Space Lesson 2
Theories on the formation of the solar system and the universe

SciencePower 9 pages 474-482

ON Science 9 pages 333-335

SciencePower 9 pages 508-509

Formation of the Solar System

- Watch the video segments:
  - “How the Solar System formed” (2:04 min) in the video, “A Spin Around the Solar System: How the Solar System Works” (Discovery Education)
  - “How Stars Form” (2:44 min) in the video, “A Spin Around the Solar System: Look to the Stars”

http://my.discoveryeducation.ca/

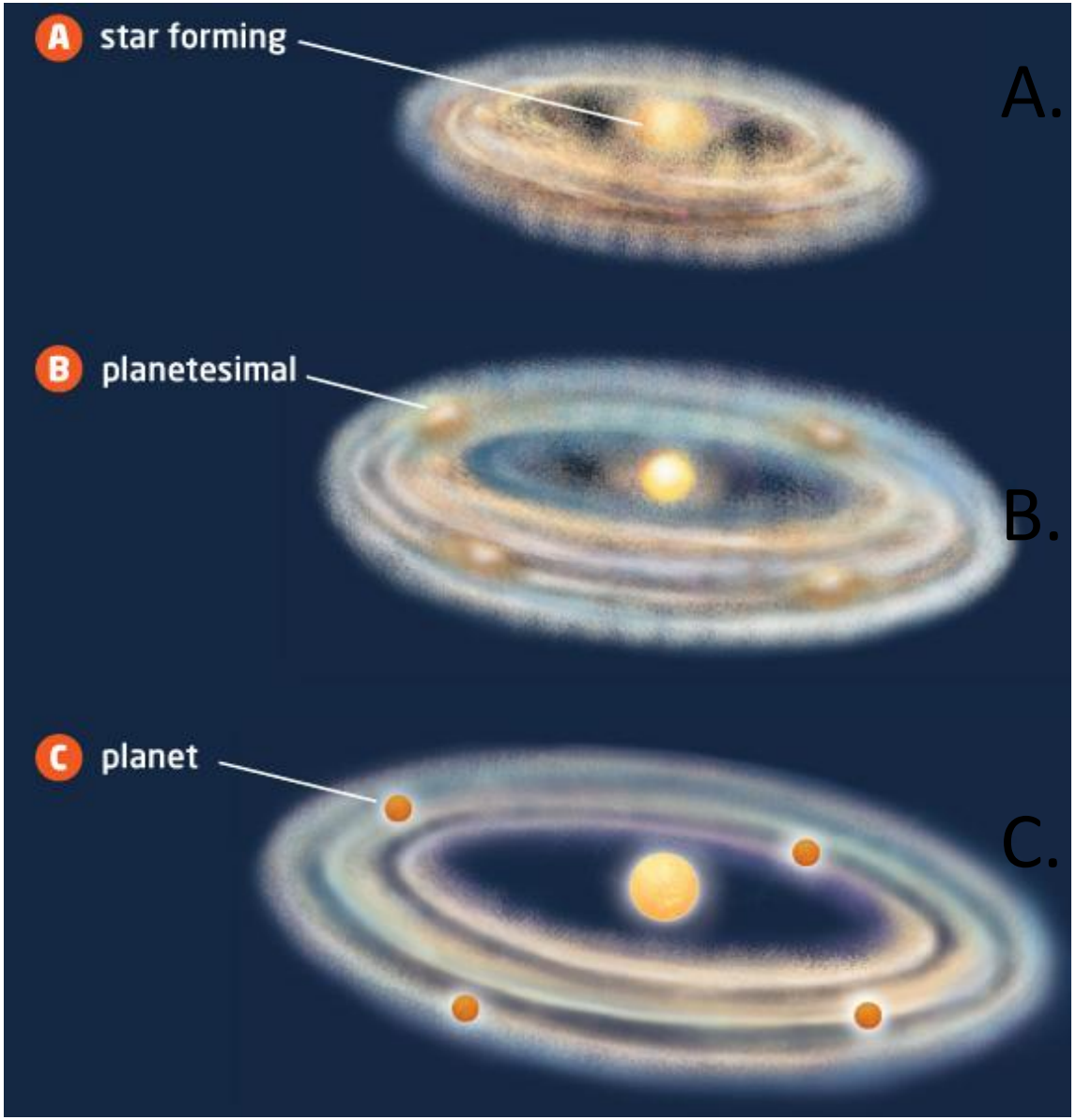
- Read page 478-479 in SciencePower 9

Solar Nebula Theory

- Stars and planets form together
- Stars are made of hot gases, mainly hydrogen and some helium
- When stars form, the hot core remains surrounded by gas and dust, held there by gravity
- The cloud of gas and dust is called a <u>nebula</u> which is believed to form planets

Solar System Formation

- Gravity causes gas and dust in the nebula cloud to spin
- The particles gather in the center
  - Demo or imagine swirling a glass of water with a bit of sand in it…what happens to the sand?
- The spinning nebula particles contract and collect into bigger, rocky lumps called planetesimals which continue to grow to become planets



A. Particles gather in center of <u>spinning nebula cloud</u>

B. Nebula contracts; <u>planetesimals form</u>

C. Planetesimals continue to develop into <u>planets</u>

Evidence for Solar Nebula Theory

- Tools and technology like telescopes show flattening dust clouds around stars outside of our solar system
- Astronomers have also discovered >300 planets orbiting stars other than the Sun (called *extra-solar planets*) which supports the theory that planets are by-products of star formation

Creationist View

- Christian belief
- God created the universe
- Astronomy has provided evidence that goes against the creationist beliefs:
  - The Sun is ~5 billion years old and ½ way through its life
  - The Earth is ~4.5 billion years old

Formation of the Universe

- BrainPOP: Big Bang, Dark Matter
- Video clips from Discovery Education:
- "How the Universe Works: Big Bang" – Something comes from nothing (5:49)
- "Through the wormhole with Morgan Freeman: How does the universe work?" – Dark Energy (7:56 – show first ~ 5min)

Big Bang Theory

- The universe and everything in it began 15-20 billion years ago during an instantaneous event – <u>a massive explosion</u>
- Prior to the Big Bang, the universe was condensed into a tiny, hot, dense mass.
- After the Big Bang the material that formed the components of the universe moved <u>outward</u> to create the stars, galaxies, etc. that astronomers study today.

Problems with the Big Bang Theory

- If the universe started at a certain point, what happened before that?

- If the universe had a beginning, and it is now in the middle, will there be an end? What that end be…what will happen?

Oscillating Theory

- This theory suggests that after the initial Big Bang, all matter rushed outward for 60-80 million years, slowed down, stopped, then rushed back to where it started and another Big Bang occurred.
  - The universe will expand to a certain point in time and then the force of gravity between the stars and galaxies will cause it to contract.

Steady State Theory

- There was no divine creator and no Big Bang
- This theory states that the universe has <u>always existed</u> in its current form.
- Old galaxies disappear and new ones appear out of nothingness
- The universe does <u>not change</u> – it is steady and there is no motion

Wrap-up Discussion

1. How have different types of technology provided information to help us learn about the origins of the universe? What data has been collected and what has it taught astronomers?
2. Explain the Big Bang theory.
3. New data in astronomy is constantly emerging with advances in technology.
   - What impact does new evidence have on new and existing theories about the formation of the solar system, galaxies, and the universe?
   - What new questions or problems might arise from studying space?

Question 1

- Technology provides data or evidence to support, change or dismiss ideas and theories about the origins of the universe.
- Astronomers have collected data such as visible light, radiation, geological age of rocks/meteors, motion of stars and galaxies, etc. which have taught us about the age and origin of the parts of the solar system and universe.

Question 2

- The Big Bang Theory attempts to explain the formation of the universe . It states that the universes began from a singularity or a tiny dense mass that exploded about 15-20 billion years ago. The explosion created all the matter that exists in the universe.

Question 3

- New evidence in science helps support or refute theories.
- It allows us to evaluate existing ideas and maintain or alter them based on how the new information fits in with the current beliefs.
- More data or information helps us to fill in gaps in our understanding…like completing a puzzle…but new data may also lead to new theories or questions if old/existing theories no longer fit with the data.
- New discoveries like extra-terrestrial life, water on other planets or moons, new elements, etc. may lead to questions about whether life can or did exist somewhere other than Earth