

**10 Molecular Mass of an Unknown Solute Lab (1723738)**

Question

1 2

**Instructions**

Molecular Mass of an Unknown Solute 2.0

Materials: wireless temperature probe, Vernier Graphical Analysis App, iPad, electronic balance, small test tube, test tube rack, repipette, cyclohexane, one-hole half sized (#0) stopper, unknown solute, sodium chloride, ice bath(400 mL beaker), magnetic stirrer, magnetic stirbar, weighing pan

Objective: To determine the molecular mass of an unknown solute.

Procedure:

Pre-Lab:

1. Obtain a wireless temperature probe and note its number.
2. Open the app "Graphical".
3. Open a New Experiment. Choose "Wireless Devices" and then select Go Wireless Temp probe with the number on your probe and click "Done".
4. Click on Mode (bottom left corner) and make sure start collection and end collection are both set to "Manually".

Lab:

1. Using the repipette, put 10.00 mL of cyclohexane into a clean dry small test tube.
2. Place a magnet stir bar in the test tube. Place a temperature probe in a one-hole (#0) half-sized stopper and then place the probe in the test tube so that it is in the liquid above the magnet and try to keep it in the middle.
3. Set up an ice bath with tap water and ice in a 400 mL beaker so that there is ice throughout the bath.
4. Place the test tube in the ice bath on a magnetic stirrer to stir the cyclohexane.
5. Click "Collect" on the iPad app. Determine the freezing point of cyclohexane(the temperature should stabilize). Watch for signs of crystallization in the cyclohexane. Record the freezing point temperature. Click "stop" button on the app.
6. Remove the test tube from the ice bath and remove the temperature probe. Set the test tube in a test tube rack.
7. Weigh out an exact mass between 0.200 g and 0.250 g of the unknown solute using the electronic balance. Record this mass and place the unknown in the cyclohexane in the test tube.
8. Hold the test tube over the magnetic stirrer (not in the ice bath) until the unknown solute completely dissolves in the cyclohexane. If the cyclohexane is frozen, warm the test tube by wrapping your fingers around it for a minute or two.
9. Add two spoonfuls of NaCl to the ice bath, place the temperature probe back in the test tube, and repeat steps 4-6.
10. Retrieve the magnetic stirrer with another magnet and empty the test tube in the waste container. (NOT in the sink) Do not clean the test tube, simply return it to the rack. The leftover cyclohexane will evaporate.

Data:

Mass of the unknown solute \_\_\_\_\_

Freezing point of cyclohexane \_\_\_\_\_

Freezing point of cyclohexane and unknown solute \_\_\_\_\_

Volume of cyclohexane \_\_\_\_\_

Calculations:

1. Calculate the freezing point temperature change of the solution.

2. Calculate the mass of the solvent. (density of cyclohexane = 0.7785 g/mL)
3. Calculate the molality of the solution. ( $K_f$  of cyclohexane =  $19.97^\circ\text{C}/m$ )
4. Calculate the molecular mass of the unknown. Round your final answer to the appropriate number of significant figures. Do not round off step calculations.

## 1. Question Details

Lab Partners [1837468]

Enter the name(s) of your lab partner(s). (If you worked by yourself, enter "none").

## 2. Question Details

Molecular Mass of an unknown Solute lab data sheet [1721707]

Enter your lab data below.

- a) Mass of the unknown solute:  4.0 ✓ grams
- b) Freezing point of the cyclohexane:  4.0 ✓  $^\circ\text{C}$
- c) Freezing point of the cyclohexane and solute mixture:  4.0 ✓  $^\circ\text{C}$
- d)  $\Delta T_f$ :  4.0 ✓  $^\circ\text{C}$
- e) Volume of cyclohexane:  4.0 ✓ mL
- f) Mass of cyclohexane:  4.0 ✓ grams
- g) Mass of cyclohexane:  4.0 ✓ Kg
- h) What is the Van't Hoff factor for a molecular solute?
- i) Molality of solution:  4.0 ✓ m
- j) Molar Mass of unknown solute:  4.0 ✓ g/mol

## Assignment Details

Name (AID): 10 Molecular Mass of an Unknown Solute Lab (1723738)

Submissions Allowed: 5

Category: Lab

Code:

Locked: Yes

Author: Ryan, Matt ( [mryan@allsaintsschool.org](mailto:mryan@allsaintsschool.org) )

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