Name(s):_____
Date:_____

3 Phases of the Moon

3.1 Introduction

You will need the following materials for this lab:

- small spheres (representing the Moon), with two different colored hemispheres. The **dark** hemisphere represents the portion of the Moon not illuminated by the Sun.
- flashlight (representing the Sun)
- yourself (representing the Earth, with your nose representing the location of Las Cruces)

Work in Groups of Three People!

The objective of this lab is to improve your understanding of the Moon phases [a topic that you WILL see on future exams!]. This concept, the phases of the Moon, involves

1. the position of the Moon in its orbit around the Earth,
2. the illuminated portion of the Moon that is visible from here in Las Cruces, and
3. the time of day that a given Moon phase is at the highest point in the sky as seen from Las Cruces.

For this lab, you will **finish** by demonstrating to your instructor that you do clearly understand the concept of Moon phases, including an understanding of

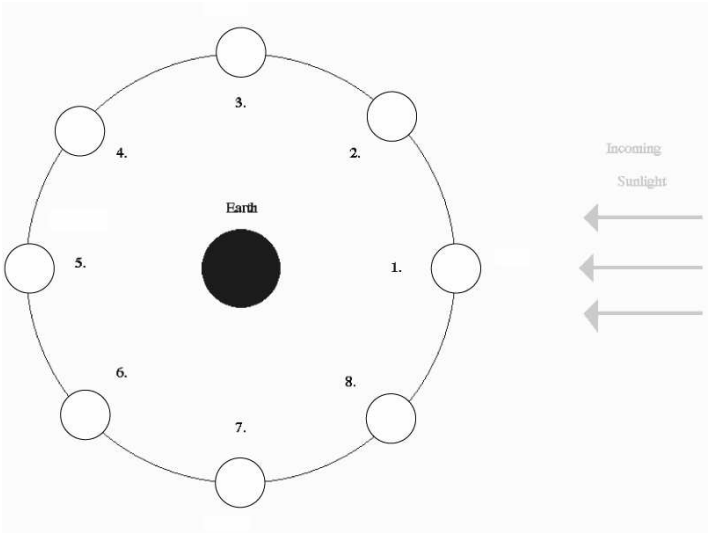
- which direction the Moon travels around the Earth
- how the Moon phases progress from day-to-day
- at what time of the day the Moon is highest in the sky at each phase

You will use the colored sphere and flashlight as props for this demonstration. Carefully read and thoroughly answer the questions associated with each of the five Exercises on the following pages. [Don't be concerned about eclipses as you answer the questions in these Exercises]. Using the dual-colored sphere to represent the Moon, the flashlight to represent the Sun, and a member of the group to represent the Earth (with that person's nose representing Las Cruces' location), 'walk through' and 'rotate through' the positions indicated in the Exercise figures to fully understand the situation presented.

Each Exercise is worth 10 points. There are additional questions at the end.

3.2 Exercise 1

The figure below shows a "top view" of the Sun, Earth, and eight different positions (1-8) of the Moon during one orbit of the Earth. Note that the distances shown are **not** drawn to scale.



Ranking Instructions: Rank (from *greatest* to *least*) the amount of the Moon's **entire surface** that is illuminated for the eight positions (1-8) shown.

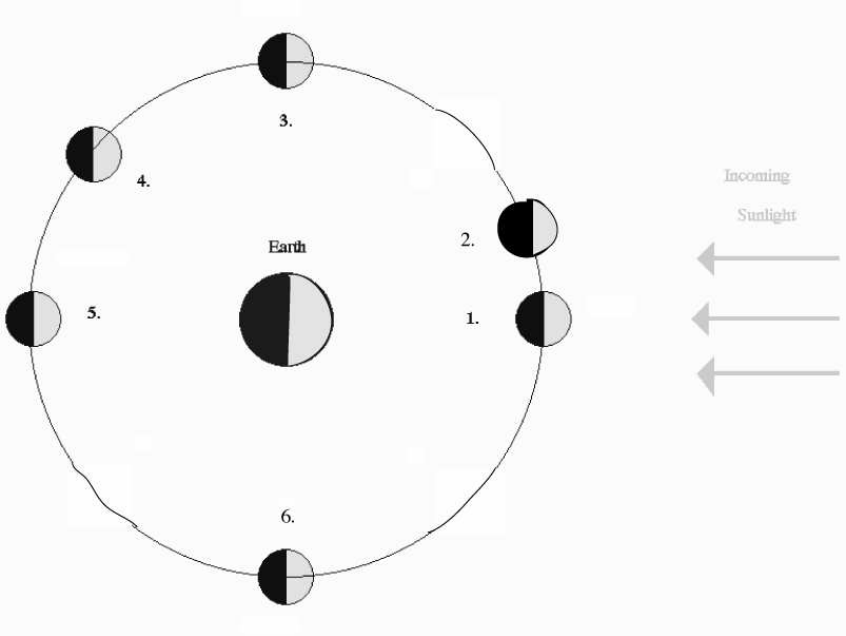
Ranking Order: Greatest A ____B ____C ____D ____E ____F ____G ____H ____Least

Or, the amount of the entire surface of the Moon illuminated by sunlight is the same at all the positions. _____ (indicate with a check mark).

Carefully explain your reasoning for ranking this way:

3.3 Exercise 2

The figure below shows a "top view" of the Sun, Earth, and six different positions (1-6) of the Moon during one orbit of the Earth. Note that the distances shown are **not** drawn to scale.



Ranking Instructions: Rank (from *greatest* to *least*) the amount of the Moon's illuminated surface that is **visible from Earth** for the six positions (1-6) shown.

Ranking Order: Greatest A _____B _____C _____D _____E _____F _____Least

Or, the amount of the Moon's illuminated surface visible from Earth is the same at all the positions. _____ (indicate with a check mark).

Carefully explain your reasoning for ranking this way:

3.4 Exercise 3

Shown below are different phases of the Moon as seen by an observer in the Northern Hemisphere.

A B C D E

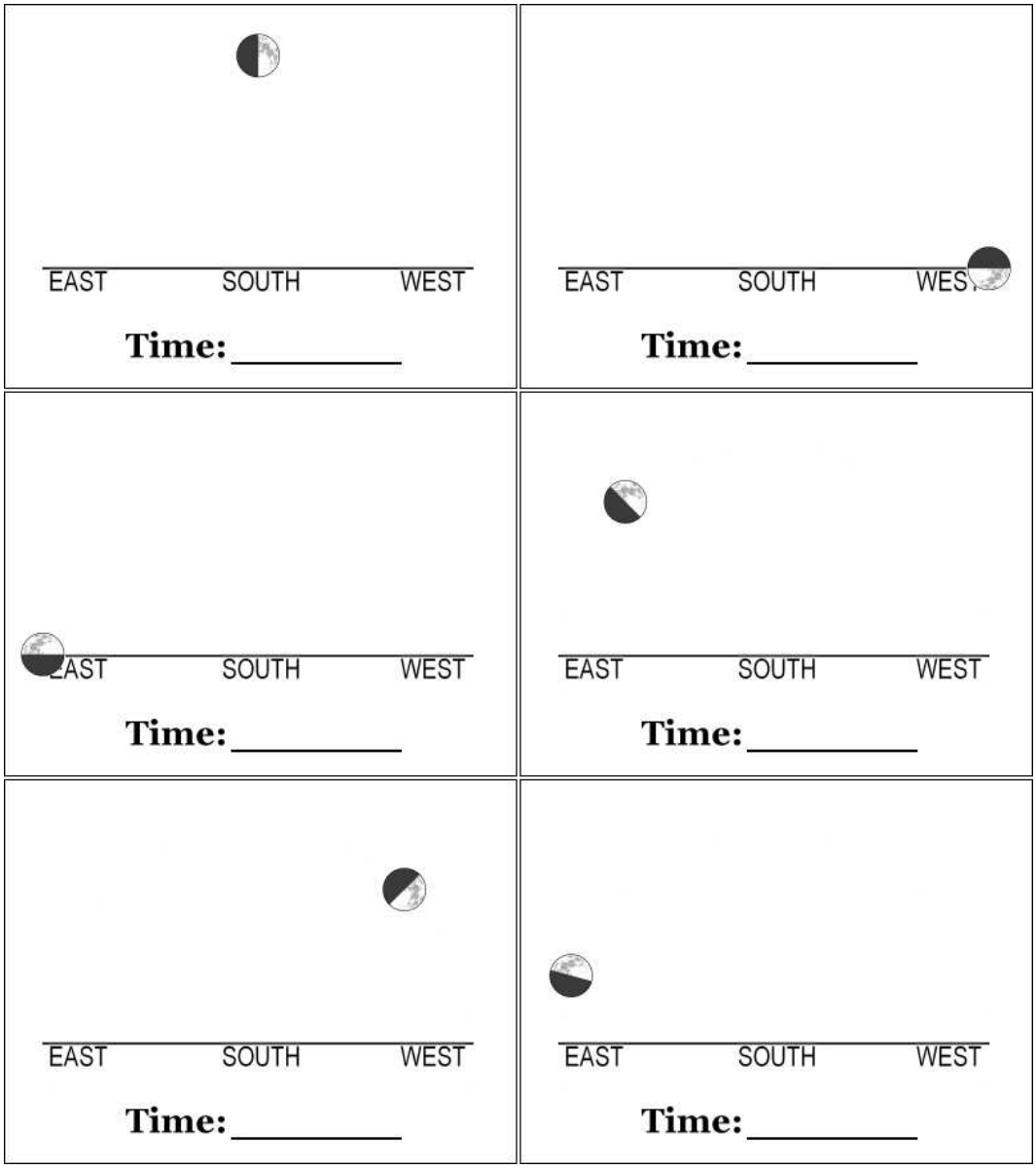
Ranking Instructions: Beginning with the *waning gibbous* phase of the Moon, rank the moon phases shown below in the order that the observer would see them over the next four weeks.

Ranking Order:
First phase following waning gibbous phase 1 ___2 ___3 ___4 ___5 ___ Last phase seen

Or, all of these phases would be visible at the same time. _____ (indicate with a check mark).

3.5 Exercise 4

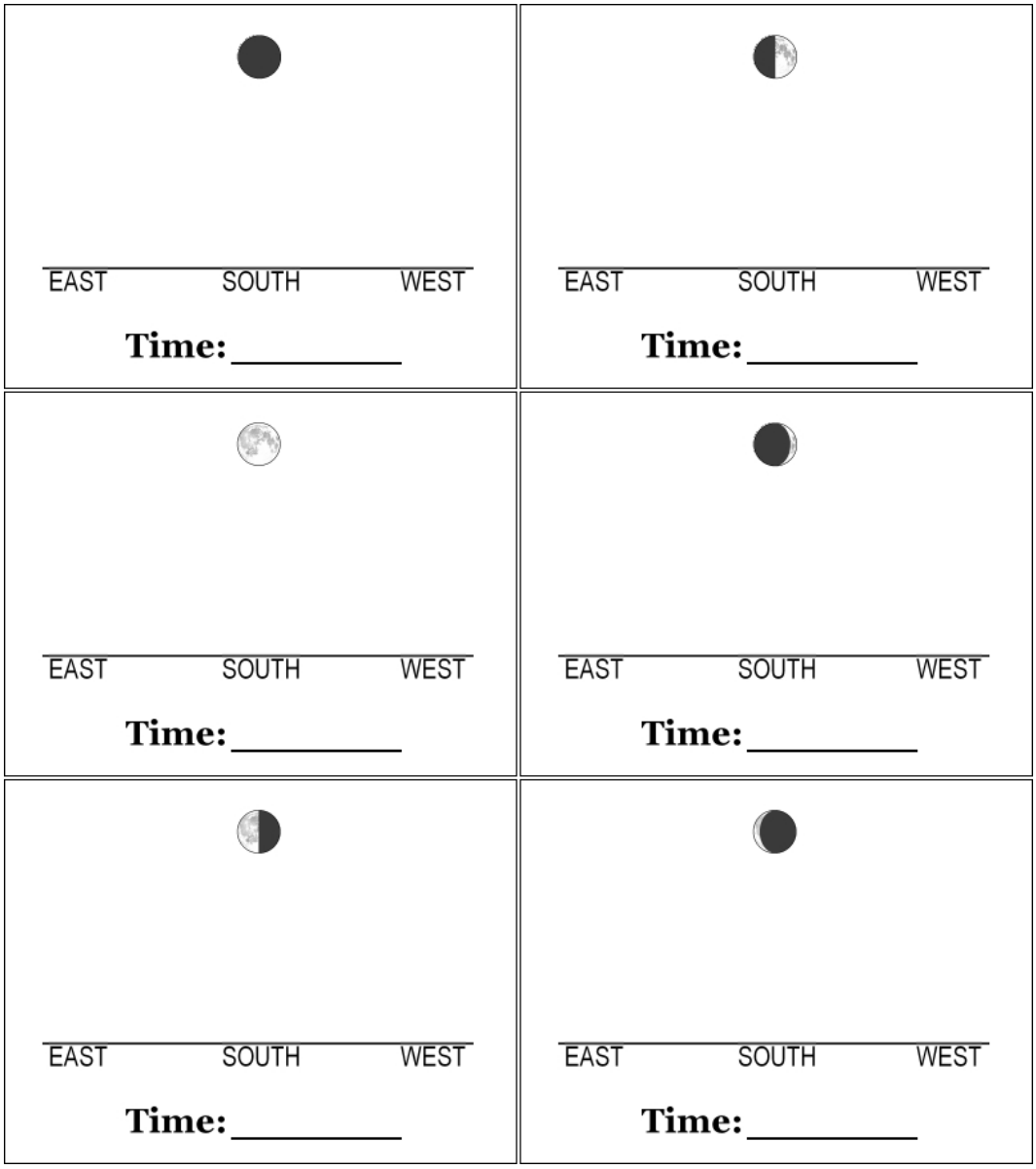
In the set of figures below, the Moon is shown in the first quarter phase at different times of the day (or night). Assume that sunset occurs at 6 p.m. and that sunrise occurs at 6 a.m.



Instructions: Determine the time at which each view of the Moon would have been seen, and write it on each panel of the figure.

3.6 Exercise 5

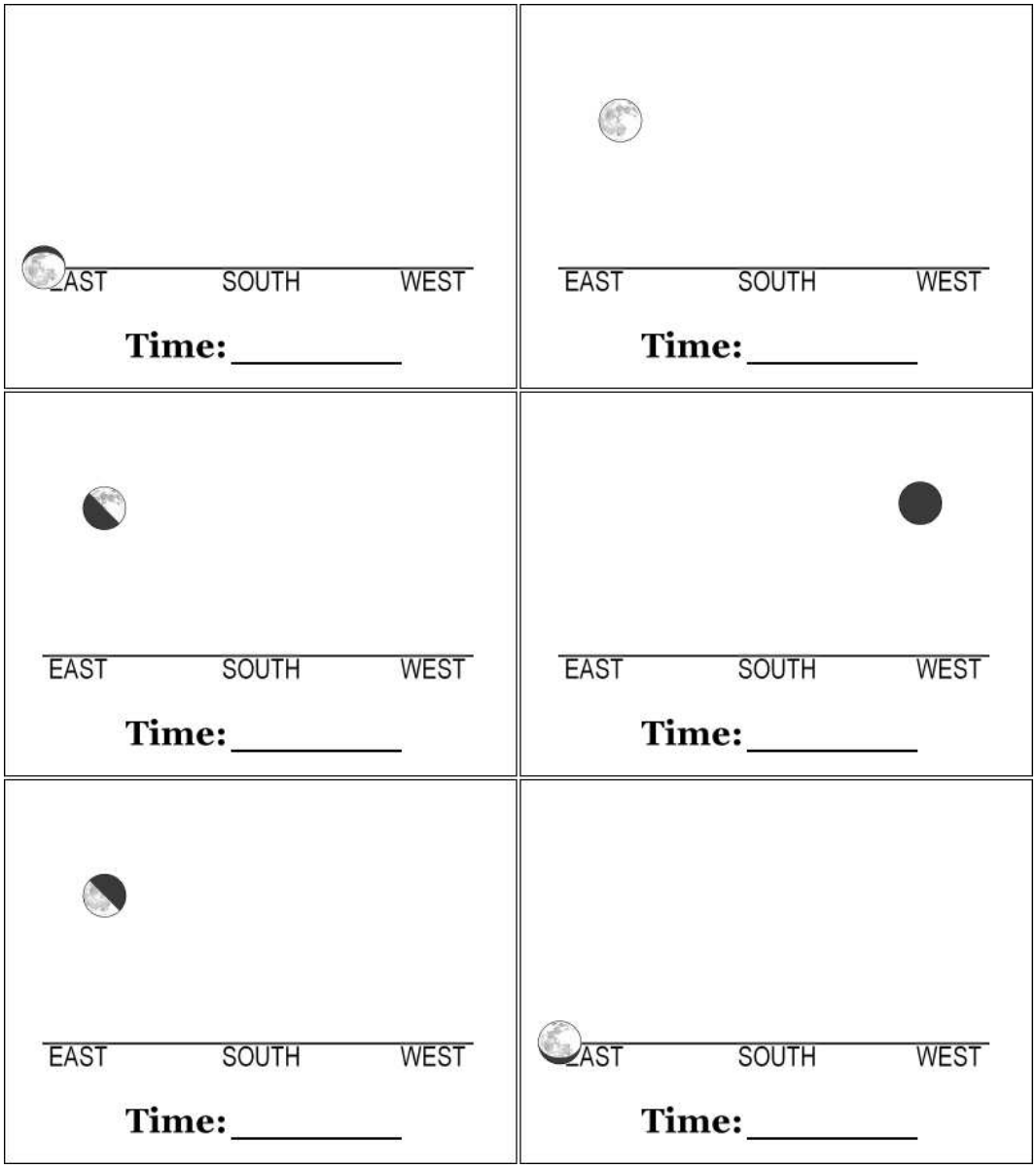
In the set of figures below, the Moon is shown overhead, at its highest point in the sky, but in different phases. Assume that sunset occurs at 6 p.m. and that sunrise occurs at 6 a.m.



Instructions: Determine the time at which each view of the Moon would have been seen, and write it on each panel of the figure.

3.7 Exercise 6

In the two sets of figures below, the Moon is shown in different parts of the sky and in different phases. Assume that sunset occurs at 6 p.m. and that sunrise occurs at 6 a.m.



Instructions: Determine the time at which each view of the Moon would have been seen, and write it on each panel of the figure.

3.8 Additional Question

After you have completed the six Exercises and are comfortable with Moon phases, and how they relate to the Moon's orbital position and the time of day that a particular Moon phase is highest in the sky, you will be verbally quizzed by your instructor (*without the Exercises available*) on these topics. You will use the dual-colored sphere, and the flashlight, and a person representing the Earth to illustrate a specified Moon phase (appearance of the Moon in the sky). You will do this for three different phases. **(18 points)**

Name:_____
Date:_____

3.9 Take-Home Questions

The following questions are worth **11 points** each.

1. If the Earth was one-half as massive as it actually is, how would the time interval (number of days) from one Full Moon to the next in this 'small Earth mass' situation compare to the actual time interval of 29.5 days between successive Full Moons? Assume that all other aspects of the Earth and Moon system, including the Moon's orbital semi-major axis, the Earth's rotation rate, etc. do not change from their current values.

2. If you were on Earth looking up at a Full Moon at midnight, and you saw an astronaut at the center of the Moon's disk, what phase would the astronaut be seeing the Earth in? **Draw a diagram to support your answer.**