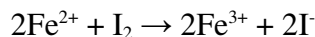


## Year 12 Chemistry Test

## Analytical Techniques 2

1. A titration was performed to determine the concentration of iron (II) ions in 50.0 mL sample.

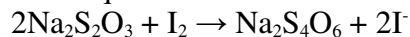
**Step 1:** The solution containing iron (II) ions was added to 100 mL of 0.0368 mol L<sup>-1</sup> iodine solution.



Excess iodine remained after the reaction was complete.

**Step 2:** A standard solution of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> was made by dissolving 1.02 g Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> in 250 mL water.

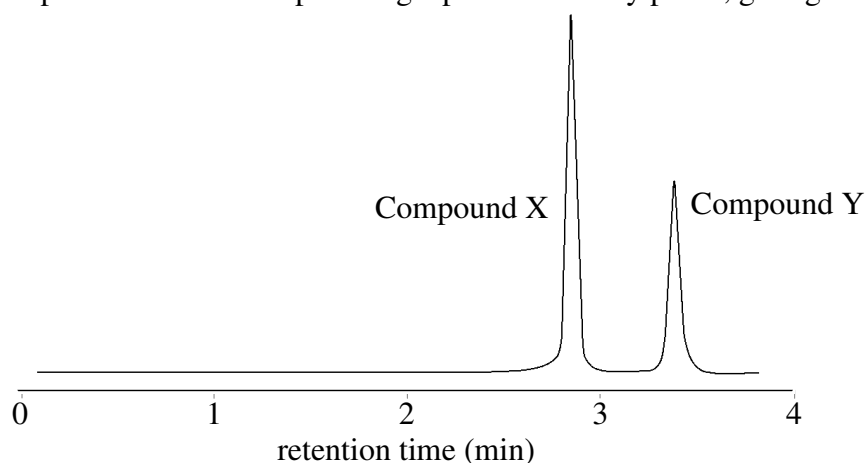
**Step 3:** 20.0 mL aliquots of the excess iodine were titrated with the standard solution of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>.



The reactants and products were colourless so a few drops of starch was added as an indicator.

- (a) Calculate the number of moles of iodine present before the reaction in Step 1. /2
- (b) Show that the concentration of the Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> solution in Step 2 was 0.0258 mol L<sup>-1</sup> /2
- (c) The average titre value for Step 3 was 24.05 mL.
- (i) Starch indicates the presence of iodine by displaying a dark blue colour.  
State the colour change that occurs at the endpoint during the titration in Step 3. /1
- (ii) Calculate the number of moles of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> that reacted with the excess iodine in Step 3. /2
- (iii) Hence calculate the number of moles of excess iodine in each 20.0 mL aliquot. /2
- (iv) Hence calculate the total number of moles of excess iodine that remained after Step 1. /2
- (d) Calculate the number of moles of iodine that reacted with the iron (II) ions in Step 1. /2
- (e) Hence calculate the number of moles of iron (II) ions that reacted in Step 1. /2
- (f) Hence calculate the concentration, in mol L<sup>-1</sup>, of the 50 mL sample of iron (II) ions. /2
- (g) Convert this concentration to %w/v. /2
- (h) Credit given for correct use of significant figures. /1

2. Gas chromatography is performed on a sample using a polar stationary phase, giving the results below:



- (a) State whether compound X or compound Y is present in greater concentration in the sample, and identify the feature of the graph that indicates this. /2
- (b) State which of compounds X and Y is more polar. /1

3. A sample of a mixture of compounds is suspected to have either compound A or compound B present, along with any number of other compounds. Assume both compounds are soluble in a polar liquid. It may also be useful to know that compound A is more polar than compound B.

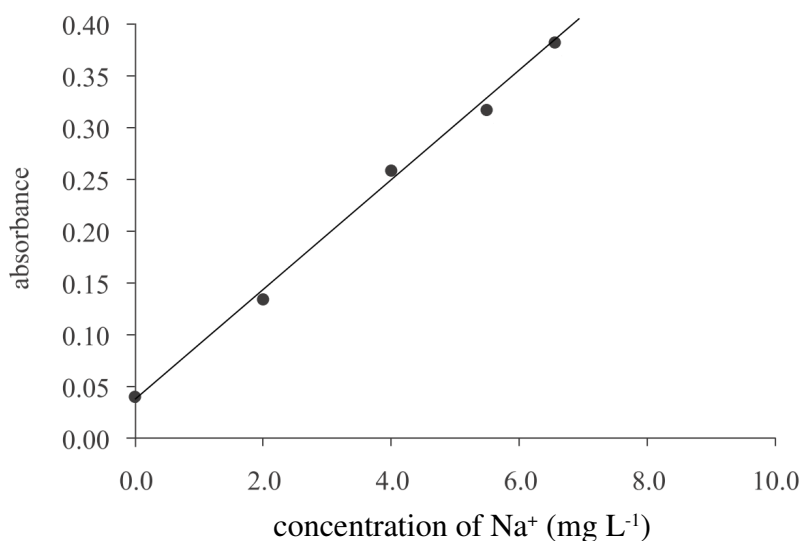
Write a procedure to determine which (if any) of the suspected compounds is present in the mixture, given:

- a sample of A (as powder)
- a sample of B (as powder)
- a sample of the mixture (as powder)
- any other necessary equipment or chemicals readily available in the lab

You are *not* required to use all the given chemicals, but you may choose to do so.

/5

4. The amount of sodium present in water can be determined by quantitative AAS by producing a calibration graph such as the one below from standard solutions of sodium ions.



- (a) Explain why calcium ions present in the water will not affect the accuracy of the analysis. /3
- (b) State one factor that could affect the accuracy of the analysis. /1
- (c) Use the graph above to determine the concentration of sodium in a solution that causes an absorbance reading of 0.27 /2
- (d) Convert this concentration to parts per billion. /2

TOTAL /36

