Astronomy 104, Spring 2024

Test 3

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.**

A **How will the Sun end its life?**

A: As a white dwarf.

B: As a supernova.

C: Nothing will remain.

D: As a planet.

E: As a black hole.

A **What is the energy source of red giants (in particular, AGB stars)?**

A: Helium fused into heavier elements.

B: Hydrogen burning into water.

C: Hydrogen fused into helium.

D: Oxydation of helium.

E: Radioactive decays.

C **What is a Cepheid?**

A: A constellation.

B: A type of an open star cluster.

C: A type of a pulsating variable star.

D: A galaxy with a supermassive black hole in its center.

E: A type of a supernova, which explodes due to mass exchange between partners of a close binary.

A **What stars blow up as supernovae?**

A: Those that are heavier than 1.4 solar masses at the end of their lives.

B: All.

C: All white dwarfs.

D: Those similar to the Sun in mass, brightness and chemical composition.

E: All red giants.

E **A planetary nebula's central star is …**

A: a neutron star.

B: a red giant.

C: a main sequence star.

D: a black hole.

E: a white dwarf.

A **What is the energy source of white dwarfs?**

A: They have none, they are only slowly cooling off.

B: Helium to carbon fusion.

C: Burning hydrogen.

D: Radioactive decays.

E: Hydrogen to helium fusion.

C **How are stars born?**

A: A molecular cloud collapses under it own weight.

B: They are not: they have existed ever since the Universe was born.

C: A dense core of a molecular cloud collapses under it own weight.

D: They are spit out of the black hole in the center of the Galaxy.

E: We do not know for sure, although there are several theories for it.

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

A: Charged particle radiation.

B: Ultraviolet.

C: Radio waves.

D: X-rays.

E: Neutrinos.

B **What is a black hole?**

A: An object, size of a ball, that suchs in everything that approches it within a few feet.

B: A 'star' (or an even larger object) with such strong gravity that nothing can escape from inside it.

C: A few miles size object that sucks in everything that approaches it within a million miles.

D: An object with such strong magnetic field that any charged particle trying to leave it would fall back to it.

E: A few miles size object that sucks in everything that approaches it within a few light years.

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

A: We measure the strength of their magnetic field.

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

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

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

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

A **Will the Sun explode as a supernova?**

A: No, it is not heavy enough for that.

B: Yes, when it uses up all its hydrogen.

C: No, because only double stars become supernovae.

D: Yes, when it exhausts its helium.

E: Yes, when it builds up iron in its core.

D **Is helium 'burning' a chemical process?**

A: Yes; but it only runs at very hot temperature.

B: Yes, and that is the process that keeps the Sun hot.

C: No, because helium has more charge than hydrogen.

D: No, because chemical processes do not change atomic nuclei.

E: No, because a chemical process can turn hydrogen only into oxygen.

A **Which stars end their lives blow up as supernovae?**

A: Those heavier than 1.44 solar masses.

B: Those heavier the 100 solar masses.

C: Those lighter than 1.44 solar masses.

D: None. Supernovae are not stars.

E: All.

E **What triggered the collapse of the gas cloud that gave birth to the Sun?**

A: It was a spontaneous collapse.

B: The capture of the Earth.

C: A sudden strengthening of the magnetic field of the Galaxy.

D: A collision with another star.

E: A nearby supernova explosion.

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

A: A magnetic field.

B: Heating to 1200 K.

C: Infrared radiation.

D: UV radiation.

E: Red light.

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

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

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

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

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

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

E **What is the relation between neutron stars and pulsars?**

A: All neutron stars are pulsars. They grow larger and then contract with a period of something like a second.

B: There is no relation. Neutron stars are a type of stars, pulsars are in fact black holes in the centers of galaxies.

C: A supernova can leave behind either a pulsar or a neutron star, but not both.

D: They are two different types of black holes.

E: All pulsars are neutron stars. Only fast spinning neutron stars with special orientation are pulsars.

C **A pulsar gives us one pulse …**

A: when hot bubbles of gas rise from its interior.

B: when it orbits another star once.

C: when it rotates once.

D: when chuncks of matter fall into it.

E: when it reaches maximum diameter in its pulsation.

D **What type of spectrum does a diffuse nebula have?**

A: Continuous spectrum, because it is glowing hot.

B: Absorption spectrum, because it is in front of a star.

C: Emission spectrum, because it is bright.

D: Emission spectrum, because its light is due to fluorescence.

E: Absorption spectrum, because is outside is colder than its inside.

A **Molecular clouds are …**

A: cold.

B: the result of SN explosions.

C: as dense as air.

D: hot.

E: made of dust particles.

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

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

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

A **How fast does a typical pulsar spin?**

A: Many times a second.

B: Once in a minute.

C: Once a year.

D: A million times a second.

E: Does not spin at all.

B **All stars start their life …**

A: as white dwarfs.

B: on the main sequence.

C: as giants.

D: as dwarfs.

E: as red giants.

A **How was interstellar matter discovered?**

A: There are dark areas in the Milky Way in the sky where stars are either missing or strongly reddened.

B: The infrared glow of interstellar matter was observed by IR satellites.

C: The gravitational force due to interstellar gas was detected.

D: Interstellar gas slows down the motion of the Moon as it orbits around Earth.

E: Spaceships encountered thin gas clouds.

E **How come we can see black holes, when they are black?**

A: Because they are not in fact black but radiate X-rays due to a quantum process.

B: They have a strong magnetic field.

C: But we don't: they exist only in theory but have not been observed.

D: It obscures the light of stars that are behind it.

E: When matter falls into the black hole, it radiates just before falling in.

C **Where are stars born in our Galaxy at present?**

A: Nowhere.

B: In the halo.

C: In the spiral arms.

D: In the center.

E: In the star cluster around the center.

E **What stars become planetary nebulae?**

A: None. Planetary nebulae are gas clouds and have nothing to do with stars.
B: All.
C: Those heavier than 1.44 solar masses.
D: Only some double stars.
E: Those lighter than 1.44 solar masses.

B **Where does the light of a planetary nebula come from?**

A: Sunshine is reflected from the atmosphere of a planet.
B: Fluorescence due to the UV radiation of the hot central star.
C: Dust particles radiate in infrared because they are hot.
D: The reflected light of the hot central star.
E: The reflected light of a low-temperature star.

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

A: Getting a laser reflection from the Moon.
B: By direct measurement in a laboratory experiment.
C: By measuring the delay in conversations of astronauts.
D: By measuring the slowing down of the time in a spaceship.
E: Measuring the delay in the eclipses of Jupiter's moons.

D **Which of the following uses the same physical process as the Sun to generate heat?**

A: A nuclear reactor.
B: An atomic bomb.
C: A car engine.
D: A hydrogen bomb.
E: A gas stove.

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

A: It is calculated based on the amount of energy the star radiates.
B: From a chemical analysis of interstellar gas blown in into the solar system.
C: From a chemical analysis of cosmic rays.
D: From the presence of each atom's spectral lines.
E: From samples returned by spacecraft.

D **Why has it been very hard to discover what is in the center of the Galaxy?**

A: Because the center of the Galaxy is a black hole, and it is invisible.

B: Because the center of the Galaxy is too far away for astronomers to see.

C: Because the galactic center is much hotter than ordinary matter.

D: Because there is much obscuring interstellar dust between us and the galactic center.

E: Because the center of the Galaxy is visible only from the Southern hemisphere.

B **What does ionization mean?**

A: A chemical reaction with an ionizing salt.

B: Atoms losing (some of) their electrons.

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

D: Mixing interstellar gas with Fe-containing dust.

E: The breakup of molecules into atoms.

D **How do we know Hubble's law?**

A: It has been proven theoretically.

B: Far-away galaxies look smaller and smaller every year.

C: Far-away galaxies look red.

D: Spectral lines in the spectra of far-away galaxies are shifted to red.

E: Far-away galaxies look fainter and fainter every year.

D **How large is a neutron star?**

A: A million miles.

B: A light year.

C: A million light years.

D: A mile.

E: A few thousand miles.

A **Production, out of nucleus X, of nuclei other than X cannot produce energy. What is X?**

A: Fe.

B: C.

C: H.

D: U.

E: He.

A **Which one is moving fastest?**

A: The same

B: Laser

C: Radio waves

D: X-rays

E: Visible light

B **In the final state of the evolution of the Sun, its chemical composition will be …**

A: helium.

B: a mix of carbon and oxygen.

C: iron.

D: a mix of hydrogen and helium.

E: hydrogen.

D **The spectrum of the Sun consists of**

A: Absorption lines without a continuum.

B: A mix of strong emission lines with some weak absorption lines.

C: only of a few strong emission lines.

D: a bright continuum with a few absorption lines.

E: a pure continuum (the rainbow).

C **The chemical composition of a 0.5 solar mass white dwarf would be …**

A: Hydrogen and helium.

B: Mostly iron.

C: Carbon and oxygen.

D: Metals heavier than iron.

E: Pure hydrogen.

E **Atoms consist of the following constituents:**

A: Electrons and nucleons.

B: Electrons, protons and neutrons.

C: Quarks, electrons, and gluons.

D: Molecules and electrons.

E: Electrons, and a nucleus.

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

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

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

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

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.

B **Which one of the following is not an electromagnetic wave?**

A: Infrared.

B: Electron beam.

C: X-ray.

D: Radio.

E: Light.

C **Stars are kept from collapse under their own gravity by …**

A: their magnetic field.

B: radiation pressure alone.

C: gas pressure + radiation pressure together.

D: gas pressure alone.

E: the strength of their solid cores.

E **What is in the center of the Galaxy?**

A: An open cluster with a very bright red giant in its center.

B: The Sun.

C: A stellar-mass black hole.

D: A large molecular cloud, but no stars.

E: A supermassive black hole.

D **What happens if two galaxies collide?**

A: They both desintegrate.

B: Stars hit each other in the collision.

C: They pass through each other without interaction.

D: They pass through each other but the gravity of each galaxy distorts the shape of the other.

E: They both blow up.