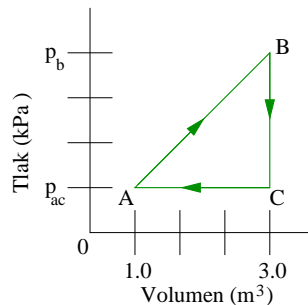


## Termodinamika

- Suppose 1.80 mol of an ideal gas is taken from a volume of  $3.00 \text{ m}^3$  to a volume of  $1.50 \text{ m}^3$  via an isothermal compression at  $30^\circ\text{C}$ . (a) How much energy is transferred as heat during the compression and (b) is the transfer *to* or *from* the gas?
- Air that initially occupies  $0.140 \text{ m}^3$  at a gauge pressure of  $103.0 \text{ kPa}$  is expanded isothermally to a pressure of  $101.3 \text{ kPa}$  and then cooled at constant pressure until it reaches its initial volume. Compute the work done by the air. (Gauge pressure is the difference between the actual pressure and atmospheric pressure).
- A sample of an ideal gas is taken through the cyclic process *abca* shown in the figure. The scale of the vertical axis is set by  $p_b = 7.5 \text{ kPa}$  and  $p_{ac} = 2.5 \text{ kPa}$ . At point *a*,  $T = 200 \text{ K}$ . (a) How many moles of gas are in the sample? What are (b) the temperature of the gas at point *b*, (c) the temperature of the gas at point *c*, and (d) the net energy added to the gas as heat during the cycle?



- A beam of hydrogen ( $H_2$ ) is directed toward a wall, at an angle of  $55^\circ$  with the normal to the wall. Each molecule in the beam has a speed of  $1.0 \text{ km/s}$  and a mass of  $3.3 \times 10^{-24} \text{ g}$ . The beam strikes the wall over an area of  $2.0 \text{ cm}^2$ , at the rate of  $10^{23}$  molecules per second. What is the beam's pressure on the wall?
- In a certain particle accelerator, protons travel around a circular path of diameter  $23.0 \text{ m}$  in an evacuated chamber, whose residual gas is at  $295 \text{ K}$  and  $1.00 \times 10^{-6}$  torr pressure. (a) Calculate the number of gas molecules per cubic centimeter at this pressure. (b) What is the mean free path of the gas molecules if the molecular diameter is  $2.00 \times 10^{-8} \text{ cm}$ ?
- At what temperature does the rms speed of (a)  $H_2$  (molecular hydrogen) and (b)  $O_2$  (molecular oxygen) equal the escape speed from Earth? At what temperature does the rms speed of (c)  $H_2$  and (d)  $O_2$  equal the escape speed from the Moon (where the gravitational acceleration at the surface has magnitude  $0.16g$ )? Considering the answers to parts (a) and (b), should there be much (e) hydrogen and (f) oxygen high in Earth's upper atmosphere, where the temperature is about  $1000\text{K}$ ?

7. The temperature of 2.00 mol of an ideal monatomic gas is raised 15.0 K at constant volume. What are (a) the work  $W$  done by the gas, (b) the energy transferred as heat  $Q$ , (c) the change  $\Delta E_{int}$  in the internal energy of the gas, and (d) the change  $\Delta K$  in the average kinetic energy per atom?
8. A container holds a mixture of three nonreacting gases: 2.40 mol of gas 1 with  $C_{V1} = 12.0$  J/mol K, 1.50 mol of gas 2 with  $C_{V2} = 12.8$  J/mol K, and 3.20 mol of gas 3 with  $C_{V3} = 20.0$  J/mol K. What is  $C_V$  of the mixture?