



Science Unit: *Space*

Lesson 1: *The Universe As We Know It!*

School year: 2006/2007

Developed for: Sexsmith Elementary School, Vancouver School District

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Grade level: Presented to grades 2 and 3, appropriate for grades 2-6 with age appropriate modifications.

Duration of lesson: 1 hour and 20 minutes

Objectives

1. Students will be able to understand what a theory is
2. Students will be able to explain and understand the Big Bang theory

Background Information

There are many theories on how the universe came to existence. The Big Bang explosion is the theory most scientists believe. There are three observations that provide some evidence for this theory. First: the fact that currently the universe is still expanding, as it did when the Big Bang happened. Second: the fact that the universe is cooling down. Third: the large quantities of helium. The universe is too young to account for such amount. When the temperature is really high nuclear reactions can convert two hydrogen atoms into one helium atom. So with a large explosion, where the temperature would be billions of degrees, lots of helium would be formed.

About 15 billion years ago a massive explosion, the so called Big Bang, caused the universe to expand from a single dense point which contained all energy and matter. With the explosion, not only all the matter and energy in the universe were created, but also space and time. So there is no 'before' the Big Bang, because then time did not exist.

In a fraction of a second after the Big Bang the makings of atoms, protons, neutrons and electrons, came into existence but the universe was still too hot for atoms to form. So for several years the universe just kept on expanding. When the universe's temperature cooled down enough, the protons, neutrons and electrons started coming together and formed atoms, especially hydrogen and helium. From the atoms that formed, matter was created and with it gravity was also created. Gravity, the force that one body of matter exerts on another, helped matter come together and form stars, planets and galaxies.

Vocabulary

<u>Theory:</u>	An explanation based on evidence, predictions and tested hypothesis for a natural phenomena
<u>Matter:</u>	Anything that has mass and occupies space.
<u>Energy:</u>	Gives the ability to power actions or events – the ability to do work
<u>Dense:</u>	Matter that is compacted in a small space, something that is too heavy for its size
<u>Gravity:</u>	The force of attraction between particles or objects that occurs because of their mass
<u>Atom:</u>	The smallest indivisible part of an element



Collide: When objects come into contact with solid impact

Fusion: When objects come together and become one

Materials for this lesson

- Puppet monster
- Report worksheet
- 1 marble
- Blender
- Frozen strawberries
- Paper cups
- 1 spoon

In the Classroom

Introductory Discussion (Hook)

1. Introduce the scenario:

“There is an inter-galactic monster threatening Earth! The monster is not bad; it is just upset because it needs to do know how the Universe began to do its homework! So in its frustration it might stomp on Earth and destroy our planet! So we are having this meeting to try helping the monster. We are the best scientists in the world and together we will try to come up with an answer for the monster and save the Earth.”

Ask about their theories on how the Universe was created – using post-its place it on the board.

Explain the concept of theory by point out that anything they suggest could be true, but explanations with a good reasoning and/or evidence to support it might be more believable than others.

Tell them that you know about one theory and give them a few facts about the Big Bang theory.

- Before the universe was one single dense point where all the matter in the universe was contained (review the words dense and matter) – show them a marble and ask them to imagine that the entire universe was contained inside that marble
 - a. How heavy would this marble be?
 - b. Would I be able to hold this in my hand? Why?
- Then, somehow, all the matter in that dense point started to come apart and move away from the dense point – but that was for only 1 second!
- During that time everything was also very hot!

Ask the students to try and put these facts together. Use the following questions to guide their thinking:

- a. What must have happened for the matter to come apart and be very hot?
- b. Show the marble and ask: “How could we get all the matter from inside the marble to come flying apart?” - An explosion, the big bang explosion!

Once the students have grasped the concept – show them a frozen strawberry and ask them to imagine that the strawberry is the single dense point. Ask:

- c. What do you think will happen when I place this frozen strawberry in the blender?
- d. Blend the strawberry and show the bits to the students – ask them to explain why we now have many more bits than before

7. Tell the students that we are very close to saving Earth. Now all we have to do is find a way to tell the monster. Ask them to come up with ways that we could communicate to the monster, guide them towards answering that we could role play the Big Bang Theory so the monster can understand.



Science Activity/Experiment

Activity Title: Being in the Big Bang – Role play activity

Purpose of Activity: To give a visual representation of how the Big Bang theory might have occurred/looked like and created all the objects in the universe.

Activity Instructions:

- Take the class to a large carpet area or outside and before starting the activity explain what will happen
 1. We are all going to become bits of matter concentrated in the single dense point before the Big Bang explosion
 2. Once we are huddled together, I (the teacher) will say “Boom!” and we are all going to come apart – no running, we are going to silently walk away from the group - after all the big bang was a silent explosion! (No air in space to cause noise!)
 3. Once you came apart if you collide with someone else, hold his or her hand – you have now become fused
 4. The farther away you or your ‘fused’ group go from the centre, the slower you move – the matter is cooling down
 5. Stop on the spot when I (the teacher) say STOP!
- After you go through the instructions, have them act it out and after the stop draw attention to the groups – large groups could be entire galaxies, the solar system, a single star or even a black hole; smaller groups could be a single planet, an asteroid, or a comet.
- Reassure students that Earth is now safe because we did a great job at communicating to the monster about the creation of the universe.

Scientific Report: you could use the worksheet provided or ask them to write on a science journal that could be used for the entire space unit

Students will fill out a report to explain the results of our meeting.

- What question were we trying to answer?
- Which theory did we demonstrate today?
- How did we show the theory? (what did you do?)
- What did you observe after acting it out? (what did you see?)
- What is your conclusion about the creation of the universe? (what did you learn today?)

Closure Discussion

Students will be sitting in groups to fill out their reports, once they are finished they will share their report with each other and the group will select a presenter to share their ideas with the class.

References

1. http://en.wikipedia.org/wiki/Big_Bang. Various Authors. Wikipedia, the free encyclopedia. [the Big Bang Theory; background information]



SCIENTIST IN RESIDENCE PROGRAM

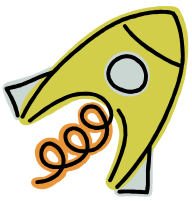
2. http://www.esa.int/esaKIDSen/SEMSZ5WJD1E_OurUniverse_0.html. European Space Agency. Story of the Universe. Web site hosted by European Space Agency [the Big Bang theory in a kid friendly format]. Accessed April 2007.

Teacher Assessment of Learning

1. Are the students able to describe what a theory is?
2. Do the students understand what the Big Bang theory is?
3. Are the students able to explain what happened after the Big Bang explosion?
4. Do the students understand that all things in the universe are the same matter that was densely packed in the single dense point?

Extension of Lesson Plan

1. Marble Art activity to interpret the Big Bang – this is an art connection that allow the students to use their imagination of how the big bang explosion might have looked like.
2. Universe expansion – using a white balloon and a pen (sharpies work well) draw dots on the balloon before blowing it up and measure the distance with a ruler. Then blow up the balloon and using the ruler measure the distance again. This activity shows how the universe can expand but not increase in total mass. The dots represent planets, or galaxies, or stars, and blowing up represents the expansion of the universe. The dots move farther apart, but no new dots are created.



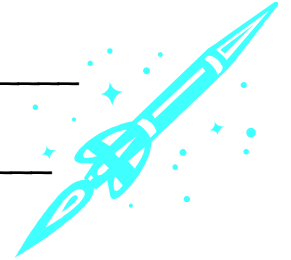
Scientist's Name: _____

The Universe Beginnings Report

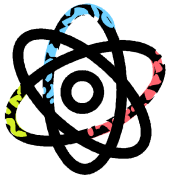


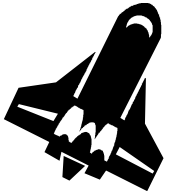
What is the question are we trying to answer?

Which theory did we act? _____



What did you do?





What did you observe?



What is your conclusion?

