CHE 112 - Homework - Ch 10e

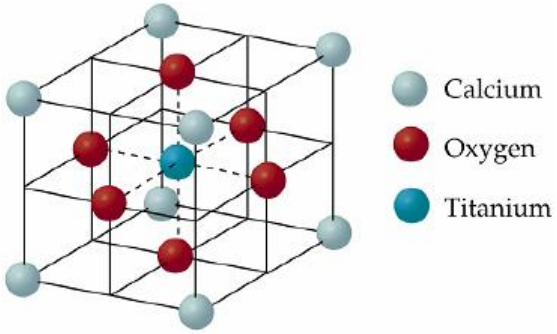
OER 10.5-10.6 **X-ray Crystallography and Structure of Solids** Score: _____/40

Name: _____ Date: _____

[6 pt] 1. Define the terms 'Constructive' and 'Destructive' Interference and sketch a picture illustrating both. How is this phenomenon used in X-ray diffraction to determine the distance between atoms in a solid?

[3 pt] 2. When an x-ray beam with wavelength of 0.752 nm is diffracted on an Cu crystal it produces a maximum diffraction angle of $\theta = 27.8^o$. Assuming that the layer spacing is 1, calculate the distance (in pm) between layers of Cu in the crystal. Explain.

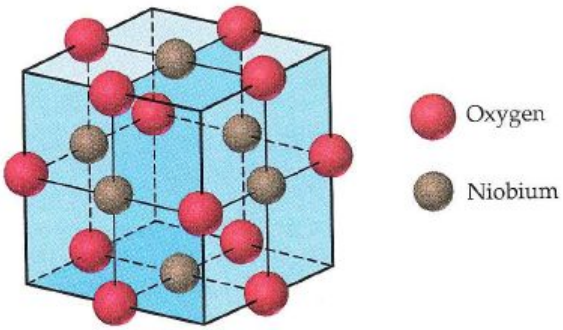
[3 pt] 3. Perovskite, a mineral containing calcium, oxygen, and titanium, crystallizes in the following cubic unit cell. Explain your answers in the space provided.



(a) What is the formula for Perovskite?

(b) What is the oxidation number of titanium?

[3 pt] 4. Niobium oxide crystallizes in the following cubic unit cell. (Hint, this is not a crystal structure covered in class, you will have to use what you learned in class and apply it to a new structure!)



(a) What is the formula for Niobium Oxide?

(b) What is the oxidation number of Niobium?

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[6 pt] 5. Pb crystallizes in a face-centered cubic unit cell with an edge length of 495 pm. What is the density of lead (in g/cm^3)?

(a) What is the radius of a lead atom (in pm)? Explain. 5(a) _____

(b) What is the density of lead (in g/cm^3)? Explain. 5(b) _____

[3 pt] 6. Tungsten crystallizes in a body-centered cubic unit cell with an edge length of 317 pm. What is the length in pm) of a unit-cell diagonal that passes through the center atom? Pictures might help.

[6 pt] 7. Calcium metal has a density of 1.55 g/cm^3 and crystallizes in a cubic unit cell with an edge length of 558.2 pm.

(a) How many Ca atoms are in one unit cell? 7(a) _____

(b) In which of the three cubic unit cells does calcium crystallize? Explain. 7(b) _____

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[10 pt] 8. Complete the following table for each of the 5 classes of solids discussed in class. Provide an example molecule, the type of particle that resides in the unit cell, and the attractive force between the particles.

Class of Solid	**Specific Example**	**Structural Unit or Particle Type**	**Attractive Force**