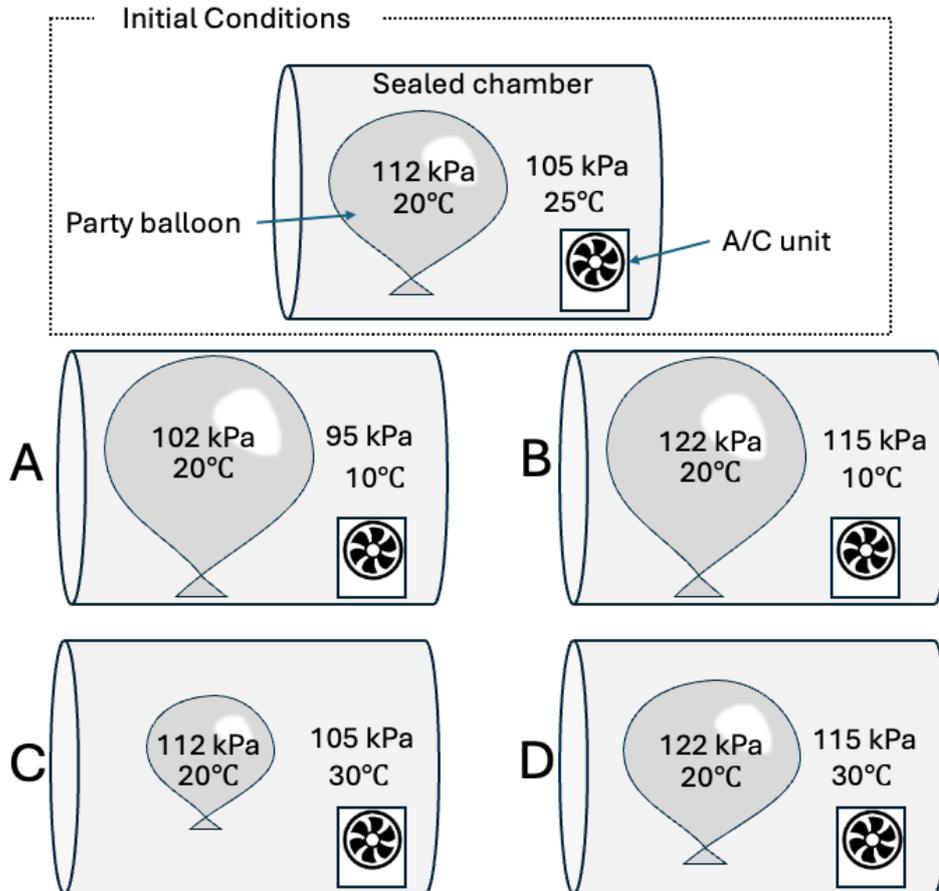


1. The illustrated apparatus was set up. The temperature of the gas inside the sealed container can be varied with the A/C unit (which can heat or cool) but no gas can enter or leave either the balloon or the chamber. Note: balloon sizes as drawn indicates volume of gas inside balloon.

Q4421

Compared to the initial conditions, which option correctly predicts an outcome of changing the temperature in the sealed chamber?



Q4421

At the level of the container and its pressure and temperature, the balloon can be ignored. Why? Because the balloon's contents are really just a small subset of the gas inside the container. Yes, the pressure inside the balloon is slightly higher because of the elasticity of the balloon itself, but that does not affect considerations at the level of the whole container.

Taking this simplification, several options can be discounted.

B – eliminated as cooling the air will reduce the pressure in the sealed container.

C -eliminated as heating the air will increase the pressure in the sealed container

This leaves A and D

D is eliminated because the temperature inside the balloon is the same as starting, the volume is the same as starting condition and the number of moles of gas inside the balloon is the same as starting. Therefore, according to Avogadro's law, the pressure must be the same as the starting pressure.

A -is the only response consistent with the laws relevant to the course. In A, the volume of the balloon is increased (because the external pressure decreased). Therefore, the pressure must also decrease. In the container, on average the air temperature has decreased hence pressure must decrease. Inside the balloon, the number of moles of gas is the same, but the volume is increased hence pressure must be decreased

Further notes

The elastic stretch of the balloon results in a pressure difference of +7 kPa inside the balloon. That is, the inward pressure of the balloon skin is increasing the internal pressure of the balloon compared to the external pressure.

It is possible to infer that with the balloon larger (as in A) the differential would increase. However, if you do the actual experiment with balloons, there is section of their size where a relatively small pressure increase results in a large volume increase. As the balloon gets near its limit (close to popping), this changes and the pressure starts increasing dramatically.

Hence, the volume difference between the starting volume and the volume in A would not be sufficient to change the pressure *difference* between inside and out.