Title: Using Disney's *The Jungle Book* to Prove or Disprove the Drowning in Quicksand Phenomena

Objectives:

9th grade earth science students will be able to:

➢ Apply knowledge of the hydrosphere and geosphere to explain the phenomena of quicksand.
➢ Describe and compare objects in terms of mass volume and density.
➢ Understand and reflect on connections among different areas of knowledge (earth and physical science and math)
➢ Propose a hypothesis.
➢ Test their hypothesis.
➢ Reflect on the results of their hypothesis.
➢ Understand the importance of collaboration.

Major Conceptual Questions:

➢ Will each sample float or sink in the quicksand?
➢ Which object has a density closest to that of humans?
➢ Based on the data will a human being sink deep enough to suffocate in quicksand?
➢ Given that the metal bolt sank in the water how does a large ship, constructed mostly of metal float?

Content Standard being addressed: V.2.3- Middle school (grade 7 or 8): Explain how water exists below the earth's surface and how it is replenished. (specifically springs since quicksand is formed by springs running through an ordinary bed of sand)

Plan:

➢ **Materials needed: 7 groups of 4**
   ▪ Sand
   ▪ Water
   ▪ Balance
   ▪ Fourteen100ml graduated cylinders (two per group)
   ▪ Stirring rod
   ▪ Seven beakers
   ▪ Data Tables #1, 2 and 3
   ▪ Seven wood skewers
   ▪ Seven grapes
   ▪ Seven wood chips
   ▪ Seven metal bolts
   ▪ Seven marbles
   ▪ Disney's *The Jungle Book*
   ▪ Lab handout

➢ **Time needed:**
   ▪ Two 50 minute class periods.
   ▪ **Day one:**
      • Watch movie clip: *The Jungle Book.* Segment 1:24:47-1:26:10
      • Review volume, mass and density, properties of water, and density of human beings.
      • Discuss the interconnectedness of earth science, physical science and math
      • Begin lab.
         ✓ Each group of 4 students will make quicksand by pouring 40ml of sand and 15 ml of water into a 100 ml graduated cylinder. Exact volume of the sand/water mixture is recorded on table #1.
         ✓ Obtain the mass of an empty 100ml graduated cylinder.
         ✓ Once the water saturates the sand (a glass stirring rod can be pushed in the center to help saturation, but do not shake the mixture to avoid packing the sand and increasing the density) students will use the balance to obtain the mass of the mixture.
         ✓ Subtract the mass of the empty graduated cylinder to get the mass of the mixture only.
         ✓ Calculate density of the quicksand: mass of quicksand/volume of quicksand.

- ✓ Pour the quicksand mixture into a 100 ml beaker (this represents the impermeable layer that water can't move through).
- ✓ Allow the students to stick their finger in the "quicksand" to observe what happens and how it feels. Do they notice the vacuum effect? This is caused by the inability of air to replace the object as it is pulled out.
- ✓ Write all the densities on the board and calculate the average density of quicksand (to eliminate experimental error). This is the density that will be used as a comparison in tomorrow's lab.
- ✓ Have the students follow the same steps to get the density of water.
- • Group discussion to generate ideas for hypotheses.
- ▪ **Day two:**
  - ✓ Students will find the density of the solids provided (grape, marble, wood chip and metal bolt).
  - ✓ Pour approximately 50 ml of water into a 100ml graduated cylinder.
  - ✓ Record the exact volume of water on the data table to the nearest decimal.
  - ✓ Use the balance to obtain the mass of the sample to two decimal places.
  - ✓ Gently place the sample into the water (if it floats use the skewer to gently push the sample underneath the water).
  - ✓ Record the volume.
  - ✓ Obtain the volume of the sample by subtracting the volume of the water only from the volume of the water plus the sample.
  - ✓ Record the volume on the table.
  - ✓ Calculate density (mass of sample/volume of the sample)
  - ✓ Repeat for all samples.
  - ✓ Tell students the average density of a human being is 1.0g/mL.
  - ✓ Have students address the major conceptual questions as a group discussion.
  - ✓ Test their answers by placing the objects in quicksand. Did the grape (close to human density) sink or float?

➢ **Prerequisite information:**
  - ▪ Volume, mass and density and calculations.
  - ▪ Density of human beings.
  - ▪ Scientific Method.
  - ▪ Components and formation of quicksand.
  - ▪ Characteristics of water.

➢ **Teaching strategies:**
  - ▪ Group discussions.
  - ▪ Individual hypotheses.
  - ▪ Lab will be carried out in seven groups of 4.

➢ **Additional activities:**
  - ▪ Reflect on what we discussed as a group and your original hypotheses.
  - ▪ Were your hypotheses correct or incorrect?
  - ▪ Lab write up.
  - ▪ Explain how agitating the sand can cause the sand to move up around the samples or a human which can then change the density and cause it to sink.
  - ▪ Discuss alteration of surface area explaining how it will help you to float and relate it to the ship floating instead of sinking.

➢ **Explanatory Notes: Physical science:** First you must calculate the density of quicksand. After calculating the density of objects it is discovered that grapes have a density close to that of humans (1.0 g/ml). Since grapes are less dense than the quicksand they float, proving that as long as you stay relatively calm humans can float in quicksand. This disproves the fallacy that you would immediately be sucked under and drown in quicksand. **Earth science:** Quicksand is most likely found in three different environments- along rivers, streams and lakes. It usually has an underlying layer of clay preventing drainage. It is unlikely that it will be found in the desert as shown in many movies. The desert is too dry to produce the water needed for quicksand. Quicksand is typically caused by underground springs running through sand beds. It is the water flow that makes the sand "quick".   The water pressure from the spring is equal to or denser than

the weight of the sand particles. When enough water is present it causes the grains of sand to push apart. This sand and water mixture forms a suspension (acquires the characteristics of a liquid) that is no longer able to support weight. When the water flow is not present it is just regular sand and can support weight once again.

➤ **Closure:** Rarely are the concepts of earth science exclusive. Most things you learn are interconnected. Phenomenon of the hydrosphere and geosphere can be explained by applying mathematical calculations and concepts of physical science. Always be cautious of bad science in the media. You be the detective, if you question something you see in the movies or on TV you can apply science to prove or disprove it.

Annotated Bibliography:

Feldman, E.S. & and Patel, R. (producers) & Sommers, S. (director). (1994). *The jungle book*. (motion picture). Walt Disney Pictures.
 I used this movie to show a segment depicting a man sinking and drowning in quicksand.

Galus, P. (2001). Quicksand query. *The Science Teacher*, 32-3
I used this article to create my lesson plan.

Last, S. (1997). What puts the "quick" in quicksand. *Wisconsin Engineer.* Retrieved October 15, 2005 from
    http://homepages.cae.wisc.edu/~wiscengr/issues/apr97/quicksand.html
    I used this article to explain the science.

Data Table #1 Recording the volume of "quicksand"
Mass of graduated cylinder + mass of cylinder – mass of graduated cylinder =mass of quicksand only

_____ - _____= _____

Mass of quicksand / volume of quicksand = density of quicksand

_____/_____= _____

Data Table #2 Recording irregular solid density information

Item	final volume of water in cylinder	initial vol. of water in cylinder	vol. of sample	Mass
Grape				
Wood chip				
Metal bolt				
Marble				

Data Table #3 Data table for the mass of irregular solids

Item	mass of sample	volume of sample	Density of sample
Grape			
Wood chip			
Metal bolt			
marble			