Warm-Up!

Answer these using proper Sig Figs:

1) 75.6 + 47.678 x 34 = 1697 1700 4000

2) 100 x 0.045 + 7,500 = ~~7504.5~~ 7500

3) If d=vt, how fast (in miles per hour) can Tyler pitch if a ball he throws travels 60.5 ft in 0.95s?

64ft/s

$$\frac{64\,ft}{8} \times \frac{1\,mi}{5{,}280\,ft} \times \frac{3600\,s}{1\,hr}$$

$$44\,mi/hr$$

Heat

The quantity of heat (q) that flows varies directly with the quantity of substance (mass or volume), the specific or volumetric heat capacity (C) and the temperature change (ΔT).

FORMULA: $\mathbf{q = mC\Delta T}$ **or** $\mathbf{q = vC\Delta T}$

In calculating q, the heat capacity constant (C) must correspond to the state of matter of the substance.

Think. Pair. Share.

$$q = mC\Delta T$$

Question:

Would an increase in the mass of a sample make the heat requirement increase or decrease?

Another Question:

Would an increase in mass cause a larger or a smaller increase in temperature?

Sample Problem

A system contains a 100.g sample of ice. 1250J of heat is added to the system.

a) should the temperature of the ice go up or down?

up

b) by how much does the temperature change?

$m = 100.\,g$

$q = +1{,}250\,J$

$c = 2.01\,\frac{J}{g \cdot °C}$

$q = mc\Delta T$

$(1{,}250\,J) = (100.\,g)(2.01\,\frac{J}{g \cdot °C})\Delta T$

$\frac{1{,}250\,J = 201\,\frac{J}{°C}\Delta T}{201\,\frac{J}{°C} \quad 201\,\frac{J}{°C}}$

$\frac{J}{\frac{J}{°C}} = J \times \frac{°C}{J}$

$6.22\,°C = \Delta T$

Sample Problem #2

A certain sample of metal has an unknown heat capacity. If 756J of heat is lost, the temperature of 150.0g of the metal decreases from 17.5°C to 12.0°C. What is the heat capacity of the metal?

$q = -756 J$
$m = 150.0 g$
$T_f = 12.0 °C$
$T_i = 17.5 °C$

$q = mC\Delta T$

$\frac{q}{m\Delta T} = C$

$\frac{(-756J)}{(150.0g)(-5.5°C)} = C$

$0.916 = C$

$0.916 \frac{J}{g \cdot °C}$

$0.92 \frac{J}{g \cdot °C}$

Sample Problem #3

A sample of lead (Pb) has a mass of 4.56 kg. After 76J of heat was added to the sample, the final temperature was 47°C.

a) What was the initial temperature of the sample?

b) Should the final temperature *always* be higher after heat is added?

$m = 4.56\,kg = 4560\,g$
$q = 76\,J$
$C = 0.159\ \frac{J}{g \cdot °C}$
$T_f = 47\,°C$

$\Delta T = T_f - T_i$

$\frac{76J}{725.04} = \frac{725.04(47 - T_i)}{725.04}$

$0.104821802\,°C = 47\,°C - T_i$

$-47 \qquad -47$

$-47 = -T_i$

$47 = T_i$

Sample Problem #4

A 25.6g piece of aluminum at 75^oC is placed in 4.56 kg of water. If the initial temperature of the water was 10^oC, then what is the final temperature of both the aluminum and the water?

Unit Conversion

6 zeroes → 3 zeroes

$1\ MJ = 10^6\ J$ $\quad$ $1\ kJ = 10^3\ J$

megajoule **kilajoule**

Ex. Convert 13000J to kJ and MJ.

Ex. Convert 41MJ to J and kJ.

If 2.50L of water at 22.0^{o}C is given 18.90kJ of heat, what will be the final temperature?

Today's Mission:

Heat Worksheet

1) 31 200 J

2) -31 700 J

3) 120^{o}C

4) 28^{o}C

5) 1100 J

6) 14 900 J

7) 0.0456 J/g ^{o}C

8) 424 g

9) 2.60 J/g ^{o}C

10) 6.21 J

11) 42.6 L