

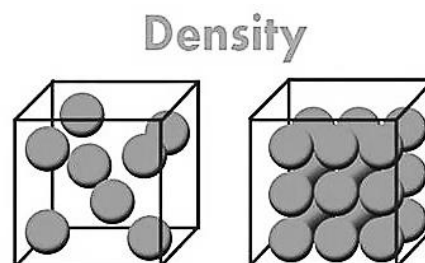
Name: \_\_\_\_\_

## Air Expands and Contracts

### Measuring air Expansion and Contraction:

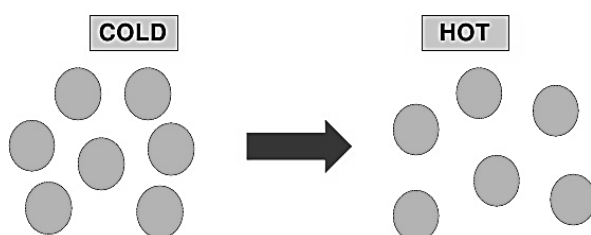
We've seen that warm air rises. This is because air expands when heating, becoming less dense.

The density of air is a measure of how many air molecules there are in a given volume of air. The more molecules there are, the denser (heavier) the air.



Or, to put it another way, density depends on how much space a given number of air molecules takes up. The smaller the space the denser the air.

### EXPANSION & CONTRACTION OF GASES



Cold gas molecules move slowly and have little energy. They stay close together and take up little space. When heated the molecules gain energy and move faster. They spread out and take up more space.

In the following video, Jared demonstrates how air expands and contracts. He actually measures how much more space the same amount of air (i.e. the same number of air molecules) takes up when heated.

Air expands and contract: <https://www.youtube.com/watch?v=1S7Qd04oL-o>

**Contraction:** Jared took a measuring bottle (open at the top) and heated the air inside. The heated air in the bottle expanded, and some of it was pushed out of the open bottle. Jared then inverted the bottle (turned it upside down) and quickly placed it (top down) in a cup of ice water.

***less      filled      high      push      half***

1. When Jared first placed the inverted bottle in the cold water, it was completely \_\_\_\_\_ with warm air. As the bottle cooled, the air molecules inside became less energetic, slowed down, and needed \_\_\_\_\_ space. Water was able to \_\_\_\_\_ its way into the bottle and fill the extra space that the cool air no longer needed.

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*less      filled      high      push      half*

2. Jared could tell how much the air in the bottle had contracted (shrunk) by measuring how \_\_\_\_\_ the water had risen in the bottle. According to Jared's measurements, the warm air in the bottle contracted to almost \_\_\_\_\_ its original amount.

**Expansion:** To measure the expansion of air on heating, Jared used three bottles connected with straws. The first bottle was filled with room-temperature air. The second bottle was halfway filled with colored water. It was connected at its top to the first air-filled bottle, and at its bottom to the third empty 'measuring' bottle.

*heated      push      expanded      cool*

When the air in the first bottle was heated, it \_\_\_\_\_, and some of it spread out into the second bottle. There it pressed down on the water at the bottom of the bottle with enough force to \_\_\_\_\_ the water out of the second bottle and into the measuring bottle. By measuring the amount of water pushed into the third bottle, Jared could tell how much the room temperature air in the first bottle had expanded when \_\_\_\_\_.

So, what should you take away from all this? Not only does air expand (fills more space) when heated and contract (fills less space) when cooled, but we can actually measure the amount of expansion or contraction. Science is so \_\_\_\_\_.