

## Move Like An Ancient Egyptian?

By Elsie Spry



### Motion Forces are Everywhere:

- Pouring a drink into your glass, you use the motion force of gravity.
- Closing a door against rain, you use the motion force of your arm.
- Riding in a car, the engine uses the motion force of a small gas explosion.

You use motion forces every day.

Ancient Egyptians used forces to move things too. Thousands of years ago, they moved huge obelisks many miles to stand in temples. Most people think they used lots of humans pulling on ropes. But what if they knew something we don't? What if they used another kind of force?

Dr. William Spry is a physicist (someone who studies forces -- and my Dad) who thinks the Ancient Egyptians used something they had a lot of: dry sand. How can you use sand to move things? By using the gravity "stored" in the sand. And by learning some new vocabulary!

### **Solid Particulate**

Sand is a solid particulate. A *solid particulate* is a solid, separate item that -- when you have a whole bunch of them -- you can pile. Other examples of particulate are rice, gravel, dirt, leaves, oatmeal, and even frosted flakes.

### **Angle-of-Repouse**

When you pile a particulate, it stops to form a hill at its special slope, called an *angle-of-repose* (sand has a different angle-of-repose than frosted flakes). When you add more to the pile, the particulate flows down the sides like a liquid. When it reaches the same slope as before -- it stops! Bigger pile, but same angle-of-repose.

### **Gravity**

*Gravity* is the constant downward force that pulls everything on the earth's surface toward the center of the earth. It pulls the particulate too!

### **Rankine Force**

When a pile of sand exceeds its angle-of-repose, the force of gravity turns all the separate grains in the pile -- flowing down the sides -- until the pile reaches its special angle-of-repose and stops. The grains -- or particulates -- keep on turning and moving as you add more. With each downward "turn" or "tumble", the force of gravity changes from downward to sideways. William

McQuorn Rankine identified this force more than 150 years ago. Physicists and Civil Engineers call it the *Rankine Force*.

Until recently, you would only hold the Rankine Force back. Civil Engineers worry about it when cutting through a hill. They don't want the hill tumbling down over a road or building. So, they build retaining walls to **stop** the Rankine Force.

But you can also use the Rankine force to **move** things. Dr. Spry calls it the *Rankine Motive Application* (I call it the *Spry Go!*).

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The **Move Like An Ancient Egyptian?** activity shows how to move a cup (with rice instead of sand), using the Rankine Motive Application (or Spry Go!).

So...Pretend you are an Ancient Egyptian Engineer moving a huge obelisk to the temple -- thousands of years ago!

# Move Like An Ancient Egyptian?

## Spry Go! Activity



### What to Have

- \_\_\_ About one (1) pint of water
- \_\_\_ A watertight bowl
- \_\_\_ Two (2) pitchers (One to pour water; one to pour rice)
- \_\_\_ Paper or other light, disposable cup
- \_\_\_ One (1) gallon of dry rice (or more)
- \_\_\_ Jelly roll pan (a cookie sheet with raised edges)
- \_\_\_ Block, book or other 1 to 2 inch object to support one end of the pan
- \_\_\_ A cup or scoop to help return the rice to the pitcher (hands work too)
- \_\_\_ Broom and dustpan (or canister vacuum) to help clean up



### What to Do

1. **Ask the following questions; test, and circle your answer:**

**? Can you pour water?**

**Pour water into the bowl**

**Yes/No**

**? Can you pour rice?**

**Pour rice on the jellyroll pan**

**Yes/No**

**? Does water make a pile?**

**Pour water in the bowl again**

**Yes/No**

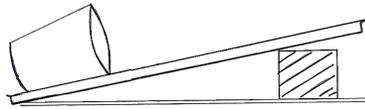
**? Does rice make a pile?**

**Pour rice on the pan again**

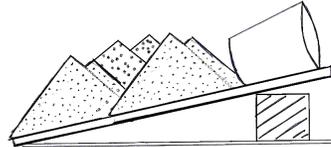
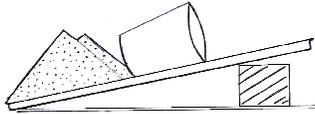
**Yes/No**

2. **Clear away the water, and put the rice back into a DRY pitcher.**

3. Set up the jellyroll pan, cup, book -- or block or other -- as shown:



4. Pour rice behind the cup, moving the cup up the jelly roll pan:



5. Describe what you did:

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6. Describe what worked and/or what didn't work:

*(For example, how does pouring the rice in front of the cup work?)*

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7. Describe how YOU would use this force in another way:

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# Move Like An Ancient Egyptian?

## NATIONAL SCIENCE STANDARDS



**PK to 12**

### **Unifying Concepts:**

Evidence, Models, and Explanation

### **Science as Inquiry:**

Understanding of Scientific Concepts

### **Physical Science:**

Motions and Forces

### **Science and Technology:**

Abilities of Technological Design

### **History and Nature of Science:**

Science as a Human Endeavor

Nature of Science

Nature of Scientific Knowledge

History of Science

Historical Perspectives