

Astronomy 104, Spring 2023

Test 2

Print your name:

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.**

Answer these questions on the scantron as indicted:

- 1 Answer E**
- 2 Answer B**
- 3 Answer A**

4 Atoms consist of the following constituents:

- A: Electrons, protons and neutrons.
- B: Electrons and nucleons.
- C: Electrons, and a nucleus.
- D: Molecules and electrons.
- E: Quarks, electrons, and gluons.

5 What does Stefan-Boltzman's law say?

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

6 What happens to the spectrum of a star that rotates?

- A: It is shifted towards red or blue by an even amount.
- B: All its spectral lines broaden the same way.
- C: They are shifted by an amount proportional to their wavelength.
- D: Spectral lines become more prominent.
- E: The spectral lines in the red part of the spectrum become brighter.

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

- A: the temperature in its core.
- B: its chemical composition.
- C: its distance.
- D: its speed of motion.
- E: its surface temperature.

8 Which one is an example of the Doppler-effect?

- A: Gas illuminated by UV radiation glows in an emission spectrum.
- B: Magnetic fields make spectral lines break up into several lines.
- C: The motion of a star makes spectral lines broaden.
- D: The spectral lines of a moving star are shifted.
- E: The overall color of a moving star changes.

9 What chemical process changes carbon into oxygen?

- A: Oxydation.
- B: None.
- C: Burning.
- D: Hydrolysis.
- E: Electrolysis.

10 What percentage of all stars are doubles?

- A: All.
- B: Almost none.
- C: Half.
- D: Almost all.
- E: There are no true double stars. They may seem so only due to perspective.

11 Which one is moving fastest?

- A: Radio waves
- B: Visible light
- C: Laser
- D: The same
- E: X-rays

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

- A: an hour.
- B: 4 years.
- C: 1 light year.
- D: 9 minutes.
- E: 4.5 billion years.

13 Which of the following is wrong?

- A: The energy of each photon does not depend on how strong the light is.
- B: The stronger the light, the more energy each of its photons has.
- C: A blue photon always has more energy than a red photon.
- D: X-ray photons have more energy than photons of light.
- E: Microwave photons have less energy than photons of light.

14 How was the speed of light measured for the first time?

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

15 What is a double-line binary star?

- A: A double star with a strong magnetic field.
- B: A short-period binary with both stars' spectral lines visible.
- C: A star that is visibly broken up into a pair in the telescope and the orbital motion is noticeable.
- D: A star that is visibly broken up into a pair in the telescope but the orbital motion is not noticeable.
- E: A double star system with strong stellar wind.

16 Strong ultraviolet radiation comes only from stars of spectral type ..., and why?

- A: All spectral types, because they are all hot.
- B: K & M, because these are hot enough.
- C: O & B, because these are hot enough.
- D: None, because stars do not radiate in UV.
- E: All spectral types, because UV production does not depend on temperature.

17 A star's color indicates its ...

- A: temperature.
- B: size.
- C: distance.
- D: mass.
- E: chemical composition.

18 The spectral type of the Sun is ...

- A: M
- B: G
- C: A
- D: B
- E: K

19 What does ionization mean?

- A: A chemical reaction with an ionizing salt.
- B: The breakup of molecules into atoms.
- C: Atoms losing (some of) their electrons.
- D: Mixing interstellar gas with Fe-containing dust.
- E: Electrons moving to a higher orbit in an atom.

20 The wavelength of light determines its ...

- A: color.
- B: ratio of electric / magnetic field strength.
- C: speed.
- D: polarization.
- E: intensity.

21 A hydrogen nucleus ...

- A: is a proton and an electron.
- B: consists of two protons.
- C: consists of one proton and one neutron.
- D: is a neutron.
- E: is a proton.

22 The spectrum of a hot glowing body is ...

- A: emission spectrum.
- B: continuous spectrum.
- C: band spectrum.
- D: a mixture of an emission and an absorption spectrum.
- E: absorption spectrum.

23 The equivalent of light at much shorter wavelength is called ...

- A: Charged particle radiation.
- B: Neutrinos.
- C: Ultraviolet.
- D: X-rays.
- E: Radio waves.

24 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: Blue photons have a hundred times less energy than red photons.
- C: Cannot tell: the energy of photons depends on the strength of the light.
- D: Blue photons have twice as much energy as red photons.
- E: Blue photons have half the energy of red photons.

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

- A: Low: deep space, High: the Solar Wind.
- B: All: beyond the Solar System
- C: Low: the Solar Wind, High: deep space.
- D: All: the Solar Wind
- E: All: from Earth, mainly nuclear reactors

26 What can excite a hydrogen atom?

- A: A magnetic field.
- B: Heating to 1200 K.
- C: Infrared radiation.
- D: Red light.
- E: UV radiation.

27 Why are double stars important in astronomy?

- A: It is easier to detect a double star than a single one.
- B: They are the only ones that blow up as supernovae.
- C: Double stars have many planets orbiting around them.
- D: They provide the only way to determine the chemical composition of stars.
- E: They provide the only way to tell stellar masses.

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

- A: An approaching star's light arrive to Earth sooner, which causes its spectral lines broaden.
- B: The star's light is stronger when the star is approaching us, and weaker when it is receding.
- C: Spectral lines shift (usually a tiny bit) when the star moves towards or away from us.
- D: The color of a moving star looks redder/bluer than normal.
- E: The spectral lines of an approaching star are shifted from the red end of the spectrum to the blue end.

29 How do we measure the mass of stars?

- A: Using Wien's law, applied to the color of the star.
- B: We measure the strength of their magnetic field.
- C: Using Kepler's II law applied on their planets.
- D: Using Kepler's III law for binary stars.
- E: We measure how strong a gravitational effect they have on the motion of Earth.

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

- A: Molecules pick up extra electrons at $\sim 10,000$ degrees to become ions.
- B: Molecules turn into protons and electrons at ~ 2000 degrees.
- C: Molecules break up into atoms at ~ 2 million degrees.
- D: Molecules break up into atoms at ~ 2000 to 3000 degrees.
- E: Molecules are fused into very large atoms at ~ 1200 degrees.

31 Why do we use spacecraft to do X-ray astronomy?

- A: Because the atmosphere is opaque in X-rays.
- B: Because X-ray telescopes radiate dangerous amounts of X-rays.
- C: Because the telescope needs to be cooled to liquid helium temperatures (3K).
- D: Because spacecraft is closer to the stars.
- E: Because of interference from medical use of X-rays.

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

- A: The atmospheric pressure in the source object.
- B: How far is the source from the observer.
- C: The temperature of the gas that emits the light.
- D: The strength of gravity of the source object.
- E: Which atom/molecule produced the line.

33 What does Wien's law say?

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

34 When do you see an absorption spectrum?

- A: When planets reflect sunlight.
- B: When hot objects glow.
- C: When charged particle hit magnetic fields.
- D: When cold gas is in front of a light source.
- E: When gas is illuminated from the side.

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

- A: Radio waves and sound are slow, light is fast.
- B: Radio waves are fastest, light is middle, sound is slowest.
- C: Sound and radio waves have the same speed, the speed of light is infinitely fast.
- D: Radio waves and light have the same speed, sound is much slower.
- E: They all have the same speed.

36 What type of spectrum does fluorescence produce?

- A: Continuous spectrum.
- B: Absorption spectrum.
- C: Distorted spectrum.
- D: Emission spectrum.
- E: Band spectrum.

37 What happens to matter at 10,000 degrees?

- A: Atomic nuclei change into each other.
- B: (At least some) atoms break up.
- C: Molecules break up.
- D: All substances become solid.
- E: All atoms become ionized.

38 How do we know the chemical composition of stars?

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

39 At what temperature will all molecules disintegrate?

- A: Above ~ 100 K
- B: Above ~ 10,000 K.
- C: Above ~ 2000 K
- D: Above ~ 273 K
- E: Above ~ 1 million K

40 What spectral type is the red giant Betelgeuse?

- A: G.
- B: C.
- C: M.
- D: He.
- E: Hydrogen.

41 The energy of each photon is determined by ...

- A: its wavelength only.
- B: the strength of the light only.
- C: nothing at all: it is a universal quantum constant of nature.
- D: the speed of the light.
- E: both the wavelength and the strength of the light.

42 How large is the Doppler effect in astronomy in practice?

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

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

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

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

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

43 What is plasma?

A: Gas that contains no electrons.

B: (At least partially) ionized gas.

C: Gas that contains no free electrons.

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

E: A viscous liquid.

44 What type of a spectrum does the Sun have?

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

B: emission spectrum.

C: absorption spectrum.

D: continuous spectrum.

E: band spectrum.

45 Why does a planetary nebula glow?

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

B: It is illuminated by the Sun.

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

D: It is illuminated by surrounding stars.

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