

Worksheet: The Accretion Model of Planet Formation



Q1: Which of the following statements most correctly describes what is meant by the term “protoplanet”?

A A protoplanet is a small, solid particle comprising mainly of water ice, methane ice, ammonia ice, and metals such as iron and nickel.

B A protoplanet is a solid object found in protoplanetary disks that is held together by its own gravity and that is approximately between 1 km and 1,000 km in diameter.

C A protoplanet is a body that orbits a star, that has a roughly spherical shape, and that has cleared its orbit of other large objects.

D A protoplanet is a solid object that is held together by its own gravity, that is greater than approximately 1,000 km in diameter, and that has become gravitationally differentiated.

Q2: Which of the following statements most correctly describes what is meant by the term “planetesimal”?

- A A planetesimal is a solid object found in protoplanetary disks that is held together by its own gravity and that is approximately between 1 km and 1,000 km in diameter.
- B A planetesimal is a solid object that is held together by its own gravity, that is greater than approximately 1,000 km in diameter, and that has become gravitationally differentiated.
- C A planetesimal is a small, solid particle comprising mainly of water ice, methane ice, ammonia ice, and metals such as iron and nickel.
- D A planetesimal is a body that orbits a star, has a roughly spherical shape, and has cleared its orbit of other large objects.

Q3: Order the following in terms of size from least to greatest.

- i. A planet
- ii. A planetesimal
- iii. A dust grain in a protoplanetary disc
- iv. A protoplanet

A A planet, a planetesimal, a protoplanet, a dust grain in a protoplanetary disc

B A planet, a protoplanet, a planetesimal, a dust grain in a protoplanetary disc

C A dust grain in a protoplanetary disc, a protoplanet, a planetesimal, a planet

D A dust grain in a protoplanetary disc, a planetesimal, a protoplanet, a planet

E A dust grain in a protoplanetary disc, a planetesimal, a planet, a protoplanet

Q4: Which of the following statements most correctly describes how dust grains in a protoplanetary disc come together to form planetesimals?

A Dust grains in a protoplanetary disc are large enough for the gravitational attraction between them to be significant. This causes them to collide, and over time they will eventually form planetesimals approximately 1 km across.

B Dust grains in a protoplanetary disc are too small for the gravitational attraction between them to be significant. However, due to their random motion, they will collide, and over time they will eventually form planetesimals approximately 1 km across.

C Where the density of dust grains in a protoplanetary disc is slightly greater than the average, the gravitational field in that region will be greater than the average. This causes the dust grains to quickly coalesce into planetesimals over just a few years.

D Dust grains in a protoplanetary disc are electrically charged. Positively charged dust grains are attracted to negatively charged dust grains. This causes the dust grains to collide, and over time they eventually form planetesimals approximately 1 km across.

Q5: Which of the following statements most correctly describes what is meant by the term “protoplanetary disk”?

- A A protoplanetary disk is a disk of dust and gas that orbits a newly formed star.
- B A protoplanetary disk is a disk of hot matter, usually ionized hydrogen, that surrounds a dense stellar remnant such as a neutron star or black hole.
- C A protoplanetary disk is a disk of dust and gas that orbits the center of a galaxy.
- D A protoplanetary disk is a band of asteroids that orbits a star.
- E A protoplanetary disk is a disk of dust and gas that orbits a newly formed planet.

Q6: Which of the following statements most correctly describes what is meant by the term “dust grain” when referring to a protoplanetary disc?

A A dust grain in a protoplanetary disc is an object that orbits a star, has a roughly spherical shape, and has cleared its orbit of other large objects.

B A dust grain in a protoplanetary disc is a small, solid particle comprising mainly of water ice, methane ice, ammonia ice, and metals such as iron and nickel.

C A dust grain in a protoplanetary disc is a solid object that is held together by its own gravity, is greater than approximately 1,000 km in diameter, and has become gravitationally differentiated.

D A dust grain in a protoplanetary disc is a solid object that is held together by its own gravity and that is approximately between 1 km and 1,000 km in diameter.