### **Sequence**

1. Activity 1 - Demo/Discussion - diffusion of dye in hot and cold water
2. Worksheet 1 - storyboard of water.
3. Lab 1 - Temperature scales - Fahrenheit and Celsius
4. Worksheet 2 - Working with Expressions
5. Worksheet 3 - Working with Functions
6. Pyret Activity 1 - Temp Converter Program
7. Follow-up - Create the inverse
8. Worksheet 4 - Working with Images
9. Pyret Activity 2 - Thermometer Program

### **Activity 1 - Demo/discussion: diffusion of dye in hot and cold water**

In this demonstration, obtain two large beakers or flasks. Fill one with cool to cold water and the other with very warm water (not boiling). Allow the water to become still on a demo table before beginning the demonstration. Add 1-2 drops of a dark food dye to the water in each flask and observe the diffusion of the dye in the water. Using two different colors, such as red and blue, makes it easier to keep track of which beaker is hot and cold during discussion.

Students are asked to describe what they saw macroscopically, and then explain their observations in terms of the particle model we have developed so far (small, separate particles in motion that move randomly by collision). The discussion should draw students to explain the observed behavior in terms of the effect that adding energy to the system of particles has on temperature and the speed of the particles.

An important aspect of our model of matter that is being developed in this unit is that particles interact via collision to change motion and transfer energy from particle to particle. This feature of our model provides a mechanism for understanding energy transfer by both heating and working (introduced in Unit 3) and for understanding reactions beginning in Unit 7. It is helpful to students to explicitly identify these features of our model following these activities.

### **2. Worksheet 1 - Storyboard**

Students will prepare two storyboard sequences, one each for the hot water and cold water diffusion observations. To contrast the difference in rate, each storyboard sequence should contain the same number of frames at the same time intervals. These can be prepared individually as a homework assignment, however, ideally as class time allows, prepared in groups on whiteboards for discussion.

### **3. Lab 1 - Temperature scales - Fahrenheit and Celsius**

Outline: multiple containers at various temperatures to be measured in both Celsius and Fahrenheit and create a data table.

|  |  |
| --- | --- |
| Celsius | Fahrenheit |
|  |  |
|  |  |
|  |  |

Graph: Fahrenheit vs Celsius

BFL: F = (1.8 \* C) + 32

Discuss slope meaning…

Discuss intercept meaning...

Discuss the FUNCTION (emphasize the term ‘function’)

### **4. Worksheet 2 - Working with Expressions**

Simple calculations….

* 2 + 3
* 3 \* 5
* 2 + (3 \* 5)
* (2 + 3) \* 5
* Etc.

### **5. Worksheet 3 - Working with Functions**

Simple functions…

* Perimeter-square
* Perimeter-rectangle
* Area-square
* Area-rectangle
* Area-triangle
* Perimeter-triangle (optional)

### **6. Pyret Activity 1 - Temp Converter Program**

Students will use the ‘function’ they developed through the lab to write a program that will convert the temp in Celsius (input) to the temp in Fahrenheit (output).

### **7. Follow-up - Create the inverse**

Students should reverse their data table…

|  |  |
| --- | --- |
| Fahrenheit | Celsius |
|  |  |
|  |  |
|  |  |

Graph: Celsius vs Fahrenheit (reverse the axes from the previous assignment)

BFL: C = (0.55 \* F) - 17.8

Discuss slope meaning…

Discuss intercept meaning...

Discuss the FUNCTION (emphasize the term ‘function’)

Students should then program the inverse function… a temp converter from Fahrenheit to Celsius.

### **8. Worksheet 4 - Working with Images (Optional)**

Simple images…

* Circle
* Square
* Rectangle
* etc.

### **9. Pyret Activity 2 - Thermometer Program (Optional)**

Students incorporate their functions for temp converter from C to F, and have the computer display a thermometer that matches it.

**include** image

background = rectangle(10, 100, “outline”, “black”)

**fun** therm(C):

overlay-align(“bottom”, “middle”, rectangle(10, C, “solid”, “red”), background)

**end**

Culminating discussion/whiteboard -

* Model So Far - What is a Function?
* Model So Far - How would you use a Function?
  + Concepts in programming come in pairs -- how to create, and how to use
  + Numbers go with arithmetic
  + Booleans go with ifs (conditionals)
  + Functions...go with function calls