

## Multiple Choice Questions

1. This is definition of Calorific value.
2. A fact
3. A fact
4. A fact
5. A fact
6. A fact
7. A fact
8. This is an Isolated System.
9. A fact
10. A fact
11. A fact
12.  $\Delta n_g = 1 - \frac{3}{2} = -\frac{1}{2} < 0 \Rightarrow \Delta H = \Delta E - \frac{RT}{2}$ . So  $\Delta H < \Delta E$
13. Use  $\Delta H = \Delta E + \Delta n_g RT$
14. A fact
15. A fact
16. A fact
17.  $W_{rev} (\text{Isothermal}) = -2.303 nRT \log \frac{V_2}{V_1}$
18. A fact
19. A fact
20.  $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$  has  $\Delta n_g = 0$
21. A fact
22. Use  $\Delta H = \Delta E + \Delta n_g RT$
23. A fact
24.  $\Delta n_g = 3 - 6 = -3$  So  $\Delta H - \Delta E = -3RT$
25. For Isothermal reversible process  $\Delta E = 0$
26.  $\Delta E = q + w$ . Use 1st law of thermodynamics
27.  $\Delta E = q - w$ , as work is done on surroundings.
28.  $W_{rev} = -2.303 nRT \log \frac{P_1}{P_2}$
29. Use  $\Delta H = \Delta E + \Delta n_g RT$  for the equation  $CH_2=CHCH_2CH_3 + O_2 \rightarrow CO_2 + H_2O$
30.  $W_{rev} = \frac{nR}{n-1} (T_2 - T_1)$
31.  $W = -P_{ext} (V_2 - V_1)$
32. Use  $\Delta S_R^0 = \sum S_{Product}^0 - \sum S_{Reactant}^0$
33. A fact
34. A fact
35. A fact
36. A fact

37.  $\Delta H_{\text{vap}} = 18 \times 3 / \text{mole}$ . Use  $\Delta S = \frac{\Delta H_{\text{vap}}}{T}$

2

38. A fact

39.  $\Delta S$  will be maximum where  $\Delta n_g$  is maximum.

40. A fact

41. A fact

42. Use  $\Delta G = \Delta H - T\Delta S$

43.  $\Delta S_{\text{vap}} = \frac{\Delta H_{\text{vap}}}{T}$  at equilibrium.

44. A fact

45. A fact

46. A fact

47. Isothermal processes have  $\Delta E = 0$

48.  $T_{\text{m.p.t}} = \frac{\Delta S}{\Delta H}$

49. Use  $\Delta H = \Delta E + P\Delta V$ .

50.  $\Delta S_f^\circ(\text{CO}_2) = [S_{\text{CO}_2}^\circ - S_{\text{C}}^\circ - S_{\text{O}_2}^\circ]$

51. A fact

52.  $\Delta S_{\text{vap}} = \frac{\Delta H_{\text{vap}}}{T}$

53. A fact

54. A fact

55.  $\Delta S^\circ > 0$  where no. of gas particles or liq particles increase in number

56. Use  $Q_p = m C_p \Delta T$

57.  $\Delta S_{\text{vap}} = \frac{\Delta H_{\text{vap}}}{T}$

58. A fact

59. A fact

60.  $T_{\text{BPE}} = \frac{\Delta S_{\text{vap}}}{\Delta H_{\text{vap}}}$

61. A fact

62. A fact

63. Add all equations

64. A fact

65. A fact

66. 39g benzene is  $\frac{1}{2}$  mole benzene. So  $\Delta H = -1632.3 \text{ kJ}$

67. A fact

68. Use rules of writing thermochemical equations

69.  $\Delta H_R^\circ = \sum \Delta H_f^\circ(\text{prod}) - \sum \Delta H_f^\circ(\text{reactants}) = [2\Delta H_f^\circ(\text{H}_2\text{O}) - \Delta H_f^\circ(\text{H}_2\text{O}_2)]$

70. A fact

71. A fact

72. A fact

73. A fact

74. A fact

75. A fact

76. A fact

77. A fact

78. A fact

79. A fact

80.  $\Delta H_{\text{neut}} = \frac{1}{5}(57) = 11.4 \text{ KJ}$

81.  $T_1 = T_2$ . Temp rise is not volume dependent

82. A fact

83. A fact

84. A fact

85. A fact

86. A fact

87.  $\Delta H_{\text{R}}(\text{NH}_3) = -2\Delta H_{\text{f}}^{\ominus}(\text{NH}_3) = -92 \text{ KJ}$

88. A fact

89. A fact

90.  $2\text{NO}_2 \rightarrow \text{N}_2\text{O}_4 \quad \Delta H_{\text{R}} = 2 - 2 \times 8 = -14 \text{ Kcal}$

91.  $\Delta H - \Delta E = \Delta n_g RT$

92.  $\text{C}(\text{graphite}) \rightarrow \text{C}(\text{diamond}) \quad \Delta H = -393.5 + 395 = +1.5 \text{ KJ}$

93. A fact

94. A fact

95. A fact

96. Use Hess's law of Heat Summation

97. A fact

98. A fact

99. A fact

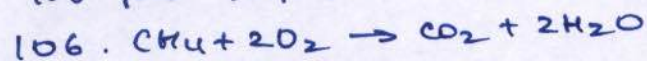
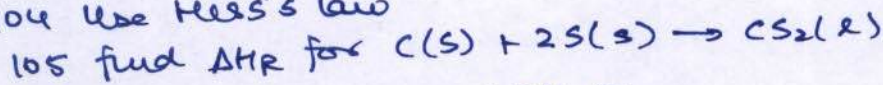
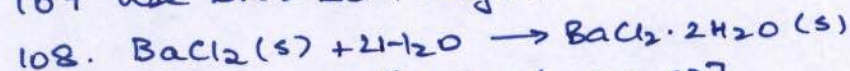
100. Use Hess's law

101. 1 mole  $\text{CH}_3\text{CHO} = 44 \text{ g} \Rightarrow 44 \text{ g}$  produces  $139.5 \times 2 = 279 \text{ Kcal}$

102. Add the equations directly

103. A fact

104. Use Hess's law

107. Use  $\Delta H = \Delta E + \Delta n_g RT$ 

$$\Delta H_{\text{solution}} = [8.8 - (-20.6)]$$

109. A fact

110. Use Hess's law

111. Production of 180g glucose will require 72 Kcal energy.

So for 1.6g we will require 6.4 Kcal.

112.  $T_1 = T_2$ . This temperature increase is not volume dependent.

113.  $\Delta H_{\text{ionization}} = -50.6 - (-55.9) = +5.3 \text{ KJ/mol}$

114. Use  $\Delta H = \Delta E + \Delta n_g RT$  and evaluate  $\Delta E$

115. Add the two equations and find half of the net value. 4

116. Use Hess's law of constant heat summation.

117. A fact

118 Use  $\Delta H = \Delta E + \Delta n_g RT$  and find  $\Delta E$

119. 18g  $H_2O$  (1mole) will require 285 kJ

120. Find  $\Delta n_g = \sum n_{\text{products}} - \sum n_{\text{reactants}}$  for gases.

121. A fact

122 A fact

123 A fact

124 A fact

125. Heat evolved =  $-\frac{393}{44} \times 176 = -1572 \text{ kJ}$

126. Use Hess's law

127.  $\Delta H_R = [(-490 \times 8) + (-240 \times 9)] - (160)$

128 A fact

129. Energy for dissociation of 1mole (2g)  $H_2$  into atoms will be 104 kcal

130 A fact

131  $\Delta H = \{ (2 \times 103) - [(104) + (58)] \}$

132 Bond energy of C-H bond will be  $\frac{166}{4} = 41.6 \text{ kJ/mole}$ .

133. C-H bond energy =  $\frac{320}{4} = 80$ . C-C bond energy will

be  $560 - (6 \times 80) = 80 \text{ calories}$ .

134.  $\Delta H = \{ (2 \times 364) - [433 + 192] \}$

135 A fact

136 A fact

137 A fact

138 A fact

139 A fact

140 A fact

141 Use  $\Delta G^\ominus = -2.303 RT \log K_{eq}$

142 Use  $\Delta G = \Delta H - T\Delta S$ .

143 A fact

144. Reverse equation (1). Multiply eq (2) by 2 and add all three equations together

145 find  $K_{eq} = \frac{[C][D]}{[A][B]}$  and use  $\Delta G^\ominus = -2.303 RT \log K_{eq}$

146. A fact

147 A fact

148 A fact

1. A fact
2. A fact
3. For different equations  $\Delta H$  and  $\Delta E$  may be related differently.
4. This is a definition
5. This is factual
6.  $\Delta n_g = 0$  for this reaction
7. This is a true fact
8. We feel cold as our hands are at a higher temperature
9. Fact
10. If external pressure is zero, no work is done
11. Only change in internal energy can be given.
12. Extensive properties are dependent on mass
13.  $H^+ + OH^- \rightarrow H_2O$  will have same  $\Delta H$  regardless of type of strong acid or strong base
14. Photochemical reactions may have  $\Delta G > 0$
15. This is by definition
16. State functions don't depend on path of a process.

## Previous Year Questions

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1. A fact
2. Find  $\Delta E$  from Bomb calorimeter equation & then use  $\Delta H = \Delta E + \Delta n_g RT$
3.  $\Delta H_R = E_{af} - E_{ab}$
4. A fact
5. A fact
6. A fact
7.  $\Delta G^\ominus = -2.303RT \log K_{eq}$
8. A fact
9. A fact
10. A fact
11.  $\Delta H_R = \sum BE_{reactants} - \sum BE_{products}$ .
12. A fact
13. Use  $\Delta H = nC_p \Delta T$
14. Overall heat is always the sum of individual heats of the steps
15.  $\Delta n_g = -3$  so  $\Delta H - \Delta E = -3RT$
16. Find  $\Delta E$  from bomb calorimeter equation & then use  $\Delta H = \Delta E + \Delta n_g RT$
17.  $\Delta H_R = \Delta H_f(A_2O_3) - \Delta H_f(O_2O_3)$
18.  $\Delta H = \frac{\Delta H_{fusion}}{18}$
19. Bond formation always results in release of energy 218 kcal is released.
20. Use  $\Delta H = \Delta E + P\Delta V$
21. A fact
22. It's a strong acid + strong base reaction
23.  $\Delta H = [8 \times \Delta H_f^\ominus(CO_2) + 9 \Delta H_f^\ominus(H_2O)] - \Delta H_f^\ominus(C_8H_{18}]$
24. Use  $\Delta H = \Delta E + P\Delta V$
25. A fact
26. A fact
27. A fact
28. A fact
29. A fact
30. A fact
31. Use Kirchhoff's equation
32.  $\Delta H = -84500 + 21700 = 62300$
33. A fact
34.  $q = -2.303nRT \log \frac{V_2}{V_1}$

35 A fact

36. Use  $\Delta H = \Delta E + \Delta n_g RT$

7

37  $\Delta H = \Delta E$  when  $\Delta n_g = 0$

38 A fact

39. A fact

40 Reverse equation (2) and add to equation (1)

41  $\Delta H_{\text{for dia graphite} \rightarrow \text{diamond}} = (395.4 - 393.5)$

42  $\Delta S_R = \sum S^\circ_{\text{products}} - \sum S^\circ_{\text{reactants}}$

43 A fact

44. A fact

45 A fact

46 A fact

47  $W_{\text{rev}} = -2.303 nRT \log \frac{V_2}{V_1}$  and  $W_{\text{rev}} = q$

Use  $\Delta H = \Delta E + \Delta n_g RT$

48 A fact

49. A fact

50.  $\Delta H - \Delta E = \Delta n_g RT$

51 A fact

52. Heat of decomposition of  $H_2O$  per mole =  $\frac{+573.2}{2} = 286.6 \text{ kJ}$

53 A fact

54 A fact

55  $T = \frac{\Delta H - \Delta G}{\Delta S}$

56. A fact

57 A fact

58 For  $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ ,  $\Delta H > 0$ ,  $\Delta S > 0$

59. In  $CO + \frac{1}{2} O_2 \rightarrow CO_2$  no. of gas moles on both sides are different

60 Use  $\Delta H = \Delta E + \Delta n_g RT$

61. For 0.1 mole heat is  $-Q$ , then for 1g eq, heat is  $-10Q$

62 A fact

63 Use  $\Delta H_P = \sum BE_{\text{reactants}} - \sum BE_{\text{products}}$

64 Find T for which  $\Delta G = 0$

65  $W = P_{\text{ext}}(V_2 - V_1)$

66. Use Hess's law

67 A fact

68 P-P bond energy will be  $[1485 - 4(318)] \text{ kJ}$

69. Conversion of units

70.  $\Delta E = \Delta H - \Delta n_g RT$

71 A fact

72 A fact

73 A fact

74 A fact

75  $\Delta G < 0$  for  $\Delta H < 0$  &  $\Delta S > 0$

76 A fact

77 Use  $\Delta H_{\text{neutralization}}$  definition

78.  $\alpha = \frac{y}{2}$  is true as  $\text{H}_2\text{SO}_4$  is dibasic.

79. A fact

80 A fact

81. Find  $\Delta S_R = \sum S_{\text{prod}}^{\ominus} - \sum S_{\text{react}}^{\ominus}$  and then use  $\Delta G = \Delta H - T\Delta S$ .  
For equilibrium take  $\Delta G = 0$

82. A fact

83 Graphite is the standard state of carbon.

84.  $W_{\text{rev}} = -2.303nRT \log \frac{V_2}{V_1}$

85.  $W = -P_{\text{ext}}(V_2 - V_1)$

86. Find  $\Delta E$  from bomb calorimetry & then use  $\Delta H = \Delta E + \Delta n_g RT$

87. Use Hess's law

88 Use definition of Heat of neutralization

89. A fact

90.  $\Delta H_R = \sum BE_{\text{Reactants}} - \sum BE_{\text{products}}$

91. A fact

92 Use  $\Delta G = \Delta H - T\Delta S$

93. A fact

94. A fact

95 for 2gm  $\text{H}_2$  (1mole),  $\Delta H_{\text{dissociation}} = \frac{+869.5}{2} = +434.8 \text{ kJ}$

96.  $\Delta S = \frac{\Delta H}{T}$  at equilibrium.

97 A fact

98. A fact

99. Use  $\Delta G = \Delta H - T\Delta S$  and find where  $\Delta G < 0$

100.  $\Delta S_{\text{vap}} = \frac{\Delta H_{\text{vap}}}{T}$

101. A fact

102 A fact

103  $\Delta H_R = E_{\text{af}} - E_{\text{ab}}$

104 A fact

105 Find  $\Delta S_R = \sum S_{\text{prod}} - \sum S_{\text{react}}$  and find  $\Delta G = \Delta H - T\Delta S$ .