

ASTR 130, Homework 2

Name: _____ Date: _____

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 $0.5 \mu\text{m}$ ($1 \mu\text{m} = 10^{-6} \text{m}$). 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, $L\alpha$, $L\beta$, etc, which are absorbed by the atoms.
 - C) It is unhindered except the Lyman $L\alpha$ 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.