

## Project Cylinder [CAT 1,2,4,8]:

### Analyze the Expansion of Refrigerant R-134a Inside a Cylinder

#### Description:

In a written technical memorandum (i.e., concise report style), analyze the two consecutive processes shown in Fig. 1 below by:

- Sketching the processes on a  $T$ - $v$  and  $p$ - $v$  diagram
- Showing the processes on an isometric view of the provided  $p$  $v$  $T$  3-D model
- Determining the total heat transfer ( $Q_{\text{total}}$ ) for the processes
- Calculating the initial quality ( $x_1$ ) of the refrigerant
- Reflecting on your learning and personal journey of working on this project

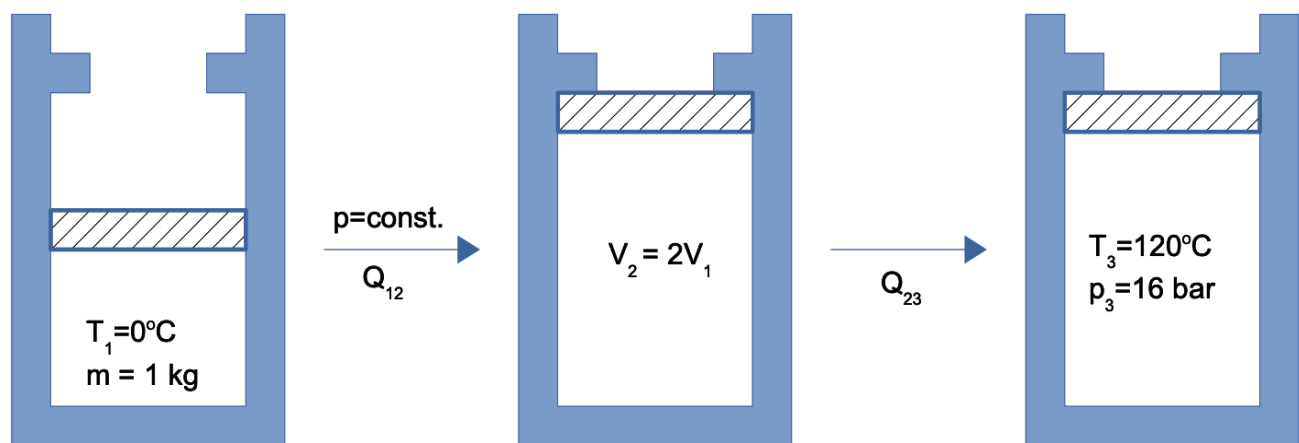


Fig. 1. Refrigerant R-134a Undergoing Two Processes

#### Deliverable:

Present your work in a typed technical memorandum (tech memo) written solely by you, in PDF only.

#### Rules and Format:

- This is an individual project, to be done by you and you alone
- No out-of-pocket expenses should be incurred!
- The tech memo must include the following sections at a minimum:
  - Cover page
  - Introduction (problem statement of the project + a sketch of the problem)
  - Methodology (assumptions, physics involved, formulation if applicable, etc.)
  - Analysis (detailed calculations with explanation or annotations, presentation of results)
  - Conclusion (any insight gained regarding your solution procedure, result accuracy, etc.)

- Reflection (*your own* learning journey while working on this project; discovery about your learning style, strengths and weaknesses; discovery of your surroundings; your worldview, etc.)
- References (optional)
- You may use any software to visualize the provided  $pV$  3-D model; a recommended software is [Paraview](#) (free and open source)

Submission:

Submit your PDF on Gradescope only. Submissions by email or other means will be disregarded.

Due July 5, 2024 (Fri) 11:59 pm.

Grading Rubric:

	Fluency		
	2	1	0
<b>CAT 1:</b> <b>Definitions &amp; Terminologies</b>	All quantities and units involved are defined and used appropriately	Some details missing; some inconsistencies	Mostly inaccurate, missing most details, or missing altogether
<b>CAT 2:</b> <b>1<sup>st</sup> Law for Closed System</b>	First law is applied accurately, appropriately and consistently; assumptions are sensible; limitations are clearly noted	Some details missing; some inconsistencies	Mostly inaccurate, missing most details, or missing altogether
<b>CAT 4:</b> <b>Property Relations (<math>pV</math>)</b>	Visual presentations of the property relations are accurate, cohesive and convincing	Some details missing; some inconsistencies	Mostly inaccurate, missing most details, or missing altogether
<b>CAT 8:</b> <b>Effective Communication</b>	Report is convincing and to the point; flow is logical; a joy to read	Somewhat difficult to follow; some formatting issues	Sketches and writing indecipherable