NAME ____SOLUTIONS____

Year 12 Chemistry

Analytical Techniques

Formative Test

1.

(a) $M = 39.998 \text{ g mol}^{-1} \quad V = 1 \text{ L} \quad C = 1.5\times10^{-5} \text{ mol L}^{-1}$ /2

$n = CV = 1.5\times10^{-5} \times 1 = 1.5\times10^{-5} \text{ mol}$

$m = nM = 1.5\times10^{-5} \times 39.998 = 6.0\times10^{-4} \text{ g}$

(b) $5.9997\times10^{-4} \text{ g in 1 L}$ /2

$\therefore 5.9997\times10^{-5} \text{ g in 100 mL}$

$\mu = 10^{-6} \quad \therefore 5.9997\times10^{-5} \div 10^{-6} = 60 \ \mu\text{g 100mL}^{-1}$

2.

(a)

(i) Student 2 /1

(ii) Student 1 /1

(b) Volumetric pipette /1

(c) With distilled water. The number of moles in the flask before titrating must be accurately known. /2

(d) Yellow to red /1

(e) $HCl + NaHCO_3 \rightarrow NaCl + H_2O + CO_2$ /4

$V_{HCl} = 0.01940 \text{ L} \quad V_{NaHCO_3} = 0.0200 \text{ L}$

$C_{HCl} = ? \quad C_{NaHCO_3} = 0.100 \text{ mol L}^{-1}$

$n_{NaHCO_3} = C_{NaHCO_3} \times V_{NaHCO_3} = 0.100 \times 0.0200 = 0.00200 \text{ mol}$

Mole ratio HCl : NaHCO3 is 1:1

So $n_{NaHCO_3} = n_{HCl} = 0.00200 \text{ mol}$

$$C_{HCl} = \frac{n_{HCl}}{V_{HCl}} = \frac{0.00200}{0.01940} = 0.103 \text{ mol L}^{-1}$$

(f) $C = 0.103 \text{ mol L}^{-1} \quad M = 36.458 \text{ g mol}^{-1}$ /2

$C = 0.103 \times 36.458 = 3.756 \text{ g L}^{-1}$

$C = 3.756 \div 10 = 0.376 \text{ \%w/v}$

(values are approx)

3.

(a) $R_{f_X} = \dfrac{\text{compound distance}}{\text{solvent distance}} = \dfrac{3.5}{4.0} = 0.88$

$R_{f_Y} = \dfrac{\text{compound distance}}{\text{solvent distance}} = \dfrac{2.5}{4.0} = 0.63$ /2

(b) **Y** is more polar as it experiences less attraction to the nonpolar solvent and hence does not travel as far. It therefore has a lower R_f value.

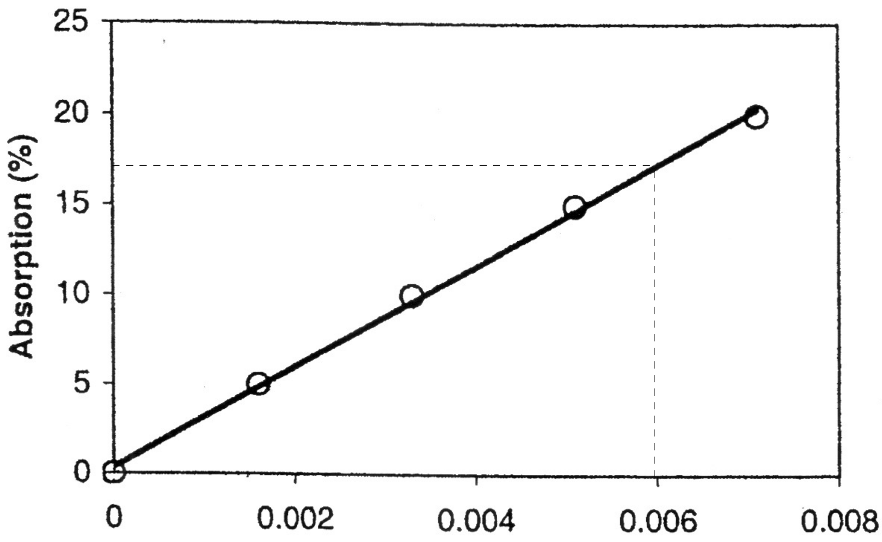
/3

4.

(a) The time it takes a particular component to travel through the system. /1

(b) Compound A. It travelled more quickly (exits the system first) meaning it is less attracted to the non-polar stationary phase (i.e., it is more polar). /3

5.



Calcium Concentration (mol L-1)

(a) Calcium. The lamp emits unique wavelengths of light (corresponding to the characteristic energy levels) from calcium, and the calcium in the sample absorbs these unique wavelengths. The absorption is used to find the concentration. /3

(b) 0.006 mol L^{-1} /2

(c) $C = 0.006 \text{ mol L}^{-1}$ /2

So $0.006 \times \dfrac{20.0}{1000} = 0.00012$ mol in 20.0 mL

$M = 40.08 \text{ g mol}^{-1}$

$m = nM = 0.00012 \times 40.08 = 0.00480$ g

(d) 0.00480 g in 4g /2

$0.00480 \times 2.5 \times 10^5$

$= 1200$ ppm

TOTAL /30