

## Chapter 7 Tro

1. The wavelength of an electromagnetic wave is
  - A) the number of complete oscillations or cycles over a distance of one meter
  - B) the number of complete oscillations or cycles in a one second time interval
  - C) the distance between successive maxima in the wave
  - D) the number of complete oscillations or cycles over a distance of one centimeter
  - E) the distance between a minimum and the nearest maximum in the oscillation
  
2. What is the wavelength of electromagnetic radiation which has a frequency of  $5.732 \times 10^{14} \text{ s}^{-1}$ ?
  - A)  $1.718 \times 10^{23} \text{ m}$
  - B)  $1.912 \times 10^6 \text{ m}$
  - C)  $5.230 \times 10^{-7} \text{ m}$
  - D)  $523.0 \text{ m}$
  - E)  $5.819 \times 10^{-15} \text{ nm}$
  
3. Which one of the following types of radiation has the lowest frequency?
  - A) FM radio waves
  - B) infrared radiation
  - C) microwave radiation
  - D) x-rays
  - E) ultraviolet rays
  
4. What is the energy, in joules, of one mole of photons associated with visible light having a wavelength of  $486.1 \text{ nm}$ ?
  - A)  $12.41 \text{ kJ}$
  - B)  $2.461 \times 10^{-4} \text{ J}$
  - C)  $2.461 \times 10^5 \text{ J}$
  - D)  $6.167 \times 10^{14} \text{ J}$
  - E)  $8.776.15 \times 10^{25} \text{ J}$
  
5. What is the frequency, in  $\text{sec}^{-1}$ , of radiation which has an energy of  $3.371 \times 10^{-19} \text{ joules}$  per photon?
  - A)  $1.697 \times 10^{15} \text{ sec}^{-1}$
  - B)  $5.893 \times 10^{-7} \text{ sec}^{-1}$
  - C)  $5.087 \times 10^{14} \text{ sec}^{-1}$
  - D)  $1.966 \times 10^{-15} \text{ sec}^{-1}$
  - E)  $6.626 \times 10^{-34} \text{ sec}^{-1}$

6. What is the energy, in joules, of one mole of photons whose wavelength is  $5.461 \times 10^2$  nm?
- A)  $2.191 \times 10^{-4}$  J  
 B)  $2.437 \times 10^{-12}$  J  
 C)  $2.191 \times 10^5$  J  
 D)  $1.376 \times 10^6$  J  
 E)  $4.06 \times 10^{-19}$  J
7. Which statement among the ones presented below is true?
- A) The spectrum of sunlight consists of a series of white lines superimposed on a colored background.  
 B) The spectrum of sunlight consists of a series of white lines superimposed on a dark background.  
 C) The spectrum of sunlight consists of a series of colored lines superimposed on a dark background.  
 D) The spectrum of sunlight consists of a series of dark lines superimposed on a colored background.  
 E) The spectrum of sunlight consists of a series of dark lines superimposed on a white background.
8. Calculate the frequency of the light emitted by a hydrogen atom during a transition of its electron from the energy level with  $n = 4$  to the level with  $n = 1$ . Recall that the quantized energies of the levels in the hydrogen atom are given by:
- $$E_n = -\frac{21.79 \times 10^{-19}}{n^2} \text{ joule}$$
- A)  $1.028 \times 10^7 \text{ s}^{-1}$   
 B)  $1.215 \times 10^{-7} \text{ s}^{-1}$   
 C)  $2.467 \times 10^{15} \text{ s}^{-1}$   
 D)  $3.083 \times 10^{15} \text{ s}^{-1}$   
 E)  $8.228 \times 10^6 \text{ s}^{-1}$
9. Calculate the wavelength of the light emitted by a hydrogen atom during a transition of its electron from the energy level with  $n = 6$  to the level with  $n = 3$ . Recall that the quantized energies of the levels in the hydrogen atom are given by:
- $$E_n = -\frac{21.79 \times 10^{-19}}{n^2} \text{ joule}$$
- A)  $2.954 \times 10^{-5} \text{ m}$   
 B) 1094 nm  
 C) 547 nm  
 D) 821 nm  
 E) 1640 nm

10. Using the de Broglie relation and ignoring relativistic effects, calculate the wavelength of a  $^{19}\text{F}^+$  ion which is moving with a speed of  $4.255 \times 10^5$  m/s. The mass of  $^{19}\text{F}$  is 18.9984 a.m.u.
- A)  $4.936 \times 10^{-17}$  m
  - B)  $4.936 \times 10^{-14}$  m
  - C)  $1.484 \times 10^{-29}$  m
  - D)  $1.484 \times 10^{-26}$  m
  - E)  $4.936 \times 10^{-20}$  m
11. All orbitals with the same value of the principal quantum number are said
- A) to belong to the same shell
  - B) to belong to the same subshell
  - C) to belong to the same group
  - D) to belong to the same period
  - E) to belong to the same class
12. The spectroscopic notation (number + letter designation) for the subshell with  $n = 5$  and  $l = 3$  is
- A) 5d subshell
  - B) 5p subshell
  - C) 5f subshell
  - D) 5g subshell
  - E) 5s subshell
13. Given the following sets of quantum numbers for  $n \ l \ m_l \ m_s$ , which one of these sets is not a possible set for an electron in an atom?
- | $n$  | $l$ | $m_l$ | $m_s$          |
|------|-----|-------|----------------|
| A) 3 | 2   | 2     | $-\frac{1}{2}$ |
| B) 3 | 1   | -1    | $\frac{1}{2}$  |
| C) 4 | 3   | 2     | $\frac{1}{2}$  |
| D) 4 | 3   | -2    | $-\frac{1}{2}$ |
| E) 5 | 2   | 3     | $\frac{1}{2}$  |

14. A possible set of quantum numbers for an electron in the partially filled subshell in the gallium atom in its ground state configuration would be

	$n$	$l$	$m_l$	$m_s$
A)	3	1	0	$-\frac{1}{2}$
B)	3	1	1	$\frac{1}{2}$
C)	4	0	0	$-\frac{1}{2}$
D)	4	1	0	$\frac{1}{2}$
E)	4	2	1	$\frac{1}{2}$

15. Which one of the following types of radiation has the shortest wavelength?

- A) FM radio waves
- B) infrared radiation
- C) microwave radiation
- D) ultraviolet rays
- E) visible light rays

16. Which statement among the ones presented below is true?

- A) The line spectra of atoms consists of a series of white lines superimposed on a colored background.
- B) The line spectra of atoms consists of a series of white lines superimposed on a dark background.
- C) The line spectra of atoms consists of a series of colored lines superimposed on a dark background.
- D) The line spectra of atoms consists of a series of dark lines superimposed on a white background.
- E) The line spectra of atoms consists of a series of dark lines superimposed on a colored background.

17. Using the de Broglie relation, calculate the wavelength of a neutron which is moving with a speed of  $4.505 \times 10^4$  m/s. The mass of the neutron is 1.008665 a.m.u.

- A)  $1.458 \times 10^{-38}$  m
- B)  $2.632 \times 10^{-3}$  m
- C)  $4.372 \times 10^{-30}$  m
- D)  $8.781 \times 10^{-15}$  m
- E)  $8.781 \times 10^{-12}$  m

18. The letter designation for the subshell is based on
- A) the value of the secondary quantum number
  - B) the value of the principal quantum number
  - C) the value of the magnetic quantum number,  $m_l$
  - D) the value of the spin quantum number,  $m_s$
  - E) the transverse polarization of the optical emission from the H atom
19. All orbitals with the same value of the principal quantum number and the secondary quantum number are said
- A) to belong to the same shell
  - B) to belong to the same subshell
  - C) to belong to the same group
  - D) to belong to the same period
  - E) to belong to the same class
20. Given the following sets of quantum numbers for  $n l m_l m_s$ , which one of these sets is not a possible set for an electron in an atom?

	$n$	$l$	$m_l$	$m_s$
A)	3	2	2	$\frac{1}{2}$
B)	3	1	-1	$\frac{1}{2}$
C)	4	3	2	$\frac{1}{2}$
D)	4	4	-3	$\frac{1}{2}$
E)	5	2	-2	$\frac{1}{2}$

## Answer Key

1. C
2. C
3. A
4. C
5. C
6. C
7. D
8. D
9. B
10. B
11. A
12. C
13. E
14. D
15. D
16. C
17. E
18. A
19. B
20. D