

Practice Question Set For A-Level

Subject : Chemistry

Paper-2 Topic: Rate Equations

Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Mark Schemes

Q1.

D

[1]

Q2.
c

[1]

Q3.

- (a) Straight line through (0.00, 0.50) which cuts time axis at between 5 and 12.5 secs OR conc 0.3 at time between 2s and 5s

If 'tangent' does not touch 0.5 mol dm^{-3} then CE=0 for (a) and (b).

no tangent scores 0 in (a) and (b).

1

- (b) Mark is for correct calculation of their gradient :

e.g. $0.50/11 = 0.045$

or $4.5 \times 10^{-2} \text{ (mol dm}^{-3} \text{ s}^{-1}\text{)}$

If 'tangent' does not touch 0.5 mol dm^{-3} then CE=0 for (a) and (b)

Ignore negative sign

Expect a value between 0.04 and 0.1

1

- (c)

[A] increases by $\sqrt{1.7}$

$$\begin{aligned} \text{new}[A]^2 &= 1.7 \times \\ (0.50)^2 & \\ &= 0.425 \end{aligned}$$

$$\begin{aligned} \text{new}[A] &= 1.30 \times 0.50 \\ &= 0.65 \text{ (mol dm}^{-3}\text{)} \\ &2 \text{ sfs min} \end{aligned}$$

$$\begin{aligned} \text{New [A]} &= 0.65 \text{ (mol} \\ &\text{dm}^{-3}\text{)} \\ &2 \text{ sfs min} \end{aligned}$$

Award 2 for 0.65

Award 1 mark for an AE using a correct method

If candidate use their rate then CE=0

0.85 scores 1 if $\sqrt{}$ shown

2

[4]

Q4.

(a)

$$k = (\text{rate}/[C][D]) = \frac{3.1 \times 10^{-3}}{(0.48) \times (0.23)}$$

Mark is for insertion of numbers into correctly rearranged rate equation

1

$$= 2.8 \times 10^{-2} \quad \text{min 2sfs}$$

1

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

Mark units separately in any order.

1

(b) $\ln k = \ln 2.8 \times 10^{-2} (= -3.58)$

M1 = $\ln$ (their k)

If incorrect then award M2 and M3 only

Alternative value

$$\ln k = \ln 3.2 \times 10^{-3} = -5.74$$

M1

$$E_a = RT(\ln A - \ln k)$$

OR

$$-E_a = RT(\ln k - \ln A)$$

If $\ln 16.9$ used max 3

If temp used 25 max 2

Incorrect rearrangement then M1 only

M2

$$E_a = 8.31 \times 298 (16.9 + 3.58) \quad (= 50716 \text{ J mol}^{-1})$$

Alternative value

$$E_a = 8.31 \times 298 (16.9 + 5.74)$$

$$(= 56076 \text{ J mol}^{-1})$$

M3

$$E_a = 51 \text{ kJ mol}^{-1}$$

– 50.7 or -51 scores max 2

Alternative value

$$E_a = 56 \text{ kJ mol}^{-1}$$

M4

[7]

Q5.

(a) **Stage 1: Calculates value of $[\text{C}_6\text{H}_5\text{CHO}]^2$:**

M1 for the values (0, 0.0625; 0.25; 0.56 and 1) in the table.

Ignore precision.

1

Stage 2: Plots graph:

M2 for the graph labels with units and appropriate scales and using sensible proportion of graph (plotted points must cover at least half the printed grid).

$[\text{C}_6\text{H}_5\text{CHO}]^2$ on x-axis (with units) $\text{mol}^2 \text{dm}^{-6}$

Initial rate on y-axis (with units) $\text{mol dm}^{-3} \text{s}^{-1}$

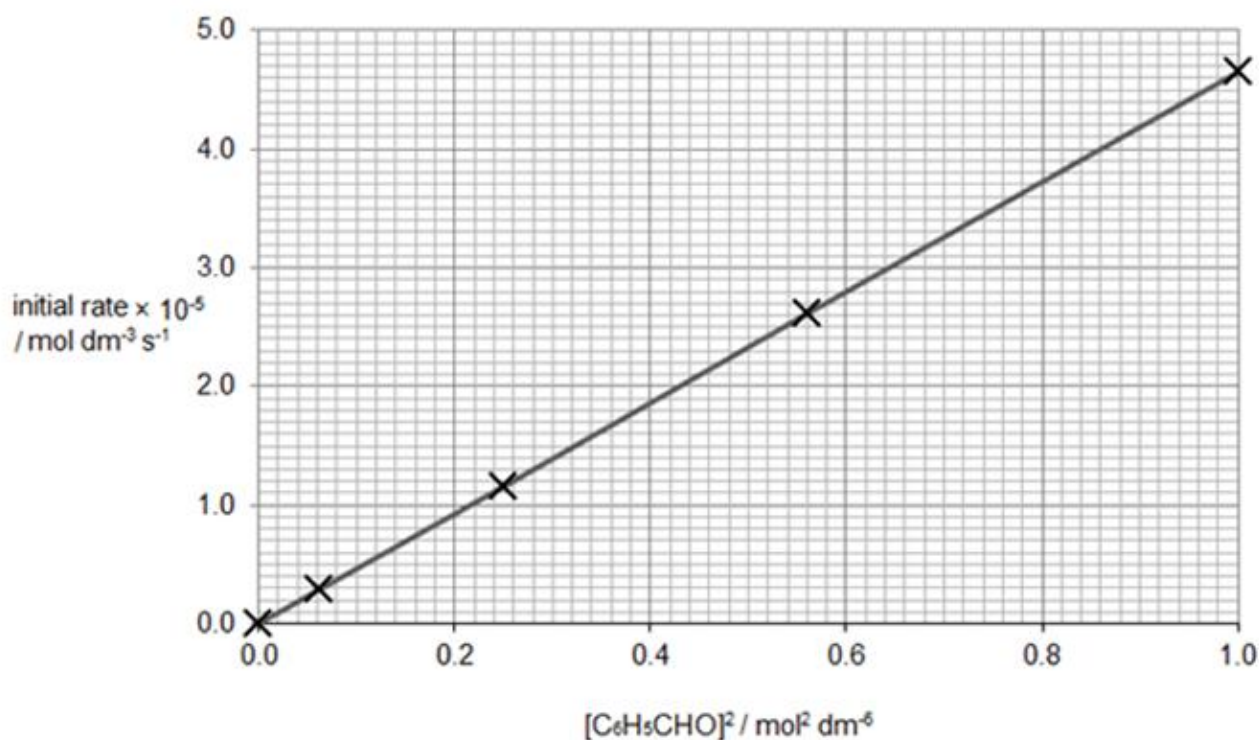
1

M3 for the plotting of 5 points.

1

Stage 3: Line of best fit:

M4 for the line of best fit.



1

(b) 2nd order

1

(since) $[\text{C}_6\text{H}_5\text{CHO}]^2$ plotted against rate is straight line / directly proportional.

1

(c) (Role of CN^-) catalyst

Ignore nucleophile.

1

CN^- appears in the rate equation but is not in the reaction equation.

1

[8]