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EB Education Revision Guide

How to work with Required Practicals: Part 6 Combined (AQA Chemistry Paper 2)

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Practical 1: Rates of Reaction

Increasing the concentration will increase the rate of reaction. As the number of particles increase there will a greater chance of more successful collisions.

What you need to know

Be able to investigate how changes in concentration affect the rates of reactions

Method 1:

Measure the volume of gas produced. This can be done by adding different concentrations of hydrochloric acid to a piece of magnesium ribbon and measuring the volume of gas produced over time.

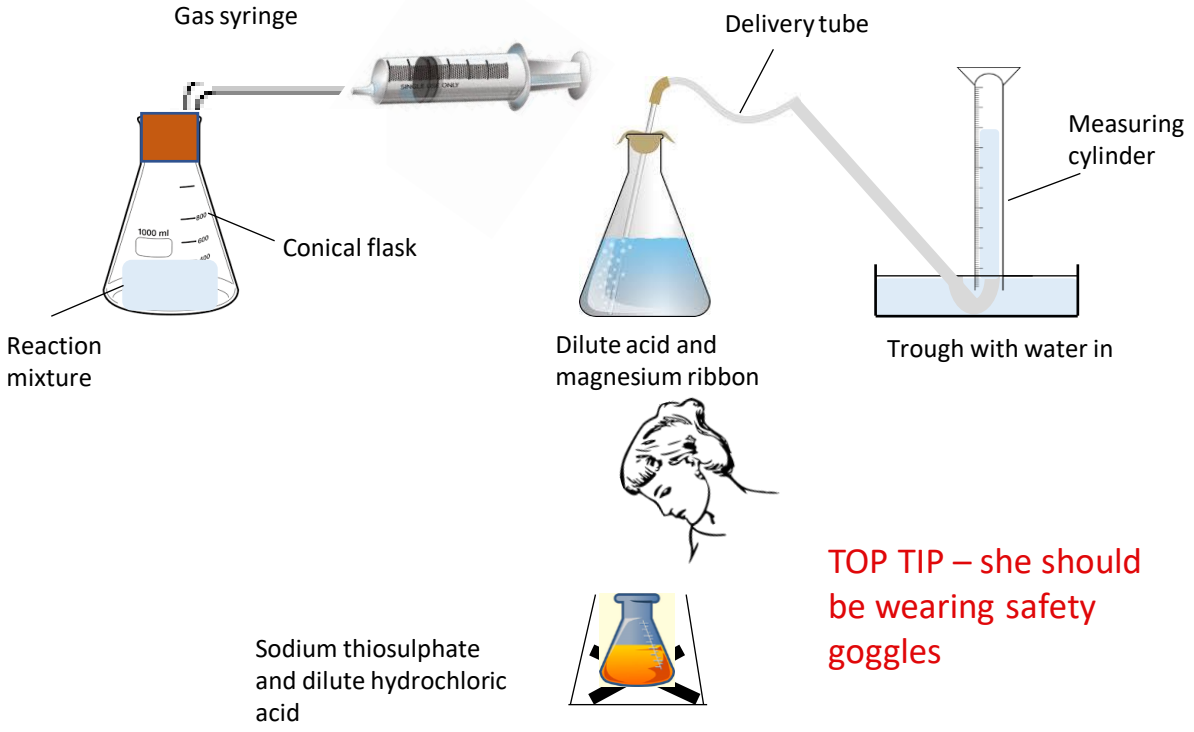
Method 2:

Measure changes in colour. This can be done by reacting different concentrations of sodium thiosulphate with hydrochloric acid placed on a cross. The solution will change from clear to cloudy as solid sulphur is produced, and the time taken for the cross to disappear can be measured.

You may be asked about:

- Control variables and why you need to keep them the same. Temperature needs to remain the same, as an increase in temperature will lead to an increase in reaction rate.
- Ways to reduce errors/reasons for anomalous results. You can discuss the difficulty of using the human eye to judge when the cross has disappeared, placing the bung quickly into the conical flask and starting the timer as soon as the reactants have been mixed.

Diagram



TOP TIP – she should be wearing safety goggles

Practical 2: Chromatography

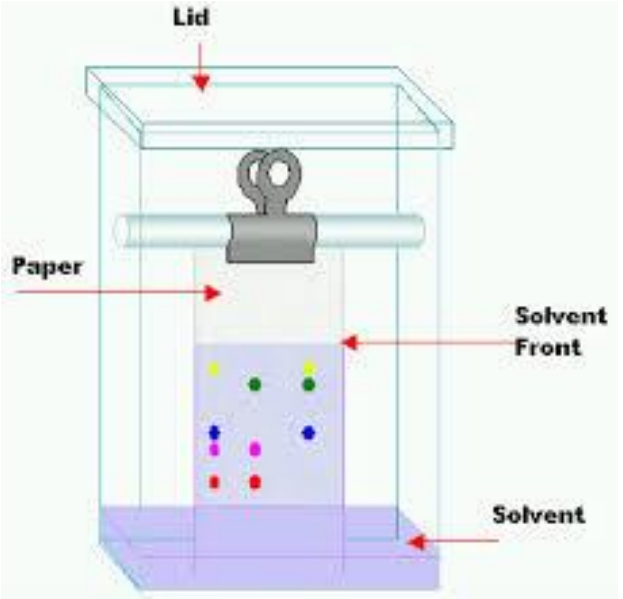
TOP TIP:
The stationary phase is the paper, and the mobile phase is the solvent.

What you need to know

To explain how paper chromatography can be used to separate and identify coloured substances.

You may be asked to explain why you carry out certain procedures in the method:

- The start line is drawn in pencil, because unlike ink, will not run in the solvent. The start line should also be drawn above the level of the solvent.
- A lid can be placed on top to prevent the solvent from evaporating.
- The paper should be removed once the solvent has travelled ¾ of the way up the paper. This will enable you to calculate an accurate R_f value.
- If a substance has not moved from the start line it may be insoluble in water – and another solvent such as alcohol should be used.



$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

A paper chromatogram can be used to distinguish between pure and impure substances:

- a pure substance produces one spot on the chromatogram
- an impure substance produces two or more spots

A paper chromatogram can also be used to identify substances by comparing them with known substances. Two substances are likely to be the same if:

- they produce the same number of spots, and these match in colour
- the spots travel the same distance up the paper (have the same R_f value)

Practical 3: Water purification

What you need to know

To describe how to analyse and purify water from different sources.

You test salt water for the presence of sodium and chloride ions. You then distil the water and test the water again. If the ions have been removed the water is now safe to drink.

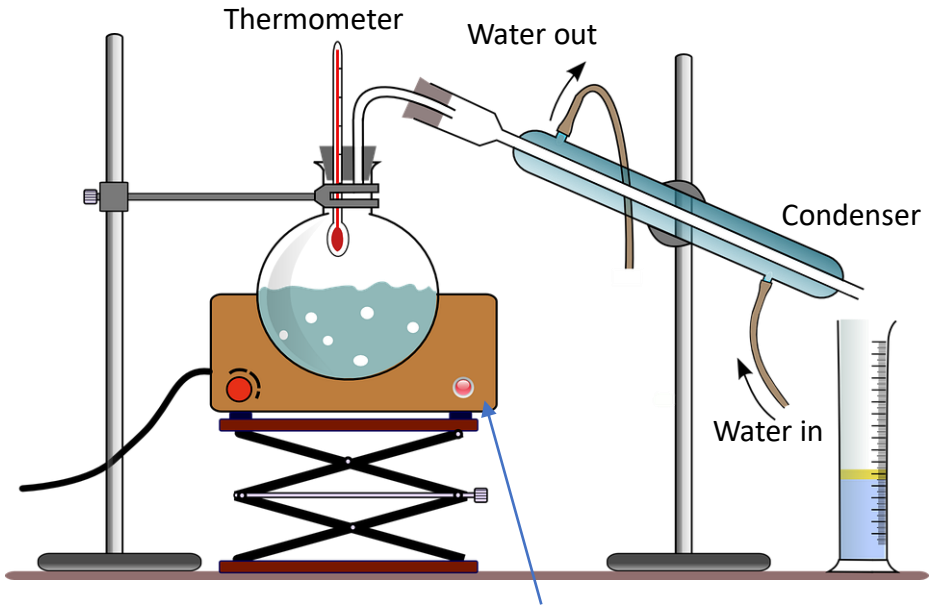
- Test for sodium ions by dipping nichrome wire into the saltwater solution and hold the tip of the wire in a blue Bunsen burner flame. A yellow flame produced confirms the presence of sodium ions.
- Test for chloride ions by adding a few drops of dilute nitric acid to the solution. Add some silver nitrate solution. A white precipitate confirms the presence of chloride ions.

The salt water can then be purified by distilling it. Water must enter from the bottom of the condenser to ensure the entire condenser fills up.

The solution collected can then be tested again for the presence of ions.

You may be asked to:

- Explain how distillation works. The water will evaporate at 100°C, then it condenses back into liquid as it cools down. The salts have a higher boiling point so will not evaporate.
- Explain that some water from the solution does not evaporate, some will stay in the tube, so not all water is collected from the solution.
- Explain that water is not purified using this method on a large scale. It would not be economical to do so, as it would cost too much to heat the water.



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Your turn:

1. Sodium thiosulphate reacts with dilute hydrochloric acid. State and explain the effect that increasing the temperature of the sodium thiosulphate solution has on the rate of reaction.

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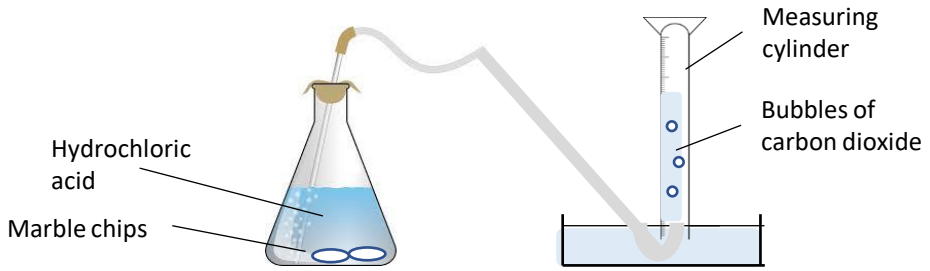
2. Libby decided to investigate the rate of reaction between marble chips (calcium carbonate) and hydrochloric acid.
The apparatus she used is shown below.



a) Explain why and how the rate of reaction changes during this reaction, in terms of particles.

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Your turn:

b) Libby also investigated how the rate of reaction changed when she changed the concentration of hydrochloric acid.
Write a method that Libby could use, including how you would carry out the investigation, the measurements you would make, and how to make it a fair test.

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3. Tom investigated the rate of reaction between sodium thiosulphate and dilute hydrochloric acid. He placed a conical flask on a cross and added the reactants.

The reaction produced a precipitate which made the mixture turn cloudy.
Tom measured how long it took until he could no longer see the cross.
He then calculated the rate of reaction.

a) The equation for the reaction is:

$$Na_2S_2O_3\ (aq) + 2\ HCl\ (aq) \longrightarrow 2NaCl\ (aq) + SO_2\ (g) + H_2O\ (l)$$

Name the product that made the mixture go cloudy.
.....
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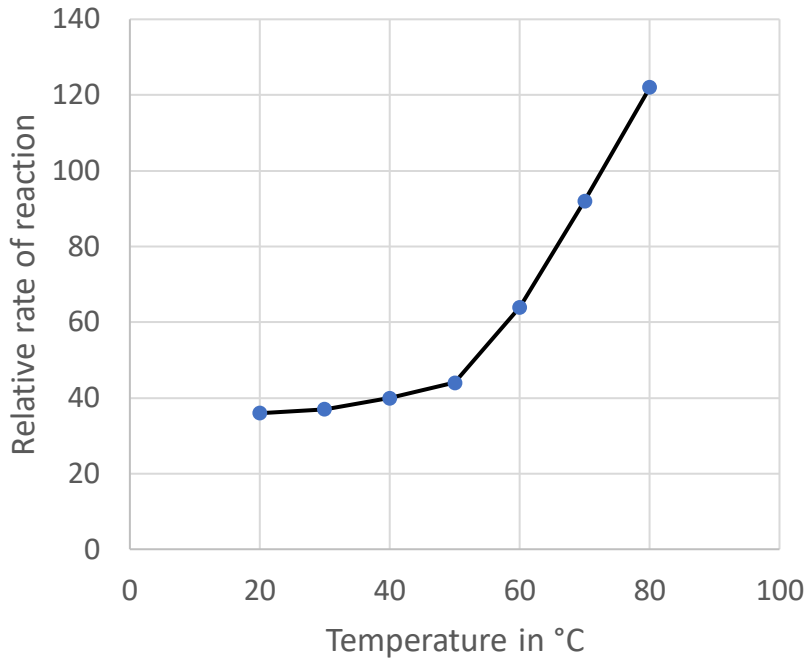
b) Tom investigated how changing the temperature of the sodium thiosulphate solution changed the rate of reaction.
He plotted his results on a graph.

Your turn:



Describe the trends shown in Tom's results.

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c) Tom then investigated how changing the concentration of sodium thiosulphate altered the rate of reaction.

i) State two variables that he would have to control to make sure his results were valid.

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ii) He concluded correctly from his investigation:

"As the concentration of sodium thiosulphate doubles, the rate of reaction also doubles"

Explain his conclusion in terms of particles.

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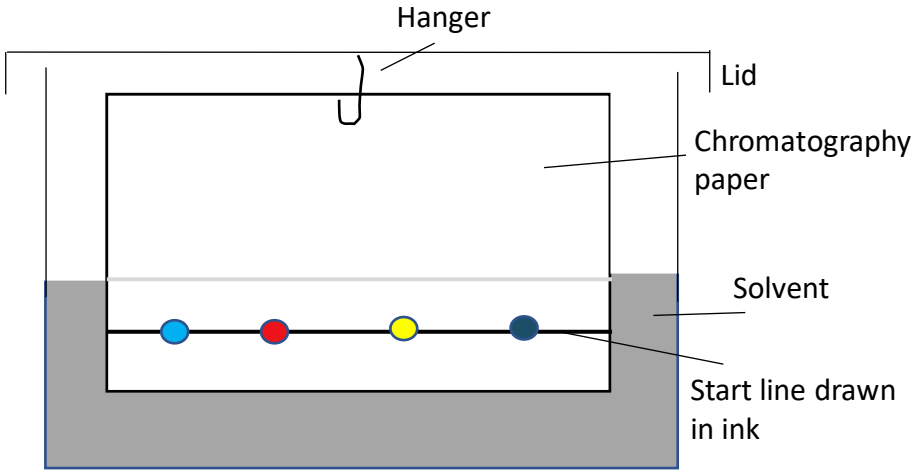
Your turn:

4. Kaylee used paper chromatography to investigate the colours in different inks.
The apparatus she used is shown below.



She made two mistakes when she set up the apparatus.
a) State the two mistakes and describe the problem each mistake would cause.

Mistake 1 ……..
Problem
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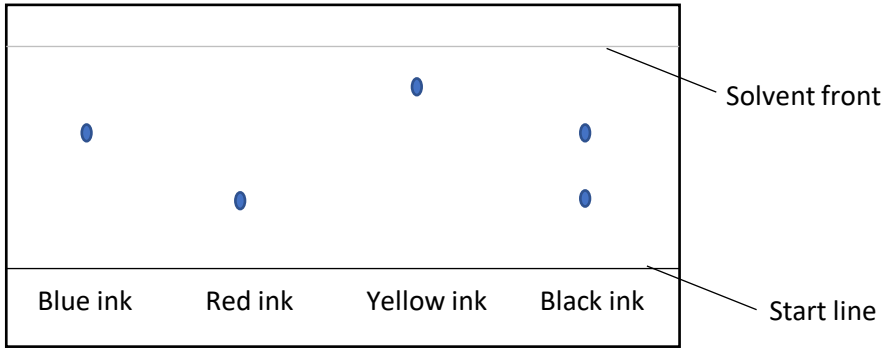
Mistake 2 ……..
Problem
……
……

b) She repeated the experiment without making any mistakes.



What colours are in the black ink?
……
c) Which ink is the most soluble in the solvent and explain your reason?
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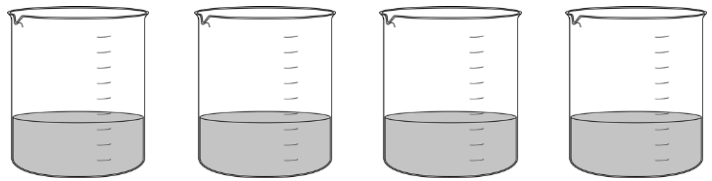
Your turn:

5. Harry was given four different colourless solutions in beakers.



He knew that the solutions were:

- Sodium iodide
- Sodium chloride
- Potassium carbonate
- Sodium carbonate

He planned a method he could use to identify each solution using the following reagents.

- Dilute nitric acid
- Silver nitrate solution

He also used a flame test to identify the positive ions. Describe a method he could use. Include the results of all the tests in your method.

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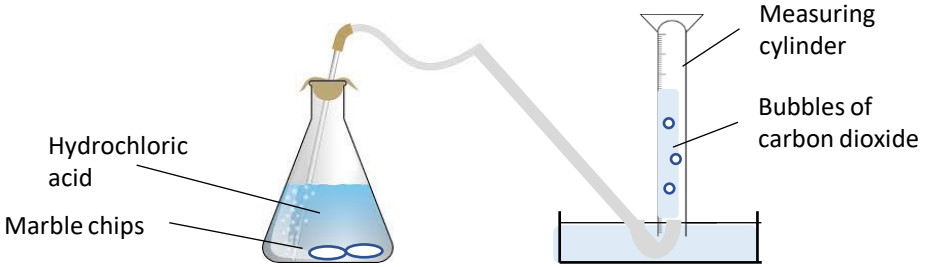
Answers:

1. Sodium thiosulphate reacts with dilute hydrochloric acid. State and explain the effect that increasing the temperature of the sodium thiosulphate solution has on the rate of reaction.

Rate of reaction increases because particles move faster
(or particles have more energy)
so frequency of collisions increases/particles are more likely
to collide or there is more chance of collisions
more particles/collisions have energy greater than (or equal
to) the activation energy

2. Libby decided to investigate the rate of reaction between marble chips (calcium carbonate) and hydrochloric acid.
The apparatus she used is shown below.



a) Explain why and how the rate of reaction changes during this reaction, in terms of particles.

The acid/marble/reactant is used up so the concentration
decreases/surface area of marble decreases
so less frequent collisions /fewer collisions per second
so rate decreases/reaction slows down

Answers:

b) Libby also investigated how the rate of reaction changed when she changed the concentration of hydrochloric acid.
Write a method that Libby could used, including how you would carry out the investigation, the measurements you would make, and how to make it a fair test.

- add magnesium to acid
- time reaction / 'count bubbles' / measure volume of gas
- change concentration of acid

Control Variables:

- amount / mass / length / same 'size' of magnesium
- volume / amount of acid

3. Tom investigated the rate of reaction between sodium thiosulphate and dilute hydrochloric acid. He placed a conical flask on a cross and added the reactants.

The reaction produced a precipitate which made the mixture turn cloudy.
Tom measured how long it took until he could no longer see the cross.
He then calculated the rate of reaction.

a) The equation for the reaction is:

$$Na_2S_2O_3\ (aq) + 2\ HCl\ (aq) \longrightarrow 2NaCl\ (aq) + SO_2\ (g) + H_2O\ (l)$$

Name the product that made the mixture go cloudy.

sulphur

b) Tom investigated how changing the temperature of the sodium thiosulphate solution changed the rate of reaction.
He plotted his results on a graph (which can be seen on the next slide).

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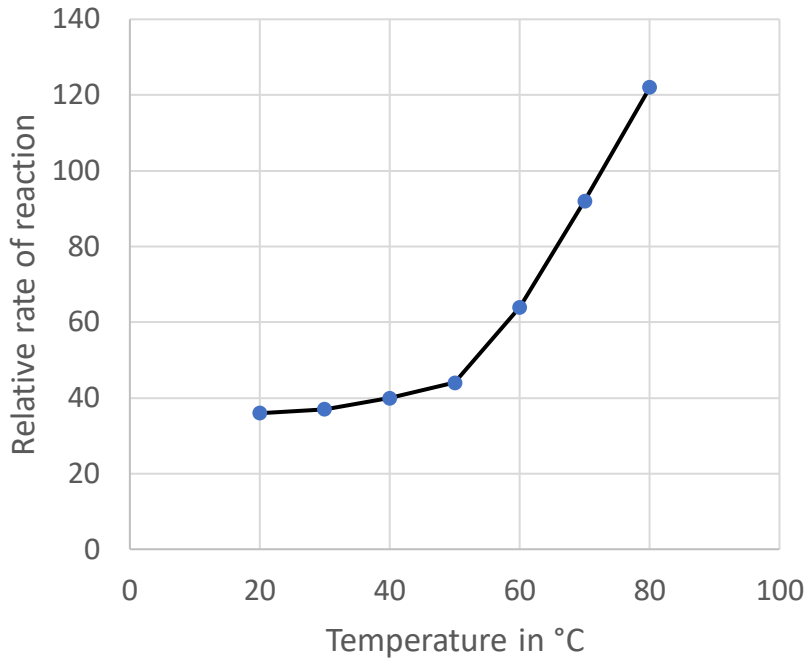
Answers:



Describe the trends shown in Tom's results.

As the temperature increases, the rate of reaction increases
The rate of increase increases (starts slowly then increases more rapidly)

c) Tom then investigated how changing the concentration of sodium thiosulphate altered the rate of reaction.

i) State two variables that he would have to control to make sure his results were valid.

temperature (of the reactants)
concentration of hydrochloric acid
volume of hydrochloric acid/sodium thiosulfate/total volume of solution
the (size/darkness/thickness of the) cross

ii) He concluded correctly from his investigation:

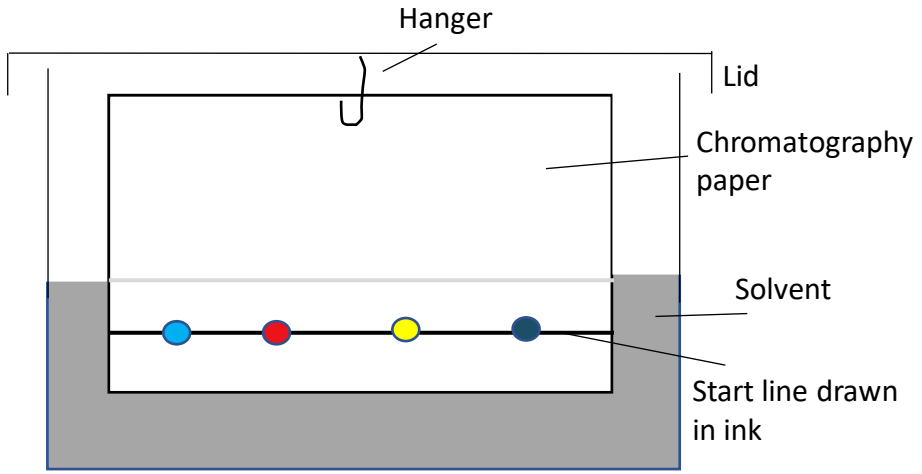
"As the concentration of sodium thiosulphate doubles, the rate of reaction also doubles"

Explain his conclusion in terms of particles.

As the concentration increases the number of particles per unit volume increases or particles are closer together.
(therefore) the frequency of (successful) collisions increases

Answers:

4. Kaylee used paper chromatography to investigate the colours in different inks.
The apparatus she used is shown below.

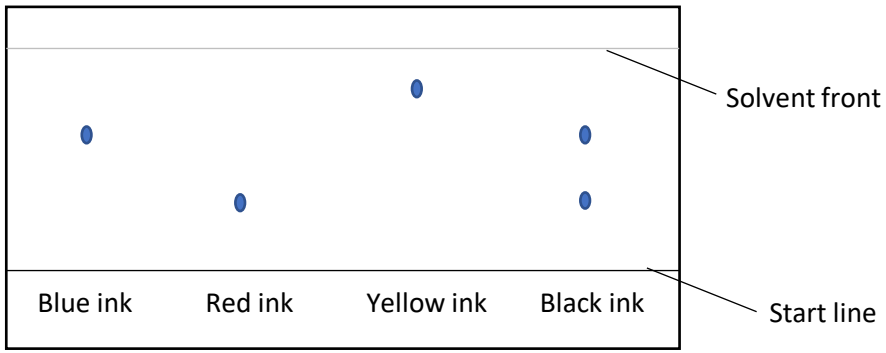


She made two mistakes when she set up the apparatus.
a) State the two mistakes and describe the problem each mistake would cause.

Mistake 1 ..Start line is below solvent level.....
Problem
.....Samples would wash off.....
.....

Mistake 2 ..Start line drawn in ink.....
Problem
.....The ink would run.....
.....

b) She repeated the experiment without making any mistakes.

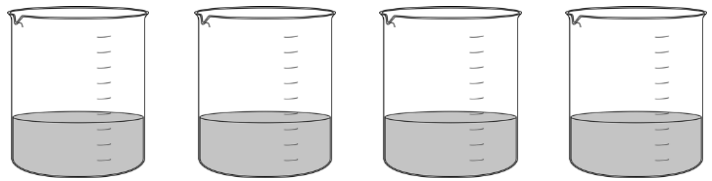


What colours are in the black ink?
.....Red and blue.....

c) Which ink is the most soluble in the solvent and explain your reason?
.....Yellow.....
.....Travels furthest up the paper.....

Your turn:

5. Harry was given four different colourless solutions in beakers.



He knew that the solutions were:

- Sodium iodide
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He planned a method he could use to identify each solution using the following reagents.

- Dilute nitric acid
- Silver nitrate solution

He also used a flame test to identify the positive ions. Describe a method he could use. Include the results of all the tests in your method.

Test: add nichrome wire (for the flame test)
(any method of introducing the solution into the flame, eg a splint soaked in the solution or sprayed from a bottle)
Result: the sodium compounds result in a yellow / orange / gold flame or the potassium compound results in a lilac / purple / mauve flame

Test: add dilute nitric acid to all four solutions [allow any acid]
Result: sodium carbonate and potassium carbonate will effervesce or sodium chloride and sodium iodide will not effervesce

Test: add dilute nitric acid followed by silver nitrate
Result: sodium chloride and sodium iodide produce a precipitate or sodium chloride produces a white precipitate and sodium iodide produces a yellow precipitate
accept sodium carbonate and potassium carbonate do not produce a precipitate

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