

# **Astronomy 104, Fall 2019**

## **Pass/Fail test**

### **CORRECT SOLUTIONS**

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**Make sure your scantron has your name and code on it.**

**Show a picture ID,  
and  
turn in the test paper with the scantron.**

**There are many scrambled versions.**

**The questions and the answers in the actual test are the same as these, but randomly scrambled.**

- 1 Depends on the version.**
- 2 Depends on the version.**
- 3 Depends on the version.**

**C Astronomy books are full of impressive pictures of deep-sky objects. Why don't they look as good in the telescope?**

A: These pictures were taken from spacecraft, so that the stars are much closer.

B: These pictures were taken from spacecraft, so that the atmosphere does not disturb picture taking.

C: When these pictures were taken, light was collected for many hours.

D: The atmosphere absorbs the type of light these object shine in.

E: These pictures were taken with large telescopes which can see much more small detail.

**A Did the Sun exist five thousand light years ago?**

A: This question makes no sense.

B: It did, but it was not a star at the time.

C: No.

D: Yes.

E: This question makes sense, but no one knows the answer.

**A Do the laws of nature exclude interstellar travel?**

A: No, but we would need much a more effective energy source than we have now.

B: No. In fact unmanned (robotic) spaceships have already visited a few stars.

C: Yes, because radiation in interstellar space would break up spaceships.

D: Yes, because the stars are so far away so that travel should take more than a few thousand years at least.

E: No. In fact manned spaceships have already visited a few stars.

**B Every year more than a hundred supernovae are discovered.**

**How does a supernova appear in the sky?**

A: It appears as a bright star zooming across the sky in a few seconds, then it suddenly vanishes.

B: It is a star that appears in a galaxy, shines as bright as the galaxy for a few weeks, then it slowly fades.

C: Supernovae are invisible, all that is detected is their gravity.

D: We cannot see them unless we approach them with a spaceship.

E: It appears as a smoking sphere in a telescope, occasionally spitting out rays of light, and then moves away from Earth within a few days.

**C Has "Big Bang Theory" (correctly called Big Bang Cosmology) been proven?**

A: It is uncertain because it is only a theory.

B: It could be proven but we'll need much more research to prove it.

C: It has been proven correct.

D: It cannot be scientifically proven because it is a question of religious preference.

E: It has been proven wrong.

**A How are stars, such as the Sun, born?**

A: From a collapsing gas cloud.

B: In supernova explosions.

C: When galaxies blow up.

D: They are erupted from volcanoes.

E: In dying black holes.

**C How do we know black holes exist when no light can ever leave them?**

- A: Light cannot leave them but radio signals can.
- B: They block the light of stars behind them.
- C: They still have their gravity.
- D: They suck in all sorts of stars from their vicinity.
- E: We often observe when they collide with each other.

**D How does a star look like in a good telescope?**

- A: An irregular-shaped patch of light, with a few rays stretching out in several directions.
- B: A large disk but without surface features.
- C: A small disk with a few surface features.
- D: A bright dot.
- E: A large disk with a lot of surface features.

**C How does the Milky Way look like in the sky in a dark location?**

- A: We cannot see the Milky Way at all because we are inside it.
- B: Like a bright cloud, looks twice as large as the Moon.
- C: It is a faint band of hazy light in a strip all around the sky.
- D: It is not visible without a telescope at all.
- E: It is a tiny, faint patch of barely visible light.

**A How fast does a comet move in the sky, compared to the stars?**

- A: It shifts a little each day.
- B: It takes a few years to shift visibly.
- C: It does not move.
- D: It crosses the sky in a few seconds.
- E: It crosses the sky in a few hours.

**A How high does the International Space Station rise above sea level?**

- A: Four hundred miles.
- B: A few million miles.
- C: A few light years.
- D: A few billion miles.
- E: A few times ten thousand miles.

**A How large is the diameter of the Earth?**

- A: 7,500 miles.
- B: 4.1 light years.
- C: 12,000 miles.
- D: 14 billion light years.
- E: 95 million miles.

**B How large is the Universe (rounded)?**

- A: 10 trillion light years.
- B: 10 billion light years.
- C: 10 light years.
- D: 1 light year.
- E: 10 million light years.

**A How many craters can you see on the Moon by the naked eye?**

- A: None, because they are too small for that.
- B: A few million.
- C: A few thousand.
- D: A few (5 to 10).
- E: There are no craters on the Moon because there is no volcanism there.

**D How many galaxies are there in the Solar System?**

A: A few thousand.

B: Billions.

C: 10 .

D: 0 .

E: 1 .

**B How many spaceships have arrived at the closest star, Proxima Centauri?**

A: A few people have traveled there in the last decade.

B: None.

C: Six all-robotic.

D: One, without humans.

E: One, with humans.

**E How many stars are there in the Solar System?**

A: Billions.

B: 0 .

C: A few thousand.

D: 10 .

E: 1 .

**A How many stars are visible to the naked eye?**

A: A few thousand.

B: A few hundred.

C: A few billion.

D: A few trillion.

E: A few million.

**E** How many stars or planets have been discovered to host intelligent life (aliens; do not count Earth)?

- A: About twenty.
- B: Millions.
- C: A few hundred.
- D: A few.
- E: None.

**B** How old is the Sun (rounded)?

- A: 4 million years .
- B: 4 billion years .
- C: 4 ,000 years.
- D: 400,000 years.
- E: 4 trillion years.

**C** How old is the Universe?

- A: 2 thousand years.
- B: 6 thousand years.
- C: 14 billion years.
- D: it has always existed.
- E: 4.5 billion years.

**A In which of the following circumstances is it impossible for any liquid water to exist?**

A: No air pressure.

B: No magnetic field.

C: Lack of oxygen in the atmosphere.

D: No gravity.

E: 214 F.

**E Is it possible to change a chemical element into another at all?**

A: There are many common chemical processes that can change one chemical element into another. These often occur in Nature.

B: There is no way to change a chemical element into another at all, whether the process is chemical or not. Even in atomic reactors chemical elements do not change.

C: There are many common chemical processes that can change one chemical element into another. However, these do not occur in Nature, only in chemistry labs.

D: Chemical processes can change one chemical element into another only at exceptionally high temperature.

E: Chemical processes cannot change one chemical element into another, but nuclear reactors/bombs can.

**E Is the far side of the Moon always in darkness?**

A: For six month in a row every year.

B: Only at at new moon.

C: Never.

D: Always.

E: Only for two weeks a month.



**B Is the Sun smaller or bigger than a star?**

A: The Sun is one of the largest stars of all.

B: The Sun is an average star.

C: The Sun is one of the smallest stars of all.

D: The Sun is much larger because it is in the center of the Universe.

E: The Sun is much larger than any star, although it is not in the center of the Universe.

**D Laser is a type of ... what?**

A: a beam of electrons.

B: a beam of atoms.

C: nuclear radiation.

D: light.

E: unknown radiation.

**C Non-nuclear radiation cannot affect humans at all. Why?**

A: Because all non-nuclear radiation is electromagnetic, and only magnetizable materials are affected.

B: Because there is no non-nuclear radiation present on Earth at all.

C: Because each individual particle has too little energy to cause damage, and only one can act at a time.

D: Because all non-nuclear radiation is too weak to affect living organisms.

E: Because living organisms immune against such radiation.

**A Radar is very rarely used in astronomy. How far does it reach, max?**

A: Only within the Solar System.

B: To all stars in the Solar Neighborhood.

C: Only to the Moon at farthest.

D: To all stars in the Galaxy.

E: To almost everything in the Universe.

**A State Kepler's I law.**

A: The shape of the orbit of the planets is an ellipse.

B: Planets revolve around the Sun.

C: A planet swipes equal areas in equal times.

D: The motion of a planet is maintained by the force of the gravity of the Sun.

E: A planet's distance from its star ( $a$ ) is related to its period of revolution ( $T$ ) and the mass of the star ( $M$ ) is  $a^3 = M T^2$ .

**C State Kepler's III law.**

A: The shape of the orbit of the planets is an ellipse.

B: A planet swipes equal areas in equal times.

C: A planet's distance from its star ( $a$ ) is related to its period of revolution ( $T$ ) and the mass of the star ( $M$ ) is  $a^3 = M T^2$ .

D: The motion of a planet is maintained by the force of the gravity of the Sun.

E: Planets revolve around the Sun.

**E What are Kepler's laws?**

A: They explain what force drives the planets around the Sun along their orbits.

B: They state the fact that the planets revolve around the Sun is explained by gravity.

C: They derive the revolution of the planets around the Sun with mathematical accuracy from the law of gravity.

D: They state the fact that the planets revolve around the Sun.

E: They explain with mathematical accuracy how the planets revolve around the Sun.

**A** **What are the dark areas on the Moon that form the "face" we can see with the naked eye?**

A: Lava-filled basins.

B: Mountains.

C: Oceans of water.

D: Impact craters.

E: Volcanic craters.

**C** **What causes the tides of the sea?**

A: The magnetism of the Sun.

B: A change in the pressure of the atmosphere.

C: The gravity of the Moon.

D: The gravity of the Sun.

E: The magnetism of the Moon.

**B** **What causes weightlessness in a spaceship?**

A: The rotation of the spaceship.

B: The spaceship is not supported on wheels or any other way.

C: There is no magnetism in space.

D: There is no air in space.

E: The rocket engine is working nonstop while the spaceship is in space.

**A** **What dangerous radiation is generated in astronomical observatories?**

A: None.

B: Dangerously strong magnetic fields.

C: Large antennas give out strong gamma rays.

D: Dangerously strong radio waves.

E: Alpha & beta rays due to nuclear processes.

**D What do asteroids orbit around?**

- A: Nothing.
- B: The center of the Galaxy.
- C: Earth.
- D: The Sun.
- E: Planets.

**A What do comets orbit around?**

- A: The Sun.
- B: Nothing.
- C: Earth.
- D: The center of the Galaxy.
- E: Planets.

**C What does 'burning' really mean?**

- A: Desintegration of atoms into electrons, protons, and neutrons.
- B: Desintegration of atoms into electrons and nuclei.
- C: Fast fusion with oxygen.
- D: Production of heat in a chemical process.
- E: Destruction of molecules due to heat.

**A What instrument do you need to see the Milky Way?**

- A: None.
- B: A radio antenna.
- C: Binoculars.
- D: A large telescope.
- E: We cannot see the Milky Way at all because we are inside it.

**E What is a black hole?**

- A: A place where objects can jump from one galaxy to another.
- B: A star that is much fainter than its bright companion.
- C: Normally, the core of a red giant star, which may be occasionally ejected.
- D: A star with no fuel left to shine.
- E: A star with very strong gravity.

**A What is a constellation?**

- A: A bunch of unrelated stars which form a shape due to perspective only.
- B: Another name for a bright galaxy.
- C: A bunch of stars held together by their gravity.
- D: A bunch of stars held together by magnetic forces.
- E: A bunch of stars that were formed together.

**B What is a galaxy?**

- A: A planet orbiting giant planets like Jupiter.
- B: A system formed by a large number of stars.
- C: A chunk of ice falling into the Sun.
- D: Glowing gas illuminated by a few very hot stars.
- E: A cloud of gas that glows because it is hot.

**A What is a light year?**

- A: A distance; the closest star is a few light years away (exclude the Sun).
- B: A time; stars normally live a lot longer than for a light year of time.
- C: A distance as large as the size of the Solar System.
- D: A distance; the closest star is a few million light years away (exclude the Sun).
- E: A time; stars normally live for a light year of time.

**E What is a shooting star?**

A: A star hitting Earth.

B: A small-size meteorite.

C: An inch-size rock or piece of ice hitting Earth.

D: A comet hitting Earth.

E: A dust particle hitting Earth.

**B What is an organic substance?**

A: One that is free of contamination.

B: One containing complex molecules that include carbon atoms.

C: One that was naturally created, without human action.

D: One created by the bodies of living organisms.

E: One not containing chemicals.

**D What is aurora?**

A: Light from the Sun before dawn, scattered in the atmosphere.

B: Light caused by electric discharge between clouds.

C: Light from the Sun before dawn, reflected on the surface of Earth.

D: Light caused by charged particles originating in the Sun, hitting the atmosphere close to the N and S poles.

E: A ring of light that occasionally appears around the Moon.

**E What is Copernicus famous for?**

A: He discovered that the Moon is revolving around Earth.

B: He discovered the universal law of gravity.

C: He turned martyr of conscience and was burned on the stake for heresy.

D: He discovered the mathematically precise laws of the motion of the planets.

E: He suggested that the planets, including Earth, revolve around the Sun.

**B What is in the center of the Universe?**

- A: Earth.
- B: The Universe does not have a center.
- C: The Galaxy.
- D: A large black hole.
- E: The Sun.

**C What is infrared (IR)?**

- A: Pieces of dust zooming around in space.
- B: A type of nuclear radiation.
- C: A type of light with longer wavelength than red.
- D: A type of telescope used in astronomy.
- E: Dangerous radiation from atomic reactors.

**A What is needed in order to change sulphur into gold?**

- A: To turn one type of atomic nucleus into another.
- B: To change the crystal structure of the solid substance through heating.
- C: To use very strong acids.
- D: To turn one type of molecule into another.
- E: To change the number of electrons in an atom.

**C What is the best time to observe the Moon early night?**

- A: At new Moon.
- B: At full Moon.
- C: At first quarter.
- D: Just before sunset.
- E: At last quarter.

**B What is the correct relation of astronomy, astrology, and science?**

A: Astronomy and astrology are both branches of science.

B: Astronomy is the science of stars; astrology is predicting the future.

C: Neither astronomy nor astrology are branches of science.

D: Astrology is the science of stars, astronomy is predicting the future.

E: Both astronomy and astrology make true statements about the world.

**E What is the largest magnification you would reasonably use with any telescope on Earth?**

A: around 50.

B: around 5,000.

C: around 5,000,000.

D: around 50,000.

E: around 500.

**B What is the light of the Milky Way in actual fact?**

A: A reflection of sunlight on interstellar gas.

B: The light of a few billion stars washed together.

C: The glow of the upper atmosphere due to cosmic radiation.

D: A reflection of sunlight in Earth's atmosphere.

E: The light of glowing gas nebulae.



- D What is the most important factor causing the seasons of the year?**
- A: The Sun is more active during the summer, due to sunspots.
  - B: The Sun is up for a longer time in the summer than in the winter.
  - C: The Sun is less active during the winter, due to sunspots.
  - D: The Sun is higher up in the sky at noon in the summer than in the winter.
  - E: The Sun is closer to us in the summer than in the winter.
- D What is the most important measure of a telescope?**
- A: Its azimuth.
  - B: Its magnification.
  - C: Its focal length.
  - D: Its diameter.
  - E: Its resolving power.
- C What is the relation of astrology to astronomy?**
- A: Both astronomy and astrology are branches of science.
  - B: Astrology is science, astronomy is fake.
  - C: Astronomy is science, astrology is fake.
  - D: One cannot say that astrology is fake, because it is a form of religion.
  - E: Both astrology and astronomy are fake.
- E What is the source of dangerous radiation on Earth (exclude atomic reactors/bombs and nuclear laboratories)?**
- A: A high-voltage electric power line.
  - B: A strong magnet.
  - C: A microwave oven.
  - D: A very loud speaker in a concert.
  - E: There is none.

**A What is the Sun mostly made of?**

A: Hydrogen.

B: Oxygen.

C: Helium.

D: Rock.

E: Metals.

**C What is ultraviolet (UV)?**

A: A type of telescope used in astronomy.

B: Pieces of dust zooming around in space.

C: A type of light with shorter wavelength than blue.

D: Dangerous radiation from atomic reactors.

E: Nuclear radiation from the Sun.

**C What keeps people on the other side of Earth from falling down, away from Earth?**

A: The effect of air.

B: The gravity of the Moon.

C: The gravitational force between them and Earth.

D: The magnetic force from Earth.

E: People live only on one side of Earth. The other side is covered with oceans.

**D What particles of matter do magnetic fields act on?**

A: All particles.

B: All moving particles.

C: All charged particles.

D: Moving charged particles.

E: Electrons only.

**E What percentage of the stars have planets orbiting them?**

A: Only a few out of a hundred.

B: Less than a millionth of a percent.

C: All.

D: None: all planets revolve around the Sun, not stars.

E: More than half.

**C What provides the energy of the Sun?**

A: It is hot and cooling off, slowly giving off its already existing heat.

B: It turns helium into carbon and oxygen.

C: It turns hydrogen into helium.

D: The black hole in its center.

E: It is burns hydrogen into water.

**C What solid or liquid substances do magnetic fields act on?**

A: Metals and rock.

B: All metals.

C: Iron, cobalt, nickel.

D: Already magnetized metals.

E: None.

**B When the shape of the Moon is like the letter D, why is the half of the Moon's disk dark?**

A: Because the Moon is located opposite to the Sun in the sky at that time.

B: Because it is night on that part of the Moon.

C: Because the shadow of the Sun is cast on it.

D: Because the shape of the Moon is not a perfect circle.

E: Because the shadow of the Earth is cast on it.

**B When were the stars of the sky born?**

- A: 4-5 billion years ago.
- B: Stars are being born at all times.
- C: At the time of the Big Bang.
- D: 6 thousand years ago.
- E: They have always been there.

**C Where do planets get their light?**

- A: They are hot, so they glow, but they have no energy source inside.
- B: They use chemical processes to keep themselves glowing hot.
- C: They reflect sunlight.
- D: They reflect the light they receive from Earth.
- E: They use nuclear processes to keep themselves glowing hot.

**D Where do stars get their light?**

- A: They reflect sunlight.
- B: They reflect the light of interstellar nebulae.
- C: They reflect light from their planets.
- D: They glow on their own.
- E: They reflect light from the Galaxy.

**E Where has the gold we have on Earth originally formed?**

- A: Inside a main sequence star.
- B: Inside Earth.
- C: In interstellar space.
- D: Inside the Sun.
- E: Inside a supernova.

**A Where in the Universe are comets located?**

- A: Comets, like planets, are part of the Solar System.
- B: Comets, like galaxies, are everywhere in the Universe.
- C: Comets are in Earth's atmosphere.
- D: Comets are in space but closer than the Moon.
- E: Comets, like the stars or the sky, are part of our Galaxy.

**E Where is the Sun located in the Universe?**

- A: In the center of the Milky Way Galaxy.
- B: Halfway from the center of the Galaxy in a spiral arm.
- C: None of the other answers is correct because the Sun is not in the Galaxy at all, nor is it in the center of the Universe.
- D: In the center of the Universe.
- E: Halfway from the center of the Galaxy, between two spiral arms.

**C Which constellation is the closest of all to Earth?**

- A: Orion.
- B: The Milky Way.
- C: This question makes no sense.
- D: Leo.
- E: The Seven Sisters.

**B Which direction does the Sun move in the sky from morning to evening?**

- A: E to Straight Up to W .
- B: E to S to W .
- C: E to S to Straight Up to N to W.
- D: S to N.
- E: N to S.

**D Which of the following does not get its light from the Sun?**

A: Pluto.

B: The moons of Jupiter.

C: Venus.

D: A star.

E: A comet.

**E Which of the following is not a star?**

A: Proxima Centauri.

B: Sirius.

C: The Sun.

D: Alpha Orionis.

E: Jupiter.

**B Which of the following takes up most of the Solar System?**

A: The Sun.

B: Empty space.

C: Comets.

D: Asteroids.

E: The planets combined.

**D Which one is the brightest star in the sky?**

A: Proxima Centauri.

B: Orion.

C: The Milky Way galaxy.

D: Sirius.

E: Venus.

**D Which one is the closest star?**

A: Sirius.

B: Mars.

C: The North Star.

D: The Sun.

E: Andromeda.

**B Who discovered the law of universal gravitation?**

A: Albert Einstein.

B: Isaac Newton.

C: Galileo Galilei.

D: Nicolaus Copernicus.

E: Johannes Kepler.

**C Why can we not see the stars during the day?**

A: Because stars reflect sunlight, but during the day stars are not located in opposite direction from the Sun.

B: Because all stars set in the morning, the same way as the Sun sets in the evening; they come up again after sunset.

C: Because the bright blue glow of the sky overwhelms starlight.

D: Because in the bright environment the human pupil contracts.

E: Because the atmosphere of Earth blocks their light during the day.

**A Why does the Hubble Space Telescope make very good images?**

A: Because it is in space where there is no seeing.

B: Because its lenses/mirrors are exceptionally good quality.

C: Because it is in space, closer to the stars than we are.

D: Because the Hubble Space Telescope is the largest telescope we have.

E: Because it can detect infrared radiation that the human eye cannot see.

**A Why doesn't the Moon fall down?**

A: It is falling but it is also moving sideways.

B: Because the gravity of Earth keeps it up.

C: Because the magnetism of Earth keeps it up.

D: Because there is no air on the Moon.

E: Because gravity does not act at such a distance.

**D Why is it that the constellation of Orion cannot affect events in human life?**

A: Because Orion is not in the Zodiac.

B: Because Orion is more than a hundred light years away from us.

C: Because it is not along the ecliptic.

D: Because constellations are not real objects.

E: Because the shape of Orion changes very fast.

**D Why is Polaris special?**

A: Because it is always straight up.

B: Because it is actually a planet.

C: Because it is the largest star in the sky.

D: Because the axis of Earth points at it.

E: Because it is the brightest star in the sky.

**A Will the Sun turn into a supernova?**

A: No.

B: Yes, as soon as it uses up all of its helium.

C: Yes, and it has already turned supernova several times.

D: Yes, in a few hundred thousand years.

E: Yes, in 5 billion years.