

**(611-1282) 25-125 Pocket Accelerometer****Warranty and Parts:**

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

**Principles Illustrated:** Linear Acceleration, Conversion of Degree Units, Motion

**Theory:** Acceleration is the change in velocity over time and the accelerometer will allow the students to easily measure the acceleration changes in their car as they drive to school or on another errand. The tool works by measuring the degree of acceleration in degrees. The student then would use their knowledge of trigonometry to convert the degrees into gravitational acceleration (g's) using the formula  $a = \tan(q)$  where "a" is the acceleration in g's and "q" is the degree measured with the accelerometer.



**The velocity of an object is the rate of change of its position. As a basis for understanding this concept:**

- Students know* position is defined in relation to some choice of a standard reference point and a set of reference directions.
- Students know* that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary.
- Students know* how to solve problems involving distance, time, and average speed.
- Students know* the velocity of an object must be described by specifying both the direction and the speed of the object.
- Students know* changes in velocity may be due to changes in speed, direction, or both.

**Assembly:** Simply open the tube, while holding the accelerometer vertically; fill the tube with colored water until the top and bottom ends of the water reach the horizontal arrows on your accelerometer. Close the tube.

**Operation:**

- While sitting in a car, hold the accelerometer with the arrows pointed in the direction of movement of the vehicle.
- Allow 2-3 seconds for acceleration and then lock the accelerometer by holding down the metal bar with your thumb. Push it down until the tube is squished flat. This allows you to record the units of acceleration in your data table.
- Record the acceleration every 30 seconds for 5 minutes and record in the data table on the next page. Convert degrees to g's using the formula  $a = \tan(q)$  or pull directly from the accelerometer.

Time in Seconds (s)	Degrees (q)	Acceleration in (g)
0		
30		
60		
90		
120		
150		
180		
210		
240		

**Things you may have noticed:**

At zero acceleration the fluid level stays at zero degrees; there is zero angular deflection.

The larger the angle the greater the acceleration.

Positive forward acceleration is seen when the liquid **rises** on the right side of the accelerometer.

Deceleration is recorded when the liquid is **below** the 0.0 mark on the right hand side.

**What's Going On?**

When the fluid is accelerated to 45 degrees, your acceleration is equal to 1g.

When the fluid is accelerated to 60 degrees your acceleration is 2g.

**Benchmarks and Standards**

This investigation provides support for the *Benchmarks for Science Literacy* and *National Science Education Standards* shown in the table below.

<i>Benchmarks for Science Literacy</i>				<i>National Science Education Standard</i>
			Grades 5 – 8 <b>Physical Science Content Standard B.1 – Motions and Forces</b>	“The motion of an object can be described by its position, direction of motion and speed. The motion can be measured and represented on a graph.” (p. 154)
Grades 3 – 5 <b>The Physical Setting</b>	<b>4B.1</b>	“Changes in speed or direction of motion are caused by forces. The greater the force is the greater the change in motion will be.”	Grades 5 – 8 <b>Physical Science Content Standard B.2 – Motions and Forces</b>	“An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.” (p. 154)
Grades 6 – 8 <b>The Physical Setting</b>	<b>4B.3</b>	“An unbalanced force acting on an object changes its speed or direction of motion, or both.”	Grades 5 -8 <b>Physical Science Content Standard B.3 – Motions and Forces</b>	“If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in speed or direction of an object’s motion.” (p. 154)
Grades 9 – 12 <b>The Physical Setting</b>	<b>4B.1</b>	“The change in motion of an object is proportional to the applied force and inversely proportional to the mass.”	Grades 9-12 <b>Physical Science Content Standard B.1 – Motions and Forces</b>	“Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship $F = ma$ , which is independent of the nature of the force. Whenever one object exerts a force on another, a force equal in magnitude and opposite in direction is exerted on the first object.” (p. 180)