Determining the activation energy for the reaction between bromide and bromate(v) ions

Chemistry Portfolio By Clement Ng 12.6

Data Processing

Quantitative Data:

Temperature ($^{\circ}C$) ($\pm 1^{\circ}C$)	Time taken to turn clear (s) ($\pm 1s$)
75	6.0
65	8.0
55	15.3
47	26.3
36	76.0
25	240.0

Errors:

- ($\pm 1^{\circ}C$) Temperature error
  As contents in boiling tube may not be the same as the temperature in the water bath, due to heat lost in transfer process through glass. Furthermore, during the mixing of the contents, boiling tubes were removed from water bath, lowering the supposed temperature. Even though after mixing, the boiling tubes were immediately placed back into the water bath, temperature in water bath is already altered, further increasing the temperature error.
- ($\pm 1s$) Time error
  This was due firstly to the reaction time needed to press the start and stop button on the stopwatch. Secondly, it is very hard to detect the colour change; is it truly clear, or is it still faint in red colour. Therefore the stopwatch maybe stopped a little bit earlier or a little bit too late, the duration needed to turn the methyl red clear would be inaccurate, increasing the time error.
- ($\pm 0.5 cm^3$) Volume error
  This was due to the meniscus/parallax effect. The angle in which the chemicals are measured in, vary the volume. Furthermore, for some chemicals, a 50 cm^3 measuring cylinder was used instead of a 10 cm^3 one, this also increases the volume error as a wider scale often produces more accurate results.

Quantitative Data (observations)
Throughout the experiment it was observed that when methyl red indicator was inserted inside the phenol and bromide/bromate solution, it turned faint yellow. However when the acid was mixed with the solution, it quickly turned bright red. Once rested on the water bath again, the solution slowly turned colourless, finally it started to go cloudy, a milk like solution.

Data Processing

Processed table:

Time (s) ($\pm 1s$)	$\ln t$	Temperature (k) ($\pm 1K$)	$\frac{1}{T}$
6.0	1.791	348	0.00287
8.0	2.079	338	0.00296
15.3	2.728	328	0.00305
26.3	3.270	320	0.00313
76.0	4.331	309	0.00324

240.0	5.481	298	0.00336

Graphs are presented at the last page of this report.

Percentage Errors

- Time

Initial error: $\frac{1}{6}\times 100\% = 16.67\%$

Final error: $\frac{1}{240}\times 100\% = 0.417\%$

Average error: $\frac{16.67 + 0.417}{2} = 8.54\%\ (3.s.f)$

- Temperature

Initial error: $\frac{1}{348}\times 100\% = 0.287\%$

Final error: $\frac{1}{298}\times 100 = 0.336\%$

Average error: $\frac{0.287 + 0.336}{2} = 0.311\%\ (3.s.f)$

- Total Error: $8.54 + 0.311 = 8.85\%\ (3.s.f)$

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