1. Cepheid-variable stars pulsate regularly in size. During the contraction part of the cycle, when the star's temperature is increasing, the peak wavelength of the emitted radiation
A) shifts toward longer or shorter wavelengths at random as the temperature changes.
B) remains unchanged.
C) shifts from the visible to the UV part of the spectrum.
D) shifts from the UV to the visible part of the spectrum.

2. The human eye has evolved over time so that its peak wavelength sensitivity is about 0.5 µm (1 µm = 10^{-6} m). Use Wien's law to calculate the temperature of blackbody radiation to which the eye is most sensitive.
A) 14,240 K
B) 0.58 K
C) 580 K
D) 5,800 K

3. A piece of iron is heated from 400 to 800 K (127 to 527°C). By what factor will the total energy per second emitted by this iron increase?
A) 2
B) 296.5
C) 4
D) 16

4. 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.

5. 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
6. What happens in general when ultraviolet radiation passes through a tube of cool hydrogen gas?
   A) Radiation at all wavelengths is absorbed, reducing the intensity at all wavelengths uniformly.
   B) It is unhindered except at the specific wavelengths of the Lyman series, Lα, Lβ, etc, which are absorbed by the atoms.
   C) It is unhindered except the Lyman Lα wavelength, which is absorbed by the atoms.
   D) It is unhindered since the hydrogen gas is cool and cannot absorb energy.

7. An electron is in the n = 3 energy level in a hydrogen atom. To ionize this atom it is necessary for the electron to gain a minimum of how much energy?
   A) 1.5 eV
   B) 4.5 eV
   C) 12.1 eV
   D) 13.6 eV

8. Hydrogen gas emits a strong spectral line of red light with a wavelength of 656.3 nm (Balmer α 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

9. 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.