Create a model to explain how lungs work.

1.What materials would you use to construct your model?

    i.   How would you represent the lungs in your model?

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   ii.   How would you represent a trachea and bronchial tubes (bronchi) in your model?

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  iii.   How would you represent a diaphragm in your model?

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  iv.   How would you represent a chest cavity in your model?

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   v.   Discuss with your group your suggestions and explain your reasoning.

Discuss with your group how you can use the following materials for the construction of a model to interpret how lungs work and particularly breathing in (inhalation) and breathing out (exhalation). Then, follow the instructions below to construct a model and make observations.

Materials

Plastic water bottle 1L (cut in half)

Water balloons (2)

Small rubber band (2)

Plastic tube with two outlets

15-20 cm balloon or plastic film

2. Instructions

i. Put the plastic tube with two outlets in the plastic bottle (See the picture below for reference).

ii. Put the water balloons onto the end of each tube outlet and secure them with the small elastic.

iii. Cut the 15-20 cm balloon just where it starts to curve. (See the picture below for reference).

iv. Have a partner hold the plastic bottle still while you wrap the balloon around the bottom edge of the plastic bottle. Make sure that the balloon is securely around the plastic bottle.

v. Pull down on the bottom balloon to observe what happens and write your observation.

vi. Push up to see what happens and write your observation.

A **B**

Plastic film
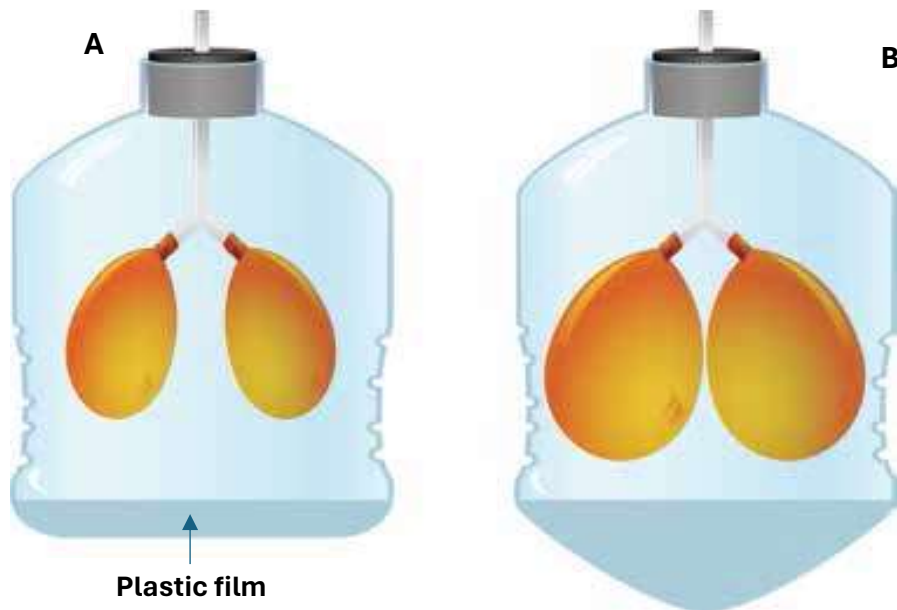
3. Using your model to interpret how lungs work.

Use your model to explain the mechanism of breathing: Match the parts of your model and the parts of human respiratory system and write down your conclusions.

(a) Matching (https://archeia.moec.gov.cy/sm/41/viologia_c_gymn.pdf)

No	Parts of Model lung	No	Parts of Human Respiratory System
1.	Water Balloons	A	chest cavity
2.	Plastic bottle 1L	B	breathing in (inhalation)
3.	15-20 cm bottom balloon	C	lungs
4.	pull down on the bottom balloon in your model.	D	breathing out (exhalation
5.	Push up on the bottom balloon in your model).	F	diaphragm

(b) Conclusions and Limitations of your Model:

From the obtained matching, explain the mechanism of breathing: ……………………………
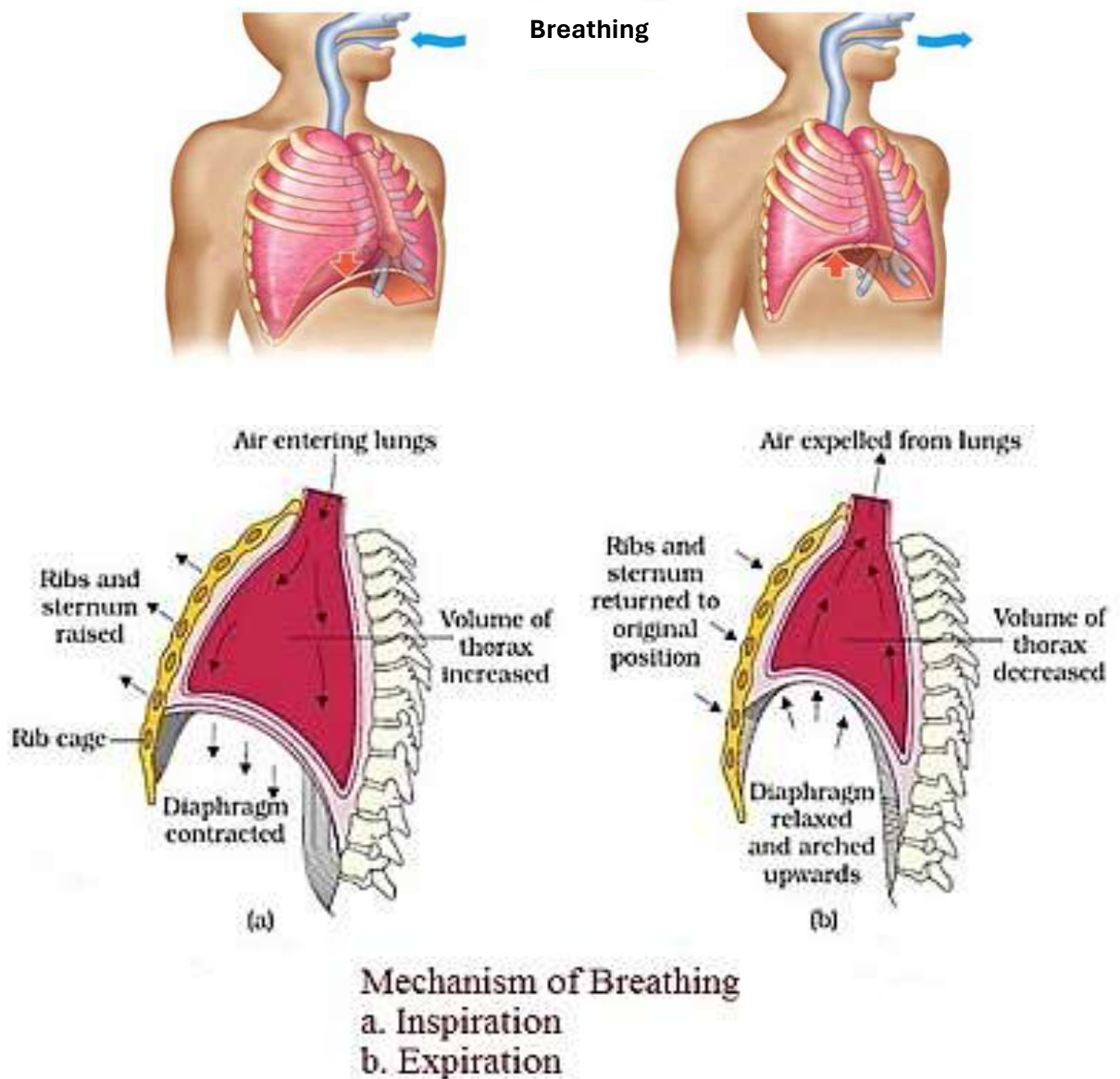
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Write down limitations of your model: ....

WHAT DOES SCIENCE TELL US?

Breathing: The action of breathing in and out is due to changes of pressure within the thorax, in comparison with the outside. This action is also known as external respiration. When we inhale the intercostal muscles (between the ribs) and diaphragm contract to expand the chest cavity. The diaphragm flattens and moves downwards, and the intercostal muscles move the rib cage upwards and out.

Inspiration: This increase in size decreases the internal air pressure and so air from the outside (having a higher pressure than that inside the thorax) flows into the lungs to equalise the pressures.

Expiration: When we exhale the diaphragm and intercostal muscles relax and return to their resting positions. This reduces the size of the thoracic cavity, thereby increasing the pressure and forcing air out of the lungs.

Breathing

Air entering lungs

Ribs and sternum raised

Volume of thorax increased

Rib cage

Diaphragm contracted

(a)

Air expelled from lungs

Ribs and sternum returned to original position

Volume of thorax decreased

Diaphragm relaxed and arched upwards

(b)

Mechanism of Breathing
a. Inspiration
b. Expiration

4. Evaluating the predictive power of your model

4.1. Models have a representative, interpretive and predictive power. To evaluate the predictive power of your model, investigate the follow questions:

No	Question	Prediction	Experiment	Observation and Conclusion
1.	Having a cold sometimes causes extra mucus to form in the lungs. How does the extra "mucus" affect how much air can be inhaled?		Add one spoonful of water to the small balloon inside the bottle. Push and pull on the handle and observe what happens.	
2.	(a) How does a dirty air affect breathing? (b) How does tobacco smoking could affect breathing?		(a) Put some sand in the airway of our model	
3.	How does the size of your lungs affect breathing?		Put a bigger balloon on our model instead of water balloons?	

4.2. Based on the table above, briefly discuss the similarities and differences between your predictions and your observations.

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4.3. Conclusion

Complete the sentence: The predictive power of our model to interpret how lungs work and particularly breathing in (inhalation) and breathing out (exhalation) is ……………………….