloured flame
test 2 Dissolve the remaining solid B in distilled water to form solution B . Divide solution B into three portions. To the first portion of solution B , add a few drops of acidified aqueous potassium manganate(VII).	pale purple solution
test 3 To the second portion of solution B , add about 1 cm ³ of aqueous sodium hydroxide.	solution remains colourless
test 4 Warm the product of test 3 and test any gas given off with damp red litmus paper.	damp red litmus paper remains red
test 5 To the third portion of solution B , add about 1 cm ³ of dilute nitric acid followed by a few drops of aqueous barium nitrate.	white precipitate

(d) Describe how to carry out the flame test used in **test 1**.

.....

 [2]

(e) Identify the **ion** that is tested for in **test 4**.

..... [1]

Q52 (continued)

0620/62/F/M/25/Q3

Hard



(f) Identify the **two** ions which are in solid **B**.

.....

.....

..... [2]

[Total: 9]

Q53

0620/42/F/M/22/Q3(c)(iii)

Easy

(iii) State the test for ammonia.

test

observations [2]

Q54

0620/42/F/M/25/Q5(d)(ii)

Easy

(ii) Describe a test for chlorine gas.

test

observations [1]

Q55

0620/43/M/J/24/Q5(c)(i)

Easy

(c) Nitrates decompose when they are heated.

When hydrated copper(II) nitrate is heated, oxygen gas is produced.

(i) Describe a test for oxygen.

test

observations [1]

Q56

0620/41/M/J/24/Q5(b)

Easy

(b) When iron(II) sulfate crystals are heated strongly, sulfur dioxide gas is given off.

Describe a test for sulfur dioxide gas.

test

observations [2]

Q57

0620/42/O/N/23/Q4(b)(iii)

Easy

(iii) State the test for chlorine gas.

test

observations [2]

Q58

0620/42/M/J/25/Q5(b)(iv)

Easy

(b) Identify the alkali metal which:

(iv) burns with a lilac flame

..... [1]

Q59

0620/42/O/N/21/Q5(d)(i)

Easy

(d) Chemical properties of some Group I elements are shown in the table.

element	reaction with cold water	reaction with oxygen	flame test colour
lithium	- steadily effervesces - forms a colourless solution	very slowly forms an oxide layer	red
sodium	- strongly effervesces - forms a colourless solution	slowly forms an oxide layer	
potassium	- very strongly effervesces - forms a colourless solution	quickly forms an oxide layer	
rubidium			ruby red

(i) Add to the table:

- the flame test colours for sodium and potassium
- the predicted reactions of rubidium with water and with oxygen.

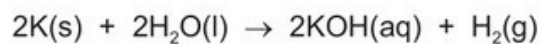
[4]

Q60

0620/41/O/N/22/Q2(c)(i)

Easy

- (c) When potassium is added to water, it reacts vigorously and a coloured flame is seen. The equation for the reaction is shown.



- (i) State the colour of the flame seen.

..... [1]

Q1

0620/41/O/N/23/Q6(c)(i)

6(c)(i)	proton donor	1
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Q2

0620/43/O/N/24/Q4(e)(i)

Question	Answer	Marks
4e(i)	acid / acidic	1

Q3

0620/42/O/N/25/Q4(a)(i)-(ii)

Question	Answer	Marks
4(a)(i)	H ⁺	1
4(a)(ii)	M1 complete (dissociation) M2 partial (dissociation)	2

Q4

0620/42/M/J/23/Q4(f)(ii)-(iii)

4(f)(ii)	$3 \leq \text{pH} < 7$	1
4(f)(iii)i	$\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+$ M1 H^+ M2 CH_3COO^- M3 use of $\rightleftharpoons$	3

Q5

0620/41/O/N/23/Q6(c)(ii)

Official MS

6(c)(ii)	partial dissociation	1
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Q6

0620/42/O/N/25/Q4(b)(i)-(ii)

Official MS

[illegible]

Q7

0620/42/M/J/21/Q5(e)(i)

Official MS

5(e)(i)	proton acceptor	1
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Q8

0620/41/O/N/22/Q2(c)(ii)

Official MS

2(c)(ii)	OH ⁻	1
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Q9

0620/42/O/N/22/Q2(c)(i)

Official MS

5(e)(i)	proton acceptor	1
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Q10

0620/42/F/M/23/Q2(b)(ii)-(iii)

Official MS

2(b)(ii)	14	1
2(b)(iii)	universal indicator	1

Q11

0620/42/M/J/22/Q2(b)(i)-(ii)

Official MS

2(b)(i)	$7 < \text{pH} \leq 12$	1
2(b)(ii)	OH^-	1

Q12

0620/41/O/N/21/Q3(d)

Official MS

4(b)(ii)	Above pH 7 up to 11	1
4(b)(iii)	blue precipitate	1
	precipitate dissolves	1
	deep blue solution remains	1
4(c)(i)	neutralisation	1
4(c)(ii)	Na ₂ SO ₄	1
	2H ₂ O	1
4(d)(i)	methyl orange	1

Q13

0620/42/M/J/21/Q5(e)(ii)

Official MS

5(e)(ii)	$7 < x \leq 11$	1
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Question	Answer	Marks
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Q14

0620/42/O/N/21/Q5(d)(iv)

Official MS

5(d)(iv)	any number in the range $7 < \text{pH} \leq 14$	1
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Q15

0620/42/O/N/22/Q2(c)(ii)

Official MS

2(c)(ii)	pH 14	1
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Q16

0620/42/F/M/24/Q3(c)

Official MS

3(c)	M1 blue M2 colourless	2
------	--	----------

Q17

0620/41/O/N/25/Q3(f)

Official MS

3(f)	M1 yellow M2 orange	2
------	--------------------------------------	----------

Q18

0620/41/O/N/22/Q2(c)(iii)

Official MS

2(c)(iii)	blue	1
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Q19

0620/42/O/N/22/Q2(c)(iii)

Official MS

2(c)(iii)	yellow	1
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Q20

0620/41/O/N/23/Q6(f)

Official MS

6(f)(i)	calcium ethanoate	1
6(f)(ii)	$(\text{CH}_3\text{COO})_2\text{Ca}$	1
6(f)(iii)	hydrogen	1

Q21

0620/43/M/J/22/Q5

Official MS

5(d)	solid undissolved	1
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Q22

0620/42/M/J/24/Q5(c)

Official MS

5(c)(i)	H_2SO_3	1
5(c)(ii)	SO_3^{2-}	1

Q23

0620/41/O/N/24/Q1(a)

Official MS

1(a)	D	1
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Q24

0620/43/O/N/22/Q5(d)(ii)

Official MS

5(d)(i)	lilac flame	1
5(d)(ii)	Any Two from • solid disappears • blue solution • bubbles / effervescence / fizzing	2
5(d)(iii)	white precipitate	1

Q25

0620/42/F/M/21/Q3(b)

Official MS

3(b)	$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ (NH_4) ₂ SO ₄ (1) correct equation (1)	2
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Q26

0620/41/M/J/23/Q6(c)

Official MS

6(c)	$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ M1 $(\text{NH}_4)_2\text{SO}_4$ on the right (1) M2 equation correct(1)	2
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Q27

0620/41/M/J/21/Q5(a)

Official MS

5(a)	(add) water (to both salts) (1) dissolve both salts / make solutions (1) filter (lead(II) iodide)(1) wash (residue of lead(II) iodide) with water AND dry e.g. with filter paper / description of washing and drying (1) $\text{Pb}(\text{NO}_3)_2 + 2 \text{NaI} \rightarrow 2\text{NaNO}_3 + \text{PbI}_2$ OR $\text{Pb}^{2+} + 2\text{I}^- \rightarrow \text{PbI}_2$ (1)	5
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Q28

0620/41/O/N/25/Q3(g)-(h)

Official MS

3(g)	repeat steps 1 and 3 without indicator	1
3(h)(i)	M1 (a solution containing the) maximum concentration of a solute dissolved in the solvent M2 at a specified temperature	2
3(h)(ii)	solubility decreases as temperature decreases	1
3(h)(iii)	none	1

Q29

0620/43/M/J/24/Q5(b)

Official MS

5(b)	M1 sulfuric (acid) M2 copper(II) carbonate / copper(II) oxide / copper(II) hydroxide	2
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Q30

0620/43/M/J/21/Q5(a)

Official MS

5(a)	add zinc carbonate to sulfuric acid until • it stops dissolving OR • no more effervescence (1) filter (zinc carbonate) (1) evaporation of filtrate to form dry crystals (1) $\text{ZnCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$ CO_2 product in equation (1) rest of equation correct (1)	5
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Q31

0620/41/M/J/22/Q6(b)(i)-(ii)

Official MS

6(b)(i)	no bubbles or no fizzing or no effervescence	1
6(b)(ii)	zinc / zinc oxide / zinc hydroxide	1

Q32

0620/43/M/J/23/Q6(c)(i)-(iii)

Official MS

6(c)(i)	$\text{CuCO}_3 + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$ M1 $\text{Cu}(\text{NO}_3)_2$ M2 correct equation	2
6(c)(ii)	M1 undissolved solid M2 effervescence stops on addition of more copper(II) carbonate	2
6(d)(iii)	copper(II) oxide or copper(II) hydroxide	1

Q33

0620/41/M/J/25/Q3(c)(i)-(vii)

Official MS

3(c)(i)	Any two from:- - solid disappears / solid dissolves - fizzing / bubbling / effervescence - blue solution	2
3(c)(ii)	all the sulfuric acid had reacted	1
3(c)(iii)	copper(II) carbonate	1
3(c)(iv)	copper(II) oxide / copper(II) hydroxide	1
3(c)(v)	saturated (solution)	1
3(c)(vii)	hydrated	1
Question	Answer	Marks

Q34

0620/43/M/J/25/Q3(c)(i)-(v)

Official MS

3(c)(i)	M1 solid stops dissolving / disappearing M2 no more bubbles / fizzing / effervescence on addition of solid	2
3(c)(ii)	aqueous zinc sulfate	1
3(c)(iii)	zinc oxide OR zinc hydroxide	1
3(c)(iv)	M1 (a solution containing the) maximum concentration of a solute dissolved in the solvent M2 at a specified temperature	2

Q35

0620/43/O/N/23/Q4(a)(i)-(iii)

Official MS

4(a)(i)	dilute sulfuric acid	1
4(a)(ii)	M1 solid remains / solid undissolved (1) M2 bubbling / effervescence / fizzing stops (1)	2
4(a)(iii)	aqueous zinc sulfate	1

Q36

0620/43/O/N/21/Q5(a)-(b)

Official MS

5(a)(i)	too many colour changes	1
5(a)(ii)	Any acid-base indicator, e.g. methyl orange or phenolphthalein	1
5(b)	M1 repeat without indicator using same volumes OR remove indicator by adding charcoal or carbon and filtering (1) M2 evaporate / heat / warm/ boil/leave in hot place (1) M3 until most of the water is gone / some water left / saturation(point) / crystallisation (point) / evaporate some of the water (1) M4 cool / leave to crystallise(1) M5 description of drying (1)	5

Q37

0620/43/O/N/24/Q4(a)

Official MS

4(a)(i)	blue (1) to colourless (1)	2
4(a)(ii)	too many colour changes	1

Q38

0620/41/O/N/25/Q3(a)-(b)

Official MS

3(a)	M1 $2\text{H}_2\text{O}$ M2 state symbols (aq) and (l)	2
3(b)	neutralisation	1

Q39

0620/41/O/N/22/Q2(d)

Official MS

2(d)(i)	hydrochloric (acid)	1
2(d)(ii)	neutralisation	1
2(d)(iii)	titration	1

Q40

0620/41/M/J/23/Q6(d)

Official MS

6(d)(i)	lead(II) nitrate	1
6(d)(ii)	$\text{Pb}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s})$ M1 PbSO_4 on the right(1) M2 only Pb^{2+} and SO_4^{2-} on the left(1) M3 $(\text{aq}) + (\text{aq}) \rightarrow (\text{s})(1)$	3
6(d)(iii)	M1 filter(1) M2 wash (the residue or lead sulfate) with distilled or deionised water (1) M3 description of drying(1)	3

Q41

0620/42/O/N/24/Q4(a)-(b)

Official MS

4(a)	$\text{Ag}^+(\text{aq}) + \text{Br}^-(\text{aq}) \rightarrow \text{AgBr}(\text{s})$	1
4(b)	(silver) nitrate	1

Q42

0620/43/O/N/25/Q5(a)

Official MS

5(a)(i)	$\text{Pb}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s})$ M1 PbSO_4 as the ONLY formula on the right M2 ONLY Pb^{2+} and SO_4^{2-} on the left M3 state symbols	3
5(a)(ii)	lead(II) nitrate	1
5(a)(iii)	sodium sulfate / potassium sulfate / ammonium sulfate	1
5(a)(iv)	residue	1
5(a)(v)	M1 wash with distilled water M2 suitable method of drying	2

Q43

0620/41/M/J/24/Q5(a)

Official MS

5(a)(i)	M1 lead(II) nitrate(1) M2 sodium bromide / potassium bromide / ammonium bromide(1)	2
5(a)(ii)	M1 filter precipitate or lead(II) bromide or solid or residue(1) M2 wash the residue with distilled water AND dry e.g. between filter papers(1)	2
5(a)(iii)	$\text{Pb}^{2+}(\text{aq}) + 2\text{Br}^{-}(\text{aq}) \rightarrow \text{PbBr}_2(\text{s})$ M1 PbBr_2 as the only product (1) M2 $\text{Pb}^{2+} + 2\text{Br}^{-}$ as the only reactants in a balanced equation(1) M3 state symbols (aq) + (aq) → (s)(1)	3

Q44

0620/43/M/J/24/Q5(a)

Official MS

5(a)(i)	M1 named soluble barium salt e.g. barium chloride / barium nitrate M2 named soluble sulfate salt e.g. sodium sulfate / potassium sulfate / ammonium sulfate / sulfuric acid	2
5(a)(ii)	M1 filter M2 wash (residue) with water and dry (residue) between filter papers / in a warm place	2
5(a)(iii)	$\text{Ba}^{2+} (\text{aq}) + \text{SO}_4^{2-} (\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$ M1 BaSO_4 as only product M2 $\text{Ba}^{2+} + \text{SO}_4^{2-}$ as only reactants M3 state symbols	3

Q45

0620/41/O/N/22/Q2(e)

Official MS

2(e)(i)	white	1
2(e)(ii)	silver chloride	1
2(e)(iii)	$\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$ M1 AgCl (as <i>only</i> product) (1) M2 Ag ⁺ and Cl ⁻ (as <i>only</i> reactants) (1) M3 state symbols (1)	3

Q46

0620/43/O/N/22/Q5(d)(iii)-(e)

Official MS

5(d)(i)	lilac flame	1
5(d)(ii)	Any Two from - solid disappears - blue solution - bubbles / effervescence / fizzing	2
5(d)(iii)	white precipitate	1
5(e)	$\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$ M1 BaSO_4 on the right (1) M2 ONLY Ba^{2+} and SO_4^{2-} on the left (1) M3 state symbols (1)	3

Q47

0620/42/O/N/23/Q4(a)

Official MS

4(a)(i)	M1 lead nitrate (1) M2 soluble chloride e.g. sodium chloride (1)	2
4(a)(ii)	$\text{Pb}^{2+}(\text{aq}) + 2\text{Cl}^{-}(\text{aq}) \rightarrow \text{PbCl}_2(\text{s})$ M1 PbCl_2 as only product (1) M2 $\text{Pb}^{2+} + 2\text{Cl}^{-}$ as only reactants (1)	3
4(a)(iii)	M1 filter (1) M2 wash (the residue) using water (1) M3 dry the residue between filter papers / in a warm place (1)	3

Q48

0620/62/F/M/21/Q3

Official MS

3(a)	ammonia / NH_3	1
3(b)	lithium nitrate	1
	lithium (ions) / Li^+	
	nitrate / NO_3^-	1
3(c)	white precipitate	1
	dissolves / disappears / forms colourless solution	1
3(d)	white precipitate	1
	remains / does not dissolve / no further change / white precipitate / nothing happens	1
3(e)	no change	1
3(f)	white precipitate	1

Q49

0620/62/F/M/22/Q3

Official MS

3(a)	blue-green (flame)	1
3(b)	(light/pale) blue precipitate	1
	dissolves / forms a solution	1
	deep(er) blue	1
3(c)	cream precipitate	1
3(d)	any pH in range 8 to 14	1
3(e)	calcium / Ca^{2+}	1
	hydroxide / OH^-	1

Q50

0620/62/F/M/23/Q3

Official MS

3(a)	orange-red (flame)	1
3(b)	M1 white precipitate	1
	M2 (precipitate) remains / does not dissolve / insoluble / white precipitate	1
3(c)	(damp red) litmus (paper) turns blue	1
3(d)	no change / no reaction / no precipitate	1
3(e)	any pH in range 1 to 3	1
3(f)	carbon dioxide / CO ₂	1
3(g)	hydrogen (ion) / H ⁺	1
	sulfate (ion) / SO ₄ ²⁻	1

Q51

0620/62/F/M/24/Q3

Official MS

3(a)	no change	1
3(b)	yellow precipitate	1
3(c)(i)	no change	1
3(c)(ii)	(red) litmus (paper) turns blue	1
3(d)	pink	1
3(e)	nitrate / NO_3^-	1
3(f)	carbon dioxide / CO_2	1
3(g)	M1 Na^+ / sodium (ion)	1
	M2 Fe^{2+} / iron(II) (ion)	1
	M3 CO_3^{2-} / carbonate (ion)	1

Q52

0620/62/F/M/25/Q3

Official MS

3(a)	M1 green precipitate	1
	M2 dissolves / forms a (green) solution	1
3(b)	no change	1
3(c)	white precipitate	1

Q52 (continued)

0620/62/F/M/25/Q3

Official MS

3(d)	M1 description of using a non-luminous / blue / roaring (Bunsen) flame	1
	M2 description of how the substance is put into the flame – on a wire / on a splint / spray a solution	1
3(e)	ammonium / NH_4^+	1
3(f)	M1 lithium / Li^+	1
	M2 sulfate / SO_4^{2-}	1

Q53

0620/42/F/M/22/Q3(c)(iii)

Official MS

3(c)(iii)	(damp red) litmus (litmus) turns blue	2
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Q54

0620/42/F/M/25/Q5(d)(ii)

Official MS

5(d)(ii)	(damp) litmus (paper) and is bleached / goes white	1
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Q55

0620/43/M/J/24/Q5(c)(i)

Official MS

5(c)(i)	glowing splint and relights	1
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Q56

0620/41/M/J/24/Q5(b)

Official MS

5(b)	M1 acidified aqueous potassium manganate(VII) (1) M2 purple to colourless (1)	2
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Q57

0620/42/O/N/23/Q4(b)(iii)

Official MS

4(b)(iii)	M1 (damp) litmus (paper) (1) M2 is bleached / goes white (1)	2
4biv	(shiny) grey AND solid	1

Question	Answer	Marks
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Q58

0620/42/M/J/25/Q5(b)(iv)

Official MS

5(b)(iv)	potassium / K	1
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Q59

0620/42/O/N/21/Q5(d)(i)

Official MS

5(d)(i)	Na – yellow (1) K – lilac (1) colourless solution (1) clear idea of increased reactivity in both reactions (1)	4
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Q60

0620/41/O/N/22/Q2(c)(i)

Official MS

2(c)(i)	lilac	1
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