Chemistry: *Calorimetry Problems 1*

*Solve the following problems. As always, include work and show the units to ensure full credit.*

1. A 445 g sample of ice at $-58^\circ C$ is heated until its temperature reaches $-29^\circ C$. Find the change in heat content of the system.

2. A 152 g sample of ice at $-37^\circ C$ is heated until it turns into liquid water at $0^\circ C$. Find the change in heat content of the system.

3. A 218 g sample of steam at $121^\circ C$ is cooled to ice at $-14^\circ C$. Find the change in heat content of the system.

4. If 161 g of water at $85^\circ C$ is cooled to ice at $0^\circ C$, find the change in heat content of the system.

5. A 79 g sample of water at $21^\circ C$ is heated until it becomes steam with a temperature of $143^\circ C$. Find the change in heat content of the system.

6. If a 348 g sample of steam at $127^\circ C$ is cooled to $103^\circ C$, find the change in heat content of the system.

7. In going from ice at $-34^\circ C$ to steam at $138^\circ C$, a sample of water absorbs $1.41 \times 10^5$ J. Find the mass of the sample.

*Answers: 1. $2.68 \times 10^4$ J 2. $6.23 \times 10^4$ J 3. $-6.71 \times 10^5$ J 4. $-1.11 \times 10^5$ J 5. $2.11 \times 10^5$ J 6. $-1.71 \times 10^4$ J 7. 44.7 g*
Find the energy change of the system required to change…

8. …150 g of ice at $-15^\circ C$ to ice at $-63^\circ C$.

9. …200 g of water at 4°C to water at 88°C.

10. …54 g of steam at 150°C to steam at 112°C.

11. …18 g of water at 0°C to ice at 0°C.

12. …215 g of water at 100°C to steam at 100°C.

13. …44 g of ice at $-13^\circ C$ to water at 58°C.

14. …330 g of steam at 100°C to ice at 0°C.

15. …1200 g of steam at 118°C to water at 100°C.

16. …60 g of water at 43°C to steam at 140°C.

17. …400 g of ice at $-38^\circ C$ to steam at 160°C.

Answers:

1. $-1.50 \times 10^4$ J
2. $7.02 \times 10^7$ J
3. $-4.19 \times 10^5$ J
4. $-5.99 \times 10^7$ J
5. $4.85 \times 10^5$ J
6. $2.65 \times 10^4$ J
7. $-9.92 \times 10^5$ J
8. $-2.75 \times 10^6$ J
9. $1.55 \times 10^5$ J
10. $1.28 \times 10^6$ J
Chemistry: **Calorimetry Problems 2**

Solve the following problems. As always, include work and show the units to ensure full credit.

1. If 20 g of silver at 350\(^\circ\)C are mixed with 200 g of water at 30\(^\circ\)C, find the final temperature of the system.

2. If 26 g of water at 18\(^\circ\)C are mixed with 49 g of water at 70\(^\circ\)C, find the final temperature of the system.

3. If 84 g of water at 22\(^\circ\)C are mixed with 150 g of ethanol at 88\(^\circ\)C, find the final temperature of the system.

4. If 24 g of sodium chloride at 25\(^\circ\)C are mixed with 272 g of mercury at 50\(^\circ\)C, find the final temperature.

5. 240 g of water (initially at 20\(^\circ\)C) are mixed with an unknown mass of iron (initially at 500\(^\circ\)C). When thermal equilibrium is reached, the system has a temperature of 42\(^\circ\)C. Find the mass of the iron.

6. 135 g of aluminum (initially at 400\(^\circ\)C) are mixed with an unknown mass of water (initially at 25\(^\circ\)C). When thermal equilibrium is reached, the system has a temperature of 80\(^\circ\)C. Find the mass of the water.

7. In the lab, an experimenter mixes 75.0 g of water (initially at 30\(^\circ\)C) with 83.8 g of a solid metal (initially at 600\(^\circ\)C). At thermal equilibrium, he measures a final temperature of 50.0\(^\circ\)C. What metal did the experimenter probably use?

Answers: 1. 31.8\(^\circ\)C  2. 52.0\(^\circ\)C  3. 55.7\(^\circ\)C  4. 41.1\(^\circ\)C  5. 107.3 g  6. 168.6 g  7. tungsten
8. A 97 g sample of gold at 785°C is dropped into 323 g of water, which has an initial temperature of 15°C. If gold has a specific heat of 0.129 J/g°C, what is the final temperature of the mixture? Assume that the gold experiences no change in its state of matter.

9. If 59 g of water at 13°C are mixed with 87 g of water at 72°C, find the final temperature of the system.

10. A 38 g sample of ice at –11°C is placed into 214 g of water at 56°C. Find the system’s final temperature.

11. 25 g of 116°C steam are bubbled into 0.2384 kg of water at 8°C. Find the final temperature of the system.

12. A 322 g sample of lead (specific heat = 0.138 J/g°C) is placed into 264 g of water at 25°C. If the system’s final temperature is 46°C, what was the initial temperature of the lead?

13. A sample of ice at –12°C is placed into 68 g of water at 85°C. If the final temperature of the system is 24°C, what was the mass of the ice?

Answers: 8. 22.1°C 9. 48.2°C 10. 34.7°C 11. 68.7°C 12. 568°C 13. 37.8 g