Down to Earth
KS3

Teacher Guide

Deep Impact Collision Energy

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Deep Impact collision energy

The aim of this activity is to calculate the kinetic energy of the impact and to learn how the kinetic energy changed when NASA decided to alter the weight of the impactor.

Objectives

Students should:

- Remember the equation for kinetic energy
- Use the equation to calculate the kinetic energy of the impactor

Resources required

Pencils and paper

Teaching activities

In order to make a hole in the side of the comet, a lot of energy needs to be given up on impact. This energy comes from the kinetic energy of the impactor which has a net velocity toward the comet.

The question posed to the students is:

“In order to reduce costs, the Deep Impact Mission Team decided to make a slightly smaller launch rocket than initially planned. This meant that they had to reduce the overall mass of the spacecraft as the smaller rocket could not carry as much.

One of the places where they were able to reduce mass was on the impactor. The mass of the impactor was changed from 500kg to 370 kg. The scientists were concerned though because this means that the amount of energy produced at impact will be reduced as well.

If the impactor is traveling at 10.2 km/s with respect to the comet, how much energy is produced on impact by the 2 different masses?”

The students should think about the energy that the impactor has because it is moving and that that they will need to use the equation:

Kinetic energy = ½ mv^2

Mass = 370 kg
Velocity = 10.2 km/s
= 10200 m/s

Plugging in the numbers
KE = ½ x 370 x $(10200)^2$
= 1.92×10^{10} J

1 Megaton of TNT (or 1 million tonnes of TNT) is equivalent to 3×10^{15} J.

Some more converting:

KE = $1.92 \times 10^{10} \times (1 \times 10^6$ tons TNT/3×10^{15} J)

the joules cancel, $10^9 \times 10^6/10^{15}$ cancels leaving

= 19/4 tons of TNT
= 4.8 tons of TNT