

# AST1004 EXAM 1

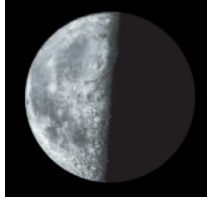
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Prof. Douglas H. Laurence

## Abstract

This exam consists of **30 multiple choice questions**. **You must record your answers on a Scantron sheet.** Don't record your answers on this print-out; I will not accept it as a submission. Fill the Scantron sheet in with a pencil, not a pen. **Don't forget to include your name on the Scantron sheet, as well as the course: AST1004.**

1. A science is:
  - (a) Any field of study aimed at finding the truth
  - (b) Any field of study aimed at describing the physical world
  - (c) Any field of study centered around experimental tests of conjectures
  - (d) Any field of study that uses mathematics
2. The procession of the Earth's North pole is caused by:
  - (a) The fact that the Earth isn't perfectly spherical, but is an oblate sphere
  - (b) The gravitational attraction from the Sun
  - (c) The tilt in the Earth's North pole
  - (d) The tilt in the Moon's orbital plane
3. In isotropic emission of light, brightness:
  - (a) Increases with distance
  - (b) Decreases with distance
  - (c) Remains the same regardless of distance
  - (d) None of the above
4. Which of the choices below is a list of things in correct order from smallest to largest?
  - (a) Star, Solar System, Galaxy, Universe
  - (b) Star, Galaxy, Solar System, Universe
  - (c) Solar System, Star, Galaxy, Universe
  - (d) Universe, Galaxy, Solar System, Star



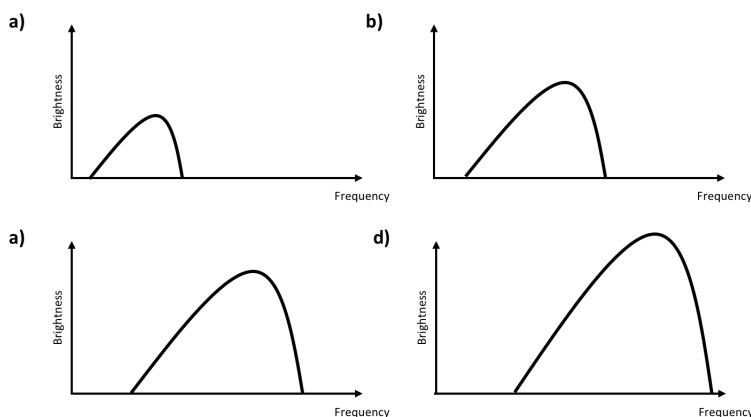
5. Shown above is an image of the Moon in some phase. Which position from the diagram below is the correct position of the Moon around the Earth for this phase?



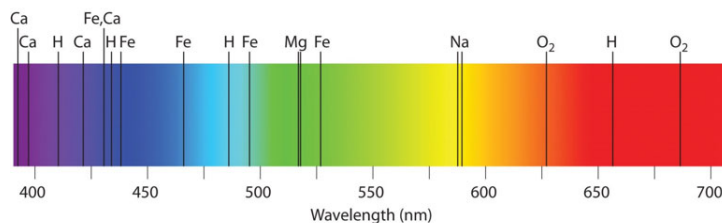
- (a) 1
  - (b) 3
  - (c) 5
  - (d) 7
6. An annular lunar eclipse is caused when:
- (a) The Moon's umbra touches the Earth
  - (b) The Moon's umbra doesn't touch the Earth
  - (c) The Earth's umbra touches the Moon
  - (d) The Earth's umbra doesn't touch the Moon
7. The nucleus of an atom is composed of:
- (a) Electrons and neutrons
  - (b) Protons and neutrons
  - (c) Electrons and protons
  - (d) Electrons, protons, and neutrons
8. A proton is:
- (a) A meson, composed of two leptons
  - (b) A meson, composed of two quarks
  - (c) A baryon, composed of three leptons
  - (d) A baryon, composed of three quarks

9. Electrons are which type of elementary particles?
  - (a) Leptons
  - (b) Quarks
  - (c) Photons
  - (d) Bosons
10. The splitting of two heavy nuclei to release energy is called:
  - (a) Alpha decay
  - (b) Beta decay
  - (c) Fission
  - (d) Fusion
11. Plutonium-239,  ${}_{94}^{239}\text{Pu}$ , decays via  $\alpha$  emission. What would the daughter nucleus of this  $\alpha$  decay be?
  - (a)  ${}_{93}^{237}\text{Np}$
  - (b)  ${}_{91}^{238}\text{Pa}$
  - (c)  ${}_{90}^{231}\text{Th}$
  - (d)  ${}_{92}^{235}\text{U}$
12. Neptunium-239,  ${}_{93}^{239}\text{Np}$ , decays via  $\beta$  emission. What would the daughter nucleus of this  $\beta$  decay be?
  - (a)  ${}_{93}^{239}\text{Np}$
  - (b)  ${}_{94}^{239}\text{Pu}$
  - (c)  ${}_{91}^{235}\text{Pa}$
  - (d)  ${}_{92}^{235}\text{U}$
13. Which of the following particle processes *cannot* occur because it violates charge conservation?
  - (a)  $\pi^+ \rightarrow \mu^+ + \nu_\mu$
  - (b)  $\Sigma^+ \rightarrow \pi^0 + p^+$
  - (c)  $n + e^- \rightarrow p^+$
  - (d)  $p^+ + e^- \rightarrow n$
14. An electron in some atom is in the first excited state, which has an energy of 15.7 eV. In the ground state, the electron would have an energy of 5.7 eV. What will happen to the electron in this case?
  - (a) It will emit a photon of 10 eV to go to the ground state
  - (b) It will absorb a photon of 10 eV to go to the ground state
  - (c) It will absorb a photon of 10 eV to stay in the excited state
  - (d) Nothing will happen

15. Consider two beams of light: beam 1 has a frequency  $f_1 = 5 \times 10^{14}\text{Hz}$  and beam 2 has a frequency  $f_2 = 6.5 \times 10^{14}\text{Hz}$ . Which of the following statements is true?
- (a) Beam 2 has a larger wavelength than beam 1
  - (b) Beam 1 has a larger wavelength than beam 2
  - (c) Beam 1 has more energy than beam 2
  - (d) Beam 2 is redder than beam 1
16. Below is a selection of brightness vs. frequency graphs of blackbodies. Choose the graph that corresponds to the blackbody at the highest temperature. (**Note: the lower-left graph should be marked (c), not (a).**)



17. Which of the following properties is the same for all types of electromagnetic radiation?
- (a) Wavelength
  - (b) Frequency
  - (c) Speed
  - (d) Photon energy



18. The above image is of:
- (a) A gas composed of a single element emitting light
  - (b) A gas composed of multiple elements emitting light
  - (c) A gas composed of a single element absorbing light
  - (d) A gas composed of multiple elements absorbing light



19. The above image is of:
  - (a) A cold gas emitting light
  - (b) A hot gas emitting light
  - (c) A cold gas absorbing light
  - (d) A hot gas absorbing light
20. Which of the following is the Doppler Effect?
  - (a) Objects moving towards us appear redder
  - (b) Objects moving towards us appear brighter
  - (c) Objects moving away from us appear redder
  - (d) Objects moving away from us appear brighter
21. The Doppler Effect is a phenomenon that allows one to measure a star's:
  - (a) Radial velocity
  - (b) Transverse velocity
  - (c) Distance from Earth
  - (d) Parallax
22. Spectroscopy is the study of:
  - (a) Unaltered light
  - (b) Gravitational waves
  - (c) The spectrum of light
  - (d) The polarization of light
23. A CCD chip in the camera of a telescope can determine the color of light on its own.
  - (a) True
  - (b) False
24. A  $\gamma$ -ray telescope can be constructed on Earth.
  - (a) True
  - (b) False
25. Chemical composition of a gas determines which feature of its spectrum?
  - (a) Overall brightness
  - (b) Line width
  - (c) Line shift
  - (d) Which spectral lines are present

26. Temperature of a gas determines which feature of its spectrum?
- (a) Overall brightness
  - (b) Line width
  - (c) Line shift
  - (d) Which spectral lines are present
27. A shift of the spectral lines emitted by a gas depends upon:
- (a) Temperature
  - (b) Line-of-sight speed
  - (c) Rotational motion
  - (d) Chemical composition
28. The light we see from the Sun comes from which region?
- (a) The core
  - (b) The radiation zone
  - (c) The convection zone
  - (d) The photosphere
29. Suppose a star was significantly cooler than the Sun. What color would we expect the star to be?
- (a) Red
  - (b) Yellow
  - (c) White
  - (d) Blue
30. In theory, fusion in a star's core can occur until the core is filled with which element?
- (a) Hydrogen
  - (b) Helium
  - (c) Carbon & Oxygen
  - (d) Iron