ELABORATE

HOW CAN WE MAKE THAT?

TRAJECTORIES

30 MINUTES

SUMMARY

Humans have highly developed minds which can estimate the trajectory of an object flinging through the sky. This helps us catch balls, hunt animals and anticipate fireworks. In this activity we'll look at impact craters from a different angle - the path the object takes to get there.

The Fireballs in the Sky team can extrapolate a meteor's path from original orbit in space to its final resting place on Earth from just a few seconds flash. This requires a great understanding of trajectories.

A trajectory is the path followed by a flying object, or an object under force. We'll experiment with different objects being launched in different ways to compare trajectories. We can't organise test drops from space, so these items will have to go up before they come down. Get the students immersed in the activity to learn the terminology and think about applying it to space.

Water balloon launcher, available in online shops: 'Wild Sling Solo'

OUTCOMES

1. Students learn about trajectories and experiment with force required to make a crater
2. Students measure, order and compare objects and distances using scaled instruments, choosing appropriate units and converting between units.
3. Students identify, compare, estimate and measure angles of different sizes in everyday situations.

EQUIPMENT

See if you can obtain some of these more unusual launchers:

- Water balloon launcher and water balloons (check you have an appropriate tap fitting)
- T-ball stand, bat and ball
- Nerf dart gun or other foam bullet toy guns and darts
- Water pistols, super soakers and bucket
- Construction equipment – cardboard, glue, sticky tape, pop sticks, paper, elastic bands, plastcine to make launch pads and:
  - home made pea shooter
  - home made sling shots
- Inclinometers, graph paper, calculators
- Rulers, tape measures
- Worksheet, page 68

SAFETY

It is important to establish clear safety rules and consequences for failure to be safe. It is suggested that you enlist extra adult help for supervision so that students can spread out to do their tests. In all cases, establish a countdown to launch and for each device establish a safety distance for spectators to stay away from launchers. If you have mulitple objects, students won't need to run into the line of fire to measure/retrieve until the end.

THE EXPERIMENT

Set up:
Students will use various devices to investigate trajectories and angles. They will need to fully understand and follow the safety measures required. They will need to measure and compare angles and distances between devices and within the same device

Predict:
Students predict the best angle for launching from each device, and the corresponding best distance and best height an object will reach under those conditions (see worksheet).

Test:
In small groups, students undergo a comprehensive analysis of their device to determine th best angle of launch for highest and furthest trajectory. They may need to make launch pads for their devices in order to change the angle of launch. To measure the height of objects at the top of their curve, students will need their inclinometers and to choose a measuring point perpendicular to the launch zone.

For repeat experiments by a different launch team, have groups swap their devices and repeat the investigation.

Analyse:
Students discuss the differences between their prediction and the findings. Students discuss negative factors that contribute to the experiment – e.g. wind, human error, inaccuracies when measuring

Students create two graphs per launcher:
1. Distance travelled for their object against angle of launch
2. Height reached against angle of launch

Communicate:
Students share their graphs with the class and compare the findings with predictions and outliers and discuss reasons for discrepancies

Students devise statements that describe the relationship between angle/height and angle/distance travelled.

SUGGESTIONS FOR THE CLASSROOM

- Discuss what sciences would use the study of trajectories: e.g. Astronomy, aeronautics, toy-making industry, weapons, studying migratory birds, sports science