Thermodynamics   tutorhour 1

Question 1
In a cylinder with a movable piston, 5.0 mol of a mono-atomic perfect gas at
$p = p_0$ (= $1.0 \cdot 10^5$ Pa) and T = 100°C is present. The gas is cooled to 0°C during
a reversible and isobaric process.

a) Calculate the volume of the gas in the cylinder at 100°C.
b) Explain whether W > 0 or W < 0 during this process.
c) Calculate the volume of the gas in the cylinder at 0°C.
d) Calculate the work done on the gas.
e) Calculate ΔU for this process.

Question 2
A chemical reaction takes place in a container of cross-sectional area 100 cm^2.
As a result of the reaction, a piston is pushed out through 10 cm against an external
pressure of $1.0 \cdot 10^5$ Pa.
Calculate the work done by the system.

Question 3
A sample consisting of 1.00 mol Ar (consider argon to behave as a perfect gas) is
expanded isothermally at 0°C from 22.4 dm^3 to 44.8 dm^3 under three different
conditions:
a) freely (against zero external pressure)
b) reversibly
c) against a constant external pressure equal to the final pressure of the gas
Determine ΔU, Q and W for these three processes.

Additional material:

Question 4
A sample consisting of 1.00 mol of perfect gas atoms, initially at p_1= $1.00 \cdot 10^5$ Pa and
T_1= 300 K, is heated reversibly to 400 K at constant volume. Calculate the final
pressure, ΔU, Q and W.