

# Astronomy 104, Spring 2018

## 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.**

**It is advisable but not required  
to fill in the answers on the test paper.**

**There were many scrambled versions.  
Here is a solved copy of one of the versions.**

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

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

- A: A few hundred
- B: A few billion
- C: A few thousand
- D: A few trillion
- E: A few million

**A What is an organic substance?**

- A: One containing complex molecules that include carbon atoms.
- B: One that was naturally created, without human action.
- C: One that is free of contamination.
- D: One not containing chemicals.
- E: One created by the bodies of living organisms.

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

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

**C What is a galaxy?**

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

**C What is a shooting star?**

- A: A comet hitting Earth.
- B: A small-size meteorite.
- C: A dust particle hitting Earth.
- D: An inch-size rock or piece of ice hitting Earth.
- E: A star hitting Earth.

**E Where is the Sun located?**

A: In the center of the Milky Way Galaxy.

B: Halfway from the center of the Galaxy in a spiral arm.

C: In the center of the Universe.

D: 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.

E: Halfway from the center of the Galaxy, between two spiral arms.

**E What is a light year?**

A: A distance as large as the size of the Solar System.

B: A time. Stars normally live a lot longer than for a light year of time.

C: A distance. The closest star is a few million light years away (exclude the Sun).

D: A time. Stars normally live for a light year of time.

E: A distance. The closest star is a few light years away (exclude the Sun).

**E What causes the seasons? Pick the most important factor.**

A: The Sun is up for longer in the Summer than in the Winter.

B: The Sun is less active during the Winter, due to sunspots.

C: The Sun is more active during the Summer, due to sunspots.

D: The Sun is closer to us in the Summer than in the winter.

E: The Sun is higher up in the sky at noon in the Summer than in the Winter.

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

A: Oceans of water.

B: Impact craters.

C: Volcanic craters.

D: Mountains.

E: Lava-filled basins.

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

A: A few (5 to 10).

B: None, because they are too small for that.

C: A few thousand.

D: There are no craters on the Moon because there is no volcanism there.

E: A few million.

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

A: A star.

B: The moons of Jupiter.

C: A comet.

D: Pluto.

E: Venus.

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

A: It is not visible without a telescope at all.

B: We cannot see the Milky Way at all because we are inside it.

C: It is a faint band of hazy light in a strip all around the sky.

D: Like a bright cloud, looks twice as large as the Moon.

E: It is a tiny, faint patch of barely visible light.

**B What is the most important measure of a telescope?**

A: Its magnification.

B: Its diameter.

C: Its resolving power.

D: Its focal length.

E: Its azimuth.

**D The far side of the Moon is**

A: dark for six months in a row every year.

B: always dark.

C: visible at new moon.

D: dark for two weeks a month.

E: never dark.

- B Why is it that the constellation of Orion cannot affect events in human life?**
- A: Because Orion is more than a hundred light years away from us.
  - B: Because constellations are not real objects.
  - C: Because the shape of Orion changes very fast.
  - D: Because it is not along the ecliptic.
  - E: Because Orion is not in the Zodiac.
- C Who discovered the law of universal gravitation?**
- A: Galileo Galilei.
  - B: Albert Einstein.
  - C: Isaac Newton.
  - D: Nicolaus Copernicus.
  - E: Johannes Kepler.
- C Which of the following is a cause of weightlessness in a spaceship? (Note that some of the following statements are incorrect!)**
- A: The rotation of the spaceship.
  - B: There is no magnetism in space.
  - C: The spaceship is not supported on wheels or any other way.
  - D: The rocket engine is working nonstop while the spaceship is in space.
  - E: There is no air in space.
- A How many spaceships have arrived at the closest star, Proxima Centauri?**
- A: None.
  - B: One, without humans.
  - C: A few people have traveled there in the last decade.
  - D: Six all-robotic.
  - E: One, with humans.

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

A: The black hole in its center.

B: It is burns hydrogen into water.

C: It turns helium into carbon and oxygen.

D: It turns hydrogen into helium.

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

**B What is Copernicus famous for?**

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

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

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

D: He discovered the universal law of gravity.

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

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

A: Because the gravity of Earth keeps it up.

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

C: Because there is no air on the Moon.

D: Because the magnetism of Earth keeps it up.

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

**B Which of the following is a source of radiation? (Radiation is: invisible, energetic particles that can be damaging to whatever gets in their way.)**

A: A strong magnet.

B: None of these.

C: A microwave oven.

D: A very loud speaker in a concert.

E: A high-voltage electric power line.

**C How large is the Universe?**

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

**E 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 suck in all sorts of stars from their vicinity.
- D: We often observe when they collide with each other.
- E: They still have their gravity.

**A What is a constellation?**

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

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

- A: In supernova explosions.
- B: They are erupted from volcanoes.
- C: In dying black holes.
- D: From a collapsing gas cloud.
- E: When galaxies blow up.

**A How high does the space shuttle rise above sea level?**

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

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

A: No.

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

C: Yes, in 5 billion years.

D: Yes, in a few hundred thousand years.

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

**D Which one is correct?**

A: Neither astronomy nor astrology are branches of science.

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

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

D: Astronomy is the science of stars, astrology is predicting the future.

E: Astronomy and astrology are both branches of science.

**C What is the largest magnification you would reasonably use with the largest telescope in the world, located in Mauna Kea, Hawaii?**

A: around 40

B: around 4,000

C: around 400

D: around 4,000,000

E: around 40,000

**C 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 with a lot of surface features.

C: A bright dot.

D: A small disk with a few surface features.

E: A large disk but without surface features.



**D 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 atmosphere does not disturb picture taking.

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

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

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

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

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

A: A few.

B: Millions.

C: About twenty.

D: A few hundred.

E: None.

**B What is a black hole?**

A: Normally, the core of a red giant star, which may be occasionally ejected.

B: A star with very strong gravity.

C: A place where objects can jump from one galaxy to another.

D: A star with no fuel left to shine.

E: A star that is much fainter than its bright companion.

**C What causes the tides of the sea? (Pick the most important factor.)**

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

A: The magnetic force from Earth.

B: The gravitational force between them and Earth.

C: The gravity of the Moon.

D: The effect of air.

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

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

A: This question makes no sense.

B: Orion.

C: The Milky Way.

D: Leo.

E: The Seven Sisters.

**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: 214 F

D: Lack of oxygen in the atmosphere.

E: No gravity.

**B When the shape of the Moon is a letter D, the half of the Moon is not visible**

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 shape of the Moon is not a perfect circle.

D: because the shadow of the Earth covers it.

E: because the shadow of the Sun is covering it.

- C 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: We cannot see them unless we approach them with a spaceship.
- C: It is a star that appears in a galaxy, shines as bright as the galaxy for a few weeks, then it slowly fades.
- D: Supernovae are invisible, all that is detected is their gravity.
- 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.
- A Which of the following takes up most of the Solar System?**
- A: Empty space
- B: The Sun
- C: Asteroids
- D: The planets combined
- E: Comets
- E What is ultraviolet (UV)?**
- A: Dangerous radiation from atomic reactors.
- B: Nuclear radiation from the Sun.
- C: Pieces of dust zooming around in space.
- D: A type of telescope used in astronomy.
- E: A type of light with shorter wavelength than blue.
- E Which one is the closest star?**
- A: Sirius.
- B: Andromeda.
- C: Mars.
- D: The North Star.
- E: The Sun.

**A What is aurora?**

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

B: Light caused by electric discharge between clouds.

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

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

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

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

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

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

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

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

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

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

A: At full Moon.

B: At first quarter.

C: At new Moon.

D: At last quarter.

E: Just before sunset.

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

A: Billions.

B: 1

C: 0

D: A few thousand.

E: 10

**A Which one is correct?**

A: Astronomy is science, astrology is fake.

B: Astrology is science, astronomy is fake.

C: Both astrology and astronomy are fake.

D: One cannot say that astrology is fake, because it is a form of religion.

E: Both astronomy and astrology are branches of science.

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

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

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

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

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

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

**D Has the big Bang theory been proven?**

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

B: It has been proven wrong.

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

D: It has been proven correct.

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

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

A: Metals.

B: Hydrogen.

C: Helium.

D: Oxygen.

E: Rock.

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

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

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

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

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

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

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

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

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

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

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

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

**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 much larger than any star, although it is not in the center of the Universe.

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

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

**D Why is Polaris special?**

A: Because it is actually a planet.

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

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

D: Because the axis of Earth points at it.

E: Because it is always straight up.

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

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

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

- A: 10
- B: 1
- C: 0
- D: A few thousand.
- E: Billions.

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

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

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

- A: A reflection of sunlight on interstellar gas.
- B: The glow of the upper atmosphere due to cosmic radiation.
- C: The light of a few billion stars washed together.
- D: A reflection of sunlight in Earth's atmosphere.
- E: The light of glowing gas nebulae.

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

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

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

A: Only a few out of a hundred.

B: About half.

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

D: Less than a millionth of a percent.

E: All.

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

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

B: Yes.

C: This question makes no sense.

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

E: No.

**C Which one is a correct phrasing of Kepler's I law?**

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

B: Planets revolve around the Sun.

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

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

E: A planet swipes equal areas in equal times.

**B Which one is a correct phrasing of Kepler's III law?**

A: A planet swipes equal areas in equal times.

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

D: Planets revolve around the Sun.

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



**A Which one is correct?**

A: Chemical processes cannot change one chemical element into another.

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

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: 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.

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

**E How old is the Sun?**

A: 4 trillion years

B: 4 million years

C: 4 ,000 years

D: 400,000 years

E: 4 billion years

**E The diameter of the Earth is**

A: 4.1 light years

B: 12,000 miles

C: 95 million miles

D: 14 billion light years

E: 7,500 miles

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

A: They are hot, so they glow, but they have no energy source inside.

B: They use nuclear processes to keep their glowing heat.

C: They reflect the light they receive from Earth.

D: They use chemical processes to keep their glowing heat.

E: They reflect sunlight.

**D Non-nuclear radiation cannot affect humans at all. Why? (Note the single exception of solar UV radiation which causes sunburn.)**

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

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

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

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

E: Because living organisms immune against such radiation.

**A To change sulphur into gold, one needs to**

A: turn one type of atomic nucleus into another.

B: turn one type of molecule into another.

C: use very strong acids.

D: change the number of electrons in an atom.

E: change the crystal structure of the solid substance through heating.

**C The properties of chemical processes are explained by the fact that**

A: an atom consists of an almost equal mixture of electrons, protons and neutrons.

B: an atom consists of a mixture of electrons and protons.

C: an atom consists of a nucleus surrounded by electrons.

D: an atom consists of positively charged electrons and negatively charged nucleons.

E: an atom consists of one proton, possibly several neutrons, and several electrons.

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

A: E to Straight Up to W

B: S to N

C: E to S to W

D: E to S to Straight Up to N to W

E: N to S

**C Laser is**

A: unknown radiation.

B: a beam of atoms.

C: light.

D: a beam of electrons.

E: nuclear radiation.