

Recitation Worksheet 2: Solids (10.3-10.4 and 10.6-10.7)

Name:

MyID:

Instructions:

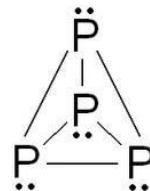
- Please enter your first and last name as it appears on the eLC classlist (do not use a nickname).
 - Your UGA myID is a combination of letters and numbers (example: Dr. Abdelrahman MyID is ema88805).
Do not use your 81x number.
 - If you do not have access to a printer, type your answers in the worksheet PDF and then upload it to **Gradescope** by Friday, February 3rd at 11:59 pm. Write your work on separate sheets of paper, convert to a PDF and upload to the "Recitation Worksheet 2 Dropbox" on eLC.
 - If you are using an app to annotate the worksheet, make sure the pages are in the correct order and have the same layout as the original or Gradescope will not be able to read it.
 - If you have access to a printer, print out the worksheet, write your answer in the answer boxes, and show your work on it when appropriate. Then convert it to a PDF and upload to **Gradescope** by Friday, February 3rd at 11:59 pm. You do not need to upload anything to eLC. The pages must be in the correct order and have the same layout as the original, or Gradescope will not be able to read it.
 - There is a **Gradescope App** available for both iOS and Android devices that allows you to scan and submit your printed work or you can submit your fillable PDF directly. Detailed instructions on how to access and use the app can be found on your CHEM 1212 class eLC page under content → Welcome module → Gradescope → Gradescope new mobile app.
 - Answers must be written in the corresponding answer box, or no credit will be awarded.
 - The instructions for uploading worksheets to Gradescope can be found in the Content area of eLC in the Welcome Module.
1. Classify the following solids as either:
- Molecular solid
 - Metallic solid
 - Ionic solid
 - Network covalent solid

For your answer insert one of the choices A – D in the answer box. Example, if the answer is metallic, then the answer is choice B.

A. $\text{Ca}_3(\text{PO}_4)_2$

B. Fe

C. P_4 (hint: melting point 44.1°C)



D. SiO_2

E. Naphthalene ($C_{10}H_8$)

F. C (s, graphite)

G. Caffeine ($C_8H_{10}N_4O_2$)

2. Covalent bonding occurs in both molecular and covalent network solids. Which of these statements best explains why these two kinds of solids differ so greatly in their hardness and melting points?

- A. The molecules in molecular solids have stronger covalent bonding than covalent-network solids do.
- B. The molecules in molecular solids are held together by weak intermolecular interactions.
- C. The atoms in covalent-network solids are more polarizable than those on molecular solids.
- D. Molecular solids are denser than covalent network solids.

3. Polonium crystallizes in a simple cubic cell unit. If the edge length of the unit cell is 336 pm, calculate the density of polonium in g/cm^3 . ($1\text{ cm} = 1 \times 10^{10}\text{ pm}$, molar mass of Po = 209 g/mol). Keep your answers to 3 sig figs.

g/cm^3

4. In the following solid pairs, which substance has the **higher** melting point?

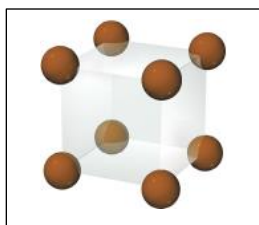
A. Pd or HOOH

B. SiCl_4 or SiBr_4

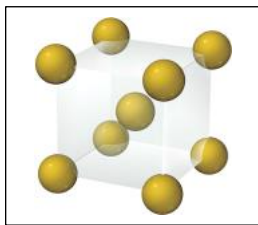
C. KF or HF

D. C (s, diamond) or K

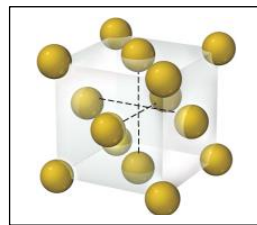
5. Nickel is a hard silver-white metal which occurs as face-centered cubic crystal, while polonium is a radioactive metal that occurs as a simple cubic crystal, and tungsten is a rare earth metal that occurs as a body-centered cubic crystal. Examine the images A – C below and answer the following questions:



A



B



C

I. Tungsten metal crystal unit cell is (choose one of images A – C)

II. Nickel has atoms in its unit cell (insert numerical value, example: 1, 2, 3, etc.)

III. The coordination number of unit cell in a polonium crystal is (insert numerical value, example: 1, 2, 3, etc.)

IV. Image C matches the description for (Choose either Ni, W, or Po. Write the chemical symbol in the answer box and NOT the full name of the element).

6. Arrange the solid compounds below in order of **increasing** melting points.

Ar(s), CCl₄(s), LiCl(s), C₄H₉OH(s)

- A. LiCl(s) < C₄H₉OH(s) < CCl₄(s) < Ar(s)
- B. Ar(s) < CCl₄(s) < C₄H₉OH(s) < LiCl(s)
- C. CCl₄(s) < LiCl(s) < Ar(s) < C₄H₉OH(s)
- D. C₄H₉OH(s) < LiCl(s) < CCl₄(s) < Ar(s)
- E. Ar(s) < C₄H₉OH(s) < CCl₄(s) < LiCl(s)

7. Nickel has a face-centered cubic structure and has a density of 8.90 g/cm³. What is the volume of the unit cell in cm³? Report your answer to 3 sig figs and use scientific notation. (Molar mass of nickel = 58.69 g/mol).

× 10 cm³

8. You are given a set of ions: Na⁺, K⁺, Ca²⁺, Mg²⁺, F⁻, Br⁻, O²⁻, and S²⁻. Which cation and which anion do you expect to combine to form the highest melting ionic compound? Insert your answer as a formula, example **NaCl**.

9. A diamond unit cell has a volume of 0.0454 nm^3 . If the density of diamond is 3.52 g/cm^3 , how many carbon atoms are in a unit cell of diamond? ($1 \text{ cm} = 1 \times 10^7 \text{ nm}$, molar mass of carbon = 12.01 g/mol).

- A. 11 atoms
- B. 20 atoms
- C. 10 atoms
- D. 14 atoms
- E. 8 atoms

10. Among the options shown, which chemical formula is paired with an **incorrect** crystal type? Select all that apply. Insert letters without spaces or commas, example: **ABCD**.

- A. I_2 , Molecular
- B. C_2H_6 , Covalent Network
- C. C (graphite), Molecular
- D. NaF, Ionic
- E. Cu, Metallic

11. Which of these statements is **false**?

- A. Molecular solids generally have lower melting points than covalent solids.
- B. Metallic solids exhibit a wide range of melting points because metallic bonds cover a wide range of bond strength.
- C. The metallic solid can be viewed as positive ions closely packed in a sea of valence electrons.
- D. Most molecular solids melt at lower temperatures than metallic solids.
- E. The interactions among the molecules in molecular solids are generally stronger than those among the particles that define either covalent or ionic crystal lattices.

12. Which statement is true regarding the different types of cubic unit cells? Select all that apply. Insert letters without spaces or commas, example: **ABCD**.

- A. Simple cubic unit cell has two atoms per unit cell whereas body centered cubic unit cell has four atoms per unit cell
- B. A fraction of a corner sharing atom is $1/8$ in face centered cubic unit cell
- C. The coordination number for body centered cubic is 12
- D. A fraction of face sharing atom is $1/2$ in face centered cubic unit cell
- E. None of these statements are true

13. Which of these ionic solids has the **highest** melting point?

- A. CaF_2
- B. KCl
- C. LiCl
- D. NaCl
- E. MgS