INST 2403 **First Exam** **Test Form A**

Monday, February 10, 2020

Instructions

1. Use a number 2 pencil.
2. Important: Write your name on the computer form and fill in the appropriate circles.
   (a) Bubble in your student ID.
   (b) Bubble in **A** in the KEY field.
3. Select only the best answer to each question; multiple answers will be marked wrong. No points are taken off for wrong answers, so it is to your advantage to guess if you are unsure of the answer.
4. Mark your answers on the computer form. You may write in the exam booklet if you wish, but only the computer form will be graded.
5. You must sign and return this exam booklet in order to receive credit for the exam!
6. You will have a maximum of 55 Minutes to complete the exam.
7. This exam contains 35 questions.
8. Use the backside of this manual or white paper to record the answers to the last three questions, which are not multiple-choice but short answer questions.
9. You should be able to answer all questions without using a calculator, but if you wish, you can use a scientific calculator.

1. An 8-inch telescope collects how many more times the light collected by a two-inch telescope? (Hint: the amount of light collected scales like the area of the telescope.)

   (a) 64
   (b) 16
   (c) 8
   (d) 4
   (e) 2

2. To see a constellation at a particular position in the sky, you need to know date and time. As an example, say we are seeing Taurus in the south at midnight on December 1. At what other combination of date and time do we see Taurus in the south?

   (a) January 1 at 2 am
   (b) November 1 at 10pm
   (c) February 1 at 6pm
   (d) December 15 at 11pm
   (e) None of the above

3. Westerville is located at 40 degrees northern latitude. If you are observing from Westerville, which is NOT a correct statement?

   (a) Some stars never rise or set.
   (b) You can see stars of the southern sky up to declination –50 degrees
   (c) The Celestial Equator is 40 degrees off the Celestial North Pole.
   (d) The ecliptic is inclined 23.5 degrees with respect to the Celestial equator.
   (e) All are correct.

4. The *lunar month*

   (a) ... is about 27 days long.
   (b) ... is about 29 days long.
   (c) ... is either 30 or 31 days long.
   (d) ... is not properly defined. There are several different ways to define a month.
   (e) None of the above.

5. Which of the following is explained by the rotation of the Earth around its axis?

   (a) Mars occasionally exhibits retrograde motion.
   (b) When it is summer in the northern hemisphere, it is winter in the southern hemisphere.
   (c) The orbit of the Earth is an ellipse, not a circle
   (d) The Sun, the Moon, and most of the stars rise in the east and set in the west.
   (e) All of the others.

6. At last quarter moon, which of the following drawings best represents the relative positions of Sun (S), Moon (M), and Earth (E) ?

   (a) S——M—E

   (b) S——E—M

   (c) M——S—E

   (d)
   ```
   S
   |
   |
   E --- M
   ```

   (e)
   ```
   S
   |
   M --- E
   ```

7. The ecliptic is . . .

   (a) the day of the year when daylight is longest.

   (b) the apparent path of the Sun through the stars in the sky.

   (c) the dark inner shadow of a solar eclipse.

   (d) the astrological term for when Jupiter aligns with Mars.

   (e) the scientific name for the celestial equator.

8. It is noon in Westerville. What is the time in Paris, France?

   (a) Noon

   (b) Earlier, same day

   (c) Later, same day

   (d) Noon, the next day

   (e) Noon, the previous day

9. It is first quarter moon. In five days, what will the phase of the moon be?

   (a) Last Quarter Moon

   (b) Waxing Gibbous

   (c) Waning Gibbous

   (d) New Moon

   (e) Waning Crescent

10. You are stranded on a desert island. On a clear night, you try to locate Polaris, but you are unable to do so. What can you conclude?

    (a) You are at the south pole.

    (b) You are in the southern hemisphere.

    (c) It is summer.

    (d) It is winter.

    (e) You are at 23.5 degrees northern latitude.

11. A star is in its highest position in the south at midnight. In two weeks it will be at this position around ...

    (a) midnight
    (b) 10 pm
    (c) 11 pm
    (d) 1 am
    (e) 2 am

12. The fixed stars are not moving ...

    (a) ... in the alt-azimuth (horizon) system.
    (b) ... in the equatorial system.
    (c) ... with respect to the constellations.
    (d) Two of the above
    (e) None of the above

13. A planet in *opposition* is opposite of the sun, i.e. sun, earth and planet form a straight line. When does a planet in *opposition* rise?

    (a) At sunrise.
    (b) At noon.
    (c) At midnight.
    (d) At sunset.
    (e) The planet is always above the horizon, i.e. it does not rise.

14. *Aries* and *Cancer* are zodiac constellations. The path of the sun leads through these constellations. There are two other zodiac constellations in between the two. How long will the sun take to move from (the middle of) *Aries* to (the middle of) *Cancer*?

    (a) One year.
    (b) Two hours.
    (c) Three months.
    (d) Four weeks.
    (e) Five hours.

15. Compare the daily motion of two *fixed stars* with different celestial latitude (RA) and different celestial longitude (declination). Which is a true statement?

    (a) Both rise at the same time.
    (b) Both culminate with the same altitude angle.
    (c) Both culminate at the same azimuth angle.
    (d) There exists a time when one but not the other star is visible (above the horizon).
    (e) Two of the above.

16. The shadows cast by the sun in Westerville

    (a) ... are longest at noon

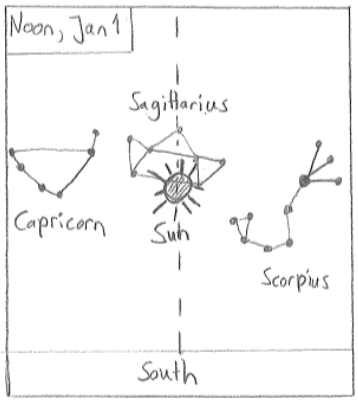
    (b) ... are in the west in the morning

    (c) ... are shorter in winter

    (d) ... vanish at noon

    (e) None of the above

17. On January 1, at noon, you are looking toward the south and see the Sun among the stars of the constellation Sagittarius as shown in the figure below. At 8 am in the morning, where was the Sun with respect to the stars shown in this diagram?



    (a) in the constellation Sagittarius

    (b) in the constellation Scorpius

    (c) in the constellation Libra

    (d) west (right) of Libra

    (e) east (left) of Sagittarius

18. If the Moon would orbit the Earth in the plane of the Earth's orbit around the sun, how many lunar eclipses would you expect?

    (a) 2, one each half year

    (b) 12, one each month

    (c) 26, one every two weeks

    (d) 52, one every week

19. If the Moon was full when it was rising above the horizon, what phase will it be in when it sets?

    (a) New Moon

    (b) First Quarter

    (c) Waxing Gibbous

    (d) Last Quarter

    (e) Full Moon

20. What is NOT a consequence of the fact that the Earth's equator is tilted with respect to the plane of its orbit around the Sun?

    (a) We experience seasons on Earth.

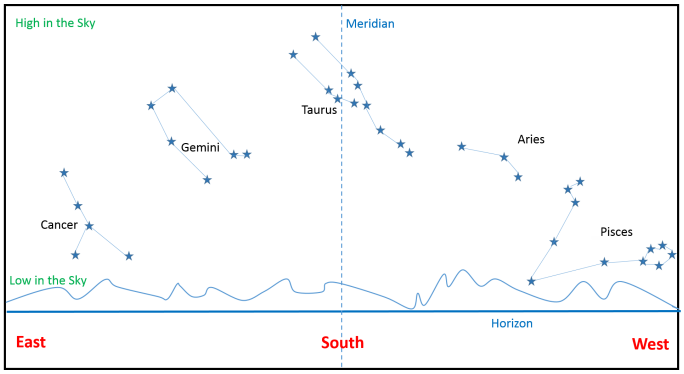
    (b) Days and nights are typically of different length.

    (c) At noon, the Sun appears at different heights in the sky in different months.

    (d) There is a non-zero angle between the celestial equator and the ecliptic.

    (e) The Sun, the Moon and the stars rise in the East.

21. The figure on the right shows a horizon view of what you would see when facing south at midnight on the night of December 1 in the northern hemisphere. How would this view change if you were to look towards south at midnight a month earlier?



(a) You would have the same view as on December 1 because it still is autumn.

(b) Aries would have been in the South because the stars rise earlier in the East every day.

(c) Cancer would be in the South because the seasons were closer to summer.

(d) Gemini would have been highest in the South because the stars set earlier in the West.

(e) Pisces would have been highest in the South because the Sun has moved a lot with respect to the stars in one month.

22. A lunar eclipse can only happen at the time of a _____ moon.

(a) New moon

(b) Gibbous moon

(c) Crescent moon

(d) Full moon

(e) Half moon

23. Night and day have approximately equal length at what time or times during the year?

(a) Winter solstice

(b) Vernal and autumnal equinoxes

(c) Summer and winter equinoxes

(d) Summer solstice

24. During the course of a single night, a planet in prograde motion will ...

(a) ... do what the stars do.

(b) ... loop around in the sky.

(c) ... none of the other things.

(d) ... shift westward with respect to the stars.

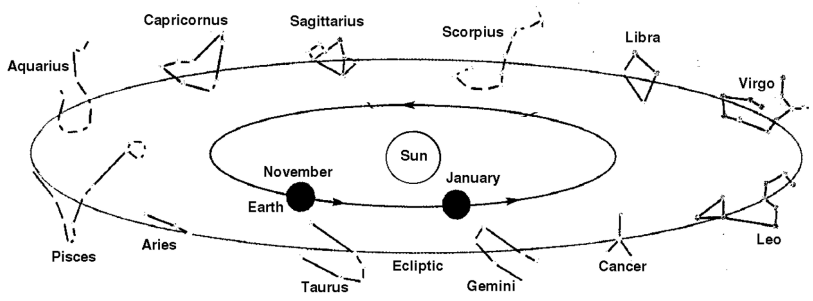
(e) ... rise in the west and sink in the east.

25. Noticing the relative position of Sun, Earth and Moon during New Moon, when does the New Moon rise?

    (a) Sunrise
    (b) Sunset
    (c) Noon
    (d) Midnight
    (e) None of the above

26. Look at the figure of the zodiac below. Shown is the position of the Earth on November 1 and January 1. The Earth rotates counterclockwise around the sun. In which zodiac constellation can the sun be found on December 1?

    (a) Cancer
    (b) Virgo
    (c) Scorpius
    (d) Capricorn
    (e) None of the above



27. A fast food chain is trying to decide whether to use standard size potatoes or double-sized potatoes for french fry production. Which kind yields more french fries per time spent peeling the potatoes? *Hint: Think about how french fry yield and peeling time scale with the size of a potato.*

    (a) Standard size potatoes
    (b) Double-sized potatoes
    (c) They both yield the same
    (d) Not enough information

28. The waxing gibbous moon and the sun are separated by an angle of about 135 degrees in the sky, as we are seeing more than half of the moon lit up by the sun. When is the waxing gibbous moon at its highest, daily altitude above the horizon?

    (a) between 6pm and midnight
    (b) 6am
    (c) Noon
    (d) 6pm
    (e) between 6am and noon

29. The waxing gibbous moon and the sun are separated by an angle of about 135 degrees in the sky, as we are seeing more than half of the moon lit up by the sun. In which direction do you have to look to see the waxing gibbous moon when it is at its highest daily altitude above the horizon?

    (a) North
    (b) West
    (c) South
    (d) None of the above

30. To see the greatest number of stars possible throughout the period of one year, a person should be located at latitude

    (a) 23.5 degrees
    (b) 0 degrees
    (c) Anywhere, since latitude makes no difference
    (d) 66.5 degrees
    (e) 90 degrees

31. Two objects appear to be the same size in the sky. This means that ...

    (a) ... if one object is bigger than the other, it also has to be closer than the other object.
    (b) ... they are at the same distance from the observer.
    (c) ... the ratio of diameter to distance is the same for both of them.
    (d) ... they have the same diameter.
    (e) None of the above

32. You are observing the sky from longitude 145W. Where in the sky do you find Polaris?

    (a) Halfway up
    (b) Not enough information
    (c) In the South
    (d) Polaris is not visible
    (e) In the North

Short Answer Questions [3 points each]

(Please use the back side of this manual or a white sheet of paper to record your answers)

33. State and explain the two main reasons for the seasons resulting from the axis tilt of the Earth.

34. Explain why the moon has phases.

35. What is the physical reason for the fact that a *sidereal* day is four minutes shorter than a *solar day* day?