ASTRO 130, FALL 2014, Homework on Chapter 5
Name: _____ Date: _____

1. Choose the correct sequence of electromagnetic radiations, in order of increasing wavelengths.
   A) radio, IR, visible, UV
   B) UV, visible, radio, IR
   C) UV, visible, IR, radio
   D) visible, UV, IR, radio

2. What is the wavelength of electromagnetic radiation whose frequency is 10^6 cycles per second (10^6 Hz or 1000 kHz, the frequency of ordinary AM radio)?
   A) 3 mm
   B) 3 cm
   C) 3 m
   D) 300 m

3. The temperature of a gas cloud in space is directly related to and representative of the
   A) number of atomic collisions per second within the cloud.
   B) average speed of its atoms.
   C) density of the cloud.
   D) color of the cloud.

4. A typical but very cool star might have a temperature of 3100°C. On the Kelvin scale, this is about
   A) 2827 K.
   B) 3068 K.
   C) 3373 K.
   D) 3100 K, since Kelvin and Celsius degrees are the same.

5. 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.

6. 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

7. The total energy emitted per unit time at all wavelengths from an object increases by what factor if its temperature is increased by a factor of 3 (e.g., from room temperature to 900 K)?
   A) 27
   B) 81
   C) 3
   D) 9

8. Which is the correct sequence of electromagnetic radiation in order of increasing energy of the photons (or quanta)?
   A) visible light, UV radiation, X-rays, gamma rays
   B) radio waves, microwaves, gamma rays, UV radiation
   C) gamma rays, radio waves, X-rays, infrared rays
   D) visible light, microwave, radio waves, infrared rays.

9. The human eye is most sensitive to light with a wavelength near 550 nm. To what photon energy is the human eye most sensitive?
   A) 2.49 eV
   B) 3.61×10^{-19} eV
   C) 2.25 eV
   D) 1.83 eV

10. Isotopes of a particular element in the periodic table have which nuclear property in common?
   A) same number of neutrons but different numbers of protons
   B) same number of neutrons, but different numbers of protons and electrons
   C) same total number of protons and neutrons
   D) same number of protons but different numbers of neutrons

11. The Balmer series of visible spectral emissions from hydrogen gas arises from transitions in which electrons jump between energy levels
    A) from higher levels to the second excited level, $n = 3$.
    B) between adjacent levels (e.g., $n = 2$ to $n = 1$, $n = 3$ to $n = 2$, $n = 4$ to $n = 3$, etc.)
    C) from higher levels to the first excited level, $n = 2$.
    D) from all levels to the ground state, $n = 1$.

12. 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 μm, in the near infrared
    C) 19.05 μm, in the infrared
    D) 38.9 nm, in the ultraviolet

13. 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