

## Gas exchange in humans: model lung – transcript

Human lungs are situated in the thorax, surrounded by the ribs, intercostal muscles and the diaphragm. Air is moved into and out of the lungs along the trachea, bronchi, bronchioles and alveoli. But what makes this air move?

In this experiment, first a model lung is built to show how lung ventilation works and then a simulation will show how inspired and expired air differs.

For the model lung, first, the neck of a balloon is cut off. The large part of the balloon acts as the diaphragm.

Next, the plastic bottle is cut in half. The top part of the bottle acts as the thorax.

The balloon is then stretched tightly over the open end of the bottle and secured with sticky tape.

A straw is placed into the other balloon through the neck and secured in place with sticky tape. This balloon acts as the lung and the straw acts as the trachea.

A ball of modelling clay is made slightly larger than the neck of the bottle. The pencil is used to make a hole through the modelling clay.

The straw is pushed through the hole and the modelling clay is squashed against the straw to hold it in place.

The balloon is then carefully placed into the top of the bottle. The modelling clay is squashed against the neck.

The model lung is now complete.

To see the model in action, the diaphragm is pulled down and then allowed it to return to its original position. This movement is repeated several times. Watch what happens to the balloon. As the diaphragm is pulled down, the lungs (red balloon) inflate and as the diaphragm returns, the lungs deflate.

A different model is required to find out how inspired and expired air differ. This time, two small conical flasks will act as the lungs and lime water is used as a test for carbon dioxide.

First, the lime water (about one centimetre depth) is added to each conical flask

Then two balls of modelling clay slightly larger than the neck of the conical flasks is made. The pencil is used to make two holes through each. One ball of modelling clay is placed into the neck of each conical flask.

Straws are placed through each hole in the modelling clay. Ensure that at this stage the straws do not touch the limewater.

The height of the first straw is adjusted so that it dips into the limewater whilst the other straw is kept well above the limewater. The conical flask is sealed and straws held in place with the modelling clay.

This is repeated for the other conical flask and they are placed side-by-side.



The setup should look like this.

Inhalation is simulated by sucking air through the straw that is above the limewater in one of the conical flasks. Exhalation is simulated by blowing air through the straw that is in the limewater of the other conical flask.

This cycle is repeated until a change in the limewater is observed. The limewater in the flask will go cloudy.

Now the modelling clay is removed and a piece of Universal indicator paper is dipped into the limewater in each conical flask to record the pH.

The paper dipped into the clear limewater turns purple whereas the paper dipped into the cloudy lime water turns green.

As the ribs move up and out and the diaphragm flattens, air flows into the lungs – this is inhalation.

As the ribs move down and in and the diaphragm comes up, air flows out – this is exhalation.

The simple models in this experiment demonstrate the physical and chemical changes that happen during breathing.

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