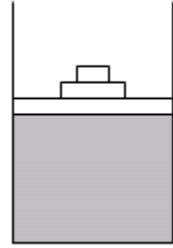


PROBLEM 1 – 15 points

You have some monatomic ideal gas in a cylinder. The cylinder is sealed at the top by a piston that can move up or down, or can even be fixed in place to keep the volume constant. Blocks can be added to, or removed from, the top of the cylinder to adjust the pressure, as necessary. Starting with the same initial conditions each time, you do six experiments. Each experiment involves the same amount of heat, Q .

- A – Add heat Q to the system at constant pressure.
- B – Add heat Q to the system at constant temperature.
- C – Add heat Q to the system at constant volume.
- D – Remove heat Q from the system at constant pressure.
- E – Remove heat Q from the system at constant temperature.
- F – Remove heat Q from the system at constant volume.



[2 points] (a) Which experiments result in a final temperature higher than the initial temperature?

Select all that apply.

- ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F

[2 points] (b) Which experiment results in the highest final temperature?

- ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F

[2 points] (c) Which experiments result in a final volume larger than the initial volume?

Select all that apply.

- ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F

[2 points] (d) Which experiment results in the largest final volume?

- ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F

[2 points] (e) Which experiments result in a final pressure higher than the initial pressure?

Select all that apply.

- ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F

[5 points] (f) Rank the experiments based on the work done by the gas, from most positive to most negative. Use only $>$ and/or $=$ signs in your rankings (e.g., $B=D>C>A=F>E$).

PROBLEM 2 – 10 points

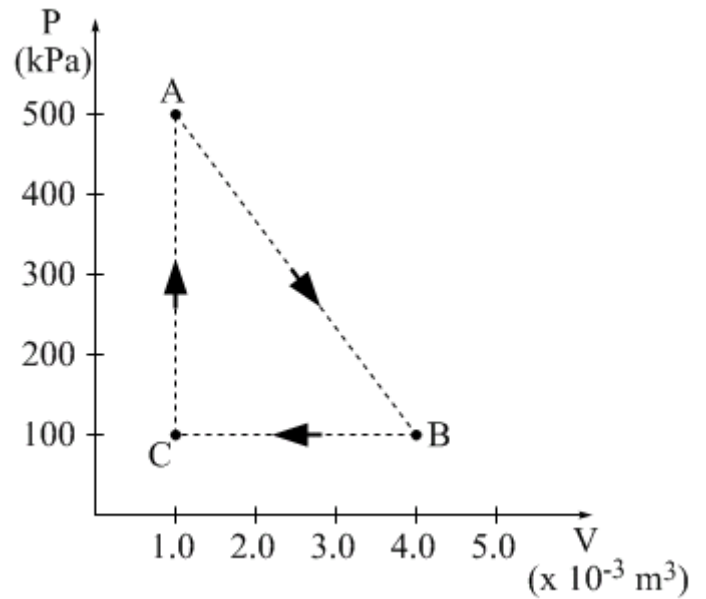
A monatomic ideal gas is subject to the series of processes $A \rightarrow B \rightarrow C \rightarrow A$, as shown on the P-V diagram. The number of moles is such that nR is exactly 4 J/K.

For a monatomic ideal gas

$$\Delta E_{\text{int}} = \frac{3}{2} nR \Delta T$$

$$1 \text{ Pa} = 1 \text{ N/m}^2$$

[6 points] (a) What is the amount of heat involved in the process $A \rightarrow B$?



[2 points] (b) Is the heat in the process $A \rightarrow B$ absorbed by the gas or given off by the gas?

[] absorbed by the gas

[] given off by the gas

[2 points] (c) What is the total amount of heat involved in the whole cycle $A \rightarrow B \rightarrow C \rightarrow A$?