Investigation 6: Evaporative cooling of a solvent mixture

Moderator comments

Criterion	D	DCP	CE
Achievement level awarded	5	6	6
Achievement of aspects	c, c, p	c, c, c	c, c, c

Design

Defining the problem and selecting variables

Complete

This aim nicely focuses the general aim given by the teacher by clearly identifying the system under investigation (propanone/ethanol) and the independent variable (mole composition of mixture). The dependent variable, although given by teacher, was clearly identified as such by the student. Sufficient control variables were identified. All four key components of aspect 1 (focused research question/dependent/independent/control variables) have been fulfilled.

Controlling variables

Complete

The student explicitly stated steps that were intended to control variables such as the draught excluder and the constancy of the size and exposed surface area of the tissue paper. This last factor helps control the volume of liquid used. Although not perfect there is sufficient evidence to satisfy this aspect.

Developing a method for the collection of data

Partial

Although a sufficient number of data points were designed for, the compositions to be used were not well defined and there was no consideration of duration over which data was to be collected. This was apparent in the outcome of the experiments.

Data collection and processing

Recording raw data

Complete

The data logger plots were taken as evidence towards this aspect. All relevant data can be easily identified by the reader.

Processing raw data

Complete

The student satisfied the aim of the experiment by plotting mole composition versus degree of cooling. There is good use of MS Excel® since the student also found a curved trend line with a greater correlation coefficient than the linear plot. This is where the use of IT extends opportunity for processing.

Presenting processed data

Complete

The mole composition versus cooling plots were well formed and clearly presented. The plotting with best-fit lines satisfies the requirement regarding consideration of errors and uncertainties. Error bars are not stipulated in chemistry internal assessment so there is no penalty for not including them.

Conclusion and evaluation

Concluding

Complete

The statement in the subject guide's clarification to this aspect, that "analysis may include comparisons of different graphs or descriptions of trends shown in graphs", is well demonstrated. The student also meets the clarification's requirement that "the conclusion must take into account any systematic or random errors and uncertainties".

Evaluating procedure

Complete

The student has identified three appropriate sources of systematic error.

Improving the investigation

Complete

The student suggested modifications to the three sources of systematic error. The student also has addressed a clear failing of the original data, its poor distribution of compositions, and since clarification to aspect 3 states that the "data range can be addressed here" it is only now that aspect 3 can be considered complete. In other cases, where a more appropriate range of data had been collected, this statement may not have been necessary and the complete could have been awarded without it. The data directs the marking of this criterion.