

**Quiz: Ch 6 & 7**  
**AP Chem**  
**Version G (30 pts)**

$$\Delta E = h\nu$$

$$c = \lambda\nu$$

$$E_n = \frac{-2.178 \times 10^{-18}}{n^2}$$

$$c = 3.0 \times 10^8 \text{ m s}^{-1}$$

$$h = 6.63 \times 10^{-34} \text{ J s}$$

**Use significant figures for atomic masses as recorded on the Periodic Table and for the constants as given to you. Show your work for all problems involving calculations and be sure to box your final answer and include sensible units**

- (3 pts) Briefly describe Max Planck's contribution to present-day quantum mechanical theory.
- One particular line in the atomic spectrum of hydrogen is part of the Brackett series.
  - (3 pts) Calculate the change in energy, in J, associated with this electronic transition that begins from an excited state equivalent to that of the valence electron of francium.
  - (3 pts) Calculate the wavelength, in nm, of the radiation associated with the spectral line.
- For the element thorium (Th),
  - (3 pts) Give one of the permissible quantum number sets for the highest energy electron.
  - (3 pts) Give the complete electronic configuration.
- (3 pts) Sketch the shape and orientation of the  $d_{x^2-y^2}$  electron density plot. Be sure to label your axes.

5. Consider atoms of nitrogen, oxygen, and phosphorus. Circle the element that correctly fits the description, then provide a brief explanation (in 1 to 2 sentences) for your choice in terms of atomic structure.

a. (4 pts) (Phosphorus / Sulfur / Selenium) has the smallest (least negative) electron affinity because...

b. (4 pts) (Phosphorus / Sulfur / Selenium) has the smallest atomic radius because...

6. (4 pts) The successive ionization energies for an unknown element are:

$$I_1 = 896 \text{ kJ/mol}$$

$$I_2 = 1,752 \text{ kJ/mol}$$

$$I_3 = 4,807 \text{ kJ/mol}$$

$$I_4 = 17,948 \text{ kJ/mol}$$

a. (2 pts) Briefly explain why successive ionization energies are increasing.

b. (3 pts) To which family in the periodic table does the unknown element most likely belong? Explain briefly.