

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) What kind of a spectrum is produced by an incandescent object?
  - A) dark line absorption
  - B) continuous
  - C) bright line absorption
  - D) bright line emission
  - E) none of the preceding
  
- 2) Phosphorescent decay (return to the ground state) takes place over approximately what time interval
  - A) picosecond
  - B) millisecond
  - C) nanosecond
  - D) microsecond
  - E) second or longer
  
- 3) 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 color of the phosphorescence
  - B) the absorption maximum ( $\lambda_{\max}$ ) of the material in question.
  - C) the color of the fluorescence
  - D) all of the preceding
  - E) none of the preceding
  
- 4) Fraunhofer lines represent
  - A) emission lines in the spectrum of the Sun
  - B) infrared hydrogen absorption lines.
  - C) ultraviolet hydrogen emission lines.
  - D) absorption lines in the spectrum of the Sun.
  - E) none of the preceding

- 5) 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)
- emitter
  - quencher
  - phosphor
  - phosphor
  - none of the preceding
- 6) 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
- spin conversion
  - spin-lattice coupling
  - intersystem crossing
  - spin-spin coupling
  - none of the preceding
- 7) When a fluorescent material is also phosphorescent, the emitted light will almost always be
- shorter wavelength
  - higher frequency
  - longer wavelength
  - greater in amplitude
  - the same frequency
- 8) 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?
- Wien's Law
  - Blackbody Law
  - Planck's Law
  - Stefan-Boltzmann Law
  - none of the preceding
- 9) 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?
- first excited state ( $n = 2$ )
  - third excited state ( $n = 4$ )
  - second excited state ( $n = 3$ )
  - fourth excited state ( $n = 5$ )
  - none of the preceding
- 10) The mineral Scheelite, an important ore of tungsten, is identified by the fact that
- it fluoresces brilliant blue-white under short-wave ultraviolet light
  - it fluoresces brilliant red under long-wave ultraviolet light
  - it is highly phosphorescent under long-wave ultraviolet light
  - unlike most tungsten minerals, it is not fluorescent or phosphorescent.
  - it is highly fluorescent under mid-wave ultraviolet light
- 11) The hydrogen alpha line is what color?
- green
  - yellow
  - red
  - violet
  - blue

- 12) Which of the following are frequently fluorescent?
- A) zinc sulfide
  - B) the mineral willemite
  - C) scorpions
  - D) all of the preceding.
  - E) none of the preceding.
- 13) The energy of a photon is
- A) directly proportional to its wavelength.
  - B) inversely proportional to its frequency.
  - C) the quotient of Planck's constant and the frequency of the photon.
  - D) all of the preceding.
  - E) none of the preceding.
- 14) 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) quadruplet
  - B) singlet
  - C) multiplet
  - D) doublet
  - E) triplet
- 15) Electrons may be raised to a higher energy level by
- A) absorption of sufficiently energetic photons.
  - B) heating matter to very high temperatures.
  - C) electrical excitation.
  - D) all of the preceding.
  - E) none of the preceding
- 16) Which of the following expressions correctly relates temperature in Kelvins to peak wavelength of emitted light in a perfect absorber (Wien's Law)?
- A)  $\lambda_{\max} = b/T^4$
  - B)  $\lambda_{\max} = bT^4$
  - C)  $\lambda_{\max} = 1/T$
  - D)  $T = hc/\lambda_{\max}$
  - E) none of the preceding
- 17) Fluorescent decay or deexcitation takes place in approximately which of the following time intervals?
- A) nanosecond
  - B) second or longer
  - C) millisecond
  - D) picosecond
  - E) microsecond
- 18) 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) 20 milliwatt violet laser
  - C) 250 milliwatt green laser
  - D) all of the preceding
  - E) none of the preceding

- 19) What is the energy of a photon having a wavelength of 530 nm?  
A)  $1.19 \times 10^{-26}$  j      B)  $1.20 \times 10^{-27}$  j      C)  $2.40 \times 10^{-34}$  j      D)  $3.75 \times 10^{-19}$  j      E)  $1.17 \times 10^{-32}$  j
- 20) The incandescence of an object that absorbs all light that is incident upon it is called  
A) luminosity.  
B) Stefan-Boltzmann radiation.  
C) blackbody radiation.  
D) Cherenkov radiation  
E) none of the preceding.
- 21) Which series of emission lines have frequencies in the visible region of the spectrum?  
A) Brackett  
B) Lyman  
C) Balmer  
D) Paschen  
E) none of the preceding
- 22) Light emitted in the ultraviolet region of the spectrum forms which of the following series of lines?  
A) Paschen  
B) Balmer  
C) Lyman  
D) all of the preceding  
E) none of the preceding
- 23) In what region of the electromagnetic spectrum do electrons falling from higher energy states to the second excited state ( $n = 3$ ) radiate?  
A) infrared      B) x-ray      C) microwave      D) ultraviolet      E) visible
- 24) Helium  
A) has twice the number of spectral lines as hydrogen, because it has twice the number of electrons  
B) has more total emission lines than hydrogen, but fewer lines in the visible spectrum  
C) was discovered in the spectrum of the Sun before it was ever found on the Earth.  
D) all of the preceding  
E) none of the preceding
- 25) Fluorescence differs from incandescence in that the energy of excitation is  
A) provided by photons  
B) thermal  
C) chemical  
D) electrical  
E) none of the preceding