

①

Question 1 Procedure 1

Table 1 ... 5 marks

Distributed as follows:

A: COMPLETE TABLE ..... 1mk.

- (i) Complete table with 3 titrations done ... 1mk.
- (ii) Incomplete table with 2 titrations done ...  $\frac{1}{2}$ mk
- (iii) Incomplete table with only one titration done ... 0mk.

Penalties

- (i) Wrong arithmetic / subtraction
  - (ii) Inverted table
  - (iii) Burette readings beyond  $50\text{cm}^3$  unless explained.
  - (iv) Unrealistic titre values i.e too low (below  $1.0\text{cm}^3$ ) or too high (greater than  $100.0\text{cm}^3$ )
- NB: Penalize  $\frac{1}{2}$ mk ONCE for any of the above mistakes.

B: USE OF DECIMALS ..... 1mk(Tied to 1<sup>st</sup> and 2<sup>nd</sup> rows only)Conditions

- (i) Accept 1 or 2 decimal places consistently used for 1mk otherwise penalise FULLY (Award 0mk).
- (ii) If 2 decimal places are used, then the 2<sup>nd</sup> decimal place must be "0" or "5" otherwise penalise fully (Award 0mk).
- (iii) Accept inconsistencies in the use of zeros as initial burette readings eg 0.0, 0, 0.00, 00.0, 00.00



C: ACCURACY . . . . 1mk.

Compare the candidate's correct titre value with the school value (S.V)

Conditions

- (i) If at least one titre value is within  $\pm 0.10 \text{ cm}^3$  of S.V, award 1mk.
- (ii) If no titre value is within  $\pm 0.10 \text{ cm}^3$  of the S.V but at least one is within  $\pm 0.20 \text{ cm}^3$  of S.V . . . award  $\frac{1}{2}$ mk.
- (iii) If none of the titre values is within  $\pm 0.20 \text{ cm}^3$  award 0mk.

NOTE:

- (i) If there was wrong arithmetic/subtraction in the table in the table, compare the S.V with the worked out correct titres and award accordingly.
- (ii) If no S.V is given by the teacher or the S.V cannot be worked out from the teacher's titres according to the principles of averaging, then
  - @ Sample the candidate's values and average those that are close to get the S.V
- (b) If the candidates' values are too varied then use  $12.7 \text{ cm}^3$
- (iii) Where there are two possible S.V from the teacher's titre values, both should be written on the candidate's script and the one closer to the candidate's values be used for awarding accuracy and final accuracy.



(iv) Tick (✓) the candidate's chosen titre on the table if it earns a mark before pasting the mark.

D: PRINCIPLES OF AVERAGING ----- 1mk.

Condition:

- (i) Values averaged must be shown and must be within  $\pm 0.20\text{cm}^3$  of each other.
- (ii) If 3 consistent titrations are done and averaged ----- 1mk.
- (iii) If 3 titrations are done but only two are consistent and averaged ... 1mk.
- (iv) If only two titrations are done, are consistent and averaged ----- 1mk.
- (v) If 3 titrations are done, are consistent but only two are averaged ---- 0mk
- (vi) If 3 titrations are done, are inconsistent and averaged ---- award 0mk.
- (vii) If only two titrations are done, are inconsistent and averaged, award 0mk.
- (viii) If only one titration done ----- 0mk.

Penalties

- (i) Penalise  $\frac{1}{2}$ mk for wrong arithmetic in the answer if error is outside  $\pm$ units in the second decimal place.
- (ii) Penalise  $\frac{1}{2}$ mk if NO WORKING is shown but correct answer is given.
- (iii) Penalise FULLY (award 0mk) if no working is shown and answer given is wrong.
- (iv) For wrong working with correct answer award ... 0mk.

e.g



(04)

$$25.0 + 25.0 + 25.0 = \frac{75}{3} = 25.0$$

OR

where the division line is missing

### NOTE

- (i) Accept answer if it works out exactly to a whole number or to 1 decimal place and award FULLY.
- (ii) The working of average value must be marked before the mark for principles of averaging is awarded to the table.
- (iii) Accept rounding off/truncation of answer to 2.d.p otherwise penalise  $\frac{1}{2}$ mk if answer is rounded off/truncated to 1.d.p or to a whole number.
- (iv) Units may or may not be given but when given, must be correct otherwise penalise  $\frac{1}{2}$ mk for wrong units attached.

### ● E: FINAL ACCURACY.

- (i) If within  $\pm 0.10\text{cm}^3$  of s.v. .... 1mk.
- (ii) If not within  $\pm 0.10\text{cm}^3$  of s.v but within  $\pm 0.20\text{cm}^3$  of s.v. ....  $\frac{1}{2}$ mk.
- (iii) If beyond  $\pm 0.20\text{cm}^3$  of s.v. .... 0mk.

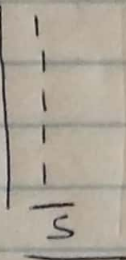
### NOTE

- (i) Where there are two possible average titres, use the one which is closest to the s.v and award accordingly.
- (ii) If wrong titrations are averaged, pick the correct titres (if any) following the principles of averaging, average and

(05)

Award accordingly.

Summary



CALCULATIONS

(b)  $\frac{25 \times 2}{1000} \sqrt{\frac{1}{2}} = 0.05 \sqrt{\frac{1}{2}}$

02

$\frac{1000 \times 0.05}{250} \sqrt{\frac{1}{2}} = 0.2 \text{M} \sqrt{\frac{1}{2}}$

(c)  $\frac{0.2 \times 25}{1000} = 0.005 \sqrt{\frac{1}{2}}$

OR

$\frac{0.05 \times 25}{250} = 0.005$

02

$\frac{0.005 \times 1}{3} = 0.00166 \sqrt{\frac{1}{2}}$

$\frac{1000 \times 0.00166}{\text{titre value}} \sqrt{\frac{1}{2}} = \text{correct answer} \sqrt{\frac{1}{2}}$

(d)  $\frac{25}{\text{answer from (c)}} \sqrt{\frac{1}{2}} = \text{correct answer} \sqrt{\frac{1}{2}}$

01



## NOTES

- (i) For part b and c, the values must be transferred intact otherwise penalise fully for strange figures used.
- (ii) For part b or c the units may or may not be given, but if given must be correct eg M // moles per litre // moles/dm<sup>3</sup> // moles/1000cm<sup>3</sup> // moles/L // moles l<sup>-1</sup> otherwise penalise 1mk. for wrong units. eg mols
- (iii) For part b and c the answer must be written to at least 4dp unless it works out into a value that is less than 4dp otherwise penalise ½mk at the answer.
- (iv) For part b the answer must be within 0.1 - 0.3 otherwise penalise ½mk at the answer.
- (v) For part d, penalise ½mk if units are given otherwise mark accordingly.
- (vi) For part d the answer must be written to at least 2dp unless it works out into a value that is less than 2dp.
- (vii) For part d, the answer must be between 180 - 210 otherwise penalise ½mk.
- NB For an error in part (v), (vi) and (vii) penalise ½mk once.



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## Procedure 11

Table 2 ..... 4 mks

Distributed as follows

A: COMPLETE TABLE ..... 1mk.

Award 1mk for complete table with Grading penalties

- (i) Penalise  $\frac{1}{2}$ mk for each space not filled to a maximum of 1mk subject to at least 4 readings otherwise penalise fully.
- (ii) Penalise  $\frac{1}{2}$ mk once for unrealistic initial temperature reading (when volume of  $A = 5\text{cm}^3$ ) (i.e. below  $10^\circ\text{C}$  or above  $50^\circ\text{C}$ )
- (iii) Penalise  $\frac{1}{2}$ mk once the temperature readings are constant for the row of "maximum temperature"
- (iv) Penalise  $\frac{1}{2}$ mk if there is arithmetic error in any of the columns.

B: USE OF DECIMALS ..... 1mk

Subject to at least two readings in 1<sup>st</sup> and 2<sup>nd</sup> row.

### Conditions

Must be consistently recorded as a whole number consistently or to 1 d.p recorded as .5 or .0 otherwise penalise fully.

C: ACCURACY ..... 1mk.

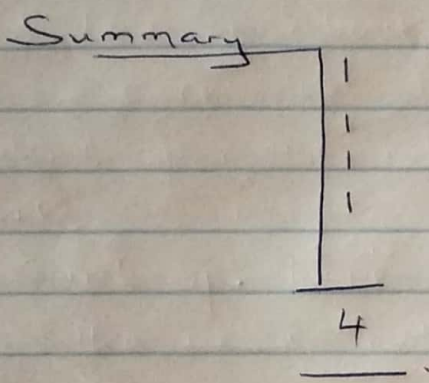
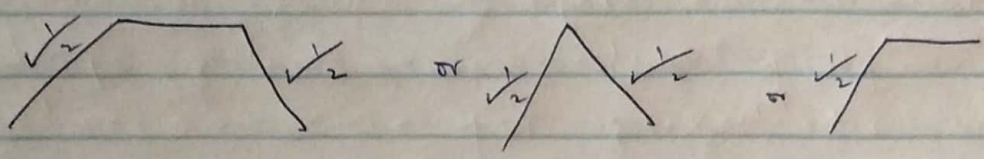
Compare the candidate's initial temperature reading when volume of  $A = 5\text{cm}^3$ , and award 1 mark if within  $\pm 2.0^\circ\text{C}$  of the S.V otherwise penalise fully (award 0mk).

Put a tick (✓) on the candidate's initial temperature reading if credited.



D: TRENDS . . . . . 1mk

Award 1<sup>st</sup> 1/2mk for continuous rise in temperature upto a maximum, and the 2<sup>nd</sup> 1/2mk for temperature being either constant at maximum, followed by a continuous drop after the maximum eg.



GRAPH . . . . . 3marks

Distributed as follows:

A: LABELLING . . . . . 1mk

Award 1/2mk if both axes are correctly labelled.

Penalties

- (i) Penalise fully for inverted axes.
- (ii) Penalise fully for wrong units used otherwise ignore if units are omitted.
- (iii) Penalise fully if only one axis is labelled.



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B: SCALE: . . . . .  $\frac{1}{2}$  mk.

Conditions

- (i) Area covered by the plots should be at least half the grid provided i.e.  $3\frac{1}{2}$  big squares vertical by 4 big squares (horizontal)
  - (ii) Scale interval chosen must be consistent on both axes
  - (iii) Scale chosen must be able to accommodate all plots/points whether plotted or not.  
NB
- (i) Award for correct scale even if the axes are inverted.
  - (ii) Penalise fully if any of the above conditions is not met.

C: PLOTTING: . . . . . 1mk

- (i) If 5 or 6 points are correctly plotted . . . 1mk.
  - (ii) If 3 or 4 points are correctly plotted . . .  $\frac{1}{2}$ mk.
  - (iii) If  $< 3$  points are correctly plotted . . . 0mk.  
NB
- (i) If scale interval are inconsistent, credit correct plots (if any) within the first scale interval and treat all others as wrong.
  - (ii) Accept correct plots even if the axes are inverted and award accordingly.
  - (iii) Mark all the plots on the graph ( $\checkmark$  or  $\times$ ) depending on whether they are correct or not respectively.



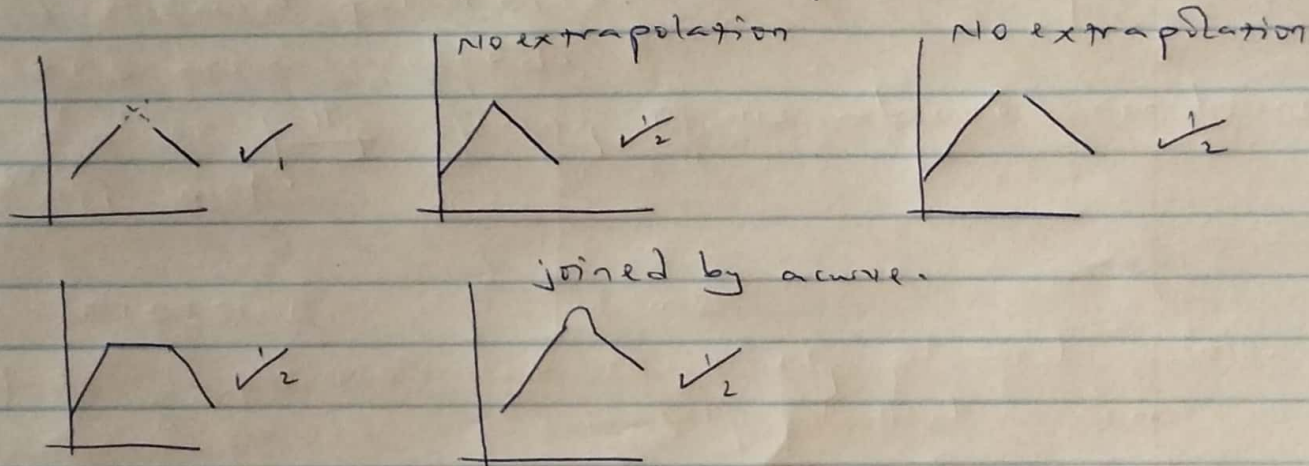
(10)

D: LINE/SHAPE: - - - - - 1mk.

Conditions

- (i) Accept two straight lines intersecting on extrapolation with the first line passing through the initial temperature, for 1mk
- (ii) Accept two straight lines not extrapolated whether joined or not for  $\frac{1}{2}$ mk on condition that the first line passes through the initial temperature.

expected graph versions.



NB: The two extrapolated lines must meet above the highest plot otherwise penalise  $\frac{1}{2}$ mk/mark accordingly.

- (b)(i) Accept correct volume of A from a correctly extrapolated graph for 1mk.  
 $\frac{1}{2}$ mk for showing and  $\frac{1}{2}$  for correctly reading what has been shown.
- (ii) Award 0mk for volume of A stated from a wrong graph.



(11)

$$(c) (30 - \text{answer from (b)}) \sqrt{2}$$

$$= \text{correct answer } \sqrt{2}$$

01

d (i)

$$\frac{\text{answer b: smallest volume}}{\text{answer c: smallest volume}} \sqrt{2}$$

$$= \text{correct answer } \sqrt{2}$$

01

NB: Penalise  $\frac{1}{2}$  mark if the answer is outside ratio of 1:1

$$(ii) \frac{2 \times \text{volume from answer (b)}}{1000} \sqrt{2} = \text{correct answer } \sqrt{2} \text{ step I}$$

Mole ratio A : B = 1 : 1

$$\frac{\text{Answer from step I} \times 1000}{\text{answer from (b)}} \sqrt{2}$$

02

$$= \text{correct answer } \sqrt{2}$$

(22)



## Question 2.

a)

Observation	Inference.
Gas that changes acid litmus paper blue is produced $\frac{1}{2}$	$\text{NH}_4^+$ present $\frac{1}{2}$
Blue litmus paper remains blue $\frac{1}{2}$	Solid D is <u>03</u> hydrated $\frac{1}{2}$
colourless liquid is formed on the cooler parts of the test tube $\frac{1}{2}$ or	paralise fully for contradictory ion mentioned as either present or absent.
Vapour condenses on the cooler parts of the test tube white sublimate $\frac{1}{2}$	

b)

Observation	Inferences
(Green solution) changes to yellow/yellow solution is formed $\frac{1}{2}$	$\text{Fe}^{2+}$ oxidised to $\text{Fe}^{3+}$ $\frac{1}{2}$
Brown precipitate $\frac{1}{2}$ insoluble in excess $\frac{1}{2}$	<u>02</u>



c(i)

Observation	Inferences
White precipitate ✓	$SO_4^{2-}$ $SO_3^{2-}$ $CO_3^{2-}$ ✓ present All 3 — 1mk 2 — ½mk <span style="float: right;"><u>02</u></span> 1 — 0mk penalise ½mk to a maximum of 1m for any contradictory ion.

c(ii)

Observation	Inference
Efferescence ✓ / White precipitate dissolves ✓	$CO_3^{2-}$ ½ $SO_3^{2-}$ ½ present. <u>conditions</u> (i) Only award if the two anions had correctly been inferred in c(i) (ii) Accept for ½mk $SO_4^{2-}$ absent only if it had been correctly inferred in c(i) above (iii) Penalise fully for any other ion mentioned here.

c(iii)

Observation	Inference
Orange acidified potassium dichromate(VI) changes to green ✓	$SO_3^{2-}$ present ✓ (i) penalise fully for any contradictory ion. (ii) Award only if it had been scored in part c(ii)



Question 3

(a) colourless liquid  $\checkmark \frac{1}{2}$

$\frac{0}{2}$

(b)

Observation

Liquid burns with a blue flame  $\checkmark \frac{1}{2}$

Inference

$C=C$   $\checkmark \frac{1}{2}$  OR  $C \equiv C$   $\checkmark \frac{1}{2}$   
absent.

$\frac{0}{2}$

penalise fully for any other functional group mentioned as either present or absent.

(c)

Observation

No effervescence  $\checkmark$

Inference

$R-COOH$  /  $-COOH$   
absent  $\checkmark$

Accept for  $\frac{1}{2}$  mark  $H_3O^+ / H^+$   
absent

$\frac{0}{2}$

(i) Penalise fully for any other functional group mentioned as absent/present.

(d)

Observation

Orange acidified potassium dichromate  $\checkmark$  changes to green

Inference

$R-OH$  present

penalise fully for any contradictory functional group



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(2)

Observation

Inference

Substance is miscible with water ✓

Substance F is

polar ✓ 02

07