Chapter 2: Mixtures

Challenge 2.1: Comparing different types of mixtures

Experiment worksheet answers (pages 30–31 and 174)

Discussion

A Dirty water

1 What happens to the soil particles?

Student answers will vary according to the soil samples used. Some soil particles will float, others will sink. Some soil particles will remain suspended.

2 Does anything float on the water?

Student answers will vary according to the soil samples used.

3 How can you explain the behaviour of this mixture?

Some of the particles in the soil are less dense than the water. Therefore they will float. Other particles in the soil are more dense and insoluble. These particles will settle on the bottom and become sediment. Some particles are insoluble and a similar density to that of water. These particles will be suspended in the water.

4 What type of mixture is dirty water?

It is usually an insoluble suspension with some sediment.

B Making a foam

Explain why the foam you have created is classified as a colloid.

Foam is an even mixture of air and liquid that does not separate.

C Mixing olive oil and water

1 How does the mixture change when you add the detergent?

When detergent is added, the oil and water is able to mix more evenly.

2 Explain what is happening using the terms ‘colloid’, ‘mixture’, ‘emulsion’ and ‘emulsifier’.

A mixture of oil and water is able to form an emulsion (a special type of colloid) when the detergent emulsifier is added.

D Adding sugar to water

Describe what happens to the sugar.

The sugar dissolves in the liquid. It does not disappear. Instead it breaks into small enough particles that are able to remain suspended among the water molecules.

E Making perfume: another solution

1 Why is this mixture considered to be a solution? Identify the solute and the solvent.

A solution is a mixture of one substance evenly mixed throughout another substance. In this case, the particles that cause the scent in the lavender flowers (solute) are mixed evenly throughout the methylated spirits (solvent).

2 Would this experiment work if you put the lavender flowers in a jar of water?

This may not work as well as the particles that cause the scent in the lavender flowers may not be as soluble in water. Students could test their hypothesis by comparing the results for water and methylated spirits.

3 Why is it handy that the methylated spirits evaporate easily?

When the methylated spirits evaporates, it is mixed with some of the perfume particles with it. This means the smell reaches our noses and we can detect it.

Experiment 2.2A: What if salt were dissolved in water?

Experiment worksheet answers (pages 32–33 and 175)

Discussion

1 How many substances were soluble in water? List them.

Student answers will vary.

2 Of the substances that did not dissolve, did any form a suspension?

Student answers will vary.

3 Which substances took the longest to dissolve? Why do you think this happened?

Student answers will vary.

4 Were any of your results unexpected?

Student answers will vary.

5 Name three other substances you know dissolve in water.

Student answers will vary.

6 Do you think water is a good solvent? Give reasons based on the results of your experiment.

Yes. Many substances are able to dissolve in water. Students should list examples from their experiment.

7 How would you change this experiment to find out more about dissolving substances?

Student answers will vary. Examples include; repeating the experiment to confirm results; test if substances dissolve in other liquids; test the solubility of other substances.

Experiment 2.2B: What if the solvent were heated when making a mixture?

Experiment worksheet answers (pages 32–33 and 176)

Discussion

1 Describe how the amount of Milo that dissolved changed the second time.

Increasing the heat will increase the amount of Milo that is able to dissolve. Decreasing the heat of the milk will decrease the amount of Milo that is able to dissolve.

2 What did you do differently to achieve this change?

Student answers will vary.

3 What variables did you keep the same during the experiment?

Student answers will vary. Controlled variables should include the amount of milk, the size of the spoons of Milo, the number of times that the milk was stirred and the type of milk.

4 Can you think of any situations in everyday life that would benefit from understanding the results of your investigation?

Student answers will vary.

5 How would you change this experiment to find out more about dissolving substances?

Student answers will vary.

Skills Lab 2.3A: Separation using magnetic properties

Experiment worksheet answers (pages 34–35 and 177)

Questions

1 How effective do you think this method was at separating the iron filings from the sand?

Student answers will vary.

2 Could you use this method for all metals? Explain.

No. Some metals (such as aluminium) are not attracted by magnets.

Skills Lab 2.3B: Separating mixtures using sedimentation and floatation

Experiment worksheet answers (pages 34–35 and 177)

Questions

1 How successful was the method for separating and collecting the sand from mixture A?

Student answers will vary.

2 How successful was this method for collecting sand from mixture B?

Student answers will vary.

3 What are some of the difficulties with decanting?

Making sure no sediment is poured off with the liquid.

4 List the advantages of the combined sedimentation–flotation separation system.

This method is good for removing larger objects that sink or float. It does not remove suspended particles.

5 After separating the two substances from mixture B, what would need to be done to collect the salt as a solid?

The water would need to be evaporated off to leave the salt remaining.

Experiment 2.3: What if a flocculant were added to muddy water?

Experiment worksheet answers (pages 34–35 and 178)

Discussion

1 What effect did the aluminium sulfate solution have on the muddy water?

The aluminium sulfate should have caused the muddy water to settle on the bottom.

2 What effect did the sodium carbonate solution have on the muddy water?

The sodium carbonate should have had little effect on the muddy water.

3 Which of the two substances (aluminium sulfate or sodium carbonate) acted as a flocculent? Give evidence to support your answer.

Aluminium sulfate acted as a flocculent as it caused the mud in the water to form a sediment.

4 Why might it be important for water treatment plants to minimise the amount of flocculent added to waste water?

Too much flocculent can contaminate the waste water when it is released back into the environment.

Conclusion

What effect does a flocculent have on mixtures?

Flocculent can help the separation of suspended particles from water.

Skills Lab 2.4: Filtering a mixture of sand and water

Experiment worksheet answers (pages 36–37 and 179)

Questions

1 Draw a scientific diagram of your equipment. Label the filtrate and residue.

Student answers will vary.

2 What physical properties are being used to filter substances?

the size of the particles

3 Describe at least three things you need to be careful about when filtering.

Student answers will vary. Possible answers include: do not allow the mixture to spill over the edges of the filter paper; do not poke holes in the filter paper; remember to use filter paper.

Experiment 2.4: What if you centrifuge tomato sauce?

Experiment worksheet answers (pages 36–37 and 180)

Discussion

1 What differences did you notice between the different brands of tomato sauce after they had been centrifuged?

Student answers will vary. Some tomato sauces will have a larger watery layer than others.

2 Can you explain why the different types of tomato sauce might vary in their components?

Some brands of tomato sauce have more water and less tomato than other brands.

Experiment 2.5: Crystallisation of salt water

Experiment worksheet answers (pages 38–39 and 180)

Discussion

After the water has evaporated from the solution, salt remains in the evaporating dish.

1 If the solution contained a mixture of more than one solute, would the separation technique used in this experiment be suitable? Explain.

No. Both solutes would crystallise when the water is evaporated.

2 What is wasted in this experiment? Can you think of any way this could be avoided?

The solvent (water) is lost. This water vapour could be collected and cooled.

Conclusion

Explain how evaporation and crystallisation can be used to separate a mixture of salt and water.

When a solvent is evaporated, the solute is crystallised and left behind.

Challenge 2.5: Design a way to purify water from sea water

Experiment worksheet answers (pages 38–39 and 181)

Processing, analysing and evaluating

Student responses for this challenge will vary based on their own planning and evaluation of their experiment design.

Communicating

Present the various stages of your investigation in a formal experimental report.

Student responses will vary, but posters should include consideration of their aim, equipment, method, evaluation of their method, and conclusion.

Experiment 2.6: Who wrote the nasty note?

Experiment worksheet answers (pages 40–41 and 182)

Discussion

1 Compare the chromatogram for the extortionist with the chromatograms from the three suspects. Do any of the suspects’ chromatograms match the one from the original note? If so, who is most likely to be guilty?

Student answers will vary.

2 Which felt-tip pen (A, C or U) had the most colours in its black ink?

Student answers will vary.

Conclusion

How can the inks from three different black felt-tip pens be separated?

Black felt-tip pens are made up of different coloured ink. Some of these colours are more soluble than others. If an ink is more soluble, then it will move up to the top of the paper more quickly.

Challenge 2.6: Separation challenge

Experiment worksheet answers (pages 40–41 and 183)

Processing, analysing and evaluating

Student responses for this challenge will vary based on their own planning and evaluation of their experiment design.

Communicating

Present your investigation in a formal experimental report.

Student responses will vary, but posters should include consideration of their aim, equipment, method, evaluation of their method, and conclusion.