Year 12 Chemistry Test
Analytical Techniques

1.

    (a) Calculate the mass of sodium hydroxide needed to prepare 1 L of 1.5×10^{-5} mol L^{-1} solution.   /2

    (b) Calculate this concentration in micrograms per hundred millilitres (μg / 100 mL)   /2

2. 20.0 mL aliquots of 0.100 mol L^{-1} sodium bicarbonate were titrated with a hydrochloric acid solution using methyl orange as an indicator. Methyl orange is red in acid and yellow in base.

   Three students performed the titration, and their results are shown below:

Student 1	Student 2	Student 3
19.50	19.30	19.35
19.20	19.35	19.50
19.35	19.20	19.60

    (a) The correct titration figure was 19.40 mL. State which student's results were:

        (i) most precise   /1

        (ii) most accurate   /1

    (b) Name the apparatus which would have been used to deliver the 20.0mL aliquots.   /1

    (c) State and explain the procedure for rinsing the conical flask between titrations.   /2

    (d) State the colour change of the indicator at the endpoint   /1

    (e) Calculate the concentration of the hydrochloric acid solution using the correct titration figure.   /4

    (f) Calculate the hydrochloric acid concentration in %w/v   /2

3. Two organic samples were analysed for purity by thin layer chromatography, using a polar stationary phase and a nonpolar organic solvent as the mobile phase. The chromatogram obtained is shown in the diagram below:


Sample 1   Sample 2
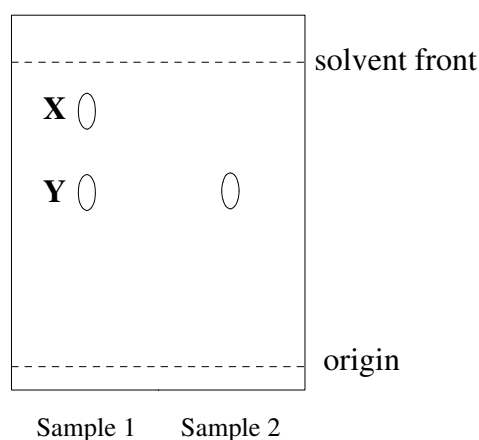
    (a) Calculate the R_f values of components **X** and **Y**.   /2

    (b) State and explain with reference to the R_f values whether component **X** or component **Y** is more polar.   /3

THERE ARE ALSO QUESTIONS ON THE OTHER SIDE

4. High-performance liquid chromatography, using a non-polar stationary phase, was used to separate two compounds in a sample. The chromatogram obtained is shown below:

Compound A   Compound B
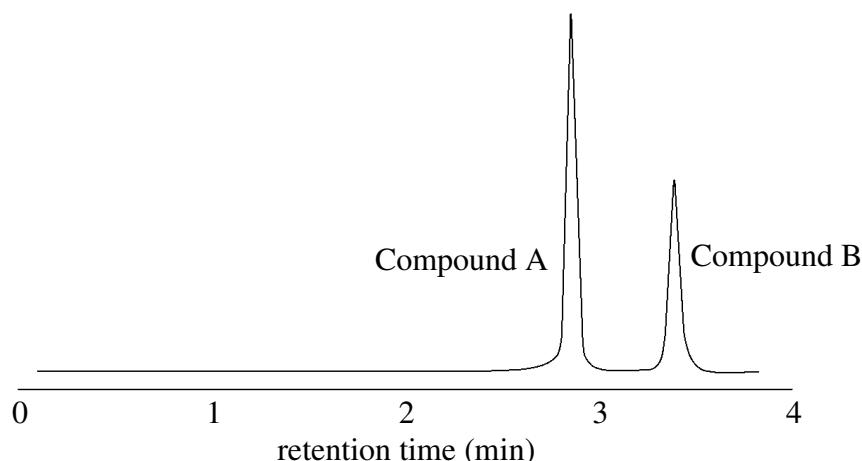
retention time (min)

(a) State the meaning of the term 'retention time'. /1

(b) Identify which of compounds A and B is more polar. Explain your answer. /3

5. To find the calcium concentration in a piece of chalk, a 4.00 g sample of the chalk was dissolved in 20.0 mL of sulphuric acid. This solution was sprayed into a flame of a previously calibrated spectrometer. The percentage absorption of the sample was 17.0%. The calibration graph is shown below:
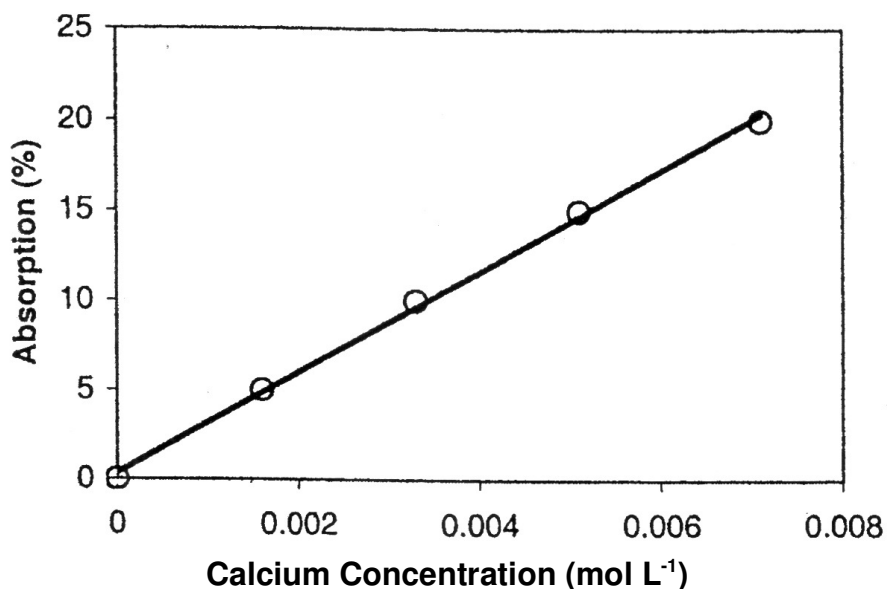
(a) State and explain the element which must be in the lamp of the atomic absorption spectrometer. /3

(b) Use the graph to find the calcium concentration in the solution. Show your working on the graph. /2

(c) Calculate the mass of calcium in the 20.0 mL of solution. /2

(d) Calculate the calcium concentration in the chalk sample in ppm. /2

TOTAL   /34