LESSON PLAN

17 OUR EARTH UNDER THREAT

14-16

OVERVIEW

This activity is designed as a 'virtual mission'. Students will play the part of Near Earth Asteroid (NEA) scientists to the scenario of a possible asteroid impact with the Earth. By following the story of the mission (led by an automated powerpoint), students will apply their understanding of kinetic energy, density and probability to perform calculations and research possible methods of deflecting the asteroid.

This mission is decision based – at several points they will have to make decisions about how to tackle the asteroid, and the outcome for each group will depend on the decisions that they have made.

CURRICULUM LINKS

Reading and taking measurements from a graph.

Speed, distance, and time.

Calculating time given a speed and distance.

Making measurements.

Gravity, weight and mass.

WHAT YOU NEED

- **Laptop with "Our Earth Under Threat" PowerPoint running and internet access** (one per group)
- **17.1 Earth Under Threat student sheet** (one per student)
- **17.2 Near Earth Asteroid report** (one per student)
- **A17 Earth under threat briefing Powerpoint**

STARTER

Run through the briefing PowerPoint and explain to the students that in groups, they will work through the simulated scenario to apply the physics that they have learnt to the protection of the planet. Also point out that at every step, there will be hints that they can click on to help them if they are necessary.

45 MINS

MAIN ACTIVITY 1

Students run through the virtual mission.

A17 Earth under threat PowerPoint


BORROW THE MOON NEWS

IS THE EARTH REALLY UNDER THREAT?

ROCK ALERT!

4,700 Potentially Dangerous Asteroids Lurk Near Earth, NASA Says

This image shows the difference in the orbits of a typical near-Earth asteroid (blue) and a potentially hazardous asteroid, or PHA (orange)A new NASA survey by the WISE telescope has pinned down the number of asteroids that could pose a collision threat to Earth in what scientists say is the best estimate yet of the potentially dangerous space rocks.

The survey found there are likely 4,700 potentially hazardous asteroids, plus or minus 1,500 space rocks, that are larger than 330 feet (100 meters) wide and in orbits that occasionally bring them close enough to Earth to pose a concern, researchers said. To date, only about 30 percent of those objects have actually been found, they added.

Potentially hazardous asteroids, or PHAs in NASA-speak, are space rocks in orbits that come within 5 million miles (8 million kilometers) of Earth and are large enough to cause damage on regional or global scale if they were ever to hit our planet. According to the survey, about twice as many asteroids are in so-called "lower-inclination orbits" — which are more closely aligned with Earth's path around the sun than other objects — than previously thought researchers said.

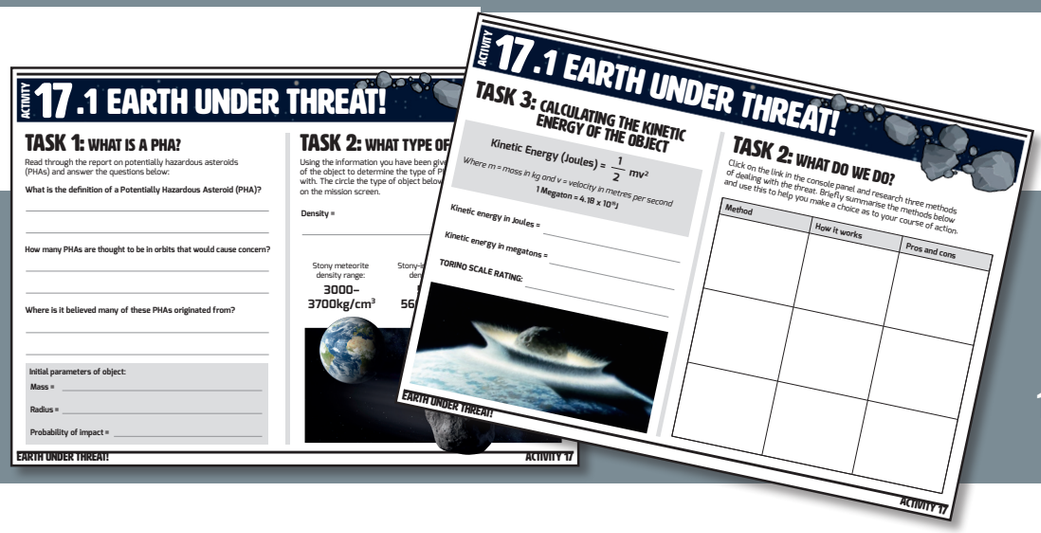
"A possible explanation is that many of the PHAs may have originated from a collision between two asteroids in the main belt lying between Mars and Jupiter," NASA officials explained in a statement. "A larger body with a low-inclination orbit may have broken up in the main belt, causing some of the fragments to drift into orbits closer to Earth and eventually become PHAs."

"Because they will tend to make more close approaches to Earth, these targets can provide the best opportunities for the next generation of human and robotic exploration," During its asteroid hunt, the WISE telescope searched for space rocks within about120 million miles (195 million km) of the sun. For comparison, the Earth is about 93 million miles (150 million km) from the sun. The data from NEOWISE, when combined with other asteroid data observations, helped NASA announce in 2010 that about 90 percent of the largest near-Earth asteroids that come close to our planet had been identified.

Source: Space.com

This image shows the difference in the orbits of a typical near-Earth asteroid (blue) and a potentially hazardous asteroid, or PHA (orange)

17.2 NEO report


ACTIVITY 17.1 EARTH UNDER THREAT!

TASK 1: WHAT IS A PHA?

Read through the report on potentially hazardous asteroids (PHAs) and answer the questions below:

What is the definition of a Potentially Hazardous Asteroid (PHA)?

How many PHAs are thought to be in orbits that would cause concern?

Where is it believed many of these PHAs originated from?

Initial parameters of object:
Mass =
Radius =
Probability of impact =

TASK 2: WHAT TYPE OF

Density =

Stony meteorite density range: 3000–3700kg/cm³

EARTH UNDER THREAT! ACTIVITY 17

ACTIVITY 17.1 EARTH UNDER THREAT!

TASK 3: CALCULATING THE KINETIC ENERGY OF THE OBJECT

Kinetic Energy (Joules) = $\frac{1}{2}mv^2$

Where m = mass in kg and v = velocity in metres per second

1 Megaton = 4.18 x 10¹⁵J

Kinetic energy in joules =

Kinetic energy in megatons =

TORINO SCALE RATING:

TASK 2: WHAT DO WE DO?

Click on the link in the console panel and research three methods of dealing with the threat. Briefly summarise the methods below and use this to help you make a choice as to your course of action.

Method	How it works	Pros and cons

EARTH UNDER THREAT! ACTIVITY 17

17.1 Earth under threat

10 MINS

PLENARY

Ask the students what the outcome of their mission was and run through the answers on the powerpoint. Did they experience any problems? Do they think we should invest more time and money into researching the risk of NEAs?

If students have time, they can spend some time at the end of the lesson using the Down2Earth impact calculator (linked to in their powerpoint) to investigate impacts on the Earth.