Chapter 6 - Lecture Worksheet 1 - Answers

A. A sample of solid aluminum is heated with an electrical coil. If **186 Joules** of energy are added to a **11.8 gram** sample initially at 21.0°C, what is the final temperature of the aluminum ?

q	186 J
m	11.8g
C_s	0.90 J/g^0
T_2	?
T_1	21.0^{0}C
ΔT	?

$$q = mC_s\Delta T$$

$$\Delta T = \frac{q}{mC_s} = \frac{186J}{(11.8g)(0.90J/g^o)} = \mathbf{17.5^0 = T_2 - T_1}$$

$$\mathbf{T_2 = (17.5 + 21.0)^0C = 38.5^0C}$$

B. In the laboratory a student uses a "coffee cup" calorimeter to determine the specific heat of a metal.

She heats 19.0 grams of silver to 99.32^{0}C and then drops it into a cup containing 78.6 grams of water at 21.14^{0}C. She measures the final temperature to be 22.24^{0}C. Assuming that all of the heat is transferred to the water, she calculates the specific heat of silver to be ____ J/g^{0}C.

(1) 0.204 (2) -0.0144 (3) - 0.247 (4) + 0.247 (5) 0.0144 (6) - 0.204

Table your data:

	Water	Silver
m	78.6 g	19.0 g
C_{sp}	4.184 J/g ^{0}	?
T_2	22.24 ^{0}C	22.24 ^{0}C
T_1	21.14 ^{0}C	99.32 ^{0}C
ΔT	1.10 ^{0}C	–77.08 ^{0}C

$-q_{Ag} = q_{H2O} + q_{calorimeter} \approx q_{H2O}$ (assume all heat transferred to water)

$q_{H2O} = m_{H2O}\,Csp(H_2O)\,\Delta T_{H2O} = (78.6\text{ g})(4.184\text{ J/g }^0)(1.10\,^0C) = 361.75\text{ J}$

$q_{Ag} = -q_{H2O} = -361.75\text{ J} = m_{Ag}\,Csp(Ag)\,\Delta T_{Ag}$

Solve for specific heat of silver:

$Csp(Ag) = -q_{H2O} / (m_{Ag}\Delta T_{Ag}) = (-361.75\text{ J}) / (19.0\text{ g})(-77.08\,^0C) = +0.247\text{ J/g}^0$

From Exam 1 Spring 06

C. In the General Mills laboratory a nutritionist measured the calorie content of the newest taste sensation, *blue cheese pizza*. She found that when a 0.567g sample of homogenized freeze-dried pizza was burned in a bomb calorimeter the temperature increased from 22.73^0C to 27.35^0C. The calorimeter contained 525.4 g water. The heat capacity of the calorimeter was found in a separate experiment to be 377.3 J/^{0}C. Calculate the number of food calories (kcal) per slice of pizza where one slice weighs 117 grams.

(1) 2.84   (2) 5.02   (3) 179   (4) 433   (5) 587   (6) 1,190   (7) 11,900

0.567 g pizza	$q_{pizza} = -(q_{water} + q_{cal})$
$T_2 = 27.35^0$C	$= -(mC_{sp}(water) + C_{cal})\,\Delta T$
$T_1 = 22.73^0$C	$= -[(525.4\text{ g})(4.184\text{ J/g}^0) + 377.3\text{ J/}^0]\,(4.62^0\text{C})$
$\Delta T = 4.62^0$C	$= -(2575.6)(4.62)$ J
$m_{water} = 525.4$ g	$= -11{,}899\text{ J }(1\text{ cal/4.184 J})(1\text{ kcal/1000 cal}) = -2.844$ kcal
$C_{cal} = 377.3$ J/^{0}	
1 slice = 117 g	Calorie content = (2.844 kcal) / (0.567 g) = 5.016 kcal/g
? = Cal (kcal)/slice	
	(1 slice) (117g/slice) (5.016 kcal/g) = 587 kcal **= 587 Food Calories**
	Not a low cal pizza !