**37.22** $5lb_m$ **of** $80°F$ **air is compressed at constant temperature from** $15psia$ **to** $90psia$**. How much work is done on the closed system?**

A. $50Btu$

B. $110Btu$

C. $220Btu$

D. $330Btu$

For a Constant Temperature Process in a Closed System, with the initial and final pressures known, select the equation below. Make sure to use absolute temperature. Look up the Gas Constant for air.

$$w = RTln\left(\frac{P_1}{P_2}\right)$$

$$w = \left(53.35\frac{ft \cdot lb_f}{lb_m °R}\right)(540°R)\,ln\left(\frac{15psia}{90psia}\right) = -51,619\frac{ft \cdot lb_f}{lb_m}$$

Convert units to $\frac{Btu}{lb_m}$. Search Measurement Relationships for relevant conversions.

$$w = \left(-51,619\frac{ft \cdot lb_f}{lb_m}\right)\left(\frac{1Btu}{778ft \cdot lb_f}\right) = -66\frac{Btu}{lb_m}$$

Note this result is the *specific* work i.e. the work per unit mass. Multiply by the mass to determine the total work. The negative sign implies work done *on the system* and may be omitted since the problem statement calls for the work on the system.

$$W = mw = (5lb_m)\left(66\frac{Btu}{lb}\right) = 330Btu$$

**Answer D**