DCP/CE

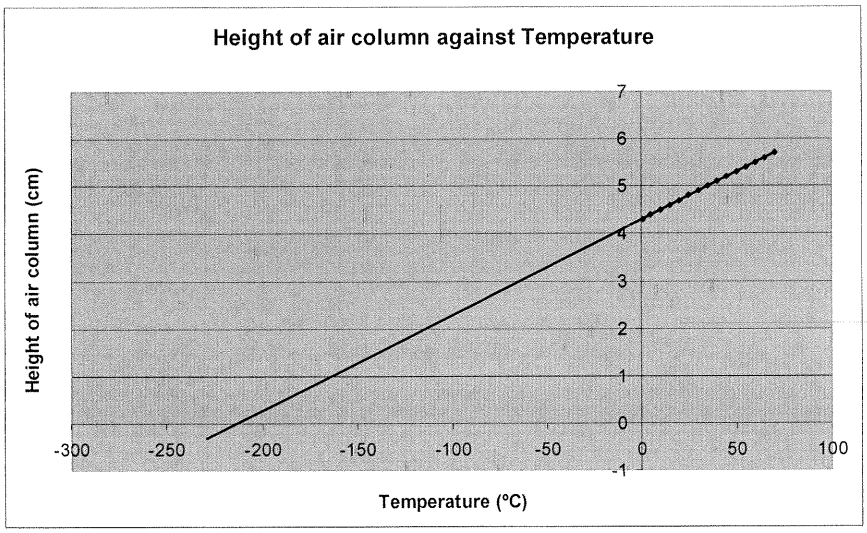
DETERMINATION OF ABSOLUTE ZERO ON THE CELSIUS SCALE

Data collection and processing:

DCP 1

Temperature °C (+/- 0.05 °C)	Length (cm) (+/- 0.05 cm)
1	4.4
5	4.4
10	4.5
15	4.6
20	4.7
25	4.8
30	4.9
35	5.0
40	5.1
45	5.2
50	5.3
55	5.4
60	5.5
65	5.6
70	5.6

DCP 2/3



Percentage Error (-220 - -273)/-273 x 100 = 19%

Conclusion:

CE 1 After having carried out my planned investigation, I found absolute zero on the Celsius scale to be -220 °C. The point of absolute zero on the Celsius scale is -273 °C (literature value). This gives us a percentage error of 19 %. The uncertainty in our result would be due to systematic errors rather than random errors.

CE 2 A systematic error that could influence our result could be a difference between the measured temperature of the water bath and the actual temperature of the air inside the capillary tube. The temperature of the water bath was unstable and therefore it was difficult to compare temperature and length so that results could be efficient.

Investigation 5: Absolute zero

Criterion	D	DCP	CE
Achievement level awarded	3	2	
Achievement of aspects	p, p, p	p, p, n	

Assessment

Data collection and processing

Recording raw data

Partial

The uncertainty in temperature given does not seem to reflect the precision of a thermometer. There was probably relevant qualitative data to be recorded such as a comment about the rate of heating, especially since the student does refer to a possible temperature inequality between the water bath and the air in the tube.

Processing raw data

Partial

The student has correctly plotted the data on a graph that can be extrapolated back to the x-axis. However, the measurement of the intercept is incorrect. On careful inspection it can be seen that the intercept as at T=-213° C (which is T=-210° C to two significant figures) not T=-220° C as given by the student.

Presenting processed data

Partial

The graph is fairly well constructed with the trend line apparently being best fit. This is hard to judge but the benefit of the doubt is given here. However, the labelling of the y-axis is in an inappropriate position and should have been correctly inserted by hand if the software could not be correctly manipulated. The student should have inserted minor tick marks every 10° C on the x-axis since this would have prevented the error in reading off the intercept value. This example demonstrates that MS Excel® graphing is a skill that has to be carried out every bit as carefully as traditional graphing by hand if full marks are to be gained.

Conclusion and evaluation

Concluding

Partial

The student has concluded an experimental value for absolute zero temperature in Celsius and has compared it to the literature value. The student has not fully justified the assertion that systematic error is

needed to explain the difference from the literature value. The student has addressed the components described in clarification to this aspect in the subject guide without really fulfilling them.

Evaluating procedure

Partial

The student has identified one realistic source of systematic error, just enough to gain credit.

Improving the investigation

Not at all

No improvements/modifications are mentioned when there clearly were quite a number possible, for example, there is no mention of how to ensure enough time has been allowed for the water and the air in the capillary tube to reach thermal equilibrium.