Date _____ First name _____ Last name _____

LABORATORY 2

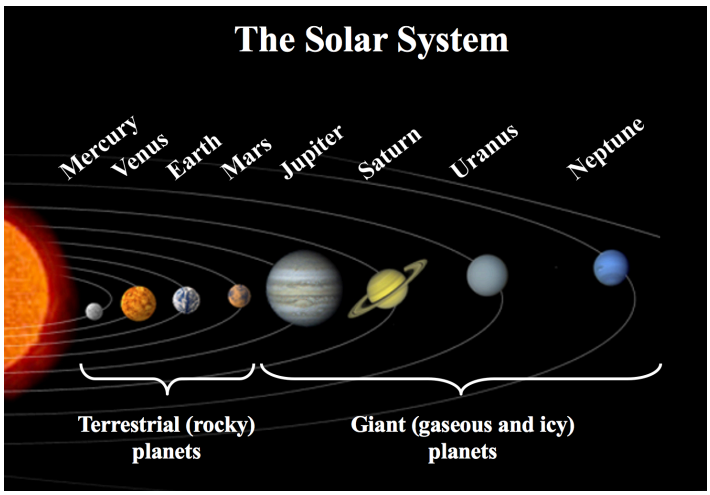
The Sun, Starts, and the Planets; The view from Earth

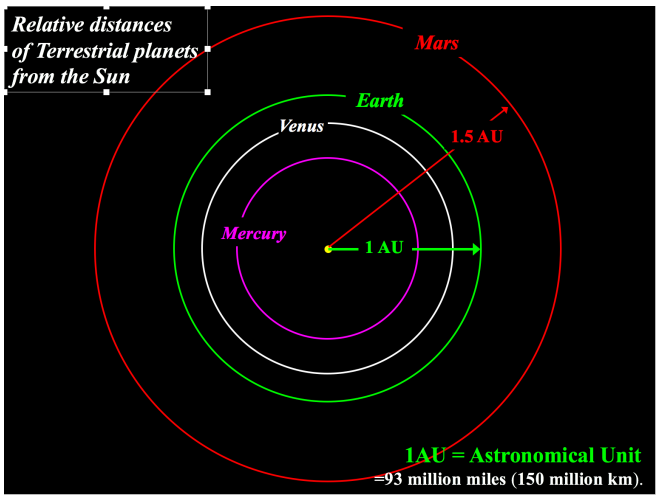
Introduction

In this series of laboratory exercise you will gain new insight into Earth's place in the Solar System, the relationship between the Earth, Moon, Sun and other planets. You will work on basic skills of conceptualizing, doing calculations, and problem solving.

Earth is a rock that orbits a star know as the Sun (the Sun is 109 times bigger than the Earth and is approximately 150 million kilometers away from us). To our everyday thinking, it is almost impossible to conceive of such sizes and scales. There exercises will supplement your lecture notes on Earth's place in the Cosmos, by giving you a fuller understanding of Earth's place in the Solar System.

Exercise 1: Distances





A. What is the definition of 1 A.U. (Astronomical Unit)?

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B. How long is 1 A.U. in kilometers?

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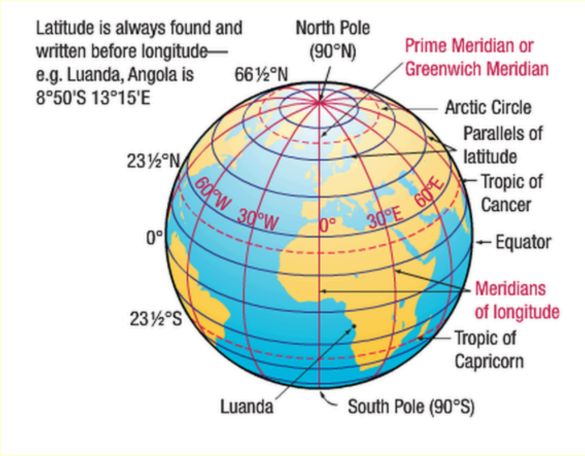
Exercise 2: Earth's rotation

The Earth is a sphere (almost) that rotates once per day (every 24 hours) around its own axis (an imaginary line drawn through the center of the planet between the north pole and the south pole).



https://sncyear8geography.weebly.com/latitude-and-longitude.html

A. Locate the equator of the Earth (an imaginary circle around the circumference of the Earth, halfway between the north and south poles). The radius of the Earth is 6379 kilometers. How many kilometers would you have to travel if you went around the Earth at its equator?

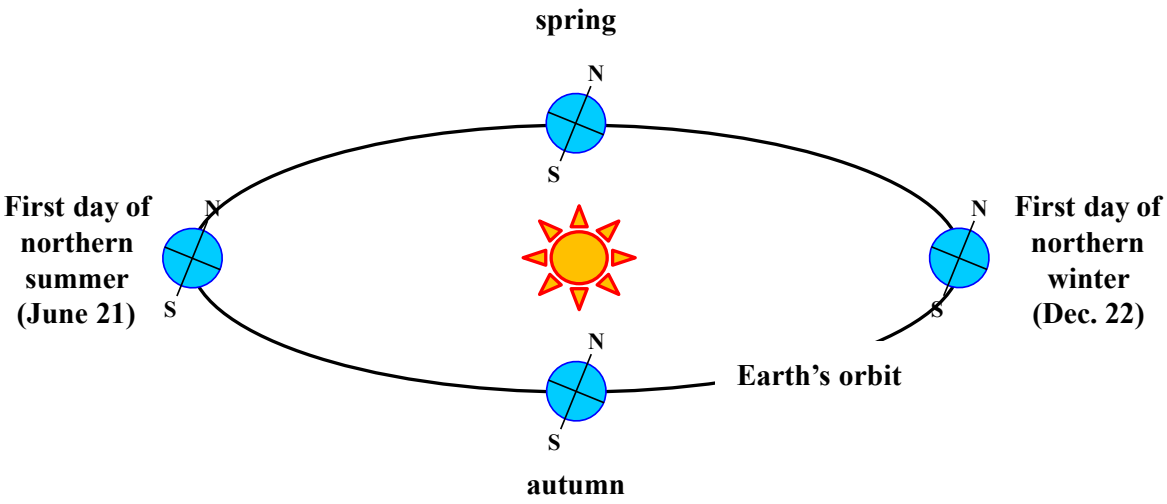
B. If you travel at 100 kilometers per hour, how many days would your journey around the circumference of the Earth take?

C. Find out the latitude and the longitude of the New York.

D. As a result of Earth's rotation, we see the Sun rise in the east and set in the west, and the Sun appears to move across the sky from east to west during the course of the day. Looking down at the north pole, does Earth rotate clockwise or counter clockwise?

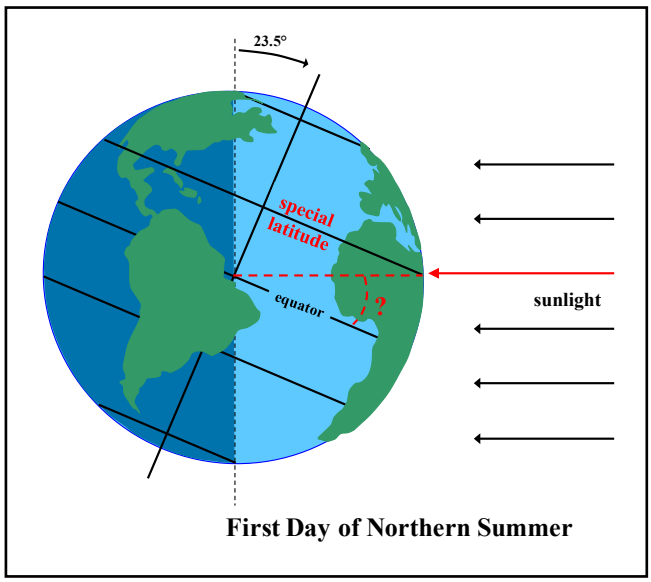
Exercise 3: Earth's revolution around the Sun

The Earth revolves (orbits) around the Sun once approximately every 365.25 days (a standard solar year is 365 days, with every 4 year of Feb, 29, leap year). The path of the Earth around the Sun defines a plane. The Earth is tilted on its axis by 23.5 º relative to that plane. Because of this tilt, Earth's annual (once per year) revolution around the Sun causes changes that we know as the seasons. These changes include changes in the number of hours of sunlight per day, changes in temperature, and changes in the apparent position of the Sun in the sky. If the Earth were not tiled on its axis, there would essentially be no seasons.

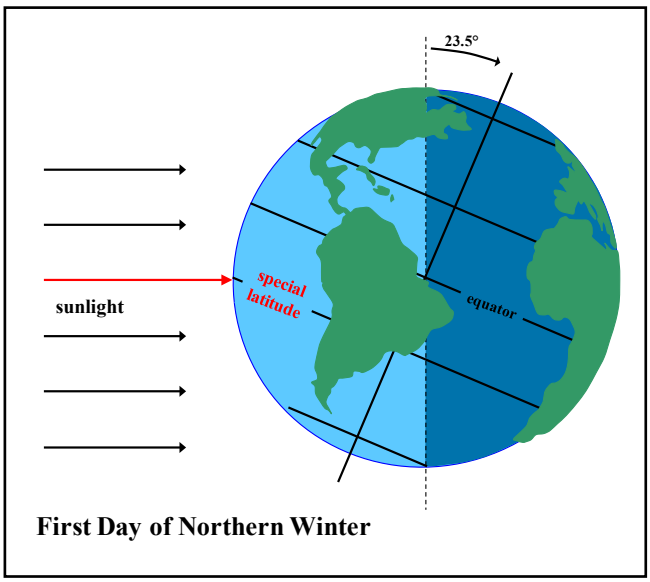


A. Why is it winter in the southern hemisphere when it is summer in the northern hemisphere?

B. There is a special latitude on the Earth, called the Tropic of Cancer. The Tropic of Cancer is defined as the latitude at which the Sun is directly overhead at noontime on the first day of northern summer. Using the diagram below, figure out the latitude of the Tropic of Cancer from geometry (this question is asking for an exact number).



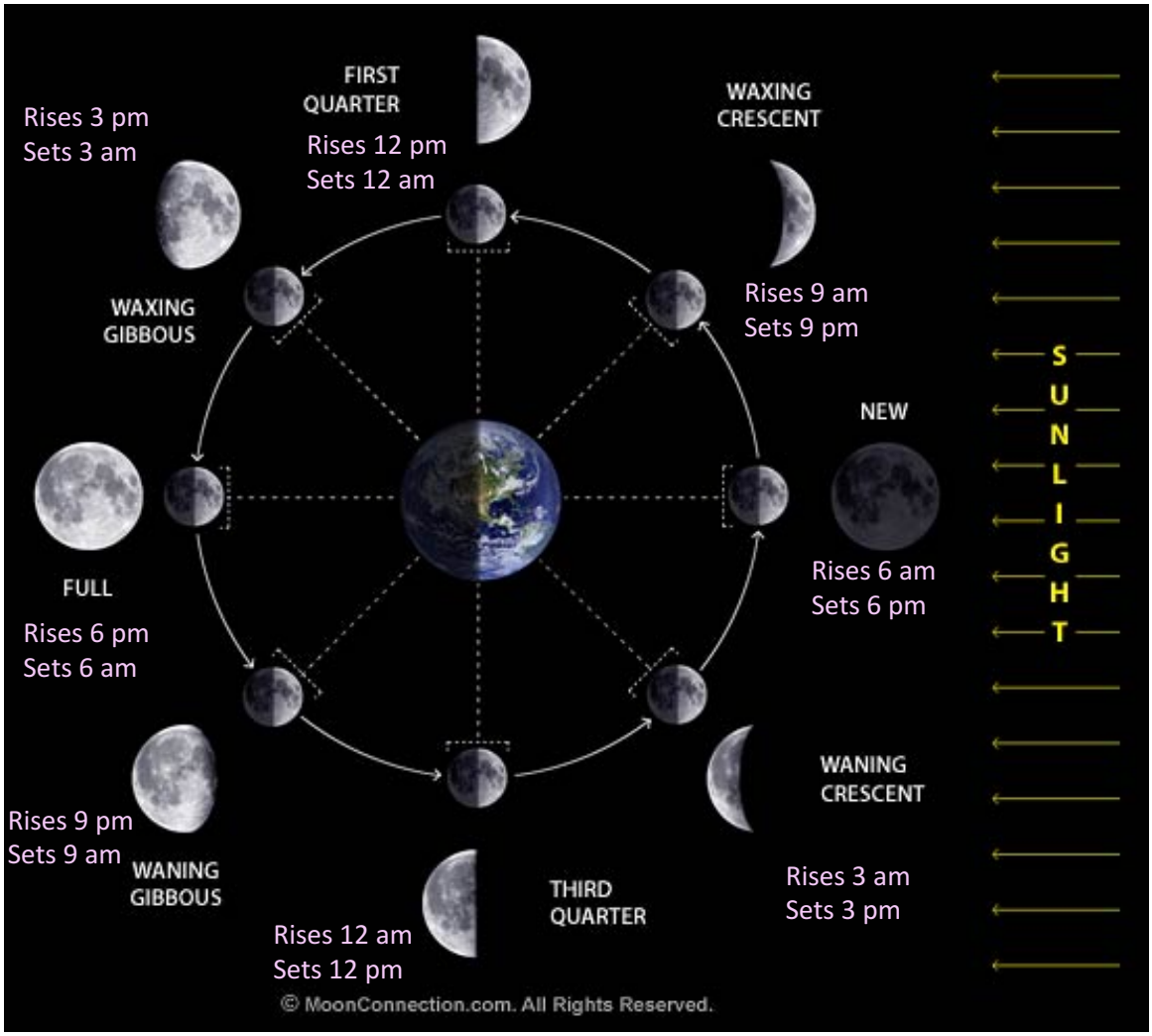
C. There is also a special latitude on the Earth, called the Tropic of Capricorn The Tropic of Capricorn is defined as the latitude at which the Sun is directly overhead at noontime on the first day of northern winter. Using the diagram below, figure out the latitude of the Tropic of Capricorn from geometry (this question is asking for an exact number).



D. Why is it warmer in the summer than it is in the winter?

Exercise 4: Phases of the Moon

Everyone has seen the Moon, which is a natural satellite that orbits the Earth. As the Moon rotates around the Earth it is exposed to various amounts of light from the Sun. The reason for this is simple, the Moon at night because it is reflecting light produced by the Sun and because the Earth is slightly out of the direct line of sight between the Moon and Sun. If it were not, a lunar eclipse would occur. Essentially half of the Moon is illuminated by the Sun, but because of its rotation around the Earth we do not all witness the "full" illumination. The Moon also rotates around its axis, but it does so very slowly and thus one side is always facing the Earth. It takes the Moon time it takes to make one complete orbit around the Earth. However, because the Earth is also moving during that time period, it actually takes 29.3 days for it to arrive at the same position again. This is also one complete cycle of lunar phases. The lunar phases represent the amount of sunlight that the Moon receives or reflects relative to its position or orbit around the Earth. Lunar is required that the Moon receives full light from the Sun. For this to occur, the Moon must be directly opposite the Sun, with the Earth slightly out of the direct line of sight. Therefore, the full Moon rises in the east around sunset, reaches the halfway point in its orbit in the ecliptic around midnight, and sets around sunrise. The image below shows the lunar phases and the time the Moon rises and sets in these phases.



A. If the Moon is full, approximately what time of day does the Sun set and the Moon rise in the sky?

B. Where is the Moon with respect to the position of the Sun and Earth when it is in the New Moon phase. Be specific (if necessary, draw them)?

C. A Quarter Moon phase is always how many degrees of a circle away from the Sun when it rises in the eastern sky (e.g., is it 180º, 45º, etc)?

D. Please define the term of lunar eclipse and solar eclipse. And draw them.