Ideal Gas Ranking Problems

1. Five points representing five different states of one mole of an ideal gas are labeled on the pressure—volume graph below.

Rank the temperatures of the ideal gas in the five labeled states.

Explain your reasoning.

1. Two cylinders are filled to the same height *H* with ideal gases. The gases are different, and the cross-sectional areas of the cylinders are different. Both cylinders have pistons that are free to move without friction.

Is the temperature of the gas in cylinder *A* (a) *greater than,* (b) *less than,* or (c) *equal to* the temperature of the gas in cylinder B? \_\_\_\_\_\_\_\_\_\_\_\_\_

Explain.

1. Four sealed containers hold different amounts of an ideal gas at different temperatures and pressures. The amount of gas is given in each case as the number of molecules *N.*



Rank the temperatures of these ideal gas samples.



Explain your reasoning.

1. ****An insulated cylinder contains an ideal gas. The cylinder has a piston that is initially locked in place with pins. When the pins are moved outward, the piston can move freely without friction. On top of the piston is an 8 kg metal disc.

A student who is asked what will happen to the temperature of the gas after the piston is unlocked makes the following contention:

“The piston will move but we don’t know which way. Whether it moves up or down, though, since the cylinder is insulated the temperature of the gas cannot change during the process.”

What, if anything, is wrong with the student’s contention? If something is wrong, identify it and explain how to correct it. If nothing is wrong, explain the physics behind the student’s answer.

1. Each cylinder contains an ideal gas trapped by a piston that is free to move without friction. The pistons are at rest. All gases are at the same temperature. The diameter of the cylinder in case Bis twice the diameter of the cylinders in the other cases, and the mass of the piston in case Cis twice the mass in the other cases.



Rank the pressures of the gases.



Explain your reasoning.