

Name

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# QUIZ 1

Attempt all 25 questions in Part A and 1 of the 6 questions in Part B. Please write all answers to Part A on these sheets; extra paper is available if needed. Write your answer to the B question on extra sheets. *Time allowed = 75 minutes.* 

For all questions in Part B, I expect at least a short paragraph of a few complete sentences. Clear labelled diagrams may be helpful in many cases. Answers that consist solely of a keyword or key phrase will not be graded.

## Part A

A1. The "Local Group" refers to

a. stars in our Galaxyb. galaxies in our neighborhoodc. planets in our solar systemd. comets passing near the Sun

A2. The average distance from the Earth to the Sun is

a. 1 AU b. 1 ly c. 1 million km. d. none of these

A3. List the following angles in order of decreasing size:

5", 1°, 2'10", 2°5, and 0".02

A4. In which of the following cities are you if the celestial equator passes (almost) directly overhead?

a. Sydney, Australia b. Nairobi, Kenya c. Moscow, Russia d. Austin, Texas

A5. As you look to the south from the northern hemisphere, the stars appear to move

a. to your right b. to your left c. perpendicular to the horizon

A6. As you look to the north from Santiago, Chile, the stars appear to move

a. to your right b. to your left c. perpendicular to the horizon

A7. The Moon is slowly receding from the Earth. In the future, total solar eclipses will

a. become less frequent b. become more frequent c. occur at night

A8. The phase of the Moon seen due south at sunrise is

a. full b. quarter c. new d. gibbous

A9. Select the correct answer. If you lived on the Moon, at a location from which you could see the Earth, the Earth

a. would seem to go through phases
b. would always appear full
c. would appear in about a quarter phase
d. would seem to rise and set periodically
e. both a. and d. above.
(N.B. The Moon orbits the Earth keeping the same face towards the Earth)

A10. What phase must Mars be at when it is closest to the Earth?

a. Full b. New c. Last quarter d. First quarter

A11. Planets in elliptical orbits move

a. fastest when furthest from the Sun b. slowest when closest to the Sun c. at a constant velocity d. none of the above A12. Kepler's third law of planetary motion states that

a. P = ab.  $P^2 = a^3$ c.  $P = a^2$ d.  $P^2 = a$ e.  $P = a^3$ 

A13. In the third law, what quantity is represented by P? And what by a?

A14. If a planet had an average distance from the Sun of 4AU, its orbital period is?

a. 4 years b. 8 years c. 16 years d. 8 months

A15. Newton's law of gravity states that the force attracting two bodies depends on

- a. the product of the masses divided by the square of the distance between them.
- b. the sum of the masses divided by the distance between them.
- c. the product of the masses divided by the distance between them.
- d. the square of the product of the masses divided by the distance between them.
- e. the square of the product of the masses divided by the cube of the distance between them.

A16. If the mass of both the Earth and Moon were quadrupled, how would the force of gravity change?

A17. If the distance between the Earth and Moon were quadrupled, how would the force of gravity between the Earth and Moon change?

A18. The mass of the Sun is 30,000 times the mass of the Earth. How does the amount of acceleration of the Earth towards the Sun compare to the amount of acceleration of the Sun towards the Earth?

a. 30,000 times stronger b. times stronger c. the same d. 30,000 times weaker

A19. The Moon has no atmosphere. At what wavelengths of the electromagnetic spectrum could we observe if we had an observatory on the lunar surface?

A20. Arrange the following regions of the electromagnetic spectrum by increasing wavelengths:

radio, ultraviolet, gamma ray, red, blue

A21. A beam of light falls at an angle on a mirror. Which color will be reflected at the greatest angle?

a. red b. blue c. yellow d. green e. They will be reflected at the same angle.

A22. UT is completing the Hobby-Eberly Telescope whose primary mirror is made of many 1 meter mirrors. How many of these mirrors do we need in order to have the light gathering power of a telescope with a single 8meter primary mirror? (Assume all mirrors are square)

A23. Mark the following statements as true or false.

a. A telescope just able to resolve two seconds of arc is twice as good as one just able to resolve one second of arc.

b. One of the most important problems with refracting telescopes is that the position of the focus depends on wavelength.

c. The Earth's atmosphere is transparent to electromagnetic radiation of all wavelengths.

A24. Why do we not include sound waves when we list the regions of the electromagnetic spectrum?

A25. Arrange the following in order of increasing size (i.e., length):

atomic nucleus, solar system, the Earth, our galaxy, yourself, an atom, the Local Group, this campus.

## Part B

#### B1.

a. The sketch shows the Pole Star and two other stars (A and B), as observed from your backyard. Show with sketches how the stars will appear in the sky in 3 hours time, and in 9 hours time.b. Tonight, the Big Dipper and Pole Star are easily seen towards the north. Explain why the Big Dipper is easily seen every night of the year..

c. Explain with a diagram (and a sentence or two) why the Big Dipper is not visble tonight or any night from Santiago, Chile.

#### B2.

a. Explain clearly how Copernicus determined the relative size (i.e. radius in AU) of the Venusian orbit to be 0.7 AU. Clearly, state what observations he used and the assumptions he adopted.

b. Explain why Mercury as a "crescent" appears larger in angular size than when it is 'full'.

## B3.

a. Draw and label a diagram showing the positions of the Sun, Earth, and Moon during a total solar eclipse. Clearly show the locations of the Moon's umbra and penumbra.

b. Explain why it may be necessary to travel halfway around the world to view a solar eclipse, but a lunar eclipse may be readily observed at home.

c. Discuss how the following actions of a cosmic demon would affect the frequency of total solar eclipses observed by a resident of the Lone Star State.

i) The diameter of the Moon is halved.

ii) The diameter of the Sun is halved.

iii) The diameter of the Earth is doubled.

a. Describe the experiment conducted by Rutherford that led him to a new model for the atom.

b. Rutherford said the results of this experiment were "the greatest surprise of life." Knowing that he presumed J.J. Thompson's "plum pudding" model of atom to be correct, explain what particular aspect of the experimental result surprised him so greatly.

c. The results of this experiment forced Rutherford to propose a quite different (and correct) model of the atom. Describe the Rutherford model of the atom and show it accounts for the above surprising results.

#### B5.

a. Give **one** reason why the largest astronomical optical telescopes are reflector rather than refractors.

b. Discuss the two principal factors (diameter of the telescope, the Earth's atmosphere) that limit a telescope's resolving power?

c. Henry Norris Russell (one of the past giants of US astronomy) once said, "When old astronomers die, they should be allowed to go to the moon because it is the ideal site for an astronomical laboratory." Identify two distinct astronomical reasons for his wish.

#### B6.

a. Why did Newton conclude that some force has to pull the Moon toward the Earth?

b. Explain why the discovery of the planet Neptune was regarded as a triumph for Newton's theory (law) of gravitation.

c. Explain why the orbit of Mercury showed that Newton's theory of gravitation was incomplete.

B4.