ELABORATE

WHAT MADE THAT?!

MAKING CRATERS

30 MINUTES

SUMMARY

If something hits the Earth hard enough, it makes a dent. While it's not often seen, rocks do fall from the sky and can create large impact craters. This experiment is an upscaled version of that in the 'Space Rocks' unit. You might like to start there for extra ideas, or work with a buddy class.

In this activity, students experiment with different objects and dropping heights to determine a relationship between object and crater. They will then extrapolate that data to a crater the size of the school oval. This will be a wild estimate, since it's not going to take into account a multitude of factors affecting a real meteor. Discuss the limits of extrapolation with students and check out the online impact crater simulator - where you can much more accurately estimate the size of the object that could take out the school oval!

Invesitigate the other affects a large meteorite will have on the Earth's surface and systems. It's widely suspected that a meteorite wiped out some of the dinosaurs and it's impact crater takes up a relatively small part of the Gulf of Mexico. How, then, did it massacre dinosaurs across the globe?

The infamous Peekskill meteorite car - the only known manmade object to be hit by a meteorite

OUTCOMES

1. Students experiment with crater making and use their results to extrapolate data for an oval-sized impact crater
2. Students use scaled instruments to order, estimate, measure, and compare objects and impacts
3. Students investigate how forces exerted on the Earth's surface can change it's shape and affect the atmosphere, hydrosphere, biosphere and lithosphere

EQUIPMENT

- See 'crater making' in junior section for ideas
- Plasticine
- Rulers
- String
- Tape measures
- Measuring scales
- What made that?! Worksheet,page 67

THE EXPERIMENT

Plan:
Using data collected in sand pit experiments, students will calculate the mass of a meteorite required for an impact crater the size of the school oval (or similar).

Students will need to establish a relationship between size/weight of object and size (diameter) of crater. To maintain the same size/mass for each object, use something uniform and changeable, such as plasticine or clay for students to compare different sized objects. This is the independent variable, with the diameter of the crater being dependent.

Discuss - what else needs to be kept the same in this experiment? (controlled variables - e.g. height, speed, angle of drop, 3D shape of object, surface material)

Predict:
Students predict the mass of the object big enough to make a school oval sized crater. We will be estimating this, based on the experiments.

Students also predict impact crater size for the smaller object bombardments used in the data gathering phase (see worksheet).

Test:

Students experiment with crater making - they will need to repeat each set of conditions at least three times to get an average crater size. - see worksheet.
Ensure that the controlled variables are kept the same.

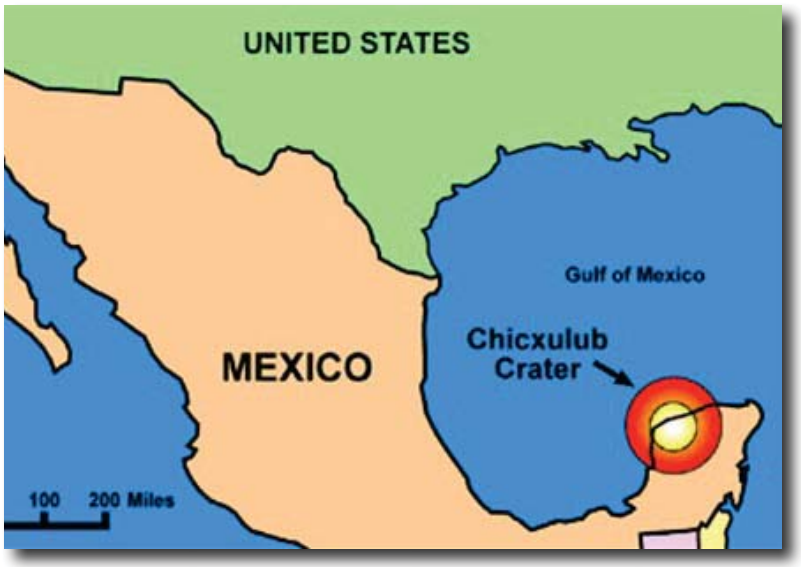
Analyse:
Students discuss the results of their experiments. Can they see a pattern? What kind of graph would best represent this data? Students will turn their data into a line graph showing size of impact crater (dependent variable) against the mass of the object.
Can you draw a relationship between these two? Using a very large sheet of paper, or chalk on the cement, extend the axes out to reach the size of the oval and extend the line graph. The generally agreed on distance to space is 100km from sea level (although this doesn't include the exosphere).
Is this a reliable interpretation? Why not? What is the greatest size of crater/object that you could extrapolate on the graph to be a reliable estimate?

Craters in the sand

Communicate:
Discuss what happens when an object makes a crater. How does it affect the 'land'? Many scientists think that the extinction of lots of dinosaurs at the end of the Cretaceous period was caused by a large meteorite impact. How could the impact affect animals and plants on the other side of the planet?

How do meteorite craters on Earth differ to those on the moon? Why?

SUGGESTIONS FOR THE CLASSROOM



Location of the Chicxulub crater, where a 10 - 20 km asteroid is thought to have put an end to a great many dinosaurs

http://www4.nau.edu/meteorite/meteorite/book-glossaryc.html

- In this experiment we have ignored the influences of some variables that would affect real meteor impacts, such as: angle of descent, atmospheric friction, velocity of meteor, shape of meteor. What other factors would be important? How could we simulate these variables in our experiment?

- Students will enjoy the Impact Crater simulator online when they have finished this activity to compare their class calculation to a real simulator:

  http://simulator.down2earth.eu/

This allows you to choose the object size and density, the angle of trajectory, speed and the target area (on google maps) and impact the Earth!

- Explore Google Earth looking for craters such as Chicxulub crater in Mexico or Wolfe Creek crater in Western Australia.
- Explore Google Moon or Google Mars looking for more craters - where is the biggest?