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.

Please circle the
correct 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 **Atoms consist of the following constituents:**

A: Electrons, protons and neutrons.

B: Electrons, and a nucleus.

C: Quarks, electrons, and gluons.

D: Electrons and nucleons.

E: Molecules and electrons.

C **How was the speed of light measured for the first time?**

A: By measuring the slowing down of the time in a spaceship.

B: By measuring the delay in conversations of astronauts.

C: Measuring the delay in the eclipses of Jupiter's moons.

D: Getting a laser reflection from the Moon.

E: By direct measurement in a laboratory experiment.

C **How do we know the chemical composition of stars?**

A: From samples returned by spacecraft.

B: It is calculated based on the amount of energy the star radiates.

C: From the presence of each atom's spectral lines.

D: From a chemical analysis of interstellar gas blown in into the solar system.

E: From a chemical analysis of cosmic rays.

D **How do we measure the mass of stars?**

A: We measure the strength of their magnetic field.

B: We measure how strong a gravitational effect they have on the motion of Earth.

C: Using Wien's law, applied to the color of the star.

D: Using Kepler's III law for binary stars.

E: Using Kepler's II law applied on their planets.

A **How long does light take to arrive from the Sun to Earth?**

A: 9 minutes.

B: 1 light year.

C: an hour.

D: 4 years.

E: 4.5 billion years.

C **The energy of each photon is determined by …**

A: the speed of the light.

B: nothing at all: it is a universal quantum constant of nature.

C: its wavelength only.

D: the strength of the light only.

E: both the wavelength and the strength of the light.

D **The equivalent of light at much shorter wavelength is called …**

A: Neutrinos.

B: Radio waves.

C: Charged particle radiation.

D: X-rays.

E: Ultraviolet.

E **The spectrum of a hot glowing body is …**

A: emission spectrum.

B: band spectrum.

C: a mixture of an emission and an absorption spectrum.

D: absorption spectrum.

E: continuous spectrum.

D **What can you tell from the wavelength of a spectral line?**

A: The strength of gravity of the source object.

B: The temperature of the gas that emits the light.

C: The atmospheric pressure in the source object.

D: Which atom/molecule produced the line.

E: How far is the source from the observer.

B **What does ionization mean?**

A: The breakup of molecules into atoms.

B: Atoms losing (some of) their electrons.

C: A chemical reaction with an ionizing salt.

D: Mixing interstellar gas with Fe-containing dust.

E: Electrons moving to a higher orbit in an atom.

E **What happens to matter at 10,000 degrees?**

A: All substances become solid.

B: Atomic nuclei change into each other.

C: All atoms become ionized.

D: Molecules break up.

E: (At least some) atoms break up.

B **What is plasma?**

A: Gas that contains no electrons.

B: (At least partially) ionized gas.

C: Gas that contains no free electrons.

D: A viscous liquid.

E: Hot gas with most molecules broken up into atoms.

C **Where do 1. low energy, 2. high energy cosmic rays come from?**

A: All: beyond the Solar System

B: All: the Solar Wind

C: Low: the Solar Wind, High: deep space.

D: All: from Earth, mainly nuclear reactors

E: Low: deep space, High:the Solar Wind.

E **A hydrogen nucleus …**

A: is a neutron.

B: is a proton and an electron.

C: consists of two protons.

D: consists of one proton and one neutron.

E: is a proton.

A **At what temperature will all molecules disintegrate?**

A: Above ~ 2000 K

B: Above ~ 10,000 K.

C: Above ~ 273 K

D: Above ~ 1 million K

E: Above ~ 100 K

E **How does the Doppler-effect affect the spectrum of a star?**

A: The color of a moving star looks redder/bluer than normal.

B: The spectral lines of an approaching star are shifted from the red end of the spectrum to the blue end.

C: The star's light is stronger when the star is approaching us, and weaker when it is receding.

D: An approaching star's light arrive to Earth sooner, which causes its spectral lines broaden.

E: Spectral lines shift (usually a tiny bit) when the star moves towards or away from us.

E **How does the speed of light relate to the speed of radio waves and the speed of sound?**

A: Sound and radio waves have the same speed, the speed of light is infinitely fast.

B: Radio waves and sound are slow, light is fast.

C: They all have the same speed.

D: Radio waves are fastest, light is middle, sound is slowest.

E: Radio waves and light have the same speed, sound is much slower.

A **What can excite a hydrogen atom?**

A: UV radiation.

B: Heating to 1200 K.

C: Red light.

D: Infrared radiation.

E: A magnetic field.

E **What type of a spectrum does the Sun have?**

A: emission spectrum.

B: continuous spectrum.

C: band spectrum.

D: a mixture of an emission and an absorption spectrum.

E: absorption spectrum.

B **What type of spectrum does fluorescence produce?**

A: Band spectrum.

B: Emission spectrum.

C: Distorted spectrum.

D: Absorption spectrum.

E: Continous spectrum.

C **Which one is an example of the Doppler-effect?**

A: Magnetic fields make spectral lines break up into several lines.

B: Gas illuminated by UV radiation glows in an emission spectrum.

C: The spectral lines of a moving star are shifted.

D: The overall color of a moving star changes.

E: The motion of a star makes spectral lines broaden.

C **How large is the Doppler effect in astronomy in practice?**

A: It is impossible to detect the Doppler effect in the spectra of individual stars.

B: Both the position of the spectral lines and the overall color of the star changes noticeably.

C: A tiny (say, 0.01%) shift in the wavelength of spectral lines.

D: A large shift (say, 10%) in the wavelength of spectral lines.

E: A large shift in the overall color of a star, say, from blue to red appearence.

C **Relate the energy of a blue photon to the energy of a red photon.**

A: Blue photons have half the energy of red photons.

B: Blue photons have a hundred times less energy than red photons.

C: Blue photons have twice as much energy as red photons.

D: Cannot tell: the energy of photons depends on the strength of the light.

E: Blue photons have a hundred times as much energy as red photons.

D **What happens to the spectrum of a star that rotates?**

A: It is shifted towards red or blue by an even amount.

B: Spectral lines become more prominent.

C: The spectral lines in the red part of the spectrum become brighter.

D: All its spectral lines broaden the same way.

E: They are shifted by an amount proportional to their wavelength.

A **The wavelength of light determines its …**

A: color.

B: speed.

C: ratio of electric / magnetic field strength.

D: intensity.

E: polarization.

B **What change occurs to molecules in hot matter such as the matter of a star? At what temperature?**

A: Molecules are fused into very large atoms at ~ 1200 degrees.

B: Molecules break up into atoms at ~ 2000 to 3000 degrees.

C: Molecules break up into atoms at ~ 2 million degrees.

D: Molecules turn into protons and electrons at ~ 2000 degrees.

E: Molecules pick up extra electrons at ~ 10,000 degrees to become ions.

E **When do you see an absorption spectrum?**

A: When charged particle hit magnetic fields.

B: When planets reflect sunlight.

C: When hot objects glow.

D: When gas is illuminated from the side.

E: When cold gas is in front of a light source.

A **Which of the following is wrong?**

A: The stronger the light, the more energy each of its photons has.

B: X-ray photons have more energy than photons of light.

C: A blue photon always has more energy than a red photon.

D: Microwave photons have less energy than photons of light.

E: The energy of each photon does not depend on how strong the light is.

E **Which one is moving fastest?**

A: Visible light

B: Radio waves

C: Laser

D: X-rays

E: The same

C **Why do we use spacecraft to do X-ray astronomy?**

A: Because spacecraft is closer to the stars.

B: Because X-ray telescopes radiate dangerous amounts of X-rays.

C: Because the atmosphere is opaque in X-rays.

D: Because the telescope needs to be cooled to liquid helium temperatures (3K).

E: Because of interference from medical use of X-rays.

E **Why does a planetary nebula glow?**

A: It is illumnated by the Sun.

B: It reflects the light of the star in its center.

C: It is illuminated by the planet whose atmosphere it is.

D: It is illuminated by surrounding stars.

E: It fluoresces in the UV of the central white dwarf.

D **What chemical process changes carbon into oxygen?**

A: Hydrolysis.

B: Burning.

C: Oxydation.

D: None.

E: Electrolysis.

B **A star's color indicates its ...**

A: chemical composition.

B: temperature.

C: mass.

D: size.

E: distance.

B **What does Stefan-Boltzman's law say?**

A: Each absorption line is brightest at a particular temperature.

B: The power radiated by a surface element of a glowing body is proportional to the 4th power of its temperature.

C: The temperature of a star is inversely proportional to the wavelength of its color.

D: The absolute magnitude of a star is independent of its distance.

E: The speed of rotation of a star is inversely proportial to its temperature.

B **What does Wien's law say?**

A: Hotter objects appear redder (I.e. radiate in longer wavelength).

B: Thermal glow gets of shorter wavelength when the temperature of the body is increased.

C: The wavelength of the light of an approaching body is shifted towards blue.

D: Hotter gas radiates stronger than cold, proportionally to the fourth power of temperture.

E: Warmer material absorbs red light stronger.

C **What is a double-line binary star?**

A: A star that is visibly broken up into a pair in the telescope and the orbital motion is noticeable.

B: A doule star system with strong stellar wind.

C: A short-period binary with both stars' spectral lines visible.

D: A double star with a strong magnetic field.

E: A star that is visibly broken up into a pair in the telescope but the orbital motion is not noticeable.

B **Why are double stars important in astronomy?**

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

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

C: Double stars have many planets orbiting around them.

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

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

C **The spectral type of the Sun is …**

A: M

B: B

C: G

D: K

E: A

A **What percentage of all stars are doubles?**

A: Half.

B: All.

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

D: Almost none.

E: Almost all.

E **What spectral type is the red giant Betelgeuse?**

A: C.

B: G.

C: Hydrogen.

D: He.

E: M.

B **The spectral type of a star is related to …**

A: the temperature in its core.

B: its surface temperture.

C: its distance.

D: its speed of motion.

E: its chemical composition.

B **Strong ultraviolet radiation comes only from stars of spectral type …, and why?**

A: All spectral types, because they are all hot.

B: O & B, because these are hot enough.

C: K & M, because these are hot enough.

D: All spectral types, because UV production does not depend on temperature.

E: None, because stars do not radiate in UV.