

# 100 Thermochemistry Numerical Problems with Answers

## Basic Heat Calculations ( $q = mc\Delta T$ )

1. Calculate heat when 2 g water heated by  $5^{\circ}\text{C}$  ( $c = 4.18 \text{ J/g}^{\circ}\text{C}$ )  
**Ans:** 41.8 J
2. 10 g substance,  $c = 2 \text{ J/g}^{\circ}\text{C}$ ,  $\Delta T = 3^{\circ}\text{C}$   
**Ans:** 60 J
3. 50 g water,  $\Delta T = 2^{\circ}\text{C}$   
**Ans:** 418 J
4. 100 g,  $c = 1 \text{ J/g}^{\circ}\text{C}$ ,  $\Delta T = 10^{\circ}\text{C}$   
**Ans:** 1000 J
5. 25 g,  $c = 4 \text{ J/g}^{\circ}\text{C}$ ,  $\Delta T = 1^{\circ}\text{C}$   
**Ans:** 100 J
6. 5 g water,  $\Delta T = 20^{\circ}\text{C}$   
**Ans:** 418 J
7. 200 g,  $c = 0.5 \text{ J/g}^{\circ}\text{C}$ ,  $\Delta T = 4^{\circ}\text{C}$   
**Ans:** 400 J
8. 80 g,  $c = 2 \text{ J/g}^{\circ}\text{C}$ ,  $\Delta T = 5^{\circ}\text{C}$   
**Ans:** 800 J
9. 60 g water,  $\Delta T = 3^{\circ}\text{C}$   
**Ans:** 752.4 J
10. 40 g,  $c = 1.5 \text{ J/g}^{\circ}\text{C}$ ,  $\Delta T = 2^{\circ}\text{C}$   
**Ans:** 120 J

## Enthalpy Change ( $\Delta H$ )

11. Reaction releases 200 J  
**Ans:**  $\Delta H = -200 \text{ J}$
12. Absorbs 150 J  
**Ans:** +150 J
13. Releases 500 kJ  
**Ans:** -500 kJ
14. Absorbs 75 kJ  
**Ans:** +75 kJ
15. Heat lost = 300 J  
**Ans:** -300 J
16. Heat gained = 100 J  
**Ans:** +100 J
17. 250 J released  
**Ans:** -250 J

18. 400 J absorbed

**Ans:** +400 J

19. 600 kJ released

**Ans:** -600 kJ

20. 50 kJ absorbed

**Ans:** +50 kJ

### Calorimetry Problems

21. 100 g water,  $\Delta T = 5^\circ\text{C}$

**Ans:** 2090 J

22. 200 g water,  $\Delta T = 2^\circ\text{C}$

**Ans:** 1672 J

23. 50 g water,  $\Delta T = 10^\circ\text{C}$

**Ans:** 2090 J

24. 25 g water,  $\Delta T = 4^\circ\text{C}$

**Ans:** 418 J

25. 150 g water,  $\Delta T = 3^\circ\text{C}$

**Ans:** 1881 J

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### Hess's Law (Concept-based numericals)

26.  $\Delta H_1 = -100$ ,  $\Delta H_2 = -50 \rightarrow$  total

**Ans:** -150 kJ

27.  $-200 + 100$

**Ans:** -100 kJ

28.  $-300 + (-200)$

**Ans:** -500 kJ

29.  $150 - 50$

**Ans:** 100 kJ

30.  $-400 + 250$

**Ans:** -150 kJ

### Specific Heat Capacity

31.  $q = 200$  J,  $m = 10$  g,  $\Delta T = 5^\circ\text{C}$

**Ans:** 4 J/g $^\circ\text{C}$

32.  $q = 100$  J,  $m = 5$  g,  $\Delta T = 2^\circ\text{C}$

**Ans:** 10 J/g $^\circ\text{C}$

33.  $q = 500$  J,  $m = 25$  g,  $\Delta T = 5^\circ\text{C}$

**Ans:** 4 J/g $^\circ\text{C}$

34.  $q = 300 \text{ J}$ ,  $m = 10 \text{ g}$ ,  $\Delta T = 3^\circ\text{C}$

**Ans:**  $10 \text{ J/g}^\circ\text{C}$

35.  $q = 600 \text{ J}$ ,  $m = 20 \text{ g}$ ,  $\Delta T = 3^\circ\text{C}$

**Ans:**  $10 \text{ J/g}^\circ\text{C}$

### Mixed Practice

36.  $100 \text{ g}$ ,  $c = 4.18$ ,  $\Delta T = 1$

**Ans:**  $418 \text{ J}$

37.  $20 \text{ g}$ ,  $c = 2$ ,  $\Delta T = 5$

**Ans:**  $200 \text{ J}$

38.  $10 \text{ g}$ ,  $c = 1$ ,  $\Delta T = 10$

**Ans:**  $100 \text{ J}$

39.  $50 \text{ g}$ ,  $c = 4$ ,  $\Delta T = 2$

**Ans:**  $400 \text{ J}$

40.  $80 \text{ g}$ ,  $c = 1$ ,  $\Delta T = 5$

**Ans:**  $400 \text{ J}$

### Continue (41–100 Short Practice)

41.  $10\text{g water}$ ,  $\Delta T=1 \rightarrow 41.8 \text{ J}$

42.  $20\text{g water}$ ,  $\Delta T=2 \rightarrow 167.2 \text{ J}$

43.  $30\text{g water}$ ,  $\Delta T=3 \rightarrow 376.2 \text{ J}$

44.  $40\text{g water}$ ,  $\Delta T=1 \rightarrow 167.2 \text{ J}$

45.  $50\text{g water}$ ,  $\Delta T=2 \rightarrow 418 \text{ J}$

46.  $60\text{g}$ ,  $c=2$ ,  $\Delta T=2 \rightarrow 240 \text{ J}$

47.  $70\text{g}$ ,  $c=1$ ,  $\Delta T=3 \rightarrow 210 \text{ J}$

48.  $80\text{g}$ ,  $c=2$ ,  $\Delta T=1 \rightarrow 160 \text{ J}$

49.  $90\text{g}$ ,  $c=1$ ,  $\Delta T=2 \rightarrow 180 \text{ J}$

50.  $100\text{g}$ ,  $c=1$ ,  $\Delta T=1 \rightarrow 100 \text{ J}$

51. Heat released  $700 \text{ J} \rightarrow -700 \text{ J}$

52. Heat absorbed  $800 \text{ J} \rightarrow +800 \text{ J}$

53. Heat released  $900 \text{ J} \rightarrow -900 \text{ J}$

54. Heat absorbed  $1000 \text{ J} \rightarrow +1000 \text{ J}$

55. Heat released  $1100 \text{ J} \rightarrow -1100 \text{ J}$

56.  $\Delta H: -50 + (-50) \rightarrow -100 \text{ kJ}$

57.  $\Delta H: 100 - 200 \rightarrow -100 \text{ kJ}$

58.  $\Delta H: -300 + 100 \rightarrow -200 \text{ kJ}$

59.  $\Delta H: 200 + 200 \rightarrow 400 \text{ kJ}$

60.  $\Delta H: -150 + 50 \rightarrow -100 \text{ kJ}$

61.  $q=420$ ,  $m=10$ ,  $\Delta T=10 \rightarrow 4.2 \text{ J/g}^\circ\text{C}$

62.  $q=210$ ,  $m=5$ ,  $\Delta T=10 \rightarrow 4.2 \text{ J/g}^\circ\text{C}$

63.  $q=84$ ,  $m=2$ ,  $\Delta T=10 \rightarrow 4.2 \text{ J/g}^\circ\text{C}$

64.  $q=42$ ,  $m=1$ ,  $\Delta T=10 \rightarrow 4.2 \text{ J/g}^\circ\text{C}$

65.  $q=4200$ ,  $m=100$ ,  $\Delta T=10 \rightarrow 4.2 \text{ J/g}^\circ\text{C}$   
66.  $10\text{g}$ ,  $c=2$ ,  $\Delta T=2 \rightarrow 40 \text{ J}$   
67.  $20\text{g}$ ,  $c=3$ ,  $\Delta T=2 \rightarrow 120 \text{ J}$   
68.  $30\text{g}$ ,  $c=1$ ,  $\Delta T=3 \rightarrow 90 \text{ J}$   
69.  $40\text{g}$ ,  $c=2$ ,  $\Delta T=4 \rightarrow 320 \text{ J}$   
70.  $50\text{g}$ ,  $c=1$ ,  $\Delta T=5 \rightarrow 250 \text{ J}$   
71.  $5\text{g water}$   $\Delta T=2 \rightarrow 41.8 \text{ J}$   
72.  $15\text{g water}$   $\Delta T=2 \rightarrow 125.4 \text{ J}$   
73.  $25\text{g water}$   $\Delta T=2 \rightarrow 209 \text{ J}$   
74.  $35\text{g water}$   $\Delta T=2 \rightarrow 292.6 \text{ J}$   
75.  $45\text{g water}$   $\Delta T=2 \rightarrow 376.2 \text{ J}$   
76.  $\Delta H: -10 + -20 \rightarrow -30 \text{ kJ}$   
77.  $\Delta H: -30 + 10 \rightarrow -20 \text{ kJ}$   
78.  $\Delta H: 40 - 10 \rightarrow 30 \text{ kJ}$   
79.  $\Delta H: -100 + 50 \rightarrow -50 \text{ kJ}$   
80.  $\Delta H: 60 + 40 \rightarrow 100 \text{ kJ}$   
81.  $q=100$ ,  $m=10$ ,  $\Delta T=1 \rightarrow 10 \text{ J/g}^\circ\text{C}$   
82.  $q=200$ ,  $m=20$ ,  $\Delta T=1 \rightarrow 10 \text{ J/g}^\circ\text{C}$   
83.  $q=300$ ,  $m=30$ ,  $\Delta T=1 \rightarrow 10 \text{ J/g}^\circ\text{C}$   
84.  $q=400$ ,  $m=40$ ,  $\Delta T=1 \rightarrow 10 \text{ J/g}^\circ\text{C}$   
85.  $q=500$ ,  $m=50$ ,  $\Delta T=1 \rightarrow 10 \text{ J/g}^\circ\text{C}$   
86.  $60\text{g}$ ,  $c=1$ ,  $\Delta T=6 \rightarrow 360 \text{ J}$   
87.  $70\text{g}$ ,  $c=2$ ,  $\Delta T=5 \rightarrow 700 \text{ J}$   
88.  $80\text{g}$ ,  $c=1$ ,  $\Delta T=4 \rightarrow 320 \text{ J}$   
89.  $90\text{g}$ ,  $c=2$ ,  $\Delta T=3 \rightarrow 540 \text{ J}$   
90.  $100\text{g}$ ,  $c=1$ ,  $\Delta T=2 \rightarrow 200 \text{ J}$   
91. Heat absorbed  $2000 \text{ J} \rightarrow +2000 \text{ J}$   
92. Heat released  $1500 \text{ J} \rightarrow -1500 \text{ J}$   
93. Heat absorbed  $1200 \text{ J} \rightarrow +1200 \text{ J}$   
94. Heat released  $800 \text{ J} \rightarrow -800 \text{ J}$   
95. Heat absorbed  $600 \text{ J} \rightarrow +600 \text{ J}$   
96.  $\Delta H: -200 + -300 \rightarrow -500 \text{ kJ}$   
97.  $\Delta H: 300 - 100 \rightarrow 200 \text{ kJ}$   
98.  $\Delta H: -400 + 200 \rightarrow -200 \text{ kJ}$   
99.  $\Delta H: 500 - 200 \rightarrow 300 \text{ kJ}$   
100.  $\Delta H: -600 + 100 \rightarrow -500 \text{ kJ}$