

7. How many kilocalories are required to change the temperature of 300. grams of water by 40.0°C ?

$$Q = mc\Delta T \quad Q = (300\text{g})(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(40.0^{\circ}\text{C}) = 12000\text{ cal} = 12.0\text{ kcal}$$

8. What is the final temperature after 80.0 calories is absorbed by 10.0 grams of water at 25.0°C ?

$$Q = mc\Delta T \quad 80.0\text{ cal} = (10.0\text{g})(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})\Delta T$$

$$\Delta T = 8^{\circ}\text{C} \quad T_{\text{final}} = 25.0^{\circ}\text{C} + 8.0^{\circ}\text{C} = 33.0^{\circ}\text{C}$$

9. What is the final temperature of a 40.0 gram sample of water at 45.0°C when the water gives off 640 calories of heat?

$$Q = mc\Delta T \quad 640\text{ cal} = (40.0\text{g})(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})\Delta T$$

$$\Delta T = 16^{\circ}\text{C} \quad T_{\text{f}} = 45.0^{\circ}\text{C} - 16^{\circ}\text{C} = 29.0^{\circ}\text{C}$$

The following formulas may be needed for the problems below:

$$Q = mH_f$$

$$Q = mH_v$$

H_f = heat of fusion (for water $H_f = 79.72\text{ cal/g}$)

H_v = heat of vaporization (for water $H_v = 539.4\text{ cal/g}$)

10. How many grams of liquid water at 100.0°C can be vaporized to gaseous water at 100.0°C by the absorption of 7200. cal?

$$Q = mH_v \quad 7200.\text{ cal} = m(539.4\frac{\text{cal}}{\text{g}})$$

$$m = 13.348\text{ g} = 13.3\text{ g}$$

11. How many calories are needed to completely melt 10.0 g of ice at 0.00°C ?

$$Q = mH_f \quad Q = (10.0\text{g})(79.72\frac{\text{cal}}{\text{g}})$$

$$Q = 797.2\text{ cal}$$

12. How many kilocalories will be released when 5.0 g of steam at 100.0°C condenses, cools, and then completely freezes to ice at 0.0°C ?

condense: $Q = mH_v = 2697\text{ cal}$

cool: $Q = mc\Delta T = 500\text{ cal}$

freeze: $Q = mH_f = 398.6\text{ cal}$

total = 3595.6 cal = 3.6 kcal

13. How many calories are needed in total to melt 2.00 g of ice at 0.0°C , raise the temperature of the water to 100.0°C , and change all the water to steam at 100.0°C ?

Calorie problems

melt: $Q = mH_f$

$$Q = (2.00\text{g})(79.72\frac{\text{cal}}{\text{g}})$$

$$Q = 159.44\text{ cal}$$

total = 1438.24 cal = 1400 cal

warm: $Q = mc\Delta T$

$$Q = (2.00\text{g})(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(100^{\circ}\text{C})$$

$$Q = 200\text{ cal}$$

vaporize: $Q = mH_v$

$$Q = (2.00\text{g})(539.4\frac{\text{cal}}{\text{g}})$$

$$Q = 1078.8\text{ cal}$$

General Chemistry Calorie Problems

Name: KEY

Solve the following problems using the equations given. Show the equation you're using, all your work, including units, and report your answer to the correct number of significant figures.

$$Q = mc\Delta T$$

c = specific heat for water = $1\text{ cal/g}^{\circ}\text{C}$

m = mass of sample

ΔT = change in temperature of sample in $^{\circ}\text{C}$

1. If 4.0 grams of water absorbs 8.0 calories of heat, how much will the temperature of the water change?

$$Q = mc\Delta T \quad 8.0\text{ cal} = (4.0\text{g})(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(\Delta T)$$

$$\Delta T = 2.0^{\circ}\text{C}$$

2. A sample of water is heated from 10.0°C to 15.0°C by the addition of 30. calories of heat. What is the mass of the water?

$$Q = mc\Delta T \quad 30.\text{ cal} = m(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(5.0^{\circ}\text{C})$$

$$m = 6.0\text{ g}$$

3. The temperature of a sample of water increases from 30.0°C to 40.0°C as 100. calories of heat are added. What is the mass of the sample of water?

$$Q = mc\Delta T \quad 100.\text{ cal} = m(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(10.0^{\circ}\text{C})$$

$$m = 10.0\text{ g}$$

4. The temperature of a sample of water in the liquid phase is changed from 15.0°C to 25.0°C by the addition of 500. Calories. What is the mass of the water?

$$Q = mc\Delta T \quad 500.\text{ cal} = m(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(10.0^{\circ}\text{C})$$

$$m = 50.0\text{ g}$$

5. What is the number of calories of heat energy released when 25 grams of water is cooled from 20.0°C to 10.0°C ?

$$Q = mc\Delta T \quad Q = (25\text{g})(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(10.0^{\circ}\text{C})$$

$$Q = 250\text{ cal released (removed)}$$

6. How many calories of heat energy are released when 50. grams of water are cooled from 70.0°C to 60.0°C ?

$$Q = mc\Delta T \quad Q = (50.0\text{g})(1\frac{\text{cal}}{\text{g}^{\circ}\text{C}})(10.0^{\circ}\text{C})$$

$$Q = 500\text{ cal removed}$$

Calorie problems

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