

ASTR101 – Unit 12 Assessment – Answer Key

1. Our model for the formation of the solar system is the nebular hypothesis. In this model, a cloud of interstellar matter begins to contract gravitationally, heating, spinning more rapidly, and eventually flattening out. The emission of high speed charged particles through the sun's magnetic field exerts a braking force on the sun's rotation, causing it to slow. Tiny, solid grains in the material in orbit around the sun accrete to begin the planet-forming process. This model predicted that other stars like our sun should have planets, a prediction that has been observationally confirmed.

2. Most of the evidence comes from radiometric dating of earth rocks, moon rocks, and meteorites. Radioactive matter decays at a known rate, depending on the isotope. Thus determining the amount of radioactive atoms of a particular type present in a rock and the amount of the atoms to which they decay can determine the age of the rock. The oldest rocks in the solar system, some of the meteorite, are about 4.6 billion years old.

3. The early earth was homogeneous and the present earth has a crust, a rocky mantle, a molten outer iron core, and a solid inner iron core. This transformation was produced by the melting of the earth's interior due to heat produced by radioactive decay and by the formation of the earth itself. The early earth had no oceans. The oceans formed from water that was outgassed and added as a result of comet bombardment. The early earth had no significant atmosphere. The nitrogen and argon in the present atmosphere were produced by outgassing, while the oxygen was added by photosynthesis. The early earth's surface was heavily cratered. All of the original craters have been removed by the reprocessing of continental material by plate tectonics.

4. Plate tectonics refers to the movement of continental plates laterally across the surface of the earth. The rate at which North America and Europe are separating from one another has been measured as a centimeter or so per year. Also the dating of rocks on either side of the Mid-Atlantic Ridge indicates that the rocks nearest the ridge are youngest while they get progressively older as the distance from the ridge increases. This indicates that the plates on the sides of the ridge are moving apart from one another and that new rocks are filling the gap. The evidence for the original theory was the similarity between the shapes of the west coast of Africa and the east coast of South America and between their flora and fauna. Consequences of plate tectonics include earthquakes, volcanoes, and mountain ranges.

5. Our current best theory for the origin of the moon is that early in the earth's history, but after it had become chemically differentiated, it was struck a glancing blow from a Mars-sized object. Some of the ejected material escaped the solar system, some fell back to earth, and some went into orbit around the earth. The solid material in orbit accreted to form the moon. This model can explain the chemical composition of the moon rocks, specifically the water and iron deficiencies. A computer simulation using this model shows that it is possible for the moon to have formed in this way.