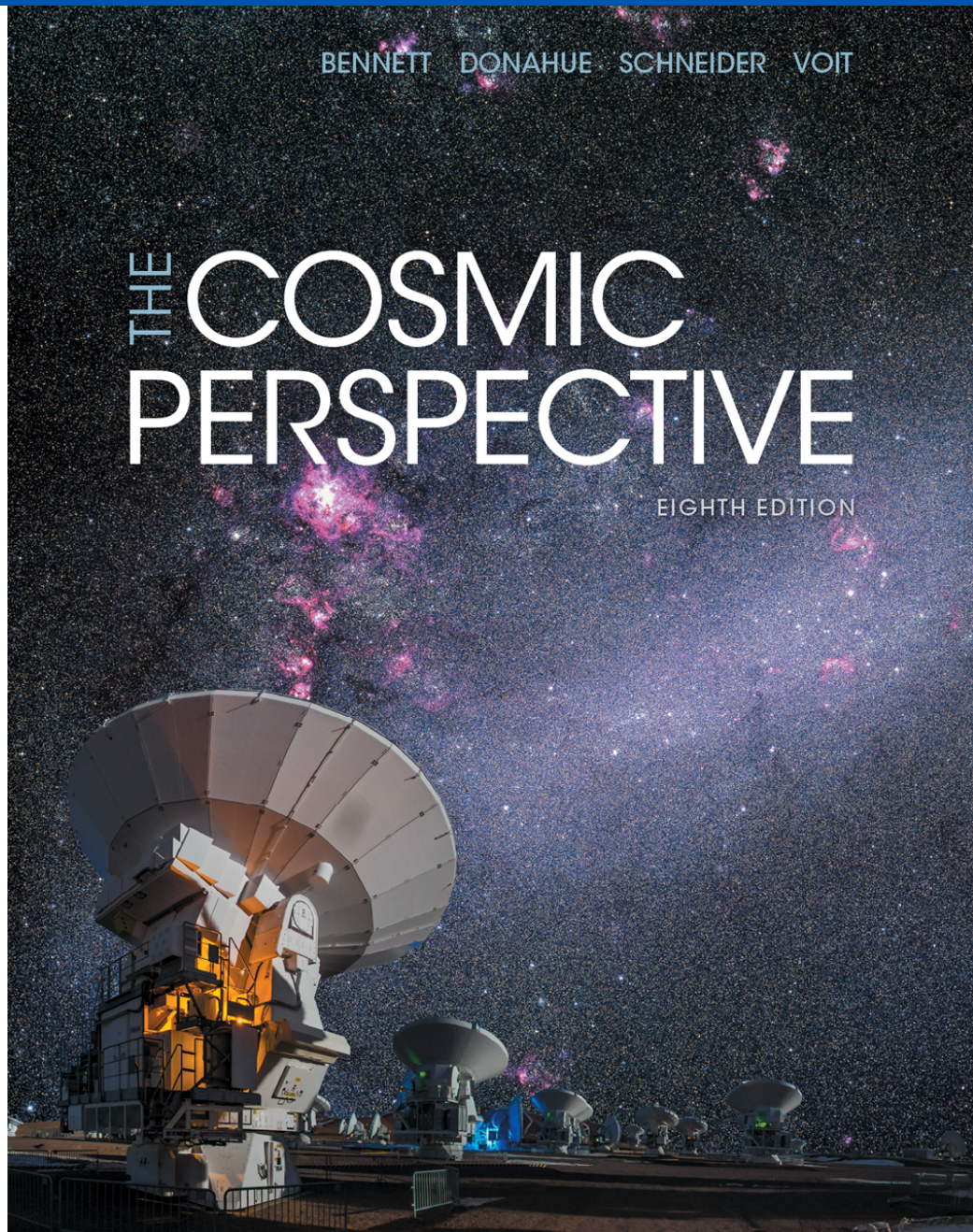
Reading Quiz Clickers

Chapter 8: Formation of the Solar System



8.1 The Search for Origins

- How did we arrive at a theory of solar system formation?
- Where did the solar system come from?

In order to be successful, a theory of the formation of the solar system must explain

a) the orderly patterns of motion of objects.
b) why planets fall into two major categories (terrestrial and jovian).
c) why comets reside in the Kuiper belt and Oort cloud.
d) the exceptions to the general rules.
e) all of the above

In order to be successful, a theory of the formation of the solar system must explain

a) the orderly patterns of motion of objects.
b) why planets fall into two major categories (terrestrial and jovian).
c) why comets reside in the Kuiper belt and Oort cloud.
d) the exceptions to the general rules.
e) all of the above

Which of the following is *not* a problem for the *close encounter hypothesis* for the origin of the planets?

a) It relies on an improbable event (a very close encounter between the Sun and another star).
b) It predicts that planetary systems are rare.
c) It fails to explain the orbits of the planets.
d) It fails to explain the existence of two types of planets.
e) none of the above (all are problems with the *close encounter hypothesis*)

Which of the following is *not* a problem for the *close encounter hypothesis* for the origin of the planets?

a) It relies on an improbable event (a very close encounter between the Sun and another star).
b) It predicts that planetary systems are rare.
c) It fails to explain the orbits of the planets.
d) It fails to explain the existence of two types of planets.
e) none of the above (all are problems with the *close encounter hypothesis*)

8.2 Explaining the Major Features of the Solar System

- What caused the orderly patterns of motion in our solar system?
- Why are there two major types of planets?
- Where did the asteroids and comets come from?
- How do we explain "exceptions to the rules"?

What is the origin of the elements heavier than hydrogen and helium that made up the protoplanetary nebula?

a) They were produced in the big bang.
b) They were formed inside stars or supernovae that exploded before the solar system formed.
c) They were produced in the Sun's early strong solar wind.
d) They were formed inside the Sun shortly after its formation and blown out by its early strong solar wind.
e) They were formed by fusion at the time of the formation of the Milky Way galaxy.

What is the origin of the elements heavier than hydrogen and helium that made up the protoplanetary nebula?

a) They were produced in the big bang.

b) They were formed inside stars or supernovae that exploded before the solar system formed.

c) They were produced in the Sun's early strong solar wind.

d) They were formed inside the Sun shortly after its formation and blown out by its early strong solar wind.

e) They were formed by fusion at the time of the formation of the Milky Way galaxy.

Why was the protoplanetary nebula flat?

a) Nebulae form in a variety of shapes, and ours happened to be disk-shaped.
b) The nebula became flat due to gravitational contraction along its axis.
c) It flattened as a result of collisions between particles in the nebula.
d) The force of a nearby supernova flattened the nebula.

Why was the protoplanetary nebula flat?

a) Nebulae form in a variety of shapes, and ours happened to be disk-shaped.
b) The nebula became flat due to gravitational contraction along its axis.
c) It flattened as a result of collisions between particles in the nebula.
d) The force of a nearby supernova flattened the nebula.

Which lists the ingredients of the solar nebula in order of increasing abundance?

a) metals, rocks, hydrogen compounds
b) rocks, metals, hydrogen compounds
c) hydrogen compounds, metals, rocks
d) metals, hydrogen compounds, rocks
e) hydrogen compounds, rocks, metals

Which lists the ingredients of the solar nebula in order of increasing abundance?

a) **metals, rocks, hydrogen compounds**
b) rocks, metals, hydrogen compounds
c) hydrogen compounds, metals, rocks
d) metals, hydrogen compounds, rocks
e) hydrogen compounds, rocks, metals

Why are the planets closest to the Sun denser than those farther from the Sun?

a) Dense objects sink toward the Sun while less dense objects are less strongly bound by the Sun's gravity.
b) Jupiter scattered denser planets inward and less dense objects outward.
c) Only dense materials could condense close to the Sun.
d) The heat at that proximity to the Sun makes it difficult for them to think.

Why are the planets closest to the Sun denser than those farther from the Sun?

a) Dense objects sink toward the Sun while less dense objects are less strongly bound by the Sun's gravity.
b) Jupiter scattered denser planets inward and less dense objects outward.
c) Only dense materials could condense close to the Sun.
d) The heat at that proximity to the Sun makes it difficult for them to think.

How did the small particles that condensed in the solar nebula accrete to grow into planetesimals?

a) They collided gently and stuck together through electrostatic forces.
b) They collided gently and stuck together through magnetic forces.
c) They collided gently and stuck together through the gravitational force.
d) They collided forcefully so that they stuck together through mechanical forces.

How did the small particles that condensed in the solar nebula accrete to grow into planetesimals?

a) **They collided gently and stuck together through electrostatic forces.**
b) They collided gently and stuck together through magnetic forces.
c) They collided gently and stuck together through the gravitational force.
d) They collided forcefully so that they stuck together through mechanical forces.

How did the formation of jovian planets differ from the formation of terrestrial planets?

a) The jovian planetesimals were larger than those that made terrestrial planets.
b) The jovian planetesimals became large enough to gravitationally capture hydrogen and helium from the nebula.
c) The jovian planetesimals formed by direct collapse of the gas in the solar nebula rather than accretion of planetesimals.
d) The jovian planetesimals were icier than those that made terrestrial planets.
e) A and D

How did the formation of jovian planets differ from the formation of terrestrial planets?

a) The jovian planetesimals were larger than those that made terrestrial planets.

b) The jovian planetesimals became large enough to gravitationally capture hydrogen and helium from the nebula.

c) The jovian planetesimals formed by direct collapse of the gas in the solar nebula rather than accretion of planetesimals.

d) The jovian planetesimals were icier than those that made terrestrial planets.

e) A and D

What condensed beyond the frost line?

a) hydrogen compounds
b) rocks
c) metals
d) all of the above

What condensed beyond the frost line?

a) hydrogen compounds
b) rocks
c) metals
d) all of the above

Why does the Sun rotate slowly today?

a) The rate of the Sun's rotation is a consequence of the solar nebula's initial angular momentum.
b) The Sun transferred angular momentum to the planets through torques when the planets formed.
c) The Sun transferred angular momentum to charged particles in the solar wind.
d) The Sun gradually slowed down as material flowed into it through the solar nebula.

Why does the Sun rotate slowly today?

a) The rate of the Sun's rotation is a consequence of the solar nebula's initial angular momentum.
b) The Sun transferred angular momentum to the planets through torques when the planets formed.
c) The Sun transferred angular momentum to charged particles in the solar wind.
d) The Sun gradually slowed down as material flowed into it through the solar nebula.

Why did planet formation eventually end?

a) The solar wind removed the remaining nebular gas.
b) There were no more planetesimals left.
c) All gas was captured by the jovian planets.
d) The planets migrated to orbits farther from the Sun where there was not any gas or planetesimals.

Why did planet formation eventually end?

a) **The solar wind removed the remaining nebular gas.**
b) There were no more planetesimals left.
c) All gas was captured by the jovian planets.
d) The planets migrated to orbits farther from the Sun where there was not any gas or planetesimals.

What happened to most of the mass originally in the asteroid belt?

a) It became part of Mars.
b) It became part of Jupiter.
c) It was scattered into the Oort cloud.
d) Some of it crashed into the inner planets while some was ejected from the solar system.
e) It is still in the asteroid belt.

What happened to most of the mass originally in the asteroid belt?

a) It became part of Mars.
b) It became part of Jupiter.
c) It was scattered into the Oort cloud.
d) Some of it crashed into the inner planets while some was ejected from the solar system.
e) It is still in the asteroid belt.

Why do some of Jupiter's moons orbit in the opposite direction of Jupiter's rotation?

a) They are captured planetesimals that encountered Jupiter in such a way that they ended up orbiting backward.
b) When moons form in a circumplanetary nebula they have roughly equal probability of orbiting forward and backward.
c) Jupiter's strong tidal force caused the orbits to evolve into backward orbits.
d) Jupiter's rotation is backward due to a giant impact, so its forward-orbiting moons are orbiting in the opposite direction of Jupiter's spin.
e) Jupiter does *not* have any moons orbiting backward.

Why do some of Jupiter's moons orbit in the opposite direction of Jupiter's rotation?

a) **They are captured planetesimals that encountered Jupiter in such a way that they ended up orbiting backward.**

b) When moons form in a circumplanetary nebula they have roughly equal probability of orbiting forward and backward.

c) Jupiter's strong tidal force caused the orbits to evolve into backward orbits.

d) Jupiter's rotation is backward due to a giant impact, so its forward-orbiting moons are orbiting in the opposite direction of Jupiter's spin.

e) Jupiter does *not* have any moons orbiting backward.

Which of the following features of the solar system can be explained by giant impacts?

a) the existence of Mars's two small moons
b) the existence of Earth's large moon
c) the backward orbit of Neptune's moon Triton
d) the large number of objects in the asteroid belt
e) all of the above

Which of the following features of the solar system can be explained by giant impacts?

a) the existence of Mars's two small moons
b) the existence of Earth's large moon
c) the backward orbit of Neptune's moon Triton
d) the large number of objects in the asteroid belt
e) all of the above

Which of the following characteristics of the solar system would we not necessarily expect to find around other stars?

a) a distant disk of comets like the Kuiper belt
b) jovian planets
c) a terrestrial planet with a large moon
d) an Oort cloud of comets

Which of the following characteristics of the solar system would we not necessarily expect to find around other stars?

a) a distant disk of comets like the Kuiper belt
b) jovian planets
c) a terrestrial planet with a large moon
d) an Oort cloud of comets

8.3 The Age of the Solar System

- How do we measure the age of a rock?
- How do we know the age of the solar system?

Radiometric dating can be used to determine the amount of time since

a) a rock most recently solidified.
b) a rock first solidified.
c) the elements in a rock were formed inside stars or a supernova.
d) the big bang.

Radiometric dating can be used to determine the amount of time since

a) a rock most recently solidified.

b) a rock first solidified.

c) the elements in a rock were formed inside stars or a supernova.

d) the big bang.

How old are the oldest meteorites?

a) 3.95 billion years
b) 3.85 billion years
c) 4.35 billion years
d) 4.55 billion years
e) 5.45 billion years

How old are the oldest meteorites?

a) 3.95 billion years
b) 3.85 billion years
c) 4.35 billion years
d) 4.55 billion years
e) 5.45 billion years

How do we verify the validity of radiometric dating?

a) Some archeological artifacts have dates on them.
b) We use multiple radiometric techniques to see if the same ages are found.
c) Both A and B.
d) None of the above.

How do we verify the validity of radiometric dating?

a) Some archeological artifacts have dates on them.
b) We use multiple radiometric techniques to see if the same ages are found.
c) Both A and B.
d) None of the above.