

TALKING ABOUT GRAVITY

Two friends were talking about gravity.

Ben said, "Gravity needs an atmosphere or air. If there is no air or atmosphere, there will be no gravity."

Kelly said, "Gravity doesn't need an atmosphere or air. If there is no air or atmosphere, there will still be gravity."

Which friend do you agree with?

14 agreed with Ben (60.86% of total). 9 agreed with Kelly (39.13% of total).

Responses for Ben:

1. I agree with Ben because I think air and atmosphere are necessary for gravity.
2. I agree with Ben because in space there is no air or atmosphere and there is no gravity either. That's why things float in space.
3. Because gravity is determined by the atmosphere.
4. I agree with Ben because the moon doesn't have an atmosphere and doesn't have gravity.
5. Because we have an atmosphere so we have gravity. For example, the moon doesn't have an atmosphere there fore there isn't any gravity.
6. I agree with Ben because gravity does need air and atmosphere. Places like the moon and outerspace do not have gravity but thing with both have gravity.
7. I agree with Ben because there is gravity and atmosphere and atmosphere is what holds gravity and matter together so if there is was no atmosphere than gravity wouldn't be there because gravity is a certain force and gravity holds air and atmosphere to both. That's why I agree with Ben
8. I agree with Ben because in space there is no atmosphere and there is no air.
9. I think that if there is no air or atmosphere there will be no gravity because planets that don't have air or atmosphere don't have gravity and earth does which has air and atmosphere.
10. I agree with Ben because the moon doesn't have air, and because it doesn't have air it doesn't have gravity. It also doesn't have an atmosphere so it just may be true.
11. I agree with Ben because I believe that gravity is based on our atmosphere and the air.
12. I agree with Ben because that's what the world is made of air and atmosphere and without all that would we have anything in are universe.
13. I agree with Ben because he is right about gravity needing an atmosphere or air. Because the atmosphere is what keeps gravity, if there is no atmosphere there would be no gravity.

14. I agree with Ben because if where you are standing doesn't have no air then nothing will be able to float in mid-air. I disagree with Kelly because you need air and a atmosphere for objects to float.

Recurring or interesting responses:

Gravity needs an atmosphere and air to exist. One student specifically ties the idea of gravity to things floating in space. The atmosphere is what causes gravity. Gravity is the force that holds air and atmosphere together.

Responses for Kelly:

1. I agree with Kelly because gravity really does not need anything for it to be gravity. If there is no air or atmosphere, gravity will still be there. Gravity is what makes things fall down.
2. I agree with Kelly because gravity needs something to act on without anything for gravity to act on is pointless. It also needs to come from something
3. I agree with Kelly because you can have an atmosphere but no gravity.
4. I agree with Kelly because when you are on the moon there is no gravity and there is an atmosphere. I disagree with Ben because of the opposite reasoning.
5. I agree with Kelly because there is no gravity in the moon, but the moon has an atmosphere and I disagree with Ben because as I stated before there is no gravity on the moon but it has an atmosphere.
6. I agree with Kelly because you really don't need weather like anywhere for there to be gravity. Gravity is just pulling on other things not atmosphere or air. Ben was wrong but it's ok, I really think you don't have to have air or an atmosphere to have gravity, look at the moon, no atmosphere or air but still gravity.
7. I agree with Kelly because the atmosphere doesn't really effect gravity because the moon effects us and it is in outer space and has no atmosphere. I disagree with Ben due to the fact that the moon doesn't have any air or atmosphere and it pulls the Earth water.
8. Even if the atmosphere didn't exist, the moon and the sun would still have gravitation effect on us. The atmosphere contributes to the adherence of earth's life.
9. I agree with Kelly because gravity acts on any force that has mass. Does not matter if there is an atmosphere or if there is no atmosphere. The more mass an object has the more gravity it has.

Recurring or interesting responses:

Mass is required for gravity. You don't need air or an atmosphere. Higher mass means higher gravitational pull. Most of these ideas are tied to other planets without atmospheres, or the moon ("the moon doesn't have any air or atmosphere and it pulls the Earth water").

Teacher notes

Purpose

The purpose of this assessment probe is to elicit student's ideas about gravity. The probe is designed to determine whether students recognize that gravity is a universal force that exists everywhere in space, regardless of whether air is present.

Explanation

Gravity is a universal attraction between any two objects with mass. Every object in the universe is affected by the force of gravity. The two factors that affect the magnitude of gravity are the mass of the attracted objects and the distance between them. The greater the masses the greater the gravitational force between two objects. The greater the distance between two objects, the less the gravitational force between them. Each object with mass in the universe is attracted to all other objects regardless of size or distance. Whether you are on the Moon, Earth or deep in outer space, gravity is present. Air or an atmosphere is not needed for gravity.

Elementary students

Most students know that things fall toward the Earth, have heard the word gravity, and have begun to understand that gravity pulls things toward the Earth. They have seen videos of astronauts in space and have heard the misuse of terms in the media such as zero gravity and weightlessness. These images and terms may result in students formulating early ideas that gravity affects objects on Earth but not in space, particularly since their experiences and contexts deal with terrestrial gravity.

Middle school

Students expand on their previous knowledge of gravity to include the idea of gravity in space. They develop the idea of a gravitational force that is center-directed, affects all objects, and depends on objects mass and distance. They develop a notion of weight as being distinct from mass. This is also a time when students learn about moons that lack an atmosphere, and hear references to astronauts being weightless in space.

High School

Students continue to build a more sophisticated understanding about gravity by using proportional relationships to explain increases or decreases in gravitation attraction. Even though students may quantitatively understand gravitational force, there is a likelihood that they may hold on to their preconceived ideas about air being necessary. This may be compounded by confusing air pressure with gravity. The probe is useful in uncovering misconceptions that may go unnoticed during formal instruction.

Research

- Students confusion about air being necessary for gravity may be related to their view of weight as a force. Some students think air is the force that results in weight. A large sample of middle school students also think that air must be present for gravity to act.

- Relating gravity to air provides insight into students ideas about gravity being something that resides outside of objects rather than all objects exerting a gravitational pull.
- Misconceptions about the cause of gravity persist even after high school physics instruction.
- Some students describe a holding idea that an atmosphere holds gravity in.
- Some students think that Earth's magnetism and spin cause gravity.
- Some studies show that very few middle and high school students believe all objects exert a gravitational force.

Suggestions:

- Explicitly point out that air or an atmosphere is not a factor in gravity and provide evidence like men walking on the Moon.
- Place an object in a vacuum jar and remove all the air. Ask students to predict what would happen to the object if there were no gravity acting on it as a result of removing all the air from the jar. Ask if students want to revise their opinion about air being necessary. If they still maintain this, show a video of astronauts dropping objects on the Moon, where there is no air (or videos showing objects falling in a vacuum tube).
- Gravity keeps an atmosphere in place and not vice versa. Use planets as an example of large objects exerting a strong gravitational pull and contrast it to smaller objects like the moon, which are not large enough to exert a pull that will maintain an atmosphere.
- Use the term microgravity to refer to a small gravitational effect.
- Demonstrate weightlessness and floating by using diagrams to show that astronauts are actually in free fall around earth.