Chapter 1: Pure substances and mixtures
Then and now

Questions from page 4 of *ESA Study Guide Year 10 Science*

Understanding

1. What name has been given to the early chemists?
2. What was the main aim of alchemy?
3. What replaced alchemy in the way people thought about matter?

Thinking

1. What do you think *bio*chemists study?
2. Explain why chemistry is often called the 'central science'.

Contributing

1. Find out about some other prominent alchemists. Choose one of the following to research, finding out where and when he lived and giving two of his main ideas. Share your findings with your group or class.
   a. Roger Bacon b. Saint Thomas Aquinas c. Al-Razi

Answers (except for 'Contributing') are provided on page 289 of *ESA Study Guide Year 10 Science*

Chapter 1: Pure substances and mixtures
Differences between pure substances and mixtures

Questions from page 7 of *ESA Study Guide Year 10 Science*

Understanding

1. Give a definition of a mixture: _____

2. Explain why air is called a mixture.

Thinking

1. Decide whether each of the following substances is a pure substance or a mixture, and give a reason for each answer.
   a. Sea water: _____
   b. Magnesium: _____
   c. Carbon dioxide gas: _____
   d. Marble (a rock, made of calcium carbonate): _____
   e. Wine: _____

2. Chocolate is a mixture of ingredients: cocoa, butter, sugar, milk and flavourings blended together to give a great taste. Some of the ingredients in chocolate are pure substances and some are mixtures. For chocolate name:
   a. One ingredient that is a pure substance. Explain your answer.
   b. One ingredient that is a mixture. Explain your answer.

Contributing

Find out about concrete. Is it a mixture or a pure substance? Discuss your answer with your group.

Answers (except for 'Contributing') are provided on page 289 of *ESA Study Guide Year 10 Science*

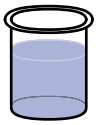
Chapter 1: Pure substances and mixtures
Types of mixture

Questions from pages 9, 10 of *ESA Study Guide Year 10 Science*

Understanding

1. a. Describe the liquids in beakers A and B in the diagram as either 'transparent' or 'opaque'.

A _____



B _____

b. Which beaker contains a solution? Explain your answer.

_____

c. What has happened to the solute particles in the solution?

_____

2. How can you tell if:

a. A solid has dissolved in a liquid?

_____

b. A solid has not dissolved in a liquid?

_____

3. If you add a teaspoon of sugar, mass 5 g, to a cup of coffee, mass 250 g, what is the mass of the resulting solution?

_____

4. Classify each of the following as a solution, a suspension, a colloid or an emulsion:

cup of black tea, sea water, aioli, bleach, cup of white coffee, gloss paint, petrol and water, perfume, mouthwash, liquid spray cleaner, low-fat milk, flour and water, lemonade, chicken soup, cream, mayonnaise.

Solutions: _____

Suspensions: _____

Colloids: _____

Emulsions: _____

Thinking

1. In a clear, transparent solution, you can't tell if there is any solute present. How could you show that a liquid is a salt solution and not pure water?

_____

_____

_____

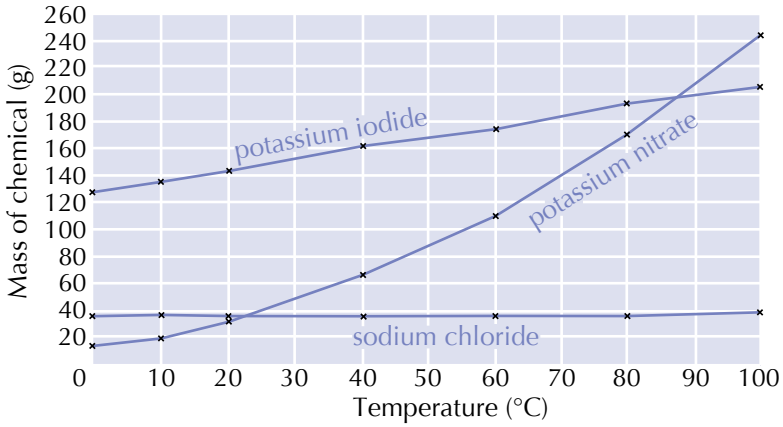
_____

2. 'Milk of Magnesia' is used to treat upset stomachs. It is a suspension of magnesium oxide in water. Explain why it is necessary to shake the substance well before use.

_____

_____

3. Three different chemicals were used to find out what mass of chemical would dissolve in 100 g of water at different temperatures.



a. Name the solutes used in the experiment. _____

_____

b. Which substance is the solvent? _____

_____

c. What units is solubility measured in? _____

d. The solubility of potassium nitrate at 40 °C is 64 g/100 g of water. What does this mean?

_____

_____

e. Results show the trend that more/less solid dissolves at higher temperatures. Which?

_____

f. Which chemical's solubility increases only slightly at higher temperatures? _____

g. Which chemical is most soluble at 25 °C? _____

h. Which chemical is least soluble at 75 °C? _____

i. Estimate the temperature at which the solubility of potassium nitrate and potassium iodide are the same. _____

Contributing

Design an experiment to work out whether salt or sugar is the more soluble in water. Think about what you would measure and how you would make the experiment a fair test.

_____

_____

_____

_____

_____

_____

_____

_____

Answers (except for 'Contributing') are provided on pages 289 and 290 of *ESA Study Guide Year 10 Science*

Chapter 1: Pure substances and mixtures
Separating mixtures (1)

Questions from pages 15, 16 of *ESA Study Guide Year 10 Science*

Understanding

1. Describe how to decant a mixture.

2. Describe how to filter a substance in the laboratory.

3. Match the correct term to each of the following statements.

decanting evaporating filtering insoluble mixture 'pure substance' soluble solution

   a. Does not dissolve in a solvent _____
   b. Dissolves in a solvent to make a transparent solution: _____
   c. Pouring the liquid from a mixture after solid material has settled on the bottom of the container: _____
   d. Passing through paper to separate soluble and insoluble substances: _____
   e. More than one substance: _____
   f. Liquid becoming a gas: _____
   g. A solute dissolved in a solvent: _____
   h. A substance on its own, could be an element or a compound; _____

4. What method would you use to separate the following mixtures?
   a. Sand and water: _____
   b. Salt and water: _____
   c. Iron filings and sand: _____

Thinking

1. Explain why filtering does not separate a solute from a solution.

2. When separating salt from sand:
   a. Describe *what you would see* for each of the following steps:
      i. Water is added to the sand and salt mixture.

ii. The sand, salt and water mixture is filtered.

iii. The filtrate is poured into an evaporating dish and heated.

b. What would the filtrate look like? _____

c. Is the salt completely separated from the sand? _____

3. Complete the following paragraph.

When separating salt from sand, the salt dissolves in water because salt is **a.** _____ in water. The sand is **b.** _____ in water so it remains. The mixture of salt, sand and water is filtered to remove the **c.** _____. The particles in the solid are too **d.** _____ to pass through the filter paper. The filtrate is heated to **e.** _____ the water so the **f.** _____ can be recovered.

4. Why are some mixtures easier to separate than other mixtures are?

5. Which of the following substances could be separated by stirring with water, filtering, and evaporation of the filtrate? Salt and sugar; copper sulfate and sand; sawdust and salt.

6. Demerara sugar, a brown sugar, is only partly purified, and contains both sugar and molasses. Molasses is brown in colour. Explain how to find out if the brown colouring dissolves in water.

Contributing

Many ships have 'desalination equipment' on board. Find out what desalination equipment is and explain why it is a good idea for ships to have this equipment.

Answers (except for 'Contributing') are provided on pages 290 and 291 of *ESA Study Guide Year 10 Science*

Chapter 1: Pure substances and mixtures
Separating mixtures (2)

Questions from pages 21–23 of *ESA Study Guide Year 10 Science*

Understanding

1. **a.** Put the following statements in the correct order to describe the distillation of a solution of ethanol and water.
   - **i.** The ethanol evaporates.
   - **ii.** Pure ethanol drips from the condenser and is collected.
   - **iii.** The mixture of ethanol and water is heated until the mixture starts to boil.
   - **iv.** The gas that enters the condenser is cooled and condenses.

   b. Which liquid starts to boil first? Explain your answer.

2. Copy and complete the following sentences, using the word list provided.

   condenses **distilled** **distillation** **gas** **vapour**

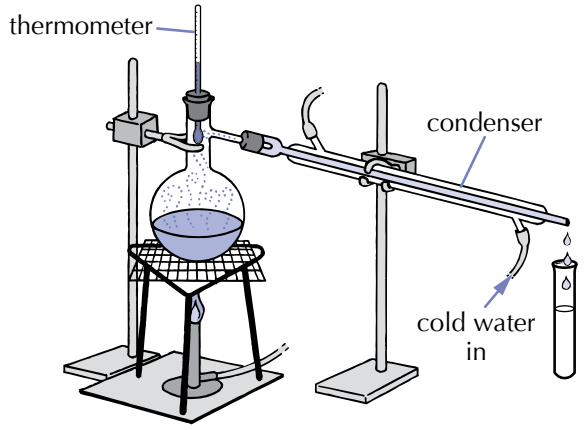
   To separate salt and water we use a process called **a.** _____. The water is boiled and turns into a **b.** _____. The water **c.** _____ reaches the condenser where it cools down and **d.** _____. The pure water is called **e.** _____ water.

3. Give a name to each of the following processes:
   - **a.** Separating complex mixtures of substances dissolved in a solution: _____
   - **b.** Using a magnet to remove magnetic substances from a mixture: _____
   - **c.** Separating two or more substances by evaporating, then condensing the liquids one at a time: _____

4. Imagine you drop nails in some sawdust. Describe a reliable way of separating the nails from the sawdust.

Thinking

A solution of blue copper sulfate is placed in the round flask shown in the following diagram, and heated. The thermometer in the apparatus reads approximately 100 °C as the distillate starts to form.



1. a. What observations do you expect to make during this distillation?

   b. What colour is the distillate? _____

   c. What is the distillate? _____

   d. What does the condenser do? _____

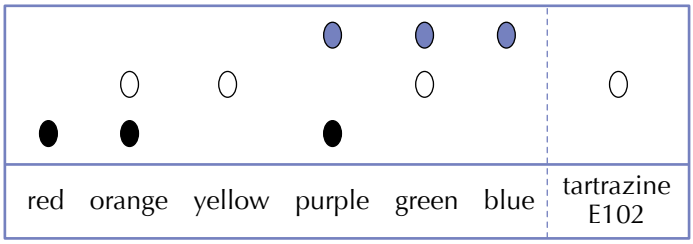
   e. Explain what would happen if the cold water tap was turned off.

2. Explain what happens to the particles in water when they evaporate.

3. Explain why you can't just evaporate a liquid to find out what substances were dissolved in it.

4. Explain why different substances travel different distances in chromatography.

5. Stephanie has found a new type of sweet, Gummy Delights, which she wants to try. The information on the packet indicates that the food colouring tartrazine E102 has been used. Stephanie knows that this food colouring sometimes gives her a rash. Gummy Delights come in six different colours: red, yellow, orange, blue, green and purple. Stephanie uses chromatography to separate out the food colourings used in each colour of Gummy Delight. She compares the colours to tartrazine E102. The results are shown in the following diagram.



   a. Identify the colours of Gummy Delights that are mixtures.

   b. Which coloured Gummy Delights should Stephanie avoid? Explain your answer.

Answers are provided on pages 291, 292 of *ESA Study Guide Year 10 Science*