TITLE: Cryoscopy

ASSESSMENT CRITERION: C

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| 7-8 | The student is able to:  i. **correctly collect, organize, transform and present** data in numerical and/or visual forms  ii. **accurately interpret** data and **explain** results **using correct scientific reasoning**  iv. **evaluate** the validity of the method based on the outcome of a scientific  investigation  v. **explain** improvements or extensions to the method that would benefit the  scientific investigation. | The student registers in a well formatted table (title, labeled columns including magnitudes and units) the raw and/or processed data obtained in the lab.The student plots correctly (title, axes labelled with magnitudes and units, right scale, points well drawn, best fit line present) the raw and/or processed data obtained in the lab.  * The calculations are right and an example of them is shown. * The student explains scientifically the trend/pattern observed. * The student gets a main conclusion from a right interpretation of the results. * The conclusion is argued with comments on precision and accuracy of the results, and, when applicable, of the percentage difference between the obtained value and the awaited one. * The student establishes the validity of the method, discussing its implications and limitations (precision, accuracy, etc.) based on the right interpretation of the results. * The student explains in detail two or more non trivial sources of error or weaknesses of the method. * The student explains in detail realistic improvements for each mentioned weaknesses and/or extensions of the method that would benefit the investigation. |

OBJECTIVES: Verify decreasing freezing point law. Obtain the cryoscopic constant of water.

MATERIALS:

* 6 short test tubes in a rack
* Thermometer
* Large beaker
* Crushed ice
* Salt
* Water
* Sugar (sucrose)
* Scale

SECURITY:

* Use goggles.

PROCEDURE:

1. Set up the freezing mix in the beaker by adding salt to the crushed ice.
2. Fill each test tube with 3.0-3.5 g of water, weighing exactly the amount with the scale.
3. Put in each tube the following amounts (approximately) of sugar: 0, 0.2, 0.4, 0.6, 0.8, 1.0 and dissolve them. Weigh the exact amount with the scale.
4. Dip each tube in the freezing mix and allow it to freeze. Use the thermometer to measure the temperature as well as a stirrer. (It is not unusual that the temperature drops a lot and when freezing occurs it rises, this is called overcooling).

TASKS:

1. Make a table with your data including molality and freezing point.
2. Plot your data in a suitable way to find out the cryoscopic constant of water.
3. Find out the real value in the bibliography (REFERENCE!) and compare your value with it.
4. Explain the meaning of your results and write out your conclusion, including if possible, data from the bibliography.
5. Evaluate the procedure in respect to precision and accuracy of the results. Indicate weaknesses and sources of error and improvements for them.