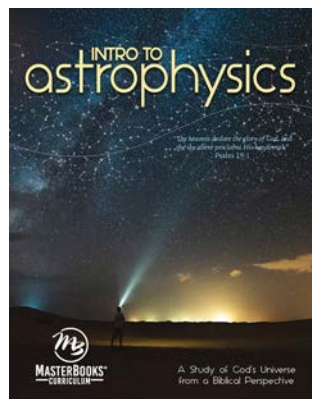




# INTRO TO astrophysics worksheets

**For use with:**  
*Intro to  
Astrophysics*



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**Reference:** Pages 5–9 to Scriptural Perspective

**Fill in the Chart:** Put an X in the column to indicate whether the belief is that of a creationist or an evolutionist.

	a. Creationists	b. Evolutionists
1. Have a bias toward God and the supernatural		
2. Hold that truth is relative and changeable, with new information or new perspectives		
3. Hold certain things forever to be true and hence beyond debate		
4. Have a bias against the possibility of the supernatural		

**Matching Terms:** Mark the letter in front of the best answer.

- a. Astronomy                      b. Astrology

5. \_\_\_\_\_ Comes from two Greek words that mean “star” and “word”  
 6. \_\_\_\_\_ Comes from two Greek words that mean “star” and “to arrange”

**Fill in the Blank:** Write the best answer in the line provided.

7. A full moon at the first \_\_\_\_\_ allowed the Hebrews to travel at night.  
 8. One purpose for heavenly bodies is the marking of \_\_\_\_\_ and time.  
 9. Astrology is a pagan religion that is \_\_\_\_\_ to Christianity.

**Short Answer:** Write out the best possible answer as addressed in the text.

10. What does the text say regarding Romans 1:25?

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**Reference:** Pages 9–14 (from Scriptural Perspective)

**Biblical Short Answer:** Write out the Scripture verse in the translation provided in the student text or in your preferred version.

1. Write out the passage from Isaiah 40:26.

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**Fill in the Blank:** Write the best answer in the line provided.

2. \_\_\_\_\_ is the science that the Bible most explicitly mentions.
3. Science is not \_\_\_\_\_, but instead it is the man-made method of studying the natural world.
4. Science is a very changeable thing, but the \_\_\_\_\_ of God never changes.

**Matching Terms:** Mark the letter in front of the best answer.

- a. Natural                      b. Special                      c. Dual

5. \_\_\_\_\_ Revelation that believes the other forms of revelation are parallel ways of finding God's truth
6. \_\_\_\_\_ Revelation that is the concept that the world shows that God exists
7. \_\_\_\_\_ Revelation that is the revealed truth of the Bible

**Glossary Terms:** Write out the definition of each word from the glossary (starting on page 363 of the student text).

8. Scientific method: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
9. Hypothesis: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

10. Naturalism: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



**Glossary Terms:** Write out the definition of each word from the glossary.

- Heliocentric theory: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- Geocentric theory: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Short Answer:** Write out the best possible answer as addressed in the text.

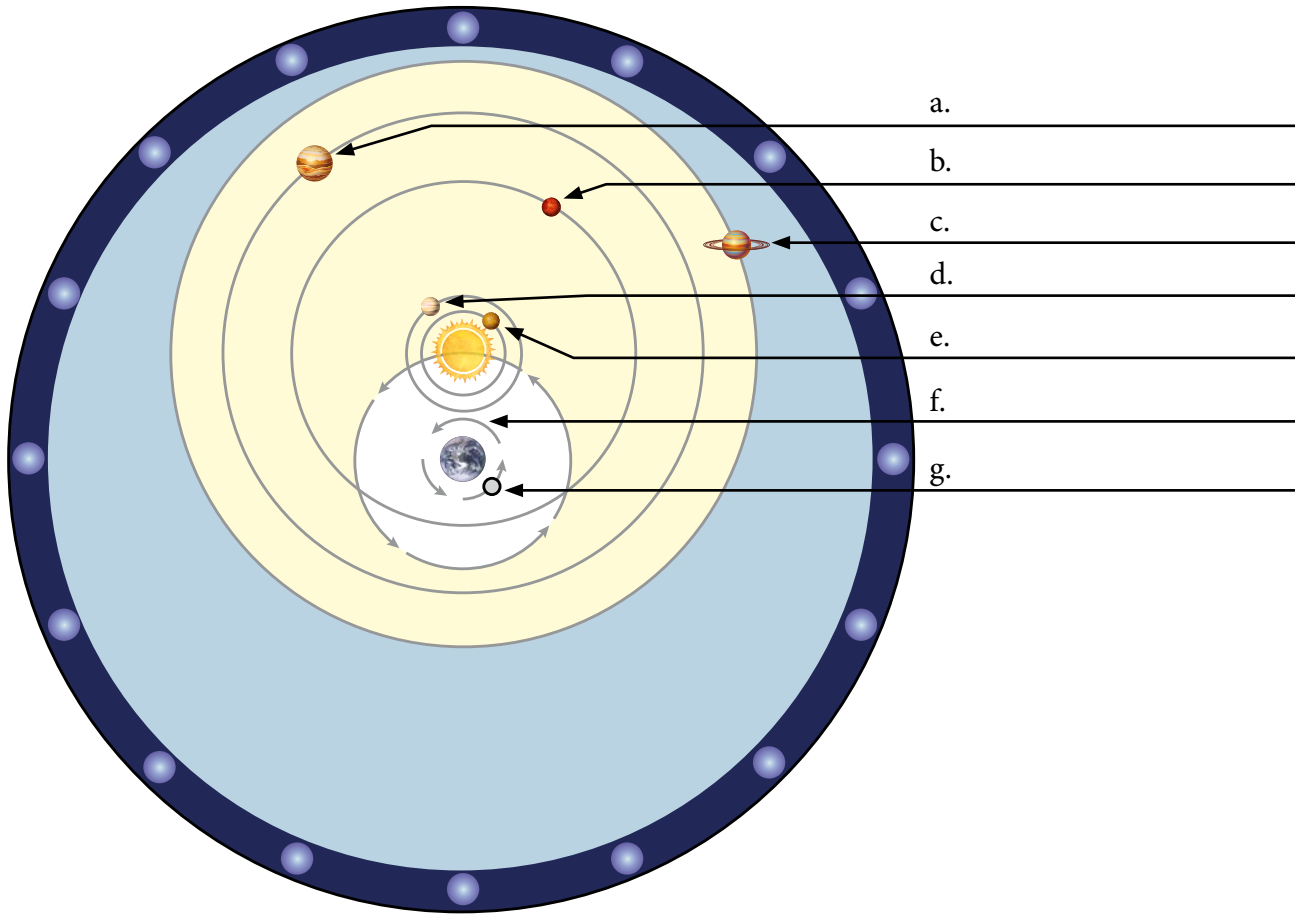
- Discuss why creationists believe the theory of evolution is an attack on God’s Word and what this is based on.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Fill in the Blank:** Write the best answer in the line provided.

- One limitation of science is our fallibility, meaning that we make \_\_\_\_\_.
- Another limitation of science is that we have incomplete \_\_\_\_\_.
- One more limitation is that competing \_\_\_\_\_ may equally explain data.
- Science is also limited by the fact that all people have \_\_\_\_\_.
- A bias that all scientists have is that the natural world is \_\_\_\_\_.
- \_\_\_\_\_ razor suggests that when confronted with two competing explanations of some phenomenon, we tend to choose the simpler one as the correct one.

**Complete the Diagram:** Draw and/or label the diagram as instructed.

10. Label the diagram depicting the Tychonian geocentric system.







**Short Answer:** Write out the best possible answer as addressed in the text.

1. Summarize the text that responds to the statement on page 19: “If evolution were true...”

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**Fill in the Blank:** Write the best answer in the line provided.

2. Scientists such as Johannes \_\_\_\_\_ pursued their work to the glory of God, and freely wrote such opinions in their work.
3. Most scientists now assume that everything must have a \_\_\_\_\_ explanation, rather than assuming the world is a creation of God.
4. \_\_\_\_\_ has become the single unifying theme of science to many scientists and science educators.

**Matching Terms:** Mark the letter in front of the best answer.

- a. Evolution                      b. Error                      c. Scripture                      d. Atheistic

5. \_\_\_\_\_ We will assume that when the Bible and science disagree, it must be science that is in \_\_\_\_\_.
6. \_\_\_\_\_ At its core, evolution is an \_\_\_\_\_ idea.
7. \_\_\_\_\_ A Christian who believes in \_\_\_\_\_ fails to see its philosophical foundation.
8. \_\_\_\_\_ We should interpret science in the light of \_\_\_\_\_.

**Calculation:** Write out the mathematical equation as instructed.

9. Write out 93,000,000 miles in scientific notation.

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10. Write out 149,730,000 kilometers in scientific notation.

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**Fill in the Chart:** Put an X in the column to indicate whether the belief is that of a creationist or an evolutionist.

	a. Creationist	b. Evolutionist
1. Was surprised to learn that Pluto has regions on its surface with few craters		
2. Was not surprised to learn that Pluto has few craters on portions of its surface		
3. Believes comets indicate the solar system is not billions of years old		
4. Thinks that comets originate from the Kuiper belt and the Oort cloud		

**Fill in the Blank:** Write the best answer in the line provided.

- A \_\_\_\_\_ microscope allows a person to rapidly alternate views of two photographs made on separate nights.
- Clyde \_\_\_\_\_ found Planet X, which astronomers chose to name Pluto.
- Astronomers now classify Pluto as an asteroid, or \_\_\_\_\_ planet.
- Some creationists think that there used to be a \_\_\_\_\_ where the asteroid belt is now, but that a catastrophe destroyed it.
- God often intervenes in a way that would violate normal \_\_\_\_\_ law.

**Fill in the Chart:** Complete the chart as directed.

10. Fill in the missing information from Table 9.1.

Planet	Bode's Law Distance	Actual Distance
Mercury		
Venus		
Earth		
Mars		
Vesta		
Jupiter		
Saturn		
Uranus		
Neptune		
Pluto		



**Reference:** Pages 176–181 (to Comets)

**Matching Terms:** Mark the letter in front of the best answer.

- a. Trojan
- b. Metals
- c. Planets
- d. Composition

1. \_\_\_\_\_ Astronomers know that a few dozen minor ones of these have orbits that cross the earth's orbit, which are called near-earth orbit (NEO) asteroids.
2. \_\_\_\_\_ A group of minor planets is called this kind of group, named from characters in Homer's history.
3. \_\_\_\_\_ In addition to classification based upon their orbits, we can group minor planets according to this.
4. \_\_\_\_\_ The M-type minor planets contain large amounts of this, presumably iron and nickel.

**Fill in the Blank:** Write the best answer in the line provided.

5. Pluto and Charon have wide portions of their surfaces with relatively few craters, which suggests much \_\_\_\_\_ of their surfaces, though this is not easy to explain from a secular standpoint.
6. When astronomers reclassified Pluto as a minor planet, they also created a new category of minor planets: \_\_\_\_\_ planets.
7. A planet orbits the sun, while a \_\_\_\_\_ orbits a planet or minor planet.
8. Our understanding of Pluto improved dramatically with the arrival of the New \_\_\_\_\_ mission to Pluto in the summer of 2015.
9. \_\_\_\_\_ would have been given the provisional designation 1801 AA.

**Short Answer:** Write out the best possible answer as addressed in the text.

10. How are minor planets labeled if not given names?

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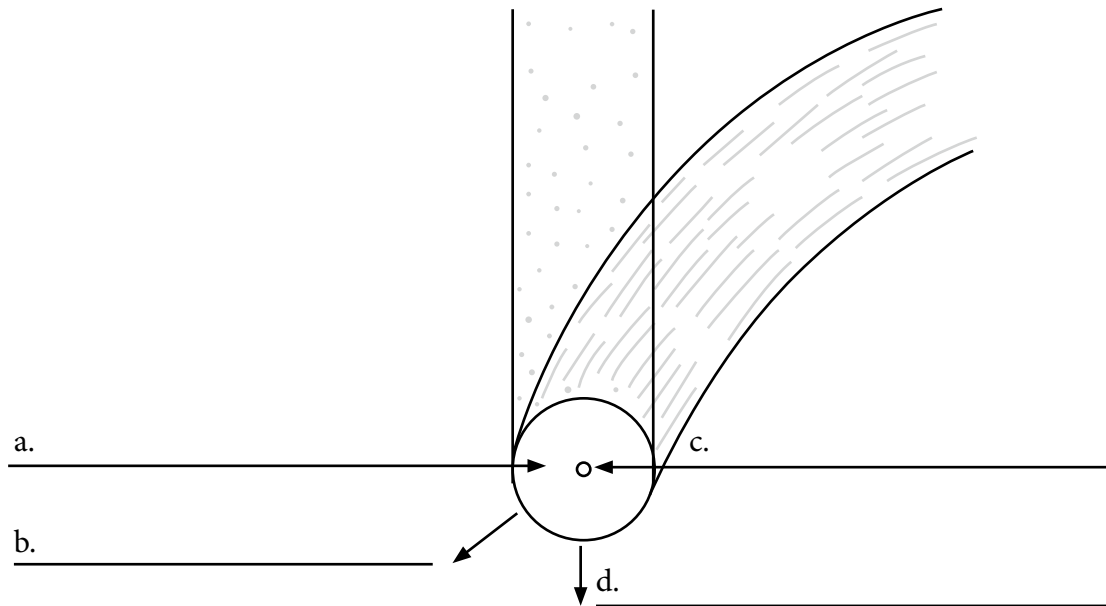
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**Reference:** Pages 181–187 (from Comets)

**Fill in the Chart:** Complete the chart as directed.

1. Label the image of Figure 9.1 showing the structure of a comet.



**Glossary Terms:** Write out the definition of each word from the glossary.

2. Nucleus: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
3. Coma: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
4. Gas tail: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
5. Dust tail: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

6. Oort cloud: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Fill in the Blank:** Write the best answer in the line provided.

7. If new comets continuously enter the inner solar system at a rate that is \_\_\_\_\_ enough, then there would still be billions of comets after billions of years.
8. It is conceivable that the Oort cloud exists, but simple conception is not how science works, because science requires \_\_\_\_\_.
9. A \_\_\_\_\_ is a brief streak of light in the sky due to release of kinetic energy as a piece of ice or rock enters the upper atmosphere of the earth at high speed.
10. Before striking the earth's atmosphere, the debris of rock or ice moving through space is a \_\_\_\_\_, while if a solid piece of material survives to the ground, we call it a meteorite.





**Glossary Terms:** Write out the definition of each word from the glossary.

1. Iron meteorites: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. Carbonaceous meteorites: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. S-type asteroids: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. C-type asteroids: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Fill in the Blank:** Write the best answer in the line provided.

5. Creationists generally agree that when God made the sun, moon, and planets on the \_\_\_\_\_ day, He chose not to include the material that is now in minor planets.
6. \_\_\_\_\_ records that one of the things that happened after the opening of the sixth seal is that all the stars of heaven fell to the earth.
7. In the original languages of the Bible, the words for \_\_\_\_\_ referred to any bright object in the sky other than the sun and moon.
8. We can reasonably conclude that the falling of the stars in the Bible is a reference to \_\_\_\_\_.

**Short Answer:** Write out the best possible answer as addressed in the text.

9. Explain angular momentum and how it is a problem for the evolutionist.

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10. What are some of the oddities of the solar system as described in the text?

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**Choose One of the Following Projects to Complete.**

- Using an app, locate all planets visible to the eye in the night sky. A parent’s permission is needed to confirm that the app is safe to use. Also, please use caution if the app provides secular information about space.
- The rings of Saturn.

Supplies needed:

- Wooly Willy (You may purchase a “Wooly Willy” for a dollar or two at many toy and novelty stores. This toy has a drawing of a bald man on thick card stock under a hard, transparent plastic sheet with a small gap between the card and the plastic sheet.)

A good way to illustrate how spokes in Saturn’s rings can line up and move with the magnetic field of Saturn is to use “Wooly Willy.” You use a magnet on the end of a small wand to move clumps of iron filings trapped under the plastic to produce “hair” on the face of the man. If you pick up a clump of iron filings and slowly rotate the magnet around the axis of the wand, you will find that the iron filings will rotate with the magnet as stretched out lines.

- Choose a smaller object in the solar system to do further research on, including comets or asteroids. Write a paper on your research. The paper should be one to two pages typed, single spaced. You may use the space below for your thoughts and observations.

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**Glossary Terms:** Write out the definition of each word from the glossary.

1. Cosmology: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. Cosmogony: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Static universe: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. General relativity: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Short Answer:** Write out the best possible answer as addressed in the text.

5. What is the biblical teaching in relation to an eternal universe?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Fill in the Blank:** Write the best answer in the line provided.

6. Einstein imagined that \_\_\_\_\_ is something, when previously, people thought that it was nothing.
7. Wanting to keep the idea of an eternal universe, Einstein included a cosmological \_\_\_\_\_ in his solution to his equation.
8. A \_\_\_\_\_ universe is one that has a boundary or edge.
9. An \_\_\_\_\_ universe has no boundary or edge.
10. We say the universe is \_\_\_\_\_, which means that the universe has the same properties throughout.

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**Glossary Terms:** Write out the definition of each word from the glossary.

1. Isotropic: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. Cosmological principle: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Big bang: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Hubble flow: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Fill in the Blank:** Write the best answer in the line provided.

5. The actual model states that the big bang happened everywhere at the same time so that the big bang \_\_\_\_\_ the universe from the very beginning.
6. If \_\_\_\_\_ are cosmological, then they result from the expansion of the universe and they truly reflect distance.
7. A misconception about the big bang and the expansion of the universe is that the universe must be expanding into \_\_\_\_\_.
8. The big bang theory states that the universe and \_\_\_\_\_ had a beginning.
9. Acceptance of the big bang usually leads to acceptance of theistic evolution or progressive \_\_\_\_\_.

**Short Answer:** Write out the best possible answer as addressed in the text.

10. Why is it a dangerous precedent to reinterpret Scripture in terms of science?

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**Short Answer:** Write out the best possible answer as addressed in the text.

1. What is the principle of causality in brief?

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**Matching Terms:** Mark the letter in front of the best answer.

- a. Creation
- b. Isotropic
- c. Cosmic
- d. Density

2. \_\_\_\_\_ The perfect cosmological principle states that the universe is always homogeneous and this.
3. \_\_\_\_\_ The universe can remain homogeneous and at the same temperature as it expands only if this remains the same.
4. \_\_\_\_\_ A model where the universe never changes is called the steady state model or this kind of model.
5. \_\_\_\_\_ In 1964, two scientists discovered this microwave background radiation.

**Fill in the Blank:** Write the best answer in the line provided.

6. Medieval scholars reasoned that in the beginning there must have been some \_\_\_\_\_ Cause.
7. The best reading of the creation account is that it took \_\_\_\_\_ normal days a few thousand years ago.
8. Far from being an evidence of God's existence, the big bang is the ultimate \_\_\_\_\_ theory.
9. Theorists altered the big bang model to fit the \_\_\_\_\_, which are very loose rules for verification.
10. Neither the Cold Spot nor the \_\_\_\_\_ of Evil were expected from the big bang model, nor can the big bang model explain them.

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**Short Answer:** Write out the best possible answer as addressed in the text.

1. Briefly describe the anthropic principle.

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2. What examples of the anthropic principle are mentioned regarding the amount of clumping in the supposed early big bang universe?

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**Fill in the Blank:** Write the best answer in the line provided.

3. We should use our creation model to look for \_\_\_\_\_ in the world that suggests that it was designed and created for our benefit.
4. The third evidence for the big bang frequently cited is the abundances of the \_\_\_\_\_ elements in the universe.
5. If real, then red shift \_\_\_\_\_ is a difficulty for the big bang.
6. Instead of a gradual heat death, we know from the Bible that the universe will end in \_\_\_\_\_, but that God will replace it with a more glorious new heaven.

**Matching Terms:** Mark the letter in front of the best answer.

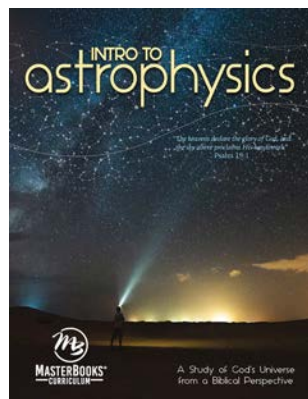
- a. Dark energy      b. Circular      c. Antimatter      d. Inflation

7. \_\_\_\_\_ This kind of reasoning happens when someone starts with an assumption or bit of information, develops a conclusion based upon the starting information, and then uses the starting information as “proof” that the conclusion is true.
8. \_\_\_\_\_ When matter and its counterpart meet, they annihilate one another in a burst of energy.
9. \_\_\_\_\_ This was supposedly far faster than the speed of light at the beginning of the universe.
10. \_\_\_\_\_ Einstein introduced the cosmological constant, an idea that soon was discarded, only to be revived at the end of the 20th century and rechristened this.



# INTRO TO astrophysics quizzes & tests

**For use with:**  
*Intro to  
Astrophysics*



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**Matching Terms:** Mark the letter in front of the best answer.

- a. Astronomy                      b. Astrology                      c. Heliocentric                      d. Geocentric

1. \_\_\_\_\_ Comes from two Greek words that mean “star” and “word.”
2. \_\_\_\_\_ Comes from two Greek words that mean “star” and “to arrange.”
3. \_\_\_\_\_ The belief that the earth is the center of the universe.
4. \_\_\_\_\_ The belief that the sun is the center of the solar system.

**Fill in the Blank:** Write the best answer in the line provided.

5. A full moon at the first \_\_\_\_\_ allowed the Hebrews to travel at night.
6. \_\_\_\_\_ is the science that the Bible most explicitly mentions.
7. One limitation of science is our fallibility, meaning that we make \_\_\_\_\_.

**Glossary Terms:** Match glossary terms to definitions.

- a. Hypothesis                      b. Scientific Method                      c. Naturalism

8. \_\_\_\_\_ The belief that scientific principles can adequately explain all things in nature, including origins.
9. \_\_\_\_\_ The method that scientists used to establish theories.
10. \_\_\_\_\_ An educated guess

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**Matching Terms:** Mark the letter in front of the best answer.

- a. Evolutionist      b. Creationist      c. Coma      d. Trojan

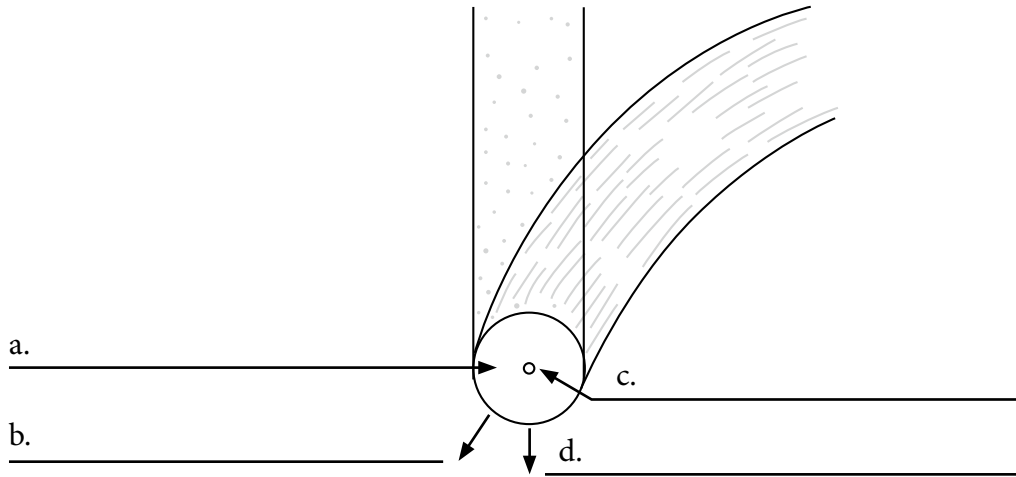
1. \_\_\_\_\_ A group of minor planets is called this kind of group, named from characters in Homer's history.
2. \_\_\_\_\_ A defect usually found in reflecting telescopes, so called because of the appearance of stars near the edge of the field of view.
3. \_\_\_\_\_ Was surprised to learn that Pluto has regions on its surface with few craters
4. \_\_\_\_\_ Was not surprised to learn that Pluto has few craters on portions of its surface

**Fill in the Blank:** Write the best answer in the line provided.

5. When astronomers reclassified Pluto as a minor planet, they also created a new category of minor planets: \_\_\_\_\_ planets.
6. Before striking the earth's atmosphere, the debris of rock or ice moving through space is a \_\_\_\_\_, while if a solid piece of material survives to the ground, we call it a meteorite.
7. Creationists generally agree that when God made the sun, moon, and planets on the \_\_\_\_\_ day, He chose not to include the material that is now in minor planets.
8. We can reasonably conclude that the falling of the stars in the Bible is a reference to \_\_\_\_\_.
9. It is conceivable that the Oort cloud exists, but simple conception is not how science works, because science requires \_\_\_\_\_.

**Fill in the Chart:** Complete the chart as directed.

10. Label the image of Figure 9.1 showing the structure of a comet.





**Glossary Terms:** Match the definition of each word with the glossary word.

- a. Isotropic      b. Cosmology      c. Cosmogony      d. Cosmological principle

1. \_\_\_\_\_ The study of the structure of the universe.
2. \_\_\_\_\_ The assumption that the universe is both homogeneous and isotropic.
3. \_\_\_\_\_ The assumption that the universe looks the same in all directions.
4. \_\_\_\_\_ The study of the origin and history of the universe.

**Fill in the Blank:** Write the best answer in the line provided.

5. A misconception about the big bang and the expansion of the universe is that the universe must be expanding into \_\_\_\_\_.
6. Far from being an evidence of God's existence, the big bang is the ultimate \_\_\_\_\_ theory.
7. Medieval scholars reasoned that in the beginning there must have been some \_\_\_\_\_ Cause.
8. The third evidence for the big bang frequently cited is the abundances of the \_\_\_\_\_ elements in the universe.
9. Instead of a gradual heat death, we know from the Bible that the universe will end in \_\_\_\_\_, but that God will replace it with a more glorious new heaven.

**Short Answer:** Write out the best possible answer as addressed in the text.

10. Why is it a dangerous precedent to reinterpret Scripture in terms of science?

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**Fill in the Blank:** Write the best answer in the line provided.

1. \_\_\_\_\_ is the science that the Bible most explicitly mentions.
2. When three or more objects align, we call this a \_\_\_\_\_.
3. It was not the theologians who opposed Galileo, but other \_\_\_\_\_.
4. If a source of light is moving toward us, the light shifts to \_\_\_\_\_ frequency (shorter wavelength).

**Glossary Terms:** Match the definition of each word with the glossary word.

- a. Ellipse                      b. Photon                      c. Perihelion                      d. Hypothesis

5. \_\_\_\_\_ On an orbit around the sun the point that is closest to the sun.
6. \_\_\_\_\_ The method that scientists used to establish theories.
7. \_\_\_\_\_ A particle of light.
8. \_\_\_\_\_ A conic section similar to an oval.

**Short Answer:** Write out the best possible answer as addressed in the text.

9. When people appeared before the Inquisition, what source of authority did their accusers use?

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10. In addition to discussing theological issues, what did the Council of Nicaea establish?

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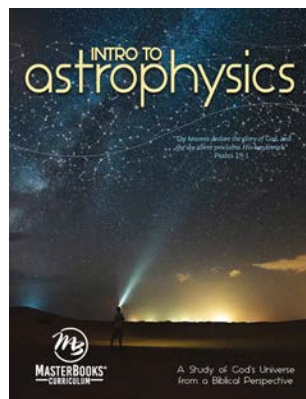
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# INTRO TO astrophysics appendix

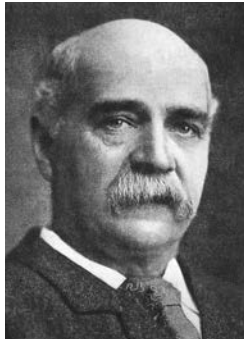
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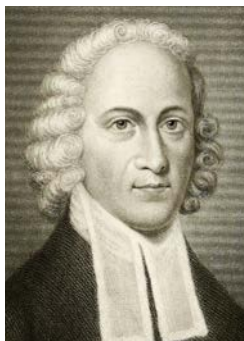


## Christian Astronomers



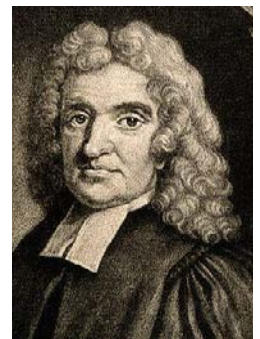
**Sir William Abney** (1843–1920) was the son of a clergyman and firmly believed in the harmony of science and Scripture. As president of both the Royal Astronomical Society and the Royal Physical Society, he made a number of significant studies identifying interstellar molecules through studies of spectroscopic absorption.

**David Brewster** (1781–1868) founded the science of optical mineralogy, describing light polarization and inventing the kaleidoscope. He also made notable studies in astronomy and received many scientific prizes and honors. He was one of the founders of the British Association for Advancement of Science, later serving as its president. One paper he published in the association's journal described a large nail found embedded in a large stone taken from a quarry. This discovery was, of course, ignored by the scientific world, which had recently become enamored of the geological ages. As Darwinism came on the scene, Brewster was one of its chief opponents in the scientific world for both scientific and biblical reasons. He had studied for the ministry and combined his scientific research with preaching the Word. The Lord became much more personally real to him, however, after the death of his wife, when he experienced a true conversion and regeneration.



**Jonathan Edwards** (1703–1758) is not generally known as a scientist, but as a theologian and college president, a leader of American thought in the colonies. Nevertheless, while still in his teens, Edwards exhibited deep understanding and original insights into physics, meteorology, and astronomy, far in advance of his time. He continued to exhibit an aptitude in science throughout a busy career in missionary, pastoral, and educational work. He could almost certainly have become an outstanding man of science during a critical epoch in the development of science, but the Lord had other plans for him. Instead he was destined to play a key role in the colonies' Great Awakening and to help prepare them for the unique spiritual ministry they would one day have in world history.

**John Flamsteed** (1646–1719) was the founder of the famous Greenwich observatory and the first Astronomer Royal of England. He produced the first great star map of the telescopic age, after innumerable observations. The meridians of the world are, as a result, referenced to 0° longitude through his observatory. He was also a faithful clergyman, very devout in his life and preaching.





**James Glaisher** (1809–1903) was for 34 years superintendent of the department of meteorology and magnetism at the Greenwich Observatory, publishing his standard dew-point tables that are still in use. He established the British Meteorological Society in 1850 and the Aeronautical Society in 1866. As a convinced, Bible-believing Christian, he was one of the signers of the famous *Declaration* of 1864, affirming this belief in response to the tide of Darwinism then sweeping the country. In addition to the scientists discussed in this chapter, it is significant that 717 scientists signed a remarkable manifesto entitled “The Declaration of Students of the Natural and Physical Sciences,” issued in London in 1864. This declaration affirmed their confidence in the scientific integrity of the Holy Scriptures. The list included 86 fellows of the Royal Society. Among the more prominent signers were Brewster, Joule, Rawlinson, and Sedgwick.

**John Herschel** (1792–1871) was the son of Sir William Herschel and, like his father, was both an outstanding astronomer and devout Christian. He discovered over 500 new nebulae and performed the prodigious task of cataloging the stars and nebulae of both Northern and Southern Hemispheres. Concerning the Bible, he said: “All human discoveries seem to be made only for the purpose of confirming more and more strongly the truths come from on high and contained in the sacred writings.”



**William Herschel** (1738–1822) has long been recognized as both an outstanding Christian and an outstanding astronomer. In astronomy he made many great discoveries, perhaps the most notable being the recognition of double stars and the discovery of Uranus. He constructed the greatest reflecting telescopes of his day and cataloged and studied the nebulae and galaxies as never before. As a Christian, Sir William was said by his biographer to be “a great, simple, good old man,” noted for his kindness and his sublime conception of the universe as a marvelous witness to the handiwork of God. It was Herschel who said: “The undevout astronomer must be mad.”

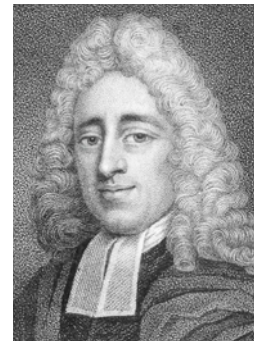
**Sir William Huggins** (1824–1910) was well known as both an openly confessed Christian and a brilliant astronomer. He was the first to demonstrate from spectral studies that stars were comprised mostly of hydrogen, along with smaller amounts of the same elements existing on earth. He was also the first to identify the Doppler Effect in astronomy, leading to the idea of the expanding universe. He was a president of the Royal Society.





**Johann Kepler** (1571–1630) is considered to be the founder of physical astronomy. To some extent, he built upon the foundational studies of Copernicus and Tycho Brahe, as well as utilizing the telescope developed by Galileo, but it was he who discovered the laws of planetary motion and who established the discipline of celestial mechanics. He conclusively demonstrated the heliocentricity of the solar system and published the first ephemeris tables for tracking star motions, contributing also to eventual development of the calculus. Kepler was an earnest Christian and studied for two years in a seminary, leaving only with reluctance to enter the study and teaching of astronomy when the Lord opened that door. He was apparently the first scientist to state that, in his astronomical researches, he was merely “thinking God’s thoughts after Him,” a motto adopted by many believing scientists since his time. His astronomical studies also led him into studies of biblical chronology, and he believed that the world was created about 7,000 years ago. Kepler wrote in one of his books: “Since we astronomers are priests of the highest God in regard to the book of nature, it befits us to be thoughtful, not of the glory of our minds, but rather, above all else, of the glory of God.”

**Increase Mather** (1639–1723) is best known as a clergyman and leading theologian in colonial New England, the father of Cotton. He was also an avid avocational astronomer and promoter of science in the colonies. He was the primary founder of the Philosophical Society and one of the first presidents of Harvard, when that school was still sound and zealous in the Christian faith. He diligently studied comets and wrote a number of monographs on them.



**Edward Maunder** (1851–1928) was a prominent British astronomer who was a Fellow of the Royal Astronomical Society, as well as founder and president of the British Astronomical Association. He was in charge of the Solar Department of the Greenwich Observatory and probably the outstanding authority on solar astronomy of his day. He authored many books, both technical and popular, including at least one book on the astronomy of the Bible, defending the Bible’s accuracy and insights in astronomical matters. He served six years as secretary of the Victoria Institute, the venerable British society for the defense of the Christian faith.

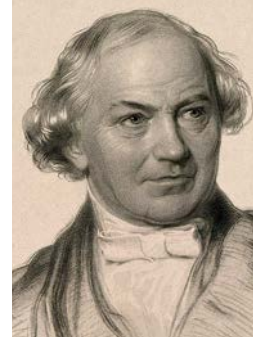
**Isaac Newton** (1643–1727) is famous for, among other things, his discovery of the law of universal gravitation, the formulation of the three laws of motion that make possible the discipline of dynamics and all its sub-divisions, and his development of the calculus into a comprehensive branch of mathematics, now a basic tool in every science. He anticipated the great law of energy conservation, developed the particle theory of light propagation, and as an astronomer constructed the first reflecting telescope. This man of gigantic intellect was also a genuine believer in Christ as his Savior and in the Bible as God’s Word. He wrote many books on biblical subjects, especially prophecy. This was not a senile aberration, as some have alleged, because he was a committed believer from his youth. He even wrote a book defending the Ussher chronology against those who would try to push back the date of creation. He wrote strong papers refuting atheism and defending creation and the Bible. He believed that the worldwide Flood of the Bible accounted for most of the geological phenomena, and he believed in the literal six-day creation record. Finally, he said: “We account the Scriptures of God to be the most sublime philosophy. I find more sure marks of authenticity in the Bible than in any profane history whatsoever.”





**Charles Piazzi Smyth** (1819–1900) was the Astronomer Royal for Scotland and professor of astronomy at the University of Edinburgh. He also made extensive studies at the great pyramid in Egypt and became a founder and leader of the cult of pyramidology and Anglo-Israelism. He also published many significant studies on astronomy and meteorology. Though his commitment to the British-Israel concept may have been unfortunate, he did believe the Bible and sought diligently to apply its teaching to his scientific studies.

**William Whewell** (1794–1866) served at Cambridge University as an Anglican clergyman almost all his life. As a scientist, he authored one of the Bridgewater Treatises: *Astronomy and General Physics Considered with Reference to Natural Theology*. His scientific interests were wide-ranging. He is credited with naming the Eocene, Miocene, and Pliocene geological epochs, as well as coining the scientific terms *anode*, *cathode*, and *ion*. In fact, he was even the inventor of the terms *scientist* and *physicist*, as well as the term *catastrophism* in geology, which he defended against uniformitarianism. He made important contributions to the study of tides and invented the anemometer.



**Please note:** You may also choose to write a summary paragraph about the lives and astronomical interests of Dr. Danny Faulkner, author of this astrophysics course, or Dr. Jason Lisle, the Christian astrophysicist mentioned in the main student text of this course. You will need a parent's permission if you choose to do additional studies from online resources.

# INTRO TO astrophysics answer keys

## Grading

It is always the prerogative of an educator to assess student grades however he or she might deem best. The following is only a suggested guideline based on the material presented through this course. To calculate the percentage of the worksheets and tests, the educator may use the following guide. Divide total number of questions correct (example: 43) by the total number of questions possible (example: 46) to calculate the percentage out of 100 possible.

$$43/46 = 93 \text{ percent correct.}$$

The suggested grade values are noted as follows:

90 to 100 percent = A

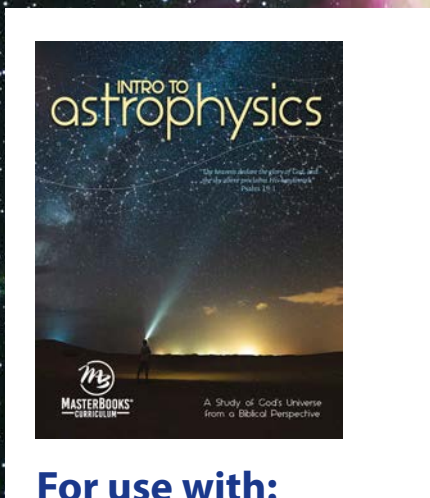
80 to 89 percent = B

70 to 79 percent = C

60 to 69 percent = D

0 to 59 percent = F

**Please Note:** All Scripture passages are taken from the King James Version. A student may choose to write out a verse from a preferred translation, so please be aware of this when grading these assignments.



**For use with:**  
*Intro to Astrophysics*

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## Exercise Answers

### Lesson 1, Exercise 1

1. a. Creationists
2. b. Evolutionists
3. a. Creationists
4. b. Evolutionists
5. b. Astrology
6. a. Astronomy
7. Passover
8. seasons
9. opposed
10. In the past, many people lost sight of the true purpose of the stars and began to worship the “creature more than the Creator” (Romans 1:25).

### Lesson 1, Exercise 2

1. Lift up your eyes on high, and behold who hath created these things, that bringeth out their [starry] host by number: he calleth them all by names by the greatness of his might, for that he is strong in power; not one faileth.
2. Astronomy
3. Nature
4. Word
5. c. Dual
6. a. Natural
7. b. Special
8. The method that scientists used to establish theories.
9. An educated guess. A hypothesis becomes a theory once it has been tested many times.
10. The belief that scientific principles can adequately explain all things in nature, including origins.

### Lesson 1, Exercise 3

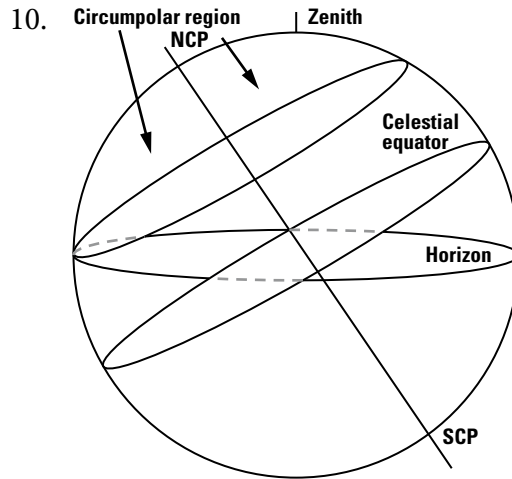
1. The belief that the sun is the center of the solar system.
2. The belief that the earth is the center of the universe.
3. Creationists believe that the theory of evolution is a great attack upon God’s Word in that it brings into question the authority of Scripture in the first chapters of Genesis. This attack is usually traced to the 19th century, particularly to the publication of Darwin’s *Origin of Species* in 1859. But the roots go back a bit earlier. Prior to Darwin, geologists of the late 18th century had argued for geological evolution and millions of years. However, geocentrists believe that the root of the problem began much earlier with the adoption of the heliocentric theory. They argue that the acceptance of the heliocentric theory attacked scriptural integrity and laid the groundwork for the later assault of evolution.
4. mistakes
5. knowledge
6. theories
7. biases
8. understandable
9. Occam’s
10. a. Jupiter  
b. Mars  
c. Saturn  
d. Venus  
e. Mercury  
f. Earth  
g. Moon

### Lesson 1, Exercise 4

1. If evolution were true, then there is no need for a Creator. This does not mean that one cannot believe in both evolution and God, for there are many people who do believe in both. However, belief in evolution ultimately causes one to dismiss God's existence and influence upon the world when developing scientific ideas. This leads to the assumption that the physical world is all that exists.
2. Kepler
3. material
4. Evolution
5. b. Error
6. d. Atheistic
7. a. Evolution
8. c. Scripture
9.  $9.3 \times 10^7$
10.  $1.4973 \times 10^8$

### Lesson 2, Exercise 1

1. b. Evolutionists
2. b. Evolutionists
3. a. Creationists
4. a. Creationists
5. A model of the universe where stars are located on the surface of a large, clear sphere centered on the earth.
6. Stars that from a given location do not rise or set but always move in circles around the celestial pole.
7. The point on the celestial sphere about which the celestial sphere spins each day due to the earth's rotation.
8. The point in the southern part of the celestial sphere about which all points on the celestial sphere appear to spin each day due to the earth's rotation.
9. Polaris. A moderately bright star located near the north celestial pole, and so for locations in the Northern Hemisphere always is seen in the northern direction.



### Lesson 2, Exercise 2

1. The two points on the ecliptic that are farthest from the celestial equator. The solstice that is north of the equator is called the summer solstice; the winter solstice is the one south of the equator.
2. On an orbit around the sun, the point that is closest to the sun.
3. On an orbit around the sun, the point that is most distant from the sun.
4. One of 88 recognized groups of stars in the sky that represent a picture of a person, animal, or thing.
5. b. Revolution
6. d. Equinoxes
7. a. Rotation
8. c. Ecliptic
9. It is reasoned that from Adam to the writing of the Bible, God needed to communicate His story of redemption to mankind. How else could God have done this than by giving us signs in the sky? After all, being signs was one of the original purposes of the stars (Genesis 1:14).
10. First, many of the supposed meanings of the star names are very questionable. Second, similarities between the true gospel and false gospels (such as astrology) are surely not coincidental. Third, there is no clear indication in the Bible of this theory, even though there were many opportunities to do so.



### Lesson 9, Exercise 1

1. b. Evolutionist
2. a. Creationist
3. a. Creationist
4. b. Evolutionist
5. blink
6. Tombaugh
7. minor
8. planet
9. physical

10.

Planet	Bode's Law Distance	Actual Distance
Mercury	0.4	0.387
Venus	0.7	0.723
Earth	1.0	1.000
Mars	1.6	1.524
Vesta	2.8	
Jupiter	5.2	5.20
Saturn	10.0	9.58
Uranus	19.6	19.3
Neptune	38.8	30.2
Pluto	77.2	39.3

### Lesson 9, Exercise 2

1. c. Planets
2. a. Trojan
3. d. Composition
4. b. Metals
5. reworking
6. dwarf
7. satellite
8. Horizons
9. Ceres

10. A minor planet is designated with its sequential number, plus its provisional designation. The provisional designation is the year of discovery, followed by a (capitalized) two-letter code and usually a subscripted number. The first letter indicates which half-month of the year the minor planet was discovered. The letter I is omitted because it can be confused with J, and the letter Z is not needed. The second letter indicates the order of discovery within the half month (again omitting the letter I).

### Lesson 9, Exercise 3

1. a. Coma  
b. Motion of comet  
c. Nucleus  
d. Direction to sun
2. The small ice and dust core of a comet
3. A defect usually found in reflecting telescopes, so called because of the appearance of stars near the edge of the field of view; the stars look like little comets
4. Molecules and ions that are dislodged from a comet and blown outward from the sun by the sun's radiation; a gas tail is visible from fluorescence of the molecules
5. Microscopic solid particles that are dislodged from a comet and blown away from the sun by the solar wind; we see the dust tail because of the sunlight that the particles reflect
6. The hypothetical source of long-period comets far from the sun; the Oort cloud is necessary to explain why comets are still present in an old solar system
7. slow
8. evidence
9. meteor
10. meteoroid

### Lesson 9, Exercise 4

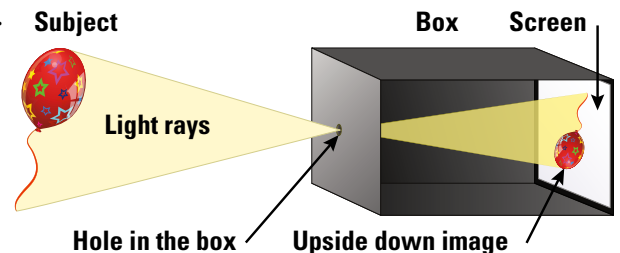
1. A class of meteorite that consists primarily of iron and nickel
2. A meteorite that contains small particles that contain carbon compounds; these are believed to be primitive meteorites
3. A class of asteroids that have stony composition as inferred from their spectra
4. A class of asteroids that contain much carbon, as deduced from their spectra
5. fourth
6. Revelation 6:13
7. star
8. meteors
9. Angular momentum is a quantity possessed by rotating or revolving objects. The sun has more than 99% of the mass of the solar system but only about 1% of the angular momentum. The planets have less than 1% of the mass but have 99% of the angular momentum. This should not be; most of the mass should contain most of the angular momentum. It is not clear how the sun could have shed nearly all its angular momentum.
10. Two planets rotate backwards, while the other six planets rotate in the same direction that nearly everything else moves. How did this happen? Uranus has a peculiar axial tilt, and Neptune's moon Triton has a strange backward orbit. Satellites are common in the solar system, and yet the earth's moon is very strange. Most of the moons in the solar system orbit in the equatorial plane of their respective planets. Only the earth's moon orbits near the ecliptic.

### Lesson 10, Exercise 1

1. The day is thine, the night also is thine: thou hast prepared the light and the sun. Psalm 74:16
2. minutes
3. years
4. sphere
5. darkening
6. chromosphere
7. b. Spectroscopic
8. c. Photosphere
9. a. Darker
10. a. Corona  
b. Transition zone  
c. Chromosphere  
d. Photosphere  
e. Convection zone  
f. Radiative zone  
g. Core

### Lesson 10, Exercise 2

1. corona
2. heat
3. project
4. pinhole
5. rotation
6. c. Sunspots
7. d. Zeeman
8. a. Umbra
9. b. Penumbra
10. **Subject**





### Lesson 17, Exercise 3

- |  |
|--|
| <b>Other Indirect Methods of Finding Distances</b> |
| Tully-Fisher relation                              |
| Brightest galaxies in clusters                     |
| Hubble relation                                    |
- A relation between the width of the 21-cm emission line due to neutral hydrogen in a galaxy and the brightness of that galaxy.
- A mathematical function between red shift and distance.
- A measure of the rate of the expansion of the universe. The Hubble constant is the slope of the Hubble relation.
- A displacement of spectral lines to longer wavelengths.
- speeds
- properties
- Masses
- clusters
- rotation

### Lesson 17, Exercise 4

- The existence of clusters of galaxies would seem to be more consistent with a recent creation than one that is billions of years old.
- undermine
- millions
- magnetic
- spiral
- compatible
- A galaxy that has an unusually large amount of emission in the radio part of the spectrum.
- Large, rounded regions from which radio emission occurs in astronomical radio sources.
- A class of spiral galaxies that have bright, blue, nearly point-like nuclei.
- Abbreviated form of quasi-stellar object (QSO). Astronomers think that these are very energetic objects at great distances.

### Lesson 18, Exercise 1

- The study of the structure of the universe.
- The study of the origin and history of the universe.
- A model of the universe that is neither expanding nor contracting.
- The modern theory of gravity developed by Albert Einstein. The presence of matter curves space-time. The motion of particles through this curved space-time results in what we observe as the acceleration of gravity.
- The eternal universe is contrary to biblical teaching because Genesis 1:1 declares that the universe had a beginning. The eternal universe is a pagan idea that Christians never should have entertained in the first place.
- space
- constant
- bound
- unbound
- homogeneous

### Lesson 18, Exercise 2

- The assumption that the universe looks the same in all directions.
- The assumption that the universe is both homogeneous and isotropic.
- A popular theory of the origin of the universe where the universe began as a high density and temperature state about 12–15 billion years ago.
- The rate at which galaxies are carried along by the expansion of space.
- filled
- redshifts
- something
- time
- creation
- Because it signals a belief that we are better to trust science to understand certain things. People who take this approach are very subtly indicating that science is of higher authority than the Bible.

### Lesson 18, Exercise 3

1. The principle of causality is an ancient idea. Everything that happens is caused by something else. Conversely, every cause has an effect.
2. b. Isotropic
3. d. Density
4. a. Creation
5. c. Cosmic
6. Uncaused
7. six
8. atheistic
9. data
10. Axis

### Lesson 18, Exercise 4

1. The name comes from the Greek root *anthropos*, meaning “man.” We get the word “anthropology” from the same root. The anthropic principle is the idea that there are certain characteristics about the universe that seem to demand that humans exist.
2. If the early universe were too smooth, then no structures such as galaxies, stars, planets, and ultimately people would have come into existence. On the other hand, if the early universe had been too clumped, then nearly all matter would have formed into massive black holes so that no galaxies, stars, planets, and hence people would have formed. The range in the distribution of matter in the early universe that would have led to our existence is extremely narrow.
3. evidence
4. lighter
5. quantization
6. judgment
7. b. Circular
8. c. Antimatter
9. d. Inflation
10. a. Dark energy

### Lesson 19, Exercise 1

1. The root word of “apologetics” means to offer a defense. Therefore, Christian apologetics is a defense of the Christian faith. Every Christian should be equipped in this so that he or she may be ready always to give an answer for the reason for our hope (1 Peter 3:15).
2. fourth
3. Heaven
4. yom
5. 24
6. science
7. history
8. Adam
9. allegorical
10. It shall be established for ever as the moon, and as a faithful witness in heaven. Selah. (Psalm 89:37)



## Quizzes Answers

### Quiz

#### Lesson 1

1. b. Astrology
2. a. Astronomy
3. d. Geocentric
4. c. Heliocentric
5. Passover
6. Astronomy
7. mistakes
8. c. Naturalism
9. b. Scientific Method
10. a. Hypothesis

#### Quiz Lesson 2

1. b. Circumpolar
2. a. Draconic month
3. c. Perihelion
4. Northern
5. syzygy
6. Designer
7. b. Apogee
8. c. Equinoxes
9. a. Rotation
10. The Council of Nicaea established the rules for determining the dates of certain holidays such as Easter.

#### Quiz Lesson 3

1. Abraham
2. theology
3. scientists
4. circle
5. c. Deferent
6. b. Terminator

7. d. Ellipse
8. a. Epicycle
9. “think God’s thoughts after him.”
10. Contrary to popular belief, it was not primarily the Bible. The authority generally used to suppress the heliocentric theory was Aristotle and the other ancients.

#### Quiz Lesson 4

1. c. Photon
2. b. Bright line
3. a. Frequency
4. d. Wien’s Law
5. higher
6. Pleiades
7. absorption
8. objective
9. Different elements produce different sets of spectral lines.
10. It can help us measure how fast stars, planets, and many other bodies are moving toward or away from us.

#### Quiz Lesson 5

1. c. Saturated
2. d. Catastrophe
3. a. Terrestrial
4. b. Jovian
5. basalt
6. Rodinia
7. radiometric
8. WNW
9. Evolutionists
10. One is the great diversity that is appearing. Two is that creation scientists have been more open to new ideas.

### Quiz Lesson 6

1. 20
2. core
3. maria
4. lifting
5. c. *Ex nihilo*
6. e. Neap tide
7. d. Spring tide
8. a. *Asah*
9. b. *Bara*
10. With no weather, the moon lacks rapid erosion that exists on the earth. With little erosion, surface features tend to last a very long time on the lunar surface.

### Quiz Lesson 7

1. c. Jovian planets
2. a. Opposition
3. d. Terrestrial planets
4. b. Perturbations
5. conjunction
6. density
7. plate
8. life
9. Noah
10. Many unique things about the earth make it ideally suited for life. This is a strong case for design. Design implies a Designer.

### Quiz Lesson 8

1. density
2. cratering
3. mass
4. evolutionary
5. c. Io
6. d. Occultation
7. e. Metal
8. b. Volatiles
9. a. Liquid
10. It suggests that it is a geologically dead world.

### Quiz Lesson 9

1. d. Trojan
2. c. Coma
3. a. Evolutionist
4. b. Creationist
5. dwarf
6. meteorite
7. fourth
8. meteors
9. evidence
10. a. Coma  
b. Motion of comet  
c. Nucleus  
d. Direction to sun

### Quiz Lesson 10

1. d. Sunspots
2. b. Spectroscopic
3. a. Neutrinos
4. e. Filaments
5. c. Solar
6. chromosphere
7. heat
8. wind
9. fourth
10. ...for he maketh his sun to rise on the evil and on the good, and sendeth rain on the just and on the unjust. (Matthew 5:45)

### Quiz Lesson 15

1. b. Energy
2. a. Planetary nebulae
3. d. Neutron star
4. c. Stellar
5. new
6. singularity
7. dwarf
8. light
9. ton
10. The fact that we cannot directly observe black holes and must rely upon indirect methods to find and study them.

### Quiz Lesson 16

1. d. HI region
2. c. Spiral arms
3. a. Variable star
4. e. HII region
5. b. RR Lyrae stars
6. galaxy
7. spectral
8. structure
9. blue
10. It may account for most of the mass of the universe and the majority of the Milky Way's mass.

### Quiz Lesson 17

1. island
2. dynamic
3. undermine
4. galaxy
5. brightness
6. d. Lobes
7. c. Novae
8. a. Barred
9. b. Redshifts

### 10. Other Indirect Methods of Finding Distances

---

Tully-Fisher relation

---

Brightest galaxies in clusters

---

Hubble relation

---

### Quiz Lesson 18

1. b. Cosmology
2. d. Cosmological principle
3. a. isotropic
4. c. Cosmogony
5. something
6. atheistic
7. Uncaused
8. lighter
9. judgment
10. Because it signals a belief that we are better to trust science to understand certain things. People who take this approach are very subtly indicating that science is of higher authority than the Bible.

### Quiz Lesson 19

1. The root word of “apologetics” means to offer a defense. Therefore, Christian apologetics is a defense of the Christian faith. Every Christian should be equipped in this so that he or she may be ready always to give an answer for the reason for our hope. (1 Peter 3:15)
2. 24
3. 6,000
4. cosmology
5. travel
6. e. Canopy
7. c. Solar analog
8. d. Life
9. a. Transit
10. b. Ussher



## Tests Answers

### Test 1

1. Astronomy
2. syzygy
3. scientists
4. higher
5. c. Perihelion
6. d. Hypothesis
7. b. Photon
8. a. Ellipse
9. Contrary to popular belief, it was not primarily the Bible. The authority generally used to suppress the heliocentric theory was Aristotle and the other ancients.
10. The Council of Nicaea established the rules for determining the dates of certain holidays such as Easter.

### Test 2

1. e. *Ex nihilo*
2. c. *Asah*
3. d. *Bara*
4. b. Terrestrial
5. a. Jovian
6. plate
7. density
8. meteors
9. wind
10. With no weather, the moon lacks rapid erosion that exists on the earth. With little erosion, surface features tend to last a very long time on the lunar surface.

### Test 3

1. c. Stellar model
2. d. Proto star
3. a. Magnitude
4. b. Zero-age main sequence
5. b. Nucleus
6. c. Hottest
7. d. Inclination
8. e. Cooler
9. a. Stellar
10. In order to find the complete motion of a star, we must know both its radial and tangential velocities.

### Test 4

#### Exercises 16–19

1. b. Variable star
2. e. Novae
3. c. Cosmology
4. d. Cosmogony
5. a. Spiral arms
6. galaxy
7. brightness
8. 24
9. travel
10. It may account for most of the mass of the universe and the majority of the Milky Way's mass.