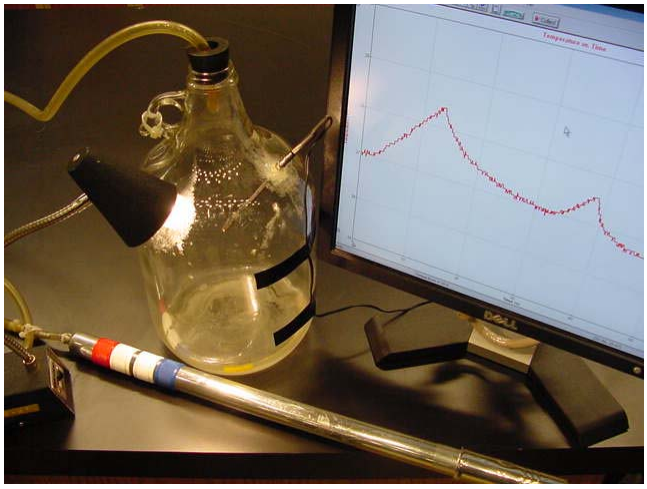
# Answer #347

The answer is (b): The temperature of the air will become lower, as can be seen in an mpeg video by clicking your mouse on the photograph below. For this video we have changed the bottle a bit: a temperature probe has been added to the system, so that when we pump air into the bottle and the cork blows off we can track the temperature of the air in the bottle. The probe sticks into the bottle through a hole drilled on the right side of the bottle.



Notice that when the cork blows off the bottle a cloud forms inside the bottle. This cloud results as the air cools when the cork is blown off the bottle: the air in the bottle expands rapidly and cools so much that the temperature falls below the dew point, and the water condenses into water droplets, forming a cloud. The fact that the air cools when the cork is blown off is verified by the plot of temperature vs. time on the graph.

The temperature of the air in the bottle falls when the cork blows off due to the physical process known as *adiabatic expansion*. The same thing happens when you open a bottle of beer or a can of soda: if you look carefully into the can or bottle you will see a small cloud immediately after the cork blows.

This is a result of conservation of energy. The air in the bottle expands very rapidly, pushing back the atmospheric air occupying the volume into which the higher pressure air expands. This process requires energy, which is obtained from the heat energy in the expanding air. Because this process occurs *rapidly*, that is, without exchange of heat energy between the expanding air and the outside air, it is known as *adiabatic expansion*, or *adiabatic cooling*.

Notice that a reverse process occurs when you pump air into the bottle. You can also see this midway in the video, when a hand reaches in to replace the cork, followed by more pumping to blow the cork off again. The temperature rises, as seen in the graph, and this rise in temperature results in the water droplets changing back into the vapor phase, causing the cloud to disappear.

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