AP Physics 2 – Thermal Expansion & Ideal Gas Law

C3-CT17: Using a Steel Tape at Different Temperatures—Actual Length

A surveyor's 100 m steel tape is calibrated to be precise to 0.1 mm at a temperature of 15 °C. A distance between two points is measured as 63.7300 m with this steel tape on a 40 °C day. The linear temperature coefficient of expansion for steel is $\alpha_{Steel} = 11 \text{ x } 10\text{-}6/°C$.

Is the actual (or correct) distance (i) *shorter than*, (ii) *longer than*, or (iii) *the same as* the measured distance of 63.7300 m? _____

Explain your reasoning.

C3-CT19: Heated Beaker Filled with Glycerin—Overflow

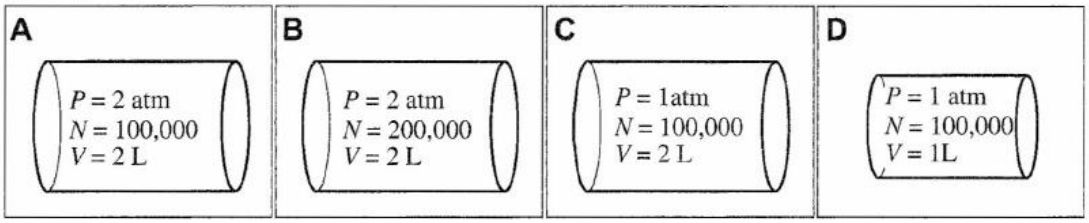
A glass beaker is partially filled with 500 cm^3 of glycerin at 15 °C. The beaker and the glycerin are then heated to 40 °C. The thermal linear coefficient of expansion for the glass is $\alpha_{glass} = 3 \text{ x } 10^{-6}/°C$. The thermal volume coefficient of expansion for glycerin is $\beta_{Glycerin} = 5.1 \text{ x } 10^{-4}/°C$.

As the beaker and contents are heated, will the glycerin level (i) *increase*, (ii) *decrease*, or (iii) *remain the same*? _____

Explain your reasoning.

C3-RT20: Ideal Gas Samples—Temperature I

Four sealed containers hold different amounts of an ideal gas at different temperatures and pressures. The pressure P of the gas is given in each case, as is the number of molecules N and the volume V.



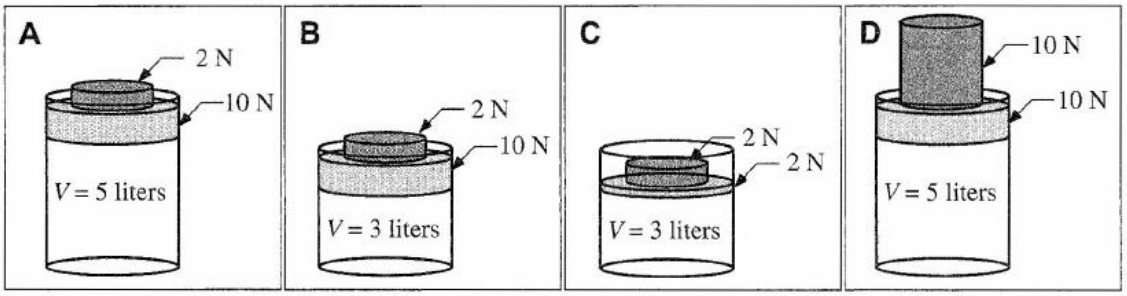
Rank the temperatures of these ideal gas samples.

				OR			
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.

C3-RT21: Ideal Gas in Cylinders with Moveable Pistons I—Pressure

Cylinders with equal cross-sectional areas contain different volumes of an ideal gas sealed in by pistons. There is a weight sitting on top of each piston. The gas is the same in all four cases and is at the same temperature. The pistons are free to move without friction.



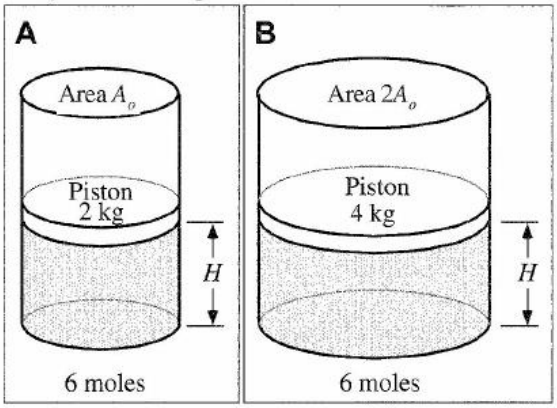
Rank the pressure of the gas in each cylinder.

				OR			
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.

C3-CT24: Ideal Gases in Cylinders—Temperature

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.

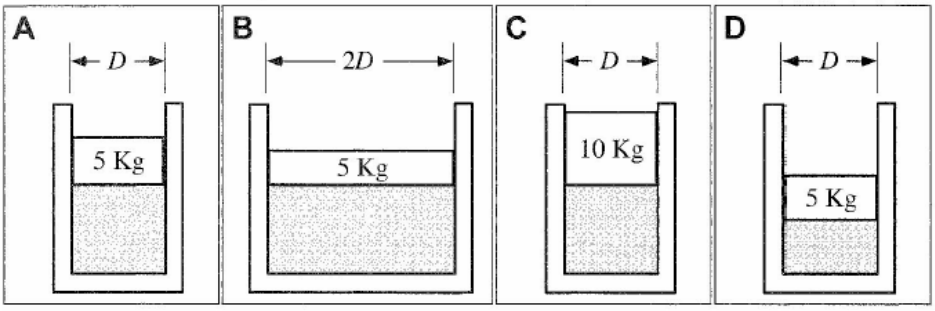


Is the temperature of the gas in cylinder A (i) *greater than*, (ii) *less than*, or (iii) *equal to* the temperature of the gas in cylinder B? _____

Explain your reasoning.

C3-RT27: Ideal Gas in Cylinders with Moveable Pistons II—Pressure

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 B is twice the diameter of the cylinders in the other cases, and the mass of the piston in Case C is twice the mass in the other cases.



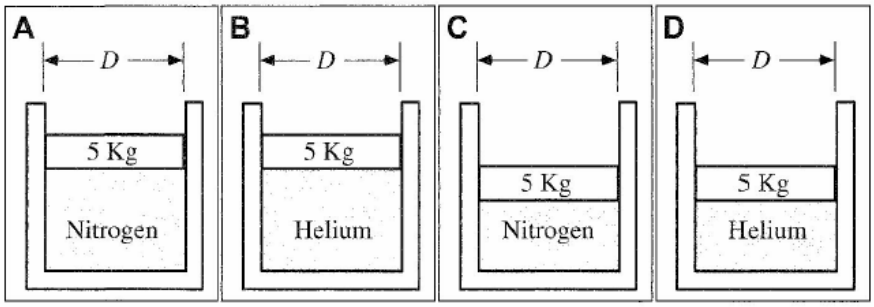
Rank the pressures of the gases.

1	2	3	4	OR			
Greatest			Least		All the same	All zero	Cannot determine

Explain your reasoning.

C3-RT30: Ideal Gases in Cylinders with a Piston—Number of Moles

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, and the pistons and cylinders are identical. The cylinders in Cases A and C contain nitrogen, and the cylinders in Cases B and D contain helium, which has fewer grams per mole. The volume of gas is the same for Cases A and B, and the same for Cases C and D.



Rank the number of moles of gas in the cylinders.

1	2	3	4	OR			
Greatest			Least		All the same	All zero	Cannot determine

Explain your reasoning.