Topic Test: OxfordAQA International GCSE Combined Science 9204 Chemistry

Acids, bases and salts

Name: _____

Class: _____

Date: _____

Time: **45 minutes**

Marks: **45 marks**

Comments:

1 Salts can be prepared by the reaction of acids with alkalis.

(a) (i) The reactions of acids with alkalis can be represented by the equation below. Choose a substance from the box to complete the equation.

carbon dioxide	**hydrogen**	**oxygen**	**water**

acid + alkali → salt + _____

(1)

(ii) Draw a ring around the word which best describes the reaction.

displacement **neutralisation** **oxidation** **reduction**

(1)

(b) Sodium sulphate is an important salt.

The table gives a list of some substances.

Put a tick (✓) next to the names of the acid **and** the alkali that would react to make sodium sulphate.

Substances	**(✓)**
Hydrochloric acid	
Nitric acid	
Potassium sulphate	
Sodium hydroxide	
Sodium nitrate	
Sulphuric acid	

(2)

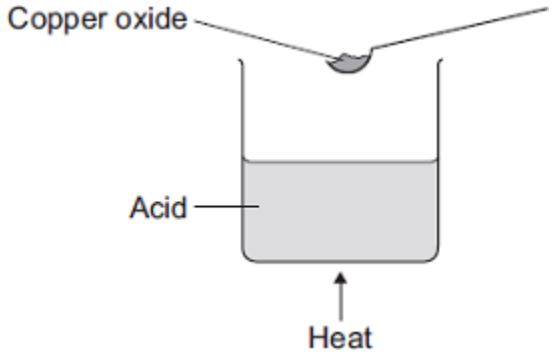
(Total 4 marks)

2 A student added copper oxide to an acid to make copper sulfate.

The student heated the acid.

The student added copper oxide until no more reacted.

(a) The diagram shows the first stage in the experiment.



(i) Complete the word equation.

Copper oxide + _____ acid → copper sulfate + water

(1)

(ii) Which **one** of these values could be the pH of the acid?

Draw a ring around the correct answer.

1 **7** **11**

(1)

(iii) Why is the acid heated?

_____

_____

(1)

(b) After the reaction is complete, some solid copper oxide remains.
Why?

_____

_____

(1)

(c) The student removed the solid copper oxide from the solution.

Suggest what the student should do to the solution to form copper sulfate crystals.

_____

_____

(1)

(d) The mass of copper sulfate crystals was less than the student expected.

Tick (✓) the **one** statement that explains why the mass of copper sulfate crystals was less than expected.

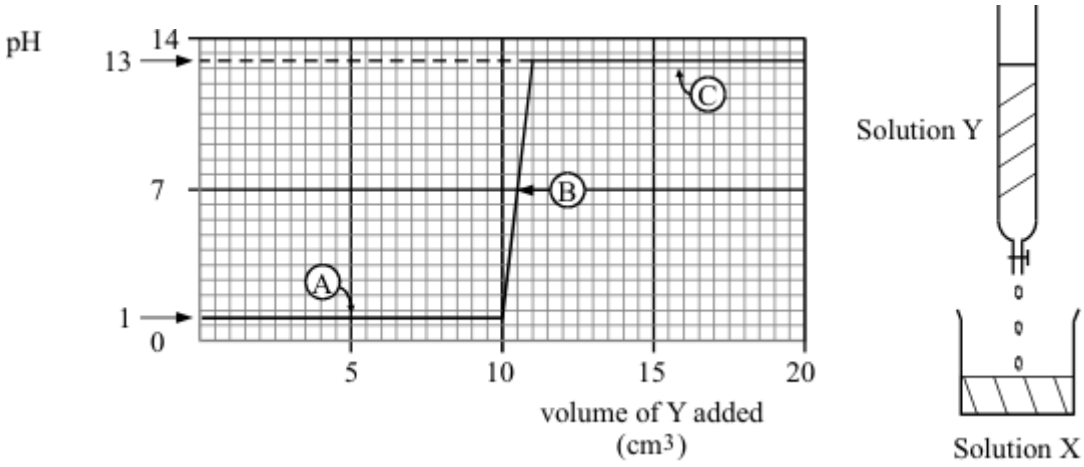
Statement	Tick (✓)
Some copper sulfate may have been lost during the experiment.	
The student added too much copper oxide.	
The copper sulfate crystals were wet when they were weighed.	

(1)

(Total 6 marks)

3 Some students slowly add solution Y to solution X.

The graph shows what happens to the pH of the solution in the beaker as they do this.



(a) Choose words from this list to complete the sentences below.

acidic **alkaline** **neutral**

At point A on the graph the solution in the beaker is _____

At point B on the graph the solution in the beaker is _____

At point C on the graph the solution in the beaker is _____

(2)

(b) Describe, as fully as you can, what happens to the pH of the mixture as solution Y is slowly added.

_____

_____

_____

_____

_____

_____

(5)

(Total 7 marks)

4 Lead bromide is a solid. Some students were measuring how soluble lead bromide is at different temperatures.

This is the method they used.

A Pour 100 cm^3 of water into a beaker.

B Heat or cool the water to the required temperature.

C Add lead bromide to the water.

D Stir until no more lead bromide dissolves.

E Transfer 50 cm^3 of the lead bromide solution into an evaporating basin of known mass.

F Heat the evaporating basin until all of the water has evaporated.

G Measure the mass of the evaporating basin containing the dry lead bromide.

(a) (i) How could the lead bromide solution be separated from the undissolved solid lead bromide after step **D**?

Draw a ring around the correct answer.

electrolysis **filtration** **neutralisation**

(1)

(ii) Draw a ring around the correct answer to complete the sentence.

A suitable item of apparatus for measuring 50 cm^3 of the lead bromide solution

in step **E** is a measuring

cylinder.
funnel.
tube.

(1)

(iii) One student's results are shown in **Table 1**.

Table 1

Volume of lead bromide solution	50 cm^3
Mass of empty evaporating basin	35.4 g
Mass of the evaporating basin containing dry lead bromide	36.0 g

Calculate the mass of lead bromide dissolved in 50 cm^3 of lead bromide solution.

_____

_____

Mass of lead bromide dissolved = _____ g

(2)

(b) A different student got the results shown in **Table 2**.

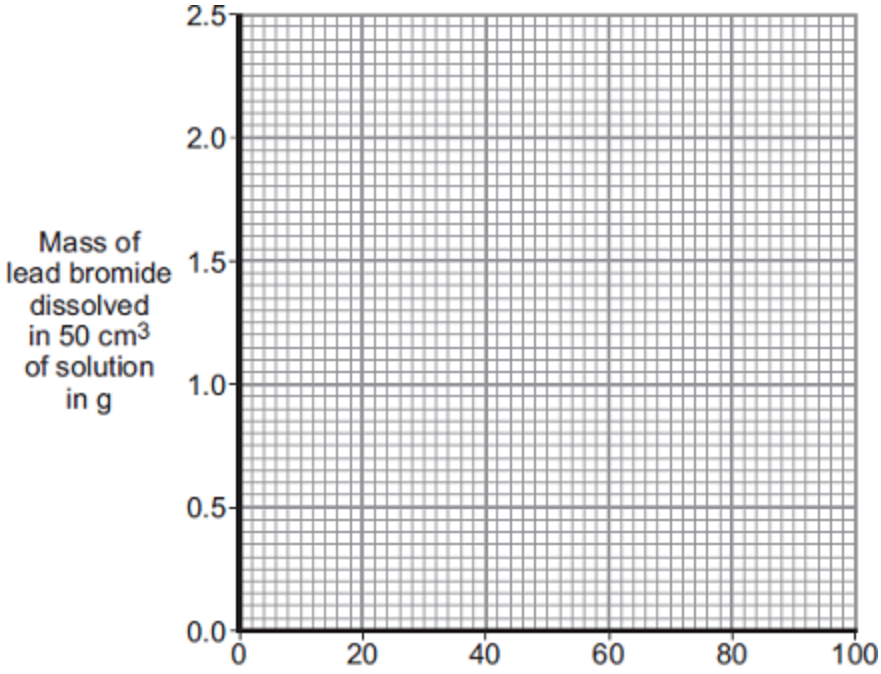
Table 2

Temperature of lead bromide solution in °C	**Mass of lead bromide dissolved in 50 cm^3 of solution in g**
0	0.20
20	0.40
40	0.70
60	1.70
80	1.55
100	2.30

(i) Plot these results on the grid in **Graph 1**.

Draw a smooth curve of best fit.

Graph 1



(3)

(ii) One of the points is anomalous.

Draw a ring around the anomalous point on the graph.

Suggest **one** possible error in the experiment, and give a reason why this error would cause the anomalous point.

_____

_____

_____

_____

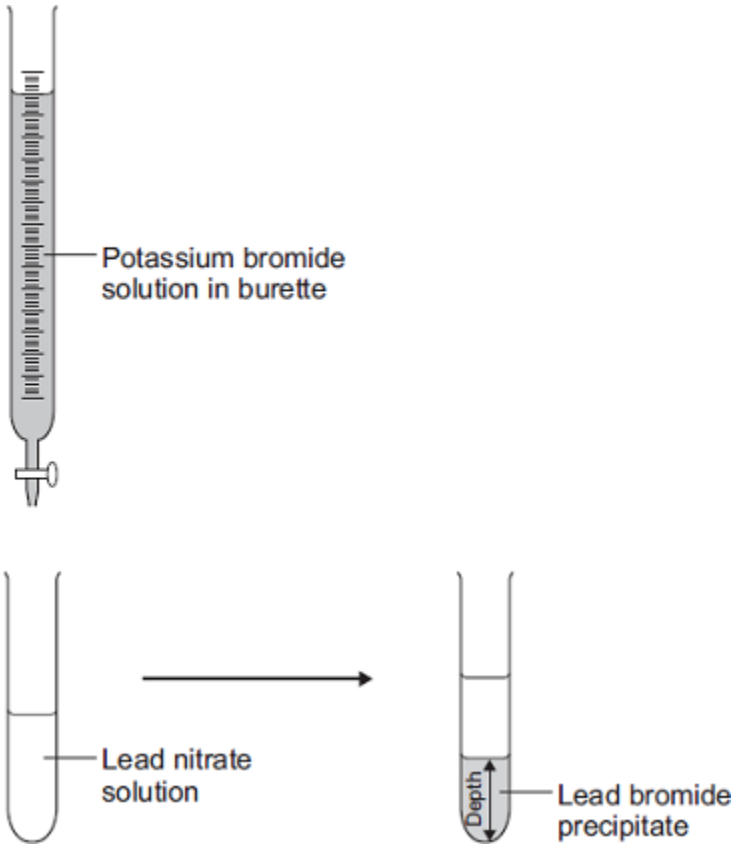
(3)

(c) The solubility of lead bromide is so low that it can be made using a precipitation reaction.

A student investigated how much lead bromide was precipitated when different volumes of potassium bromide and lead nitrate solutions were mixed together.

This is the method the student used.

- Place 10 cm^3 of lead nitrate solution in a boiling tube.
- Using a burette, add 2 cm^3 of potassium bromide solution to the boiling tube containing the lead nitrate solution.
- Leave the mixture to stand.
- Measure the depth of the lead bromide precipitate using a ruler.
- Repeat using different volumes of potassium bromide solution.



(i) A teacher suggested that the student should do the reaction in a measuring cylinder.

Explain why it is a good idea to do the reaction in a measuring cylinder.

_____

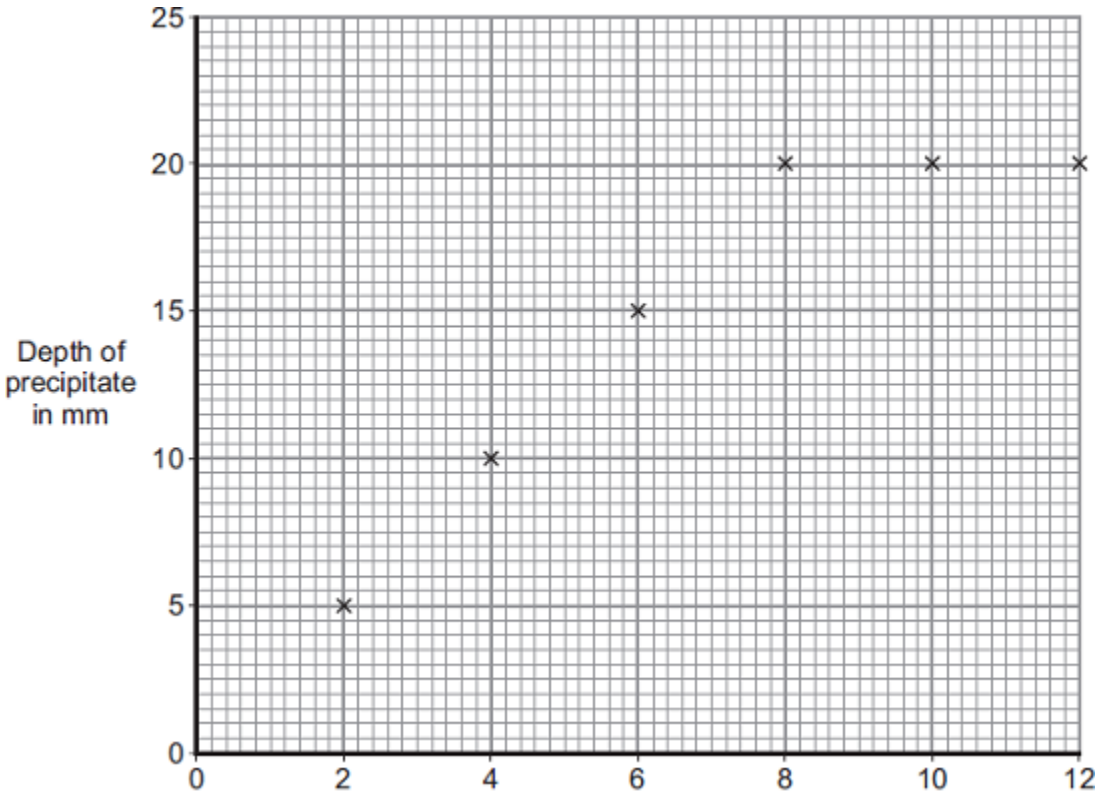
_____

_____

(2)

(ii) The student's results are plotted on **Graph 2**.

Graph 2



There are no anomalous points.

Complete the graph by drawing two straight lines through the points.

(2)

(iii) What depth of precipitate would you expect to get if 14 cm^3 of potassium bromide was used?

Give a reason for your answer.

Depth of precipitate _____ mm

Reason _____

_____

_____

(2)

(iv) How would the results be different if the experiment was repeated using solutions at a higher temperature?

Give a reason for your answer.

_____

_____

_____

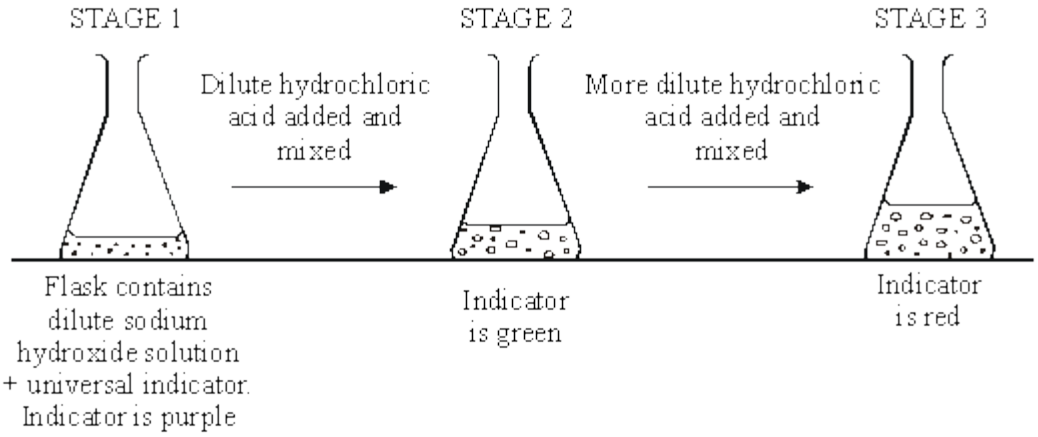
_____

_____

(2)

(Total 18 marks)

5 The diagrams show what happens when an acid is added to an alkali.



(a) What is present in the solution at stages 2 and 3 apart from universal indicator and water?

(i) At stage 2 _____

(ii) At stage 3 _____

(3)

(b) Write an ionic equation to show how water is formed in this reaction and state the sources of the ions.

_____

_____

_____

_____

(3)

(Total 6 marks)

6 Use the Formulae of Some Common Ions table on the Data Sheet to help you to answer this question.

Acids react with alkalis to form salts and water.

Complete the table below by writing in the name and formula of the salt formed in each reaction.

The first one has been done for you.

Acid	Alkali	Salt	Formula of salt
Hydrochloric acid	Sodium hydroxide	Sodium chloride	NaCl
Nitric acid	Sodium hydroxide		
Sulphuric acid	Potassium hydroxide		

(Total 4 marks)

1 (a) (i) water

accept H_2O
accept correct ringed answer in box

1

(ii) neutralisation

accept underlining or any indication, eg tick

1

(b) sodium hydroxide

1

sulphuric acid

apply list principletotal

1

[4]

2 (a) (i) sulfuric

1

(ii) 1

1

(iii) to speed up the reaction

1

(b) because copper oxide in excess

allow copper oxide unreacted

or

because acid all used up / neutralised

1

(c) evaporation

allow heating
allow cooling
allow leave (to evaporate)
*do **not** accept freezing*

or

crystallisation

1

(d) Some copper sulfate may have been lost during the experiment

1

[6]

3 (a) acidic }
neutral } *in this order*
alkaline}

all correct 2 marks
one correct 1 mark

2

(b) *ideas that*

- nothing happens at first (to pH) / pH stays the same
- then (rapidly) changes / increases
- then stays at same (higher) level

5

[7]

4 (a) (i) filtration

1

(ii) cylinder

1

(iii) 0.6

*correct answer with or without working gains **2** marks*

*if answer incorrect, allow mass of lead bromide = 36.0–35.4 for **1** mark*

2

(b) (i) all points plotted correctly

± *half a small square*

*4 or 5 correct for **1** mark*

2

smooth curve through five points (excluding anomaly)

*do **not** accept straight sections / multiple lines*

1

(ii) point at 60°C circled

1

measured out more than 50 cm^3

*explanation **must** explain why mass dissolved is too large*

1

so solution contained more lead bromide

or

did not heat until all water gone

so additional mass of water

or

heated water to over 60 °C

so more dissolved

allow correct explanation for an incorrectly circled point

1

(c) (i) because (a measuring cylinder) has graduations on it

1

so it is easier to read how much precipitate

or

(a measuring cylinder) has a flat bottom

so measurement of depth is more accurate

1

(ii) straight line covering points from (2,5) to (8,20)

line need not be extrapolated to (0,0), but line is correct only if any extrapolation would go through (0,0)

1

straight line through points (8,20) and (10,20)

all straight lines must be drawn with a ruler

1

(iii) 20 mm

1

all of the lead nitrate has reacted **or** lead nitrate is limiting **or** potassium bromide is in excess **or** reaction was over when 8 cm^3 potassium bromide were used

1

(iv) amount / depth of precipitate would be less

1

because lead bromide is more soluble at higher temperatures **or** less solid / more dissolved **or** solution of lead bromide more concentrated

1

[18]

5 (a) (i) sodium ions and chloride ions

(allow sodium chloride/salt) [not "chlorine"] for 1 mark

1

(ii) sodium ions and chloride ions

(allow sodium chloride/salt) for 1 mark

H + ions (*allow* hydrochloric acid)

for 1 mark

2

(b) $H^+ + OH^- \rightarrow H_2O$ [N.B Na^+ and Cl^- may also be present]

H^+ ions from acid

OH^- ions from alkali

each for 1 mark

[N.B First mark lost if changes on ions not shown]

3

[6]

6 sodium nitrate

1

N_aNO_3

*do not credit lower case N **or** O**,** upper case A*

1

potassium sulphate

1

K_2SO_4

*accept potassium hydrogen sulphate **or*** $KHSO_4$

do not credit lower case K, S or O

ignore charges on ions

1

[4]