NAME: ______________________________

Student Worksheet

Activity One

Musical Water Glasses

FOR THIS ACTIVITY, you will need:

- **8 water glasses** (make sure they are all the same size and shape)
- **a spoon**
- **a musical instrument** (such as a guitar, piano or a pitch pipe)

STEPS

1. Fill the water glasses with different amounts of water.
2. Tap the glasses with a spoon and listen to the notes they make.
3. With the help of a musical instrument, try to make an **eight-note musical scale** with the glasses.
4. See if you can play a simple tune on the glasses.

Now, notice which glasses have higher notes and which ones have lower notes. **How is the height of water in the glasses related to the pitch of the notes?**

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Answers: Lower water gives higher notes.

Activity Two

Speeds in Nature

Speeds in nature go from very, very slow to very, very fast. Some speeds are so slow you can't see the motion. Some speeds are so fast you can't see the motion. Search the Internet or books your teacher suggests for some very different speeds in nature.

Here are some speeds to look for:

Speeds too SLOW to see:

- continental drift
- hair growing
- plants growing (look for fastest and slowest growth)

Speeds you CAN see:

- snail moving
- fast animals
- cars (What is the record?)
- planes (What is the record?)
- speed of sound
- speed of Earth traveling around the sun

Speeds too FAST to see:

- electrical signal through a wire
- speed of light

Look for these and other speeds you think would be interesting to know. Make a chart like the one below and record the speeds in it.

Item	Speed

NAME: ______________________________

Activity Three

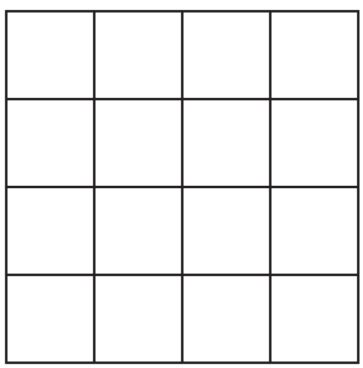
Graphing Acceleration

In this activity you will see how acceleration looks on a graph. The acceleration we will look at is the acceleration caused by GRAVITY. This is the acceleration of something that is FALLING. (We won't worry about air resistance slowing things down. Air resistance doesn't make much difference for small dense things, like a pebble, during the first few seconds of falling.)

The table below shows how far a pebble falls during the first 4 seconds. It also shows how its speed changes.

Time in seconds	Distance in meters	Speed in meters per second
0	0	0
1	5	10
2	20	20
3	45	30
4	80	40

1. Use a ruler to make a grid like the one below. Make it with four columns and four rows.



Next, use your grid to make a graph of DISTANCE and TIME. Put the numbers for distance on the left and the numbers for time along the bottom. Add the labels from the top of the table.

2. **Now, make a graph of SPEED and TIME.** (You will need to make another grid like the one in Question 1 above. Make it with four columns and four rows.) Put the numbers for speed on the left and the numbers for time along the bottom. Add the labels from the top of the table.

3. **a)** What is the acceleration caused by gravity in meters per second per second?
b) Why is the first graph a curved line?
c) Is the speed of a falling pebble constant? Explain.
d) Why is the second graph a straight line?
e) Is acceleration caused by gravity constant acceleration? Explain.

Answers: 3. a) 10 meters per second per second, **b)** Speed is changing, **c)** No, because the slope is changing, **d)** Because acceleration is constant, **e)** Yes, because the slope is not changing

NAME: ____________________

Activity Four

Acceleration and "Gs"

A falling object accelerates at about 10 meters per second per second (10 m/s^2). This is called the **acceleration due to gravity.** That is speeding up pretty fast. It is more acceleration than a runner can get as he or she takes off from the starting line of a race.

Some things, like race cars, can accelerate much faster. Sometimes acceleration is given in **Gs.** If something accelerates at 10 m/s^2, we say it has an acceleration of 1 G. If the acceleration is 20 m/s^2, it has 2 Gs of acceleration.

Search the Internet for the acceleration of different things. Try searching for "speed and acceleration" and for "dragster acceleration" with and without the quotation marks. Look for the acceleration of these things:

- **race cars**
- **dragsters**
- **rocket dragsters**
- **roller coasters**
- **jet planes**
- **humans**
- **cheetahs**
- **space shuttle**

Write what you find in the table below. Put the acceleration of different things in order from HIGHEST acceleration to LEAST acceleration.

Item	Its Acceleration

Activity Five

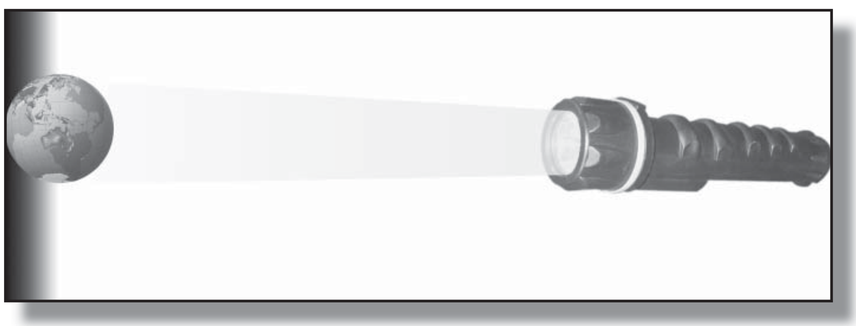
Earth's Motion

We have learned that the sun *looks like* it is circling the Earth because it moves across the sky during the day. We have also learned that it looks this way because we are standing on the Earth which feels like it is not moving. It is actually the Earth that is spinning.

In this activity you will try to really believe that the Earth is spinning and the sun is sitting still.

STEPS

1. Begin by making a **simple model of the Earth and sun**. Use a flashlight for the sun and any large ball for the Earth. A globe would be even better for the Earth. Your model will look like this:



2. Now, make the room as dark as you can. Turn on the flashlight, and slowly spin the "Earth." Picture yourself on a place on the surface of the Earth. Imagine yourself in that spot watching the sun as it rises in the morning, as it seems to move across the sky, and as it sets in the evening.

3. Next, **look at the real thing**. Find a spot where you can see the sun set in the evening. Wait until the sun begins to dip below the horizon. (Do **not** look directly at the sun until it has become red and dim. You can damage your eyes if you look at it while it is still bright.)

   Think about your model as you look at the sun. If you look very closely, you can see it moving. But forget that the sun looks like it is moving. Try to SEE and FEEL the Earth you are standing on spinning away from the sun. Can you do it? It's hard to imagine, but that is what is really happening!

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Student Worksheet

Activity Six

Measuring Waves

In this activity you will measure the SPEED, WAVELENGTH, FREQUENCY, and AMPLITUDE of waves on water.

It is easiest to do this activity with a partner. Find a large puddle of water outside, or go to a still pond. As you follow the steps below, record your answers to each question in your notebook.

FOR THIS ACTIVITY, you will need:

- **a stopwatch**
- **a ruler or tape measure**

STEPS

1. Drop a pebble in the water and watch the waves as they move across the water.
2. Put the ruler up and down in the water, resting on the bottom. Measure the **high** and **low** points of the waves as they pass the ruler.
3. How do you find the **amplitude** of the wave from the high and low points?
4. Find the speed of the waves. Drop the pebble and measure **how long** it takes a wave to reach shore. Measure the **distance** to where you dropped the pebble.
5. How do you find the **speed** of the wave?
6. Drop the pebble and count **how many** waves come to shore in one minute.
7. What is the **frequency** of the waves?
8. Measure the **distance** between wave tops. This will be tricky. You will have to read the ruler as you move it along with the waves.
9. For any kind of wave, the **speed equals the wavelength times the frequency**. See if your measurements agree with this equation.

CHALLENGE! How do different sizes of pebbles affect the speed, wavelength, frequency, and amplitude of the waves? You can also try this: drop the same pebble from different heights and see how height affects the speed, wavelength, frequency, and amplitude of the waves.

Answers: **3.** Subtract low from high and divide by 2, **5.** Divide distance by time, **7.** Number of waves divided by minutes