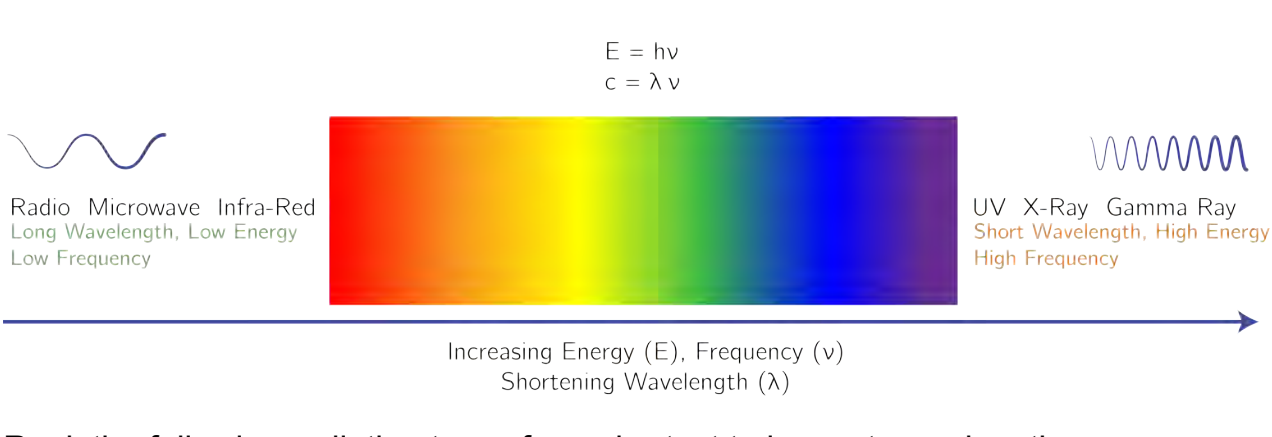
HW03

Question 1 — 1 pts

As the wavelength of a light wave gets longer, frequency and energy...

- ◯ decrease
- ◯ increase
- ◯ remain unchanged

Question 2 — 1 pts



Rank the following radiation types from shortest to longest wavelength:

UV, X-Ray, Red light, Green light

- ◯ Red light, Green light, UV, X-Ray
- ◯ X-Ray, Green light, Red light, UV
- ◯ X-ray, UV, Green light, Red light
- ◯ Green light, X-Ray, Red light, UV

Question 3 — 1 pts

How would you describe the most likely effect of visible light on a molecule?

- ◯ molecular ionization
- ◯ molecular vibration
- ◯ molecular rotation
- ◯ electron excitation

Question 4 — 1 pts

How would you describe the most likely effect of infra-red radiation on matter?

- ◯ ionization
- ◯ excitation
- ◯ rotation
- ◯ vibration

Question 5 — 1 pts

DNA, generally considered a very stable organic polymer, is first damaged at which region of the electromagnetic spectrum?

- ◯ Visible light
- ◯ Radio waves
- ◯ IR region
- ◯ UV region

Question 6 — 1 pts

Which of the following pairs the correct definition of frequency along with the correct units shown in parenthesis?

- ◯ The time it takes for a full wavelength to pass a single point (s)
- ◯ The number of wavelengths that pass a single point per second (s^{-1})
- ◯ The time it takes for a full wavelength to pass a single point (s^{-1})
- ◯ The number of wavelengths that pass a single point per second (s)

Question 7 — 1 pts

What is the frequency of yellow light with a wavelength of 580 nm?

- ◯ $2.39 \times 10^{-19} s^{-1}$
- ◯ $1.80 \times 10^{-7} s^{-1}$
- ◯ $5.17 \times 10^{5} s^{-1}$
- ◯ $5.17 \times 10^{14} s^{-1}$

Question 8 — 1 pts

Which of the following equations directly solves for energy using wavelength?

- ◯ $E = h\nu/\lambda$
- ◯ $E = h\lambda/\nu$
- ◯ $E = h\lambda$
- ◯ $E = hc/\lambda$

Question 9 — 1 pts

FM radio stations correspond to the frequency of the channel in MHz. If you want to listen to a radio station that has a frequency equal to 1.015×10^8 Hz, you should tune your radio to...

- ◯ 1015
- ◯ 10.15
- ◯ 101.5
- ◯ 1.015

Question 10 — 1 pts

Microwaves, such as those used for radar and to heat food in a microwave oven, have wavelengths greater than about 3 mm. What is the corresponding frequency of radiation of a wavelength of 13.4 mm?

- ◯ 6.82×10^{10} Hz
- ◯ 4.81×10^{10} Hz
- ◯ 2.24×10^{10} Hz
- ◯ 7.52×10^{10} Hz

Question 11 — 1 pts

It takes light with a wavelength of 212 nm to break the N–H bond in ammonia. What energy is required per photon to break this bond? What is the N–H bond strength in terms of kJ per mole?

- ◯ 6.61×10^{-22} kJ/photon; 398 kJ/mol
- ◯ 9.38×10^{-22} kJ/photon; 565 kJ/mol
- ◯ 9.38×10^{-22} kJ/photon; 565,000 kJ/mol
- ◯ 6.61×10^{-22} kJ/photon; 0.398 kJ/mol

Question 12 — 1 pts

Which of the following is the most energetic form of UV light?

- ◯ UV-B
- ◯ UV-A
- ◯ UV-C
- ◯ UV-A, UV-B, and UV-C are equally energetic

Question 13 — 1 pts

Sodium vapor lamps, used for public lighting, emit yellow light of a wavelength of 570 nm. How much energy is emitted by an excited sodium atom when it generates a photon?

- ◯ 3.5×10^{-19} J
- ◯ 3.5×10^{-28} J
- ◯ 2.8×10^{-19} J
- ◯ 2.8×10^{-20} J

Question 14 — 1 pts

Consider the sodium vapor lamps described in the previous question. How much energy is emitted by 45.8 mg of sodium atoms emitting light at this wavelength? Assume each sodium atom emits one photon.

- ◯ 2.0×10^{21} J
- ◯ 4.2×10^{5} J
- ◯ 2.0×10^{-3} J
- ◯ 420 J

Question 15 — 1 pts

Which of the following statements are consistent with modern atomic theory? Multiple answers may apply.

- ☐ The solutions to the Schrödinger Equation are wavefunctions that describe the energy and position of electrons in an atom.
- ☐ The vast majority of mass exists in the nucleus of an atom, but the radius of the nucleus is only about 1/10000th the radius of the overall atom
- ☐ Electrons exist in discrete, quantifiable energy levels.
- ☐ An electron that has zero energy when it is closest to the nucleus

Question 16 — 1 pts

Which of the following **is** a possible quantum number set for an electron in a 4d orbital?

- ◯ $n = 4,\ \ell = 3,\ m_\ell = 3,\ m_s = ½$
- ◯ $n = 4,\ \ell = 2,\ m_\ell = -1,\ m_s = ½$
- ◯ $n = 4,\ \ell = 3,\ m_\ell = 0,\ m_s = ½$
- ◯ $n = 2,\ \ell = 4,\ m_\ell = 2,\ m_s = -½$

Question 17 — 1 pts

An electron is found in a 6f orbital. What is the value of the angular momentum quantum number (ℓ)?

- ◯ 4
- ◯ 3
- ◯ 6
- ◯ 1
- ◯ 2

Question 18 — 1 pts

Which of the following sets of quantum numbers is not possible?

- ◯ n = 3, l = 2, m_l = 1, m_s = 1/2
- ◯ n = 3, l = 4, m_l = -3, m_s = 1/2
- ◯ n = 5, l = 3, m_l = 3, m_s = -1/2
- ◯ n = 2, l = 0, m_l = 0, m_s = -1/2

Question 19 — 1 pts

How many unique quantum number sets are possible for a 3p electron in an argon atom?

Question 20 — 1 pts

Which of the following is **not** a possible quantum number set?

- ◯ $n = 2,\ \ell = 1,\ m_\ell = 0,\ m_s = ½$
- ◯ $n = 4,\ \ell = 2,\ m_\ell = -1,\ m_s = -½$
- ◯ $n = 3,\ \ell = 2,\ m_\ell = -3,\ m_s = -½$
- ◯ $n = 3,\ \ell = 0,\ m_\ell = 0,\ m_s = ½$

Question 21 — 1 pts

An electron orbital has a round, spherical shape (s-orbital). Its n value equals 3. What is a possible quantum number set for this electron orbital?

- ☐ n = 3, l = 1, ml = 0, ms = 1/2
- ☐ n = 3, l = 0, ml = 0, ms = 1/2
- ☐ n = 2, l = 3, ml = 0, ms = 1/2
- ☐ n = 5, l = 3, ml = 0, ms = 1/2

Question 22 — 1 pts

The electron configuration for the Mn atom is...

- ◯ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 4p^5$
- ◯ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
- ◯ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$
- ◯ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$

Question 23 — 1 pts

How many total s electrons does P (atomic number 15) possess?

- ◯ 2
- ◯ 5
- ◯ 6
- ◯ 4

Question 24 — 1 pts

What is the electronic configuration of a selenium atom (Se)?

- ◯ $[Ar]4s^2 3d^{10} 4p^4$
- ◯ $[Kr]4s^2 4d^{10} 4p^4$
- ◯ $[Kr]4s^2 3d^{10} 4p^4$
- ◯ $[Ar]4s^2 4d^{10} 4p^4$
- ◯ $[Kr]4s^2 4p^{14} 4d^{10} 4p^4$

Question 25 — 1 pts

What is the electron configuration of the chloride anion, Cl^-?

- ◯ $1s^2 2s^2 2p^6 3s^2 3p^4$
- ◯ $1s^2 2s^2 2p^6 3s^2 3p^6$
- ◯ $1s^2 2s^2 2p^6 3s^2 3p^5$
- ◯ $1s^2 2s^2 2p^6$

Question 26 — 1 pts

A **neutral** atom has a ground state electronic configuration designated $1s^2 2s^2 2p^2$. Select the statement that best describes this atom.

- ◯ All are true.
- ◯ The atom has 2 unpaired electrons.
- ◯ The atom is carbon.
- ◯ The element has atomic number 6.
- ◯ The atom has electrons in four different, separate orbitals.
- ◯ The atom contains 6 protons.

Question 27 — 1 pts

The electron configuration for the most common sodium ion is isoelectronic with...

- ◯ krypton
- ◯ helium
- ◯ neon
- ◯ magnesium
- ◯ argon