

Separating and Purifying substances

Total Marks : 18

Q1.

Inks contain coloured dyes.

Samples of four inks, **W**, **X**, **Y** and **Z**, were separated using paper chromatography.

Figure 5 shows the chromatogram obtained.

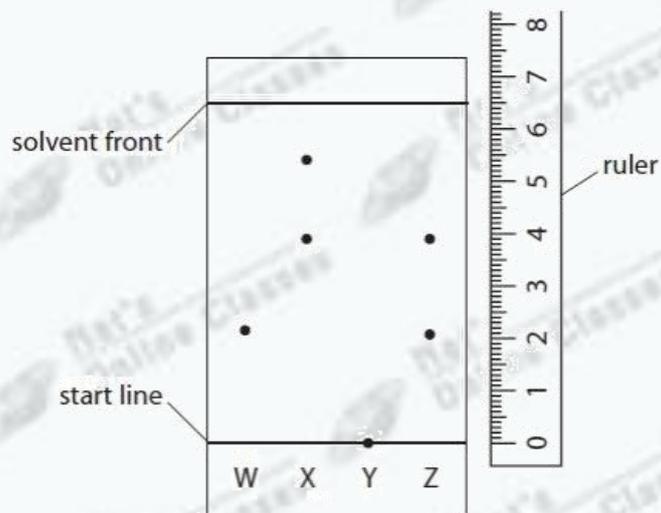


Figure 5

(i) In the experiment, the solvent front moved 6.5 cm.

Calculate the R_f value of the dye that is present in both inks **X** and **Z**.

(1)

.....
.....
 $R_f =$

(ii) State what could be changed in the experiment to make the R_f value more accurate.

(1)

.....

.....

(iii) In this experiment, ink sample Y did not move from the start line.

Explain a change to the experiment that would be needed to separate the dyes in ink sample Y.

(2)

.....

.....

.....

(Total for question = 4 marks)

Q2.

A sample of rock salt contains a mixture of sodium chloride and some insoluble substances.

The rock salt is added to water and the mixture stirred.

The mixture is then filtered to obtain a filtrate of sodium chloride solution.

(i) Draw a labelled diagram of the apparatus used to filter the mixture and collect the sodium chloride solution.

(2)

(ii) Describe how a sample of pure, dry sodium chloride crystals can be obtained from the filtrate.

(3)

.....

.....

.....

.....

.....

(Total for question = 5 marks)

Q3.

A student set up the apparatus shown in Figure 4 to obtain pure water from sea water by distillation.

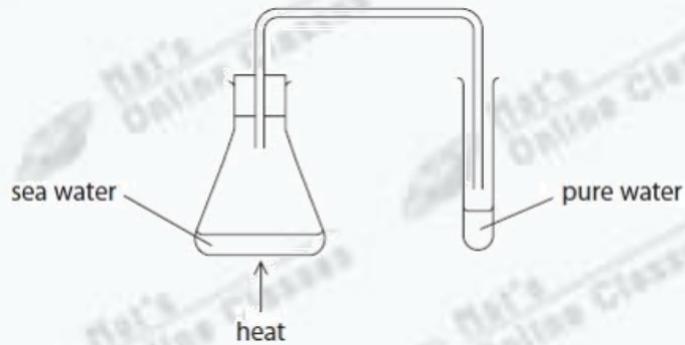


Figure 4

(i) Explain how the water in sea water separates to produce the pure water in this apparatus.

(2)

.....

.....

.....

.....

(ii) Explain how the apparatus could be improved to increase the amount of pure water collected from the same volume of sea water.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

Q4.

Figure 2 shows a label from a bottle of drinking water.

Pure drinking water	
Mass of dissolved solids in mg per 1000cm ³	
calcium ions	60
sodium ions	2
hydrogencarbonate ions	200
pH of water	
pH	7

Figure 2

(i) Explain why this drinking water should not be described as pure water.

(2)

.....

.....

(ii) State the information from Figure 2 that shows that the drinking water is neutral.

(1)

.....

(iii) Calculate the mass of calcium ions in 250 cm³ of this drinking water.

(2)

.....

.....

mass = mg

(Total for question = 5 marks)

Mark Schemes :

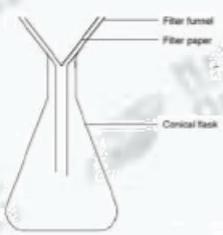
Q1.

Question number	Answer	Additional guidance	Mark
(i)	0.6 or <u>3.9</u> 6.5		(1)

Question number	Answer	Additional guidance	Mark
(ii)	longer paper/ different {medium/ paper}	ignore repeat experiment ignore more accurate ruler	(1)

Question number	Answer	Additional guidance	Mark
(iii)	An explanation linking use a different solvent (1) so that the ink will dissolve (1)	allow any suitable named solvent allow because the ink does not dissolve in water	(2)

Q2.

Question number	Answer	Additional guidance	Mark
(i)	 <p style="text-align: right;">(2)</p> <p>OR</p> <p>diagram: funnel with separate filter paper and (conical) flask (1)</p> <p>labels: (filter) funnel and filter paper and (conical) flask (1)</p>	<p>reject diagram with funnel 'closed' at bottom/top but can score MP2</p> <p>allow 'closed' filter paper</p> <p>allow any suitable apparatus for conical flask e.g. beaker</p> <p>'flask' label should be appropriate to apparatus drawn</p> <p>ignore labelling of filtrate/residue etc</p>	(2)

Question number	Answer	Additional guidance	Mark
(ii)	<p>a description including any three from:</p> <ul style="list-style-type: none"> • heat solution (to concentrate) (1) <p>then either</p> <ul style="list-style-type: none"> • leave solution {in warm place / to crystallise} (1) • scrape crystals (from container) / pat dry between filter papers (1) <p>OR</p> <ul style="list-style-type: none"> • leave solution {to crystallise / to cool} (1) • filter off crystals / decant liquid from the crystals / pat dry between filter papers / dry in oven (1) 	<p>if no other marks are scored , allow max 1 for crystallisation (1)</p>	(3)

Q3.

Question Number	Answer	Additional guidance	Mark
(i)	<p>An explanation linking</p> <ul style="list-style-type: none"> water {boils / evaporates} (to form steam / water vapour / leaving salt behind) (1) (steam / water vapour) condenses (to form pure water) (1) <p>allow alternative wording for evaporate and condense</p>	<p>ignore sea water evaporates</p> <p>sea water evaporates and condenses scores 1 overall</p> <p>mark independently</p>	<p>(2)</p> <p>AO 1 1</p>

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An explanation linking</p> <ul style="list-style-type: none"> use a (Liebig) condenser / surround test tube with (beaker of) {iced/cold} water / wrap delivery tube with cold cloth (1) to increase effectiveness of cooling / amount of condensation / remove the heat energy more effectively / ensure all the water vapour condenses (1) 	<p>ignore anti bumping granules / fractionating column</p> <p>allow alternative suitably described methods / prevent water vapour escaping / cools water vapour faster</p> <p>ignore sea water vapours</p> <p>a closed system scores 0 overall</p> <p>mark independently</p>	<p>(2)</p> <p>AO 3 3b</p>

Q4.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking <ul style="list-style-type: none">pure water contains {only water (molecules)/ only one substance} / impure water contains more than one substances (1)identification <u>from label</u> of impurity: dissolved solids/ calcium (ions) / sodium (ions) / hydrogencarbonate (ion) / ions	ignore all references to pH	(2) A03

Question number	Answer	Mark
(ii)	pH (=7)	(1) A02

Question number	Answer	Mark
(iii)	15 mg with or without working scores 2 <ul style="list-style-type: none">250/1000 (1) (=0.250)60 x 250/1000 (1) (=15) OR <ul style="list-style-type: none">1000/250 (1) = 460/4 (1) (=15)	(2) A02