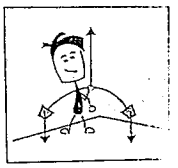
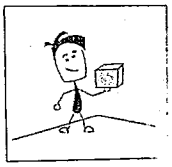
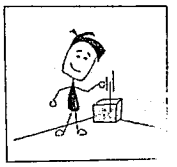
Date:

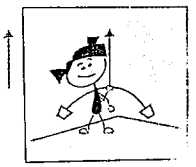
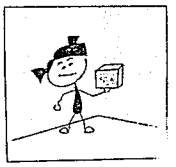
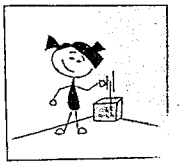
VI: Scientific Models: Gravity

Scientists use models to try to explain the observations they make. In this activity you are going to use two *different* models to explain the *same* observations of an everyday phenomenon—gravity.

Force Model: You are standing in a room that is on the Earth; the Earth exerts a downward force on objects inside the room. Explain the following phenomena using this downward force. Follow the sagging rod example.

Explain the Sagging Rod	Explain Weight (use words and arrows)	Explain Freefall (use words and arrows)
 - the Earth pulls down on the rod and your hand pushes up - the rod bends because your hand is only in the middle - the rod does not accelerate because the two opposing forces are balanced		

Acceleration Model: You are standing in a room that is inside a rocket; the rocket is accelerating "upwards" in deep space. plain the following phenomena using this upward acceleration. Follow the sagging rod example.

Explain the Sagging Rod	Explain Weight (use words and arrows)	Explain Freefall (use words and arrows)
 - the room is accelerating up; so are you and the rod - the rod accelerates up because there is now only one force—your hand pushing up - the rod bends because the ends have mass, which resist acceleration (inertia)		

SUMMARIZE:

	Force Model	Acceleration Model
What is the "big idea" behind each model? How does each explain effects we call "gravity"?		

Discussion:

1. Examine both of your explanations for freefall.
   (a) What do you actually observe about an object in freefall?

   (b) What can you infer about the nature of gravity from your observations of freefall?

2. A flexible rod bends when opposing forces act on it. The same rod bends when suspended horizontally from the middle. Does this *prove* that gravity is a force? Explain.

3. A friend shows you a video on the Internet of a guy who can make objects "float" in the air. You know this is impossible—how might you explain the video?

4. You wake up in a closed room with no windows, with no idea how you got there. Describe an experiment you could do to determine if the room is on the Earth or inside a rocket accelerating in deep space.

>> Watch the animation: ***What Keeps Us Stuck to the Earth?***

Thinking Deeper:

1. Both the force model and the acceleration model make claims that are hard to accept. What are they?
2. Both models of gravity explain everyday observations equally well. However, Newton's force model fails to correctly describe the orbit of Mercury, so it ultimately fails the test for a valid scientific model. Inspired by the acceleration model, Einstein developed an alternative model of gravity. His *curved spacetime* model made several successful predictions that have conclusively ruled out Newton's model. Does this mean we should throw out Newton's model? Does a model have to be correct in order to be useful?