

Astronomy 104, Spring 2023

Test 2

CORRECT SOLUTIONS

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.**

B Compare a red star to a blue star. Surely, ...

- A: the red star is older.
- B: the blue star is hotter.
- C: the red star is hotter.
- D: the red star is younger.
- E: the red star is more massive.

C What is parallax?

- A: The motion of a star all the way around the sky, once a day.
- B: The motion of a star all the way around the sky, once a year.
- C: The tiny motion of the star in the sky in a little circle, once a year.
- D: The motion of stars in a binary system around each other.
- E: The slow, straight-line motion of a star in the sky, due to its revolution around the center of the Galaxy.

E What is a CCD?

- A: A type of telescope that replaces reflectors.
- B: A type of an instrument that separates colors in starlight.
- C: A type of a telescope mount.
- D: A type of optical device that replaces the lens or mirror of a telescope.
- E: A type of a detector that replaces photography.

A Seeing, at best, is as good as ...

- A: 0.4 arc seconds.
- B: 7 magnitudes.
- C: 1000 times.
- D: 2.5 million light years.
- E: 5 meters in diameter.

C What does Stefan-Boltzman's law say?

- A: The absolute magnitude of a star is independent of its distance.
- B: Each absorption line is brightest at a particular temperature.
- C: The power radiated by a surface element of a glowing body is proportional to the 4th power of its temperature.
- D: The speed of rotation of a star is inversely proportional to its temperature.
- E: The temperature of a star is inversely proportional to the wavelength of its color.

- E A star whose mass is higher than the Sun has a ... lifetime, because it is**
- A: shorter - hotter.
 - B: longer - heavier.
 - C: longer - larger.
 - D: equally long - brighter, but also has more fuel.
 - E: much shorter - much brighter.
- A What are the two main (chemical) constituents of the solar photosphere?**
- A: Neutral hydrogen and helium atoms.
 - B: Ionized hydrogen and neutral helium.
 - C: Hydrogen and helium molecules.
 - D: Ionized hydrogen and metals.
 - E: Hydrogen molecules and helium atoms.
- B How hot is the center of the Sun? (Ballpark number only.)**
- A: 20 F.
 - B: 10 million degrees.
 - C: -200 F below.
 - D: 1 trillion degrees.
 - E: 6000 degrees.
- B Define the photosphere.**
- A: The illuminated, bright half of the Sun where it is day.
 - B: The visible outside 'shell' of the Sun.
 - C: The non-convective inner part of the Sun.
 - D: The part of the Sun that is hot, from the center out.
 - E: The part of the Sun where heat is produced in a nuclear reaction.
- C What is aurora?**
- A: The light of the rising/setting sun scattered in the atmosphere.
 - B: Sunlight is reflected in interplanetary dust particles.
 - C: Fluorescing air due to charged particles from the Sun.
 - D: The upper atmosphere glows due to extreme solar heating.
 - E: Sunlight reflected in very high elevation clouds.

D A red star is ... and a blue star is ...

- A: A red star is hot, a blue star is cold.
- B: A red star is large, a blue star is small.
- C: A red star is heavy, a blue star is light.
- D: A red star is cold, a blue star is hot.
- E: A red star is small, a blue star is large.

B Why is a sunspot colder than the photosphere?

- A: The high turbulence ('wind') in sunspots has a cooling effect.
- B: The increased magnetic field in the sunspot stops convection.
- C: Because they appear darker.
- D: There is no nuclear reaction in sunspots, which means there is no heating.
- E: A sunspot contains an accumulation of metals which give off their heat more quickly.

A How do you calculate the magnification of a telescope?

- A: focal length of objective / focal length of eyepiece
- B: diameter of telescope / focal length of objective
- C: diameter of telescope X focal length of eyepiece
- D: focal length of objective X focal length of eyepiece
- E: diameter of telescope / focal length of eyepiece

E How much better is the Hubble Space Telescope than ground-based telescopes?

- A: The Hubble is as good as a decent ground-based telescope in Hawaii.
- B: The contribution from the Hubble is marginal because it is not a very large telescope.
- C: The Hubble is not used for research, only for taking pretty pictures for the public.
- D: The contribution from the Hubble is marginal because of faulty optics.
- E: The Hubble made more discoveries than everything else combined.

B How easy is it to measure stellar parallax with, say, high-quality amateur equipment?

A: Even professional instruments cannot detect parallax. It exists only in theory.

B: Very difficult but barely possible.

C: It is impossible.

D: It is very easy.

E: Parallax is detectable even without instruments.

E Which of the following indicates a good telescope used for research?

A: A telescope with 800 times magnification.

B: A 21 magnitude telescope.

C: A telescope with 16 m long focal length.

D: A 1.5 arc resolution telescope.

E: A 100-inch telescope.

E What is granulation?

A: Giant waves travelling along the surface of the Sun.

B: Rotating storms on the Sun, the equivalent of tornadoes.

C: The 'surface' of the Sun is very uneven. Higher elevations look brighter.

D: Matter falling onto the Sun from outer space makes the Sun look grainy.

E: The heads of hot upcoming gas bubbles in the Sun look like bright spots.

C How is the motion of charged particles restricted by the magnetic field of Earth?

A: Charged particles are slowed and stopped by magnetic field lines.

B: Charged particles cancel out the magnetic field lines of Earth.

C: Charged particles closely follow magnetic field lines.

D: Charged particles are reflected by field lines back into space.

E: Charged particles do not interact with magnetic field lines but move on straight.

E What are granules?

A: Accumulation of dark dust particles, mainly made of silicates and graphite.

B: Dark areas where the magnetic field stops the convection.

C: Accumulation of dark metal particles.

D: Dark grainy spots on the face of the Sun caused by the motion of the atmosphere of Earth (i.e. seeing).

E: The tops of upcoming convection channels.

D In non-convective parts of the Sun, heat is transferred by

A: conduction.

B: boiling.

C: It is not transferred but is completely isolated.

D: radiation.

E: neutrinos.

A How long is the sunspot cycle?

A: 11 years.

B: 1 month.

C: 350 years.

D: 1 day.

E: 9 months.

D What is an 8 x 50 pair of binoculars?

A: length 8 inches, weighs 50 ounces.

B: magnification 50 X, diameter 8 inches.

C: magnification 50 X, diameter 8 cm.

D: magnification 8 X, diameter 50 mm.

E: costs \$50, worth \$8.

B What makes the stars on the main sequence different from all the others?

A: They are all very young.

B: Their energy source is hydrogen to helium fusion in their centers.

C: They are all very old.

D: They produce energy while all the other stars do not.

E: They were born from gas that contained a large amount of metals.

D A telescope mirror has 12 in diameter, 120 in focal length, and a 1-inch eyepiece is used. What is the magnification?

A: 1.2 arc seconds

B: 12 times

C: 8.5 mg

D: 120 times

E: 10 times

B Solar flares take their energy from ...

A: the kinetic energy of the upcoming convection zone.

B: magnetic reconnection.

C: burning of hydrogen.

D: the Solar Wind.

E: the rotation of the Sun.

A What seeing is considered very good seeing on Earth?

A: 0.4 arc seconds.

B: 1000 times.

C: 5 meters in diameter.

D: 7 magnitudes.

E: 2.5 million light years.

E Which of the following would be considered good but not excellent seeing in a Mississippi location?

A: 10 parsecs.

B: 11 hours.

C: 1 million light years.

D: 5 magnitudes.

E: 0.8 arc seconds.

B How does adaptive optics work?

A: The telescope is turned around the North-South axis, once a day.

B: The shape of the mirror is distorted to compensate for seeing.

C: The magnification of the telescope is changed according to seeing conditions.

D: The diameter of the mirror is chosen according to the brightness of the observed star.

E: A laser beam is used to illuminate stars that are too dim for observation.

E Where in the Sun is there energy production?

A: Nowhere: the Sun is only hot because is cooling off.

B: Only in the photosphere.

C: Everywhere inside.

D: Only in the convection zone.

E: Only in the core.

B What is the solar wind?

A: Atoms of heavy metals, such as iron, leaving the Sun due to high temperature.

B: The Sun keeps blowing off a small amount of matter, mainly protons and electrons.

C: The Sun keeps blowing off a small amount of matter, mainly hydrogen atoms.

D: The sun's radiation of a large amount of low energy photons, such as IR or radio.

E: The sun's radiation of energetic photons, such as UV or X-rays.

E The two stars Alcor and Mizar are easily separated by the human eye. This means that they must be farther apart than ...

A: a few degrees

B: a few light years.

C: a million light years.

D: a few million kilometers.

E: one arc minute.

E An M2 star is ...

- A: a deep-sky object.
- B: red and hot as stars go.
- C: blue and cool as stars go.
- D: blue and hot as stars go.
- E: red and cool as stars go.

C Why does the right ascension axis of a telescope mount point at the North Pole, and what is such a mount called?

- A: Because the North Pole is very rarely observed; called alt-azimuthal mount.
- B: The North Pole is often observed; called polar mount.
- C: It makes tracking easy; called equatorial mount.
- D: It makes tracking easy; called polar mount.
- E: The North Pole is often observed; called equatorial mount.

D The magnification of a telescope is ...

- A: diameter of telescope / focal length of eyepiece.
- B: diameter of telescope / focal length of objective.
- C: diameter of telescope X focal length of eyepiece.
- D: focal length of objective / focal length of eyepiece.
- E: focal length of objective X focal length of eyepiece.

D Which star lives longer, one with a small or a large mass?

- A: The one with a large mass, because it is hotter.
- B: The one with a large mass, because it contains more hydrogen.
- C: The one with a small mass, because it contains more hydrogen.
- D: The one with a small mass, because it is much dimmer.
- E: Equal: heavy stars have more fuel but use it faster in proportion.

B What does Wien's law say?

- A: Warmer material absorbs red light stronger.
- B: Thermal glow gets of shorter wavelength when the temperature of the body is increased.
- C: Hotter objects appear redder (i.e. radiate in longer wavelength).
- D: Hotter gas radiates stronger than cold, proportionally to the fourth power of temperature.
- E: The wavelength of the light of an approaching body is shifted towards blue.

D What is the resolution of the human eye?

A: 200 kilometers.

B: 250 times.

C: 4 light years.

D: 1 arc minute.

E: 2 million light years.

C Which one is true about astronomical telescopes?

A: Large refractors (mirror-based telescopes) are not made any more.

B: Both large refractors and large reflectors are built and used for modern research.

C: Large refractors (lens-based telescopes) are not made any more.

D: Large reflectors (lens-based telescopes) are not made any more.

E: Large reflectors (mirror-based telescopes) are not made any more.

D How large is the largest telescope in the world?

A: 120 meters in diameter.

B: 5 meters in diameter.

C: 120 meters in length.

D: 10 meters in diameter.

E: 10 meters in length.

B Where in the Sun are prominences observed?

A: At the equator only.

B: At the edge.

C: Prominences are not on the Sun at all: they are in the atmosphere of Earth.

D: Only in the middle of the disk.

E: Anywhere in the disk.

E Why do we not see deep into the Sun, even though the Sun is mostly hydrogen gas, which should be transparent?

A: The 2% metal content forms dust particles which are opaque.

B: Hydrogen is normally transparent, but at 6000 degrees it becomes opaque.

C: The solid crust of the photosphere is not transparent.

D: Hydrogen is a much less transparent gas than air, so it blocks light.

E: A small amount of partially ionized metals produce free electrons, which attach to H to form H⁻ ions, which are highly opaque.

C What percentage of all stars are doubles?

A: Almost all.

B: All.

C: Half.

D: Almost none.

E: There are no true double stars. They may seem so only due to perspective.

B Why are double stars important in astronomy?

A: Double stars have many planets orbiting around them.

B: They provide the only way to tell stellar masses.

C: They provide the only way to determine the chemical composition of stars.

D: It is easier to detect a double star than a single one.

E: They are the only ones that blow up as supernovae.

C What detector is used almost exclusively in professional astronomy?

A: The human eye.

B: Photographic plates.

C: A CCD camera.

D: A GM counter.

E: Film.

C Sirius, the Dog Star, has its parallax measured as 0.33 arc seconds. How far is it?

A: 100 light years.

B: 0.33 light years.

C: 3 parsecs.

D: 5 AU's.

E: 1 million light years.

A The spectral type of a star is related to ...

A: its surface temperature.

B: its speed of motion.

C: the temperature in its core.

D: its chemical composition.

E: its distance.

D What is a reasonable magnification for a very good telescope?

A: 2 million light years.

B: 2 million times.

C: 0.1 arc seconds.

D: 500 times.

E: 20 times.