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

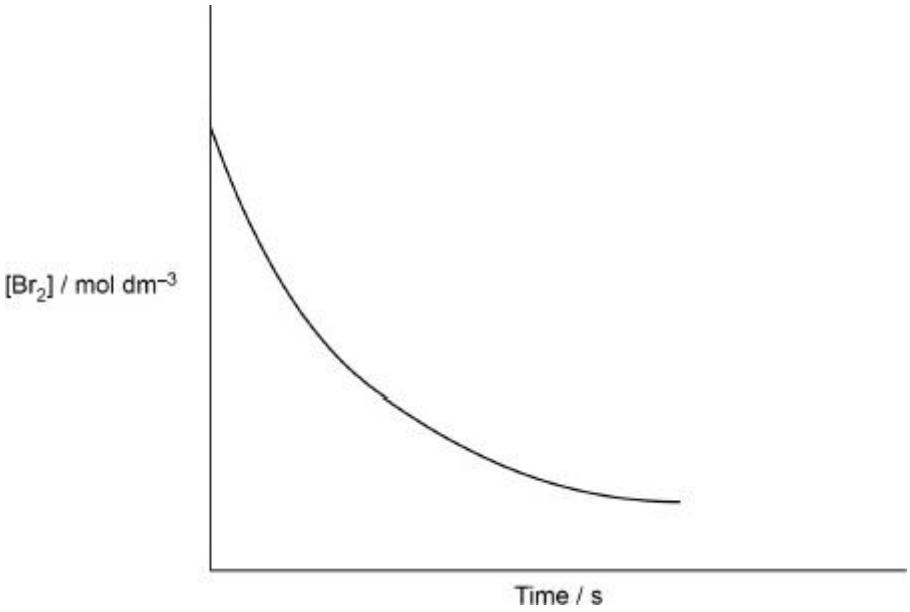
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Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Mark Schemes

Q1.

(a) Curve e.g.



Curve with decreasing gradient

1

(b) **M1** For $[OH^-] = 7.50 \times 10^{-2}$

M2 For rate = 2.75×10^{-11}

M3 $k = \frac{\text{rate}}{[CH_3COCH_3][OH^-]}$

M3 For rearranging rate equation

OR

$k = \frac{2.75 \times 10^{-11}}{(1.5 \times 10^{-2}) \times (2.5 \times 10^{-2})}$

For inserting correct numbers in rearranged equation

M4 $k = 7.3(3) \times 10^{-8}$

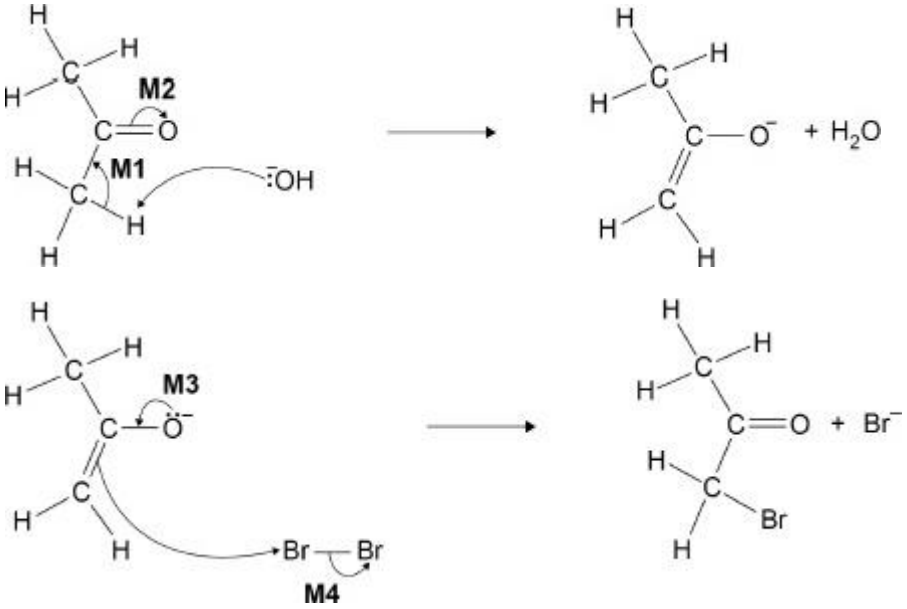
M5 Units = $mol^{-1}dm^3s^{-1}$

If rearrangement upside down lose M3 but can score M4 for 1.36×10^7 as ECF
M5 for mol dm^{-3} s as ECF

5

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(c)



M1 Arrow from C-H bond to C-C

M2 Arrow from C=O bond to O

M3 Arrow from lone pair on O to C-O bond

M4 Arrow from Br-Br bond to Br

Dipoles must be correct if shown for M4

4

(d) Step 1 includes CH_3COCH_3 <u>and</u> OH^- and these are also in the rate equation
OR
Step 1 contains all the species in the rate equation

Br_2 not in step 1 <u>and</u> not in rate equation so it has to be step 1

1

[11]

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Q2.

(a) **M1** (Instead of leaving the flask open) to avoid acid/solution/liquid escaping
OR
to avoid (acid/solution/liquid) splashing/spraying/spitting (out).

Ignore evaporation/spilling/to let gas escape/to avoid loss of product/reactant/impurities getting in

M2 (Instead of inserting a bung) to allow gas/CO_2 to escape

Ignore pressure would build up

Ignore air

NOT other wrongly identified gas(es)

2

(b) So that surface area/mass/amount stays (approx./effectively) constant

Ignore concentration stays constant

Ignore volume

Ignore so HCl is the limiting factor

Ignore so rate is only affected by [HCl] (as in Q)

1

(c) **M1** m_t/mass of CO_2 produced in time *t* is proportional to the (amount/concentration of) HCl that has reacted (at time *t*)

M2 m_{total}/total mass of CO_2 produced is proportional to the total (amount/concentration of) HCl that has reacted/was present initially

(therefore $m_{total} - m_t$ is proportional to (amount/conc of) HCl present at time *t*)

Allow 'Equal to'/'represents' for proportional to

Allow m_{total} is proportional to HCl 'added'

Alternative answer:

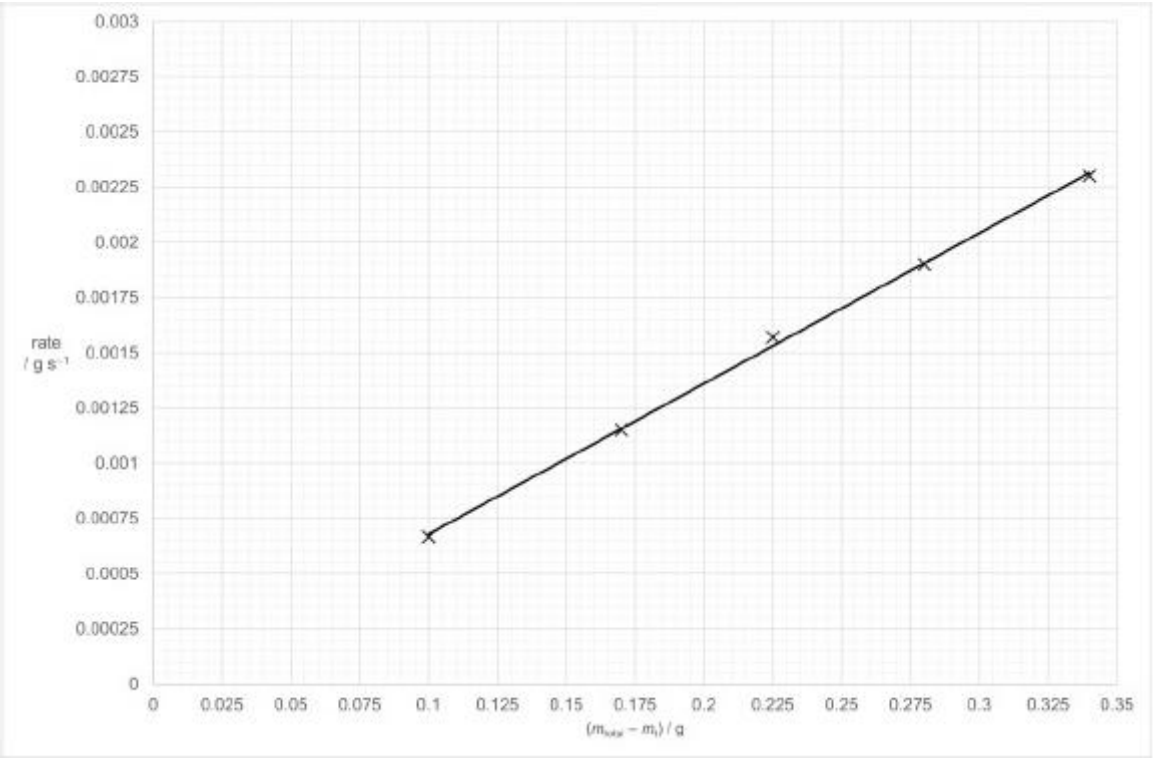
M1 $m_{total} - m_t$ is equal/proportional to (mass/amount of) CO_2 still to be produced

M2 (Mass/amount of) CO_2 still to be produced is proportional to (amount/concentration of) HCl still to react

2

(d)

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M1 Scales designed so that plotted points (and origin if shown) occupy >50% along each axis **and** axes labelled including units

NOT if either/both scale reversed but allow ecf M2 and M3.

M2 Plotted points (all within half a small square)

M3 Suitable straight line (should be within one square of all points except potentially the middle one)

M3 ECF for best fit line (points above and below) from their plotted points

3

(e) Straight line **AND** through origin

Allow 'constant gradient' for straight line

Ignore (directly) proportional

1

(f) Any two from:

- Volume of gas / CO_2
- pH
- Concentration of HCl/acid/H^+
- Conductivity

NOT temperature

NOT 'volume' or 'concentration' unqualified

NOT time for $CaCO_3$ to 'dissolve'/disappear (as in excess)

Ignore mass loss

Ignore amount of CO_2

2

[11]

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