

Astronomy 100—Exam 1

Prof. Mo

Exam Version A

INSTRUCTIONS: Write your name and ID number on BOTH this sheet and the computer grading form. Use a #2 Pencil on the computer grading form. Be careful to match up your question number with the number on the computer form, and thoroughly erase all changed answers and stray marks on the form.

Reference Section

$M_{\odot} = M_{sun} = 2 \times 10^{30} \text{ kg}$	$M_{\oplus} = M_{earth} = 6 \times 10^{24} \text{ kg}$	$1^{\circ} = 60 \text{ arcminutes}$
$1 \text{ mm} = 10^{-3} \text{ m}$	$1 \text{ km} = 10^3 \text{ m}$	$1 \text{ pc} = 3.26 \text{ ly}$
$1 \text{ nm} = 10^{-9} \text{ m}$	$1 \mu\text{m} = 10^{-6} \text{ m}$	$1 \text{ AU} = 1.5 \times 10^{11} \text{ m}$
Radius of Earth = 6378 km	Radius of Moon = 1700 km	Distance to Moon = 380,000 km
$c = 3.0 \times 10^8 \text{ m s}^{-1}$	$G = 6.7 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$	
$P_{yr}^2 = a_{AU}^3$	$F = ma$	$F = \frac{GMm}{R^2}$
$\lambda\nu = c$	$E = \frac{hc}{\lambda} = h\nu$	$\lambda_{peak}(mm) = 2.93/T(K)$
	$\frac{\Delta\lambda}{\lambda_{lab}} = \frac{\lambda - \lambda_{lab}}{\lambda_{lambda}} = \frac{v}{c}$	$I_{bb} = \sigma T^4$

1. **BE SURE TO ANSWER THIS QUESTION** This test is VERSION A. What version of the test do you have?

A. VERSION A.	B. wrong!	C. wrong!	D. wrong!	E. wrong!
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2. 2.1×10^7 is the same as

A. 2.1 thousand	B. 21 thousand	C. 210 thousand	D. 2.1 million	E. 21 million
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3. If a person's mass is 60 kilograms on the surface of the earth, what is his/her mass on the surface of the Moon?

A. 120 kilograms	B. 30 kilograms	C. 60 kilograms	D. 60 lb	E. 30 lb
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4. If you see that the spectral lines of a distant star are all shifted to wavelengths longer than their rest wavelengths, you can infer

A. that the star is moving towards you.	D. nothing.
B. that the star is moving away from you.	E. that the star is becoming cooler.
C. that the star is at rest.	
5. At room temperature, a blackbody will emit photons mostly

A. in X-ray and radio	B. in infrared.	C. in visible light.	D. in Gamma ray.
E. none of above: objects at room temperature do not emit radiation.			
6. A "light-year" is defined as

A. the distance between the sun and the earth.	B. the distance that the earth travels in one year as it orbits the sun once.	C. the time required for light to travel between the earth and the sun.	D. the time require for light to travel between the sun and the nearest star.
E. the distance that light travels in one year.			
7. When does the new moon rise?

A. at sunset.	B. at noon.	C. at sunrise.	D. it never rises.	E. at midnight.
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8. If the Sun were a grapefruit in this room, the nearest star (Proxima Centauri) would be
- A. more-or-less another grapefruit on the West Coast.
 - B. a poppyseed about 15 m away.
 - C. a peppercorn about 100 m away.
 - D. a poppyseed on the other side of the campus.
 - E. a creampuff at Bart's.
9. Your friend, living on a planet 100 light-years away from the earth, has just sent to you a short message to inform you that she has just given birth to a baby. What is the age of the baby when you receive the message on the earth?
- A. The baby was just born.
 - B. The baby is about 4 years old.
 - C. The baby is about 100 light-years old.
 - D. The baby is about 1 day old.
 - E. The baby is about 100 years old.
10. The principal use of dividing the sky up into constellations today is to
- A. identify regions and/or designate positions for objects in the sky.
 - B. allow historians to recall and/or identify the ancient gods and goddess.
 - C. establish the basis for the retelling of mythological stories of the stars.
 - D. allow astrologers to predict the future.
 - E. prohibit stars from crossing the borders.
11. For mapping purpose, the Earth is divided into two equal halves by an imaginary line called the equator. Likewise, the sky is divided into two equal halves by an imaginary line called the
- A. ecliptic.
 - B. line of nodes.
 - C. celestial equator.
 - D. zodiac.
 - E. none of the above.
12. Which of the following best defines the celestial equator?
- A. A real line that divides the sky into two equal halves.
 - B. An imaginary line that divides the sky into two equal halves.
 - C. A line of nodes.
 - D. zodiac.
 - E. A line that divides the earth into two equal halves.
13. If you observe the sky for several hours during a particular clear night, you will observe
- A. the star Polaris remaining stationary at your zenith.
 - B. the celestial sphere spinning from west to east.
 - C. the constellations changing shape as the stars move relative to one another.
 - D. the Moon changes position slightly from west to east with respect to the stars.
 - E. the Moon changes position slightly from east to west with respect to the stars.
14. Absolute zero degree is
- A. zero degree Celsius.
 - B. the temperature at which water freezes.
 - C. the temperature at which atoms have no remaining energy from which we can extract heat.
 - D. both a and b.
 - E. none of the above.
15. In the hydrogen atom, the electron and proton are bound together by
- A. gravitational force.
 - B. electromagnetic force.
 - C. nuclear force.
 - D. chemical force.
 - E. none of the above.

16. Each day, from a point on Earth north of the equator, most stars appear to
- A. remain stationary overhead.
 - B. rise in the east and set in the west.
 - C. rise in the west and set in the east.
 - D. move to the north.
 - E. move to the south.
17. A hydrogen atom making a direct transition from an upper energy level to the ground (lowest) energy level
- A. emits a photon which has an energy which depends on the temperature of the atom.
 - B. emits a photon with an energy exactly equal to the difference in energy between the two states.
 - C. experiences a Doppler shift.
 - D. absorbs a photon which has an energy which depends on the temperature of the atom.
 - E. emits a continuous spectrum.
18. In a clear night you observed that Polaris was about 50 degrees above your northern horizon. What was your latitude (in degrees) at the time of your observation?
- A. 40
 - B. 50
 - C. 23.5
 - D. 42
 - E. 58
19. Blackbody radiation
- A. is due to the thermal motion of electrons, which emit photons.
 - B. has continuous spectrum.
 - C. is invisible to the naked eye.
 - D. confined to a few specific wavelengths, depending on the material.
 - E. a and b.
20. Blackbody radiation
- A. is due to the thermal motion of electrons, which emit photons.
 - B. has continuous spectrum.
 - C. is bluer at higher temperature
 - D. invisible to the naked eye.
 - E. a, b and c
21. Which of the following statements about radiation is true?
- A. Ice cubes at a temperature below the freezing point do not emit black body radiation.
 - B. The maximum intensity of radiation emitted by a human body is at visible wavelengths.
 - C. Solid objects emit radiations; objects composed of gas do not.
 - D. Hot objects emit less short wavelength radiation than cooler objects.
 - E. All objects with a temperature above absolute zero degree radiate.
22. Which of the following statements about radiation is true?
- A. Ice cubes at a temperature below the freezing point do not emit black body radiation.
 - B. The maximum intensity of radiation emitted by a human body is at infrared wavelengths.
 - C. Solid objects emit radiations; objects composed of gas do not.
 - D. Hot objects emit less short wavelength radiation than cooler objects.
 - E. Hot objects emit less energy than cooler objects.

23. Objects A and B have the same size, but the temperature of B is twice as high as that of A. Which of the following statement is correct?
- A. Object B emits 8 times more radiation than object A.
 - B. Object B emits 16 times more radiation than object A.
 - C. Object B emits 4 times more radiation than object A.
 - D. Object B emits 2 times more radiation than object A.
 - E. Object B emits the same amount of radiation as object A.
24. Objects X and Y have the same size; object X has a temperature of 200 degree Kelvin, whereas object Y has that of 400 degrees.
- A. Object Y emits 2 times more radiation than object X.
 - B. Object Y emits 4 times more radiation than object X.
 - C. Object Y emits 8 times more radiation than object X.
 - D. Object Y emits 16 times more radiation than object X.
 - E. Object Y emits the same amount of radiation as object X.
25. What causes season here on planet Earth?
- A. the Earth's elliptical orbit brings it closer and farther from the Sun.
 - B. The elliptical orbit of the Moon.
 - C. because of the alignment of the solar and lunar cycles.
 - D. The earth's rotation axis is tipped relative to its orbit.
 - E. periodic changes in the heat retention of the Earth's atmosphere.
26. Newton concluded that some force had to act on the Moon because
- A. a force is needed to keep the Moon in motion.
 - B. a force is needed to pull the Moon outward.
 - C. the Moon moved at a constant velocity.
 - D. a force is needed to pull the Moon away from straight-line motion.
 - E. all of the above.
27. Some force must act on the earth because
- A. a force is needed to keep the earth in motion.
 - B. otherwise the earth would fly away in straight line.
 - C. a force is needed to keep the moon in motion.
 - D. the earth moves at a constant velocity.
 - E. all of the above.
28. Which of the following best describes Newton's First Law?
- A. For each and every force, there is an equal force in the opposite direction.
 - B. The acceleration of an object is proportional to the net force on it and inversely proportional to its mass.
 - C. In the absence of a net force, an object either remains at rest or moves with a constant speed in a straight line.
 - D. The gravitational force between two objects is proportional to the product of the two masses and inversely proportional to the square of their separation.
 - E. None of above
29. From largest to smallest, what is the correct order of the following distance? (ly stands for light year)
- A. 1 cm, 1 km, 1ly, 1 AU
 - B. 1 km, 1 cm, 1 AU, 1 ly
 - C. 1 ly, 1 AU, 1 km, 1 cm
 - D. 1 AU, 1 ly, 1 km, 1 cm
 - E. 1 ly, 1 AU, 1 cm, 1 km

30. All planetary orbits are
- A. circles with the Sun at center.
 - B. circles with the Sun at focus.
 - C. ellipses with the Sun at the center.
 - D. ellipses with the Sun at one focus.
 - E. ovals with the Sun at the center.
31. What best describes the orbit of the earth around the sun?
- A. a circle with the Sun at focus.
 - B. an ellipse with the Sun at the center.
 - C. a circle with the Sun at its center.
 - D. an ellipse with the Sun at one focus.
 - E. an oval with the Sun at the center.
32. The Sun is
- A. a star.
 - B. 1 AU from Earth.
 - C. more than 100 times the diameter of Earth.
 - D. all of the above.
 - E. none of the above.
33. The Sun is
- A. a planet.
 - B. 1 AU from the earth.
 - C. the center of the universe.
 - D. all of the above.
 - E. none of the above.
34. The moon moves about ____ eastward in the sky each night.
- A. 1°.
 - B. 5°.
 - C. 13°.
 - D. 29°.
 - E. 0°.
35. Which of the following does describe an acceleration:
- A. a car travelling with constant speed around a bend.
 - B. A car increasing speed on a straight road.
 - C. the moon revolving around the earth.
 - D. a planet orbiting around the sun.
 - E. all of above.
36. Our solar system contains
- A. primary gas and dust.
 - B. a single star and a number of planets.
 - C. two stars and a number of planets.
 - D. a number of stars.
 - E. no star at all.
37. What phase would be the *Earth* appear to be in if you were standing on the moon at Full Moon?
- A. New.
 - B. Crescent.
 - C. Only the Moon can show phases.
 - D. Waxing gibbous.
 - E. Full.
38. From largest to smallest, the correct order of the following objects is
- A. Earth's orbit, Jupiter, Milky Way Galaxy, Solar system
 - B. Milky Way Galaxy, Solar system, Earth's orbit, Jupiter
 - C. Jupiter, Earth's orbit, Solar system, Milky Way Galaxy
 - D. Solar system, Earth's orbit, Milky Way Galaxy, Jupiter
 - E. Earth's orbit, Milky Way Galaxy, Solar System, Jupiter
39. Which of the following best describes gravity?
- A. A force that larger objects exert on smaller ones.
 - B. The pressure of the atmosphere on us.
 - C. An attraction force that exists only among astronomical objects
 - D. A force that keeps electrons on their orbits in atoms.
 - E. The attraction force between any two objects with mass.

40. Each atom has a unique spectrum, because
- A. The spectral lines of different atoms are shifted differently by Doppler's effect.
 - B. Each element has a unique set of electron energy levels.
 - C. Each element has a unique temperature.
 - D. All of above
 - E. None of above
41. The principal difference between visible light and X-ray is
- A. visible light travels at the speed of sound.
 - B. visible light carries substantially more energy per photon.
 - C. X-ray has a higher frequency than visible light.
 - D. only visible light can travel through the vacuum of space.
 - E. X-ray cannot be produced by blackbody radiation.
42. If light takes 8 minutes to reach the earth from the sun and 4 hours (i.e. 240 minutes) to reach Neptune, what is the distance from the sun to Neptune?
- A. 5 AU
 - B. 30 AU
 - C. 37.5 ly
 - D. 37.5 AU
 - E. 30 ly
43. The sun shines most directly on Amherst, MA at the time of
- A. the vernal equinox.
 - B. the autumnal equinox and the vernal equinox.
 - C. the summer solstice.
 - D. the autumnal equinox and the winter solstice.
 - E. the autumnal equinox.
44. Which of the following statements is correct
- A. The sun is a planet.
 - B. The moon is a star.
 - C. Mars is a star.
 - D. The sun is a star.
 - E. Venus is a star.
45. If the distance between the moon and the earth were two times as large as it is now, the gravitational force between them would be
- A. 0
 - B. 1/4 as strong
 - C. half as strong
 - D. twice as strong
 - E. 4 times as strong
46. The temperature of a gas is a measure of
- A. the color of the gas
 - B. the composition of the gas
 - C. the average speed of particles in the gas.
 - D. blue shift
 - E. the binding energy of the gas
47. From the shortest to the longest in wavelength, the correct order is
- A. Gamma-ray, ultraviolet, X-ray, visible, infrared, microwave, radio
 - B. visible, infrared, microwave, radio, Gamma-ray, ultraviolet, X-ray
 - C. radio, microwave, infrared, visible, ultraviolet, X-ray, Gamma-ray
 - D. ultraviolet, X-ray, Gamma-ray, visible, infrared, microwave, radio
 - E. Gamma-ray, X-ray, ultraviolet, visible, infrared, microwave, radio
48. As a blackbody cools, the wavelength of maximum intensity of its radiation will
- A. decrease.
 - B. increase.
 - C. stay the same, but the frequency will decrease.
 - D. stay the same, but the frequency will increase.
 - E. none of the above.
49. A lunar eclipse can only occur when the Moon is
- A. New.
 - B. Waxing.
 - C. Waning.
 - D. Blue.
 - E. Full.

50. How many arcseconds are there in two arcminutes?
A. 2 B. 48 C. 120 D. 360 E. 3600
51. An atom can be excited
A. if it emits a photon. D. b and c above.
B. if it collides with another atom or electron. E. a and b above.
C. if it absorbs a photon.
52. If the Earth were tipped 50° instead of 23.5° , seasons on Earth would be
A. hotter in the northern hemisphere, colder in the southern.
B. more or less the same as they are now.
C. much less severe.
D. much more severe.
E. b and c.
53. You can view a total solar eclipse if
A. you are in the penumbra of the moon D. the moon is in the umbra of the earth
B. you are in the umbra of the moon E. the earth is in your umbrella
C. the moon is in the penumbra of the earth
54. The sun appears in front of a different constellation each month due to
A. the earth's rotation on its axis.
B. the earth's revolution around the sun.
C. the sun's motion around the center of the Milky Way Galaxy.
D. precession of the rotation axis of the earth.
E. the moon's orbit around the earth.
55. The most important aspect of Copernican model of the universe was that it
A. contained epicycles.
B. included elliptical orbits.
C. was a heliocentric model.
D. made very accurate predictions for the positions of the planets.
E. all of the above.
56. Each day, the Moon sets
A. at about the same time. D. at a time that depends on the season.
B. at a time that depends on the year. E. about an hour earlier than previous day.
C. about an hour later than previous day.
57. If an atom absorbs a photon,
A. the atom will gain energy.
B. the atom will move into a higher energy level.
C. the photons must have the right energy for the atom's energy levels.
D. other photons summing to the same total energy may later be emitted.
E. all of the above.

58. The celestial sphere
- A. is a real sphere surrounding the earth upon which the stars, sun, moon and planets reside
 - B. is a real sphere because the stars, sun, moon and planets all have the same distances from the earth
 - C. is an imaginary sphere surrounding Earth upon which the stars, sun, moon and planets appear to reside
 - D. A and B
 - E. A and C
59. If a person's weight is 100 lb on the surface of the earth, what would be his/her weight on the surface of a planet which has the same mass as the earth but has a radius that is two times as large as that of the earth?
- A. 100 lb B. 200 lb C. 25 lb D. 400 lb E. 1000lb
60. A beam of light from a laser has a frequency of 1×10^{15} Hz, what is the wavelength of this light?
- A. 300 m B. 300 nm C. 300 cm D. 300 mile E. 600 nm

Please answer the following survey questions:

61. This test was ___ I expected.
- A. much harder than C. about as hard as E. a lot easier than
B. a little harder than D. a little easier than
62. The course has been ___ I expected.
- A. much harder than C. as difficult as E. much easier than
B. harder than D. easier than

Key for Exam1a

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

- 43. C
- 44. D
- 45. B
- 46. C
- 47. E
- 48. B
- 49. E
- 50. C
- 51. D
- 52. D
- 53. B
- 54. B
- 55. C
- 56. C
- 57. E
- 58. C
- 59. C
- 60. B