WJEC Chemistry GCSE

1.3: Water

Practice Questions

Wales Specification

1.

The table below shows the amount of soap solution required by different samples of water to form a permanent lather. In each case 25 cm^3 of the water samples were used and the soap solution was added 1 cm^3 at a time.

	Volume of soap solution added (cm^3)				
Sample	Test 1	Test 2	Test 3	Test 4	Mean
distilled water	2	2	2	2	2
A	8	8	9	7	8
B	11	18	12	13	
C	15	14	14	13	14
A after boiling	8	7	9	8	8
B after boiling	6	5	6	7	6
C after boiling	2	2	2	2	2

(a) Two pupils, David and Haf, calculated the mean value for sample **B**. David calculated a value of 13.5 and Haf calculated a value of 12. Show how both values were obtained. State which is the better value to use and give a reason for your choice. [3]

.....

.....

.....

.....

(b) State which of water samples **A**, **B** and **C** is the **least** hard. [1]

Water sample .....

(c) State which of water samples **A**, **B** and **C** contains **both** temporary and permanent hardness. Give the reason for you answer. [2]

Water sample .....

Reason .....

.....

(d) Name an ion which causes hardness in water. [1]

.....

7

2.

(a) A group of students were given three water samples labelled **A**, **B** and **C**.

They were told that one was temporary hard water, one was permanent hard water and one distilled water, but they were not told which was which. Temporary hard water is softened by boiling.

Describe an investigation you would carry out using soap solution to identify each sample. [5]

.....

.....

.....

.....

.....

.....

.....

.....

(b) Suggest a reason why energy may be wasted in homes in hard water areas. [1]

.....

6

3.

(a) A group of students carry out an experiment to investigate the relative hardness of four samples of water, **A**, **B**, **C** and **D**.

The students add soap solution, 0.5 cm^3 at a time, to sample **A**. The mixture is shaken after each addition. The volume of soap solution needed to produce 1 cm of lather is recorded. They test samples **B**, **C** and **D** in exactly the same way. They then repeat the experiment after boiling each sample of water.

The results obtained are shown in the table below.

Water sample	Volume of soap solution needed (cm^3)	
	Before boiling	After boiling
A	10.5	10.5
B	1.5	1.5
C	6.0	1.5
D	9.5	7.0

(i) State which water sample is the hardest and give a reason for your answer. [1]

.....

.....

(ii) State which water sample contains both permanent and temporary hard water and give a reason for your answer. [2]

.....

.....

.....

(b) A different group of students carry out a similar investigation with the same water samples, **A**, **B**, **C** and **D**.

Their results are as follows.

Water sample	Volume of soap solution needed (cm^3)	
	Before boiling	After boiling
A	6.0	6.0
B	1.0	1.0
C	3.5	1.0
D	5.5	3.0

Compare the results obtained by the two groups, commenting on the similarity and suggesting a reason for the difference. [2]

.....

.....

.....

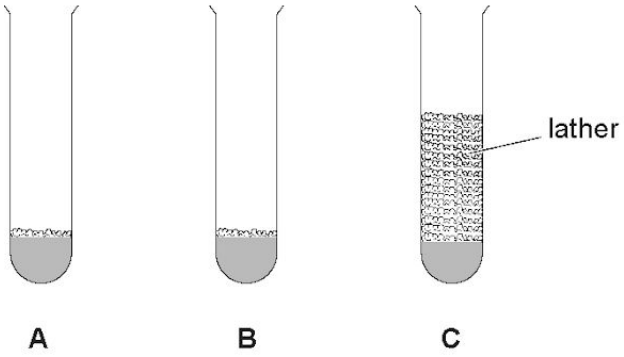
.....

5

4.

(a) An investigation was carried out to compare the hardness of three water samples **A**, **B** and **C**.

(i) $1\,cm^3$ of soap solution was added to $5\,cm^3$ of the three water samples.
Each tube was shaken for 1 minute. The results are shown in the diagram below.



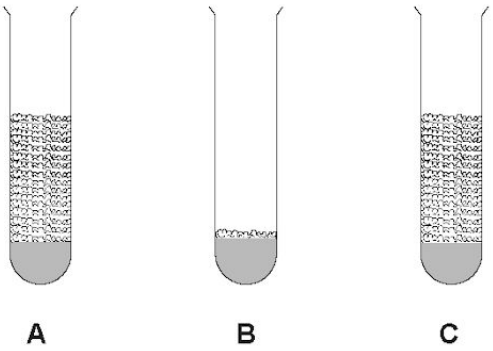
State which of the samples contain hard water. Give the reason for your answer. [2]

.....

.....

(ii) Water can contain temporary or permanent hardness. Water containing temporary hardness can be softened by boiling.

$1\,cm^3$ of soap solution was added to $5\,cm^3$ of **boiled** samples of **A**, **B** and **C**.
Each tube was shaken for 1 minute. The results are shown below.

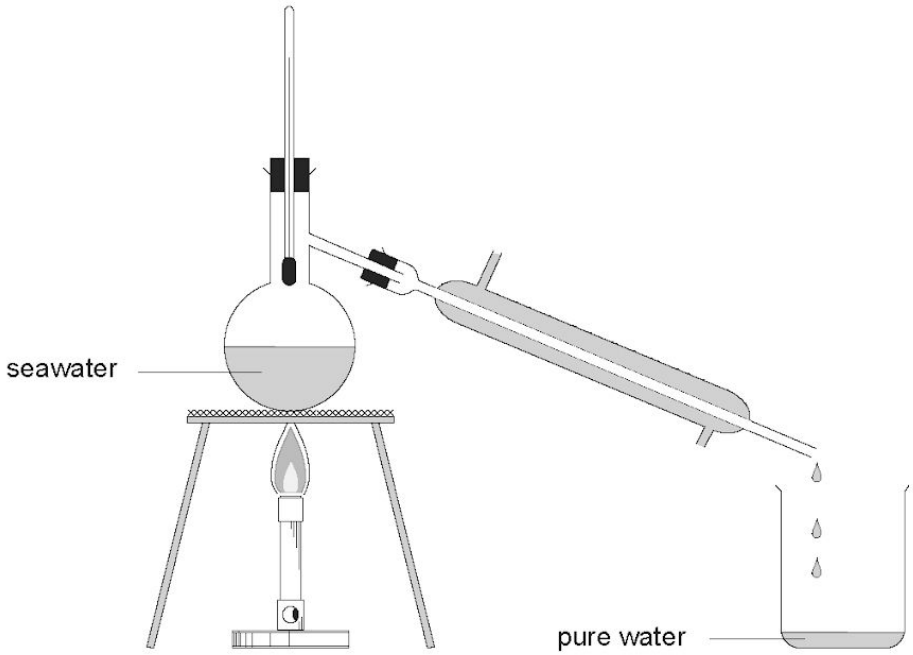


State what these results tell you about samples **A**, **B** and **C**. Include your reasoning. [2]

.....

.....

The diagram below shows apparatus that can be used to obtain pure water from seawater.



(i) Describe how pure water is separated from seawater. [3]

.....

.....

.....

.....

.....

.....

(ii) Suggest what you would **see** if 1 cm^3 of soap solution were added to 5 cm^3 of pure water in a test tube and the tube shaken for 1 minute. Give the reason for your answer. [2]

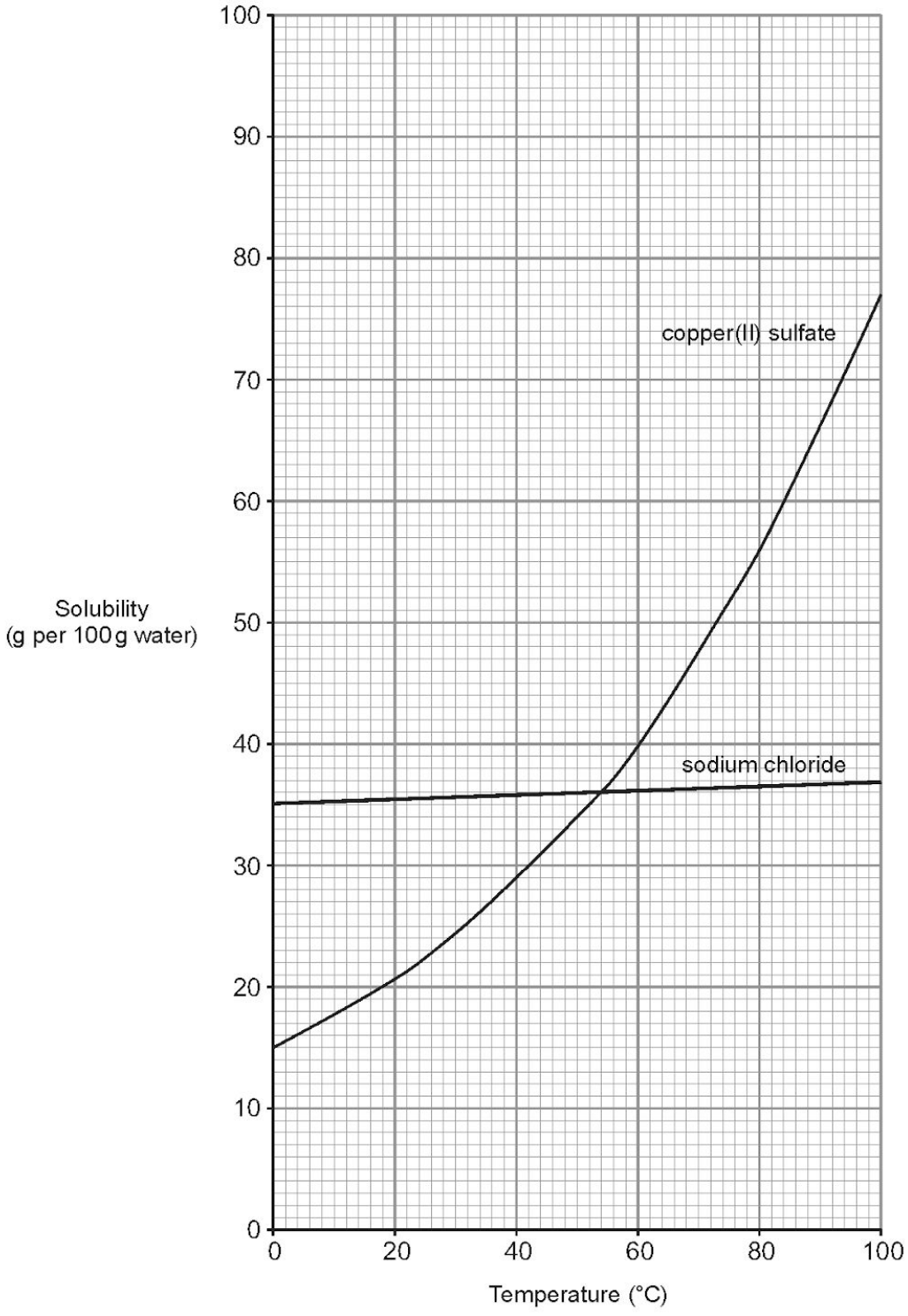
.....

.....

9

5.

The graphs below show the solubilities of sodium chloride and copper(II) sulfate in water at different temperatures.



(a) Compare the solubilities of copper(II) sulfate and sodium chloride below 54 °C, at 54 °C and above 54 °C. [3]

.....

.....

.....

.....

(b) Calculate the mass of solid copper(II) sulfate that forms when a saturated solution in 50 g of water at 80 °C cools to 40 °C. [2]

Mass of solid copper(II) sulfate = ... g

(c) State why the temperature scale on a solubility graph ranges from 0 °C to 100 °C. [2]

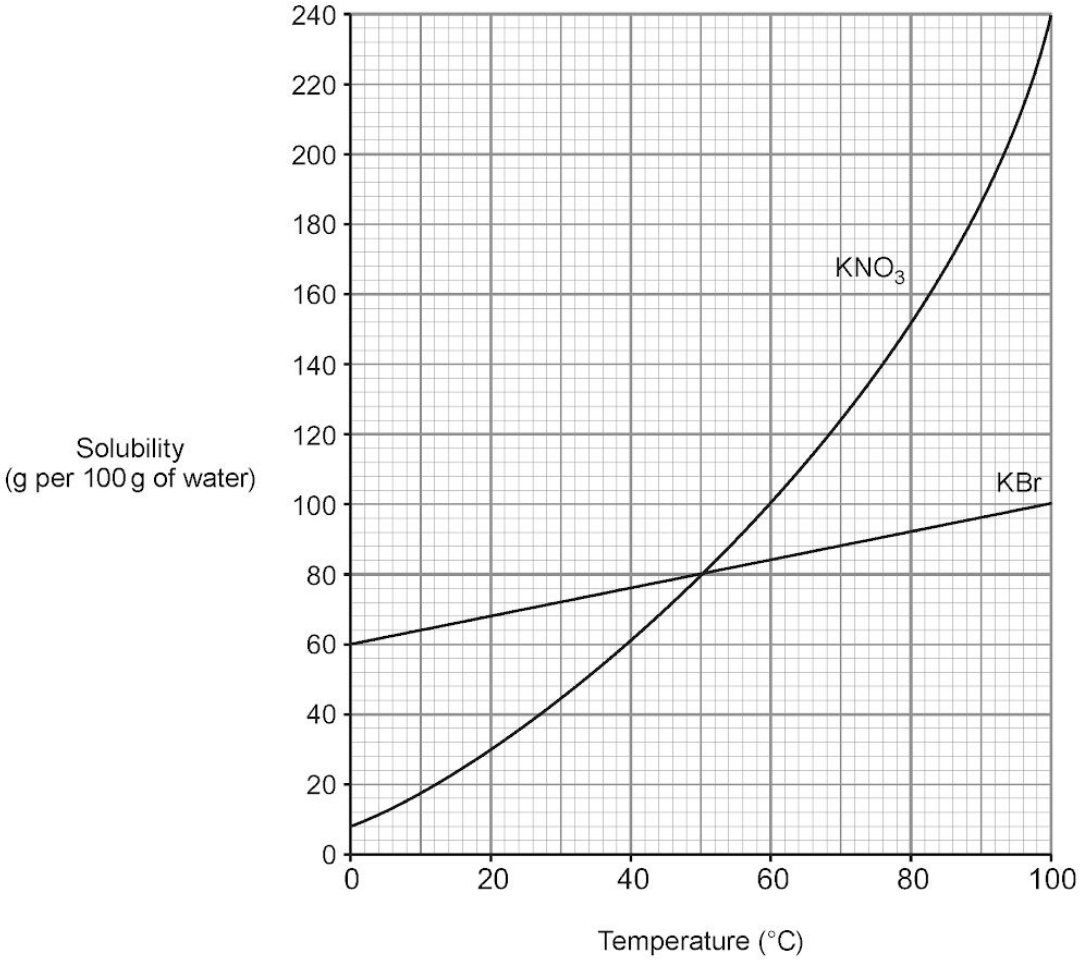
.....

.....

7

6.

The following graph shows the solubility curves of two substances.



(a) (i) Use the graph to find the solubility of potassium bromide, KBr, at 60 °C. [1]

Solubility = ... g per 100 g of water

(ii) A student places 200 g of potassium bromide in 200 g of water at 60 °C and stirs until no more dissolves. Calculate the mass of solid that remains undissolved. [2]

Mass of undissolved solid = ... g

(b) Compare the solubilities of potassium bromide and potassium nitrate between 0 °C and 100 °C. [3]

.....

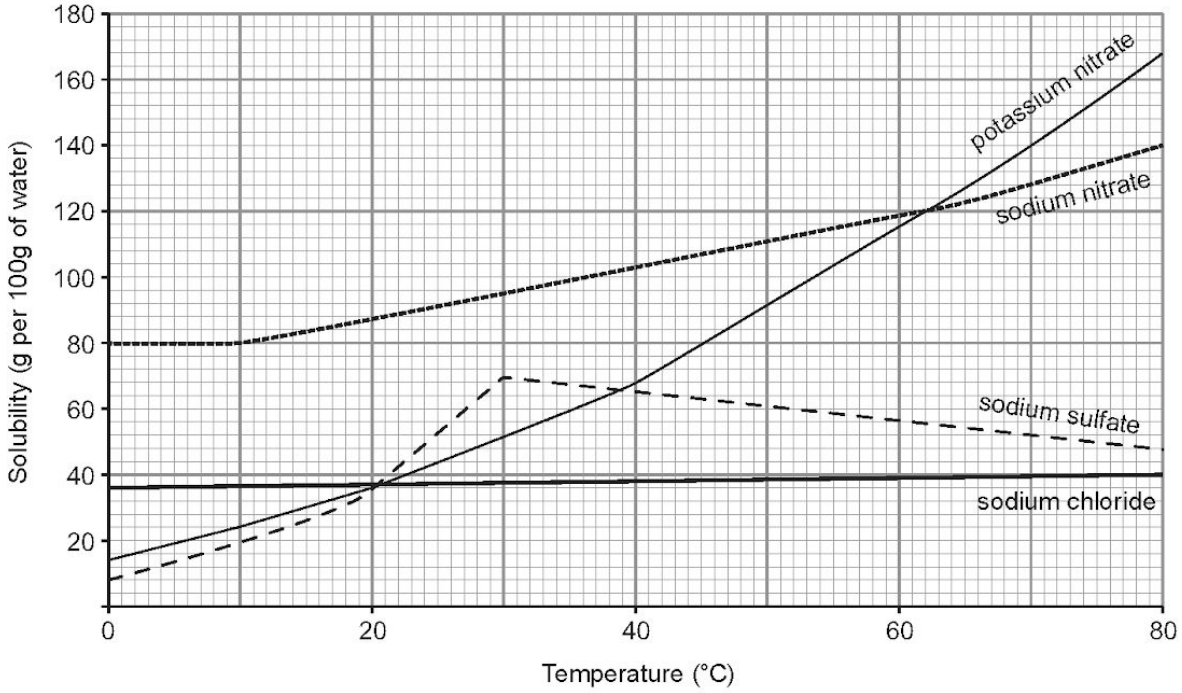
.....

.....

6

7.

The following graph shows how the solubility of four different substances varies with temperature.



(a) Name the substance that shows the smallest change in solubility. [1]

.....

(b) Give the temperature at which the solubility of potassium nitrate and sodium nitrate is the same.

..... °C [1]

(c) If a saturated solution of sodium nitrate in 100g of water is cooled from 80°C to 10°C, calculate the mass of crystals that will be formed. [2]

Mass of crystals formed = ... g

(d) Describe, **using data from the graph**, how the solubility of sodium sulfate changes with temperature. [2]

.....

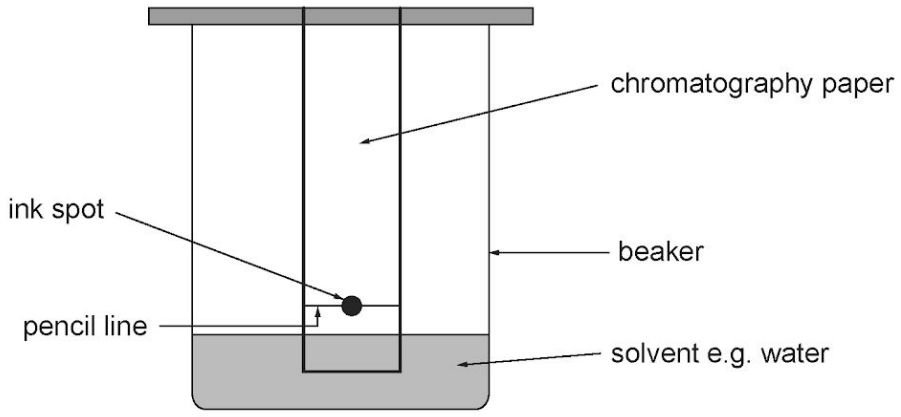
.....

.....

6

8.

Chromatography can be used to separate the pigments in ink.



Describe how chromatography can be used to determine whether two inks contain the same pigments. [6 QWC]

Your answer should include

- a description of how chromatography is carried out
- a description of what happens during the process
- how the results would show whether the two inks contain identical or different pigments.

You may include a diagram in your answer.