



GRACE Education Curriculum Gravity	
Teachers	Grades 3-5
Science & Physics	

## Gravity on Earth

*What effect does gravity have on objects with different masses?*

**Background:** There is a legend that says that Galileo once dropped two objects off the Leaning Tower of Pisa to show that the heavier of the two objects dropped faster. If a feather and hammer were the two objects he used, then obviously the hammer would hit the ground first. What would happen if this experiment would be repeated on the moon? On Earth there is a thick atmosphere; therefore, there is a large air resistance to a falling object. On the moon, the atmosphere is so thin that it has effective zero air resistance. This is why on the moon the two objects hit the ground at the same time. This experiment was actually carried out by American astronauts on the moon to prove that Galileo was correct in thinking the effect was due to air resistance. Gravity's force on objects is the same. Therefore, if you drop 2 things (a hanger and a penny) they will hit the ground at the same time. With added air resistance, this will not hold true (dropping a sheet of paper or a feather).

**Objectives:** Following this lesson, students will be able to:

- Identify that gravity is the force that pulls objects towards the center of the Earth.
- Explain why all objects free of air resistance (a feather) will fall at the same rate.
- Write a paragraph explaining their hypothesis and the actual results.

**Standards:** Science: earth & space science; science & inquiry; physical science

**Materials:** Five or more different-sized objects [balls etc.]  
- any variety that can be dropped without being damaged.  
Stopwatch

---

**Directions to Teacher:**

1. Show the class the different objects you plan to use in the experiment.
2. Pose the question: "If I dropped each of these objects from the same height, which would hit the ground first?" Have students write their ideas/hypothesis on the worksheet provided. Be sure each student gives a reason why they chose each object.
3. Find a good place to drop the objects. A jungle gym or something over 10 feet is recommended as an object dropped from 8 feet will only take a half second to hit the ground.
4. One by one, drop the objects from the same height. The timer needs to stop the stopwatch when they see the object hit the ground rather than when they hear it. This short time can be important.
5. Have students keep track of each object's free fall time on the data recorder sheet.
6. Repeat the free fall three times with each object.

**Notes:**

- Results should all be the same. If they are not, you may wish to conduct another trial or problem solve with the class what some of the errors could be. Some errors could be human error on the stopwatch, a lack of consistency in the drop, wind effects or other factors at your site.
- After the lesson has been completed, have students examine the results. They will see that the times are consistent with one another.
- Tell students that the force of gravity is the same on all objects. It does not change according to the mass of the object.
- Ask: "How do the results compare with your hypothesis?" "Which would hit the ground first if we dropped an elephant and a marble off a bridge at the same time?"

**Extensions:**

**Homework:** Write two paragraphs about today's project. The first paragraph should describe your hypothesis before the experiment and the second paragraph should cover the experiment results.

**References / Resources:**

[http://outreach.web.cern.ch/outreach/public/nl/physics\\_fair/Exp38.html](http://outreach.web.cern.ch/outreach/public/nl/physics_fair/Exp38.html)

<http://www.nku.edu/~kellyp/freefall.html>

---

---

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## **Gravity of Earth Worksheet**

A **hypothesis** is an educated guess about something before you perform an experiment.

By answering the following questions, you will be making your **hypothesis**.

1. Which object do you think will hit the ground in the fastest time?

---

---

2. Why do you think this object will be the fastest to hit the ground?

---

---

---

---

3. Which object do you think will take the longest to hit the ground?

---

---

4. Why do you think this object will take the longest to hit the ground?

---

---

---

---

---

---

---

---

---

---