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.

C

[1]

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Q2.

D

[1]

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Q3.

$A = k / e^{-E_a/RT}$

$= (3.46 \times 10^{-8}) / e^{-96200/(8.31 \times 298)}$

$= 2.57 \times 10^{9}$

s^{-1}

OR using $\ln k = \ln A - E_a/RT$

$\ln A \rightarrow = \ln k + E_a/RT$

$\rightarrow = -17.179 + 38.847 = 21.667$

$A \rightarrow = 2.57 \times 10^{9}$

s^{-1}

M1 *Rearrangement (if wrong can only score M2 & M4)*

1

M2 *Correct conversions of both E_a and T*

1

M3 *Answer allow 2.45×10^{9} to 2.6×10^{9}*

1

M4 *Units*

1

If use 96.2kJ, $A = 3.60 \times 10^{-8}$
If use 96.2kJ and 25°C, $A = 5.50 \times 10^{-8}$

[4]

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Q4.

(a) Expt 2 3.2×10^{-4}

Expt 3 3.2×10^{-4}

Both needed

1

(b) P order = 1

1

Q order = 2

1

These answers only, not consequential on part (a)

Allow if part (a) blank.

(c) (Rate = $k[R]^2[S]^2$)

k = Rate/$[R]^2[S]^2$ **OR** $1.20 \times 10^{-3}/(1.00 \times 10^{-2})^2(2.45 \times 10^{-2})^2$

***M1** for rearrangement*

M1

k = 19992 = 2.00×10^4

***M2** for answer (Allow 1.99×10^4)*

M2

Units $mol^{-3}\ dm^9\ s^{-1}$

*Allow conseq units for their expression in **M1***

M3

[6]

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Q5.

C

[1]

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Q6.

(a) $k = \frac{2.4 \times 10^{-2}}{0.10 \times 0.20 \times (0.30)^2}$

Mark is for insertion of numbers into a correctly re-arranged equation.

1

= 13 (must be 2 sfs)

1

Units $\underline{mol^{-3}\ dm^{+9}\ s^{-1}}$

Can be in any order

1

(b) Experiment 2 $[BrO_3^-] = 0.15$

1

Experiment 3 rate = 0.26 or 0.27

1

Experiment 4 $[H^+] = 0.45$ or 0.46

If k wrong in (a) : allow the expected answer OR values conseq to their k (allow mix & match)

Ex 2 $[BrO_3^-] = 2/k$

Ext 3 rate = 0.02 × k

Ex 4 $[H^+]$ = square root of (2.7/k)

1

(c) 1/T value $3.31(1) \times 10^{-3}$ or 0.00331(1)

Must be 3 sig figs or more

1

ln(1/t) value –3.30 or –3.297

Not allow –3.29

1

(d) **M1** y axis labelled with values (no units) and plotted points use over half of the axis

1

M2 points plotted correctly (see graph below)

1

M3 best fit straight line (minimum 3 points plotted)

+ - one small square for line of best fit

1

M4 gradient = $– 6.64 \times 10^3$ (K) or -6640 (K)

Range - 6.5×10^3 to - 6.8×10^3 or -6500 to -6800

1

M5 E_a = M4 × 8.31

If gradient outside range then max 4 for M1, M2, M3 and M5

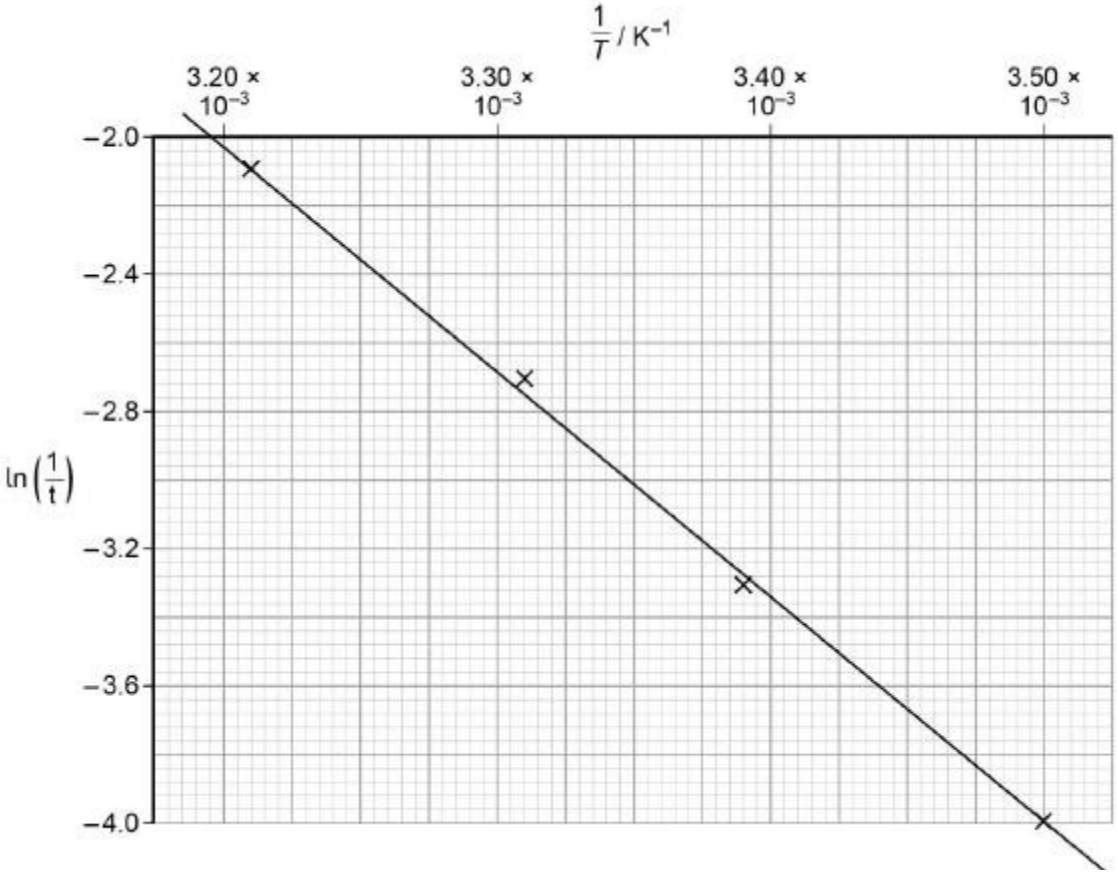
1

M6 = 55.2 kJ mol^{-1}

Range 54.0 - 56.5

1

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[14]

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