

Chemistry 11 Spring 2008 Exam 3 May 6, 2008

Show all of your work and reasoning to receive credit. Include units as well. You may not share calculators.

1. What is the frequency of light having a wavelength of 322 nm? What is the wavelength (in nanometers) of radiation having a frequency of 8.22×10^{16} Hz?

2. Calculate the energy of a photon with a wavelength of 622 nm. Calculate the energy of 1 mole of photons with this wavelength.

3. Calculate the wavelength (in nanometers) of a photon emitted by a hydrogen atom when its electron drops from the $n = 5$ to the $n = 3$ state.

4. Give the values of the quantum numbers associated with the following orbitals:
3p 4d

5. What is the total number of electrons that can be held in all orbitals having the principal quantum number 4?

6. Write the ground-state electron configuration for the following elements:
Ni I

7. Thermal neutrons are neutrons that move at speeds comparable to those of air molecules at room temperature. Calculate the wavelength (in nanometers) associated with a beam of neutrons moving at 7.00×10^2 m/s. The mass of a neutron is 1.675×10^{-27} kg.

8. Explain why the radius of a lithium atom is considerably larger than the radius of a hydrogen atom.

9. Arrange the following in order of increasing first ionization energy: Na, Cl, Al, S, and Rb.

10. Explain why potassium has a greater affinity for electrons than calcium.

$$N_A = 6.022 \times 10^{23}/\text{mol} \quad R = 0.08206 \frac{\text{L atm}}{\text{mol K}} = 8.31 \frac{\text{J}}{\text{mol K}}$$

$$C = 3.00 \times 10^8 \text{ m/s} \quad h = 6.626 \times 10^{-34} \text{ Js}$$

STP = 1 atm and 273 K

$$\Delta E = q + w \quad \Delta H = q \quad q = -ms\Delta T$$

$$PV = nRT \quad P_T = P_a + P_b + P_c + \dots P_n$$

Metric Prefixes

$$\text{atto (a)} = 10^{-18}$$

$$\text{femto (f)} = 10^{-15}$$

$$\text{pico (p)} = 10^{-12}$$

$$\text{nano (n)} = 10^{-9}$$

$$\text{micro } (\mu) = 10^{-6}$$

$$\text{milli (m)} = 10^{-3}$$

$$\text{centi (c)} = 10^{-2}$$

$$\text{kilo (k)} = 10^3$$

$$\text{mega (M)} = 10^6$$

$$\text{giga (G)} = 10^9$$

$$\text{tera (T)} = 10^{12}$$

$$\text{peta (P)} = 10^{15}$$

$$T_K = T_C + 273$$

$$E = hv$$

$$c = v\lambda$$

$$E = 2.178 \times 10^{-18} \text{ J} [1/n_1^2 - 1/n_2^2]$$

$$mv = h/\lambda$$

$$n = 1, 2, 3, \dots \quad \ell = 0, 1, 2, 3, \dots n-1$$

$$m_\ell = 0, \pm 1, \dots \pm \ell$$

$$m_s = \pm 1/2$$