

Name:

Directions: Listed below are twenty (20) multiple-choice questions based on the material covered by the lectures this past week. Choose the correct response from those listed, **along with at least a one (1) sentence justification for your answer**. In the case of a question involving math, the calculation can serve as your justification. Each question is worth 5 points: 2 for the letter response and 3 for the justification. Collaboration with your peers is permitted, but all justifications must be in your own words. If you are unsure about a question, make an educated guess, and justify your guess (which can include why you can rule out certain choices from the list). If you get stuck, **please seek assistance from your peers, the TA, or the professor**. Note: It may be helpful to place your answers on a separate sheet of paper and staple it to this assignment sheet.

WARNING: Please **DO NOT** copy material word for word from sources such as textbooks, a peer's notes, online references (i.e. Google or Wikipedia), etc in any responses to homework, quiz, or exam questions. Ideas should be expressed in your own words. Not only does this protect you from illegal acts of plagiarism and/or accusations of cheating, but it also aids your future studying by having ideas expressed in a way that you, personally, can best understand. If for some reason you **MUST** quote text from a source in your answer, properly reference your quote.

1. Two spaceships that have different masses but rocket engines of identical force are at rest in space. If they fire their rockets at the same time, which ship will speed up fastest?
 - A) They will not speed up at all but will move at a constant speed.
 - B) the one with the lowest mass
 - C) They will increase speed at the same rate.
 - D) the one with the highest mass
2. The old story about the person who sneezed so hard that he fell off his barstool is an exaggerated illustration of which physical law?
 - A) the law forbidding the partaking of alcohol during physical experiments
 - B) Law of Inertia, Newton's first law
 - C) Law of Universal Gravitation
 - D) Newton's third law
3. A person standing on a bathroom scale sees a reading on the scale of 148 pounds. This person is acted on by
 - A) no forces at all.
 - B) only one force, of 296 pounds ($= 2 \times 148$ pounds).
 - C) two forces of equal size acting in opposite directions.
 - D) only one force (148 pounds, as shown by the reading on the scale).
4. In which direction would Earth move if the Sun's gravitational force were suddenly removed from it?
 - A) in a straight line toward the Sun
 - B) It would continue in a circular orbit.
 - C) in a straight line directly away from the Sun
 - D) in a straight line along a tangent to its circular orbit

5. Suppose that a planet of the same mass as Earth were orbiting the Sun at a distance of 10 AU. The gravitational force on this planet due to the Sun would be
- A) 100 times the gravitational force the Sun exerts on Earth.
 - B) 10 times the gravitational force the Sun exerts on Earth.
 - C) 1/10 of the gravitational force the Sun exerts on Earth.
 - D) 1/100 of the gravitational force the Sun exerts on Earth.
6. A person orbiting Earth in the Space Shuttle feels weightless because
- A) only one force (gravity) acts on her, but gravity also accelerates the shuttle at a similar rate.
 - B) there are two forces acting on her in opposite directions, so they cancel and produce the same effect as if no force at all were acting.
 - C) her mass is zero in space, and weight requires mass.
 - D) there is no gravity in Earth orbit.
7. In the early Solar System, two planetesimals (the large and solid building blocks of planets) have a head-on collision and stick together. One body has a mass m and was traveling with velocity v . The other has a mass $2m$ and a velocity of $-0.25v$. What is the approximate velocity of the new and bigger planetesimal with mass $3m$? (Remember that a negative velocity is in the opposite direction of a positive velocity. Hint: You should use momentum conservation.)
- A) $-1/3v$
 - B) $1/6v$
 - C) $3v$
 - D) $-1/2v$
8. Mars has a mass of about 0.1 times that of the Earth and a radius of around $\frac{1}{2}$ of the Earth's radius. Roughly how does the escape velocity from the surface of Mars compare to that of the Earth?
- A) 2 times bigger than that of the Earth
 - B) 0.4 that of the Earth
 - C) Not enough information to give an estimate
 - D) 0.2 that of the Earth
9. Titan, the largest satellite of Saturn, orbits Saturn with a semi-major axis of 1.22×10^9 meters and an orbital period of 1.38×10^6 seconds (about 16 days). What is the combined mass of both Saturn and Titan using this data?
- A) 4.65×10^{17} kg
 - B) 4.09×10^{20} kg
 - C) 5.65×10^{26} kg
 - D) 7.80×10^{32} kg
10. The water on the side of Earth that faces away from the Moon experiences
- A) a high tide.
 - B) a low tide.
 - C) no tidal force.
 - D) either a high tide or a low tide, depending on the angle to the Sun.

11. Suppose I am at the Earth's equator at a time when my location is experiencing a high tide that is higher than usual. What is happening one quarter of the way around the equator at this same time?
- A) This location will also experience an exceptionally high tide.
 - B) This location will experience a high tide, but it will be lower than usual.
 - C) This location will experience a low tide, but it will be higher than usual.
 - D) This location will experience an exceptionally low tide.
12. The reason the Moon always keeps one face toward Earth is that
- A) the impact of asteroids on the Moon early in its history slowed its rotation rate.
 - B) gravitational forces from the Sun act on the tidal bulge of the Moon.
 - C) the Moon was spinning this way when it was formed and has maintained this rotation.
 - D) gravitational forces from Earth act on the tidal bulge of the Moon.
13. A scientist reports the detection of an atomic particle that came toward his experiment from outer space at a speed of $4 \times 10^5 \text{ km s}^{-1}$. What conclusion can we draw from this report?
- A) He has made an error in his experiment, since such a speed is considered to be impossible by all previous experiments.
 - B) This "particle" must have been a photon or quantum of electromagnetic radiation of very high energy in order to have traveled this fast.
 - C) This result is acceptable since atomic particles can travel this fast, whereas larger bodies are limited to $3 \times 10^5 \text{ m s}^{-1}$.
 - D) This is an acceptable result for a particle originating from outer space, since particle speed from such regions is unlimited.
14. The average distance of Pluto from the Sun is 40 AU. How long does it take for light to travel across the solar system from one side of Pluto's orbit to the other?
- A) 8 min
 - B) 22 hrs
 - C) 5½ hrs
 - D) 11 hrs
15. Suppose an astronomical satellite observes the Orion Nebula at a wavelength of 1250 nm. In what wavelength range is this satellite observing?
- A) X rays
 - B) ultraviolet
 - C) infrared
 - D) visible light
16. What is the one fundamental difference between X rays and radio waves?
- A) They always come from different sources.
 - B) Their wavelengths are very different.
 - C) Radio waves are always wavelike, while X rays always behave like particles.
 - D) Their speeds in outer space are different.

17. What is the wavelength of radiation emitted by an FM radio station transmitting at a frequency of 100 MHz?
- A) 300 m
 - B) 0.03 m
 - C) 1 m
 - D) 3 m
18. White light passes through a prism and separates into a spectrum of colors. A second prism is placed so that only the green light from the first prism falls upon it. After passing through this second prism the light will be
- A) white.
 - B) green.
 - C) ultraviolet.
 - D) infrared.
19. The temperature of a normal, healthy, human being (37°C) expressed on the Kelvin (absolute) scale is approximately
- A) 137 K.
 - B) 410 K.
 - C) 310 K.
 - D) 236 K.
20. As a newly formed star continues to contract, its temperature increases while the chemical nature of the gas does not change. What happens to the peak wavelength of its emitted radiation?
- A) It moves toward shorter wavelengths (e.g., IR to visible).
 - B) It moves toward longer wavelengths (e.g., visible to IR).
 - C) It remains constant, since the chemical state of the gas does not change.
 - D) It does not change, since it does not depend on temperature.

Answer Key

1. B
2. D
3. C
4. D
5. D
6. A
7. B
8. B
9. C
10. A
11. D
12. D
13. A
14. D
15. C
16. B
17. D
18. B
19. C
20. A