# 100 Thermodynamics Numerical Problems (with Answers)

## 🔹 Basic Heat & Temperature (1–20)

1. Calculate heat required to raise 100 g water by 10°C (c = 4.18 J/g°C) → **4180 J**
2. Heat released when 50 g water cools by 5°C → **-1045 J**
3. Heat needed for 200 g metal (c=0.5) to rise 20°C → **2000 J**
4. Temperature rise if 1000 J added to 50 g water → **4.78°C**
5. Heat for 1 kg water, 2°C rise → **8360 J**
6. Heat loss for 250 g water drop 4°C → **-4180 J**
7. Energy for 100 g copper (c=0.39) +10°C → **390 J**
8. ΔT if 2000 J to 100 g water → **4.78°C**
9. Heat needed for 500 g water +1°C → **2090 J**
10. Heat released 100 g metal drop 15°C (c=0.2) → **-300 J**
11. Energy for 300 g water +3°C → **3762 J**
12. ΔT if 100 J to 10 g water → **2.39°C**
13. Heat for 1 g water +100°C → **418 J**
14. Heat for 100 g ice melt (Lf=334) → **33400 J**
15. Heat for boiling 50 g water (Lv=2260) → **113000 J**
16. Heat to cool 500 g by 2°C → **-4180 J**
17. Heat for 150 g water +5°C → **3135 J**
18. ΔT for 209 J in 10 g water → **5°C**
19. Heat for 20 g metal (c=0.9) +10°C → **180 J**
20. Heat loss for 100 g drop 1°C → **-418 J**

## 🔹 Enthalpy Changes (21–40)

21. ΔH if 500 J absorbed → **+500 J**
22. ΔH if 200 J released → **-200 J**
23. Reaction absorbs 2 kJ → **+2000 J**
24. Releases 5 kJ → **-5000 J**
25. If q=1000 J at constant pressure → **ΔH = 1000 J**
26. Endothermic reaction sign → **Positive ΔH**
27. Exothermic reaction sign → **Negative ΔH**
28. ΔH for combustion given -890 kJ → **-890 kJ**
29. Heat absorbed 3 kJ → **+3000 J**
30. Heat released 1.5 kJ → **-1500 J**
31. ΔH for neutralization ≈ → **-57 kJ/mol**
32. Reaction releases 10 kJ → **-10000 J**
33. If q = -250 J → **ΔH = -250 J**

34. ΔH of formation sign varies → **Depends**
35. Combustion always → **Exothermic**
36. If ΔH > 0 → **Endothermic**
37. If ΔH < 0 → **Exothermic**
38. Energy absorbed 750 J → **+750 J**
39. Reaction releases 8 kJ → **-8000 J**
40. Heat gained → **Positive ΔH**

## 🔹 Entropy & Gibbs Free Energy (41–60)

41. ΔG = ΔH – TΔS → formula
42. ΔG negative means → **Spontaneous**
43. ΔG positive → **Non-spontaneous**
44. ΔS increase means → **More disorder**
45. ΔS decrease → **More order**
46. ΔG = 0 → **Equilibrium**
47. If ΔH negative & ΔS positive → **Always spontaneous**
48. ΔH positive & ΔS negative → **Never spontaneous**
49. ΔG = -500 J → **Spontaneous**
50. ΔG = +200 J → **Non-spontaneous**
51. Entropy unit → **J/K**
52. Temperature unit → **Kelvin**
53. ΔG equation units → **J or kJ**
54. ΔS positive → **Disorder increases**
55. ΔS negative → **Order increases**
56. High T favors → **Entropy term**
57. Low T favors → **Enthalpy term**
58. ΔG = ΔH – TΔS importance → **Predicts feasibility**
59. ΔS gas > liquid → **True**
60. ΔS liquid > solid → **True**

## 🔹 Hess's Law & Bond Energy (61–80)

61. Hess law → **Add equations**
62. ΔH total = sum of steps
63. Reverse reaction → **Change sign**
64. Multiply equation → **Multiply ΔH**
65. Bond breaking → **Endothermic**
66. Bond forming → **Exothermic**
67. ΔH = bonds broken – formed
68. Strong bonds → **High energy**
69. Weak bonds → **Low energy**
70. Formation releases energy → **Exothermic**
71. Breaking absorbs energy → **Endothermic**
72. ΔH depends on bonds

73. Double bond stronger than single
74. Triple bond strongest
75. Bond energy unit → **kJ/mol**
76. ΔH negative means → **Stable products**
77. Reaction energy = bond difference
78. Hess law applies to → **State functions**
79. Path independent → **Yes**
80. ΔH total remains same

## 🔹 Advanced / Mixed (81–100)

81. 1 mol gas expands → work done
82. Work = PΔV
83. Internal energy formula → ΔU = q + w
84. If system absorbs heat → q positive
85. If system does work → w negative
86. Adiabatic process → q=0
87. Isothermal → constant T
88. Isochoric → constant V
89. Isobaric → constant P
90. ΔU depends on → state
91. Heat capacity Cp > Cv
92. Ideal gas → PV=nRT
93. R = 8.314 J/molK
94. T must be Kelvin
95. Pressure unit → atm/Pa
96. Volume unit → L/m³
97. Energy unit → Joule
98. Work unit → Joule
99. Heat unit → Joule
100. Thermodynamics deals with → Energy changes