

ACTIVITY ONE: FIRE POWER**Learning Objectives:**

ALL: Students will be able to discuss what affects the size of the crater caused by a flying object

MOST: Students will be able to show this pattern graphically

SOME: Students will know how the placement of an attacker can affect the size of a crater.

HSW:

- setting up simple practical enquiries, comparative and fair tests
- making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment
- gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- recording findings using simple scientific language, drawings, labelled diagrams, bar charts, and tables

Resources per group:

- Large tray of sand
- Water: to add to sand to mimic wetter conditions in trenches if you wish – only to make paste or investigation not possible.
- 3 x different sized ball bearings (choose a magnetic substance eg steel)
- Magnet
- Ruler
- Rake for smoothing of sand
- Meter rule

STARTER:

Show students some pictures of trenches destroyed by shelling and ask: What type of weapons caused this damage? Link to shells and explosive force over guns.

INTRODUCTION:

Look at development of shells from basic solid cannon-balls(1), through adding a release of gas to propel them across distances (2) to the devastating use of shrapnel based shells in WWI (3).

You may wish to demo/show videos of these:

1. Use a ball and sling-shot
2. Use a water rocket
3. Find a stop motion video of an exploding container

MAIN TASKS

Students to investigate how different sized balls affect their crater size

Students to clearly explain in their work what the different variables are:

Independent: Size of projectile (cm)

Dependent: width of crater (cm)

Control: force projectile thrown with (keep same student doing this task), same 3 projectiles, type of ground landing in (sand and water mix constant during investigation)

Method;

1. Students to drop ball from a set height (e.g. 1m top of meter rule/top of desk)
2. Use magnet to carefully remove ball from sand without affecting crater and measure crater width with ruler.
3. Use rake to smooth over sand.
4. Drop second ball and repeat steps 1-3.
5. Drop largest ball and repeat steps 1-3.
6. If you want to focus on calculating a mean and reliability you could get students to repeat readings 3 times and make sure they remove any anomalous results.

Students to complete a results table such as:

| Size of ball (cm) | Size of crater 1 (cm) | Size of crater 3 (cm) | Size of crater 3 (cm) | Average size of crater (cm) |
|-------------------|-----------------------|-----------------------|-----------------------|-----------------------------|
| 0.5 | | | | |
| 1.0 | | | | |
| 2.0 | | | | |

Extension: Observing pattern from several firing positions:

- a) From top of a hill: suggest 1m height/desk height
- b) From bottom of a hill: throw up similar height
- c) From a flat position: throw up gently with both objects starting on floor

Method:

1. Students to set up tray of sand on desk/set height of 1m.
2. Students to throw ball bearing up (being aware of other students for safety). Another member of the group should use the magnet to carefully remove the ball without disturbing the crater.
3. Third member of group should measure widest part of crater.
4. Repeat steps 1-3 for all three sizes of ball bearings.
5. Swap the positions of the tray and ball throwing student and complete steps 1-4 for this set up
6. Put tray on floor and throw ball from floor as well, repeating steps 1-4 again.

REVIEW:

All students: Write a concluding statement along the lines of: *As the size of the shell got bigger, the crater got bigger.*

Most students: Draw a graph with size of ball on x-axis and average size of crater on y-axis.

Some students: Draw 3 graphs showing the difference height of attacker makes when compared. Includes a statement referring to this in their conclusion.