#76279 Chemistry, General Chemistry

A 20.0 mL sample of benzene at 21.4°C was cooled to its melting point, 5.5°C, and then frozen. How much energy was given off as heat in this process? (The density of benzene is 0.80 g/mL, its specific heat capacity is 1.74 J/g · K, and its heat of fusion is 127 J/g).

Answer:

$\rho = m/V$ $m = \rho \cdot V$
m (benzene sample) = 25.0 mL · 0.80 g/mL = 20.0 g
Specific heat capacity for benzene indicates that cooling 1 g of benzene by 1 K requires 1.74 J.
Therefore cooling 20.0 g of benzene by 14.4 K requires the removal of energy: 20.0 · 14.4 · 1.74 J = 501.12 J
As this is loss of energy by the system, it has a negative sign (-501.12 J).

Heat of fusion for benzene indicates that 1 g of benzene loses 127 J to freeze. That is why, 20.0 g loses:
20 x 127 J = 2540 J
As this is also loss of energy by the system, it also has a negative sign (-2540 J).

Total energy lost: -501.12 + (-2540 J) = 3041 J

Processes that are exothermic (give out heat) have a negative sign.
Processes that are endothermic (absorb heat) have a positive sign.