

Answer Keys for Teachers

KINESTHETIC ASTRONOMY™

Written Assessment Options for the *Sky Time* Lesson Table of Contents

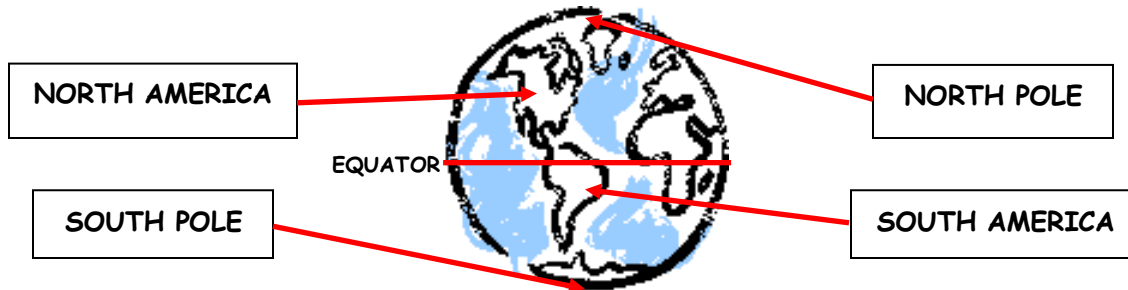
WORKSHEET or ACTIVITY	PAGE NUMBERS
1. What Do You Know? (Pre-assessment questionnaire)	STA 2 – 4
2. Scale Model of the Sun, Earth & Moon – Cutout Activity	No Answer Key
3. Body Geography – Student Worksheet	STA 6
4. Kinesthetic Times of the Day – Student Worksheet	STA 7
5. Rotation vs. Orbit – Student Worksheet	STA 8
6. Your Birthday Stars – Student Worksheet	STA 9 – 10
7. Night Sky in China – Student Worksheet	STA 11
8. What Have You Learned? (Post-lesson assessment)	STA 12 – 15

Answer Key for Teachers

WHAT DO YOU KNOW? [p 1 of 3]

This questionnaire is not meant to be graded, but rather to inform the teacher about the prior knowledge of his or her students.

1. Draw arrows to connect each box with the correct place on planet Earth.



2. Draw the EQUATOR on the Earth cartoon above.

3. Order the objects below from smallest (1) to largest (3).

__2__ Earth

__1__ Moon

__3__ Sun

4. Order the objects below from closest (1) to farthest (3) from Earth.

__2__ Sun

__1__ Moon

__3__ North Star

5. How many stars are in the Solar System? _____1_____

6. How do you think people kept track of time before the invention of clocks, watches, and numbered calendars? What is a day? What is a year?

Basic examples include: Using sundials to tell the time of day, watching the changing phases of the Moon to count weeks and months, and watching the rising & setting positions of the Sun or the height of the Sun at noon to tell the seasons. More advanced examples: Seasons could also be determined by observing which stars were rising just before sunrise or noting the constellation that was visible during that time of year.

A DAY is the time it takes for Earth to spin once (rotate) once on its axis. A YEAR is the time it takes for Earth to go once (orbit) around the Sun.

7. If it is noon where you are, what time is it on the opposite side of Earth?

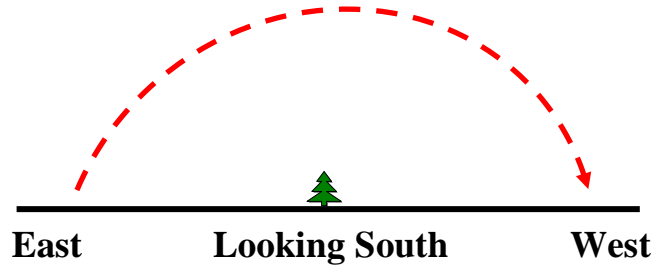
_____Midnight_____

Answer Key for Teachers

WHAT DO YOU KNOW? [p 2 of 3]

8. How does the Sun appear to move in the sky during the day? Draw the path of the Sun on the diagram below.

The Sun appears to rise in the east and set in the west.



9. Why do you think the Sun appears to rise in the East and set in the West?

This occurs because Earth is turning (rotating) toward the east.

10. Do stars and constellations also appear to rise and set?

Circle one: **YES** NO

Explain: Because Earth is turning (spinning or rotating).

11. Does Earth move in space? Circle one: **YES** NO

Explain (draw pictures if it helps to explain):

Basic:

Earth is spinning (rotating) on its North-South axis once each day.

Earth is going around (orbiting) the Sun once each year.

Answer Key for Teachers

WHAT DO YOU KNOW? [p 3 of 3]

12. How many trips around the Sun have you made in your life? Your age (in years)

13. Do we see the same stars and constellations at different times of year?

Circle one: YES **NO**

Explain (use drawings if it helps you to explain):

No. Because as Earth orbits the Sun during the year, the night side of Earth will be facing out into different directions in the galaxy. Thus we will generally see different stars and constellations at different times of year. For northern hemisphere viewers, we can see Ursa Major and Ursa Minor (as well as other constellations near the North Pole) all year long.

Answer Key for Teachers

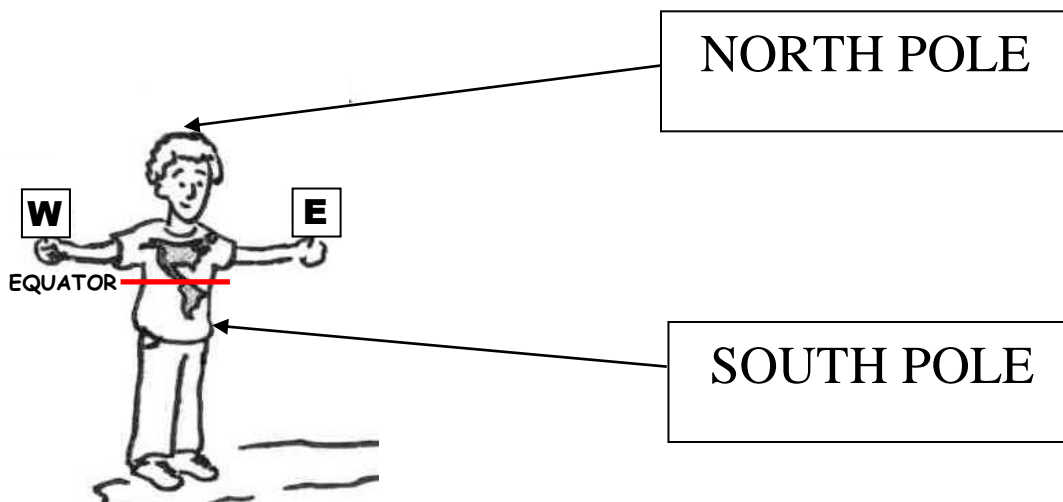
**PAGE INTENTIONALLY LEFT BLANK TO RETAIN
CORRESPONDENCE of PAGE NUMBERS BETWEEN
ASSESSMENT OPTIONS (pp ST1 – ST15)
and the
ASSESSMENT ANSWER KEY (pp STA1 – STA15)**

Answer Key for Teachers

BODY GEOGRAPHY

DIRECTIONS:

1. Label the North and South Poles by filling in the boxes shown.
2. Fill in the “E” and “W” signs in the student’s hands.
3. Draw the Equator on the boy (whose body represents the whole Earth).



Answer Key for Teachers

KINESTHETIC TIMES OF DAY

A. Write the correct times of day for someone on the front of the rotating boy.

Choose from: **SUNRISE, SUNSET, NOON OR MIDNIGHT**



1. NOON



2. SUNSET

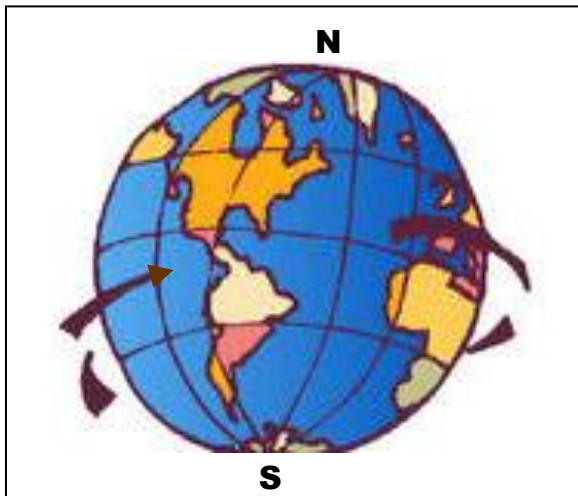


3. MIDNIGHT



4. SUNRISE

B. Fill in the blanks below



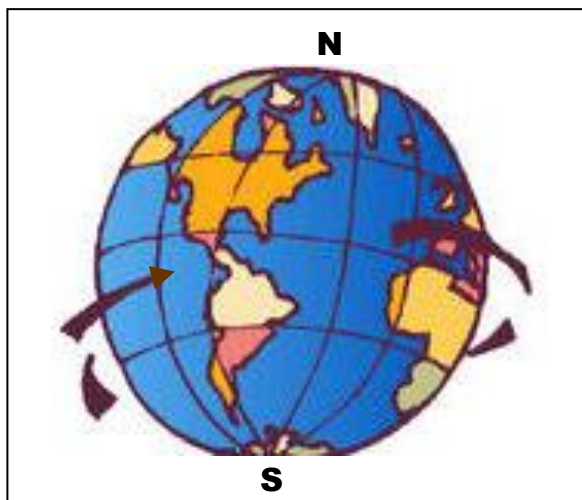
Earth turns about its axis. We call this movement A DAY.

Earth takes 24 hours to rotate around. We call this length of time Earth's rotational period.

Answer Key for Teachers

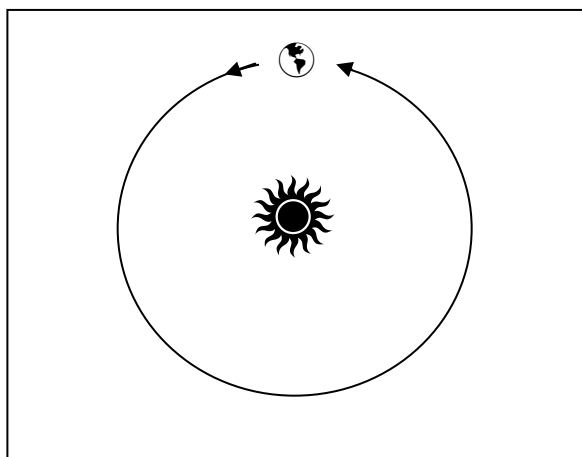
ROTATION VS. ORBIT

Fill in the blanks below



Earth turns about its own axis. We call this movement ROTATION.

Earth takes 24 hours to rotate around. We call this length of time Earth's rotational period.



Earth moves around the Sun. We say that Earth ORBITS the Sun.

Earth takes 365 days to go once around. We call this length of time Earth's orbital period.

Answer Key for Teachers

YOUR BIRTHDAY STARS [p 1 of 2]

Use the *Zodiac Diagram* to answer these questions.

1. Estimate the date at the girl's position: ~ 2 Feb (Ground Hog Day).

2. Name a Zodiac constellation that would be visible to her *at midnight*:

_____ **Cancer** _____

3. Write the names of two Zodiac constellations that would be visible in the night sky *at midnight* on the Summer Solstice (21 June).

_____ **Scorpius** _____ _____ **Sagittarius** _____

4. Do we see different stars at different times of year?

Circle one: **YES** NO

Explain: At different times of year the nighttime side of Earth is facing out different directions in space.

5. Write down your birthdate (day, month, year): Example: 21 Aug 1995

6. Mark an "X" on the Diagram to show your birthday position in Earth's orbit around the Sun.

7. Write the names of two constellations that would be visible in the night sky *at midnight* on your birthday:

__ **Aquarius** __ __ **Capricorn** __

8. Can you see the constellation representing your "sign" of the Zodiac in the night sky on your birthday?

Circle one: YES **NO**

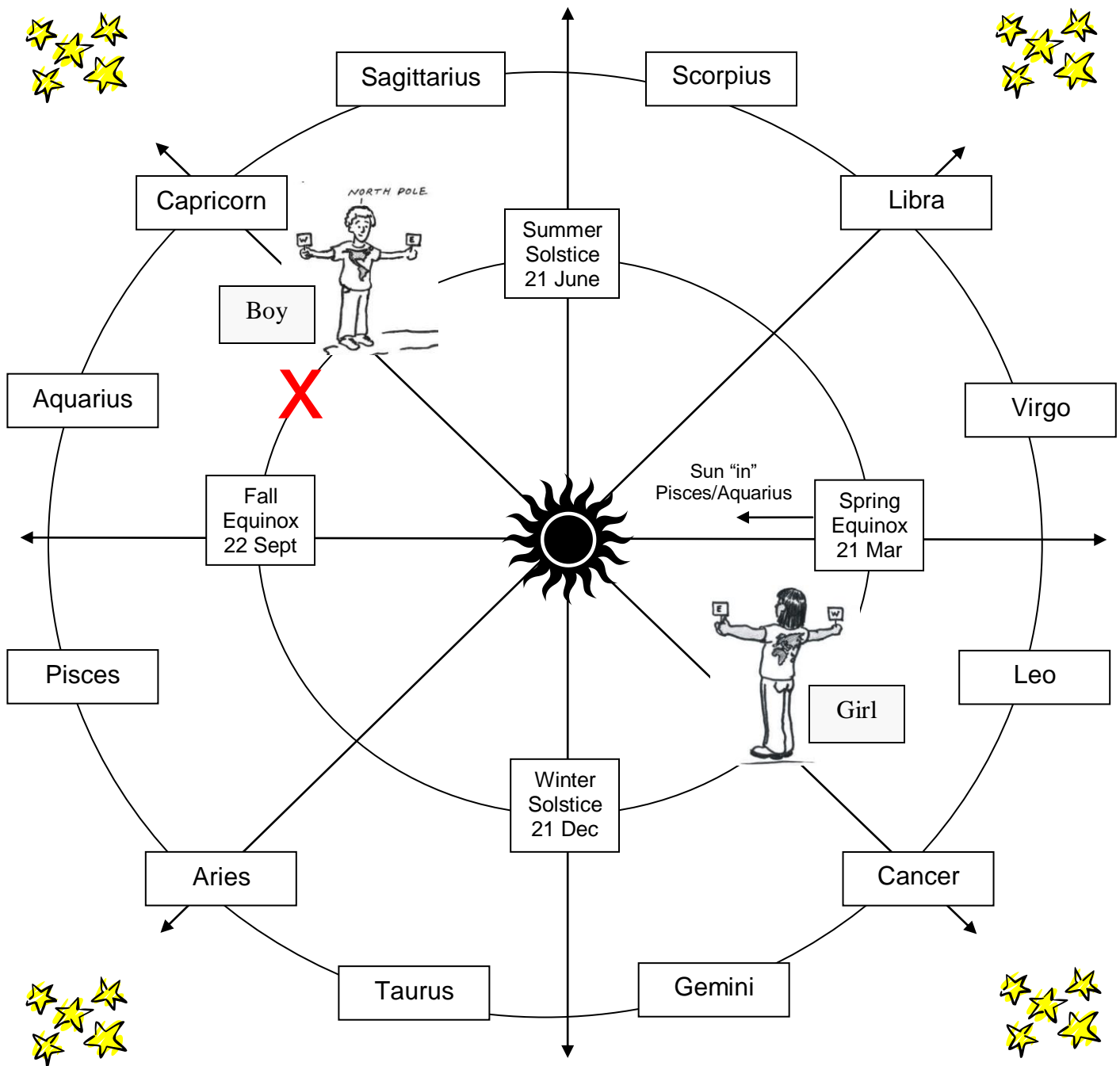
Explain: On my birthday, those stars that make up that constellation are being blocked by the Sun, and when it is nighttime, I am looking out away from those stars. (*NOTE: That's why your sign is called your "sun sign".)

Answer Key for Teachers

THE ZODIAC DIAGRAM [p 2 of 2]

Use this Zodiac Diagram to answer questions.

REMEMBER: During the lesson, you were standing around the inner circle with your body representing Earth in orbit around the Sun.





Answer Key for Teachers

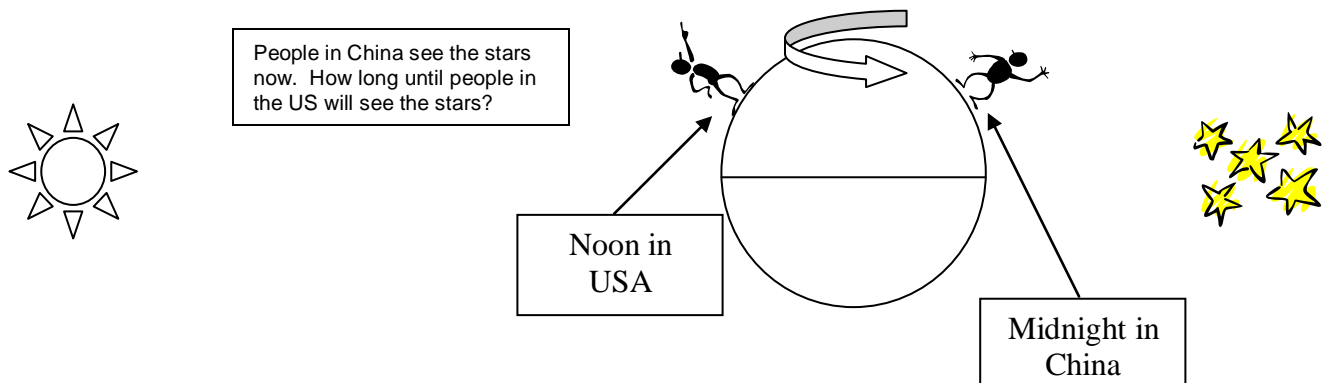
THE NIGHT SKY IN CHINA

Fill in the answers and design a kinesthetic demonstration

1. Do you think people in the US will see pretty much the same stars tonight as people in China saw 12 hours ago? Circle one: **YES** NO

 **STOP! RECORD AND KEEP YOUR ANSWER ABOVE. THEN GO ON TO SEE IF YOUR ANSWER CHANGES OR STAYS THE SAME BY THE END. LET'S GO!** 

2. What is Earth's rotational period (in hours)? 24
3. What is Earth's orbital period around the Sun (in days)? 365
4. How many times does Earth rotate during one orbit of the Sun? 365
5. How many degrees are in a circular orbit? 360°
6. So *about* how many degrees does Earth move in orbit in one day? 1°
Explain: With 365 days in a year and 360° in a circle, Earth must complete about 1° of orbit each day to complete one orbit each year.
7. Look at the diagram. How long will it take for Earth to rotate from noon in the USA (midnight in China) to midnight in the USA (noon in China)? 12_hrs?
8. So *about* how far will Earth have moved in its orbit during this time? 1/2 °



9. Will people in the US see pretty much the same stars tonight as people in China saw 12 hours ago? Circle one: **YES** NO
10. Work in pairs to design a kinesthetic demonstration that proves your answer.

Answer Key for Teachers

WHAT HAVE YOU LEARNED? [p 1 of 4]

1. How many stars are in the Solar System? _____ 1 _____

2. Provide the TWO answers requested in the box below:

Sun-Scale

If the Sun were this BIG what size would Earth be, compared to the Sun?

Circle your answer.

A

B

C

LOOK! SUNSPOTS!
Compare the correct size of Earth to these solar features!

On this scale, about how far from the Sun would Earth be?
14 meters (~45 ft.)

Layout adapted from the *Family Guide to the Sun*
See <http://www.spaceweathercenter.org/resources/04/04.html>

3. Write the correct times of day for someone on the front of the rotating boy.



1. _____ NOON _____



2. _____ SUNSET _____



3. _____ MIDNIGHT _____



4. _____ SUNRISE _____

Choose from **SUNRISE**, **SUNSET**, **NOON** or **MIDNIGHT**.

Answer Key for Teachers

WHAT HAVE YOU LEARNED? [p 2 of 4]

4. Do stars appear to rise and set? Why or why not?

YES. Because Earth is turning (rotating), stars rise, travel through the sky and set like the sun and moon.

5. Fill in the blanks below and DRAW PICTURES to show what you mean.

a) Earth turns about its own axis. It takes 24 hours to turn once around.

We call this movement ROTATION.

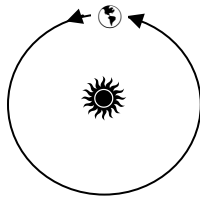
DRAWING of Earth doing this movement:



b) Earth moves around the Sun. It takes 365 days to go once around.

We say that Earth is in ORBIT around the Sun. How many trips around the Sun have you made in your life? [YOUR AGE]

DRAWING of Earth doing this movement:



6. How many times does Earth rotate during one orbit of the Sun? 365

7. About how much (out of 360°) does Earth move in orbit in one day? 1°
Explain your reasoning: With 365 days in a year and 360° in a circle, Earth must complete about 1° of orbit each day to complete one orbit each year.

Answer Key for Teachers

WHAT HAVE YOU LEARNED? [p 3 of 4]

8. Refer to the Zodiac Diagram on the next page to answer these questions:

a) Estimate the date at the boy's position: ___~ **5 AUG**___.

b) Name a Zodiac constellation that would be visible to him *at midnight*:

_____ **CAPRICORN** _____

c) Estimate the date at the girl's position: ~ **2 FEB (Ground Hog day)**.

d) Name a Zodiac constellation that would be visible to her *at midnight*:

_____ **CANCER** _____

e) Write the names of two constellations that would be visible in the night sky *at midnight* on the Winter Solstice (21 December).

_____ **TAURUS** _____ _____ **GEMINI** _____

f) Do we see the same stars at different times of year? Why or why not?

Yes, because at different times of year the nighttime side of Earth is facing out into different directions into space.

g) Write down the date of your birthday: ___ **Example: 31 OCTOBER** ___

h) Mark an "X" on the Diagram to show your birthday position in Earth's orbit.

i) Write the names of two constellations that would be visible in the night sky *at midnight* on your birthday.

_____ **PISCES** _____ _____ **ARIES** _____

j) **BONUS:** Can you see the constellation representing your "sign" of the Zodiac in the night sky on your birthday? Explain your answer on the back.

NO, on my birthday I am looking out away from those stars that make up that constellation when it is nighttime. At noon I am looking toward those stars, but they are being blocked by the Sun.

Answer Key for Teachers

THE ZODIAC DIAGRAM [p 4 of 4]

DIRECTIONS: Use this Zodiac Diagram to answer questions.

REMEMBER: During the lesson, you were standing around the inner circle with your body representing Earth in orbit around the Sun.

