

# FORM 4 END OF TERM 2 EXAM

## CHEMISTRY

Paper 3

July 2018

### MARKING SCHEME

#### A. PROCEDURE I

Table I

Exp. number	1	2	3	4	5
Time taken (sec)	12	18	22	32	96
$1/\text{time (sec}^{-1}\text{)}$	0.0830	0.0560	0.0450	0.0313	0.0104

#### a) Table

##### Marking areas

##### i) Complete table - 3 marks

##### Penalties /conditions

- Penalise  $\frac{1}{2}mk$  for each space not filled.
- Reject fractions for  $1/\text{Time}$  and award a max of  $1\frac{1}{2}$  mks for the table.
- if fractions appear followed by an extra column of decimals ignore the fractions and award accordingly.
- penalise  $\frac{1}{2}mk$  each for wrong arithmetic in the values of  $1/\text{Time}$  not within an error of  $\pm 2$  units in the 3rd decimal place unless it divides exactly.
- Accept reciprocals given to at least 3 decimal places. otherwise penalise  $\frac{1}{2}mk$  each for rounding off to the 2nd decimal place to a max of 1 mark, unless it divides exactly.
- penalise  $\frac{1}{2}mk$  for every reading  $<5$  and  $>240$  seconds in the time row.
- penalise  $\frac{1}{2}mk$  for each entry not in seconds.

#### ii) Use of decimals - 1 mk

(Tied to the 4th row only)

- Accept whole numbers or decimals upto the 2nd decimal place only used consistently, otherwise penalise fully.

#### iii) Accuracy - 1 mark

(Tied to 4th row only)

- Compare the candidates 1st reading to the school's value and if within  $\pm 2\text{sec}$ , award 1 mark. Otherwise penalise fully.

#### iv) Trend - 1 mark

(Tied to 4th row only)

- Award 1mk if time is continuously increasing otherwise penalise fully

#### b) Graph - 3marks

##### marking areas.

##### i) Labelling of both axes - $\frac{1}{2}mk$

##### Conditions and penalties.

- Penalise  $\frac{1}{2}mk$  for wrong units used in any of the axis.
- Penalise  $\frac{1}{2}mk$  for inverted axes.
- Accept if units not shown, otherwise if shown must be correct.
- Both axes must be labelled.

#### ii) Scale - $\frac{1}{2}$ mark

- are covered by the actual plots including the origin should be  $\frac{3}{4}$  or more of the squares provided in both axes.
- The scale interval should be consistent.

#### iii) Plotting - 1 mark

- award 1mk if all plots are correctly plotted.
- award  $\frac{1}{2}mk$  if 4 plots correct
- award 0mk if less than 4 plots correctly plotted.
- accept plots even if the axes are inverted.
- accept rounding off the values of  $1/\text{Time}$  to the 3rd decimal place when plotting.

#### iv) Line - 1 mark

- Accept a straight line passing through at least 2 points. Correctly plotted and through the origin (0,0) for 1 mk.  
OR  
if extrapolated can pass through the origin. (0,0)

#### c) Showing $1/T$ on the graph - $\frac{1}{2}$ mk

- Stating the correct reading of  $1/T$  at  $36\text{cm}^3$  -  $\frac{1}{2}mk$
- applying the expression that  
$$\text{Time} = \frac{1}{\text{correct reading}} \quad \frac{1}{2}mk$$
- correct answer  $\frac{1}{2}mk$

#### d) Rate increases with increase in concentration of hydrochloric acid or vice versa - 1 mark

OR

Rate of reaction is directly proportion to the concentration.

##### Conditions.

- tied to the correct graph or trend in the table
- If volume is used instead of concentration award full mark.

B. PROCEDURE II.  
Table II

	I	II	III
Final burette reading (cm <sup>3</sup> )	21.1	21.1	21.1
Initial burette reading (cm <sup>3</sup> )	0.0	0.0	0.0
Volume of solution R used (cm <sup>3</sup> )	21.1	21.1	21.1

*Use your school value*

Marking areas

I. Complete table - 1 mark

Conditions

- award 1mk for complete table with 3 titrations done.
- award  $\frac{1}{2}mk$  for incomplete table with 2 titrations done.
- Award 0 mark for 1 titration done.

Penalties

- wrong arithmetic.
- inverted table.
- burette readings beyond 50cm<sup>3</sup> unless explained.
- unrealistic titre values i.e. below 1.0cm<sup>3</sup> or hundreds.

NB- Penalise  $\frac{1}{2}mk$  each. For a maximum of  $\frac{1}{2}mk$  penalise once.

II. use of decimals - 1 mark

(Tied to 1st and 2nd rows only)

- Accept either 1 or 2 decimal places used consistently.
- Accept 2 decimals places only if the 2nd decimal place is 0 or 5.

NB: Penalise fully if any of the conditions is not met.

III. Accuracy - 1 mark

(Tied to the school's value (S.V))

Conditions

- If any of the titre values is within  $\pm 0.1$  of the S.V award 1mark.
  - If any of the 3 titre values is within  $\pm 0.2$  of the S.V award  $\frac{1}{2}mk$
- NB: If there is wrong arithmetic compare the S.V with the worked out correct value and award accordingly.

IV. Principles of averaging - 1 mark

$\frac{I + II + III}{3}$  = correct answer

Conditions and penalties.

- The values to be averaged MUST be within  $\pm 0.2$  of each other (i.e. consistent)
- If 3 titrations are done and all are consistent, they must all be averaged.
- If 3 titrations are done and only 2 are consistent and averaged, award 1mk

- If 2 titrations are done and are consistent and averaged award 1mark.
- If the answer is correct but no working is shown award.  $\frac{1}{2}mk$

V. Final answer - 1 mark

(Tied to the S.V. and to the correct average titre)

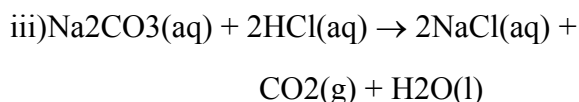
Conditions.

- If within  $\pm 0.1$  of the S.V - 1 mark
- If within  $\pm 0.2$  of the S.V -  $\frac{1}{2}$  mark
- If wrong values are averaged pick for the candidates correct values. If any and average then for the candidate and award accordingly.

NB: A total of 5 marks

ii) Moles of Na<sub>2</sub>CO<sub>3</sub> =  $\frac{0.5M \times AV. \text{ titre}}{1000}$   $\frac{1}{2}mk$   
= correct ans  $\frac{1}{2}mk$

e.g.  $\frac{0.5 \times 21.1}{1000} = 0.01055$  moles



Moles of HCl

= 2 × ans in (ii) above  $\frac{1}{2}mk$   
= correct answer  $\frac{1}{2}mk$

e.g. 2 × 0.01055 = 0.0211 moles

iv) Moles of HCl in solution P

=  $\frac{100cm^3}{25cm^3} \times$  ans in b(iii) above  $\frac{1}{2}mk$   
pipette value 25cm<sup>3</sup>  
= Correct answer  $\frac{1}{2}mk$

e.g.  $\frac{100}{25} \times 0.0211 = 0.0844$  moles

OR

4 × ans in b (iii) above = correct ans.

v) Moles of HCl in 60cm<sup>3</sup> of solution W.

=  $\frac{60 \times 2}{1000}$   $\frac{1}{2}mk$

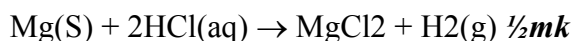
= 0.12 moles  $\frac{1}{2}mk$

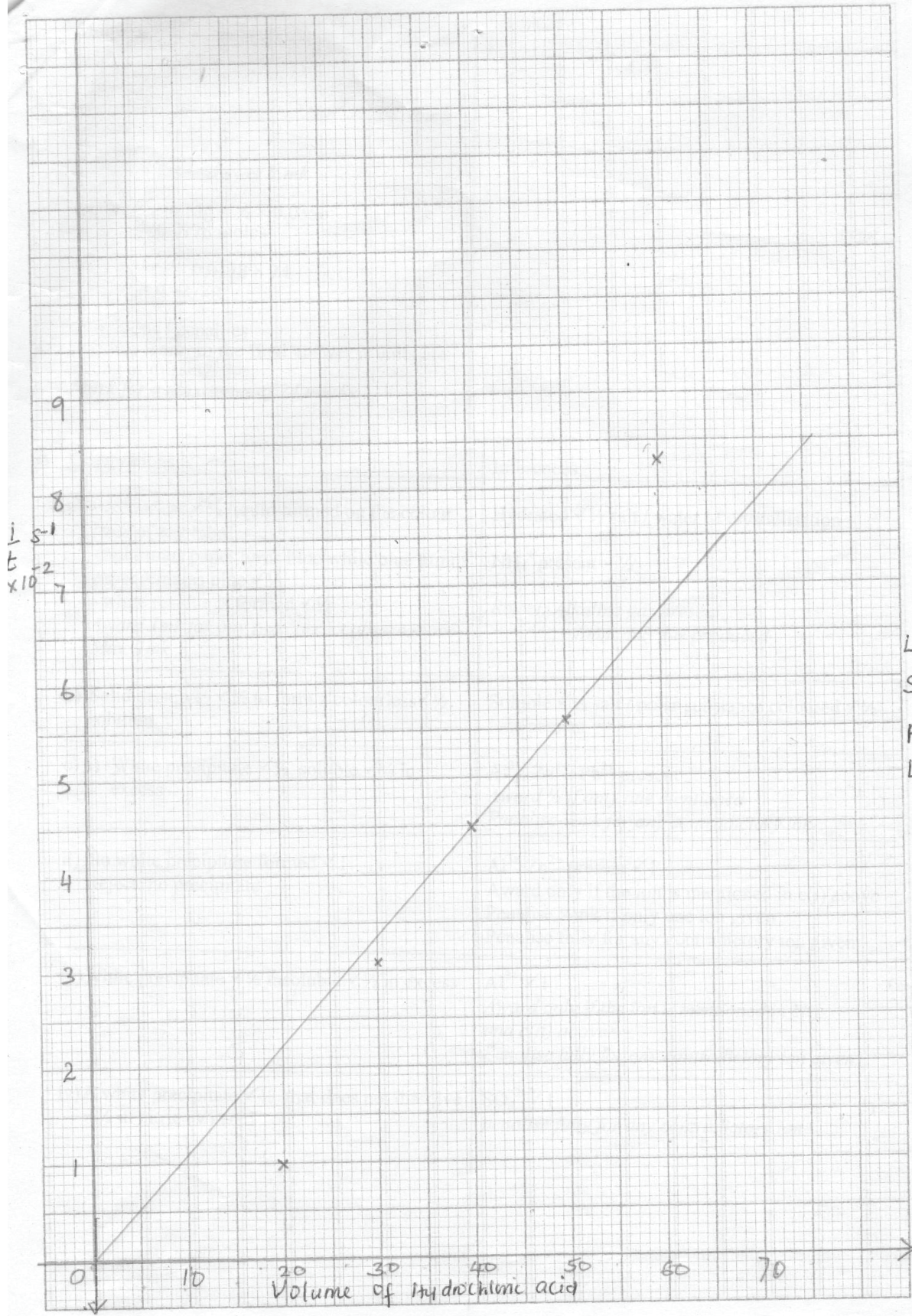
vi) Moles of HCl reacted with magnesium ribbon.

= Ans in (V) - Ans in (iv)  $\frac{1}{2}mk$   
= correct ans  $\frac{1}{2}mk$

e.g. 0.12 - 0.0844 = 0.0356 moles.

vii) Mass of magnesium present in 2cm ribbon





$L = \frac{1}{2}$   
 $S = \frac{1}{2}$   
 $P = 1$   
 $L = 1$   


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 03  


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Moles of =  $\frac{1}{2} \times$  ans b(vi) above  $\frac{1}{2}mk$

= intermediate answer.

Mass of Mg = Intermediate  $\times$  24  $\frac{1}{2}mk$   
answer

= Final answer  $\frac{1}{2}mk$

e.g. Moles of Mg =  $\frac{1}{2} \times 0.0356$   
= 0.0178 moles

Mass of Mg =  $0.0178 \times 24$   
= 0.4272g

Conditions / penalties

- penalise  $\frac{1}{2}mk$  in the final answer if units are wrong or missing.

**Mark for a maximum of 24 marks**

## 2. Observations

## Inferences

a) - colourless  $\checkmark\frac{1}{2}$  liquid formed on the colour parts of test tube  
- red litmus paper turns blue while blue litmus paper remains blue  $\checkmark\frac{1}{2}$   
- white residue is formed  $\checkmark\frac{1}{2}$   
*Award 1mk for any two correct observations*  
*Max. 1mk*

Hydrated  $\checkmark\frac{1}{2}$  salt / water of crystallisation  
 $NH_4^+$  present  $\checkmark\frac{1}{2}$   
*Reject: Alkaline gas present*  
*- Ammonia gas produced*

b) Solid dissolves  $\checkmark\frac{1}{2}$  to form a colourless  $\checkmark\frac{1}{2}$  solution

Soluble  $\checkmark\frac{1}{2}$  salt / polar substance coloured  $\checkmark\frac{1}{2}$  ions present

c) i) White precipitate  $\checkmark\frac{1}{2}$  soluble  $\checkmark\frac{1}{2}$  in excess

$Al^{3+}$ ,  $Zn^{3+}$ ,  $Pb^{2+}$  present  
*Award  $\frac{1}{2}$  if only one mentioned*  
*Penalise  $\frac{1}{2}mk$  for any contradictory ion*

ii) No white precipitate formed  $\checkmark 1$   
*Reject: no precipitate*

$Al^{3+}$   $Zn^{2+}$  present  $\checkmark 1$   
*Award only if the ion is mentioned in c(i) above*  
*Penalise  $\frac{1}{2}mk$  if only one ion given*  
*Penalise fully for any contradictory ion given*

iii) White precipitate  $\checkmark\frac{1}{2}$  insoluble  $\checkmark\frac{1}{2}$  in excess

$Al^{3+}$   $\checkmark 1$   
*Award only if the ion is mentioned in c(i) and c(ii) above*  
*Penalise fully for any contradictory ion given*

iv) A white precipitate  $\checkmark\frac{1}{2}$  that does not dissolve  $\checkmark\frac{1}{2}$  in nitric (V) acid

$SO_4^{2-}$   $\checkmark 1$   
*penalise fully for any contradictory ion*

3. Observations	Inferences
a) Burns with a yellow ✓½ / sooty ✓½ / smoky flame	$\begin{array}{c} \diagdown \\ \text{C} = \text{C} \\ \diagup \end{array} \text{ or } \text{---C} \equiv \text{C---} \quad \checkmark 1$ <p>Accept: unsaturated organic compound for ½mk            Reject: unsaturated hydrocarbon            - alkenes or alkynes written in words</p>
b) i) Effervescence / fizzing / bubbles ✓½	$\text{RCOOH} \quad \checkmark \frac{1}{2} \text{ or } \text{H}^+ \text{ present}$ <p>- award fully if only RCOOH mentioned            - penalise fully (deny ½mk) if only H<sup>+</sup> mentioned</p>
ii) Potassium manganate (VII) is decolourised ✓1 Or Purple potassium manganate (VII) solutions turns colourless Reject: solution is decolourised	$\begin{array}{c} \diagdown \\ \text{C} = \text{C} \\ \diagup \end{array} \quad \checkmark \frac{1}{2} \quad \text{---C} \equiv \text{C---} \quad \text{or ROH} \quad \checkmark \frac{1}{2}$
iii) Bromine water ✓1 is decolourised or yellow bromine water turns colourless Reject: orange / red colour - colour changes to colourless - solution is decolourised	$\begin{array}{c} \diagdown \\ \text{C} = \text{C} \\ \diagup \end{array} \quad \text{or} \quad \text{---C} \equiv \text{C---} \quad \checkmark 1$ <p>Award fully if only one functional group mentioned            Penalise fully for any contradictory functional group</p>