Table 11.1

Symbol	Definition	Measurements	Units	Errors
c_1	Specific Heat Capacity of Calorimeter	0.22	cal/g °C	-
c_w	Specific Heat Capacity of Water	1.00	cal/g °C	-
M_1	Mass of Calorimeter	45.81	g	$\Delta M_1 = 0.01$ g
M_{cw}	Mass of Calorimeter + Water ($M_{cw} = M_1 + M_w$)	111.70	g	$\Delta M_{cw} = 0.01$ g
M_w	Mass of Water ($M_{cw} - M_1$)	65.89	g	$\Delta M_w = 0.01$ g
T_1	Initial Temperature of Calorimeter	22°C	°C	$\Delta T_1 = 0.5$ C°
T_2	Initial Temperature of Metal	92°C	°C	$\Delta T_2 = 0.5$ C°
T_f	Final Equilibrium Temperature for Calorimeter + Water + Metal	29°C	°C	$\Delta T_f = 0.5$ C°
M_2	Mass of Metal	99.42	g	$\Delta M_2 = 0.01$ g

Table 11.2

$X = m_c C_c + m_w C_w = 75.96$ cal/C°	$c_2 = \frac{Xy}{m_2 z} = 0.0848$ cal/g·C°
$Y = T_f - T_1 = 7$ C°	
$Z = T_2 - T_f = 63$ C°	

2. Use the relations in the table below and calculate the error Δc_2, and express your final result as $c_2 \pm \Delta c_2$.
3. Record your calculations in Table 11.3 below.

$$\Delta c_2 = c_2 \sqrt{\left(\frac{\Delta X}{X}\right)^2 + \left(\frac{\Delta Y}{Y}\right)^2 + \left(\frac{\Delta Z}{Z}\right)^2 + \left(\frac{\Delta M_2}{M_2}\right)^2}$$

$$\Delta X = \sqrt{(c_w \Delta M_w)^2 + (c_1 \Delta M_1)^2}$$

$$\Delta Y = \sqrt{(\Delta T_1)^2 + (\Delta T_f)^2}$$

$$\Delta Z = \sqrt{(\Delta T_2)^2 + (\Delta T_f)^2}$$

Table 11.3

$\Delta X = 0.014$	$\Delta c_2 = 0.00865$ unit
$\Delta Y = 0.717$	
$\Delta Z = 0.717$	
$c_2 \pm \Delta c_2 = (0.0848 \pm 0.00865) \Rightarrow (0.076 - 0.093$ cal/g·C°)	

4. Referring to Table 11.4, what is your metal sample? (Show your calculations in detail)

⇒ (0.317 - 0.388) cal/g·C° ⇒ Copper

Table 11.4

Metal	Symbol	Specific heat (J/g °C)
Iron	Fe	0.449
Lead ✓	Pb	0.129
Magnesium	Mg	1.023
Copper	Cu	0.387
Aluminum	Al	0.900
Silver	Ag	0.235
Silicon	Si	0.703
Tin	Sn	0.540

5. What will happen to the heat capacity and specific heat capacity of your metal sample if its mass is changed by a factor (...2....)? Record your answers in Table 11.5.

Table 11.5

Change Factor = 2		
Physical Quantity	Effect	Value
Specific Heat Capacity	remain constant	0.0848 cal/g.c°
Heat Capacity	multiply	28.43 ✓ 16.99/0

6. Discuss the possible sources of errors in this experiment.

1] error in reporting of result

2] error in calculation

3] heat loos

7. How much heat is gained or lost for the given metal under the conditions specified in Table 11.6 below. Use the information from Table 11.4.

Table 11.6

Metal	Lead	Initial temperature	30 c°
Mass	100 g	Final Temperature	70 c°

$Q = mC\Delta T$

$(100) * (0.129) * (70 - 30) \Rightarrow (100) * (0.129) * (40) = 516$ J

128

$\Rightarrow 123.4$ cal