



Rewarding Learning

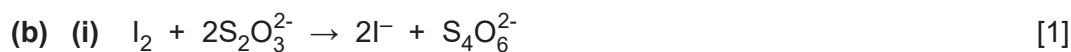
ADVANCED
General Certificate of Education
2023

Chemistry
Assessment Unit A2 3
assessing
Further Practical Chemistry
Practical Booklet B (Theory)
[ACH32]

TUESDAY 20 JUNE, MORNING

**MARK
SCHEME**

- 1 (a) pipette 25.0 cm³ of hydrogen peroxide into a conical flask [1]
 add excess sulfuric acid and excess potassium iodide [1]
 solution changes from colourless to brown [1]
 add standard sodium thiosulfate solution from the burette until the solution is straw/yellow in colour [1]
 add 3 drops of starch indicator solution [1]
 titrate until the indicator changes colour from blue-black to colourless [1] [6]



(ii) 1:1 (2:2) [1]

(iii) moles of $S_2O_3^{2-} = \frac{26.4 \times 0.1}{1000} = 2.64 \times 10^{-3}$

moles of $Cu^{2+} = 2.64 \times 10^{-3}$

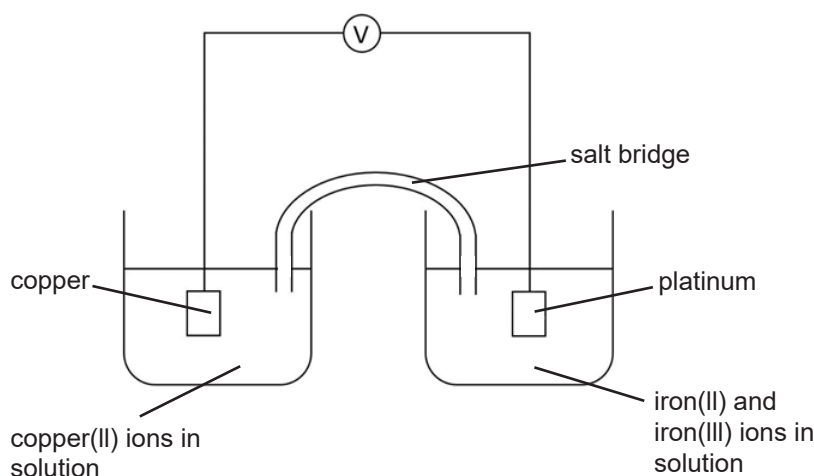
moles of Cu^{2+} in 250 cm³ = 0.0264

mass of Cu = 1.6896 g

% Cu = $\frac{1.6896}{1.93} \times 100 = 88\%$ [5]

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2 (a)



copper electrode on left and iron electrode on right [1]

copper in contact with solution of Cu^{2+} [1]

platinum in contact with solution containing both Fe^{2+} and Fe^{3+} [1]

salt bridge [1]

external circuit containing voltmeter [1] [5]



(c) $emf = 0.77 - (+0.34) = +0.43 V$ [1]

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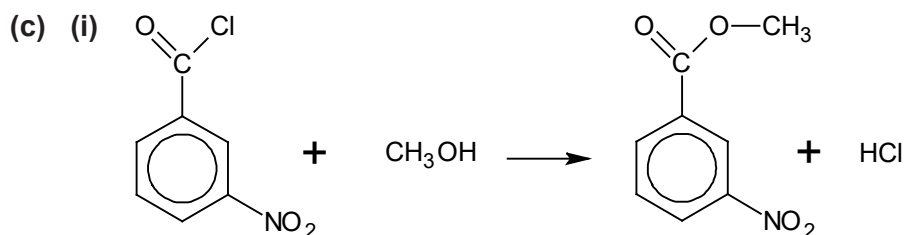
3 (a) (i) $\text{HNO}_3 + 2\text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + \text{H}_3\text{O}^+ + 2\text{HSO}_4^-$ [2]

(ii) nitration is exothermic/added slowly to control the temperature [1]
temperature kept below 10°C to prevent multiple nitrations [1] [2]

(b) (i) cream solid [1]

(ii) place crystals in capillary tube sealed at one end [1]
heat slowly (using melting point apparatus) [1]
record temperature at which crystals start and finish melting [1] [3]

(iii) pure sample sharp melting point/match data book value [1]



(ii) moles of 3-nitrobenzoyl chloride = $\frac{14.4}{185.5} = 0.0776$ [2]
moles of methanol = 0.0776
mass of methanol = $0.0776 \times 32 = 2.48\text{ g}$
volume of methyl benzoate = $\frac{2.48}{0.79} = 3.1\text{ cm}^3$ [3]

4 (a) acid H_2SO_4 [1] conjugate base HSO_4^- [1]
or acid $\text{C}_3\text{H}_7\text{COOH}_2^+$ [1] conjugate base $\text{C}_3\text{H}_7\text{COOH}$ [1] [2]

(b) (i) butanoic acid/sulfuric acid [1]

(ii) place both together in a separating funnel [1]
stopper and shake [1]
invert and open tap to release gas pressure periodically [1]
allow to stand until the layers settle/separate [1]
add water, aqueous layer increases in size [1]
run off lower layer [1] [6]

(iii) remove water/act as a drying agent/dry [1]
filter/decant [1] [2]

(c) (i) base peak = peak of greatest abundance in mass spectrum [1]
 $m/z = 43$ [1] [2]

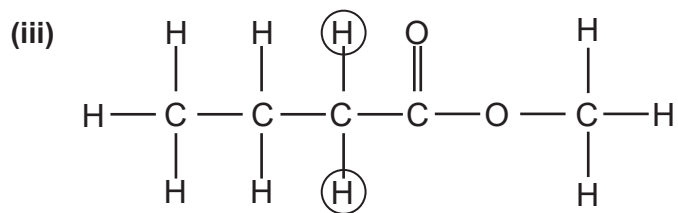
(ii) $29 = \text{CH}_3\text{CH}_2^+/\text{C}_2\text{H}_5^+$ [1]
 $71 = \text{CH}_3\text{CH}_2\text{CH}_2\text{CO}^+/\text{C}_4\text{H}_7\text{O}^+$ [1] [2]

(d) (i) tetramethylsilane [1]
one signal/inert/all ^1H equivalent/non-toxic/less deshielded ^1H than organic molecules [1] [2]

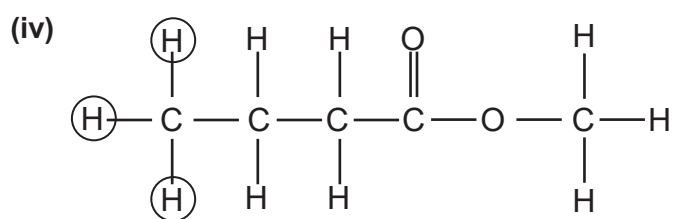
(ii) CH_3 adjacent to O [1]
highest chemical shift/most deshielded [1]
adjacent to electronegative O atom [1] [3]

AVAILABLE
MARKS

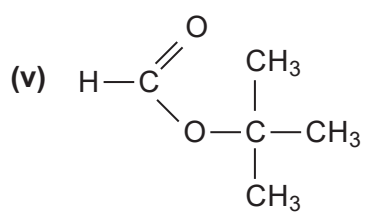
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[1]



[1]



[2]

(vi) 9:1

[1]

Total

**AVAILABLE
MARKS**

25

60