Rewarding Learning

ADVANCED
General Certificate of Education
2019

Chemistry

Assessment Unit A2 3

assessing

Further Practical Chemistry
Practical Booklet B (Theory)

[ACH32]

WEDNESDAY 19 JUNE, MORNING

MARK SCHEME

AVAILABLE MARKS

1 **(a)** Run with solvent [1]

Dry and mark the solvent front [1]

Rotate by 90° (anti-clockwise) [1]

Locate with, e.g. ninhydrin, iodine or UV light [1] [4]

(b) Solvent 1 (6 ÷ 10 =) 0.6 Solvent 2 (9 ÷ 10 =) 0.9 [1]

(c) Repeat the two-way chromatography using separate samples of pure leucine and serine [1]
Second mark dependent on first

Compare the positions of the spots/R_f values [1] [2]

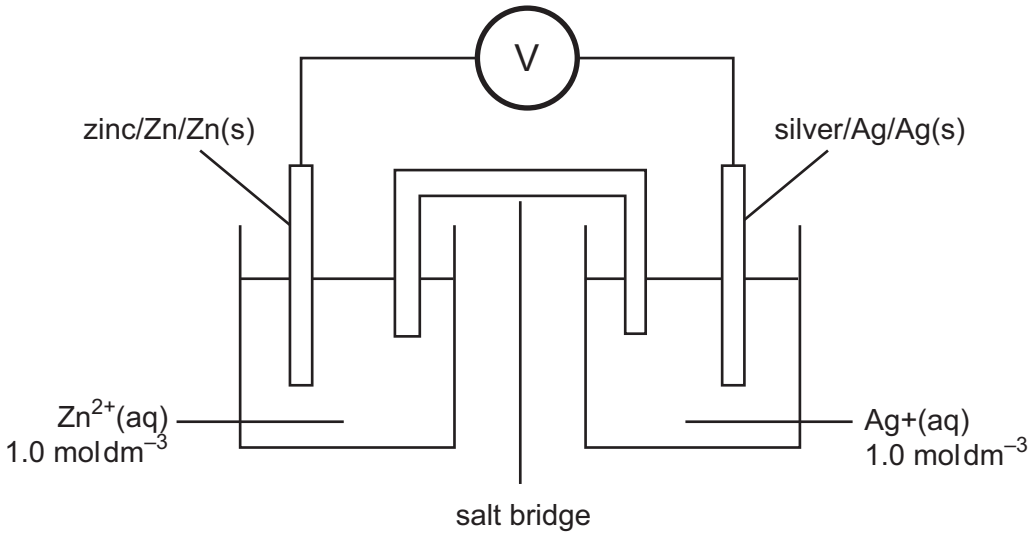
(d) Two-way chromatography improves separation/greater separation between the spots [1]

(e) **(i)** Only one peak in the chromatogram [1]

(ii) The retention time matches that of the pure drug [1]
The mass spectrum matches that of the pure drug [1] [2] 11

2 **(a)** The potential difference/voltage/emf measured when a half-cell is connected to the standard hydrogen electrode under standard conditions [2]

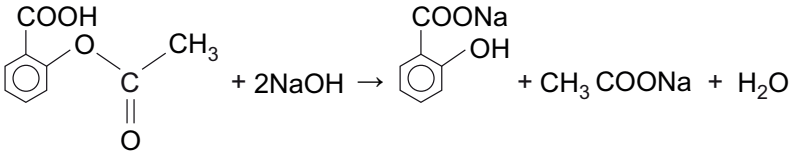
(b) **(i)** 298K (or 25° C)

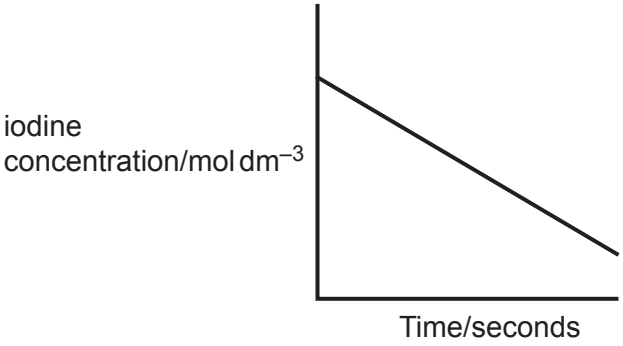


each missing detail [–1] [4]

(ii) emf = 0.80 – (– 0.76) = +1.56 V [1]

(c) +1.61 = – 0.76 – (x)
x = –2.37 V [1] 8

		AVAILABLE MARKS
3 **(a)** **(i)**	Aldehyde [1] The formation of the orange solid suggests that A is either an aldehyde or ketone/contains a carbonyl group [1] and the formation of the silver mirror means it is not a ketone [1] [3]	
(ii)	Propanal and $CH_3CH_2CHO^+$ [1]	
(b) **(i)**	Carboxylic acid [1] The vigorous reaction with phosphorus pentachloride suggests that B contains an –OH group [1], the effervescence with sodium carbonate suggests that B is a carboxylic acid/acidic [1] [3]	
(ii)	$CH_3CH_2COO\textcircled{H}$ [1] shift should be in the range 10.0–12.0 ppm [1] Second mark dependent on the first [2]	
(iii)	CH_3 triplet – two hydrogens on the adjacent carbon [1] CH_2 quartet – three hydrogens on the adjacent carbon [1] [2]	11
4 **(a)**	Either: RMM of aspirin = (9 × 12) + (8 × 1) + (4 × 16) = 180 Actual yield of aspirin = 18.0/180 = 0.1 mole Theoretical yield of aspirin = (0.1/40) × 100 = 0.25 mole RMM of salicylic acid = (7 × 12) + (6 × 1) + (3 × 16) = 138 Mass of salicylic acid = 0.25 × 138 = 34.5 g Error [–1] **Or:** Theoretical yield of aspirin = (18.0/40) ×100 = 45 g RMM of aspirin = (9 × 12) + (8 × 1) + (4 × 16) = 180 Theoretical yield of aspirin = 45/180 = 0.25 mole RMM of salicylic acid = (7 × 12) + (6 × 1) + (3 × 16) = 138 Mass of salicylic acid = 0.25 × 138 = 34.5 g Error [–1] [3]	
(b)	Dissolve the crude product in the minimum volume of hot water/methanol/ethanol [1] Filter while hot [1] Allow filtrate to cool [1] Filter crystals under suction [1] [4]	
(c)	place some solid in a capillary tube sealed at one end [1] place the capillary tube in melting point apparatus/oil bath [1] heat slowly [1] record temperature at which melting begins and ends [1] a sharp melting point confirms the purity of the aspirin [1] [5]	
(d)	 [1]	13

			AVAILABLE MARKS
5	(a)	• plot a calibration curve/graph (absorption v $[I_2]$) [1] • using known concentrations of iodine [1] • place reaction tube mixture in colorimeter recording absorption v time [1] • convert absorbance to $[I_2]$ (using calibration graph) [1] [4]	
	(b) (i)	 axes correctly labelled [1] straight line with negative gradient [1] [2]	
	(ii)	value of the gradient = rate of reaction [1]	
	(c)	so that concentrations of propanone and hydrogen ions remain (effectively) constant [1]	8
6	(a) (i)	Acidified manganate(VII) acts as (its own) indicator/titration is self-indicating [1]	
	(ii)	colourless [1] to pink [1] [2]	
	(b)	Moles of manganate(VII) = $0.020 \times (18.0/1000) = 3.6 \times 10^{-4}$ 1:5 ratio of $\left(MnO_4^-\right)$: Fe^{2+} Moles of iron(II) = $5 \times 3.6 \times 10^{-4} = 1.8 \times 10^{-3}$ [2]	
	(c) (i)	$Zn + 2\ Fe^{3+} \rightarrow Zn^{2+} + 2\ Fe^{2+}$ [1] reducing agent/ reduces iron(III) to iron(II) [1] [2]	
	(ii)	Moles of manganate(VII) = $0.02 \times (30.0/1000) = 6.0 \times 10^{-4}$ Moles of iron(II) = $5 \times 6.0 \times 10^{-4} = 3.0 \times 10^{-3}$ Increase in moles of iron(II) = $3.0 \times 10^{-3} - 1.8 \times 10^{-3} = 1.2 \times 10^{-3}$ % increase = $(1.2 \times 10^{-3}/3.0 \times 10^{-3}) \times 100 = 40\%$ **or** $(30.0 - 18.0)/30.0 \times 100 = 40\%$ [2]	9
		Total	**60**