Last Name, First Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_

Energy Transfer

Learning Objectives:

|  |  |
| --- | --- |
| **Topic** | Energy and its Transformation |
| **Benchmark** | Use known values of specific heat and latent heat of phase change to solve problems involving heat flow and temperature |
| **Topic** | Energy and its Transformation |
| **Benchmark** | Explain that chemical processes either absorb (endothermic) or release (exothermic) thermal energy |

Essential Questions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Thinking: Main Notes:

**Transfer (of energy):**

Enthalpy:

Enthalpy of Fusion

(aka: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

Enthalpy of Vaporization

(aka: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

Labeling:

Exothermic vs Endothermic:

What happens to heat transfer for an endothermic system?

Etymology – exothermic

**Thermochemistry:**

Draw a picture to represent it!

(draw it here)

What’s the difference? One absorbs heat and one gives off heat

Greek: The root exo- means: \_\_\_\_\_\_\_\_\_The root endo- means: \_\_\_\_\_\_\_\_\_\_\_\_

What about endothermic?

**TEMPERATURE VS HEAT**

What is temperatrure?

Comparing heat and temperature

What’s the difference?

Example:

(you draw)

**TEMPERATURE CHANGES:**

What happens to the temperature of an object when it absorbs heat?

What happens to the temperature of an object when it releases heat?

**CALORIMETRY:**

1st Law of Thermodynamics:

**A Sum-Up of Calorimetry:**

How do we increase the temperature?

Heat energy is measured in?

**Calories (cal)**

**Specific Heat Capacity**

What is the specific heat capacity of dihydrogen monoxide?

What are the units?

\_\_\_\_\_\_\_\_\_\_ energy depends on the \_\_\_\_\_\_\_\_\_ of the particles, the number of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (the size or mass) and the \_\_\_\_\_\_\_\_\_\_ of particles in an object. Temperature \_\_\_\_\_\_\_\_\_\_\_\_ depend on the size or type of object.

\_\_\_\_\_\_\_\_\_\_\_ is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy of molecular \_\_\_\_\_\_\_\_\_\_\_\_ in a substance while \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a measure of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

For example, the temperature of a small cup of water might be the same as the temperature of a large tub of water but the tub of water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The temperature can always be used to determine the amount of heat that was \_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_ if the relationship between these two quantities is known.

Energy can’t be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

It can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Heat released by the system \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the heat absorbed by its surroundings.

Heat absorbed by the system is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the heat released by its surroundings.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( ). One \_\_\_\_ is defined as the amount of energy expended by a force of 1 \_\_\_\_\_\_\_\_\_\_\_\_\_ moving an object 1 meter in the same direction as the force.

1 calorie = the amount of energy needed to raise \_\_\_\_\_ g of water \_\_\_ degree Celsius

The specific heat capacity ( ) of any substance is defined as the amount of energy needed to increase the temperature of \_\_\_ g of the substance by \_\_\_\_\_\_\_\_\_\_\_.

**Summary:**

**Calorimetry Practice Problems:**

Answer all questions on a separate sheet. Show your process and circle your answer. Include units and proper sig figs.

1. How many joules are needed to warm 25.5 grams of water from 14.0 °C to 22.5 °C?

2. Calculate the number of joules released when 75.0 grams of water are cooled from 100.0 °C to 27.5 °C.

3. Calculate the heat, in joules, needed to warm 225 grams of water from 88.0 °C to its boiling point, 100.0 °C.

4. The specific heat of gold is 0.128 J/g °C. How much heat would be needed to warm 250.0 grams of gold from 25.0 °C to 100.0 °C?

5. The specific heat of zinc is 0.386 J/g °C. How many joules would be released when 454 grams of zinc at 96.0 °C were cooled to 28.0 °C?

6. Phileas Fogg, the character who went around the world in 80 days, was very fussy about his bathwater temperature. It had to be exactly 38.0 °C. You are his butler, and one morning while checking his bath temperature, you notice that it’s 42.0 °C. You plan to cool the 100.0 kg of water to the desired temperature by adding an aluminum-duckie originally at freezer temperature (-24.0 °C). Of what mass should the Al-duckie be? [Specific heat of Al = 0.900 J/(g °C); density of water = 1 .00 g/ml]. Assume that no heat is lost to the air.

7. A certain material’s temperature increases by 1.0 °C for every 1560 J that it gains. A 0.1964 g sample of quinone (molar mass = 108.1 g/mole) was burnt, and the surrounding material’s temperature increased from 20.3 °C to 23.5 °C. Find the molar heat of combustion for quinone.

8. A 1.55 g of CH4O sample is burnt in a calorimeter. If the molar heat of combustion of CH4O is -725 kJ/mole, and assuming that the 2.0 L of water absorbed all of the heat of combustion, what temperature change did the water experience?

9. In real calorimeters, most of the heat released by the bomb is absorbed by water, but a certain amount is also absorbed by the metal and insulation surrounding the water tank. A certain calorimeter absorbs 24 J/ °C. If 50.0 g of 52.7 °C water is mixed with the calorimeter’s original 50.0 g of 22.3 °C water, what will be the final temperature of the mixture?