Question:

A 1.00 g sample of zinc sulfide (ZnS, M=97.47 g/mol) reacts completely with excess oxygen to produce zinc oxide (ZnO, M=81.41 g/mol) and sulfur dioxide (SO_2, M=64.06 g/mol"). The heat released is sufficient to raise the temperature of 100.0 g of water from 25.2°C to 42.8°C. What is the heat of combustion of zinc sulfide in kJ/mol?

Solution:

a) 1 calorie is the energy needed to warm 1 g of water for 1 degree Celsius.

So, the energy released: 100g · (42.8°C - 25.2°C) = 1760 cal

1 calorie = 4.184 J.

So, the energy: 1760 · 4.184 = 7363.84 J = 7.36384 kJ

b) Amount of zinc sulfide: $\frac{1\ \text{g}}{97.47\ \text{g/mol}}$ = 0.01026 mol

Finally, the heat of combustion: $\frac{7.36384\ \text{kJ}}{0.01026\ \text{mol}}$ = 717.7 kJ/mol

Answer:

717.7 kJ/mol