

חיזון המדע הירושלמי תשס"ח - Jerusalem Science Contest 2008-2009
Electromagnetic and Ionizing radiation
Exam 6 — Chapter 30 - Light Emission, Black Body Radiation,
Fluorescence and Phosphorescence

Name: _____

Date: _____

Raw Score: _____

Percentage Score: _____ %

Proctor for this Examinaton: _____ Form: _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Electrons may be raised to a higher energy level by
 - A) heating matter to very high temperatures.
 - B) absorption of sufficiently enegetic photons.
 - C) electrical excitation.
 - D) all of the preceding.
 - E) none of the preceding

- 2) The energy of a photon is
 - A) inversely proportional to its frequency.
 - B) directly proportional to its wavelength.
 - C) the quotient of Plank's constant and the frequency of the photon..
 - D) all ofthe preceding.
 - E) none of the preceding.

- 3) What is the energy of a photon having a wavelength of 530 nm?
 - A) 2.40×10^{-34} j
 - B) 1.17×10^{-32} j
 - C) 1.20×10^{-27} j
 - D) 1.19×10^{-26} j
 - E) 3.75×10^{-19} j

- 4) The visible emission spectrum of hydrogen is characterized by a series of four lines that represent electron transitions from higher energy states to a lower level at what excited state?
 - A) first excited state ($n = 2$)
 - B) second excited state ($n = 3$)
 - C) third excited state ($n = 4$)
 - D) fourth excited state ($n = 5$)
 - E) none of the preceding

- 5) Which series of emission lines have frequencies in the visible region of the spectrum?
 - A) Lyman
 - B) Balmer
 - C) Paschen
 - D) Brackett
 - E) none of the preceding

- 6) The incandescence of an object that absorbs all light that is incident upon it is called
- Cherenkov radiation
 - Stefan-Boltzmann radiation.
 - blackbody radiation.
 - luminosity.
 - none of the preceding.
- 7) The energy flux, irradiance, or power per unit area of a perfectly absorbant incandescent object is given by the formula $F = \sigma T^4$. What is the name given to this equation?
- Blackbody Law
 - Wien's Law .
 - Stefan-Boltzmann Law
 - Planck's Law
 - none of the preceding
- 8) Which of the following expressions correctly relates temperature in Kelvins to peak wavelength of emitted light in a perfect absorber (Wien's Law)?
- $\lambda_{\max} = bT^4$
 - $\lambda_{\max} = 1/T$
 - $T = hc/\lambda_{\max}$
 - $\lambda_{\max} = b/T^4$
 - none of the preceding
- 9) Fraunhofer lines represent
- ultaviolet hydrogen emssion lines.
 - infrared hydrogen absorption lines.
 - absorption lines in the spectrum of the Sun.
 - emission lines in the spectrum of the Sun
 - none of the preceding
- 10) The hydrogen alpha line is what color?
- violet
 - blue
 - green
 - yellow
 - red
- 11) Light emitted in the ultraviolet region of the spectrum forms which of the following series of lines?
- Lyman
 - Balmer
 - Paschen
 - all of the preceding
 - none of the preceding
- 12) What kind of a spectrum is produced by an incandescent object?
- bright line emission
 - bright line absorption
 - dark line absorption
 - continuous
 - none of the preceding
- 13) In what region of the elecromagnetic spectrum do electrons falling from higher energy states to the second excited state ($n = 3$) radiate?
- x-ray
 - ultraviolet
 - visible
 - infrared
 - microwave

- 14) Fluorescence differs from incandescence in that the energy of excitation is
- A) thermal
 - B) electrical
 - C) provided by photons
 - D) chemical
 - E) none of the preceding
- 15) Which of the following are frequently fluorescent?
- A) zinc sulfide
 - B) scorpions
 - C) the mineral willemite
 - D) all of the preceding.
 - E) none of the preceding.
- 16) In fluorescence, an excited electron has its spin antiparallel to the spin of the electron with which it was paired in the ground state. Which of the following describes this spin state?
- A) singlet B) doublet C) triplet D) quadruplet E) multiplet
- 17) Fluorescent decay or deexcitation takes place in approximately which of the following time intervals?
- A) picosecond
 - B) nanosecond
 - C) microsecond
 - D) millisecond
 - E) second or longer
- 18) Some fluorescent materials are also phosphorescent, as shown in the lecture. The conversion of electrons from the spin-allowed state of fluorescence to the spin-forbidden state of phosphorescence is called
- A) spin-spin coupling
 - B) spin-lattice coupling
 - C) spin conversion
 - D) intersystem crossing
 - E) none of the preceding
- 19) When a fluorescent material is also phosphorescent, the emitted light will almost always be
- A) higher frequency
 - B) shorter wavelength
 - C) longer wavelength
 - D) greater in amplitude
 - E) the same frequency
- 20) Phosphorescent decay (return to the ground state) takes place over approximately what time interval
- A) picosecond
 - B) nanosecond
 - C) microsecond
 - D) millisecond
 - E) second or longer

- 21) In a demonstration of phosphorescence in the lecture, which of the following were able to cause bright fluorescence and phosphorescence of a zinc sulfide screen?
- A) 250 milliwatt red laser
 - B) 250 milliwatt green laser
 - C) 20 milliwatt violet laser
 - D) all of the preceding
 - E) none of the preceding
- 22) Helium
- A) was discovered in the spectrum of the Sun before it was ever found on the Earth.
 - B) has twice the number of spectral lines as hydrogen, because it has twice the number of electrons
 - C) has more total emission lines than hydrogen, but fewer lines in the visible spectrum
 - D) all of the preceding
 - E) none of the preceding
- 23) Some materials respond to ultraviolet light of only a particular wavelength, as shown in the lecture. There will tend to be a direct correlation between the wavelength of the uv light and
- A) the absorption maximum (λ_{\max}) of the material in question.
 - B) the color of the phosphorescence
 - C) the color of the fluorescence
 - D) all of the preceding
 - E) none of the preceding
- 24) The mineral Scheelite, an important ore of tungsten, is identified by the fact that
- A) it fluoresces brilliant blue-white under short-wave ultraviolet light
 - B) it is highly phosphorescent under long-wave ultraviolet light
 - C) it is highly fluorescent under mid-wave ultraviolet light
 - D) it fluoresces brilliant red under long-wave ultraviolet light
 - E) unlike most tungsten minerals, it is not fluorescent or phosphorescent.
- 25) In a fluorescent lamp, mercury vapor provides uv photons which excite molecules of a chemical coated on the inside of the glass bulb. This chemical is referred to as a(n)
- A) emitter
 - B) quencher
 - C) phosphor
 - D) photofluor
 - E) none of the preceding