

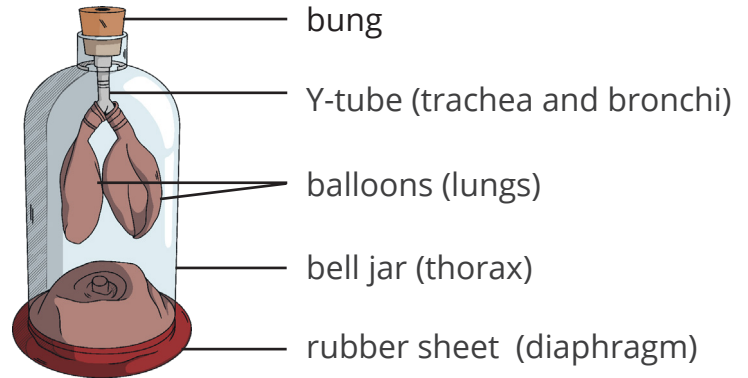
# Modelling the Mechanism of Breathing

## Demonstration Guide

A bell jar model can be used to demonstrate the mechanism of breathing.

### Equipment

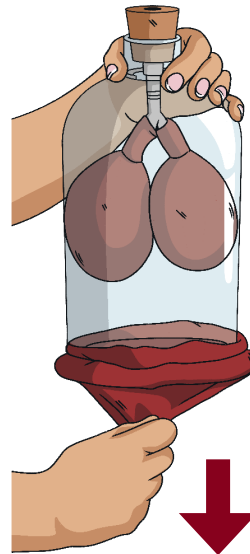
bell jar  
 rubber sheet  
 balloons ×2  
 Y-tube  
 bung



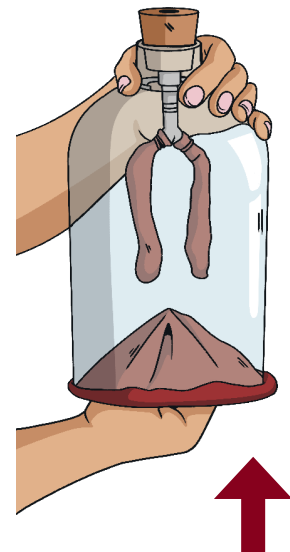
### Demonstration Method

1. Set up the bell jar as shown above, with two balloons connected to a glass or plastic Y-tube attached to a bung with a hole in it to allow air in. Stretch the rubber sheet over the opening at the bottom of the bell jar.

2. Demonstrate the process of inhalation by pulling the rubber sheet downwards. This represents the contraction of the diaphragm. The volume of the bell jar increases, which decreases the air pressure inside the bell jar. Because the pressure inside the bell jar is lower than the pressure outside, air from the outside of the jar is drawn through the Y-tube into the balloons, causing them to inflate.



3. Demonstrate the process of exhalation by pushing the rubber sheet upwards. This represents the diaphragm relaxing. The volume of the bell jar decreases, therefore increasing the air pressure inside the bell jar. The change in pressure forces the air out of the balloons, causing them to deflate.

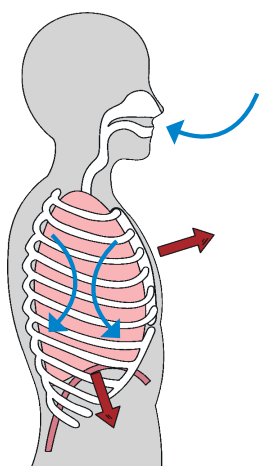


## Discussion

The process of air moving into and out of the lungs is called ventilation. This happens due to pressure differences between the atmosphere and the air inside the lungs.

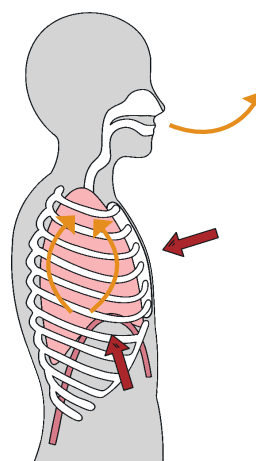
Inhalation (or inspiration) is the process of breathing in. This happens as a result of the diaphragm contracting and flattening, while the contraction of the intercostal muscles causes the ribs to move up and out. This increases the volume of the chest, which decreases the pressure. This causes air to rush in from outside the body and fill the lungs. The bell jar model demonstrates the change in pressure in the chest cavity as the diaphragm is pulled down, showing that this causes air to enter the lungs.

Exhalation (or expiration) is the process of breathing out. This is caused by the relaxation of the diaphragm and intercostal muscles. This makes the volume of the chest smaller, which increases the pressure, pushing the air out of the lungs. Pushing up on the rubber sheet in the model shows that this causes air to move out of the lungs.



### Inhalation

(diaphragm flattens, ribcage moves up and out)



### Exhalation

(diaphragm relaxes, ribcage moves down)

The bell jar model has some limitations which you could discuss during the demonstration:

- The bell jar is a rigid structure, which is unable to move in the same way as the ribcage.
- The model shows the lungs as empty sacs, whereas in reality the lungs are composed of many alveoli.
- The rubber sheet needs to be pulled down to cause the balloons to inflate, whereas the diaphragm only flattens to cause air to enter the lungs.
- The bell jar is filled with air, whereas the chest cavity is filled with pleural fluid.

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