Water and Diffusion Lab - Biofundamentals

Name: **Date**:
LA section:

Experiment 1: Water density and temperature:

Use the apparatus to determine the temperature at which liquid water has the highest density – include an image of your data graph!

Answer the questions

Q1: Why can changes in volume be used to estimate changes in density?
Q2: Where might errors creep into your observations?
Q3: Why don't all liquids display a temperature versus density relationship similar to that of water?
Q4: If a single molecule does not have a temperature, what does temperature measure?
Q5: Why is ice less dense than water?
Q6: What would happen to our apparatus if the water in it froze?

Experiment 2: Diffusion distance as a function of time

To determine the relationship between time and the average distance traveled by the particles, pick 10°C, 15°C or 20°C and this temperature through your first set of experiments. Perform at least three independent experiments using the **vScope**. Make a table of your data (this will be handed in). For each set of measurements, calculate the mean distance traveled and standard deviation for each time point.

Plot these points, with +/- the standard deviations on a graph of distance (y-axis) versus time (x-axis). Hand in your graph with your report.

Experiment 3: Diffusion as a function of temperature

Choose at least four temperatures (we suggest 5, 10, 15, 20 and 30°C). Perform at least 3 trials for each temperature; some may have to be longer than 30 seconds. For each trial, at each temperature, note the time it takes for the average distance traveled to reach 200 μm. Calculate the mean and standard deviation for each temperature, and plot these points on a graph of time (y-axis) versus temperature (x-axis). Hand in your graph with your report.

Answer the questions

Q1: Is the relationship between time and average distance traveled linear?
Q2: Is the relationship between time to travel a set distance and temperature linear?
Q3: Would changing the distance traveled change your answer?
Q4: In your experiments why did you not get exactly the same value for each measurement? What was the source of the variation?
Q5: Does the presence of variation mean that the system cannot be described mathematically?
Q6: How would decreasing the number of diffusing particle from 30 (as it is) to 5 alter your measurements?
Q7: How would increasing the number of diffusing particle from 30 to 1000 alter your measurements?
Q8: Einstein hypothesized that invisible particles were responsible for Brownian motion – was this scientific, postulating invisible particles?