**Heat Practice**

Two students are heating substances on separate hot plates. They want to determine what factors affect how hot the substances can get. What factors should the students hold constant?

Scenario 1: Student A heats 400 grams of water in the saucepan and Student B heats 800 grams of water in the stockpot, each made out of the same material, on the same setting of a hot plate. Which student’s water will be hotter after 5 minutes? Why?

Scenario 2: Student A heats 100 grams of water on a low heat setting and Student B heats 100 grams of water on a high heat setting, each for 5 minutes in a saucepan. Which student’s water will be hotter after 5 minutes? Why?

Scenario 3: Student A heats 250 grams of water from 0 to 100C and Student B heats 250 grams of water from 30 to 70C on the same setting of a hot plate in the stock pot. Which student will require more time? Why?

Scenario 4: Student A heats 200 grams of water and Student B heats 200 grams of copper, each for 5 minutes on the same setting of a hot plate. Which student’s substance will be hotter after 5 minutes? Why?

**Summary**: What factors directly affect the amount of heat needed to raise the temperature of a substance?

**Specific Heat**

**Specific heat is defined as the amount of heat (in \_\_\_\_) needed to raise \_\_\_\_ gram of a substance \_\_\_˚C.**

 **Every substance has its own specific heat depending on the bonds and forces it has.**

1. When you wake up in the morning and touch the floor, at first the carpet feels warm. The wood floor in the hallway is a bit chilly, but the tile floor in the bathroom is FREEZING! However, your whole house is probably 68˚F. What quality is different about each of these surfaces? Which has the highest specific heat?
2. At the park, why do you tend to steer clear of metal benches and prefer wooden picnic benches? Which has a lower specific heat?
3. Water has a high specific heat due to its hydrogen bonds. Explain why the fish is so happy in the picture below.

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Sample** | **Specific Heat** |
| Al | aluminum | 0.022 |
| Zn | zinc | 0.093 |
| Fe | iron | 0.11 |
| Pb | lead | 0.038 |
| Sn | tin | 0.052 |
| Cu | copper | 0.092 |
| Ag | silver | 0.057 |
| Pt | platinum | 0.032 |
| Au | gold | 0.031 |
| Ti | titanium | 0.14 |
| W | tungsten | 0.032 |



1. Based on the specific heat values in the table, why do the elements have lower specific heats than water (at 1)? What do they have in common?
2. Do you expect wood to have a higher or lower specific heat than these substances and why?
3. Glass is often called an insulator because it has a \_\_\_\_\_\_\_\_\_\_\_ specific heat.

**Heat Calculations**

**Define the following terms with units: q: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 **m: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ΔT: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Answer the following questions using the heat formula. Show work with units.**

1. How many calories of energy are needed to change the temperature of 100.0 grams of water from 20.0C to 40.0C?
2. How many calories of energy are needed to change the temperature of 15.0 grams of water from 35.0C to 75.0C?
3. How many calories of energy are needed to change the temperature of 25.0 grams of water from 25.0C to 95.0C?
4. How many calories of energy are needed to change the temperature of 50.0 grams of water from 50.0C to 75.0C?
5. How many calories of energy are needed to change the temperature of 150.0 grams of water from 35.0C to 750.0C?