Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Kinetics

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Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

(a) H_2O_2 and/or I^- concentration change is negligible /
H_2O_2 and/or I^- concentration (effectively) constant

Only the concentration of H^+ changes.

so have a constant/no effect on the rate / so is zero order (w.r.t. H_2O_2 and I^-) / a and b are zero

Ignore references to H^+ is limiting reagent / rds / H_2O_2/I^- not in rate equation

Do not allow reference to catalyst.

2

(b) Stop the reaction / quench

By dilution / cooling / adding a reagent to react with H_2O_2/I^-

Allow valid suggestions about how to stop the reaction.

Do not allow reaction with acid/alkali / neutralisation for M2

Do not penalise other named reagents.

Ignore references to measuring volume and adding indicator

2

(c) M1: constant gradient

OR

change/decrease in concentration is proportional to time

Allow constant rate / rate = k

Ignore reference to straight line

Not increase in concentration / concentration is inversely proportional / concentration (on its own) is proportional

M2: as $[H^+]$ changes/decreases

M2 dependent on correct M1

Allow rate v concentration graph would give horizontal straight line owtte

Allow so $[H^+]$ has no effect on the rate

2

(d) evidence of attempt at calculation of gradient via $\Delta y/\Delta x$

allow construction lines on graph

$k_1 = 0.0012 / 1.2 \times 10^{-3}$

At least 2 sf (0.00118 – 0.00122)

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Correct answer scores 2/2

No ecf from incorrect or inverted numbers in M1

k_1 = – 0.0012 scores 1/2

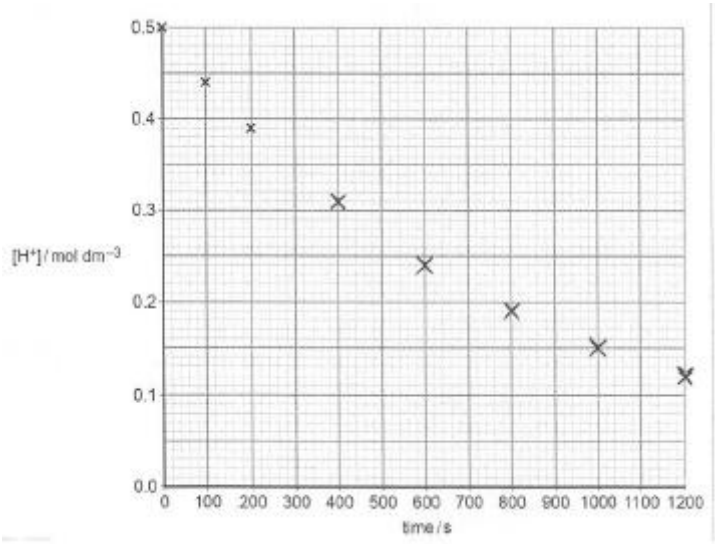
Additional processing of data such as including $[H^+]$ loses M2

units = $\underline{\text{mol dm}^{-3}\ \text{s}^{-1}}$

M3 mark independently

3

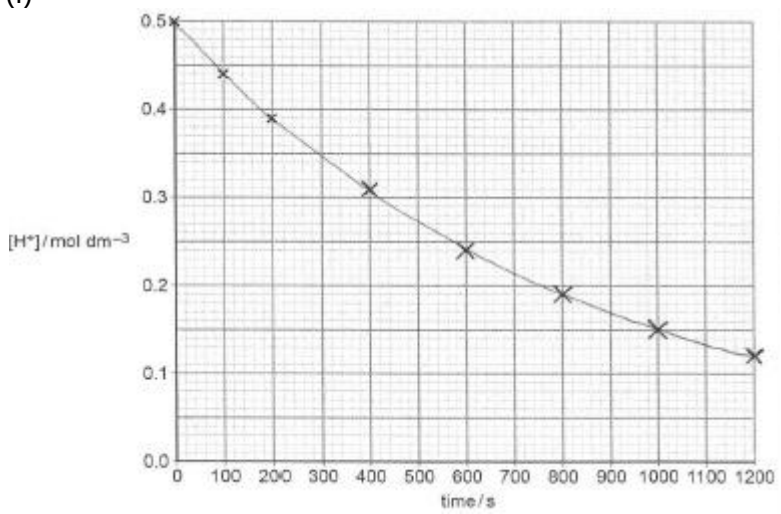
(e) 5 points correctly plotted



Allow ±half a small square for each point

1

(f)



Smooth curve only within one small square of all points (ecf on part (e))

Not a series of straight lines between points

1

(g)

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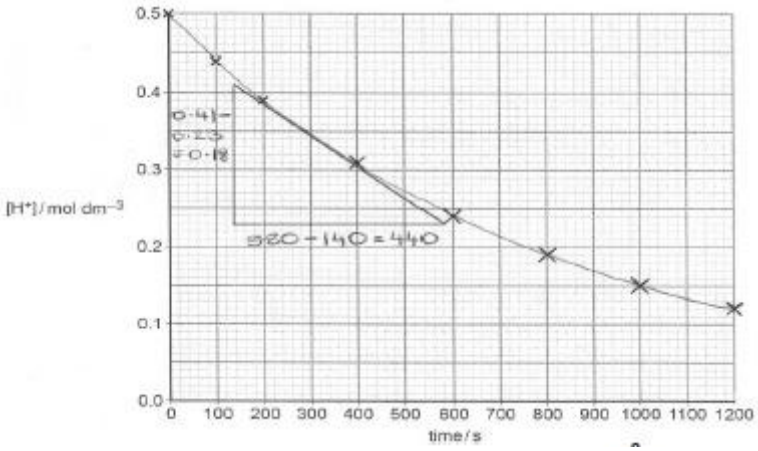

M1: Tangent to curve drawn at $[H_3O^+] = 0.35$ mol dm^{-3}
e.g. 0.18/440

M1 for a tangent / triangle / other suitable working

Allow ECF for both M1 and M2 following on from straight line drawn in 01.6, but must show suitable construction on graph for M1

M2: Rate = 4.09×10^{-4} (mol dm^{-3} s^{-1})

Ignore negative signs

Allow value in range 3.70×10^{-4} - 4.50×10^{-4}

At least 2sf

ecf from any straight line for correctly calculated gradient

2

(h) This question is marked using levels of response. Refer to the Mark Scheme Instructions for examiners for guidance on how to mark this question

Level 3 5-6 marks	All stages are covered and the explanation of each stage is correct and virtually complete. Answer is coherent and shows progression through all three stages. A clear explanation of how the order is determined from the results is needed to show coherence.
Level 2 3-4 marks	All stages are covered (NB 'covered' means min 2 from stage 2) but the explanation of each stage may be incomplete or may contain inaccuracies **OR** two stages covered and the explanations are generally correct and virtually complete Answer is coherent and shows some progression through all three stages. Some steps in each stage may be out of order and incomplete
Level 1 1-2 marks	Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies **OR** only one stage is covered but the explanation is generally correct and virtually complete Answer shows some progression between two stages
Level 0	Insufficient correct Chemistry to warrant a mark

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0 marks	

Indicative Chemistry content Method 1

Stage 1 Preparation

1a Measure (suitable/known volumes of) some reagents (ignore quoted values for volume)
1b Measure (known amount of) **X** / use a colorimeter
1c into separate container(s) – (allow up to two reagents and **X** measured together into one container); reference to **A**, **B** or **C** added last. NOT if **X** added last.

Stage 2 Procedure

2a Start clock/timer at the point of mixing (don't allow if only 2 reagents mixed) (allow even if **X** not added or added last)
2b Time recorded for appearance of blue colour/specific reading on colorimeter/disappearing cross
2c Use of same concentration of **B** and **C** / same total volume / same volume/amount of **X**
2d Same temperature/use water bath
2e Repeat with different concentrations of A (can be implied through different volumes of A and same total volume)

Stage 3 Use of Results

3a 1/time taken is a measure of the rate
3b plot of 1/time against volumes/concentrations of **A** or plot log(1/time) vs log(volume or concentration of **A**)
3c description of interpreting order from shape of 1/time vs volume or concentration graph / gradient of log plot gives order / allow interpretation of time vs concentration graph / ratio between change in concentration and change in rate (e.g, 2x[A] = 2 × rate so 1^{st} order)

Indicative Chemistry content – Alternative Method Using Colorimetry and repeated Continuous Monitoring

Stage 1 Preparation

1a Measure (suitable/known volumes of) **A**, **B** and **C** (ignore quoted values for volume)
1b Use of colorimeter
1c into separate container(s) – (allow up to two reagents measured together into one container) – ignore use of **X**

Stage 2 Procedure

2a Start clock/timer at the point of mixing
2b Take series of colorimeter readings at regular time intervals
2c Use of same concentration of **B** and **C** / same total volume / (same volume/amount of **X**)
2d Same temperature
2e Repeat with different concentrations of **A** (can be implied through different volumes of **A** and same total volume)

Stage 3 Use of Results

3a Plot absorbance vs time and measure/calculate gradient at time=0
3b plot of gradient against volumes/concentrations of **A** or plot log(1/time) vs log(volume or concentration of A)
3c description of interpreting order from shape of 1/time vs volume or concentration graph / gradient of log plot gives order

[19]

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