Astronomy 101 Quiz 1+2 Form Akey

Name: _____

Lab section number: _____

(In the format "M0**". See back page; if you get this wrong you may not get your quiz back!)

Contents:

- Question 1: which form do you have?
- Questions 2-12: Quiz 2 (10 questions and one extra-credit question)
- Questions 13-22: Quiz 1 retake (10 questions)

Instructions:

- Quiz time: 45 minutes
- Please put bags under your seats to allow proctors to move around the room.
- There is scratch paper, a blank seasons diagram, and two blank phase-of-moon diagrams for you on the back. You may tear these off.
- You may use notes that you handwrote yourself, or wrote with a stylus and printed, along with your exercises and globes. No electronic devices or things written by others are allowed, with the exception of a photocopy of a lab prepared by your group together if we ran out of printouts.
- If you have a question, raise your hand, and a proctor will assist you.
- Do not attempt to communicate with anyone other than teaching staff during the quiz.
- **Circle your answers on this paper as well as completing the Scantron. Turn both in to us at the end of class.**

Good luck!

Lab Schedule

Section	Instructor	Time
M024	Sierra Thomas	Monday 8:00 AM-9:20 AM
M003	Sierra Thomas	Monday 9:30 AM-10:50 AM
M004	Kishan Sankharva	Monday 11:00 AM-12:20 PM
M005	Kishan Sankharva	Monday 12:45 PM-2:05 PM
M006	Chad Skerbec	Monday 2:15 PM-3:35 PM
M007	Chad Skerbec	Monday 3:45 PM-5:05 PM
M008	Tyler Hain	Monday 5:15 PM-6:35 PM
M009	Tyler Hain	Monday 6:45 PM-8:05 PM
M010	Vidyesh Rao	Monday 8:15 PM-9:35 PM
M027	Tyler Hain	Tuesday 3:30 PM-4:50 PM
M028	Tyler Hain	Tuesday 5:00 PM-6:20 PM
M029	Vidyesh Rao	Tuesday 6:30 PM-7:50 PM
M030	Vidyesh Rao	Tuesday 8:00 PM-9:20 PM
M025	Sierra Thomas	Wednesday 8:00 AM-9:20 AM
M011	Sierra Thomas	Wednesday 9:30 AM-10:50 AM
M012	Chad Skerbec	Wednesday 11:00 AM-12:20 PM
M013	Chad Skerbec	Wednesday 12:45 PM-2:05 PM
M014	Byron Sleight	Wednesday 2:15 PM-3:35 PM
M015	Byron Sleight	Wednesday 3:45 PM-5:05 PM
M016	Byron Sleight	Wednesday 5:15 PM-6:35 PM
M017	Patrick Adams	Wednesday 6:45 PM-8:05 PM
M018	Patrick Adams	Wednesday 8:15 PM-9:35 PM
M019	Byron Sleight	Thursday 5:00 PM-6:20 PM
M020	Patrick Adams	Thursday 6:30 PM-7:50 PM
M031	Vincent Musso	Thursday 8:00 PM-9:20 PM
M026	Vidyesh Rao	Friday 8:00 AM-9:20 AM
M021	Kishan Sankharva	Friday 9:30 AM-10:50 AM
M022	Vincent Musso	Friday 11:00 AM-12:20 PM
M023	Vincent Musso	Friday 12:45 PM-2:05 PM

`(Question formid)`

1. What form is your exam? (Your exam is form Akey.)

   (A) Form A

   (B) Form B

   (C) Form C

   (D) Form D

   (E) Form E

`(Question kochab)`

2. You are observing one November night in Syracuse and see the star Kochab low on the northern horizon, directly below Polaris, at midnight.

   Six months later, you plan to observe Kochab again exactly at midnight. Where will it be located?

   Hint: This problem is difficult and is extra credit. Think about how many days are in six months, and what kind of days you should be thinking about.

   (A) At the same elevation as Polaris, to the West

   (B) Directly below Polaris, in the same position it was before

   (C) You won't be able to see Kochab six months from now

   (D) **Directly above Polaris**

   (E) At the same elevation as Polaris, to the East

   This one's tricky! Remember that a solar day requires the Earth to rotate 361° *on its axis. So in six months (about 180 solar days), the Earth will have rotated 180 times, plus an extra 180 degrees – 180 sidereal days, plus 1/2 of a sidereal day extra. This gives you an extra half-turn of the celestial sphere, putting Kochab above Polaris.*

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(Question scorpius)
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3. On June 1, you note that the constellation Scorpius is directly overhead, exactly at midnight.

   Which will be true about Scorpius six months later, on December 1?

   (A) It will again be highest in the sky at midnight

   (B) It will be highest in the sky at 6 AM

   (C) **It will be located behind the Sun, and will thus be highest in the sky at solar noon**

   (D) It will be highest in the sky at 1 AM

   (E) It will never come above the horizon in December

   If Scorpius is overhead at midnight, it is located on the opposite side of Earth from the Sun. Six months later, however, they will be lined up – that means Scorpius will be directly overhead at noon. (Draw a diagram.)

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(Question clockwise-motion)
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4. You look at the night sky and see a sky full of stars, rotating around the zenith (the point directly above your head). They appear to be rotating clockwise.

   Where on Earth might you be standing?

   (A) In Rovaniemi, Finland, at 66° N latitude (on the Arctic Circle)

   (B) **The South Pole**

   (C) On the Larsen Ice Shelf, in Antarctica, at 66° S latitude (on the Antarctic Circle)

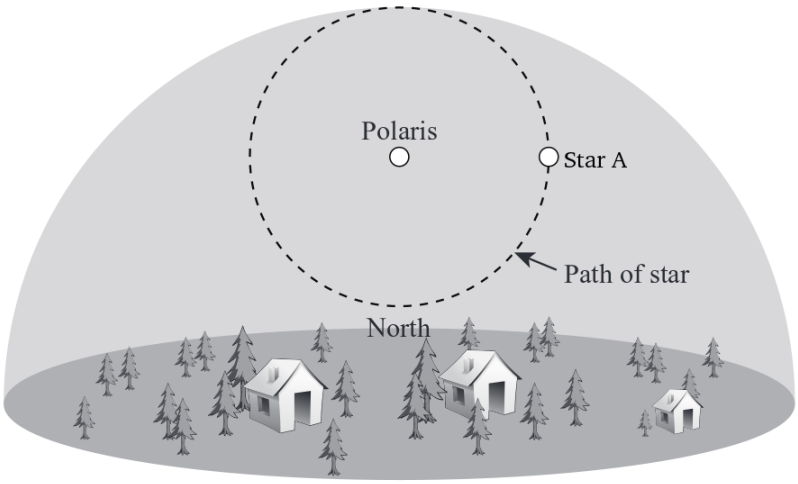
   (D) The North Pole

   (E) The Equator

   If the celestial pole (center of rotation) is at the zenith, you know you are standing either at the North Pole or the South Pole. Since they are rotating clockwise, you know you are in the Southern Hemisphere, so you are at the South Pole.

`(Question star-motion)`

5. You look north and see the following in front of you:



In what direction is Star A *moving* at this time?

(A) East
(B) **Upward**
(C) Downward
(D) South
(E) North

It is moving upward, since the star moves counterclockwise around the North Star.

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(Question procyon)
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6. You can see the star Procyon very low on the eastern horizon tonight in Syracuse at 3:00 AM.

   Tomorrow night at 3:00 AM, where will Procyon be located?

   (A) Slightly lower in the sky and slightly to the South
   (B) Slightly lower in the sky
   (C) Slightly higher in the sky
   (D) At the exact same place
   (E) **Slightly higher in the sky and slightly to the South**

   The time interval is one solar day: four minutes more than a sidereal day. So the star will move completely around Earth once, and then move four minutes more. Since it is rising in the East, and since stars move to high in the southern sky after rising in the East from here, we will see Procyon move upward and to the south.

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(Question earth-rotate-backwards)
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7. Suppose that one day the direction of Earth's rotation around its axis was reversed, so that instead of rotating counterclockwise as seen from above the North Pole, it instead rotated clockwise as seen from above the North Pole.

   The direction that it revolves around the Sun doesn't change.

   Which of the following would still be true?

   (A) The solar day would continue to be four minutes longer than the sidereal day
   (B) **The Sun would still proceed through the constellations in the Zodiac in the same order as it does now (that is, the Sun would first be lined up with Sagittarius, then Capricorn, then Aquarius, etc.)**
   (C) The stars would continue to rotate counterclockwise around Polaris as seen from Syracuse
   (D) The stars would continue to rise in the East and set in the West, as they do now
   (E) Either none of the above are true, or more than one is

   The Sun's alignment with the constellations in the Zodiac relates to its revolution around the Sun; it has nothing to do with the rotation of the Earth on its axis. So that one is still true.
   The stars rise and set because of the rotation of the Earth; this is also why they appear to rotate around Polaris. Reversing the direction of Earth's rotation would reverse these.
   The solar day is longer than the sidereal day because of the combined effect of Earth's rotation and revolution. Reversing one, but not the other, would change this difference: then the solar day would require the Earth to rotate only 359 degrees, rather than 361 as it does now.
   Thus, the only one of these that would still be true is the one that depends only on Earth's revolution: the Sun's apparent motion through the Zodiac.

`(Question scp)`

8. As seen from Syracuse (latitude 43° N), where is the South Celestial Pole?

   (A) 43 degrees above the southern horizon
   (B) We don't have a South Celestial Pole, only a North one
   (C) Right on the southern horizon
   (D) Straight downward, beneath our feet
   (E) **Below the southern horizon**

   The SCP is still there – beneath the southern horizon. The only reason we think of the stars rotating around the NCP is because it is above the horizon from Syracuse.

`(Question celestial-sphere-describes)`

9. The celestial sphere model most accurately describes:

   (A) **The changes in the sky over one day**
   (B) The changes in the sky over one year
   (C) The changes in the sky over many thousands of years
   (D) The changes in the sky over one month
   (E) The celestial sphere model doesn't describe the motion of anything very well, since it is founded on the incorrect idea that the Earth is at the center of the Universe.

   The rotation of the celestial sphere is a way of modeling the consequences in the sky due to Earth's rotation, which happens once per day. As we have studied it, it does not attempt to capture the consequences of the Earth's revolution around the Sun, or the motion of the Moon or the planets. These things happen over timescales longer than one day, so the celestial sphere model captures what happens each day rather well, but fails over longer times.

`(Question star-motion-north-pole)`

10. Suppose that you are standing on the North Pole in December at 3:00 AM. You see the star Betelgeuse low in the sky, slightly above the horizon, directly in front of you.

    Where could you look to see Betelgeuse six hours from now?

    (A) Betelgeuse will be directly overhead

    (B) You can't see Betelgeuse, since the Sun will be above the horizon at this time

    (C) Betelgeuse will be high in your northeastern sky

    (D) You can't see Betelgeuse, since it will be below the horizon at this time

    (E) **Betelgeuse will be low in the sky, slightly above the horizon to your right**

    The important thing to note here is that you are at the North Pole!
    Since the North Celestial Pole is directly above your head here, and stars appear to move in circles around it, stars will not get higher or lower in the sky; they will move in circles around you.
    Six hours is a quarter of a day. So, if Betelgeuse is directly in front of you, it will have moved 90° *around you in a quarter of a day, and will be to your right – but at the same elevation above the horizon.*
    Note that it will be 9 AM. Can you see the stars at 9 AM on the North Pole? In December you can, since it will be experiencing "polar night"; the sun will never rise.

`(Question look-west)`

11. Suppose you spend an entire night watching the eastern horizon in Syracuse, observing the paths of the stars.

    What will you see?

    (A) **Stars will appear over the horizon, then move upward and to your right.**

    (B) Stars will appear over the horizon, then move upward and to your left.

    (C) Stars will appear over the horizon, then move straight upward.

    (D) Stars will appear to move from left to right, but not get higher or lower

    (E) Stars will appear to move from right to left, but not get higher or lower

    Stars rise in the East, so you would see stars appearing over the horizon and then moving upward. However, once stars rise in the East in Syracuse, they move into the southern sky. Looking to the East, South is to your right. Thus, the stars would move upward and to the right.

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(Question see-virgo)
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12. Imagine that you could see the Sun and the stars at the same time.

    On September 28, 2021, you observe that the constellation Virgo lies behind the Sun. On which *other* days would the constellation Virgo also lie behind the Sun?

    - 1. September 29, 2021 (one day later)
    - 2. October 28, 2021 (one month later)
    - 3. September 28, 2022 (one year later)

    (A) **1 and 3**
    (B) 2 and 3
    (C) 2 only
    (D) 3 only
    (E) 1 only

    One year later the Earth will be located in the same place in its orbit. One day later it will be located very near to the same place, since it doesn't move much every day. But a month later, it will be in a different part of its orbit, and a different constellation will be behind the Sun.

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(Question hobbits)
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13. In one scene in *The Lord of the Rings*, Frodo, Sam, and Sméagol are trying to sneak into Mordor. They are afraid of being seen, and so don't want to travel when either the Sun or the Moon is visible in the sky, since sunlight or moonlight would help someone see them.

    Suppose that the phase of the Moon is waxing gibbous, and that the moon phases in this world work the same way that ours do. What time of day is it safe for our hobbit heroes to travel?

    (A) For a few hours after sunset
    (B) **For a few hours before sunrise**
    (C) All night, except for a few hours after sunset
    (D) Around midnight
    (E) All night, except for a few hours before sunrise

    By drawing a diagram of the Moon's orbit around the Earth, similar to those in Lab 3, you'll see that a waxing gibbous moon is high in the sky before midnight, and sets after midnight (around 3AM). This means that it is safe for them to travel after it sets, but before the Sun rises.

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(Question moon-phase)
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14. What phase of the Moon would be visible low on the western sky just after sunset?

    (A) **A crescent**
    (B) A full moon
    (C) A new moon
    (D) A half moon
    (E) A gibbous moon

    There are two ways to figure this out. One is to draw a diagram of the Earth, Moon's orbit, and Sun, and rotate a virtual "horizon" (piece of paper). The other is to note that if it is just after sunset, the Sun is just below the western horizon. If the Moon is just above the western horizon, this means that the Moon and the Sun are very near each other in the sky. When the Moon and Sun are on the same side of Earth, this gives a crescent moon.

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(Question sunset-svalbard)
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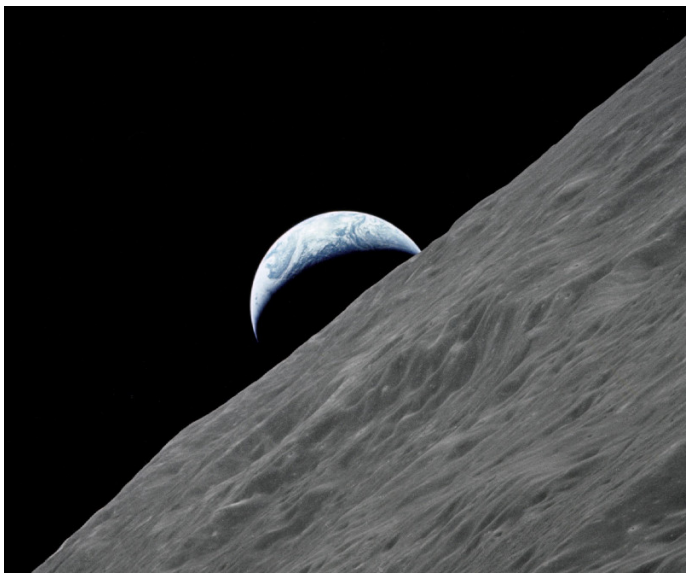
15. It is noon in late June in Svalbard, Norway (latitude 78° N). About what time will the sun set?

    (A) **A few months from now**
    (B) Around 11:00 PM (23:00)
    (C) Around 6:00 PM (18:00)
    (D) Around 3PM (15:00)
    (E) The Sun isn't visible at noon in late June in Svalbard

    Late June is near the summer solstice in the northern hemisphere. Svalbard is above the Arctic Circle, so it experiences 24-hour days in the Arctic summer. Thus the Sun won't set for a few months, until the seasons change.

`(Question earth-phase)`

16. This photograph, of a crescent Earth rising above the Moon's horizon, was taken by *Apollo 17* astronauts from the surface of the Moon.



What was the phase of the Moon, as seen from Earth, when this photo was taken?

Hint: Use the space below to draw a diagram of the Earth, direction of the Sun, and Moon, and then shade in things that are visible/invisible and light/dark as you did in lab.

(A) New

(B) Crescent

(C) Full

(D) Half

(E) **Gibbous**

Phases of Earth (as seen from the Moon) are caused by the same principle as the phases of the Moon. For the Earth to be crescent, it would be located on the "Sun side" of the Moon. This would put the Moon on the "night side" of Earth, and give a gibbous moon. By drawing a diagram, you'll see that the phases of Earth (as seen from the lunar surface) are opposite those of the Moon (as seen from Earth).

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(Question amount-lit-full-moon)
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17. What fraction of the entire surface of the Moon is lit by the Sun during a full moon?

    (A) It depends on the latitude of the observer

    (B) **Half of it**

    (C) It depends on the time of day

    (D) None of it

    (E) All of it

    The Sun always shines on half of the Moon, just as with the Earth. During a full moon the half pointing toward Earth is the same as the half that is sunlit; the "night side" of the Moon is facing away from us.

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(Question cause-moon-phase)
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18. Why do different moon phases rise and set at different times of day?

    (A) **Because each moon phase corresponds to a different location in the Moon's orbit around the Earth relative to the direction to the Sun**

    (B) Because times of day are different in different places on Earth, and people in different places see different moon phases as the Moon travels around the Earth

    (C) Because the position of the Sun determines which part of the Moon is in Earth's shadow, and the position of the Sun determines the time of day

    (D) Because the rise and set times are the same from one sidereal day to another, but we tell time in solar days

    (E) None of the above are good explanations

    The moon phases are caused by the alignment of the Earth, Moon, and Sun. They have nothing to do with Earth's shadow, are the same from every place on Earth, and have nothing to do with the sidereal days.

`(Question shortest-days)`

19. Which of the following locations on Earth experiences the shortest days on the December solstice?

    (A) Chongqing, China (latitude 30° N)

    (B) **Helsinki, Finland (latitude 60° N)**

    (C) Cape Town, South Africa (latitude 33° S)

    (D) McMurdo Station, Antarctica (latitude 78° S)

    (E) All of these places would have days that are the same length on the December solstice.

    In December the Northern Hemisphere is tilted away from the Sun. So the shortest days are in the most northerly point: Helsinki.

`(Question zenith)`

20. Where and when could we see the Sun at the zenith?

    (A) In Havana, Cuba (latitude 23° N), in late September

    (B) In Syracuse (latitude 43° N), in late June

    (C) At the North Pole (latitude $90°N$), in late June

    (D) In Quito, Ecuador (very near the Equator), in late December

    (E) **In São Paulo, Brazil (latitude 23.5° S), in late December**

    The Sun passes through the zenith at noon on the summer solstice along the tropical lines. The latitude of the Tropic of Capricorn is about 23.5° S. Thus, you can see the Sun there on the summer solstice, which in the Southern Hemisphere is late December.

`(Question full-moon-constellation)`

21. You observe that the full moon is located in front of the constellation Capricornus.

    How long will it be before the Sun is located in front of the constellation Capricornus?

    (A) Twelve hours from now
    (B) As soon as the Sun rises
    (C) **Six months from now**
    (D) One sidereal day from now
    (E) Six hours from now

    During a full moon, the Moon is on the opposite side of Earth from the Sun. If the Moon is in front of Capricornus, then this means that Capricornus is also on the opposite side of Earth from the Sun. So, for Capricornus to be behind the Sun, Earth would have to move to the other side of the Sun. This takes half a year – six months.

`(Question distance-cause-seasons)`

22. Suppose that the planet Twilo is different from Earth in two ways:

    (a) Twilo is in a more stretched-out elliptical orbit around its star, so that it is much closer to its star during part of the year than in the other part of the year

    (b) Twilo's axis of rotation is not tilted relative to its orbit.

    Thus, the changing seasons in Twilo are caused by *differences in the distance to its star*, rather than axial tilt like on Earth.

    Which things would be true on Twilo in the same way that they are on Earth?

    (A) Twileans who lived near its equator wouldn't experience seasons, while those living near its poles would experience very strong seasons

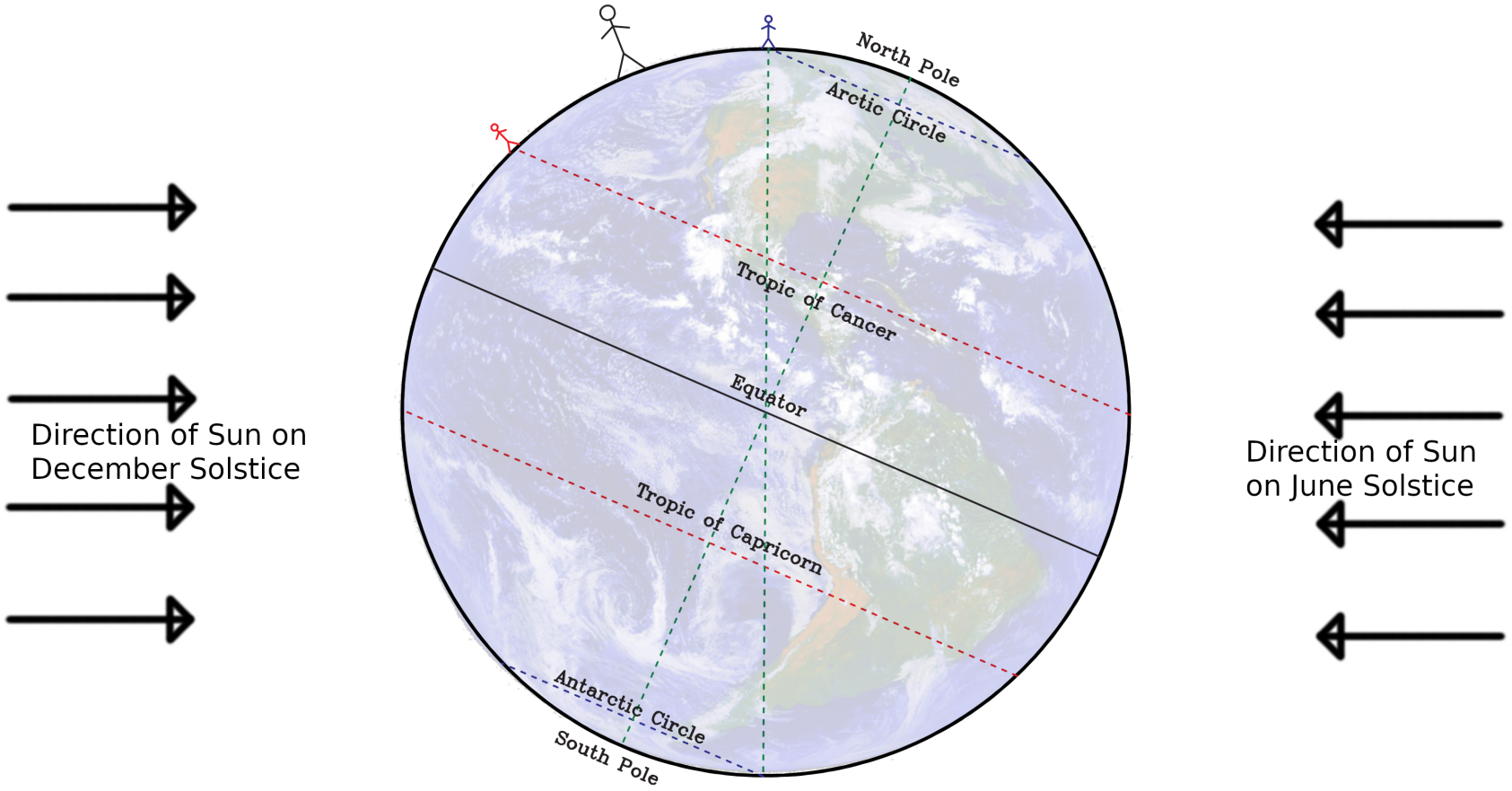
    (B) During the summer, Twileans would experience more hours of daylight than they would in the winter

    (C) Twileans who lived near its poles would never see the sun rise during the winter, and would never see it set during the summer

    (D) Twilo's northern hemisphere would experience winter at the same time that its southern hemisphere would experience summer

    (E) **None of the above are true**

    *If changing distance from their star caused the seasons on Twilo, rather than axial tilt, the whole planet would experience the same season at once, since each hemisphere of the planet would be (nearly) equally distant from their star. So everywhere on the planet – North Pole, South Pole, and equator – would experience the same season at the same time. Likewise, axial tilt causes the changing day length between summer and winter on Earth, and "polar night"/"polar day". So, *all* of the listed phenomena happen because of axial tilt on Earth; on Twilo, none of them would happen.*


North Pole
Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
Antarctic Circle
South Pole
Direction of Sun on
December Solstice
Direction of Sun
on June Solstice

PRNG seed 11 ; generated at Wed Oct 13 11:26:05 2021 from directory questions

Answer key 432252515112115212535