IGCSE (EDEXCEL) Chemistry : Solubility exam questions

Q1. This question is about soluble and insoluble compounds.

A precipitate is an insoluble compound formed when solutions of soluble compounds react after mixing.

(a). Different solutions are mixed in separate test tubes.

Tube 1 copper(II) sulphate solution and calcium chloride solution

Tube 2 magnesium nitrate solution and potassium sulphate solution

Tube 3 sodium carbonate solution and copper(II) sulphate solution

In which of the tubes will a precipitate form?

(1)

A 1 and 2 only

B 2 and 3 only

C 1 and 3 only

D 1, 2 and 3

(b). The student wants to obtain pure, dry crystals of sodium nitrate. Crystals of sodium nitrate decompose at temperatures above 300 °C.

Describe a method the student could use to obtain pure, dry crystals of sodium nitrate.

$$\mathbf{AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)}$$

(5)

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(c). Give an advantage of mixing solutions containing equal amounts, in moles, of silver nitrate and sodium chloride.

(1)

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Q 2. (i) State the meaning of the term **solute**.

(1)

(ii) State the meaning of the term **solvent**.

(1)

(iii) Explain what is meant by a saturated solution.

(2)

Q3. A teacher prepares the insoluble salt lead (II) bromide (PbBr2) by mixing solutions of lead (II) nitrate and sodium bromide.
Describe what the teacher should do next to obtain a pure, dry sample of lead (II) bromide.

(3)

Q4. Explain the different ways that magnesium and magnesium chloride conduct electricity.

(4)

Magnesium

Magnesium chloride

Q5. A student plans to obtain salt crystals from a mixture of salt and sand.
The student adds pure water to the mixture to dissolve the salt.

(i) State two things the student could do to make the salt dissolve quickly.

(2)

1._____

2._____

(ii) Describe how the student can obtain pure dry crystals of salt from the salt solution.

(4)

Q6. This question is about barium chloride.
Barium chloride can be made by reacting barium carbonate with dilute hydrochloric acid.
The chemical equation for the reaction is

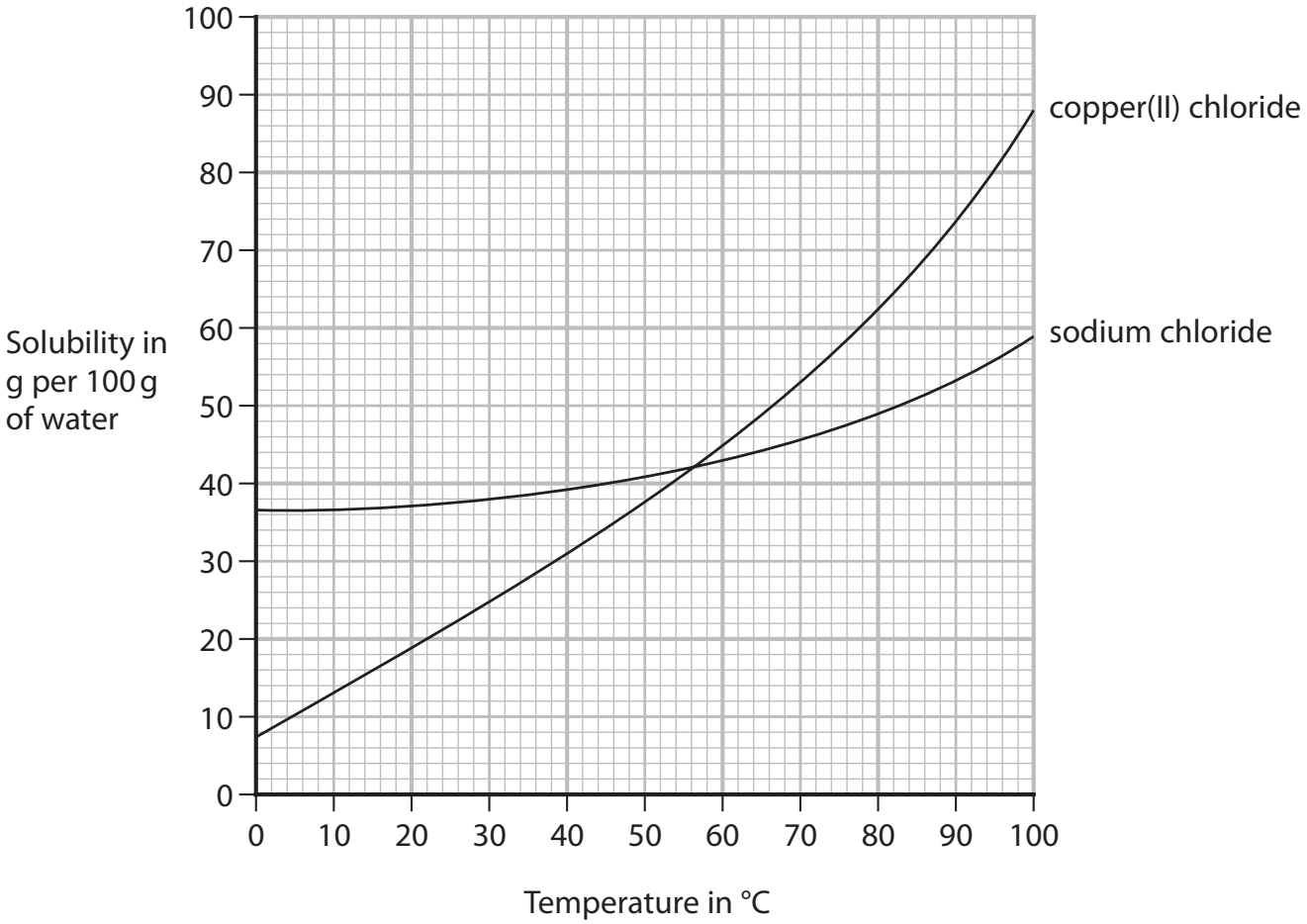
$$BaCO_3(s) + 2HCl(aq) \rightarrow BaCl_2(aq) + H_2O(l) + CO_2(g)$$

Describe a method to produce dry crystals of hydrated barium chloride, starting with barium carbonate powder and dilute hydrochloric acid.

(6)

Q7. This question is about solubility.

(a) The graph shows the solubilities of copper (II) chloride and sodium chloride at different temperatures.



(i) Determine the temperature at which copper (II) chloride and sodium chloride have the same solubility.
Show on the graph how you obtained your answer.

(2)

temperature = _____ °C

(ii) A saturated solution of copper (II) chloride in 100 g of water is cooled from 40°C to 10°C. Determine the mass, in grams, of copper (II) chloride that crystallises.

(2)

mass of copper(II) chloride = _____ g

(b) A student uses this method to determine the solubility of potassium chloride in water at room temperature.

- record the mass of an empty evaporating basin
- pour some saturated potassium chloride solution into the evaporating basin
- record the mass of the evaporating basin and saturated potassium chloride solution
- heat the evaporating basin to remove all the water
- record the mass of the evaporating basin and the dry potassium chloride

The table shows the student's results.

	Mass in grams
evaporating basin	58.1
evaporating basin and saturated potassium chloride solution	78.2
evaporating basin and dry potassium chloride	63.2

(i) Calculate the mass of dry potassium chloride obtained.

(1)

mass = _____ g

(ii) Calculate the mass of water removed.

(1)

mass = _____ g

(iii) Calculate the solubility of potassium chloride in grams per 100 grams of water.

(2)

solubility = _____ g per 100g of water

(iv) Suggest why the student's method is not suitable for determining the solubility of hydrated copper (II) sulfate.

(1)

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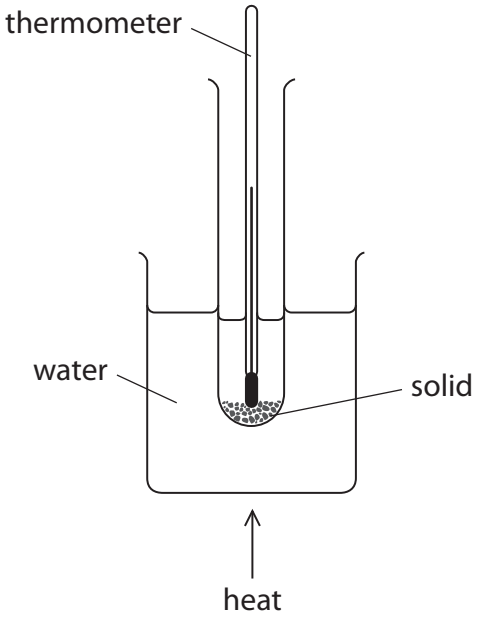
Q8. The diagram shows the apparatus a student uses to make a saturated solution.



This is the student's method.

Step 1 add 4.5 g of solid to a boiling tube

Step 2 measure exactly 10.0 cm^3 of pure water and pour into the boiling tube

Step 3 place the boiling tube in the beaker of water and heat gently, stirring the mixture continuously until all the solid dissolves

Step 4 remove the boiling tube from the beaker and allow it to cool

Step 5 record the temperature when crystals start to form in the boiling tube

The recorded temperature shows when the solution becomes saturated.

(i) Name the piece of apparatus that the student should use in Step 2 to measure exactly 10.0 cm^3 of pure water.

(1)

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(ii) Suggest why the boiling tube is not heated directly using a Bunsen burner in Step 3.

(1)

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(iii) Suggest how the student could improve the reliability of her recorded temperature in Step 5.

(1)

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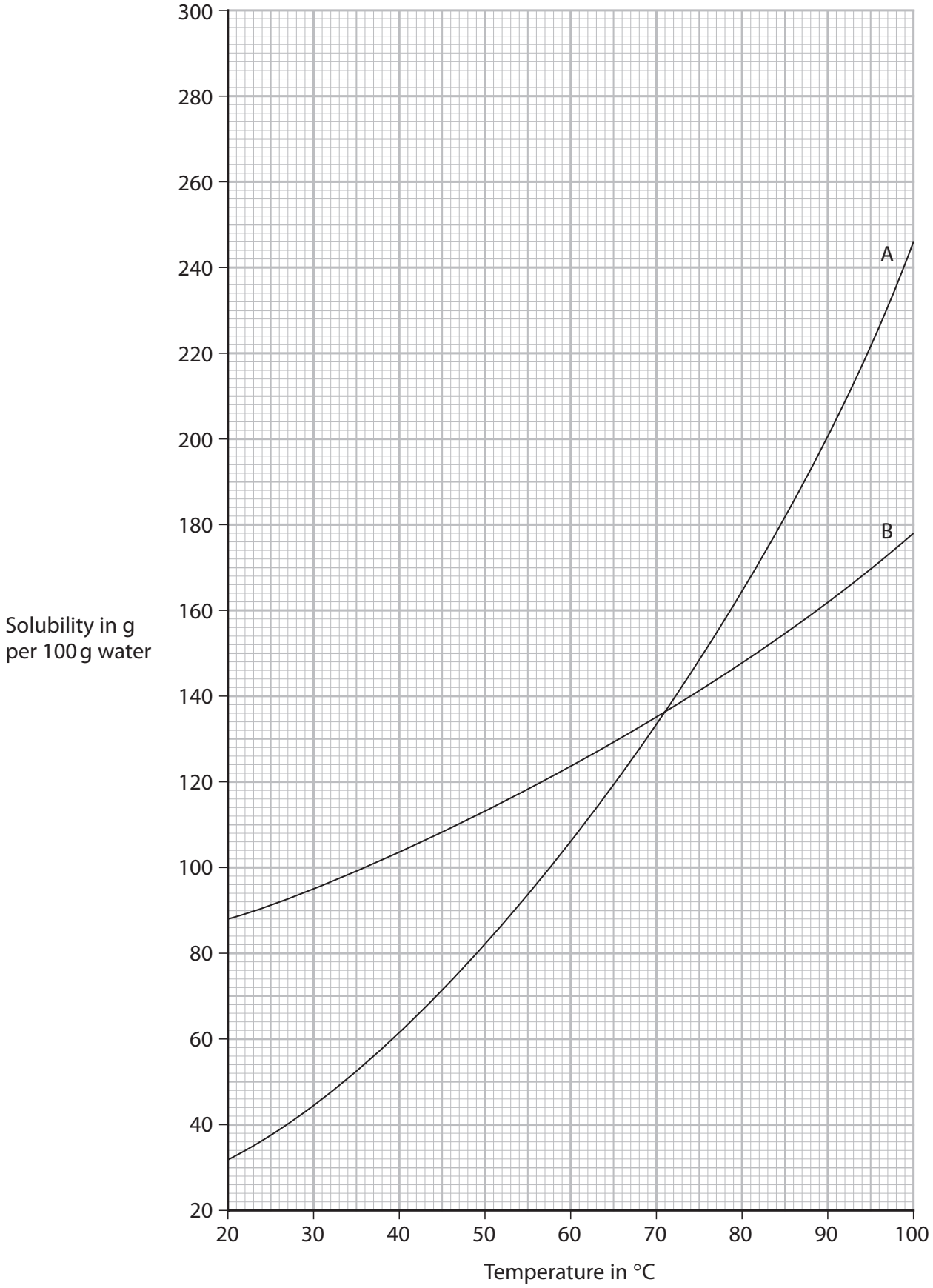
(iv) In Step 5, crystals start to form at 26°C. Calculate the solubility of the solid, in g per 100 g of water, at 26 °C. [1.0 cm^3 of pure water has a mass of 1.0 g]

(2)

solubility = _____ g per 100g of water

(c) The solubility curves for two solids, A and B, are shown on the grid.



(i) State the temperature when A and B have the same solubility.

(1)

temperature = _____ °C

(ii) Calculate the mass of B that will dissolve in 250 g of water at 60 °C.
Show your working.

(2)

mass = _____ g

(iii) Suggest why the values for the solubility of A and B may be less accurate at 95 °C than at lower temperatures.

(1)

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Q9. (a) Soluble salts can be prepared by the reaction between a metal oxide and an acid. The equation for this type of reaction is

metal oxide + acid → salt + water

(i) State the name given to this type of reaction.

(1)

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(ii) State, in terms of protons, what happens in this reaction.

(1)

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(b) A student is given 50 cm^3 of dilute sulfuric acid and a bottle of solid copper (II) carbonate. Describe the method that the student should use to prepare a saturated solution of copper (II) sulfate. In your answer, refer to the pieces of apparatus that the student should use.

(5)

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Q10. A student makes some magnesium nitrate crystals from magnesium oxide and dilute nitric acid. The equation for the reaction is,

$$MgO(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2O(l)$$

(a) (i) Give the formula of each ion in magnesium nitrate.

(1)

_____ and _____

(ii) A student has a beaker containing dilute nitric acid. Describe a method that she could use to prepare a pure, dry sample of magnesium nitrate crystals from magnesium oxide.

(6)

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Q11. Describe how a pure, dry sample of the insoluble salt, barium sulfate, could be made from the two solids sodium sulfate and barium chloride.

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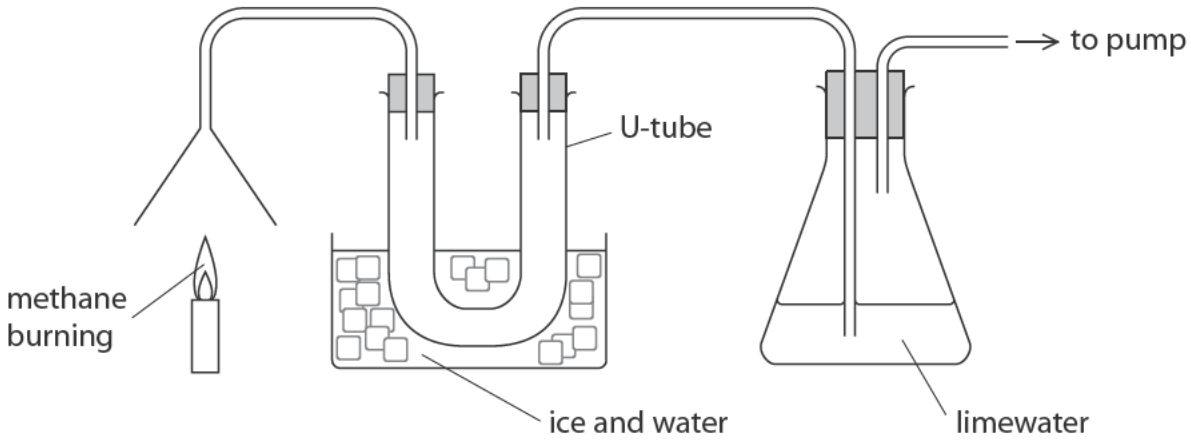
Q12. The gas burned in a Bunsen burner is methane.

(a) The diagram shows methane burning in air. It also shows how the two gases formed are collected and tested.



(i) Explain why water collects in the U-tube.

(2)

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(ii) Describe how anhydrous copper(II) sulfate is used to test for water.

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(iii) Explain the change in appearance of the limewater.

(3)

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Q13. This question is about copper chloride. Copper chloride can be made by reacting copper carbonate with dilute hydrochloric acid.
The chemical equation for the reaction is

$$CuCO_3(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l) + CO_2(g)$$

Describe a method to produce dry crystals of copper chloride, starting with copper carbonate powder and dilute hydrochloric acid.

(6)

Q14. The student wants to obtain pure, dry crystals of hydrated copper sulphate.
Describe a method the student could use to obtain pure, dry crystals of copper sulphate.

(5)

Q15. A student makes some calcium nitrate crystals from calcium oxide and dilute nitric acid. The equation for the reaction is,

$$CaO(s) + 2HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + H_2O(l)$$

(a) (i) Give the formula of each ion in calcium nitrate.

(1)

_____ and _____

(ii) A student has a beaker containing dilute nitric acid.
Describe a method that she could use to prepare a pure, dry sample of calcium nitrate crystals from calcium oxide.

(6)

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Q16. Describe how a pure, dry sample of the insoluble salt, calcium sulfate, could be made from the two solids sodium sulfate and calcium chloride.

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