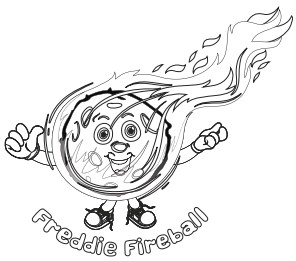

FUN FACTS FOR KIDS WITH FREDDIE FIREBALL

WHAT ARE COMETS, ASTEROIDS, METEOROIDS, METEORS AND METEORITES?

Comets are mostly made of dust and ice, like a dirty snow ball. They are very old. As comets travel close to the Sun, some of the ice becomes a gas. This process releases bits of dust and debris to trail behind the comet. Comets orbit the Sun at the very edge of the solar system, beyond Pluto. They come from two places: the Kuiper Belt and the Oort Cloud.

Asteroids are rocky, iron or icy debris flying in space. Their sizes range from 1 meter to hundreds of kilometers. Most asteroids can be found in the Asteroid Belt; others are in strange orbits straying far from home. It is currently believed that at least 5,000 asteroids cross the Earth's orbit, some coming very close. No need to worry though, large asteroids and comets hit the Earth only once every 100 million years or so.

Meteoroids are very small asteroids, with sizes between microns to 1 meter.

A meteoroid that burns up as it passes through the Earth's atmosphere produces a **meteor**. If you have ever looked up at the sky at night and seen a streak of light or 'shooting star', what you are actually seeing is a meteor. Meteors are easier to see during the lower light conditions of night. A fireball is a meteor that is brighter than the planet Venus.

A meteoroid that survives falling through the Earth's atmosphere and colliding with the Earth's surface is known as a **meteorite**. Meteorites that are observed as they fall through the Earth's atmosphere and later recovered are called 'falls', all others are called 'finds'. To this date there have been around 1,000 collected 'falls' and 60,000 'finds'.

METEOR SHOWERS AND SHOOTING STARS

Just like asteroids, comets make falling stars. Astronomers call these **meteor showers** and they are made when the Earth moves through the tail of a comet. You can usually see at least a few meteors during a shower, but on a particularly good show, you can sometimes see hundreds of shooting stars per hour! The best meteor showers are the Quadrantids that are at their best on January 3rd every year, the Lyrids that are at their best on April 22nd, the famous Perseids on August 12th, the Orionids on October 22nd, the Leonids on November 17th and the Geminids on December 14th. The Geminids, it is thought, are actually dust from an asteroid called Phaethon rather than a comet. Meteor showers are named after the constellation that they appear to be falling from. For example, the Geminids will be shooting away from the constellation Gemini (The Twins), whereas the Perseids are from Perseus (The Hero). Did you know that the meteors you see during a meteor shower might appear to be very close, but those tiny particles of burning space debris are actually about 30 to 40 miles (48 to 64 km) above Earth's surface?

The name of **shooting stars** is a little misleading because they are not stars that have fallen out of the sky. Our Sun is a star, the closest star; the other stars are far far away and they are much bigger than a shooting star. Shooting stars are actually just tiny bits of dust entering the Earth's atmosphere from space; tiny particles, like grains of sand or pebbles on a beach, that crash into the atmosphere at an amazingly fast speed! But don't worry - they are not big enough to harm you! And the light that you see is the glow of the hot air around them as they fly through the atmosphere and burn up.

DIFFERENT KINDS OF METEORITES

There are three main types of meteorites: **stony, iron and stony-iron**. Iron meteorites are typically bits of metal iron cores of large asteroids that were once hot enough to have melted, causing all of their iron to sink to the center. Stony meteorites look most like the stones that you find on Earth and come from the outer layers of asteroids, whereas stony-iron meteorites are a mixture of the two.

Examples of stony meteorites: Carbonaceous and ordinary chondrites

Scientists think carbonaceous chondrites are the most primitive of all meteorites. They formed very early in the development of the solar system and have only changed a little in their long history. Some of them actually have compositions very similar to our Sun, but without the gases. They also contain the oldest solids in the solar system: flaky white calcium-aluminum rich inclusions (CAIs). A few of these rocks also contain sugars and amino acids (some of the basic ingredients of life) and tiny diamonds, which formed in supernova explosions.

Ordinary chondrites are the most common type of meteorite that falls to Earth (hence the "ordinary" name tag): about 74% of all meteorites. If you are on a meteorite hunt and are lucky to find a meteorite, chances are it will be an ordinary chondrite. But they are still quite extraordinary because they formed in the early solar system.

Example of stony-iron meteorites: Mesosiderites

Mesosiderites are stony-iron meteorites; they are a mixture of rock and metal (from the Greek word *mesos*, meaning "half" and *sideros*, meaning "iron"). They were probably formed by huge energetic impacts. The most likely scenario is a collision between an iron asteroid with a rocky body, resulting in a mixture of both. Stony-iron meteorites are extremely rare, making up less than 2% of all known meteorites.

Iron meteorites

Some meteorites are made entirely of iron and nickel. Most come from the cores of rocky planets. The core of the Earth most likely looks like an iron meteorite. But what does it take to expose the core of a planetary body? Some asteroids were hit by huge meteorites and lost their mantle and crustal rocks. We know that there were massive impacts in the early years of the solar system because our Moon and the inner planets are covered with impact craters. Cutting up an iron meteorite isn't easy and might destroy a few saw blades in the process. But it is really worth doing, to expose the patterns and crystal shapes that are unlike anything found near the surface of Earth.

One of the most famous meteorite craters in the world is located in Arizona. A small iron asteroid entered the Earth's atmosphere. About half of it broke into many pieces and thousands of fragments were scattered onto the surface, the other half hit the ground at a speed of about 26,800 miles per hour and a huge crater formed. But no one ever found the huge iron meteorite that crashed into the ground. It simply vaporized. You now might be afraid that you will get hit by a meteorite one day. No need to worry; there is no record of anyone being killed by a meteorite. And you are more likely to win the lottery than get hit by a meteorite. If you are worried that Earth will be struck by another huge meteorite like the one that formed the Arizona crater or the one that most likely killed the dinosaurs, you should know that NASA's Near Earth Object Program is watching over us so we can sleep safe at night.

TEKTITES

People often confuse tektites with meteorites because their typical aerodynamic shapes suggest that they were flying through the air when they were molten. And that is, in fact, exactly what happened. Tektites (from the Greek word *tektos* meaning "molten") are created by enormous impacts of large meteorites on Earth's surface. There are two main varieties of tektites. Splash-form tektites form when melted material at the Earth's surface is blasted up to several hundred kilometers into space. The spinning molten material cools and solidifies to glass. Layered tektites form on the ground as puddles of melted silicate rock. Even though tektites were formed during meteorite impacts, the material tektites are made of is primarily of terrestrial origin.

There are four major areas of tektite occurrences worldwide. Locations where tektites are found are often associated with impact craters. Curiously, the largest and youngest tektite deposit in Southeast Asia is not associated with any known crater.