

Sample exam 3 (chapters 5 and 6)

Closed book; open homework, handouts, lab book, notes and calculators; no collaboration, including using other people's materials.

1. Given the deBroglie wavelength formula $\lambda = h/mv$, why do everyday objects appear solid, instead of blurry, like waves? Please use the formula to justify your answer.

2. In a titration experiment, the class obtained a mean of 0.1045 ± 0.0005 M for the hydrochloric acid solution they were trying to standardize. The actual concentration of the acid (from the instructor's notes) was 0.1004 M.

a. Calculate the percent error between the class and the instructor's value of the concentration.

b. Was there a random or systematic error in this experiment? Justify your answer.

c. One student suggested that the base solution used in the titration was mislabeled. Could this be the source of the error (remember your answer to part b, and be consistent with it)? If so, describe in what way the base was mislabeled and run through the calculations (qualitatively) to show how the error explains the results. If not, describe why this source of error does not explain the two-sigma range of the class's results.

3. An electron makes a transition in a hydrogen atom such that it starts at the $n = 5$ level and ends up at the $n = 6$ level.

a. Will a photon be **absorbed** or **emitted** by this hydrogen atom?

b. Calculate the **energy** of this transition in joules (make sure your sign is consistent with your answer to a)

c. Given the diagram below, what **part of the EM spectrum** is this located in? (By the way, the whole series of spectral lines that start with $n = 5$ is called the Pfund series).

(For the actual quiz, an EM spectrum diagram will be provided here, though you may have to play around with the units!)

4. Calculate the lattice energy of calcium carbide (CaC_2 (s)) given the following information:

Energy of formation of CaC_2 (s) from its elements = -60 kJ/mol

Heat of sublimation for Ca = $+178$ kJ/mol

Heat of sublimation for C = $+717$ kJ/mol

E_{i1} for Ca (g) = $+590$ kJ/mol

E_{i2} for Ca (g) = $+1145$ kJ/mol

E_{ea1} for C_2 (g) = -315 kJ/mol

E_{ea2} for C_2 (g) = $+410$ kJ/mol

Bond dissociation energy for C_2 (g) = $+614$ kJ/mol

5. a. What 1+ ion would be isoelectronic with xenon?

b. What 1+ ion would have the same electron configuration as $[\text{Kr}] 4d^{10}$?

c. Write the **condensed** electron configuration of Cu

6. Demonstrate how CaC_2 allows each atom to fulfill the **octet rule**.