

Name: _____ Date: _____

1. On the absolute Kelvin temperature scale, the temperature of freezing water is about
 - A) -273 K.
 - B) $+373$ K.
 - C) $+273$ K.
 - D) 0 K.

2. If all stars are considered to be perfect blackbodies, then it should follow that all stars
 - A) of the same composition (made of exactly the same material) emit the same energy flux.
 - B) of the same size emit the same energy flux.
 - C) traveling at the same speed emit the same energy flux.
 - D) of the same temperature emit the same energy flux.

3. 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.

4. The average temperature of Mars is lower than that of Earth. If a distant observer measures the infrared radiation from both Mars and Earth, then
 - A) the emission from the two planets will peak at the same wavelength, but that from Mars will be less intense than that from Earth.
 - B) the wavelength of peak emission from Earth will be longer than that from Mars.
 - C) the wavelength of peak emission from Mars will be longer than that from Earth.
 - D) it is not possible to predict the behavior of the radiation from the information given.

5. The human eye has evolved over time so that its peak wavelength sensitivity is about 0.5 μm ($1 \mu\text{m} = 10^{-6}$ 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

6. 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
7. The Stefan-Boltzmann law relating energy per unit area F emitted by an object to its temperature T , $F = \sigma T^4$, is obeyed ideally by what type of object?
- A) only hot gases, whose atoms emit and absorb only specific colors (e.g., neon tubes)
 - B) all objects, whatever their color or reflective properties
 - C) a red-colored object that absorbs blue light but reflects red light
 - D) a blackbody, a perfect absorber and emitter of energy at all wavelengths
8. The star Betelgeuse has a lower surface temperature than the Sun; therefore (with IR = infrared and UV = ultraviolet)
- A) Betelgeuse emits more IR and less UV flux than the Sun.
 - B) Betelgeuse emits less IR and more UV flux than the Sun.
 - C) Betelgeuse emits more IR and more UV flux than the Sun.
 - D) Betelgeuse emits less IR and less UV flux than the Sun.
9. If two photons in a vacuum have different energies, what can we say about the wavelengths of these photons?
- A) The wavelength depends only on color, not on energy.
 - B) The higher-energy photon has the shorter wavelength.
 - C) They have the same wavelength; all photons have the same wavelength, regardless of energy.
 - D) The higher-energy photon has the longer wavelength.
10. 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