This image of Comet ISON was taken by the Hubble Space Telescope on April 10, 2013 when the comet was 386 million miles from the sun, and 394 million miles from Earth. The icy core of the comet may only be about 5 km in diameter, but the bright head or 'Coma' is about 3,000 miles across.

Although it is too far from the sun to have a dramatic tail, from just beyond the orbit of Mars, its tail has already grown to 57,000 miles.

Measurements by NASA's Swift satellite in January, 2013 show that at a distance of 460 million miles from the sun (375 million miles from Earth), and traveling at about 21 km/sec (13 miles/sec), Comet ISON was ejecting 51,000 kg of dust and 60 kg of water every minute as its surface has been steadily heated from 40 K to about 150 K. This pace of ejection will increase enormously as the comet gets closer to the sun. By some estimates the comet will lose 10% of its total mass as it swings by the sun and heads back out into deep space in early - 2014.

Problem 1 – Suppose that the average density of the comet nucleus is 1000 km/m^3, and it is a sphere with a diameter of about 6 km. What is the total mass of the nucleus of the comet?

Problem 2 – Suppose that Comet ISON continues to lose dust mass at the rate of 51,000 kg/minute as it travels to the orbit of Earth (93 million miles from the sun) at a speed of 13 miles/sec. How much mass will it lose, and what percentage of its total mass is this?

Problem 1 – Suppose that the average density of the comet nucleus is 1000 km/m3, and it is a sphere with a diameter of about 6 km. What is the total mass of the nucleus of the comet?

Answer: $V = 4/3\ \pi\ R^3$ so

$V = 1.33 \times 3.14 \times (3000m)^3$

$= 1.1 \times 10^{11}\ m^3$.

Since Mass = density x volume, the comet's mass is

$M = 1000 \times 1.1 \times 10^{13}$

= **1.1×10^{16} kg**.

Problem 2 – Suppose that Comet ISON continues to lose dust mass at the rate of 51,000 kg/minute as it travels to the orbit of Earth (93 million miles from the sun) at a speed of 13 miles/sec. How much mass will it lose, and what percentage of its total mass is this?

Answer: It travels from 460 million miles to 93 million miles covering a total of 460-93 = 367 million miles.

At a speed of 13 miles/sec, this takes 367,000,000/13 = 28 million seconds or 470,000 minutes.

At a rate of 51,000 kg/minute, it will loose M = 51,000 x 470,000 = **2.4×10^{10} kg**.

This represents P = 100% x ($2.4 \times 10^{10} / 1.1 \times 10^{16}$) = **0.0004% of the total mass**!