

Instructions: This test is divided into two parts. Part A is entitled short answer questions where you are to pick the best word, phrase or choice of answers which best answers or, in some cases, defines the statement. Please be careful to read the entire set of answers for multiple choice questions. Part B is entitled longer answer questions. Make your answers clear and concise. If you need more room turn over the test paper and continue on the back, but please write "over" on the test. For problems, it is the procedure that will be checked, not only the answer so please try to make it clear. Be sure to include units in answering problems (such as we've done in class). For problems that include underlined precision digits, be sure to use the corresponding precision rule or significant figure rule, accordingly. Point weighing is indicated in parentheses. So for this, the third quiz of the fall poets' course, Good Luck!

Here are some recipes: $d = vt$ $v = at$ $d = \frac{1}{2}at^2$ $F = m \frac{v^2}{R}$ $F = ma$ $w = mg$ $F = G \frac{mM}{r^2}$

Use $g = 9.8 \text{ m/s}^2 = 32 \text{ ft/s}^2$ for the surface of the earth. Not needed: $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

A. Short Answer Questions (1 Point each question except as marked. Questions 1 through 14 are multiple choice.)

C 1. #9 The Earth is held in its orbit by the gravitational force of the Sun. Therefore, the force that the Sun exerts on the Earth is ? the force that the Earth exerts on the Sun. (a) greater than (b) smaller than (c) the same as

a 2. #10 Which of the following forces are exerted on a satellite that is in orbit around the Earth? (a) an attractive gravitational force directed toward the center of the Earth (b) a force in the direction of the satellite's motion (c) an outward force directed away from the center of the Earth (d) a and b (e) a, b, and c

a 3. #11 What value is closest to the acceleration due to the Earth's gravity at a distance of one Earth Radius above the Earth's surface? (a) 2.5 m/s² (b) 5 m/s² (c) 10 m/s² (d) 20 m/s² (e) 40 m/s² $F_N = \frac{(1/2)W}{(2)^2} = \frac{1}{4}W = \frac{1}{4}mg$ $g_N = \frac{1}{4}g_E$ CONSTANT

d 4. #12 Al the astronaut has a weight of 800 N when he is standing on the surface of the Earth (4,000 mi radius). What is the force of gravity acting on him when he is in a space station orbiting the Earth at a distance of three Earth radii above the surface (or 16,000 mi from the center of the Earth)? (a) 800 N (b) 200 N (c) 100 N (d) 50 N

d 5. #13 If you double the length of each side of a cube, its volume increases by what factor? (a) 2 (b) 4 (c) 6 (d) 8 $V = l^3$ $V = 8l^3$ $F \propto \frac{mM}{r^2}$

C 6. #14 In the Law of Universal Gravitation, the force ? as the mass increases and ? as the distance increases. (a) increases...increases (b) decreases...increases (c) increases...decreases (d) decreases...decreases

a 7. #2 If an astronaut with a weight of 800 N on Earth steps on a bathroom scale while she is in Earth orbit, the scale will read (a) zero. (b) less than 800 N but more than zero. (c) 800 N. (d) more than 800 N.

C 8. #3 Al the astronaut has a mass of 90 kg and a weight of 900 N when he is standing on the Earth's surface. What is his mass when he is in a space station orbiting Earth with a radius of three Earth radii? (a) zero (b) less than 800 N but more than zero. (c) 800 N (d) more than 800 N (e) none of the previous. 90 kg

d 9. #4 You are standing on a bathroom scale in an elevator that is moving upward at constant speed, when suddenly the cable breaks. From just before to just after the cable breaks, the reading on the scale (a) increases by a little bit. (b) decreases by a little bit. (c) remains the same. (d) decreases to zero.

b 10. #5 Communications satellites are synchronous satellites that orbit the Earth each (a) 90 minutes (b) 24 hours (c) 28 days. (d) They don't orbit the Earth; they just stay in one place.

d 11. #6 In a typical 24 hour day, there are (a) one high tide and one low tide. (b) one high tide and two low tides. (c) two high tides and one low tide. (d) two high tides and two low tides.

C 12. #7 An equinox occurs when (a) the sun shines equally on both northern and southern hemispheres, (b) the day and night are both 12 hours for both northern and southern hemispheres. (c) both a and b (d) neither a nor b.

C 13. #8 Our galaxy is a ? galaxy. Choose from (a) globular (b) elliptical (c) spiral (d) Kepler spiral

b 14. A summer solstice occurs when (a) the axis of the earth is pointed away from the sun and most of the sunlight is shining on the southern hemisphere, (b) the axis of the earth is pointed towards the sun and most of the sunlight is shining on the northern hemisphere, (c) the earth is closest to the sun. (d) the sun is shining equally on both northern and southern hemispheres.

$$F_x = \frac{(1)(8)}{(2)^2} (100 \text{ lb}) = 200 \text{ lb}$$

200 lb #24 15. (2) A person weighing 100 lb here on earth goes to planet X having a radius twice that of the earth and a mass eight times as large. The person will weigh ? on the surface of that planet.

800 lb #25 16. (2) A person weighing 100 lb here on earth goes to planet Y having a radius one-half that of the earth and a mass 2 times greater than the earth. The person will weigh ? on the surface of that planet. $F_y = \frac{(1)(2)}{(0.5)(0.5)} (100 \text{ lb}) = 800 \text{ lb}$

25 lb #24 17. (2) A person 4000 mi from the center of the earth weighs 100 lb. How much will she weigh at a distance of 8000 mi from the center? $F_{\text{new}} = \frac{(1)(1)}{(2)^2} (100 \text{ lb}) = 25 \text{ lb}$

Earth #15 18. REVIEW: The model of Ptolemy placed the ? at the center of the Universe

light-year #14 19. The distance that light travels in one year is an astronomical distance unit called ?.

Polaris (or North Star) #17 20. As night progresses, all the constellations move around which star?

Rotation of earth about its axis #18 21. Why is it that all the constellations appear to move around in a circle as night progresses?

Jupiter #19 22. Which planet is known for its "great red spot."

Jupiter #20 23. (1 1/2) What three planets currently are known to have 20 or more moons?

Saturn

Uranus

O₂ (oxygen) #27 24. The present atmosphere of the earth consists of about 20% ? and about 79% ?.

N₂ (nitrogen)

Milky Way #28 25. The galaxy of which our solar system is a part is called ?.

92,000 cm³ #29 26. (2) REVIEW QUESTION: A box measuring 1.05 m by .25 m by .35 m contains ? cm³.
 $(105 \text{ cm})(25 \text{ cm})(35 \text{ cm}) = 92,000 \text{ cm}^3$

980 N #30 27. (2) REVIEW QUESTION: The weight of a 100 kg object is ? while its mass is ?.
 $m = 100 \text{ kg}$ $W = mg = (100 \text{ kg})(9.8 \frac{\text{m}}{\text{s}^2}) = 980 \text{ N}$

4.6 Billion #31 28. According to astronomical data, the age of the earth is approximately ? years old; surprisingly the earliest known fossils of "life" as defined in class were dated ? years old.

3.5 Billion

#21 29. (2) The physical quantity "density" is defined as mass / volume and, of all the planets in our solar system, the one that is the most dense is the planet ?.

EARTH

#22 30. (2) The particular astronomical term that designates the time that it takes for a planet to make one complete trip around the sun is called the period of ?, while the term that designates the time that it takes for a planet to undergo one complete turn about its axis is called the period of ?.

Revolution
Rotation

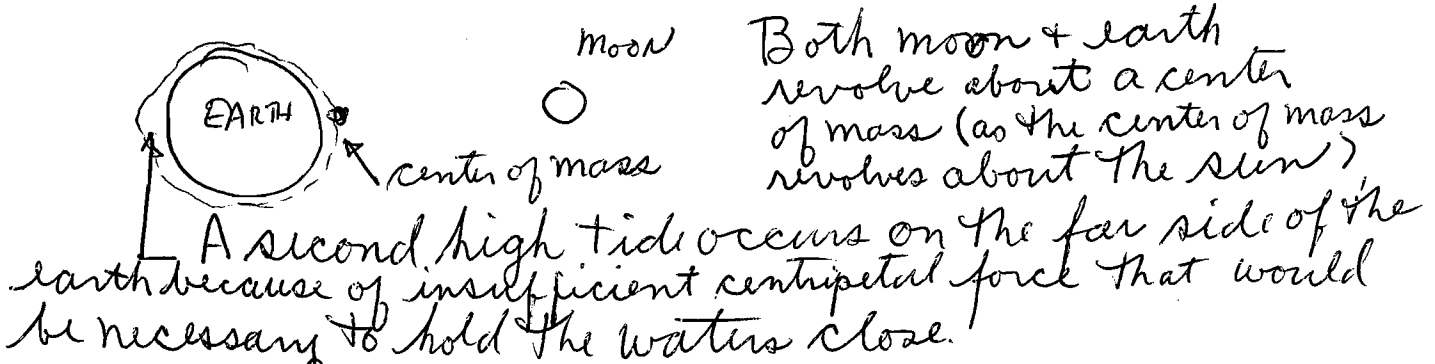
Saturn #23

31. (2) A planet whose rings can be seen through telescopes here on earth is ? while the most eccentric orbit of all planets in our solar system is ?.

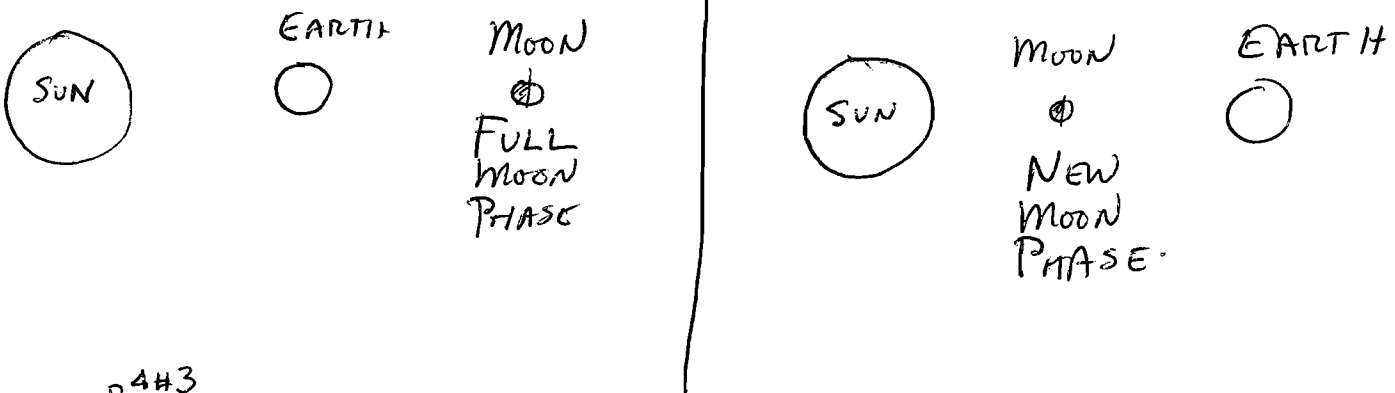
Pluto

B. Longer Answer Questions

1. (a) (3) Why is it that a high tide occurs on the side of the earth opposite the side that the moon is on? Be sure to include center of mass in your discussion.



(b) (3) Draw two diagrams that include the earth, moon, and sun that would result in maximum high tides on the earth. Which of these would occur during a full moon? A new moon?



2. (+2 Points Bonus!) Why is the study of astronomy sometimes referred to as looking through the "window of time?"

Because the light that we see from stars & galaxies has taken many years to get here. When we see light from a galaxy 14 Billion ^{light years} away, we are seeing that galaxy as it was 14 Billion years ago.

3. (4) Explain what is meant by the term "escape velocity." Use this concept to explain why it is that the moon has no atmosphere, why the earth has its corresponding atmosphere of heavier gases but not hydrogen or helium, and why the atmosphere of Jupiter retains hydrogen and helium.

The escape velocity is the velocity that you must give a particular mass here on the surface of the earth so that it will just be able to escape the gravitational pull of that moon, planet, or star.

The moon has an escape velocity of $1\frac{1}{2} \frac{mi}{s}$ & all gases travel faster than this & escape.
 The Earth " " " " $7 \frac{mi}{s}$. The lighter gases of hydrogen & helium move faster than this & escape. Heavier gases remain.
 Jupiter has an escape velocity so large that all gases remain.

