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

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Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Mark Schemes

Q1.

(a) **M1** tangent drawn to the curve at 0,0
If tangent not drawn at 0,0 then allow conseq gradient calculation
1

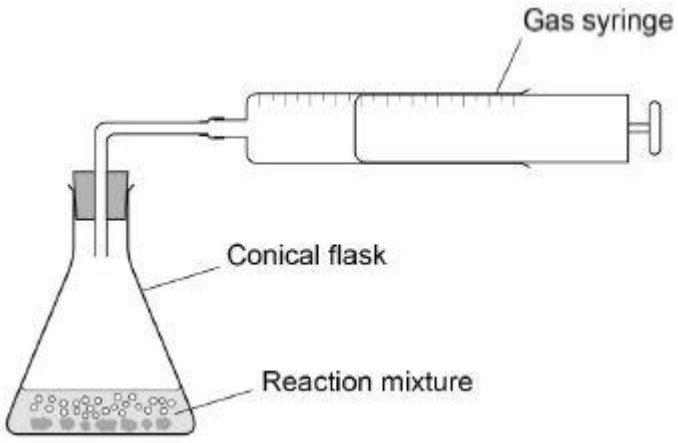
M2 Evidence of value used in calculation leading to initial rate = 5.5
Note allow 5 – 7
1

M3 $cm^3\ s^{-1}$
NOT cm^3 / s
1

(b) **M1** $[H_2PO_2^-]^2 \propto 1/t$
Accept time argument eg if conc doubled time is quartered
Accept suitable words that implies a square or square root relationship
1

M2 Order = 2
Not simple description of as conc increases time decreases 1
1

(c)



Either gas syringe or measuring cylinder over water

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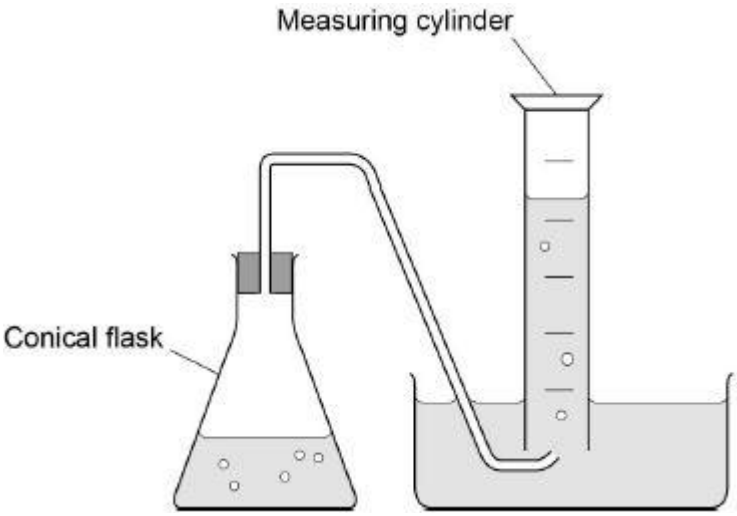

Tubing shown should not be closed
Syringe should have a plunger shown
Allow lack of graduations

1

(d) Falls by a factor of 8

OR Multiplied by $^{1}/_{8}$

OR Divided by 8
Allow halved then quartered / Decreases by 2^3

1

(e) **M1** $[M]^2 = \underline{Rate}$

Re-arrangement

1

M2 $[M]^2 = \frac{0.0250}{21.3 \times 0.0155}$ (=7.57 × 10–2)

Inserts correct numbers into their rearranged expression

1

M3 [M] = $\sqrt{7.57 \times 10^{-2}} = 0.275$ mol dm^{-3} (min 2 sf)

Takes square root (allow ecf for square root of their M2)
Common error is to use 0.25 rather than 0.025. This leads to an answer of 0.870. Scores 2
Upside-down expression leads to an answer of 3.63. Scores 2

1

(f) The sum of powers/indices (to which the concentrations are raised in the rate equation)

All the orders added/ sum of the (individual) orders
This can be explained using a general rate equation stated as an example
e.g. Rate = $k[A]^x[B]^y$ and the overall order is x + y

1

[11]

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Q2.

B

[1]

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Q3.

(a) DNA Replication

NOT mitosis
NOT DNA synthesis
Ignore terms relating to cell division processes
Ignore 'damages DNA'
Ignore DNA transcription
Ignore 'cell replication'

1

(b) $[Pt(NH_3)_2Cl_2] + H_2O \rightarrow [Pt(NH_3)_2Cl(H_2O)]^+ + Cl^-$

***M1** Correct formula **and** charge of B*

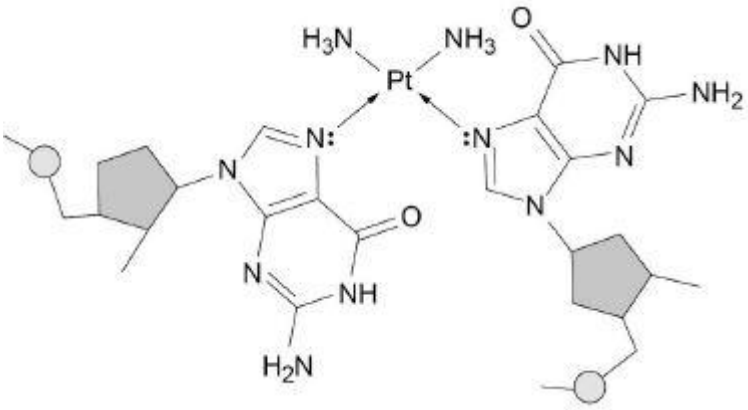
1

***M2** Correct balancing **and** charges in equation*

1

*Allow **M2** if the **only** error in complex B is the charge*
*(**M1** not awarded) with Cl^- **only***
ALLOW complexes without [ ] and/or ( ) around H_2O
IGNORE ( ) around Cl
*NOT any additional different species (loses **M2**)*
(allow uncancelled water on both sides)

(c)



***M1** Pt in a cis-diammine complex bonded to the correct nitrogen atoms*
Pt must have the two ammonia ligands shown
NOT if drawn as trans
IGNORE any charge on Pt
Ignore any wedges and dashes (3D representations)

1

***M2** both lone pairs shown **OR** two arrows indicating co-ordinate bonds*
*Allow **M2** if bonds to platinum are from the incorrect nitrogen atoms*

1

(d) **M1** plot concentration (y-axis) against time (x-axis) **and** take tangents / (calculate the) gradients (to calculate rates)

Allow concentration-time graph
NOT time-concentration graph (unless clarified in words or sketch) but mark on

1

M2 Plot rate/gradients against conc

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1

M3 straight line through origin / directly proportional confirms first order

allow first order if rate halves/doubles when conc halves/doubles

1

*Alternatives to **M2** and **M3**:*

***M2** Plot a graph of log rate vs log conc*
***M3** (Straight) line of gradient = 1*

***M2** measure (at least) two half-lives (in this case, tangents not required for M1)*
***M3** constant half-life means first order*

***M2** compare rates/gradients at different concentrations*
***M3** first order if rate halves when conc halves*

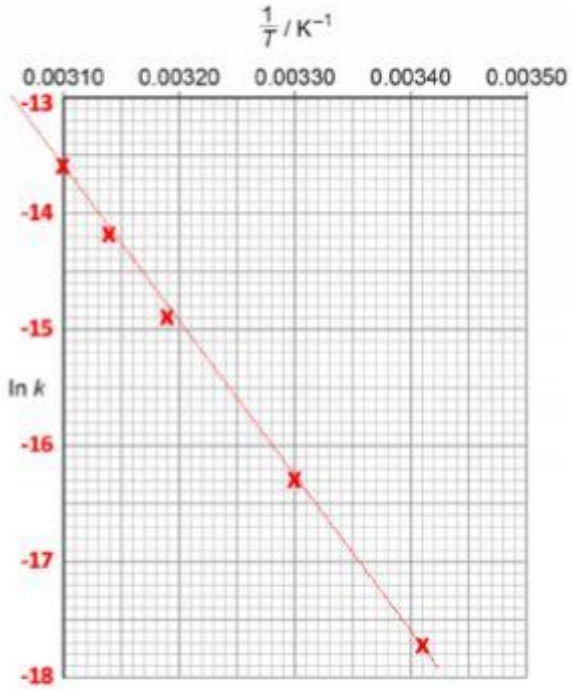
(e)

temperature, T / K	$\frac{1}{T}$ / K^{-1}	rate constant, k / s^{-1}	ln k
318	0.00314	6.63×10^{-7}	−14.2

Allow 3.14 x 10^{-3}

2

(f)



Gradient = −13 125

$\left(-13125 = \frac{-E_a}{R}\right)$

E_a = 13 125 x 8.31 = 109 069
= 109 (kJ mol^{-1})

Vertical axis with sensible scales (plotted points must take up more than half the grid) NOT M1 if y-axis in wrong direction

1

all points plotted correctly (within ±0.5 small square)

1

Best fit straight line based on the student's data (ignoring anomalous point if relevant)

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Gradient calculated within range: 12876 - 13598 **1**

Mark is for their (gradient x 8.31) ***and*** *conversion into kJmol^{-1}* **1**

E_a in the range: 107 – 114 kJ mol^{-1}

NOT a negative activation energy **1**

[15]

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