

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Atoms in a thin, hot gas (such as a neon advertising sign) emit light at
  - A) specific wavelengths, depending on the element.
  - B) all wavelengths, with the shape of the continuum distribution depending on the temperature of the gas.
  - C) only visible wavelengths.
  - D) only a specific single wavelength.
  
2. The dark absorption lines in the solar spectrum are caused by absorption
  - A) of sunlight in a layer of pure hydrogen gas overlying the solar surface.
  - B) of sunlight in a cooler layer of gas overlying the hot solar surface.
  - C) entirely by atoms and molecules in Earth's cool atmosphere.
  - D) of sunlight in a hotter layer of gas overlying the cooler solar surface.
  
3. Why is the sky blue?
  - A) The air molecules absorb red light better than blue light, allowing more blue light to reach our eyes.
  - B) The air molecules scatter blue light better than red light, so more blue light reaches our eyes.
  - C) The air molecules scatter red light better than blue light, so less red light reaches our eyes.
  - D) The air molecules absorb blue light better than red light, making the sky appear bluer.
  
4. How many electrons surround the nucleus of an atom of the isotope  $^{18}\text{O}$  of oxygen in its neutral state?
  - A) 7
  - B) 10
  - C) 18
  - D) 8
  
5. The Balmer series of spectral lines at visible wavelengths are emitted by a hot hydrogen gas when the electrons fall from all higher atomic energy levels to the
  - A) ionization level, or  $n = \text{infinity}$ .
  - B) first excited level,  $n = 2$ .
  - C) next level down for each level (e.g.,  $n = 4$  to  $n = 3$ ).
  - D) ground state,  $n = 1$ .

6. The temperature of hydrogen gas is such that electrons are excited by atomic collisions up to the  $n = 3$  atomic energy levels. Emission lines from which spectral sequences result when electrons return to the ground state?
- A) Paschen (IR), Balmer (visible), and Lyman (UV) series
  - B) Lyman (UV) series only
  - C) Balmer (visible) and Lyman (UV) series
  - D) Balmer (visible) series only
7. What type of radiation is emitted by hot hydrogen gas when electrons jump from the  $n = 8$  level to the  $n = 7$  level of the atoms?
- A) 52,489 m, in the radio
  - B) 1.905  $\mu\text{m}$ , in the near infrared
  - C) 19.05  $\mu\text{m}$ , in the infrared
  - D) 38.9 nm, in the ultraviolet
8. The spectrum of a star shows an equivalent set of dark absorption lines to those of the Sun, but with one exception: Every line appears at a slightly longer wavelength, shifted toward the red end of the spectrum. What conclusion can be drawn from this observation?
- A) The star is moving rapidly toward Earth.
  - B) A cloud of dust surrounds the star and absorbs the light.
  - C) The star is moving rapidly away from Earth.
  - D) The temperature of the star's surface is higher than that of the Sun.
9. When an object is moving toward you the visible radiation which it emits is Doppler shifted toward the
- A) ultraviolet.
  - B) infrared.
  - C) microwave.
  - D) radio.
10. Hydrogen gas emits a strong spectral line of red light with a wavelength of 656.3 nm (Balmer  $\alpha$  line). This emission line is seen in the spectrum of a distant quasar but at a wavelength of 721.9 nm. Applying Doppler's relation, how fast is this object moving with respect to Earth, in terms of the velocity of light,  $c$ ?
- A)  $1/10 c$
  - B)  $1.1 c$
  - C)  $1/100 c$
  - D)  $10 c$