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QuickView

Students calculate the altitude of the launched clay ball.

Standards Addressed

NSTA 9-12

Students develop the abilities necessary to do scientific inquiry.

- Students use technology and mathematics to improve investigations and communications.

Students develop understandings about scientific inquiry.

- Students understand mathematics is essential in scientific inquiry and understand mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations, and communicating results.

Students understand motions and forces.

- Students understand objects change their motion only when a net force is applied; understand laws of motion are used to calculate precisely the effects of forces on the motion of objects; understand the magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of force; and understand whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
- Students understand gravitation is a universal force that each mass exerts on any other mass and understands the strength of the gravitational attractive force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.

Students understand the abilities of technological design.

- Students evaluate the solution and its consequences.

Students understand about science and technology.

- Students understand creativity, imagination, and a good knowledge base are all required in the work of science and engineering.

NCTM 9-12

Students compute fluently and make reasonable estimates.

- Students develop fluency in operations with real numbers, vectors, and matrices, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases.
- Students judge the reasonableness of numerical computations and their results.

Students represent and analyze mathematical situations and structures using algebraic symbols.

- Students write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency – mentally or with paper and pencil in simple cases and using technology in all cases.

- Students use symbolic algebra to represent and explain mathematical relationships.
- Students judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.

Students analyze change in various contexts.

- Students should approximate and interpret rates of change from graphical and numerical data.

Students analyze characteristics and properties of two- and three-dimensional shapes and develop mathematical arguments about geometric relationships.

- Students use trigonometric relationships to determine lengths and angle measures

Students apply appropriate techniques, tools, and formulas to determine measurements.

- Students use unit analysis to check measurement computations.

Students build new mathematical knowledge through problem solving.

- Students solve problems that arise in mathematics and in other contexts.

Students create and use representations to organize, record, and communicate mathematical ideas.

- Students select, apply, and translate among mathematical representations to solve problems.

ITEA 9-12
Students develop an understanding of the attributes of design.

- Students learn design problems are seldom presented in a clearly defined form.
- Students learn that design needs to be continually checked and critiqued and the ideas of the design must be redefined and improved.

NCTE K-12
Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and of the cultures of United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment.

Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts; they draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features.

Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

Students use spoken, written, and visual language to accomplish their own purposes.

Time Required

45-90 minutes (will vary with class size)

Content Areas

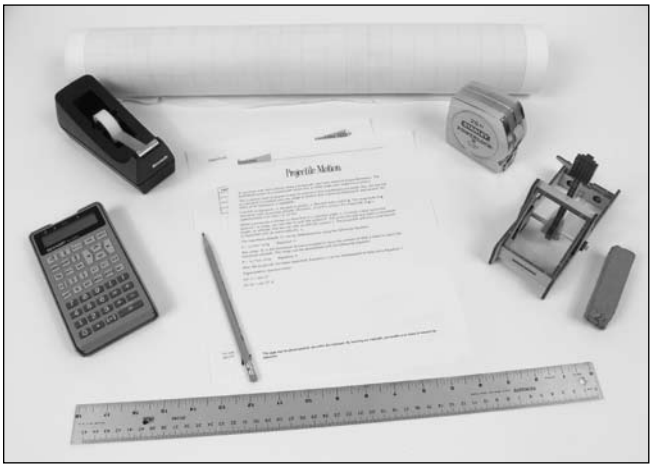
Primary: Math
Secondary: Technology, science, language arts

Vocabulary

- altitude
- diameter
- velocity

Materials

- Pencil
- Tape measure
- Tape
- Pitsco Range Paper
- Pitsco Catapult
- Modeling clay
- Calculator
- Ruler
- "Altitude Data Sheet"
- "Projectile Motion" resource page



Procedure

1 Roll out approximately six meters of Range Paper. Using tape, secure the Range Paper in position on the floor. Position the catapult on one end of the paper and draw a line where the catapult is to be placed.

Make sure the line is dark and is perpendicular to the length of the paper.

2 Using a 0.5 cm diameter clay ball, launch the clay ball with the catapult from the starting position. Mark the landing point of the clay ball. Repeat this step three times.

Stress the importance of aligning the catapult with the starting line before every launch.

3 Measure the distance between the starting point and the landing point of the clay ball after each launch. Record this number in inches on the "Altitude Data Sheet." If the measurements were taken in inches, convert the measurement values into centimeters.

1 inch = 2.54 centimeter

4 Calculate the altitude and initial velocity of each launch using the formulas provided in the "Projectile Motion" resource page. Use 35° as the launch angle.

Calculators are acceptable to help complete this step. Students may use the protractor to measure the launch angle. The launch angle should equal 90°.

QuickView

Calculate the altitude of the launched clay ball.

Materials

- Pencil
- Tape measure
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- Pitsco Range Paper
- Pitsco Catapult
- Modeling clay
- Calculator
- Ruler
- "Altitude Data Sheet"
- "Projectile Motion" resource page

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Altitude Data Sheet

Launch	Distance (in.)	Distance (cm)	Initial Velocity	Altitude
1				
2				
3				
4				