

(1) Over the course of a day, the sun angle at any particular place varies. Why?

(Note: Although all responses below are true statements, only one of them actually explains the observation!)

- (A) The sun is higher in the sky at some times than it is at others.
- (B) The sun's rays strike the earth at different angles at different times of day.
- (C)* As the earth rotates, the earth's surface faces in different directions relative to the sun's rays.

*Correct answer. The other two choices just restate the original statement without explaining anything.

(2) Which of the items below is ***NOT*** a possible explanation for why insolation at a particular place on the earth's surface might vary with time?

- (A) The output of the sun varies.
- (B) The distance between the earth and sun varies.
- (C) The sun angle varies (so the distance that solar radiation travels through the atmosphere varies).
- (D) The sun angle varies (so the degree of “spreading out” on the earth's surface varies).
- (E) * The albedo (reflectivity) of the earth's surface varies.

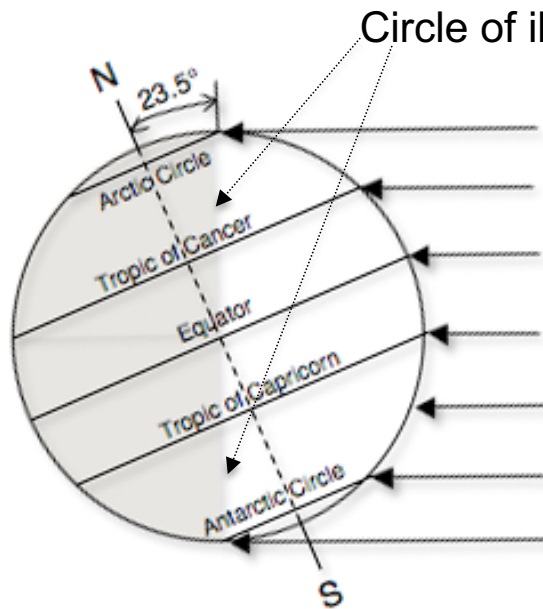
*Correct answer. Insolation has nothing to do with the nature of the surface that the solar radiation strikes—it's only about the intensity of solar radiation arriving on that surface.

(3) At any particular place, solar noon is the time of day when the sun is highest in the sky. When does solar noon occur?

- (A) * Exactly half way between sunrise and sunset.
- (B) At the summer solstice (June 21 or so in the Northern Hemisphere, December 21 or so in the Southern Hemisphere).
- (C) At the time of the equinoxes (March 21 or so and September 21 or so).
- (D) Can't say in general--it depends on the latitude of the place.

*Correct answer.

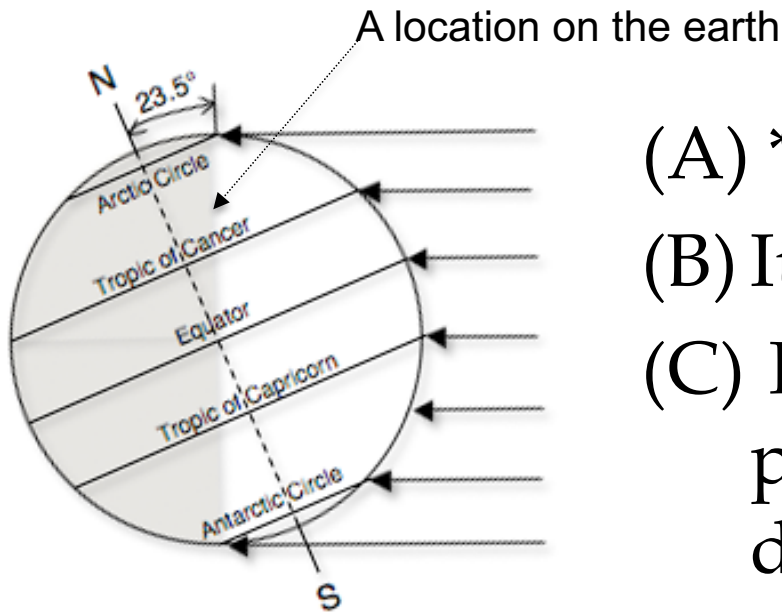
(4) If you were anywhere on the Circle of Illumination, where would the sun appear to be in the sky?



- (A) at its highest point over the course of the day
- (B) * on the horizon
- (C) below the horizon
- (D) can't say in general—it varies with latitude and time of year

*Correct answer. When transitioning between light and dark, the sun is on the horizon.

(5) At the location on the earth indicated in the diagram, what is the sun doing in the sky?



(A) * It is rising (sunrise).

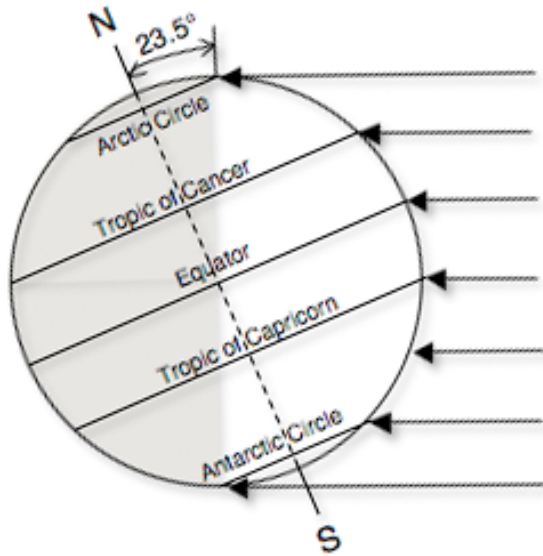
(B) It is setting (sunset).

(C) It is reaching its highest point and will start going down.

(D) Can't say in general—not enough information.

*Correct answer. Rotating west to east, you'd be passing from dark to light.

(6) At what locations on the diagram below is it solar noon?



(A) Everywhere along the axis of rotation.

(B) Everywhere along the circle of illumination.

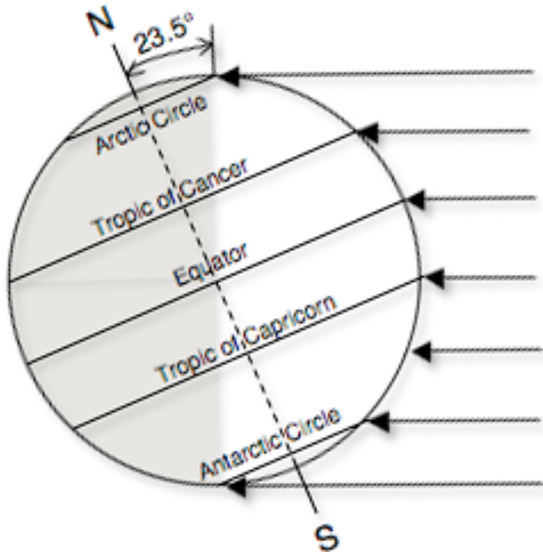
(C) At the right-hand edge of the diagram, on the equator.

(D) At the right-hand edge of the diagram, on the Tropic of Capricorn.

(E) * Everywhere from the North Pole to the South Pole along the right-hand edge.

*Correct answer. It's solar noon somewhere on every latitude circle, at the point where the sun angle is greatest.

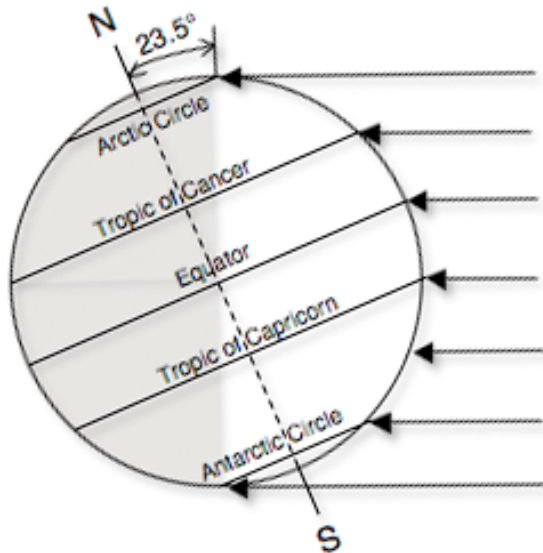
(7) At what locations on the diagram below is it solar midnight?



- (A) Everywhere on the dark (left) half of the diagram.
- (B) At the left-hand edge of the diagram, on the equator,
- (C) At the left-hand edge of the diagram, on the Tropic of Cancer.
- (D)* Everywhere from the North Pole to the South Pole, along the left-hand edge of the diagram

*Correct answer. Solar midnight is 12 hours from solar noon, which must place it on the opposite side of each latitude circle from solar noon

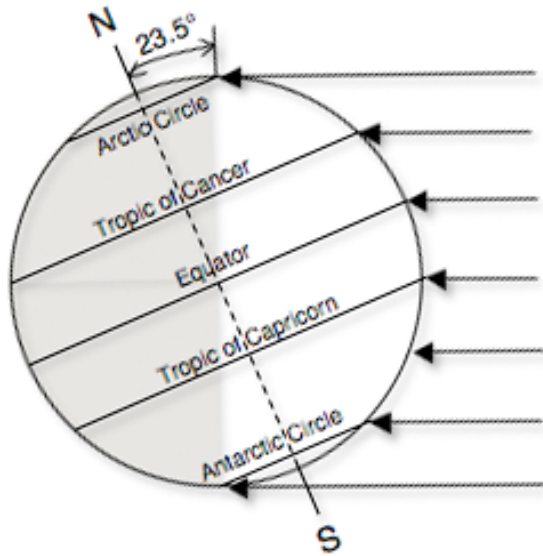
(8) At what locations on the diagram below is it (solar) 6 am?



- (A) Everywhere along the circle of illumination.
- (B) * At each latitude along the line represented by the axis of rotation.
- (C) At each latitude, closer to solar noon than solar midnight.
- (D) Can't tell--not enough information shown.

*Correct answer. Solar 6 am is exactly halfway between solar noon and solar midnight. The axis splits each latitude circle in half, between solar noon and midnight.

(9) At what location(s) on the diagram below would the sun appear directly overhead?



(A) Everywhere along the circle of illumination.

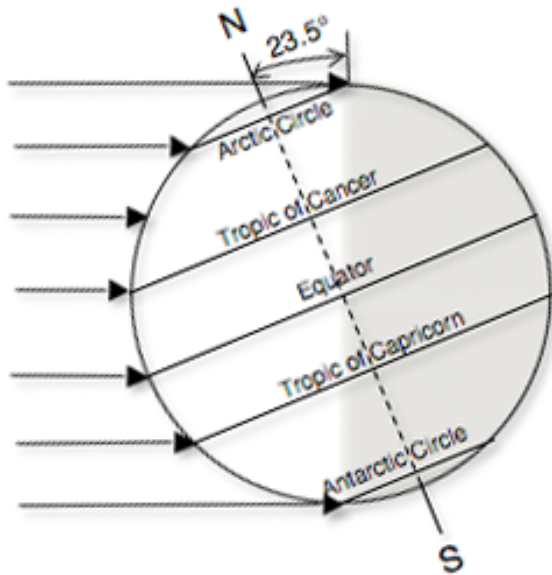
(B) At each latitude along the line represented by the axis of rotation.

(C) From the North Pole to the South Pole, along the right-hand edge.

(D) * On the right-hand edge of the diagram, at the Tropic of Capricorn.

*Correct answer. It is solar noon there, and the sun angle is 90 degrees. Nowhere else is as high at the time shown.

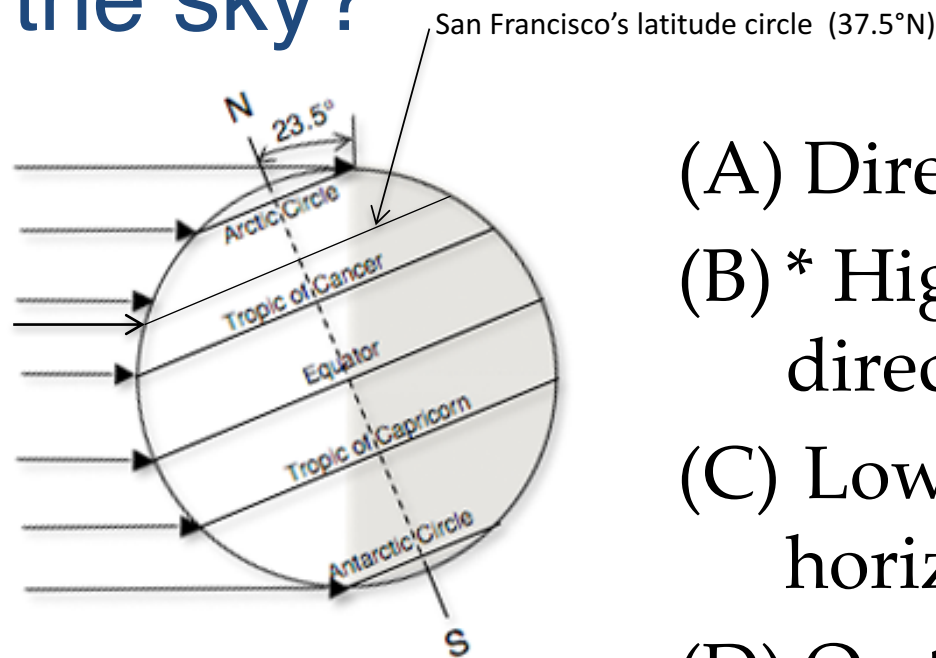
(10) At what location(s) on the diagram below would the sun appear directly overhead?



- (A) On the left-hand edge of the diagram, on the Tropic of Capricorn.
- (B) On the left-hand edge of the diagram, on the equator.
- (C)* On the left-hand edge of the diagram, on the Tropic of Cancer.
- (D) On the North Pole.

*Correct answer.

(11) The diagram below shows the earth at the time of the June solstice. At the latitude of San Francisco at solar noon, where does the sun appear to be in the sky?



- (A) Directly overhead.
- (B) * High in the sky (but not directly overhead).
- (C) Low in the sky (close the horizon).
- (D) On the horizon.

*Correct answer. We can show that

The sun angle at solar noon in S.F. at the June solstice is 76 degrees. It's never higher.