

# The Vertical Ray

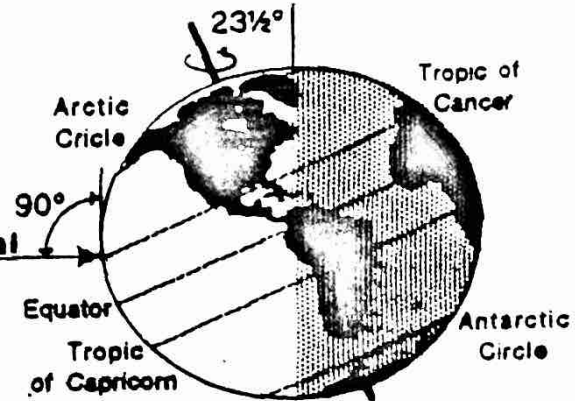
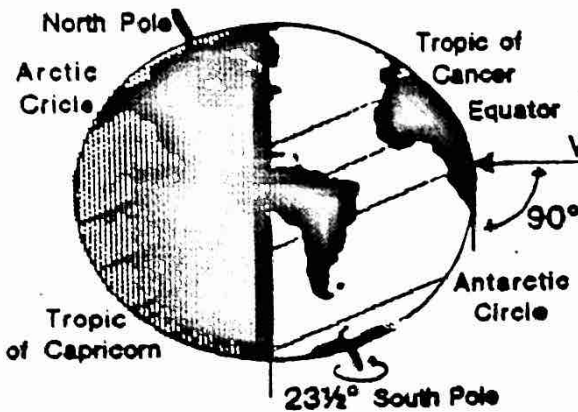
Name \_\_\_\_\_

Date \_\_\_\_\_

Per. \_\_\_\_\_

The vertical ray is the ray of sunlight from the zenith that strikes the Earth at an angle of 90°. The sun is always directly overhead at some place on the Earth.

## Winter Solstice December 22 or 23



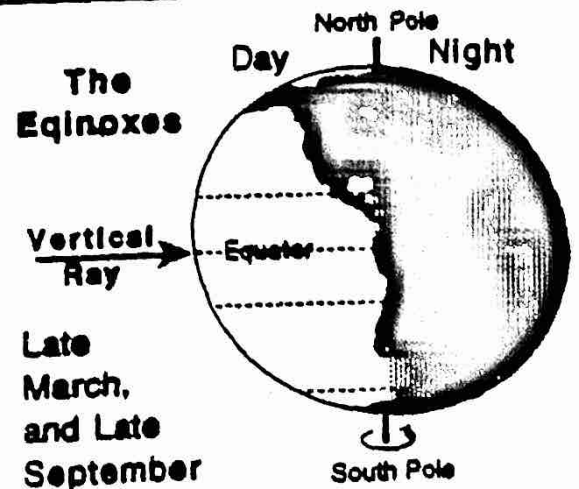
## Summer Solstice June 21 or 22

The diagrams above show the Earth at the summer and winter solstice positions. Use it to answer the questions below.

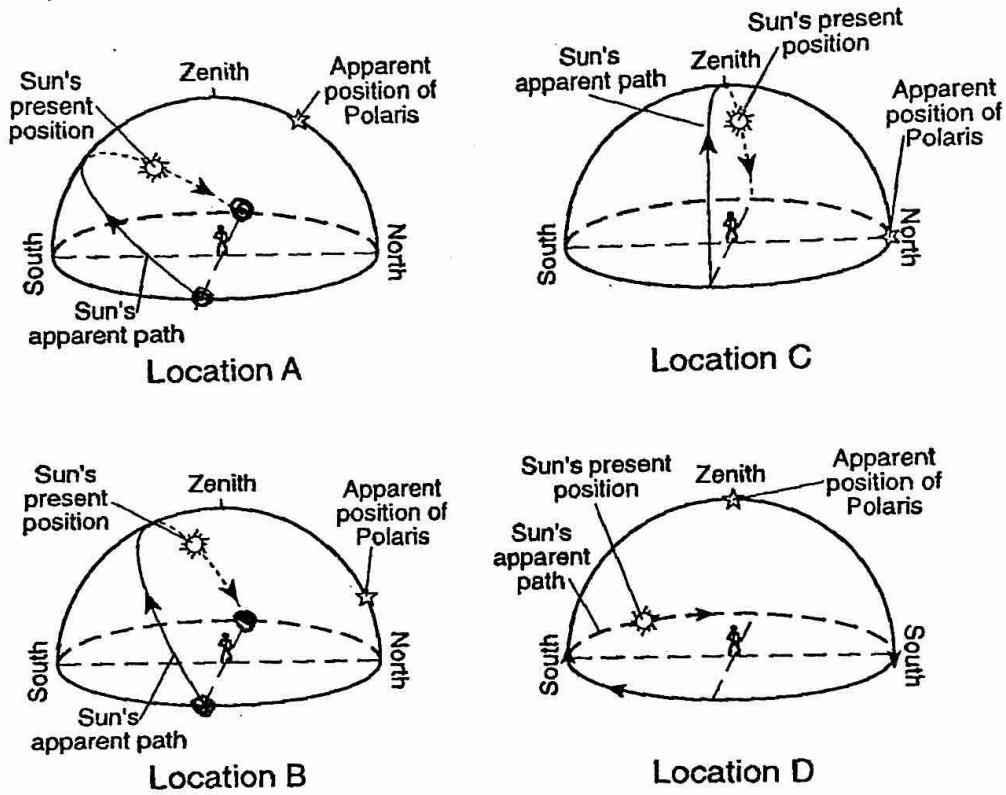
1. The vertical ray strikes the Earth at an angle of... \_\_\_\_\_
2. In June, the vertical ray strikes the... \_\_\_\_\_
3. The vertical ray hits the Tropic of Capricorn in... \_\_\_\_\_
4. On June 21, the sun is visible at midnight north of the... \_\_\_\_\_
5. The vertical ray strikes the the Tropic of Cancer on the... \_\_\_\_\_
6. The South Pole is in total darkness all day on... \_\_\_\_\_

This diagram shows the position of the vertical ray on the equinoxes, in March and September.

7. Equinox means \_\_\_\_\_
8. What is the latitude of the Tropic of Cancer? \_\_\_\_\_  
...the North Pole? \_\_\_\_\_ ...the Arctic Circle? \_\_\_\_\_
9. How could you determine the exact position of the Tropic of Cancer without using a measuring instrument or a map?  
\_\_\_\_\_  
\_\_\_\_\_



Base your answers to questions ① → ③ on the diagram below. The diagram represents the apparent path of the Sun observed at four locations on Earth's surface on March 21. The present positions of the Sun, Polaris, and the zenith (position directly overhead) are shown for an observer at each location.



- ①. The observer at location A casts a shadow at the time represented in the diagram.
- State the compass direction in which the observer at location A must look to view her shadow.
  - Describe the change in the length of the shadow that will occur between the time shown and sunset.
- ②. State the other day of the year when the Sun's apparent path is exactly the same as that shown for these four locations on March 21.

③. How does the position of Polaris (The North Star) help you know where Locations A, B, C + D are?

Where are they?

- A -
- B -
- C -
- D -