

Name and Student ID _____ Section Day/Time _____

Write your name and student ID number on this printed exam, and fill them in on your Scantron form. Both your Scantron form and this printed exam need to be turned in for you to get credit for the exam.

- 1) Suppose that a planet was discovered that has twice the mass and twice the diameter of the Earth. What would be the escape velocity at the surface of the planet? (Assume that for Earth the escape velocity is 11 km/s.) 1) _____
A) 22 km/s
B) 7.8 km/s
C) 15.6 km/s
D) 11 km/s
- 2) The planet Wozzle has the same radius as the Earth but is made out of lead, so it is 10 times more massive than the Earth. Where would you weigh more? 2) _____
A) on the Earth
B) on Wozzle
C) you would weigh the same on both planets
- 3) Star A is blue, Star B is yellow, and Star C is red. Which one of these is the hottest star? 3) _____
A) star A
B) star B
C) star C
D) From color, temperature cannot be predicted.
- 4) For someone in the Northern Hemisphere stars rise in the east and set in the west. For someone in the Southern Hemisphere 4) _____
A) the situation is the same—stars also rise in the east and set in the west.
B) the opposite is true—stars rise in the west and set in the east.
- 5) In your office, you have a rolling chair and a rolling filing cabinet. The chair weighs 10 pounds, and the filing cabinet weighs 50 pounds (it's partly full). If you push both of them away with about the same strength 5) _____
A) the chair will accelerate about 25 times as much as the cabinet.
B) the cabinet will accelerate about 25 times as much as the chair.
C) the chair will accelerate about 5 times as much as the cabinet.
D) the cabinet will accelerate about 5 times as much as the chair.
E) both will accelerate about the same.

- 6) One of two identical buildings is nearby, the other is twice as far away as the first. The angular size of the more distant building is _____ the nearby building's angular size. 6) _____
A) two times
B) four times
C) one half
D) one fourth
E) the same as
- 7) An ion engine provides a small but constant force on a spacecraft as it moves from the Earth to Pluto. Compare the speed of the spacecraft near the beginning of its journey with its speed as it flies past Pluto. 7) _____
A) The spacecraft's speed at Pluto is the same as its speed near Earth.
B) The spacecraft's speed at Pluto is slower than its speed near Earth.
C) The spacecraft's speed at Pluto is faster than its speed near Earth.
D) The relative speed cannot be determined with the information given.
- 8) During the month of January, the Earth is at the closest to the Sun on its orbit. Kepler's Second Law says planets sweep out equal area in equal time as they move in their orbits. Using Kepler's Second Law, we can conclude that the Earth moves faster in January than in July. 8) _____
A) True
B) False
- 9) A photon of blue light has _____ a photon of red light. 9) _____
A) more energy than
B) the same energy as
C) less energy than
- 10) There are constellations that are not visible for observers living in North America. 10) _____
A) True
B) False
- 11) The North Celestial Pole is located _____. 11) _____
A) directly above the Earth's equator
B) directly overhead
C) at the geographic North Pole
D) directly above the geographic North Pole
E) at the center of the celestial sphere
- 12) What is the size of an object located at a distance of 1,000 meters and that has angular size $A = 4$ degrees? 12) _____
A) about 11 meters
B) about 1000 meters
C) about 70 meters
D) about 4,000 meters

A

- 13) The semi-major axis of the moon's orbit around the earth is 1,000,000 km. If a collision with an asteroid suddenly made the moon's orbit twice as eccentric (more elliptical) but kept its semi-major axis the same, the moon's orbital period would _____ 13) _____
- A) decreases by one half.
 - B) increase by a factor of 2
 - C) stay the same
 - D) increase by a factor of 8
- 14) As a dense, opaque object cools, its spectrum will shift to _____ wavelengths. 14) _____
- A) longer
 - B) shorter
 - C) emission
 - D) absorption
 - E) continuous
- 15) If the force of gravity exerted on the Sun by the Earth is the same as the force exerted by the Earth on the Sun, why does the Earth orbit the Sun, and not the other way around? 15) _____
- A) The Earth is less massive, and is accelerated more by the gravitational force and moves faster.
 - B) Planets, by definition, orbit the Sun, and not the other way around.
 - C) They each orbit around the geometric center of the system.
 - D) The combined gravitational forces of all the planets keeps the Sun at the center of the Solar System.
 - E) None of these choices is correct.
- 16) Assuming that light could curve around the Earth, about how long would it take for one trip? 16) _____
- A) 1/7 second
 - B) 1 second
 - C) 7 seconds
 - D) 7 minutes
- 17) When they arrived on the moon, the Apollo 11 astronauts measured the moon's mass and radius and computed the escape speed from the moon to be 2.4 km/s. After the astronauts loaded their space capsule with 250 kg of moon rocks, what was the escape speed they needed to reach in order to get home? 17) _____
- A) 37 km/s
 - B) 2.4 km/s
 - C) 592 km/s
 - D) 139 km/s

- 18) If the distance between two masses is tripled (multiplied by 3), the gravitational force between them is 18) _____
A) increased by a factor of 3 (multiply by 3)
B) increased by a factor of 9 (multiply by 9)
C) decreased by a factor of 3 (multiply by 3)
D) decreased by a factor of 9 (multiply by 9)
- 19) A star's emission line of 656 nm appears shifted to 649 nm in the spectrum. What can you conclude from this shift? 19) _____
A) The star is approaching you with the speed of 3,200 km/s.
B) The star is receding (moving away) from you with the speed of 3,200 km/s.
C) The star is approaching you with the speed of 320,000 km/s.
D) The star is receding (moving away) from you with the speed of 320,000 km/s.
- 20) The wavelength of an absorption line emitted by a laboratory sample of hot, transparent hydrogen gas is 656 nm. Taking a spectrum of a star, you find that the same absorption line of hydrogen appears at 662 nm. You conclude that the star 20) _____
A) is 1% hotter than the hydrogen in the laboratory sample.
B) is moving towards us at about 1% the speed of light.
C) is 1% cooler than the hydrogen in the laboratory sample.
D) is moving away from us at about 1% the speed of light.
- 21) What are some of the things astronomers can learn about an astronomical object from their spectra? 21) _____
A) what elements the object is made of
B) whether it is dense and opaque, a transparent gas, or a combination of both
C) how fast the objects are moving
D) All of these choices are correct.
- 22) An object is moving in a straight line and at a constant speed of 60 kilometers per hour. We therefore conclude that the net force on this object is zero. 22) _____
A) True
B) False
- 23) If the Earth's axis was *not* tipped relative to the Celestial Equator, _____. 23) _____
A) the Earth would experience winter all year
B) the Earth would experience summer all year
C) the Earth would not experience seasons
D) there would be an eclipse every month
E) there would never be an eclipse
- 24) As the frequency of light increases, its energy _____. 24) _____
A) increases
B) decreases
C) remains constant
D) moves more quickly
E) moves more slowly

- 25) An ion engine provides a small but constant force on a spacecraft as it moves from the Earth to Pluto. Compare the acceleration of the spacecraft near the beginning of its journey with its acceleration as it flies past Pluto. 25) _____
- A) The spacecraft's acceleration at Pluto is the same as its acceleration near Earth.
 - B) The spacecraft's acceleration at Pluto is slower than its acceleration near Earth.
 - C) The spacecraft's acceleration at Pluto is faster than its acceleration near Earth.
 - D) The relative acceleration cannot be determined with the information given.
- 26) If there is a full moon visible from Paris one evening, twelve hours later in Australia there will be a _____ visible. 26) _____
- A) full moon
 - B) new moon
 - C) first quarter moon
 - D) crescent moon
- 27) Mercury is the closest planet to the sun. Jupiter is the fifth planet from the sun. Imagine the much more massive Jupiter were to switch places with the less massive Mercury, so that Jupiter became the closest planet to the sun. Which of the following would accurately describe the outcome? 27) _____
- A) Jupiter would have a faster orbital speed than it did before.
 - B) Mercury would have a faster orbital speed than it did before.
 - C) The orbital speed for each of the planets would not change.
- 28) The planet Wozzle has the same radius as the Earth but is made out of lead, so it is 10 times more massive than the Earth. You are planning to travel to the planet Wozzle in your spaceship, and you want to make sure you have enough fuel to lift off from Wozzle for your journey home. You expect the surface gravity of the planet Wozzle to be 28) _____
- A) the same as the surface gravity of the Earth
 - B) larger than the surface gravity of the Earth
 - C) the same as the surface gravity of the Earth
- 29) The acceleration of gravity on the Earth's surface is 9.8 m/s^2 . What is the acceleration of gravity at a height of 6,400 km above the Earth's surface? (Hint: recall the $1/r^2$ dependence and note that the Earth's radius is 6,400 km.) 29) _____
- A) 4.9 m/s^2
 - B) 2.45 m/s^2
 - C) 19.6 m/s^2
 - D) 9.8 m/s^2
- 30) During which phase of the moon do you expect to observe a lunar eclipse? 30) _____
- A) full moon
 - B) new moon
 - C) first quarter
 - D) third quarter
 - E) Lunar eclipses can occur at any phase of the moon.

- 31) A delivery truck and a car collide. Which vehicle experiences the greater force? 31) _____
A) the truck
B) the car
C) Both the car and the truck experience the same force.
D) We need to know the speed of the truck and the car to find the answer.
E) We need to know the mass of the truck and the car to find the answer.
- 32) If a photon's frequency increases, its wavelength 32) _____
A) will decrease.
B) will increase.
C) will not change.
- 33) How can we tell that the Moon is held in orbit around the Earth by a force? 33) _____
A) The Moon follows a curved path as it orbits.
B) The Moon's gravity creates tides in the Earth's oceans.
C) The Moon is always the same distance from the Earth.
D) One side of the Moon is always facing the Earth.
E) The Earth's gravitational force pulls inward on the Moon.
- 34) If the Moon is suddenly and inexplicably moved to four times its current distance from the Earth, its orbital speed _____. 34) _____
A) increases by a factor of 2
B) increases by a factor of 4
C) decreases by a factor of 2
D) decreases by a factor of 4
E) is unchanged due to its low mass
- 35) A delivery truck and a car collide. Which vehicle experiences the greater acceleration? 35) _____
A) the truck
B) the car
C) Both the car and the truck experience the same acceleration.
D) We need to know the speed of the truck and the car to find the answer.
E) We need to know the mass of the truck and the car to find the answer.
- 36) The Sun and the Moon have the same angular size. If the Sun is 400 times farther away than the Moon, the Sun must be _____ times the size of the Moon. 36) _____
A) 400
B) 1/400
C) 1/4
D) 4
E) 4π

- 37) An asteroid is discovered in our solar system with an orbital period of 25 years. What is the average distance of the asteroid to the sun? 37) _____
A) 125
B) 25 AU
C) 8.5 AU
D) 625 AU
- 38) The spectral lines of a star will appear _____ if the star is moving away from the Earth. 38) _____
A) redshifted (i.e., shifted toward the longer wavelengths)
B) blueshifted (i.e., shifted toward the shorter wavelengths)
- 39) If the net force acting on an object doubles and its mass does not change, then the _____ doubles as well. 39) _____
A) mass
B) acceleration
C) speed
D) velocity
- 40) What causes the seasons? 40) _____
A) the changing distance between the Earth and the Sun
B) the tilt of the Earth's spin axis relative to the Earth's orbit
C) the Earth's spin axis is tilted from the poles of the celestial sphere
D) the elliptical shape of the Earth's equator
- 41) How are mass and weight different? 41) _____
A) There is no difference; they are the same.
B) Weight is a measure of how much gravity pulls an object; mass is how much matter the object has.
C) Mass is the amount of matter an object contains; weight is how much mass an object contains.
D) Weight is the amount of matter an object contains; mass is the type of matter an object is made of.
- 42) As the wavelength of light increases, its energy _____. 42) _____
A) increases
B) decreases
C) remains constant
D) moves more quickly
E) moves more slowly
- 43) The change in constellations we see at night throughout the year is caused by _____. 43) _____
A) the rotation of the Earth on its axis
B) the motion of the Earth in its orbit around the sun
C) the precession of the Earth's axis
D) the Sun's orbit around the center of the galaxy
E) zodiacal shift

- 44) During which phase of the moon do you expect to observe a solar eclipse? 44) _____
A) full moon
B) new moon
C) first quarter
D) third quarter
E) Solar eclipses can occur at any phase of the moon.
- 45) Objects A and B are dense and opaque, and each emits a continuous spectrum. Object A emits the largest number of photons at a wavelength of 400 nm. Object B emits the largest number of photons at a wavelength of 800 nm. What can we say about their relative temperatures? 45) _____
A) A's temperature is twice as high as B's.
B) B's temperature is twice as high as A's.
C) A's temperature is the same as B's.
D) Nothing. Temperature is related to brightness, not emitted wavelength.
- 46) If you double (multiply by two) the distance between two bodies, the force of gravity between them would 46) _____
A) double (multiply by two)
B) become four times as strong (multiply by four)
C) decrease by one half (divide by two)
D) decrease by one fourth (divide by 4)
- 47) The Moon is gravitationally attracted to the Earth. Is the Earth gravitationally attracted to the Moon? 47) _____
A) Yes, but the force of attraction is less.
B) Yes, and the force of attraction is the same.
C) Yes, but the force of attraction is greater.
D) No, the Moon has no gravity.
- 48) Over the course of a single night, stars move overhead due to _____. 48) _____
A) their motion around the Earth
B) the rotation of the Earth on its axis
C) the motion of the Sun around the galaxy
D) the rotation of the celestial sphere
E) the tilt of the Earth's axis
- 49) As a dense, opaque body heats, the radiation it emits _____. 49) _____
A) increases in wavelength
B) decreases in intensity
C) peaks at a shorter wavelength
D) peaks at a longer wavelength
E) All of these choices are correct.

- 50) A constellation directly overhead at midnight in June will be _____ at midnight in December. 50) _____
- A) directly overhead
 - B) on the eastern horizon
 - C) on the western horizon
 - D) below the horizon (not observable)
 - E) None of these choices is correct.
- 51) An object moving on a circle at constant speed is experiencing an acceleration. 51) _____
- A) True
 - B) False
- 52) You find two new comets, X and Y, and measure their Doppler shifts. You identify an absorption line in the spectrum of comet X that is at a wavelength of 410.1 nm in the lab but 408.2 nm in the spectrum of comet X. That same absorption line is at a wavelength of 406.5 nm in comet Y. You conclude: 52) _____
- A) Both comets are approaching the earth. Comet Y is moving faster to the earth than comet X
 - B) Both comets are approaching the earth. Comet X is moving faster to the earth than comet Y
 - C) Comet X is approaching the earth. Comet Y is moving away from the earth.
 - D) Both comets are moving away from the earth. Comet Y is moving away from the earth faster than comet X
- 53) A 200-kg spacecraft is launched to the Moon. After it has landed on the Moon, its mass is _____. 53) _____
- A) zero
 - B) 200 kg
 - C) about 1/6 its weight at Earth
 - D) The answer depends on which side of the Moon the spacecraft landed on
- 54) An object is dense and opaque and emits a thermal spectrum. According to Wien's law, as it is heated the object will _____. 54) _____
- A) appear darker (emit fewer photons)
 - B) not change its spectrum. It will emit the same number of photons at every wavelength.
 - C) emit more photons at shorter wavelengths
 - D) appear the same color
- 55) The Northern Hemisphere is warmer in its summer months because _____. 55) _____
- A) the Earth is closer to the Sun during this time
 - B) the Sun is in the sky for a longer period of time
 - C) the Sun is more directly overhead during this time
 - D) the Sun is in the sky for a longer period of time and the Sun is more directly overhead during this time
 - E) the Earth is closer to the Sun during this time and the Sun is in the sky for a longer period of time

- 56) If the mass of the Earth increased by a factor of 9 the escape speed from its surface would be 56) _____
- A) nine times larger
 - B) three times larger
 - C) the same
 - D) three times smaller
 - E) 9 times smaller
- 57) Mars completes one orbit around the Sun in approximately two Earth years. Mars' average distance to the Sun is about 1.5 AU and the mass of Mars is about 1/10 of the Earth's mass. Therefore the Mars' orbital speed is lower than the Earth's orbital speed. 57) _____
- A) True
 - B) False
- 58) A new dwarf planet is discovered in our solar system. It is farther away than Pluto, with a semi-major axis of 127 AU. What is its orbital period? 58) _____
- A) 127 years
 - B) 5376 years
 - C) 1431 years
 - D) 190 years
- 59) The angular size of an object increases as the distance to the observer increases. 59) _____
- A) True
 - B) False
- 60) What is the Celestial Equator? 60) _____
- A) a band of constellations through which the planets and Sun appear to move
 - B) the line that the Sun traces across the celestial sphere
 - C) an imaginary line in the sky, directly above the Earth's equator
 - D) the cycle of lunar phases

Answer Key

Testname: AY22017_MIDTERMA

- 1) D
- 2) B
- 3) A
- 4) A
- 5) C
- 6) C
- 7) C
- 8) A
- 9) A
- 10) A
- 11) D
- 12) C
- 13) C
- 14) A
- 15) A
- 16) A
- 17) B
- 18) D
- 19) A
- 20) D
- 21) D
- 22) A
- 23) C
- 24) A
- 25) A
- 26) A
- 27) A
- 28) B
- 29) B
- 30) A
- 31) C
- 32) A
- 33) A
- 34) C
- 35) B
- 36) A
- 37) C
- 38) A
- 39) B
- 40) B
- 41) B
- 42) B
- 43) B
- 44) B
- 45) A
- 46) D
- 47) B
- 48) B
- 49) C

Answer Key

Testname: AY22017_MIDTERMA

50) D

51) A

52) A

53) B

54) C

55) D

56) B

57) A

58) C

59) B

60) C