

Solution 6:

1.)

$$\begin{aligned} \text{Apply } dE &= q - w \\ &= 0 - (-1573 \text{ kJ}) \\ &= 1573 \text{ kJ} \end{aligned}$$

The work is negative because it is performed by the surroundings. The internal energy change is calculated with the assumption of constant temperature.

2.)

Again, apply $dE = q - w$ to solve the problem.

$$\begin{aligned} dE &= 500 \text{ kJ} - 350 \text{ kJ} \\ &= 150 \text{ kJ} \end{aligned}$$

3.)

The reaction at STP:

Aragonite \rightarrow Calcite

$$q = 59 \text{ cal/mole}$$

$$\Delta V = 36.94 - 34.16 = 2.78 \text{ cm}^3/\text{mole}$$

$$\begin{aligned} p \Delta V &= 1 \text{ bar} * 2.78 \text{ cm}^3/\text{mole} = 2.78 \text{ bar} * \text{cm}^3/\text{mole} \\ &= 2.78 / 41.84 \text{ cal/mole} = 0.066 \text{ cal/mole} \end{aligned}$$

$$\begin{aligned} \Delta E &= q - W = q - p \Delta V \\ &= 59 - 0.066 \text{ cal/mole} = 58.93 \text{ cal/mole} \end{aligned}$$

4.)

Number of components: $c = 1$, CaCO_3

Number of phases: $p = 2$, Aragonite, and Calcite

So, $f = 1$

5.)

Intensive properties: a , b , d , e , and h .

Extensive properties: c , g , and f .

Attention: chemical composition is an extensive property of a system.

6.)

Number of components: $c = 1$, Al_2SiO_5

Number of phases: $p = 3$, Andalusite, Silimanite, and Kyanite

So, $f = 0$. This system is at equilibrium presented by a triple point in a P-T phase diagram, although such rock is very rarely found.

7.)

Number of components: $c = 2$, Al_2O_3 , and SiO_2

Number of phases: $p = 5$, Andalusite, Silimanite, Kyanite, Corundum, and Quartz

So, $f = -1$.

This system could not be under equilibrium situation. Therefore, we would not expect to find such rock sample.