Chapter 27.1 Name _____

The Birth of Earth Video Worksheet

Solar System Formation

The 1.) _____ _____ (including the Earth) formed from a large, rotating cloud of interstellar 2.) Dust and 3.) _____ called a 4.) _____ _____. It was composed of hydrogen and helium produced in the 5.) Big Bang about 6.) _____ Billion Years Ago, as well as heavier elements ejected by supernovas. About 7.) _____ Billion Years Ago, the solar nebula began to 8.) Contract, possibly due to the 9.) Shock Wave of a nearby 10.) _____. As the cloud began to accelerate its rotation, gravity and inertia flattened it into a 11.) Protoplanetary Disk oriented perpendicularly to its axis of rotation. Most of the mass concentrated in the middle and began to heat up, forming a 12.) _____. But gravity caused small collisions in the outer disk which then created small objects called 13.) _____.

The in fall of material, increase in rotational speed and the crush of gravity created an enormous amount of 14.) Heat at the center. Ultimately, 15.) _____ _____ of 16.) Hydrogen into 17.) _____ began, and formed our star, called the 18.) _____. Meanwhile, as gravity caused matter to condense around the previously perturbed objects outside the gravitational grasp of the new sun, dust particles and the rest of the disk began separating into rings. Successively larger fragments collided with one another and became larger objects, ultimately becoming 19.) _____. These included one protoplanet, about 150 million kilometers from the center of the disk, which would eventually become 20.) _____. Our planet formed about 21.) 4.54 billion years ago, and the planet continued to increase in size due to collisions until it was largely completed within 10–20 million years. The 22.) Solar Wind of the newly formed Sun cleared out most of the material in the disk that had not already condensed into larger bodies.

Formation of Earth's Core

The Proto-Earth continued to grow from collisions, until the inner part of the protoplanet was hot enough to melt the 23.) Heavy elements, such as 24.) _____ and 25.) Nickel. Due to their larger densities such (now liquid) metals began to sink to the Earth's center. This resulted in a separation of a 26.) _____, Mantle and a (metallic) 27.) _____ only 10 million years

after the Earth began to form. This produced the layered structure of Earth and also set up the formation of Earth's 28.)_____ _____ which protected and still protects Earth's 29.)_____ today, from being stripped away by the Sun's solar winds.

During the accretion of material to the protoplanet, a cloud of gaseous 30.)Silica must have surrounded the Earth, to condense afterwards as solid rocks on the surface. What was left surrounding the planet was an early atmosphere of 31.) Light elements from the solar nebula, mainly hydrogen and helium.

Formation of Earth's Moon

A rare characteristic of our planet is its large natural satellite, called the 32.)_____. During the 33.)_____ program, rocks from the Moon's surface were brought back to Earth. Radiometric dating of these rocks has shown the Moon to be 34.)4.527 billion years old, about 30 to 55 million years younger than other bodies in the solar system. The rocks were found to be very 35.)Dry, suggesting that they were heated to extremely high temperatures at one time. Another special feature is the relatively low 36.)_____ of the Moon, which must mean it does not have a large metallic core, like all other terrestrial bodies in the solar system. In fact, the Moon has a bulk composition closely resembling the Earth's 37.)_____ and crust together, without the Earth's core. This has led to the 38.)_____ _____ _____, the idea that the Moon was formed during a giant impact of the 39.)Proto - Earth with another protoplanet. The Moon formed by accretion of the material blown off the mantles of the proto-Earth and impactor.

The impactor, sometimes named Theia, is thought to have been a little smaller than the current planet 40.)_____. The point at which it collided with Earth is an estimated 41.)4.533 billion years ago. Models show that when an impactor this size struck the proto-Earth at a low angle and relatively low speed (8-20 km/sec), a lot of material from the mantles (and proto-crusts) of the proto-Earth and the impactor was ejected into space, where much of it stayed in orbit around the Earth. This material would eventually form the Moon. However, the metallic cores of the impactor would have sunk through the Earth's mantle to fuse with the Earth's core, depleting the Moon of metallic material. The giant impact hypothesis thus explains the Moon's abnormal 42.)_____.

The impact had some important consequences for the young Earth. It released a gigantic amount of energy, causing both the Earth and Moon to be completely molten. Immediately after the impact, the Earth's surface was a large 43.)Magma ocean. The impact is also thought to have changed Earth's 44.)_____ to produce the large 23.5° tilt that is responsible for Earth's 45.)_____.

Formation of Earth's Atmosphere and Oceans

The large impact would have blown off most of early atmosphere the Earth had. Because, the Earth lacked an atmosphere immediately after the giant impact, cooling would have been 46.)Fast. Within 150 million years a 47.)_____ crust of lighter elements like Silica would have formed.

48.)Steam escaping from the crust, and other gases being released by 49.)_____ completing the second atmosphere. Additional water was imported to Earth from numerous collisions, probably from asteroids ejected from the 50.)Asteroid Belt under the influence of Jupiter's gravity.

All of the large amount of 51.)_____ on Earth could never have been produced by volcanism and degassing alone. It is assumed that most of Earth's water was derived from millions of impacting 52.)_____, which contain large amounts of 53.)Ice, and later collisions with small, icy protoplanets similar to today's icy moons. Impacts of these objects could have enriched the 54.)_____ planets (Mercury, Venus, the Earth and Mars) with water, carbon dioxide, methane, ammonia, 55.)_____ and other gases.

As the planet cooled, 56.)Clouds formed. 57.)_____ gave rise to the oceans. Recent evidence suggests the oceans may have begun forming by 58.)4.2 billion years ago. At the start of the Archaean eon, the Earth was already covered with 59.)_____. The new atmosphere probably contained ammonia, methane, water vapor, carbon dioxide, and nitrogen, as well as smaller amounts of other gases. 60.)Oxygen was very scarce on the early Earth, until early 61.)_____ ocean organisms evolved, like cyanobacteria in 62.)Stomatilites. Changing the Earth's atmosphere to an oxygen rich environment like we see today. This also formed an 63.)_____ layer, blocking out harmful 64.)_____ radiation, allowing life to move out of the oceans and onto land.

Video Worksheet Word Bank

13.7
~~4.2~~
~~4.527~~
~~4.535~~
~~4.54~~
4.6
Apollo
~~Asteroid Belt~~
Atmosphere
Axis
~~Big Bang~~
~~Clouds~~
Comets
Composition
~~Contract~~
Core
Crust
Density
~~Dry~~
~~Dust~~
Earth
~~Fast~~
Gas
Giant Impact Hypothesis
~~Heat~~
~~Heavy~~
Helium
~~Hydrogen~~
~~Ice~~
Iron
~~Light~~
~~Magma~~
Magnetic Field
Mantle
Mars
Moon
~~Nickel~~
Nitrogen
Nuclear Fusion
Oceans
~~Oxygen~~
Ozone
Photosynthetic
Planetesimals
~~Proto-Earth~~
~~Protoplanetary Disk~~
Protoplanets
Protostar
Rain
Seasons
~~Shock Wave~~
~~Silica~~
Solar Nebula
Solar System
~~Solar Wind~~
Solid
~~Steam~~
~~Stromatolites~~
Sun
Supernova
Terrestrial
UV
Volcanoes
Water