SASTA OLIPHANT SCIENCE AWARDS

SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

Prize Winner

Scientific Inquiry

Year 5-6

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OLIPHANT SCIENCE AWARDS
SCIENCE INQUIRY POSTER

Helium Vs Air Vs Gravity and Buoyancy

Experiment Submission by
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Hypothesis and Question

I hypothesise that if two light soccer balls are rolled down a steep slope when one is filled with helium and one is filled with oxygen then the ball filled with oxygen will roll faster because oxygen is more dense than helium and therefore less affected by buoyancy and more affected by gravity.

Does a ball filled with helium take longer to be affected by gravity than a ball filled with air?

Materials & Mixed Media

Materials:
2 x Backyard mini rubber soccer balls
Helium - Fill 1 x ball with Helium
Slide—Continuous standard rolling surface
air ball pump - Fill 1 x ball with Air
phone—filming / images.
Media:
Adobe Premier Elements—Timing Video footage
Microsoft Publisher— A2 Scientific Inquiry Poster
Web Browser—Background Research

Background

Air: Nitrogen (N) (78%) & Oxygen (O)(21%) other (1%)
Air is in our earth's atmosphere, which gravity is pushing down and keeping there. Represents a Gravity of "1" (The Engineering Tools Box, 2021)

If there is no gravity we would be floating with no air to breath because the atmosphere is gone. Air transmits light. Oxygen in the air reflects UV rays from the sun. Oxygen helps you hear clearly (Bright Side 2021).

Helium symbol " He" is a noble gas meaning it is highly unlikely that you can mix other chemical gases with helium and will make a new element that is good for our experiment because it won't mix with anything to vary the experiment. Noble gas also mean that it is colourless and odourless. (Encyclopædia Britannica, Inc., 2021).

Gases including Air and Helium are affected by buoyancy. Buoyancy is the upward force when gravity is applied such as a balloon filled with helium. Helium rises since it is less dense than air, If the balloon and the helium inside is still Less dense than the air around it will make them rise. As the balloon rises the air gets less and less dense, all the air at the bottom pushes the balloon higher and higher making buoyancy. However the object will stop rising when the weight of the balloon and helium is equivalent with the buoyant force (Smithsonian National Air and Space Museum, 2021).

Gravity is a force on the earth which draws things like air to its centre. And as discussed previously keeps the earth's atmosphere in place forcing the air down. Objects with a greater mass are more affected by gravity (Nasa, 2021)

According to the chart, helium is seven times lighter than air and according to the periodic table helium is the second lightest gas and air is in between the seventh and eighth lightest gas.

Gas	Specific Gravity[1] - SG -
Air[1]	1.000
Helium - He	0.138

Table 1: Specific gravity of gases Air and Helium (Source The Engineering Tool Box, 2021)

Method

1.Weigh both uninflated balls
- Both 156 grams

2. Pump them up (Helium marked (H) with red permanent marker)

3. Weigh both balls after inflation

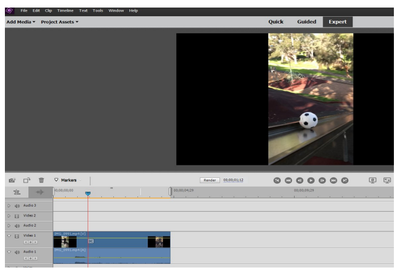
- Both Ball maintained 156 gram weight

4. Drive to Dunstan Adventure park

5. Roll the balls down the 12 metre slide at 110 degree angle. The ball is already resting at the top of the slide in a same marked spot and hands simply lift from the ball letting the ball roll down through natural gravity

6. Film it for exact time

7. Put it into the Adobe video editor to time each ball at the exact same exit and arrival point to ensure consistent result.



8. Record the results (see variables and results following):

- Variables will be bounciness and buoyancy if it hits the side of the slide more often for example
- Weather could play a factor for example strong winds however the day was still at the time of the experiment
- While both balls were of the same weight the shape could be slightly different in each ball.

Results

	Air	Helium
Time	5.20 sec	4.26 sec
Time	5.08 sec	4.26 sec
Time	4.16 sec	4.17 sec
Time	5.05 sec	4.28 sec
Time	4.25 sec	4.28 sec
Time	4.23 sec	4.29 sec
Time	5.07 sec	4.25 sec

Table 2: Specific ball travel time between identical points of the slippery dip for both Air and helium filled balls

Table 3: Average time to travel same distance of the slippery dip for both Air and helium filled balls

	Air	Helium
Average Time	4.72 sec	4.25 sec

Conclusion

From the results I am able to conclude that:

- On Average Air takes longer to travel down the slope (slippery dip)
- On Average Helium takes less time to travel down the slippery dip.

Unlike my hypothesis that helium might slow the affect of gravity, instead, the factor of buoyancy appears to have caused the ball to travel faster and perhaps bounce more over the same surface propelling the ball more quickly over a longer distance. We note that the ball was not lighter than air (same weight) but the gas itself is less dense and therefore although the ball would not rise, the effects of buoyancy may still have played a part in the difference between the 2 gases. Further experimentation could be focus a longer distance and period.

Acknowledgements / Ref-

My family helped me with helium, filming, driving to location and catching the balls

Bright Side, (2021) What If Helium Replaced Oxygen for 1 Minute?, accessed online: https://www.youtube.com/watch?v=zGEbP1Hzo58

Encyclopædia Britannica, Inc., (2021), 'Helium' Accessed Online: https://kids.britannica.com/kids/article/helium/353238

Nasa, (2021) Space Place, 'What is Gravity', accessed online: https://spaceplace.nasa.gov/what-is-gravity/en/

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The Engineering Toolbox, (2021) 'Gases - Specific Gravities', accessed online: https://www.engineeringtoolbox.com/specific-gravities-gases-d_334.html

Levi

Year 5 Oliphant Science Journal

6. background 3
7. method
8. method 2
9. results
Vocabulary

Go back to the front page!

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Youtube: https://www.youtube.com/playlist?list=PLZttrvJBoDWV9NgLozE1hD8890936bT08

Hypothesis and question

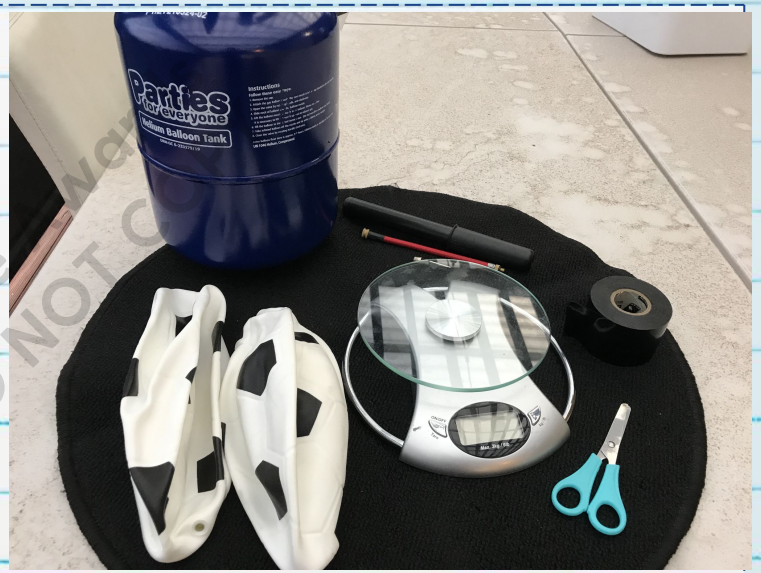
I hypothesize that if two light soccer balls are rolled down a steep slope when one is filled with helium and one is filled with oxygen then the ball filled with oxygen will roll faster because oxygen is more dense than helium and therefore less affected by buoyancy and more by Newton's law of gravity.

Does a ball filled with helium take longer to be affected by gravity than a ball filled with oxygen?

Materials and Mixed Media

Use of materials in this project are:

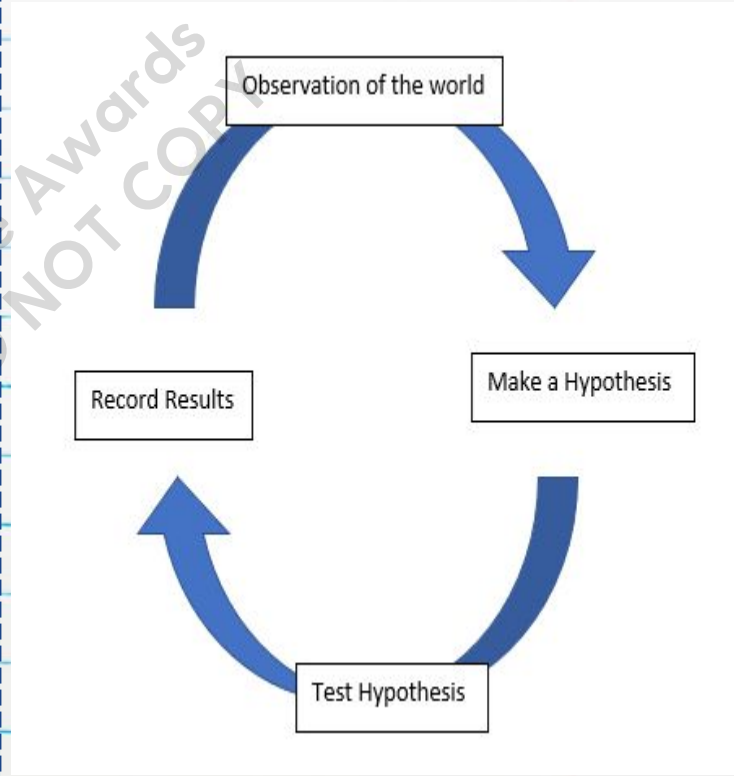
- two backyard mini rubber soccer balls
- party balloon kit with helium
- steep slope or slide
- air ball pump
- phone for filming.
  Media: Program to time footage
- Application to present findings (A2 electronic poster)
- Web Browser for research



Scientific method

The scientific method steps are

- Make an observation
- Have a hypothesis
- Test hypothesis
- Record results



Background Research (which describes the element there importance)

Identify the gases of Air and helium and their properties as well as the effect of buoyancy and gravity on those gases

Air: Nitrogen (N) (78%) & Oxygen (O)(21%) Symbol "and Helium symbol " He"

Air (which we breath)is in our earth's atmosphere which gravity is pushing down and keeping the atmosphere if there was no gravity we would be floating with no air to breath because the atmosphere is gone. Air transmits light. Oxygen in the air reflects UV rays from the sun. Oxygen helps you hear clearly.

Ref: Bright Side, (2021)

Background Research

Identify the gases of Air (Nitrogen & oxygen) and helium and their properties as well as the effect of buoyancy and gravity on those gases

Different: air can combine with most elements.

Helium however is a noble gas meaning it is unlikely you can put other chemical gases together with these gases and to make a new element which is good for our experiment because it won't mix with anything to vary my experiment. Noble gases also mean that they are odourless and colourless.

Gas	Specific Gravity[1)] - SG -
Air[1)]	1.000
Helium - He	0.138

Table 1: Gases - Specific Gravities (engineeringtoolbox.com)

According to the chart, helium is seven times lighter than air and according to the periodic table helium is the second lightest gas and air is in between the seventh and eighth lightest gas. Being less dense we would expect helium to be more buoyant and therefore longer to fall.

Background Research

Identify the gases of Air (Nitrogen & oxygen) and helium and their properties as well as the effect of gravity on those gases

Gravity is a force on the earth which draws things like air to its centre. And as discussed previously keeps the earth's atmosphere in place forcing the air down. Objects with a greater mass are more affected by gravity. Ref: Nasa, (2021)

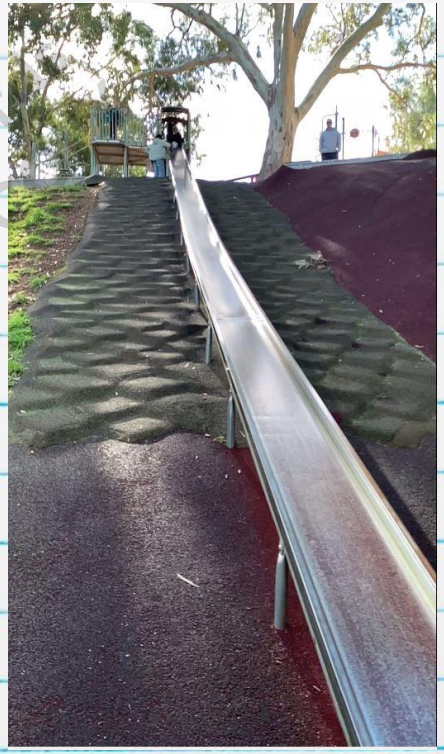
Buoyancy

Gases including Air and Helium are affected by buoyancy. Buoyancy is the upward force when gravity is applied, for example a balloon filled with helium. Helium is a rising gas since it is less dense than air, If the balloon and the helium inside is still Less dense than the air around it will make them rise. As the balloon rises the air gets less and less dense, all the air at the bottom pushes the balloon higher and higher making buoyancy. However the object will stop rising when the weight of the balloon and helium is equivalent with the buoyant force. (Ref: Smithsonian National Air and Space Museum, (2021)

Given this we suspect the ball inflated with helium will still be affected by gravity as its weight and density will be more than the equivalent air so it will roll down. However we hypothesise that the lighter gas with less density may still show some buoyancy lowering the effect of gravity

Experiment: Method

Rolling the 2 balls (1 filled with Air and one filled with Helium) down a 15 metre slide



★ 1. Weigh both not inflated balls
2. Pump them up
3. Drive to Dunstan Adventure park
4. Roll The balls down a steep slope or slide
5. Film & Time it
6. Record answer
7. Observe Results
8. Make conclusions

Results

(Table is on electronic poster)

Attempt Air - Vid967 - 5.20
Attempt Air - Vid974 - 5.08
Attempt Air - Vid976 - 4.16
Attempt Air - Vid980 - 5.05
Attempt Air - Vid986 - 4.25
Attempt Air - Vid988 - 4.23
Attempt Air - Vid990 - 5.07
Attempt Helium - Vid971 - 4.26
Attempt Helium - Vid975 - 4.26
Attempt Helium - Vid977 - 4.17
Attempt Helium - Vid983 - 4.28
Attempt Helium - Vid987 - 4.28
Attempt Helium - Vid989 - 4.29
Attempt Helium - Vid991 - 4.25

CONCLUSIONS

Hypothesis

★ Appears to be opposite of what was expected

Time

Buoyancy appears to be the most significant factor rather than gravity which affects both balls. Helium ball appears to bounce further more quickly

Helium

Helium filled ball is faster down the slide on average.

Air

Air filled ball is slower down the slide on average

Other Factors

- Weather - not windy which may have impacted speed.
- Identical points marked on the slide for consistent measurements
- Amount of bumping into the side of slide

CONCLUSIONS

More Research

There is a potential for more experimentation providing longer distances and more samples to see if the results are consistent with the small sample of findings here.

(Conclusion is on electronic poster)

BIBLIOGRAPHY

Bright Side, (2021) What If Helium Replaced Oxygen for 1 Minute?, accessed online: https://www.youtube.com/watch?v=zGEbP1Hzo58

Encyclopædia Britannica, Inc., (2021), 'Helium' Accessed Online: https://kids.britannica.com/kids/article/helium/353238

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