Teacher Guide for the 36-week, 9th-12th grade science course!

The vital resource for grading all assignments from the Survey of Astronomy course, which includes:

- Facts that challenge secular theories and models of the universe — how it began and how it continues to amaze the scientific community.
- Information about our universe and God’s powerful hand in His created cosmos, including how the moon could only have been placed in its orbit by an all-knowing, all-powerful Creator.

OVERVIEW: The Psalmist wrote, “When I consider Your heavens, the work of Your fingers, the moon and the stars, which You have ordained, what is man that You are mindful of him, and the Son of man that You visit him?” (Ps. 8:3–6). Students taking this course will tour the universe, marveling at our galaxy through full-color star charts, easy-to-use illustrations, and even glimpses of the red supergiant star Betelgeuse over 3000 trillion miles away without the need of binoculars or a telescope. They will also be able to answer questions like: “How do phases of the moon work? When will the next solar eclipse take place? What is that bright star setting in the west? How do I find Saturn? What sorts of objects can be seen with binoculars?” These questions and many more are easily answered with the helpful tips and basic understanding of astronomy presented thought the materials included in this course. Take a few moments to stand and look up at the glorious night sky, appreciating the majestic beauty of God’s vast universe.

FEATURES: The calendar provides lesson planning with clear objectives, and the worksheets and quizzes are all based on the materials provided for the course.

- Approximately 30 to 45 minutes per lesson, five days a week
- Includes answer keys for worksheets and quizzes
- Worksheets for each chapter
- Quizzes are included to help reinforce learning and provide assessment opportunities
- Designed for grades 9 to 12 in a one-year course to earn 1 science credit
- Suggested labs (if applicable)

Dr. Donald DeYoung is Chairman of the Science and Mathematics Department, Grace College, Winona Lake, Indiana. He is a graduate of Michigan Tech University (B.S., M.S., Physics), Iowa State University (Ph.D., Physics), and Grace Seminary (M.Div.).

Dr. John C. Whitcomb is president of Whitcomb Ministries, Inc., and founder and professor of Christian Workman Schools of Theology. He has been a professor of Old Testament and theology for more than 50 years and is widely recognized as a leading Biblical scholar.

Dr. Jason Lisle is the Director of Research and a featured speaker and writer for the Institute for Creation Research, and formerly the Planetarium Director for the Creation Museum in KY. He holds bachelor of science degrees in physics and astronomy from Ohio Wesleyan University, and a master’s and PhD in Astro-physics from the University of Colorado in Boulder.
Survey of Astronomy

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—Kathy ★★★★★
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## Author Bios:

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Using This Teacher Guide

**Features:** The suggested weekly schedule enclosed has easy-to-manage lessons that guide the reading, worksheets, and all assessments. The pages of this guide are perforated and three-hole punched so materials are easy to tear out, hand out, grade, and store. Teachers are encouraged to adjust the schedule and materials needed in order to best work within their unique educational program.

**Lesson Scheduling:** Students are instructed to read the pages in their book and then complete the corresponding section provided by the teacher. Assessments that may include worksheets, activities, quizzes, and tests are given at regular intervals with space to record each grade. Space is provided on the weekly schedule for assignment dates, and flexibility in scheduling is encouraged. Teachers may adapt the scheduled days per each unique student situation. As the student completes each assignment, this can be marked with an “X” in the box.

| **Approximately 30 to 45 minutes per lesson, five days a week** |
| **Includes answer keys for worksheets and quizzes.** |
| **Worksheets for each chapter** |
| **Quizzes and tests are included to help reinforce learning and provide assessment opportunities.** |
| **Designed for grades 9 to 12 in a one-year course to earn 1 science credit** |
| **Suggested labs (if applicable)** |

**Course Objectives:** Students completing this course will:

- Explore numerous evidences that point to a young universe
- Discover how you can choose the best telescope for you
- Learn the best ways and optimal times to observe planets and stars
- Investigate the universe and God’s powerful hand in His created cosmos
- Identify how the moon could only have been placed in its orbit by an all-knowing, all-powerful Creator
- Study the facts that challenge secular theories and models of the universe — how it began and how it continues to amaze the scientific community
Course Description

The Psalmist wrote, “When I consider Your heavens, the work of Your fingers, the moon and the stars, which You have ordained, what is man that You are mindful of him, and the Son of man that You visit him?” (Ps. 8:3–6). Students taking this course will tour the universe, marveling at our galaxy through hundreds of beautiful, full-color star charts, easy-to-use illustrations, and even glimpses of the red supergiant star Betelgeuse over 3000 trillion miles away without the need of binoculars or a telescope. They will also be able to answer questions like: “How do phases of the moon work? When will the next solar eclipse take place? What is that bright star setting in the west? How do I find Saturn? What sorts of objects can be seen with binoculars?” These questions and many more are easily answered with the helpful tips and basic understanding of astronomy presented through the materials included in this course. Take a few moments to stand and look up at the glorious night sky, appreciating the majestic beauty of God’s vast universe.

Suggested Optional Science Lab

There are a variety of companies that offer science labs that complement our courses. These items are only suggestions, not requirements, and they are not included in the daily schedule. We have tried to find materials that are free of evolutionary teaching, but please review any materials prior to presentation. The following items are available from www.HomeTrainingTools.com. A good telescope is highly recommended.

AS-ASTRLAB Astrolabe Kit

AS-BACSTAR Backyard Stars Guide

AS-STARLOC Star and Planet Locator
## First Semester Suggested Daily Schedule

<table>
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<tr>
<th>Date</th>
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Astronomy Worksheets

for Use with

*The Stargazer's Guide to the Night Sky*
### Short Answers

1. What are you expecting and hoping to learn from this course?

2. What are three different ways you can observe the night sky?

3. Is there a difference in the sky depending on whether you live in the Southern or Northern Hemisphere?
4. Is there a difference in the sky depending on the season?

5. What are the two largest celestial objects we can view?
**Short Answers**

1. *Why is there a trend of east-to-west motion when observing the sun, moon, and stars?*

2. *What is this trend of the earth’s rotation called?*

3. *What is the approximate rotation time of the earth that relates to other objects in the sky as well?*
4. Name the concept that is useful for understanding the positions and motions of stars.

5. Name the concept that involves expanding the earth's equator into space.

6. What are constellations called that are close enough to the celestial pole that they are visible all night, year-round?

7. Since the 23 hours and 56 minutes period is the length of time it takes the earth to turn as seen from a distant star, this is called a “__________________.”
Short Answers

1. Describe the difference between the sidereal day and the solar day.

2. Since stars rise two hours earlier every month, they rise ___ hours earlier after six months.

3. Why is it difficult to observe planets, globular clusters, and nebulae when the moon is full?

4. The moon rises (on average) about _____________ later each day.
5. Why is it ironic that the moon is called “the moon” in regards to the gravitational pull of the earth and sun?

6. The phases of the moon are not related to the earth’s shadow, but to the ___________ of the day side of the moon we can see from our position.

7. It takes _____ days for the moon to go through its phases, and ____ days for its orbital period.
Short Answers

1. The motion of the planets is complicated because their apparent motion in the sky is the combination of their ________ around the sun, plus the ______________ in position due to Earth’s motion around the sun.

2. What is responsible for the seasons on Earth?

3. Describe what the two coordinate systems widely used in astronomy are based on.

4. __________ describes how high above the horizon an object is (in angle).
5. ________ describes how far along the horizon an object is to the right of due north.

6. Equatorial coordinates are based on the _______________. In particular, they are based on the celestial ________.
Short Answers

1. Stars with a declination that is less than your latitude will pass _____ of zenith when they cross the meridian; and stars with a greater declination will pass _____ of zenith.

2. Which RA coordinates can be seen depends on the time of ___ and the time of ____.

3. Once calibrated on an object whose RA and Dec you know, you can use _______ circles on a telescope to find any other RA or Dec.

4. What is the best way to get a feel for the motions in the sky?
5. A star wheel or planisphere helps you find stars by lining up the ________ with the ________ on the planisphere.

6. A planisphere helps find constellations, but will not help with ____ or the _____.

Moon Worksheets
for Use with
Our Created Moon
**Short Answers**

1. What is a moon?

2. How is the moon described in Genesis 1:16?

3. What three Hebrew words refer to the moon in the Old Testament?

4. What is the Greek word for “moon” in the New Testament and what does it mean?

5. How far away is the moon?

6. What keeps the moon in the sky?

7. What does the word “centripetal” mean?
8. What is the elusive force that occurs between objects — Even over large stretches of empty space and continues to puzzle scientists?

9. What do physical laws say about the universe?

10. Who said, “That’s one small step for man; one giant leap for mankind?”

**Discussion Question**

“If the moon’s tangent speed ceased, it then would fall directly toward the earth and collide with us. On the other hand, if gravity ceased, the moon would leave its Earth orbit on a straight line path like a stone from a whirling slingshot.” (pg. 10, *Our Created Moon*) Secular science and evolutionary theories often rely on random events over long periods of time to explain the world we see. The Bible tells us that God created everything — including the universe — and it was good. Knowing the precision of how the moon stays in the sky, what do you think about these two opposing worldviews in explaining the moon? What details from what you have read so far support your answer?

**Bonus Activity**

Research Newton’s law of universal gravitation. How does this help us understand the effects of gravity? What do you need to know to use the following formula to determine the gravity force between two objects?

\[ F = G \frac{m_1 \times m_2}{r^2} \]

- F is the ____________________________.
- G is the ____________________________.
- m₁ is the ____________________________.
- m₂ is the ____________________________.
- r is the ____________________________.
**Words to Know**

breccias  
libration  
lowlands  
lunar eclipse  
lunar highlands  
regolith  
sidereal period  
synodic period

**Short Answer**

1. How large is the moon?

2. What is another name for the mutual balance point or center-of-mass between two objects?

3. Explain what is meant by “a many body problem” in physics in how it relates to the gravity interactions between celestial objects like the moon, sun, or earth.

4. Why is the size of the moon considered to be unusual compared to other moons we see in our solar system?
5. Why is the moon also referred to as a “secondary” or “double planet” companion to earth?

6. Why do we see only one side of the moon?

7. What are some of the previous theories on what created lunar craters? What is the predominant idea of their origin today?

8. How many estimated craters are thought to be on the moon, larger than one kilometer in size?

9. How does the lack of an atmosphere tie in with the presence of the craters?

10. There are impact craters on earth, but they don’t look the same as those on the moon. Why?

11. What are three varieties of moon rocks that have been collected?
12. How is soil on the moon different from that on earth?

13. Do lunar crystalline rocks contain the same chemical minerals that are found in earth rock?

14. What do crystalline rocks hint about the moon's history?

15. Are sodium, potassium, and lead found in rocks on the moon?

16. All moon rocks contain more heat-resistant elements than rocks on earth — true or false?

17. Where is anorthosite found on the moon?

18. What rocks help give color to the maria area of the moon?
19. What shape are lunar rocks?

20. What do the small bright beads of colored glass in the lunar soil indicate?

**Discussion Question**

Although it cannot produce light on its own, how is the moon's ability as a reflector critical in understanding 
Genesis 1:16?

**Bonus Activities**

1. Research lunar mass. Can you find the answer to the following equation? Why are complex equations 
like this one vital to the success of the space program?

   1 lunar mass = ____________ x _____________ kilograms

2. Research the moon as a reflector. Are there substances on the moon’s surface that help to reflect light or is 
the sheer size of the moon and the intensity of sunlight what makes the moonlight bright?
Words to Know

cold traps
neap tides
spring tides

Short Answer

1. By total weight, what percentage of water do most earth rocks contain?

2. What is the assumed significance of water on the moon?

3. How might water have gotten to the moon?

4. Is there life on the moon?

5. Why were the first lunar rock samples and astronauts put into isolation for a time at the end of their space missions to the moon?

6. What two things are missing from the moon that would help with the possibility of life?

7. If life is found in the universe, what are the three possible explanations for it?
8. Why is abiogenesis not a realistic expectation for life to occur?

9. Is there biblical support for life in space beyond that on earth?

10. What causes the moon phases?

11. In what Bible verses is the new moon mentioned?

12. Were some Old Testament festivals timed with the phases of the moon?

13. What do the moon phases affect here on earth?

14. What is the cause for the high spring tides?

15. Though not proven, what other things are often attributed to the moon and its phases?

16. When does a lunar eclipse occur?

17. How often do lunar eclipses occur?
18. What is a solar eclipse?

19. Why don't lunar and solar eclipses happen every month?

20. How long does a total eclipse last?

21. What causes the earth's tides?

22. How does the moon's proximity to one side of the earth or the other impact tides?

23. How quickly can the tidal bulge move at the earth's equator?

24. Does the moon's gravity affect the crust of the earth?

25. In what quarters of the moon's phases do neap tides occur?

Discussion Question

Explain how the size and relative distance of the moon and the sun can help eclipses to occur.
**Bonus Activities**

1. Research the latest findings on the question of whether or not the moon has water at www.nasa.gov. Why is water an important component of potential future missions to the moon?

2. Identify the various phases of the moon.
**Short Answer**

1. How many unmanned Soviet landings have there been on the moon?

2. What American president in 1961 set the national goal of a manned moon exploration?

3. What does it mean for a space mission to be a “manned” one?

4. Describe the Saturn rockets used in the Apollo program for manned flights to the surface.

5. Where on the moon’s surface did Astronaut Neil Armstrong take his first steps on July 20, 1969?

6. When did the Apollo program end and how do we continue to study the moon without manned missions?

7. What are the names of the two moons of Mars?
8. When were Jupiter’s largest moons discovered and by whom?

9. Are there marked similarities among the moons of our solar system that would suggest a common spontaneous origin?

10. Which American president began NASA in order to study the possibilities of space exploration?

Discussion Questions

1. What global pressures helped to initiate the Apollo space program’s moon exploration? How did these factors help or hurt space exploration in your opinion?

2. After reading the facts about NASA on page 25 of Our Created Moon, do any of the facts change some misconception you have had about the history, purpose, and events of NASA missions?

Bonus Activity

Create an informative chart and detail key factors of the Apollo Missions to the moon, or choose a particular manned Apollo mission to the moon and write a two-page essay about some aspect of the mission.
**Short Answer**

1. Has water been found in trace amounts on the moon?

2. Why have scientists been trying to find recoverable amounts of water on the moon's surface?

3. What was one extreme method NASA used to try and find water molecules on the moon?

4. Earth’s surface contains an abundance of water and it is also found in three states of solid, liquid, and gas — is this a commonly found substance throughout our own solar system?

5. Why was the South Pole of the moon a target for probes trying to find water on the moon?

6. Why hasn’t there been a continuing search for life on the moon?

7. About how much of the earth’s surface is covered by water?
8. What is one chief lesson you can take away from the explorations of space?

9. Which of the Apollo missions was considered a “successful failure”?

10. How long is a trip to the moon by rocket?

**Discussion Questions**

Which among the moons described in this part of the reading is to you the most interesting one, and why?

**Bonus Activity**

Complete the moon phase calendar activity on page 27 of the book.
Astronomy Worksheets
for Use with
Taking Back Astronomy


Words to Know

worldview
naturalism
big bang
nebular accretion

Short Answer Questions

1. A worldview is really a kind of ____________. It prevents us from being objective and “open-minded” about certain things.
2. A correct worldview can help us draw _______________ _____________________ about the evidence.
3. The Bible claims to be the _______________________ ___________ ____ _______.
4. Ultimately, we can base our beliefs about origins on the Word of God, or the speculations of other _______________ _____________________.
5. The Bible provides a _______________ ____________________ for the interpretation of scientific evidence in the field of astrophysics, as it does for other areas of science.

Discussion Questions

1. Discuss why the creation versus evolution debate is not primarily about science, but instead about worldviews.

2. What do you think it means to have the “mind of Christ”? How would having the mind of Christ affect your worldview?
Activities

Use your Bible to answer the following questions. Include at least one Scripture reference with each answer.

How was the universe formed?

When was the universe formed?

Where did mankind come from?

Why am I here?

Why is there so much pain and death in the world?

What is the definition of truth?
Words to Know

angular size
Fusion

Short Answer Questions

1. The _____________ is the nearest celestial body and is roughly the size of the continental United States.
2. The sun, like other ____________, is a glowing hot ball of ______________ ________.
3. The sun derives energy from the fusion of hydrogen to _________________ in the core.
4. According to Genesis, the moon was designed to rule the _____________ , and the sun was designed to rule the ____________.
5. We cannot see the structure of our own galaxy because we are within it. To us it looks like a faint cloud band stretching across the sky, thus giving it the name _________________ ____________.

Discussion Questions

1. Discuss the purposes of the created universe as stated in Psalm 19:1 and Genesis 1:14.

2. Discuss why the sun and moon appear to be the same size when viewed from the earth.
Activities

Write a one-page essay on one of the following prompts:

a. How do you feel when confronted with the amazing supernatural power of the Creator?

b. How do you believe the universe declares the glory of God?
**Words to Know**

nebula  
galaxy  
Virgo Cluster  
Local Group

**Short Answer Questions**

1. When a nebula is heated by ________________ ____________, it glows, often with vivid and beautiful colors.

2. The Milky Way belongs to a cluster of galaxies called the ______________ ________________.

3. The sun gives off more energy every second than one billion major cities would produce in ________ __________.

4. God has created innumerable galaxies with a wide range of shapes and sizes. Clusters of galaxies are organized into even larger bodies called ____________________________.

5. How many stars are estimated to be in the Milky Way?

**Discussion Questions**

1. Read Psalm 8, 1 Peter 5:7, Luke 12:7, John 3:16. Discuss how it makes you feel to know that this same God cares about you individually.

2. After reading these pages we get an idea that the universe is so vast it is beyond our ability to comprehend, yet Genesis 1:16 states simply that God “also made the stars.” Why do you think the Bible speaks more about God’s plan for mankind than of all His other created works?
Activity

Memorize Psalm 8:3–4.
Quizzes Section
**The Stargazer’s Guide to the Night Sky**

**Quiz 1**  
**Concepts & Comprehension**  
**Scope:** Chapters 1–2  
**Total score:** ____ of 100  
**Name**

---

**Answer Questions: (5 Points Each Question)**

1. What is this trend of the Earth’s rotation called?

2. Name the concept that is useful for understanding the positions and motions of stars.

3. What are constellations called that are close enough to the celestial pole that they are visible all night, year-round?

4. Since stars rise two hours earlier every month, they rise ____ hours earlier after six months.
5. The moon rises (on average) about ______________ later each day.

6. The motion of the planets is complicated because their apparent motion in the sky is the combination of their _________ around the sun, plus the ______________ in position due to Earth’s motion around the sun.

7. Equatorial coordinates are based on the ______________. In particular, they are based on the celestial __________.

8. A star wheel or planisphere helps you find stars by lining up the _____ with the _____ on the planisphere.

9. What does the term *equinox* mean?
10. What does the term *solstice* mean?

11. In the Northern Hemisphere, days are longer in the _____ and _____ seasons, and shorter in the _____ and ________ seasons.

12. The configuration of the sun, moon, and Earth is about the same every 18.031 years, and is called the ________ cycle.

13. The Earth actually has two shadows. A darker inner shadow called the “________” and a lighter outer shadow called the “__________.”

14. When the moon is farther from the earth, it appears smaller than the sun, and when it passes directly in front of the sun it leaves a thin “ring” or “____________.”
15. Planets orbit the sun in slightly _______ paths with the sun at one focus of the ellipse.

16. _______________ is when a planet is “behind” the sun.

17. Meteor showers are generally caused by debris left behind by a ________.

18. The most impressive, reliable meteor shower is the _____ meteor shower, occurring around August 12th each year.

19. The sun traces out a thin figure-eight shape across the sky with each day, which is called ____________.

20. The constellation in which the sun is found at equinox shifts with time. This phenomenon is called the “________________________.”
Answer Keys

to

Survey of Astronomy
Introduction – Worksheet 1
1. Answers will vary.
2. With your eyes alone, with binoculars, or with a telescope.
3. Yes. There are many similarities, but star charts can vary.
4. Yes. The book includes star charts depending on the seasonal skies.
5. The moon and the sun.

Chapter 1 – Worksheet 1
1. This is because of the earth’s rotation on its axis; because the earth is spinning in the opposite direction.
2. It is called “diurnal motion.”
3. It is an approximate 24-hour cycle.
4. It is called the “celestial sphere.”
5. It is called the “celestial equator.”
6. They are called “circumpolar” constellations.
7. Sidereal day

Chapter 1 – Worksheet 2
1. The sidereal day is the true rotation rate of Earth as seen from a distant star. The solar day is how long it takes for the sun to return to its highest point in the sky as viewed from a location on Earth.
2. 12
3. It washes out nearly everything else in the sky.
4. 50 minutes
5. The gravitational pull of the sun on the moon is about twice the pull of the sun on the moon.
6. percentage
7. 29.3, 27.5

Chapter 1 – Worksheet 3
1. true motion, apparent shift
2. The earth’s rotation axis that is tilted relative to its orbit around the sun by 23.4 degrees.
3. The first is based on our local horizon. The second is based on the celestial sphere.
4. Altitude
5. Azimuth
6. celestial sphere, equator

Chapter 1 – Worksheet 4
1. south, north
2. day, year
3. setting
4. It’s best to get outside and watch.
5. date, time
6. planets, moon

Chapter 2 – Worksheet 1
1. declination, 12
2. It means “equal night.”
3. It means “sun stop.”
4. Arctic
5. Spring/summer, fall/winter
6. Ecliptic

Chapter 2 – Worksheet 2
1. On the spring equinox
2. Solar, lunar
3. Node
4. Saros
5. Umbra, penumbra
6. Photosphere
7. 400

Chapter 2 – Worksheet 3
1. Annulus
2. Libration
3. Elliptical
4. Superior
5. Conjunction
The Stargazer’s Guide to the Night Sky Quiz Answer Keys

Quiz 1 – Chapters 1–2
1. It is called “diurnal motion.”
2. It is called the “celestial sphere.”
3. They are called “circumpolar” constellations.
4. 12
5. 50 minutes
6. True motion, apparent shift
7. Celestial sphere, equator
8. Date, time
9. It means “equal night.”
10. It means “sun stop.”
11. Spring/summer, fall/winter
12. Saros
13. Umbra, penumbra
14. Annulus
15. Elliptical
16. Conjunction
17. Comet
18. Perseid
19. Analemma
20. Precession of the equinoxes

Quiz 2 – Chapters 3–4
1. Rods, cones
2. Directly
3. Red light
4. 30
5. Brightness, constellation
6. Job
7. Demon
8. Sirius
9. North Star
10. Southern Crown

Quiz 3 – Chapters 5–6
1. Conjunction
2. Occultation
3. Meteor, meteoroid, meteorite
4. Radiant
5. Meteor storm
6. Geminids
7. Leonids
8. Wavelengths
9. Solar halo
10. Crown
11. Satellites
12. Flare
13. Aperture
14. Refractors
15. Chromatic
16. Mirror
17. Andromeda
18. Clock-drive
19. Equatorial, horizon
20. Telrad

Quiz 4 – Chapters 7–8
1. Coldest
2. Nine
3. Thermal
4. Lowest
5. Blurrier, smaller
6. Collimation
7. Averted
8. Star hopping
9. Terminator
10. Maria

Quiz 5 – Chapters 9–10
1. Ecliptic
2. Jupiter
3. Ammonia