Name Answer Key Hour _____

One vs. Two System Problems

Honors Chemistry

You must list the given, write the formula, and put a box around your final answer.

1. A 74.0 g piece of iron was inserted into 150-mL of water at 7 °C. The final temperature of the water and iron was 14°C. What was the original temperature of the iron? (C_{iron} = 0.45 J/g x °C) (C_{water}= 4.18 J/g x °C)

Fe	H_2O
ΔT ?	7°C
c .45	4.18
m 74	150g

$m_{Fe} \times C_{Fe} \times \Delta T_{Fe} = m_{H_2O} \times C_{H_2O} \times \Delta T_{H_2O}$

$(74)(0.45)\Delta T_{Fe} = (150)(4.18)(7)$

$\Delta T_{Fe} = 131.8°C$

original temp of iron = 145.8°C

2. The temperature of a 94.2-g piece of aluminum changed from 65.5 °C to 16.9 °C when added to 201.0-mL of water. What is the original temperature of the water? ($C_{aluminum}$ = 0.90 J/g x °C)

Al	H_2O
ΔT 48.6	?
c 0.9	4.18
m 94.2	201 g

$m_{Al} \times C_{Al} \times \Delta T_{Al} = m_{H_2O} \times C_{H_2O} \times \Delta T_{H_2O}$

$(94.2)(0.9)(48.6) = (201)(4.18)\Delta T_{H_2O}$

$\Delta T_{H_2O} = 4.9°C$

original temp of H_2O = 12.0°C

3. A 65.7-g piece of aluminum is at 398 K. You need the aluminum to be 323 K. How much energy is required for this change to take place? ($C_{aluminum}$ = 0.90 J/g x °C)

q = ?
m = 65.7g
ΔT = 75 °C

$q = C \times m \times \Delta T$

$q = (0.9)(65.7)(75)$

q = 4,434.8J OR 4.4 kJ

4. A piece of copper had a temperature of 97.0 °C. Its temperature dropped 81.0 °C after placing it in 136.0-mL of 6.0 °C water. What is the mass of the piece of copper? (C_{copper} = 0.39 J/g x °C) *(Hint: what is the final temp of water?)*

Cu	H_2O
ΔT 81	10°C
c .39	4.18
m ?	136g

$m_{Cu} \times C_{Cu} \times \Delta T_{Cu} = m_{H_2O} \times C_{H_2O} \times \Delta T_{H_2O}$

$m_{Cu}(0.39)(81) = (136)(4.18)(10)$

$m_{Cu} = 180.0g$

5. A 231-g sample of iron is added to 175-mL of water. The original temperature of the water is 8.0 °C. The water and iron have a final temperature of 13 °C. What was the original temperature of the iron? (C_{iron} = 0.45 J/g x °C)

Fe	H_2O
ΔT ?	5
c 45	4.18
m 231	175g

$m_{Fe} \times C_{Fe} \times \Delta T_{Fe} = m_{H_2O} \times C_{H_2O} \times \Delta T_{H_2O}$

$(231)(0.45)\Delta T_{Fe} = (175)(4.18)(5)$

$\Delta T_{Fe} = 35.2°C$

original temp of Fe = 48.2°C

6. How much heat is needed to raise 123.0 g of ice from – 35 °C to – 8 °C? *(C_{ice} = 2.03 J/g x °C)*

q = ?
m = 123g
ΔT = 27°C

$q = C \times m \times \Delta T$

$q = (2.03)(123)(27)$

q = 6,741.6 J OR 6.7 kJ

7. How much heat is needed to raise 47.0 g of steam from 104 °C to 146 °C? (C_{steam} = 2.01 J/g x °C)

$q = ?$
$m = 47g$
$\Delta T = 42°C$

$q = C \times m \times \Delta T$
$q = (2.01)(47)(42)$
$q = 3,967.7$ J OR 4.0 KJ

8. Starting with a 25.0-g piece of iron at 35 °C, you added 575 joules of heat. What is the new temperature of the iron? (C_{iron} = 0.45 J/g x °C)

$q = 575J$
$m = 25g$
$\Delta T = ?$

$q = C m \Delta T$
$575 = (0.45)(25)\Delta T$
$\Delta T = 51°C$

new temp of Fe = 86.1°C

9. The temperature of a piece of aluminum changed from 42.5 °C to 16.9 °C when 212 calories of energy was removed from the metal. What is the mass of the aluminum? ($C_{aluminum}$ = 0.90 J/g x °C)

$\frac{212\ cal}{1} \times \frac{4.18\ J}{1\ cal}$

$q = 886.2J$
$m = ?$
$\Delta T = 25.6°C$

$q = C \times m \times \Delta T$
$886.2 = (0.9)\, m\, (25.6)$
$m = 38.5\ g$

10. A 66.8-g piece of metal is heated with 2349 joules. Its temperature changed from 75 °C to 168 °C. What is the specific heat of the unknown metal?

$q = 2349J$
$m = 66.8g$
$\Delta T = 93°C$

$q = C \times m \times \Delta T$
$2349 = C(66.8)(93)$
$C = 0.38\ J/g°C$

11. Starting with a 55.0-g piece of copper at 95 °C, you removed 922.4 joules of heat. What is the new temperature of the copper? (C_{copper} = 0.39 J/g x °C)

$q = 922.4J$
$m = 55g$
$\Delta T = ?$

$q = C \times m \times \Delta T$
$922.4 = (0.39)(55)\Delta T$
$\Delta T = 43°C$

new temp of Cu = 52°C

12. A 431-g sample of iron is added to 375-mL of water. The original temperature of the water is 7.0 °C. The water and iron have a final temperature of 12 °C. What was the original temperature of the iron? (C_{iron} = 0.45 J/g x °C)

	Fe	H_2O
ΔT	?	5
c	.45	4.18
m	431	375 g

$m_{Fe} \times C_{Fe} \times \Delta T_{Fe} = m_{H_2O} \times C_{H_2O} \times \Delta T_{H_2O}$
$(431)(0.45)\,\Delta T_{Fe} = (375)(4.18)(5)$
$\Delta T_{Fe} = 40.4°C$

original temp of Fe = 52.4°C