Chapter 4 Exploring Diversity of Matter using Separation Techniques

AfL Quiz 1

Date: ……

By the end of this quiz, I should be able to:

- explain how the constituents of a mixture can be separated based on their properties, using the following techniques: filtration, evaporation, crystallization

1 Which method is used to obtain salt crystals from salt solution?

A chromatography
B distillation
C evaporation to dryness
D filtration ( )

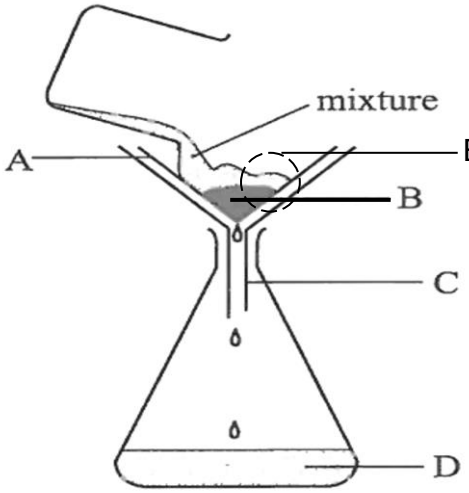
2 The table shows some information about the solidities of three solids.

Solid	Soluble in water	Soluble in ethanol
P	No	Yes
Q	Yes	No
R	No	No

By using a tick (√), choose the mixtures which can be separated by filtration.

Mixture	Solvent	Can be separated by filtration
P + Q	water	✓, Only P is insoluble in water
P + R	ethanol	✓, Only R is insoluble in ethanol
P + Q	ethanol	✓, Only Q is insoluble in ethanol
Q + R	water	✓, Only R is insoluble in ethanol

3 Diagram **I** shows a method of purification.



Enlarged image in Diagram **II** below

Diagram I

(a) Name the labelled parts **A, B and D only**.

A: filter paper

B: residue

D: filtrate

(a) Diagram **II** shows an enlarged view of a section from Diagram **I**.

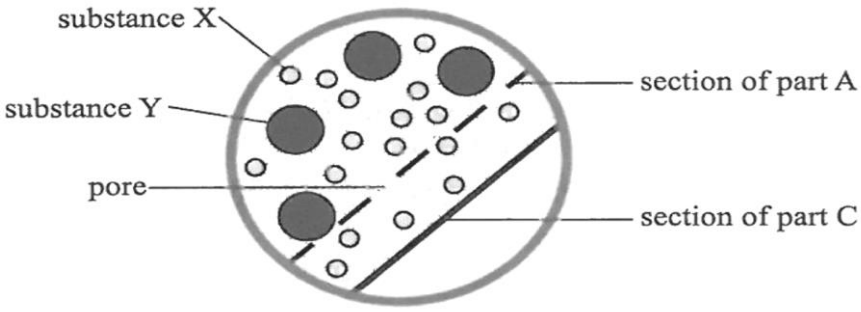
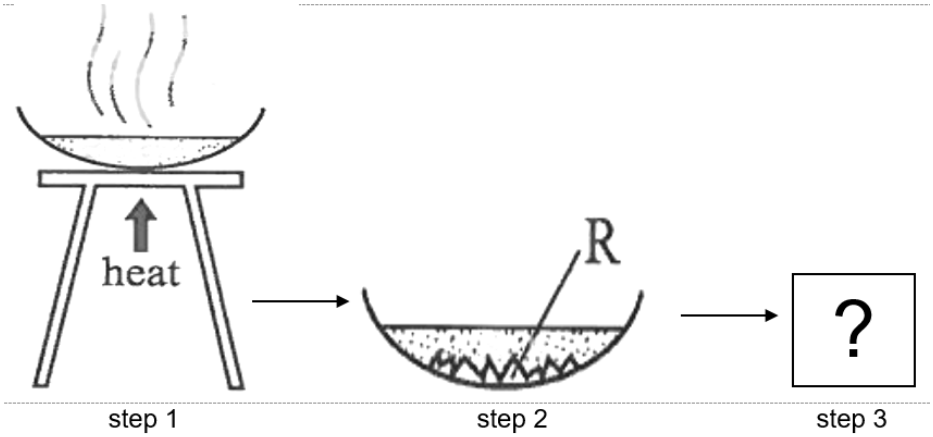


Diagram II

Based on Diagram **II**, explain how this technique is able to separate substance **X** and substance **Y**.

Since substance Y is larger than the size of the pore hole of part A (filter paper), it is unable to pass through. Whereas substance X is small enough to pass through.

4 The diagram shows a sequence of steps to obtain solid **R** from its solution.



(a) Name this process to obtain solid **R** from its solution.

Crystalisation

(b) Explain why it may not be advisable to evaporate the solution in step **1** to dryness.

Solid R might decompose on heating.

(c) State whether the solution obtained after heating in step 1 is **diluted** or **saturated**.

Saturated.

(d) Describe the step **3** that is used to obtain a dry product.

Filter to remove excess water from the crystals. Rinse with distilled water and dry between 2 pieces of filter paper.

5 The table gives some information about the properties of two chemicals.

Chemical	Solubility in water	Boiling point	Decomposed upon direct heating
P	Insoluble	150^{o}c	-
Q	Soluble	110^{o}C	Yes

Using the information from the table, how would you obtain **pure, dry samples of each chemical** if you started with a mixture of both solid **P** and solid **Q**? State all the steps clearly.

1. **Add water to the mixture to dissolve Q.**
2. **Carry out filtration to obtain solid P as the residue and solution Q as the filtrate.**
3. **Dry the residue (P) with 2 pieces of filter paper.**
4. **Heat the filtrate (solution Q) until saturated.**
5. **Leave the solution to cool for crystals to form.**
6. **Filter any excess water from the crystals.**
7. **Rinse in distilled water and dry between 2 pieces of filter paper to obtain dry crystals of chemical Q.**

Self-Evaluation: I am able to:	**Yes**	**No**
explain how constituents of a mixture can be separated using filtration		
explain how constituents of a mixture can be separated using crystallization		

Questions I still have:

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Chapter 4 Exploring Diversity of Matter using Separation Techniques

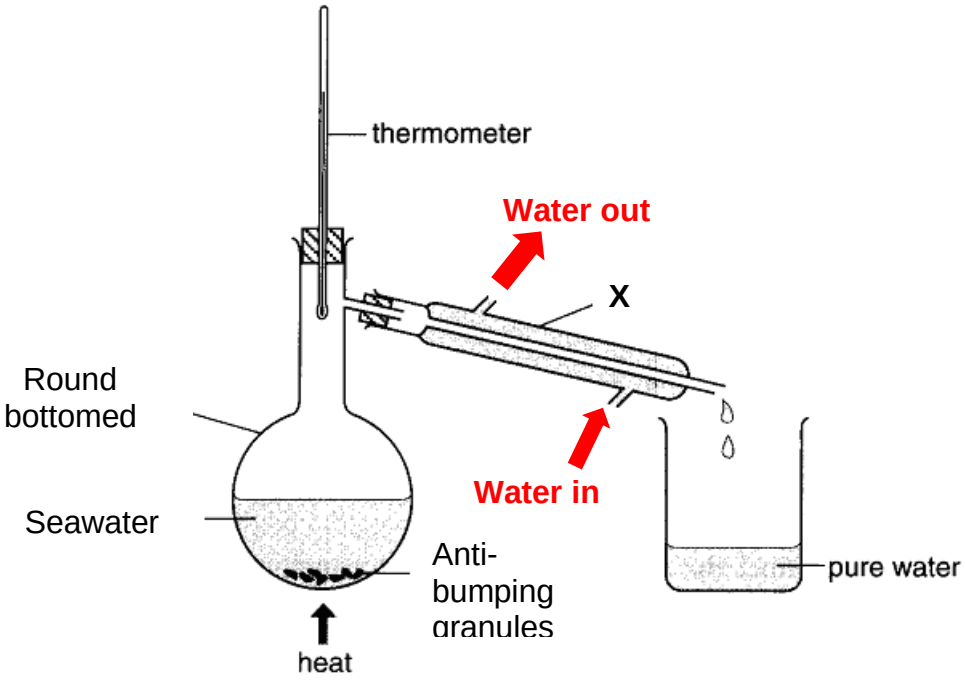
AfL Quiz 2

Date: ……

By the end of this quiz, I should be able to:

- show an awareness of basic principles involved in distillation and chromatography
- explain how the constituents of a mixture can be separated based on their properties, using distillation and chromatography

1 The figure shows the apparatus used to obtain pure water from a seawater.



(a) Name the separation process shown. **Distillation / simple distillation**

(b) Name apparatus **X** and state its function.

X is a condenser. It ensures that all vapour is converted into liquid state before exiting the condenser for maximum cooling efficiency.

(c) Using arrows, label on the diagram above where the water will enter and exit apparatus **X**.

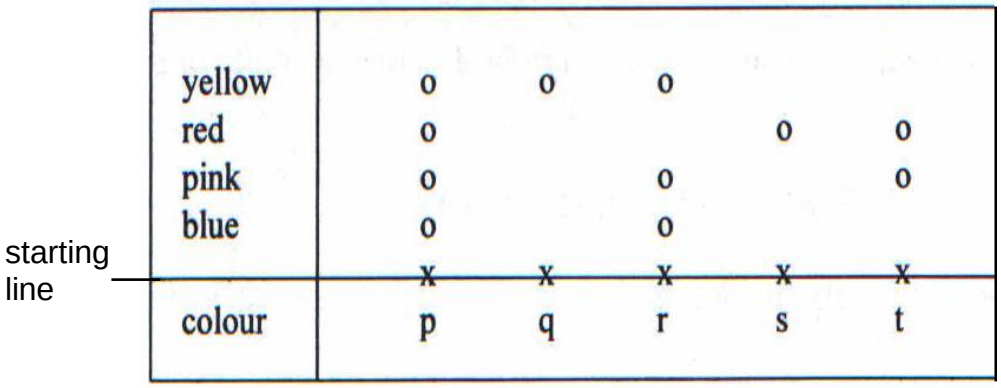
(d) State the function of adding anti bumping granules in the round-bottomed flask.

To ensure smooth boiling.

(e) What will be left behind in the round bottomed flask after separation is completed?

Salt and the anti-bumping granules.

2 A sample of colour ***p*** was analysed, together with known dyes ***q***, ***r***, ***s*** and ***t*** using paper chromatography. The solvent used was ethanol. The chromatogram below was obtained.



(a) Which two dyes when added together produce colour ***p***?

R and S

(b) Which dye (***q*** or ***s***) is more soluble in the solvent? Explain your answer.

q. Its spot travelled furthest away from the starting line.

(c) Why is the starting line drawn with a pencil and not in ink?

Since pen ink is soluble in ethanol, it will dissolve into the solvent affecting the results.

OR

Pencil is insoluble in ethanol and will not dissolve into the solvent.

Self-Evaluation: I am able to:	**Yes**	**No**
show an awareness of basic principles involved in distillation		
explain how the constituents of a mixture can be separated based on their properties using distillation		
show an awareness of basic principles involved in chromatography		
explain how the constituents of a mixture can be separated based on their properties using chromatography		

Questions I still have:

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Chapter 4 Exploring Diversity of Matter using Separation Techniques

AfL Quiz 3

Date: ……

By the end of this quiz, I should be able to:

- explain how constituents of a mixture can be separated using filtration
- explain how constituents of a mixture can be separated using crystallization
- explain how constituents of a mixture can be separated using distillation
- apply the different separation techniques to solve problems

1 Three common techniques of separating mixtures are: filtration, crystallization and distillation.

(a) Write down the purpose of each of the three separation techniques.

(i) Filtration

To remove an insoluble solid from a solid-liquid mixture.

(ii) Crystallization

To obtain a salt in the form of crystals that will decompose under high heat.

(iii) Distillation

To obtain a pure liquid from a liquid-liquid mixture. / To obtain a pure liquid from a soluble solid-liquid mixture.

(b) Given your knowledge of filtration, crystallization and distillation, choose an appropriate technique to separate the constituents from the following mixtures.

(i) Water and sand: **filtration**

(ii) Water and sugar: **crystalisation**

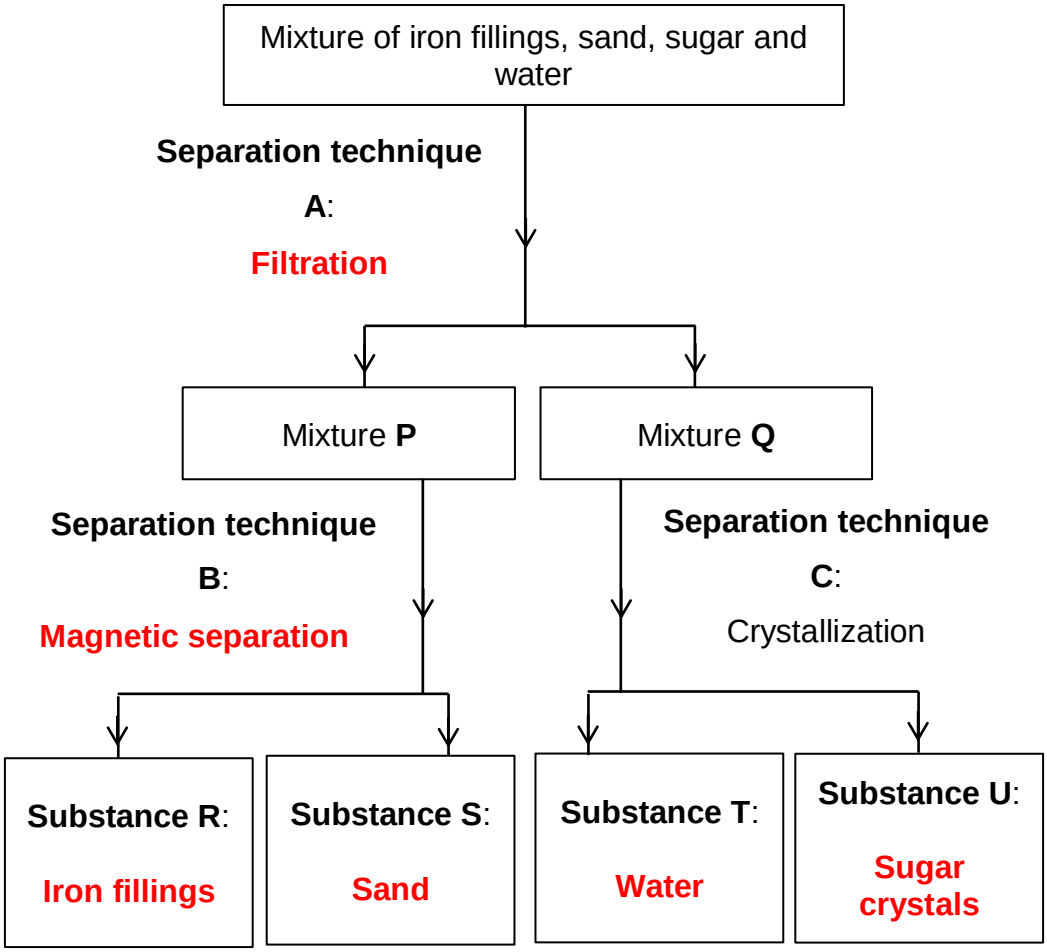
(iii) Water and coal: **filtration**

(iv) Gasoline from crude oil: **distillation**

(v) Water and Zinc Sulfate (not to dryness): **crystallisation**

(vi) Water and salt: **evaporation to dryness**

2 Tom plans to separate a mixture of iron fillings, sand, sugar and water as shown in the flow chart.



Complete the flowchart by filling in the blanks with the appropriate separation techniques **A** and **B**, as well as the substances **R**, **S**, **T** and **U** obtained.

Self-Evaluation: I am able to:	**Yes**	**No**
explain how constituents of a mixture can be separated using filtration		
explain how constituents of a mixture can be separated using crystallization		
explain how constituents of a mixture can be separated using distillation		
apply the different separation techniques to solve problems		

Questions I still have:

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