1 kg of sat vapor R134a in a closed system @ 8°C is heated in a constant volume process in which 100 kJ of energy is added via heat transfer. Calculate the final temperature and pressure and the work done.

### Summary

**Sketch:**

- Const volume, no other interactions
- w/surroundings described

**Given:**
- \( m = 1 \text{ kg} \)
- \( T_1 = 8°C \)
- \( \text{sat vapor} \)
- \( V \text{ constant} \)
- \( q_L = 100 \text{ kJ} \)

**Find:**

- \( w_2 = 0 \)
- \( P \)
- \( T \)

### Process Description

**Ident:**
- Const volume, heat addition

**Diagram:**

- States:
  - \( 1 \)
    - sat vapor
    - \( T = 8°C \)
    - \( m = 1 \text{ kg} \)
  - \( 2 \)
    - \( m = 1 \text{ kg} \)

**Analysis Plan**

At \( v = 0.0521 \text{ m}^3/\text{kg} \):

<table>
<thead>
<tr>
<th>( T ) [°C]</th>
<th>( P ) [bar]</th>
<th>( u ) [kJ/\text{kg}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>5.836</td>
<td>330.1</td>
</tr>
<tr>
<td>130</td>
<td>6.000</td>
<td>339.4</td>
</tr>
<tr>
<td>140</td>
<td>6.168</td>
<td>348.9</td>
</tr>
</tbody>
</table>

\( u_2 \) in this range. Interpolate to get \( T \) and \( P \):

\[
\frac{331.46 - 330.1}{339.4 - 330.1} = 0.0146 \Rightarrow \frac{T}{120 + 0.146(130 - 120)} = 121.5°C
\]

\[
\frac{P}{5.836 + 0.146(5.836 - 5.836)} = 0.186 \text{ bar}
\]

**State Model:**

1 kg vapor table for 134a

**Govn Eqns and Defns:**

1st law

**Assumptions:**

1) \( Q = 0 \)
2) no work interaction

**Implications:**

\( E_2 - E_1 = U_2 - U_1 \)

**Strategy:**

1) get sat \( u_1 \) data (done above)
2) solve 1st law to get \( u_2 \)
3) use \( v_2 = v_1 \) and \( u_2 \) to fix chart 2, then get \( T, P \)

**Extra:**

\[
\frac{\Delta u}{m} = \frac{\Delta q}{m} = \frac{100 \text{ kJ}}{1 \text{ kg}} = 331.46 \text{ kJ/°C}
\]

\[
\frac{u_2 - u_1}{1 \text{ kg}} = \frac{\Delta q}{1 \text{ kg}} = 331.46 \text{ kJ/°C}
\]