

# ASTRONOMY 101 EXAM 1 FORM A

Name: \_\_\_\_\_

Lab section number: \_\_\_\_\_

(In the format “M0\*\*”. See back page; if you get this wrong you may not get your exam back!)

- Exam time: one hour and twenty minutes
- Please put bags under your seats to allow proctors to move around the room.
- Please choose the **best** answer to each question.
- You may use only pencils and pens for this exam; no notes, **or cellphones** are allowed.
- 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 exam. However, “thinking with your hands” is allowed.
- **You should make liberal use of the scratch paper provided to draw diagrams to help you reason.**

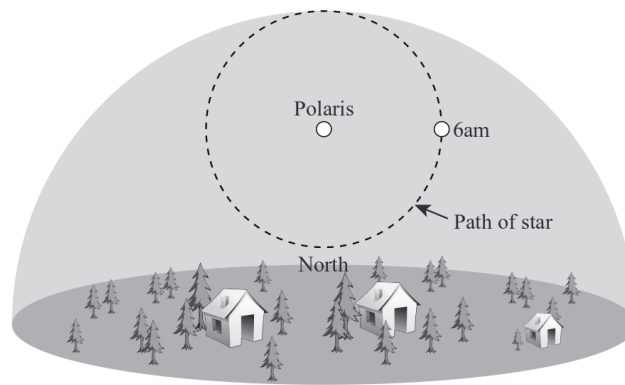
Good luck!

# LAB SCHEDULE

Day	Time	Section	Instructor
Monday	8:00-9:20 AM	M024	Scott Bassler
Monday	9:30-10:50 AM	M003	Scott Bassler
Monday	11:00 AM - 12:20 PM	M004	Lindsay DeMarchi
Monday	12:45-2:05 PM	M005	Lindsay DeMarchi
Monday	2:15-3:35 PM	M006	Jiaxin Sun
Monday	3:45-5:05 PM	M007	Jiaxin Sun
Monday	5:15-6:35 PM	M008	Manu Mannattil
Monday	6:45-8:05 PM	M009	Manu Mannattil
Monday	8:15-9:35 PM	M010	Manu Mannattil
Tuesday	3:30-4:50 PM	M027	Scott Bassler
Tuesday	5:00-6:20 PM	M028	Scott Bassler
Tuesday	6:30-7:50 PM	M029	Ohana Benevides Rodrigues
Tuesday	8:00-9:20 PM	M030	Ohana Benevides Rodrigues
Wednesday	8:00-9:20 AM	M025	Manu Mannattil
Wednesday	9:30-10:50 AM	M011	Manu Mannattil
Wednesday	11:00 AM - 12:20 PM	M012	Ohana Benevides Rodrigues
Wednesday	12:45-2:05 PM	M013	Ohana Benevides Rodrigues
Wednesday	2:15-3:35 PM	M014	Ohana Benevides Rodrigues
Wednesday	3:45-5:05 PM	M015	Nouman Butt
Wednesday	5:15-6:35 PM	M016	Nouman Butt
Wednesday	6:45-8:05 PM	M017	Jiaxin Sun
Wednesday	8:15-9:35 PM	M018	Jiaxin Sun
Thursday	5:00-6:20 PM	M019	Lindsay DeMarchi
Thursday	6:30-7:50 PM	M020	Lindsay DeMarchi
Thursday	8:00-9:20 PM	M031	Lindsay DeMarchi
Friday	8:00-9:20 AM	M026	Nouman Butt
Friday	9:30-10:50 AM	M021	Nouman Butt
Friday	11:00 AM - 12:20 PM	M022	Nouman Butt
Friday	12:45-2:05 PM	M023	Jiaxin Sun

1. Which is the correct explanation for the phases of the Moon?
  - (A) Based on the position of the Moon relative to the Sun, sometimes more than half of the Moon is sunlit, and sometimes less than half of it is
  - (B) Sometimes the Moon is in the Earth's shadow, which blocks light from more or less of the Moon, depending on the position of the Earth
  - (C) Half of the Moon is always sunlit, and we always can see half of the Moon, but those halves aren't always the same
  - (D) All of the Moon is sunlit, but based on the position of the Moon relative to the Earth, sometimes we see more than half of the Moon, and sometimes we see less than half
  - (E) All of the above are incorrect
  
2. Which of the following is *not* a reason that Syracuse is colder in January than in July?
  - (A) Syracuse is tilted toward the Sun in July and away from the Sun in January
  - (B) Syracuse receives more hours of sunlight each day in July than in January
  - (C) Syracuse receives more direct sunlight in July than in January
  - (D) Syracuse is closer to the sun in July
  - (E) More than one of the above is not true
  
3. Which moon phase is visible mostly during the day?
  - (A) Half
  - (B) Crescent
  - (C) Full
  - (D) Gibbous
  - (E) You can't see the Moon while the Sun is in the sky
  
4. Where would someone standing in Addis Ababa, Ethiopia (latitude 9° N) look to see the star Polaris?
  - (A) Polaris is not visible from Addis Ababa
  - (B) Right on the northern horizon
  - (C) Very low in the northern sky
  - (D) At the zenith (highest point in the sky)
  - (E) High in the northern sky

5. Which observational fact refutes the idea that the distance from the Earth to the Sun causes the seasons?
- (A) The Northern and Southern Hemispheres experience opposite summer/winter
  - (B) The length of day and night changes between summer and winter
  - (C) The Equator doesn't really experience either summer or winter
  - (D) The Earth is actually closest to the Sun in winter in Syracuse
  - (E) All of the above can be used to refute the misconception that the distance from the Earth to the Sun causes the seasons.
6. Consider the following star:



How would you describe this star's location at midnight?

- (A) High in the northern sky
  - (B) Low in the northern sky
  - (C) At the zenith (the highest point of the sky)
  - (D) High in the northeastern sky
  - (E) High in the northwestern sky
7. You point your left arm North, and point your other arm directly at the North Star. What is the angle between your two arms? (*Thanks to Zachary for the question!*)

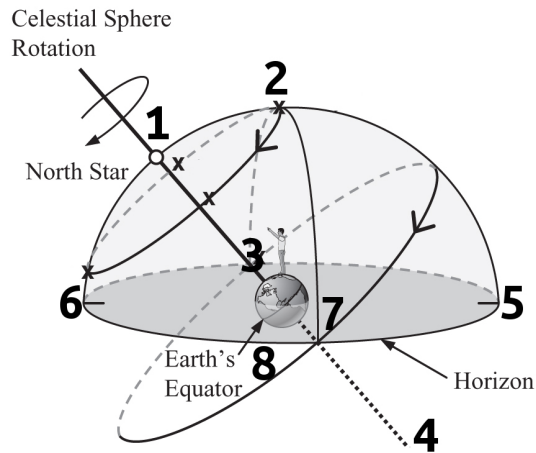
Syracuse is located at  $42^\circ$  N latitude. The axial tilt of the Earth is about  $23^\circ$  degrees.

- (A) 23 degrees
- (B) 67 degrees
- (C) 48 degrees
- (D) 0 degrees – your two arms are pointing in the same direction
- (E) 42 degrees

8. Suppose that the Earth did not revolve around the Sun, but simply stayed in one place and rotated on its axis. Which of the following would happen?
- (A) The celestial sphere would no longer rotate around the Earth
  - (B) The location of the North Celestial Pole in the sky would no longer depend on the observer's latitude
  - (C) We would no longer have day and night
  - (D) The solar and sidereal days would be the same length
  - (E) None of the above
9. In the diagram below, which letter corresponds to a location in the Southern Hemisphere during summer?



10. Here is a diagram of the celestial sphere with directions labeled. The North Star is shown (at position 1).

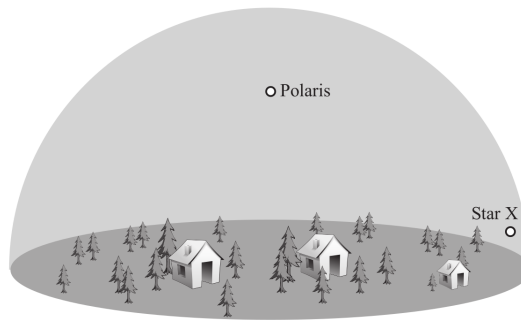


Which is the correct labeling of the cardinal directions on this diagram?

- (A) North is direction 6; South is direction 5; East is direction 3; West is direction 7
  - (B) North is direction 1; South is direction 4; East is direction 3; West is direction 7
  - (C) North is direction 2; South is direction 8; East is direction 5; West is direction 6
  - (D) North is direction 1; South is direction 4; East is direction 5; West is direction 6
  - (E) All of the above are wrong
11. Suppose that you could see the Sun, the stars, the moon, and the planets all at the same time in the sky. You look up at the sky at noon and note where all these objects are. Tomorrow at noon, which of these objects will be *most nearly* in the same place?
- (A) The planet Venus
  - (B) The Moon
  - (C) The stars
  - (D) The Sun
  - (E) More than one of these objects will be exactly in the same place
12. Why does the Earth rotate slightly more than  $360^\circ$  in a solar day? (*Thanks to John for the question!*)
- (A) None of the above
  - (B) Because the Earth slowly orbits around the Sun
  - (C) Because the Earth rotates more slowly each day
  - (D) Because the Sun moves slightly each day
  - (E) Because the Earth is tilted on its axis

13. How much of the Moon's total surface (not just the part we can see) is illuminated by the Sun during a gibbous moon? (*Thanks to Hope for the question!*)
- (A) All of it
  - (B) Some of it, but less than half
  - (C) None of it
  - (D) Half of it
  - (E) More than half, but less than all of it

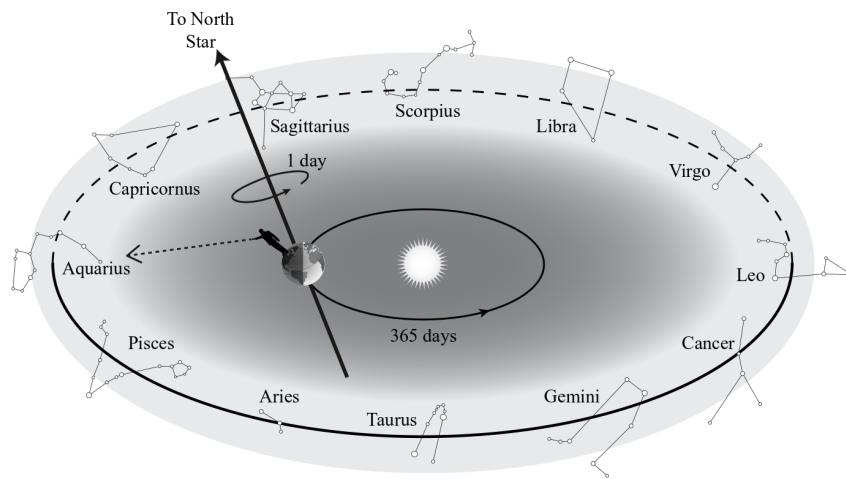
14. Consider the star shown here:



How long ago did this star rise?

- (A) Never; it is a circumpolar star
  - (B) Within twelve hours ago
  - (C) Between twelve and twenty-four hours ago
  - (D) Within an hour ago
  - (E) It depends on your latitude
15. You are standing in Wellington, New Zealand (latitude  $41^\circ$  S), watching the night sky. You see a star rise directly on your eastern horizon. How does this star move?
- (A) It moves upward and to the North.
  - (B) It moves upward and to the South.
  - (C) It moves Northwest.
  - (D) It moves Southwest.
  - (E) Since New Zealand is in the Southern Hemisphere, the star wouldn't be rising in the East.

16. A “new moon” is the phase of the lunar cycle when we can’t see the Moon at all. Which is true during a new moon?
- (A) The Moon is below the horizon
  - (B) None of the Moon’s surface is illuminated by the Sun
  - (C) The sunlit half of the Moon is facing away from us
  - (D) The Earth’s shadow falls on top of the Moon
  - (E) None of the above
17. Consider the following diagram:



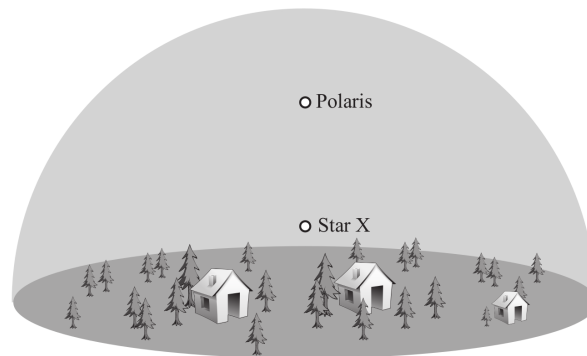
In one month, which constellation will be behind the Sun?

- (A) Capricornus
- (B) Pisces
- (C) Cancer
- (D) Leo
- (E) Virgo



18. Which statement is incorrect about the celestial sphere model?
- (A) The celestial sphere model accounts for the apparent motion of the sky due to the rotation of the Earth.
  - (B) The celestial sphere model gives a very precise prediction of the apparent motion of the stars, because the Earth's relative motion compared to the distances to the stars is so small.
  - (C) Since the Moon moves around the Earth in about thirty days, the Moon slips about  $360^\circ/30 = 12^\circ$  degrees along the celestial sphere relative to the stars.
  - (D) Since the Sun does not move, the Sun stays at a fixed position in the celestial sphere relative to the stars.
  - (E) All of the above are correct.
19. About how long does it take light to travel to the nearest stars (other than the Sun)?
- (A) Around a century
  - (B) A few hundred milliseconds
  - (C) A few minutes
  - (D) A few years
  - (E) A few days
20. Which place experiences greater variability between the seasons?
- (A) Nunavut, Canada (latitude  $63^\circ$  N)
  - (B) Cape Town, South Africa (latitude  $33^\circ$  S)
  - (C) Beijing, China (roughly  $40^\circ$  N)
  - (D) Nairobi, Kenya (roughly  $1^\circ$  S)
  - (E) Hermosillo, Mexico (roughly  $29^\circ$  N)
21. Which of the following gives the correct ranking of the distances of the following objects from Earth, from closest to furthest away?
- (A) Polaris; Moon; Sun; Saturn; the center of the Milky Way
  - (B) Moon; Saturn; Sun; Polaris; the center of the Milky Way
  - (C) Sun; Moon; Polaris; the center of the Milky Way; Saturn
  - (D) Moon; Sun; Saturn; Polaris; the center of the Milky Way
  - (E) None of the above

22. If you are standing exactly on the Antarctic Circle, you will experience exactly one day of polar night each year – a day when the Sun does not rise above the horizon at all. This day is:
- (A) The September equinox
  - (B) The June solstice
  - (C) The March equinox
  - (D) The December solstice
  - (E) None of the above
23. Suppose that you could see the Sun, the stars, the moon, and the planets all at the same time in the sky. You look up at the sky at noon and note where all these objects are. Exactly one sidereal day later, which of these objects will be *most nearly* in the same place?
- (A) The Sun
  - (B) The Moon
  - (C) The planet Venus
  - (D) The stars
  - (E) More than one of these objects will be exactly in the same place
24. Consider the star shown here:



(Both this star and Polaris are on the “background” of the image, in front of the observer.)

If it is 6PM in this picture, where will this star be at 6AM?

- (A) Low in the eastern sky
- (B) Low in the southern sky
- (C) Low in the northern sky
- (D) High in the sky, near the zenith
- (E) Low in the western sky

25. You observe the star Aldebaran low in the eastern sky at midnight. Tomorrow at 11:56PM (that is, four minutes less than one day) you observe Aldebaran again. Will Aldebaran be in the same place? If not, how many degrees will Aldebaran appear to have moved?

*The difference in length between a solar day and a sidereal day is four minutes.*

- (A) It will have moved about one degree South
  - (B) It will have moved about one degree North
  - (C) It will have moved about one degree lower in the sky
  - (D) It will have moved about one degree higher in the sky
  - (E) It will be in exactly the same place
26. Which statement correctly describes the motion of the stars in the sky each night?
- (A) All of the stars are different distances from us, but all appear to move together in the same way. This is because they are very far from Earth, much further away than the distance we move in a year, and their apparent motion is only because of our own rotation.
  - (B) All of the stars are different distances from us, but all appear to move together in the same way. This is because the Earth's orbit around the Sun causes them to be in different spots in the sky relative to the horizon.
  - (C) Different stars in the night sky seem to move at different rates based on how far they are away from Earth. Their apparent motion is due to the Earth's rotation; stars closer to Earth appear to move more quickly.
  - (D) All of the stars that we see are about the same distance away. They all appear to move together in the same way; their apparent motion is only because of our own rotation.
  - (E) None of the above are correct.
27. When you look North, you see all the stars rotating counterclockwise around a point exactly on the horizon. When you look South, you see all the stars rotating clockwise around a point on the opposite horizon. Where are you standing?
- (A) At the South Pole
  - (B) At the North Pole
  - (C) On the Equator
  - (D) Anywhere in the Southern Hemisphere
  - (E) The motion described can't happen anywhere on Earth

28. You look up at the night sky and see all of the stars rotating clockwise around the zenith (the point directly above your head). Where are you standing?
- (A) On the Equator
  - (B) At the South Pole
  - (C) Anywhere in the Southern Hemisphere
  - (D) At the North Pole
  - (E) This is possible at more than one of these places

29. You are traveling through the desert. Since it is so hot during the daytime, you would prefer to camp during the day and travel at night. However, it is too dark to travel when the Moon is not visible. Thus, you can only travel when the Moon is visible, but the Sun is not.

Suppose that the phase of the moon is third quarter – that is, a waning half moon. Approximately what times will you be able to travel tonight?

- (A) All night long
  - (B) From 6PM until midnight
  - (C) You won't be able to travel at all, and need to wait until the moon phase changes
  - (D) From midnight until 6AM
30. If the angle of the Earth's axial tilt were increased from  $23^\circ$  to  $30^\circ$ , what would change?
- (A) Syracuse, New York (latitude  $42^\circ$  N) would experience more extreme winters
  - (B) The days would be longer in July in Tierra del Fuego, Argentina (latitude  $54^\circ$  S)
  - (C) The size of the Arctic would increase
  - (D) The size of the tropics would increase
  - (E) All of the above

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