

Lesson Title	Living in a Gravity World	Grade Level	5 th / 6 th
Concept/Topic	What is Gravity		
Standards	5 th Grade Science Standard 5c, 6 th Grade Science Standard 7c, d		
General Goals	Develop knowledge of gravity to make predictions and understand the possible effects of microgravity.		
Specific Objectives	Students will be able to define gravity as an attraction between two objects and observe and identify examples of gravity on Earth. Students will understand that the gravitational force is greater with larger objects relative to their mass and distance.		
Required Materials	-NASA modified information sheet on MicroGravity. -Large feather, 8 1/2 x 11" paper, filled water bottle or other objects of similar and different size, and similar and different weights. -Drop record sheet, Pencil		
Anticipatory Set	Students should have previous knowledge of attractive forces such as in magnets (positive and negative charges attract).		
Procedures	<ol style="list-style-type: none"> 1. Students will be given word splash to look up and define words w/partner: Gravity, Attraction, Force, Mass, Weight. 2. Teacher will read first part of NASA information sheet to whole class. 3. Class will review definitions for word splash, discuss findings, and ensure words defined accurately. 4. Teacher will explain that gravity, the attraction between two objects, is the reason people and desks, etc don't fall off planet Earth. Teacher will pose questions: "If the reason I stay stuck to planet Earth is gravity, and gravity is an attraction between two objects, who can tell me what the two objects are?" and "If there is attraction between me and the earth, is it because I'm pulling the Earth to me or the earth is pull me to it? Well, just whose gravitational force or pull is stronger and why?" Students will record their thoughts and then guided experiments will be conducted (see handout) 5. Then, whole class will discuss findings, observations, recordings, predictions. 6. Students work on own to predict, observe and record items they select. 		
Guided Practice	Students will participate in demonstration/experimentation of gravitational force/pull.		
Independent Practice	Students will complete experimentation on own working in groups of 4 - 5 to generalize findings.		
Assessment	Students will be able to identify at least one example of gravity on Earth, and correctly predict its gravitational pull on other objects dependent on the size and distance of other objects.		
Adaptations	Students will be paired with same language peers to gain knowledge/ask questions in first language. Students will be provided pictures demonstrating concept with easily understood captions.		
Extensions	Students will visit the class website to read and interact with online games/activities involving gravity (Thinkquest, and Sodaplay)		

The Attractive Force of Gravity

Gravity is a force attraction between two objects. The force or pull of gravity depends on the weight and mass of the objects. Since the Earth is such a large object in comparison to a person, its gravitational pull on people is strong. Because of this, people are pulled toward the Earth, thus allowing us to walk on the Earth without having to worry about falling off. In fact, the constant pull of the Earth's gravity brings everything that's smaller toward it. That's why when we drop anything we can usually count on it going straight down toward the Earth. However, the surface area, weight and speed of objects can interfere with the Earth's gravitational pull.

We'll work together to observe and record what happens when we allow some items to be pulled by the Earth's gravity (in other words, what happens when we drop things). Look to see if you can find some generalizations or patterns.

Guided Practice

1. Choose 4 volunteers: 2 holders, and 2 observers.
2. Holders will make 2 practice drops and 3 observed drops of the feather and water bottle. During the first 2 actual drops, object will be held vertical. Last 2 actual drops, the items will be held horizontal.
3. Audience will be asked to predict which item will hit first, and why. Predictions will be written on board along with reason why.
4. Observers will watch last four drops to announce which item hits ground first.
5. Audience records information and checks last column for item that hit first.

Feather (size/weight)	Position Held	Predicted Winner	Drop 1
_____	_____	_____	_____
Water bottle (size/weight)	_____	_____	_____

Feather (size/weight)	Position Held	Predicted Winner	Drop 2
_____	_____	_____	_____
Water bottle (size/weight)	_____	_____	_____

Feather (size/weight)	Position Held	Predicted Winner	Drop 3
_____	_____	_____	_____

Water bottle (size/weight)	_____	_____	_____
_____	_____	_____	_____

Feather (size/weight)	Position Held	Predicted Winner	Drop 4
_____	_____	_____	_____

Water bottle (size/weight)	_____	_____	_____
_____	_____	_____	_____

1. Which item hit the ground first when the items were held vertically? Is this what you expected?

2. Which item hit the ground first when the items were held horizontally? Were the results of this test different than what you predicted?

3. Knowing that surface area and weight affect the pull of gravity, explain and/or generalize the results you recorded in this experiment?

Lesson Title	Gravity and Fluid Flows	Grade Level	5 th / 6 th
Concept/Topic	Gravities affect on liquids		
Standards	5 th Grade Science Standard 4e, 5c; 6 th Grade Science Standard 7c, d		
General Goals	Further study gravity and its effect on liquids		
Specific Objectives	Students will come to understand that liquids are affected by gravity, that liquids take the shape of containers, will fall to the ground the same as solids, and puddle on the floor due to gravity. Students will be able to further understand gravity's affect on objects with varying weight.		
Required Materials	-NASA materials, Microgravity packet-Microgravity in the Classroom activity sheets and noted materials (pgs. 109-113 Gravity-Driven Fluid Flows, experiments 1 and 2 only. Use as info./activity for students).		
Anticipatory Set	Students should have previous knowledge of gravity. Students should know how heart functions, and circulation of blood to/from heart, lungs, body.		
Procedures	<ol style="list-style-type: none"> 1. Students are introduced to new vocabulary: sediment, sedimentation, buoyancy, density. 2. Teacher guides reading of materials, using reading strategies (pre-read, predict) and highlighting and identifying main points. 3. Class participates in first two experiments. 4. Last experiment (original student created experiment) done as homework. Demonstrations will be done at another time as part of extension activities. 		
Guided Practice	Teacher guides whole class in initial experiment (mixing fresh, salt water). Class discusses findings, records on pg. 113 worksheet.		
Independent Practice	Students conduct second experiment working with partner and completing lab sheet (Lab Write-Up Using the Scientific Method from Brain Compatible Science, Skylight Training and Publishing)		
Assessment	Review Lab Write-Up to determine whether students understand liquids cause less dense objects to "float" rise to surface, dense objects to "sink."		
Adaptations	Students will be paired with same language peers to gain knowledge/ask questions in first language. Students will work with teacher and/or aid and be provided pictures demonstrating experiment steps.		
Extensions	Students will demonstrate accepted original experiment, reviewing steps of scientific process and vocabulary terms.		

Lesson Title	Microgravity and weightless liquids	Grade Level	5 th / 6 th
Concept/Topic	What is microgravity, how do liquids react in a microgravity environment		
Standards	5 th Grade Science Standard 4e, 5c; 6 th Grade Science Standard 7c, d		
General Goals	Develop knowledge of microgravity and understand its affect on liquids, to make predictions and understand the possible effects on the human circulatory system.		
Specific Objectives	Students will be able define microgravity and identify examples of microgravity on Earth. Students will consider the affects of gravity on liquids and infer that in a microgravity environment liquids would not be forced to take shape of containers or puddle on floor. Students will use this knowledge to hypothesize and conduct experiments with freefalling liquid.		
Required Materials	-NASA modified information sheet on MicroGravity. -NASA materials, Microgravity packet-Microgravity in the Classroom activity sheets and noted materials (pgs. 81-83 info. only) -Videorecorder -Student milk cartons, pen/scissors to puncture hole, water. -Worksheet		
Anticipatory Set	Students should have previous knowledge of gravity, and understanding of its affect on solids and liquids.		
Procedures	<ol style="list-style-type: none"> 1. Students will review reading material using reading strategies, and then highlighting main points. 2. Class will discuss understanding of microgravity, and predict behavior of liquids in microgravity environment. 3. Students will participate in team experiment and complete worksheet. 4. Teacher will videotape one for whole class review. 5. Students will view NASA videotape on Microgravity. 6. Students will go back and correct or confirm predictions. 		
Guided Practice	Worksheet/Experiment		
Independent Practice	Students will complete the Observation Log questions.		
Assessment	On Science Log Reflection (<u>Brain Compatible Science</u>) students will be able to explain reason why liquid does not leave container when falling from dropped height (both water and container are falling, creating microgravity, or “floating/weightless liquid”).		
Adaptations	Students will be paired with same language peers to gain knowledge/ask questions in first language. Students will participate in experiment with teacher and be provided pictures demonstrating steps.		
Extensions	Students can experiment with different liquids and a cup rather than a carton and set up the parameters of this experiment.		

Weightless Liquids Worksheet

Question: *Will water run out of a hole in a falling carton?*

Hypothesis: *I think the water ...*

Materials:

Milk Carton	Pen or Scissors
Water	Ladder

Procedures:

First, poke a hole on the side of an empty milk carton. Fill the carton up with water. What happens to the water? Record your observations.

Next, fill the carton with water again, only this time put your finger over the whole to stop the water from coming out. Take the water filled milk carton and climb the ladder to a good and comfortable height. Make sure your group is ready before you drop the carton. Drop the carton. Does any water come out while the carton is falling? Record your observations.

Finally, review the experiment video to more closely observe what took place while the carton was falling. Then answer the following:

OBSERVATION LOG

1. What happened when you put water in the carton the first time?
2. Now draw a diagram that shows what happened when you dropped the carton of water with the hole in it. Explain why you think this happened.
3. Explain how water inside the falling carton is similar to an astronaut inside a spaceship?

Lesson Title	How Might Microgravity Affect the Human Circulatory System	Grade Level	5 th / 6 th
Concept/Topic	What is microgravity, how do liquids react in a microgravity environment, how does microgravity affect the circulatory system.		
Standards	5 th Grade Science Standard 2b, 4e, 5c; 6 th Grade Science Standard 7c, d		
General Goals	Develop knowledge of microgravity and understand its affect on liquids to make predictions and understand the possible effects on the human circulatory system.		
Specific Objectives	Students will be able define microgravity and identify examples of microgravity on Earth. Students will consider the affects of gravity on liquids and infer that in a microgravity environment liquids would not be forced to take shape of containers or puddle on floor. Students will use this knowledge to hypothesize and conduct experiments with freefalling liquid.		
Required Materials	-NASA modified information sheet on MicroGravity. -NASA materials, Microgravity packet-Microgravity in the Classroom activity sheets and noted materials (pgs. 81-83 info. only). -Poster paper. -NASA videos: Microgravity, All Systems A Go		
Anticipatory Set	Students should have previous knowledge of gravity. Students should know how heart functions, and circulation of blood to/from heart, lungs, body.		
Procedures	<ol style="list-style-type: none"> 1. Teacher and students will reflect on previous lessons covering circulatory system, gravity, and microgravity and activities. 2. Students will complete word splash on “Heart Parts” to refresh memory, and view heart center with group. 3. After viewing NASA Microgravity videotape, students will have short period of discussion to review topics covered and form hypothesis, question and answers. 4. Students will then create individual posters predicting how microgravity affects the human circulatory system. 5. With final posters done, students will view NASA video “All Systems A Go” to determine accuracy of predictions. 		
Guided Practice	Students work in small groups to discuss possible predictions		
Independent Practice	Students create posters with final prediction.		
Assessment	Students will use knowledge gained to create individual posters correctlyhypothesizing what will happen to the circulation of blood in a microgravity environment.		
Adaptations	Students will be paired with same language peers to gain knowledge/ask questions in first language. Students will be provided pictures demonstrating concept with easily understood captions.		
Extensions			