PEARSON EDEXCEL INTERNATIONAL GCSE (9–1)

CHEMISTRY LAB BOOK

Pearson

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GCSE (9–1)

CHEMISTRY

Lab Book

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INVESTIGATE SOLUBILITY OF A SOLID IN WATER

SPECIFICATION REFERENCE

1.7C

(1.4, 1.5C, 1.6C)

Introduction

When a solid (a solute) dissolves in a liquid (a solvent), the bonds holding the solute molecules together break. This allows the molecules of both the solute and solvent to mix, producing a solution.

Solubility is how much solute will dissolve in a solvent. For most solid substances, the solubility increases as the temperature increases. In this core practical, you will measure the solubility of a solute. The solute is normally sodium chloride but your teacher may provide a different one.

Method

1. Weigh the mass of an empty evaporating basin. Record this and any other values in the results section on the next page.
2. Add approximately 50 cm^3 of distilled water into a beaker. Record the temperature of this water.
3. Using a spatula, add the solid you have been given to the water in the beaker. Stir with a glass rod and continue to add solid until no more will dissolve. The solid will be in excess (i.e. more than can be dissolved). You will know this because some of the solid will be undissolved at the bottom of the beaker.
4. Set up a conical flask with a filter funnel and filter paper. Filter the solution.
5. Put the filtrate collected into the evaporating basin and weigh both together. Record this value in the results section on the next page. Make sure that you do not pour any of the undissolved solid into the evaporating basin.
6. Heat the evaporating basin and contents gently until the water has evaporated. Your teacher may guide you to use a beaker as a water bath to ensure gentle heating.
7. When it looks like all of the water has evaporated, weigh the evaporating basin and its contents. Record this value.
8. To make sure all of the water has actually evaporated, heat the evaporating basin and the contents again and reweigh.
9. Repeat steps 1 to 8 at least three more times but with different temperatures of water.

Learning tips

- The solution you will produce each time is known as a saturated solution.
- There is no need to use a measuring cylinder to measure the volume of water, it is sufficient for this experiment to use the markings on the beaker.
- You can use the following equation to calculate solubility:

$$\text{solubility (g per 100 g of solvent)} = \frac{\text{mass of solid (g)}}{\text{mass of water removed (g)}} \times 100$$

Objectives

- To investigate how the temperature of water affects the solubility of a solute.

Equipment

- eye protection
- a powdered solid (e.g. sodium chloride)
- distilled water
- 100 cm^3 beaker
- 250 cm^3 beaker
- Bunsen burner
- heat-resistant mat
- gauze and tripod
- conical flask
- digital top pan balance
- evaporating basin
- filter funnel
- filter paper
- glass stirring rod
- spatula
- thermometer
- water bath

Safety notes

- Wear eye protection.
- Gently heat the evaporating basin to prevent spitting of hot solid.
- The solute suggested (sodium chloride) is not harmful. However, you may be given a different solute to use. If so, your teacher will provide additional guidance about using it safely.

Practical skills

- Measuring mass
- Safe handling of solids
- Using a Bunsen burner
- Using filtration apparatus

Results

1 Complete the results table below. Your teacher may instruct you to carry out your experiment at a particular temperature. You would then be asked to share your results.

Temp. of water (°C)	Mass of basin (g)	Mass of basin and filtrate (g)	Mass of basin and solid (g)	Mass of solid left (g)	Mass of water removed (g)	Solubility (g per 100 g of solvent)

Analysis

1 Plot a graph of temperature (on the *x*-axis) against solubility (on the *y*-axis). Join up the points with a smooth curve. This is known as a solubility curve.

2 What can you conclude from your solubility curve?

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Evaluation

1 Compare your solubility curve with those from other groups. Comment on the similarities and differences between the graphs.

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2 What changes could be made to the method to improve the accuracy of the results?

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INVESTIGATE PAPER CHROMATOGRAPHY USING INKS/FOOD COLOURINGS

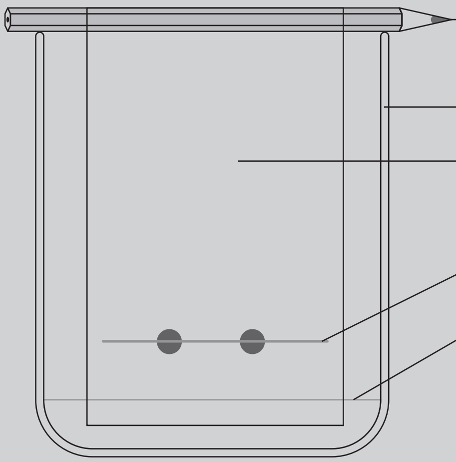
SPECIFICATION REFERENCE
1.13
(1.10, 1.11, 1.12)

Introduction

Many inks contain a mixture of dyes. Chromatography can be used to identify inks. Some examples would be inks from crime scenes or from documents that may have been forged (illegally copied to cheat somebody).

Method

1 Check that your chromatography paper hangs close to the bottom of the empty beaker but without touching it, as shown in the diagram.



2 Take the paper out of the beaker and draw a pencil line on the paper, about 2 cm from the bottom. This is the baseline.

3 Put a small spot of ink from two different pens on the baseline.

4 Write the name of each pen or ink colour below each spot. Use a pencil.

5 Pour some water into the beaker to a depth of about 1 cm.

6 Lower the chromatography paper into the beaker so that the bottom of the paper is in the water, but the water level is below the spots, as shown in the diagram.

7 Leave the paper in the beaker until the water soaks up the paper and reaches near the top of the paper. The water is the solvent for the different coloured dye compounds in each ink. The solvent is called the mobile phase in chromatography because it is the part that is moving.

8 Take the paper out and immediately use a pencil to mark the location of the solvent front (the level the water has reached) before the water evaporates. Leave the paper to dry.

Learning tip

- You could use your own pens, but they need to be water soluble if you use water as a solvent. Permanent pens and colouring pencils will not dissolve in water, so they will not work.

Results

1 Complete the results table on the next page. There is space in the table for two inks. You will be instructed how to complete the R_f value row in the **Analysis** section.
  - The 'Distance between baseline and solvent front (cm)' is the value from the lower pencil line to the solvent front.
  - The 'Ink colour' row is the starting colour spotted on the pencil line.

Objectives

- To test some inks to see how many dyes they contain and calculate their R_f values.

Equipment

- solvent (water)
- 100 cm^3 beaker
- chromatography paper attached to a pencil, rod or splint
- pencil and ruler
- two marker pens or felt-tip pens

Safety notes

- If the solvent chosen is water, then this is a low-risk experiment. However, if a different solvent is used, your teacher will provide any extra safety guidance.

Practical skills

- Measuring distance travelled by solvent
- Measuring height of dye above baseline (estimate to centre of spot)
- Ability to manipulate apparatus for chromatography, recording observations (e.g. number of dyes in each ink, distance travelled by solvent, height of each dye above baseline)
- Ability to carry out investigations safely

- The 'Colour of dye spots' row is the various colours the ink has separated into. *There are four spaces here but you may not need all of them.*
- The 'Distance of spot from baseline (cm)' row is the distance from the pencil line to the dye spot. Again, you only need to fill this in where you have filled in the box above. You should measure from the middle of the dye spot to make sure that your measuring is consistent (happening in the same way each time) throughout your measuring.

Distance between baseline and solvent front (cm)

Ink colour 1				
Colour of dye spots				
Distance of spot from baseline (cm)				
R_f value				

Ink colour 2				
Colour of dye spots				
Distance of spot from pencil line (cm)				
R_f value				

When your paper is dry, attach your chromatogram to this page. This will be a useful reminder of what you need to do to calculate R_f values when you are revising.

Analysis

1 Calculate the R_f value using the equation below for each separate colour in the inks. Add each R_f value to your table above.

$$R_f = \frac{\text{distance moved by the coloured spot}}{\text{distance moved by the solvent}}$$

2 Were any of the inks a pure colour? Explain your answer.

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3 Did the same coloured dyes appear in more than one ink? If so, do you think they were the same chemical compound? Explain your answer.

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Evaluation

1 Why was the baseline drawn in pencil?

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2 Why did you have to label the spots?

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3 Why is the chromatography paper hung with the bottom only just in the water?

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4 Why must the water level in the beaker be below the spots?

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5 How easy was it to identify the level to which each coloured dye had travelled? How would this affect the accuracy of the R_f values that you calculated?

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