Exam 1 (Horizons 11th ed., chapters 1-4 and Appendix A)

Name ________________________

Choose the best answer for each multiple-choice question, worth 2 points unless stated otherwise.

A  1. A "light-year" can be defined as
   A) the distance that light travels during the time that Earth revolves around the Sun once.
   B) the distance between the Sun and the nearest star.
   C) the distance that Earth travels in one year as it orbits the Sun once.
   D) the time required for light to travel between Earth and the Sun.

B  2. The Sun is about 8 “light-minutes” away from Earth. In order to determine the number of kilometers in a light-minute, we must multiply the speed of light (given in units of km/s) by
   A) the number of kilometers in one second.
   B) the number of seconds in one minute.
   C) the number of seconds in one year.
   D) the number of minutes in one year.

C  3. Why do scientists prefer to use the metric system over the system used in the U.S.?
   A) The metric system is more accurate.
   B) The metric system can deal with larger numbers than the other system.
   C) The metric system allows for much easier calculations.
   D) Misleading. The scientists prefer the U.S. system!

A  4. From smallest to largest (edge to edge), the objects should be ordered as follows:
   A) Earth, Sun, Solar System, Milky Way Galaxy, Filaments and Voids.
   B) Sun, Solar System, Earth, Milky Way Galaxy, Filaments and Voids.
   C) Sun, Filaments and Voids, Earth, Solar System, Milky Way Galaxy.

D  5. The astronomical unit (AU) is
   A) about 150 billion meters in length.
   B) defined as the average Earth-Sun distance.
   C) useful for the distances in the solar system.
   D) All of these.

C  6. The symbol 10^7
   A) represents the number 1,000,000,000.
   B) is the number of stars in our Galaxy.
   C) means ten million.
   D) is the number of kilometers in a light-year.

B  7. Which of the following statements is TRUE?
   A) In addition to that of Pluto, the orbit of Earth is particularly non-circular.
   B) Light from the Sun takes approximately 8 minutes to reach Earth.
   C) the Sun seems to be located in a particularly crowded (with stars) part of our galaxy.
   D) Light from the nearest star to the Sun takes about 17 months to reach Earth.

B  8. Given 1 ly ≈ 63,000 AU, the distance from Earth to the nearest star beyond the Sun is about
   A) 1000 astronomical units.
   B) 250,000 times the Earth-Sun distance.
   C) approximately 150 x 10^9 km.
   D) approximately 8 light-minutes.

D  9. Which of the following statements is TRUE?
   A) The size of a star image on a photograph tells us the actual diameter of the star.
   B) Our star, the Sun, is unique, having characteristics unlike any other.
   C) The nearest star to our Sun is Venus.
   D) There are several hundred billion stars in our galaxy.
10. A celestial object with an apparent visual magnitude of +4
   A) is 100 times brighter than an object whose visual magnitude is –1.
   B) is 30 times brighter than the dimmest star observable with the human eye.
   C) could be Venus at its brightest.
   D) is 100 times brighter than a magnitude +9 object.

11. Which of the following is a TRUE statement about stars and their constellations?
   A) Every constellation contains 10 stars.
   B) There are a total of 88 constellations in the sky, of which 48 are ancient constellations.
   C) The Big Dipper is an asterism whose stars are all at the same distance from Earth.
   D) Polaris is the brightest star of the Big Dipper.

12. Which of the following is a TRUE statement about stars and their constellations?
   A) The brightest star in the Big Dipper is the closest to Earth.
   B) α Canis Majoris (Sirius) is the faintest star to the naked eye.
   C) Every star that we can see in the sky belongs to a constellation.
   D) All of the above.
   E) None of these.

13. Which of the following statements about the sky is TRUE?
   A) The sky always looks like a great sphere centered on the Sun.
   B) We use angular measurements to describe distances between objects on the celestial sphere.
   C) The Big Dipper is a south circumpolar group of stars when observed from Australia.
   D) The zenith is a point on the celestial sphere directly over Earth’s North Pole.

14. How does the apparent brightness (intensity) compare between Star X with magnitude of +2 and Star Y with magnitude of +5?
   A) Star X looks 3 times fainter than Star Y.
   B) Star X looks 3 times brighter than Star Y.
   C) Star X looks about 16 times fainter than Star Y.
   D) Star X looks about 16 times brighter than Star Y.

15. For a person living at the North Pole,
   A) stars do not rise and set.
   B) the Sun rises in the west and sets in the east every day.
   C) Polaris is located near the horizon.
   D) there are no circumpolar constellations.

16. Seen from the northern hemisphere, the star Polaris
   A) is never above the horizon during the day.
   B) always sets directly in the north.
   C) is always above the northern horizon.
   D) is never visible in winter.

17. Precession:
   A) causes Thuban (α Draconis) to periodically become the “North Star.”
   B) causes the celestial poles to move in a circle on a celestial sphere with the period of 26,000 years.
   C) is caused by gravitational tug from the Sun and Moon on a bulging Earth.
   D) all of the above.
   E) none of these.
18. You are in the northern hemisphere **facing north**, looking near the north celestial pole (NCP). Which diagram correctly describes the horizon and the apparent motion of stars around NCP?

A) ![Diagram A]

B) ![Diagram B]

C) ![Diagram C]

D) ![Diagram D]

19. You are in the **southern** hemisphere **facing south**, looking near the **south** celestial pole (SCP). Which diagram correctly describes the horizon and the apparent motion of stars around SCP?

A) ![Diagram A]

B) ![Diagram B]

C) ![Diagram C]

D) ![Diagram D]
B 20. The third quarter moon is just setting in the west. The time is
A) early morning. B) about noon. C) shortly after sunset. D) shortly after midnight.

C 21. The Moon's orbital plane does not coincide with the ecliptic plane (the plane of Earth's orbit), but crosses it at an angle (about 5 degrees). A direct consequence of this is that
A) Earth experiences seasons. B) Earth is not always closest to the Sun at the same time of the year. C) Eclipses do not occur every lunar month. D) Earth experiences precession. E) Lunar phases do not always follow the synodic period. F) The synodic period and the sidereal period are not equal.

D 22. Summer is hot and winter is cold because
A) summer days are longer than winter days. B) the noon sun is higher in summer than in winter. C) Earth is closer to the Sun in summer than it is in winter. D) (A) and (B) only. E) (A) and (C) only. F) (B) and (C) only. G) all three (A), (B), and (C).

B 23. The Moon is setting in the west. The time is about midnight. What is its phase?

C 24. The Moon is rising in the east. The time is about 3 p.m. What is its phase?

C 25. You observe the full moon directly to the south (on the meridian) high above the horizon while in Chicago.
A) It is about 6 p.m., Central Time. B) A total solar eclipse is occurring if the Moon is at a node. C) A total lunar eclipse is occurring if the Moon is at a node. D) The Moon is near Polaris.

A 26. People along a narrow path on the daytime side of Earth are witnessing a total solar eclipse.
A) The new moon is at a node. B) The full moon is at a node. C) The Moon rises at midnight. D) The time is vernal equinox, when the Sun is at the intersection of the ecliptic and the celestial equator.

C 27. Walt Whitman wrote:

Lo, the moon ascending,
Up from the East, the silvery round moon,
Beautiful over the housetops, ghostly, phantom moon,
Immense and silent moon.

It is evident in this poem that the time was
A) early morning. B) shortly after midnight. C) shortly after sunset. D) noon.
28. The full moon rises at _______ and sets at _______.
   A) noon, midnight  B) sunset, sunrise  C) sunrise, sunset
   D) midnight, noon  E) midnight, sunset  F) noon, sunrise

29. The Moon sets in the west at about 9 a.m. What is its phase?
   A) Waxing crescent.  B) First quarter  C) Full.

30. The Moon rises in the east at about 3 a.m. What is the lunar phase?
   A) Waxing crescent.  B) First quarter  C) Full.

31. Which lunar phase CAN NEVER be seen in the sky at 9:00 p.m. in the evening?

32. The principle of parallax
   A) led classical astronomers to declare that Earth did not move.
   B) allowed Tycho Brahe to conclude that his ‘new star’ was indeed a star.
   C) explains why your thumb held at your arm’s length appears to shift position with respect to
distant objects as you switch eyes.
   D) all of these.

33. Which of the following is false or not part of Kepler’s Laws of Planetary Motion?
   A) The distance between the planet and the Sun changes as the planet orbits the Sun.
   B) A planet moves fastest at perihelion and slowest at aphelion in its orbit around the Sun.
   C) The force of attraction between the Sun and a planet depends on their masses, and inversely
   on the square of the distance between them.
   D) The square of a planet’s orbital period around the Sun is proportional to the cube of its
   average distance from the Sun.

34. If the separation distance between two objects is tripled, the gravitational force between them
   A) decreases by a factor of 3.  B) increases by a factor of 3.
   C) decreases by a factor of 9.  D) remains the same.

35. Choose the correct example/analogy related to each of Newton’s laws of motion.
   Law of Inertia  B  F = ma  A  Law of Action and Reaction  C
   A) In a Fox Trot comic strip, gravity causes Jason and his friend Marcus to go faster and faster
   as they sled down a hill.
   B) In a Fox Trot cartoon strip, Jason and his friend Marcus, sledding down a hill, open their drag
   chute to avoid collision with a tree. The sled comes to an abrupt stop, but Jason and
   Marcus, unstrapped to the sled, fly off forward and crash into the tree.
   C) In Garfield, Garfield and Odie are happily eating from their own supper dishes. Odie, out of
   joy, barks at Garfield, thereby causing Garfield’s face to splatter into the supper dish. The
   furious Garfield, reciting this Newton’s law, clobbers Odie into his supper dish.

36. Which of the following statements is not a misconception?
   A) The Moon is never visible in the daytime sky and the stars are not in the sky during the day.
   B) The light-year is a unit of time.
   C) The dark side of the Moon is a particular half of the lunar surface that never receives
   sunlight.
   D) The Moon does not rotate.
   E) Galileo did not invent the telescope, and he was not even the first to look at the sky through
   a telescope.
   F) The seasons are caused by the difference in the distance between Earth and the Sun.
37. **Bonus challenge!** If the Sun is located two thirds of the way out from the center of the Milky Way galaxy, and the diameter of the Milky Way Galaxy is 90,000 light-years, the Sun is at about ______ from the closest edge of the Galaxy.
   A) 500 light-years  
   B) 3000 light-years  
   C) 15,000 light-years  
   D) 50,000 light-years

38. **Bonus challenge!** When neap tides are occurring,
   A) Moon rises around midnight.
   B) a person experiences the lowest tides close to sunset and sunrise.
   C) the Sun, Earth, and Moon are aligned.
   D) it is 6 months away from the beginning of winter (the winter solstice).

Answer the following questions concisely in complete sentences. Make sure your answers are legible so you will get the credit you deserve. You may use a diagram, but you will still need to explain it in words.

39. What are the two things that are not right with the picture of the Moon in this Daisy Duck stamp? (4 points)

   Stars should not be visible in the unlit (dark) part of the Moon. If you accept the fact that the dark part is still there, then the stars as drawn would be between Earth and the Moon!

   Assuming the time is early evening (apparent twilight near the horizon), then the "horns" of the crescent moon should be pointing upward and the lit side should be facing the Sun, which is just below the horizon.
40. **What is a circumstellar constellation and how do these constellations vary depending on your location on Earth? (5 points)**

Due to a typo in the question statement, this was not graded and you received full credit. (Can you tell what the typo is?)

**Note:** The same question (with the typo corrected) will appear in the final exam!!

41. **Why are the seasons reversed in the southern hemisphere? (5 points)**

The tilt of the Earth's rotation axis causes seasons. When the northern hemisphere is tilted toward the Sun, it receives greater amount of energy of sunlight and it is summer there, while, at the same time, the southern hemisphere is tilted away from the Sun, receiving smaller amount of energy and it is winter there. Since the tilt of the Earth's axis remains fixed relative to the stars, the seasons are switched 6 months later, halfway around the Earth's orbit.
42. Write a short description (one sentence) of each of the following scientists with a focus on their major contribution to astronomy. (15 points)

Nicolaus Copernicus:

Copernicus developed the original form of the modern heliocentric model with the planets in uniform circular motion around the Sun.

Tycho Brahe:

Brahe made accurate and precise observations of the positions of celestial objects for 20 years, paving the way for Kepler to discover laws of planetary motion.

Johannes Kepler:

Kepler analyzed Brahe’s observations and discovered three laws of planetary motion.

Galileo Galilei:

Galileo supported the heliocentric model with his various telescopic observations.

Isaac Newton:

Newton discovered the fundamental laws of motion and the law of universal gravitation that together provided a complete description of the motions of the planets and moons.
You may find the following diagram helpful: