Huff'n'Puff

Name:

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Introduction

Testing the lung function of athletes is common place. It allows coaches to measure the effect of training on athletes and also to determine if they are suffering from any respiratory diseases. One functional test that is used to determine if an athlete is suffering from a respiratory disease is a vital capacity test.

Questions

1. **Define vital capacity when referring to the lungs.**

Maximum volume of air that can be expelled from the lungs after a deep breath.

2. **What do you think would happen to an individual's vital capacity when they are suffering from a respiratory disease?**

It would decrease as the lungs aren't functioning at their full or near full capacity.

Aim

To determine if height has an effect on someone's vital capacity.

Hypothesis

The taller someone is the **larger/smaller** their vital capacity will be.

Materials

- Balloons (one for each person you test)
- Large bucket
- Water
- Bathroom scales (see end of worksheet for alternative method if this is not available)

NOTE: Water will be spilled in this experiment. Make sure you conduct the experiment in an area where the ground can get very wet.

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Method

1. Fill the bucket to the brim with water and weigh it on the scales. Note this number down in the results table.
2. Place the full bucket in an area where the ground can get wet (the lawn is perfect).
3. Take a deep breath and expel all the air out of your lungs into the balloon. Tie off the end of the balloon after this long breath.
4. Fully submerge the balloon into the bucket so the volume of the balloon displaces the water in the bucket.
5. Remove the balloon and reweigh the bucket. Record this in your results table.
6. Determine your vital capacity by calculating the volume of water that was displaced by the balloon.
7. Conduct this experiment on different members of your household (note the height of each household member in the table).

Questions cont.

3. **The test uses displacement of the water in the bucket by the air in the balloon to determine vital capacity. What is meant by displacement?**

Replacing the water volume in the bucket with the air volume in the balloon (from the lungs).

4. **The density of water states that one litre of water is equivalent to one kilogram of water. Explain why the density of water allows us to convert kilograms directly to litres when calculating the vital capacity of the lungs.**

When looking at the density of water there is a one to one ratio between the weight and volume. This means they can be interchanged.

Working out vital capacity

Formula

Bucket mass when full (kg) – Bucket mass with displacement (kg) = vital capacity (l)

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Results

5. **Complete the table below:**

Table one. Vital Capacity of Members of the Household

Name	Bucket mass when full (kg)	Bucket mass following displacement (kg)	Vital capacity (l)	Height ranking (1 = tallest person)

6. **Display the results on a column graph using excel.**

Discussion

7. **Did you notice a trend in the results in relation to taller people and lung capacity? Reference your results when describing any trend that exists.**

Students should notice that taller people have larger lung capacity.

8. **Can you explain why this trend exists?**

Taller people have bigger lungs.

9. **Did your results prove your hypothesis correct?**

Dependent on students hypothesis.

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10. **Suggest a sport where you think the athletes would have a large lung vital capacity volume. Explain why you chose this sport.**

Rowers, basketballers, swimmers. Any sport chosen where athletes get an advantage by being tall.

11. **Did any unexpected events occur during the testing that could mean your results are not accurate? How could you improve the method to get more accurate results?**

Number of suggestions including: - Spilling of extra water when carrying the bucket. - Hand might have displaced addition water. - Get water proof scales and keep the bucket on the scales. - Put the bucket into a larger bucket and measure the volume of water that is captured as it overflows. - Use a low volume tool such as tongs to immerse the balloon.

Conclusion

11. **Write one clear paragraph that summarises your findings. The conclusion should relate directly to the question answered, your hypothesis and the results that you obtained (make sure you quote your results).**

Good sentence starters are "The question that was investigated…", "It was predicted that….","The results were …" and "The results indicated that…".

Students use sentence starters and relate to results.

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Alternative Experiment

Alterations to the method if you do not have access to a set of bathroom scales.

Alternative materials required:

- 1 L bottle
- Marker texta

Alternative method:

1. Use the marker texta to place 1 L gradation marks on the bucket by pouring 1 L of water into the bucket at a time.
2. Fill the bucket to the brim with water.
3. Place the full bucket in an area where the ground can get wet (the lawn is perfect).
4. Take a deep breath and expel all the air out of your lungs into the balloon. Tie off the end of the balloon after this long breath.
5. Fully submerge the balloon into the bucket so the volume of the balloon displaces the water in the bucket.
6. Use the gradation marks on the bucket to estimate how many litres of water have been displaced from the bucket and write this volume in the **vital capacity** column of the results table

*Note: If following this method the **bucket mass when full** and **bucket mass following displacement** columns on your results table will be left blank.