

- 1) What is the frequency (in Hz) of a photon with wavelength of 327 nm? _____ Hz
- 2) What is the wavelength (in m) of a photon with frequency of 7.92×10^{13} kHz? _____ m
- 3) What is the energy of one mole of photons from question 1? _____ kJ/mol
- 4) Find the de Broglie wavelength (in m) for an electron moving with velocity 4.7×10^2 m/s. _____ m
- 5) Organize the following in order of increasing ionization energy: Li, Be, B, C, N
 _____ < _____ < _____ < _____ < _____
- 6) Organize the following in order of increasing electron affinity: Si, P, S, Cl, Ar
 _____ < _____ < _____ < _____ < _____
- 7) Find the molecular formula of a compound with mass percent composition: 62.71% carbon, 7.25% hydrogen, 9.15% nitrogen, and 20.89% oxygen.
- 8) 8. Answer the following questions:
 - a. Balance the following equation (if the coefficient is 1, leave it blank):
 _____ Cl_2O_7 + _____ H_2O $\diamond$ _____ HClO_4
 - b. Give the full chemical names of the compounds from question 8a:
 Cl_2O_7 _____
 H_2O _____
 HClO_4 _____
 - c. 15 mL of Cl_2O_7 (density = 1.9 g/mL) reacts with 10. mL of H_2O (density = 1.0 g/mL). How many molecules of HClO_4 can theoretically be formed? _____ molecules of HClO_4
 - d. Calculate the volume (in mL) of excess reagent that is remaining from the reaction in question 8c: _____ mL
 - e. Calculate the formal charge (example +1) of chlorine in the most stable form of the perchlorate anion (Hint: draw its Lewis structure first): _____
 - f. Is Cl_2O_7 a polar or nonpolar molecule? Hint: Treat each of the two ClO_3 groups as one large atom. _____

9) A foolish man attempted to rob a bank but only brought his red laser pointer, with a wavelength of 650. nm. The lock on the vault would require 3.33 MJ of energy in order to melt completely through and grant access to the spoils. Assuming the metal of the vault absorbed each photon and converted energy to heat, how many photons would be required to melt through the lock?

- 1.09×10^{19} photons
- 1.09×10^{34} photons
- 1.09×10^{25} photons
- 3.33×10^6 photons
- 6.02×10^{23} photons

10. A hydrogen atom has been found in the $n = 4$ state. What is the **shortest** wavelength photon that could be emitted when the hydrogen atom relaxes from $n=4$ to a lower energy state?

- 97.2 μm
- 0.103 μm
- 122 μm
- 0.0214 μm
- 0.0972 μm
- 0.486 μm
- 1.87 μm
- 103 μm
- 0.187 μm

11. A neon atom is found with a de Broglie wavelength of 34.0 pm. At what velocity is this neon atom traveling?

- 9.65×10^{-25} m/s
- 1.73 m/s
- 0.581 m/s
- 1.95×10^{-21} m/s
- 581 m/s
- 273 m/s
- 1730 m/s

12. A compound is determined to be 51.8% chlorine, 1.47% hydrogen, and 46.7% oxygen by weight. The molecular weight of this compound is estimated to be below 110 g/mol. What is the name of this compound?

- Chloroacetic acid
- Chloric acid
- Perchloric acid
- Hypochlorous acid
- Chlorox
- Chlorous acid
- Chlorine dioxide

13. 454 grams of isomaltitol, $C_{12}H_{24}O_{11}$, was combusted in a furnace completely in an excess oxygen. The products of this reaction are water and carbon dioxide. What is the theoretical yield (in kilograms) of water produced from this reaction?

- 297 kg
- 285 kg
- 0.0237 kg
- 143 kg
- 5450 kg
- 0.285 kg
- 5.45 kg
- 0.297 kg

14. Of the atoms/ions listed, select those with the electron configuration $[\text{Ne}]3s^23p^6$ and no unpaired electrons.

