EN____

SPECIFIC HEAT NOTES

Specific Heat (aka heat capacity): energy required to change the temp of 1g of a substance by 1°C

- Substances with a high specific heat change temperature slowly because they require a lot of energy to Δtemp. (insulator)

  Ex. Water, air, glass

- Substances with a low specific heat change temperature quickly happen to be good conductors

  Ex. metals, sand, land

Calculations involving specific heat:

$Q = mC(\Delta T)$ → $(Temp_{final} - Temp_{initial})$

m → mass (grams)

C → Specific heat Constant

Thermal Energy ← Q

measured in Joules or Calories

Ex. How much energy is required to warm 100g of water from 15°C to 95°C? (The specific heat of water is 4.184 Joules/g°C)

$Q = m\,C\,\Delta T$

$m = 100g$

$C = 4.184\ J/g°C$

$\Delta T = (95 - 15) = 80°C$

$Q = ?$

$= 100g\,(4.184\ J/g°C)(80°C)$

$= 33,472$ Joules

Ex. If 125 joules are added to 12g of water at 10°C, what will the final temperature be?

$Q = mC(T_f - T_i) \rightarrow 125J = (12g)(4.184\ J/g°C)(T_f - 10°C)$

$Q = 125\ J$

$m = 12g$

$T_i = 10°C$

$C = 4.184\ J/g°C$

$T_f = ?$

$\frac{125J}{50.2\ J/°C} = \frac{50.2\ J/°C\,(T_f - 10°C)}{50.2\ J/°C}$

$2.49°C = T_f - 10°C$

$+10°C \quad +10°C$

$12.5°C = T_f$

NAME:_____ PERIOD: _____ DATE:_____ E.N. 17

SPECIFIC HEAT

Specific Heat Constants for Selected Substances

	J / g °C
Water (*liquid*)	4.18
Water (*gas*)	1.87
Water (*solid*)	2.06
Aluminum, Al(*s*)	0.897
Iron, Fe(*s*)	0.449
Silver, Ag(*s*)	0.235
Mercury, Hg(*l*)	0.139
Lead, Pb(*s*)	0.129

The formula for calculations involving specific heat:

$$Q = m \times C \times \Delta t$$

Q: energy in reaction
J or calories

m: mass

C: specific heat

Δt: $T_f - T_i$ ($T_2 - T_1$)

1. How much energy is absorbed when 10 grams of aluminum is heated from 25°C to 55°C?

Rounding is 8K

269.1 J

$Q = mC\Delta T = (10g)(0.897 \frac{J}{gC})(30°C)$

m = 10g

ΔT = 55 - 25 = 30

C = 0.897

2. How much energy is absorbed when 10 grams of water is heated from 25°C to 55°C?

Q = ?
m = 10g
C = 4.18 J/gC
ΔT = 30°C

1254 J

$Q = mC\Delta T$

$Q = (10g)(4.18\ J/gC)(30°C)$

Q = 1254J

3. How much energy is absorbed when 25 grams of iron is heated from 5°C to 155°C?

1683 J

$Q = (25g)(0.449\ J/gC)(150°C)$

Q = 1684 J

Try these next two if your feeling like the last three were easy.

4. A 15 gram sample of liquid mercury at 25°C is heated. A total of 8.6 joules of energy is added. What is the new temperature of this sample? 29°C

Q = 8.6 J C = 0.139 $Q = mC(T_f - T_i)$

m = 15g

T_i = 25°C

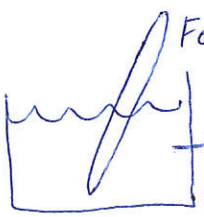
$8.6J = (15g)(0.139)(T_f - 25°C)$

$\frac{8.6J}{(15g)(0.139)} = \frac{(15g)(0.139)(T_f - 25°C)}{(15g)(0.139)}$

2.085 + 25 + 4.13 = T_f - 25°C + 25°C

29.13 °C

5. A sample of Iron with a temperature of 39°C is placed in a beaker containing 150 grams of water at 21°C. After several minutes the temperature of both the iron and the water equilibrates at 25°C. What is the mass of the sample of iron? Hint the energy gained by the water will equal the energy lost by the iron...



Fe = 39°C = T_i

150 g 21° = T_i

25° = T_f

$MC\Delta T = 0\ (150g)(4.18)(4) = 2508J$ for H_2O from Fe

$2508J = m(0.449\ J/gC)(25 - 21 = 4°C)$

$\frac{2508J}{6.286} = \frac{m(6.286)}{6.286}$

m = 399g