

Name _____

Date _____

Crystalline Solids Worksheet

Hand this in before you leave. You may work individually or in small groups of two or three.

To access the computer program click: Start

Select: Programs

Select: Chemistry

Select: Crystalline Solids

Select: Red and Blue Icon

The Menu Bar across the top reads:

File

View (includes a “Zoom-In” / “Zoom-Out” feature)

Rotation (includes automatic rotation and repositioning of the unit cell)

Lattices (all of the different unit cells available)

Closed-Packed (Specifically shows features of the Face-Centered Cubic and Hexagonal Closed Packed crystal structures)

Elements (shows unit cells of selected elements)

Compounds (shows unit cells of selected compounds)

To begin, **select Lattices**. Look through the different types.

Below, sketch (3-dimensionally) and label the following unit cells: Simple Cubic, BCC, FCC and any two other unit cells. Under the two new unit cells, state which of the three (Simple Cubic, BCC, FCC) each unit cell is most like, and then state the major difference(s). Use the rest of this page for your 5 sketches.

GRADING

2 points for each sketch. (10 pts)

2 pts for each description: +1 for similar cell, +1 for difference.

If you chose two unit cells and described the difference in exactly the same way, -1 point.

Need to differentiate between your two “different” cells.

Total point for this page: 14.

Select **Closed-Packed**. Select cubic (or face-centered).

Once the unit cell is on screen, check some of the boxes at the right to see what happens.

Keep in mind the questions below as you do the following:

- Look at a single unit cell and then multiple cells with rods.
- Select Planes (which means slip planes) and, using the arrows, watch to see how the slip planes are highlighted through the crystal.
- Select Sites, (which means interstitial sites) then octahedral. Select both half I and half II. When both are selected, all of that type of interstitial site is filled. When only one is selected the interstitial sites shown are half-filled and when neither is selected, the interstitial sites are empty.
- Select Axes to see how the sites are related to the atoms.
- Select Edges to see the geometries of the sites.
- Then do the same for the Tetrahedral sites.
- This part of the menu only works for the Closed Packed menu.

1. How many atoms are contained within each unit cell without any interstitial sites filled (keep in mind, the unit cell is a cube and the walls of the cube go through the centers of the atoms)?

Simple __1__ BCC __2__ FCC __4__

2. How many atoms are visible making up each unit cell without any interstitial sites filled?

Simple __8__ BCC __9__ FCC __14__

3. How many octahedral sites are there in the unit cell? FCC __13__

4. How many atoms are contained within each unit cell with **half and all octahedral** sites filled?

Half: FCC __5.5 or 6.5__ All: FCC __8__

5. How many tetrahedral sites are there in the unit cell? FCC __8__

6. How many atoms are contained within each unit cell with **half and all tetrahedral** sites filled?

Half: FCC __8__ All: FCC __12__

GRADING: 12 points for this page, total. 1 point, each answer.

Chemistry 1A

2 examples of FCC
Al, Cu, Au, or Pt

2 examples of FCC with Half Tetrahedral sites filled
C, Si

2 examples of BCC
Fe, Na, W

1 example of HCP (Hexagonal closed packed)
___Mg___

GRADING ABOVE: 1 point each correct answer –total 7 points.

GRADING Table below: Answers in black were graded: 0.5 pt each correct.

Answers in red were not graded, as not enough information was given to correctly assess those problems.

The 31 points possible at the end of the page are (48 graded answers below/2)+7 points for correct answers above.

Final scores:

5/5 pts for 51-57 correct

4.5 pts for 45-50.5 correct

4.0 pts for 41-44.5 correct

3.5 pts for 37-40.5 correct

3.0 pts for less than 37 correct.

Name	Unit Cell*	Site Type*	½ or Filled	Ion of Unit Cell	Ion of Site	Compound Formula
barium chloride	FCC	T	Filled	Ba ²⁺	Cl ⁻	BaCl ₂
cadmium iodide	HCP	O	Half	I ⁻	Cd ²⁺	CdI ₂
cadmium selenide	FCC	T	Half	Se ²⁻	Cd ²⁺	CdSe
calcium fluoride	FCC	T	Filled	Ca ²⁺	F ⁻	CaF ₂
cesium iodide	Simple	Cubic	Filled	Cs ⁺	I ⁻	CsI
cobalt selenide	HCP	O	Filled	Se ²⁺	Co ²⁺	CoSe
lithium oxide	FCC	T	Filled	O ²⁻	Li ⁺	Li ₂ O
nickel arsenide	HCP	O	Filled	As ²⁻	Ni ²⁺	NiAs
sodium chloride	FCC	O	Filled	Cl ⁻	Na ⁺	NaCl
potassium sulfide	FCC	T	Filled	S ²⁻	K ⁺	K ₂ S
vanadium bromide	HCP	O	Half	Br ⁻	V ²⁺	VBr ₂

*Unit Cell: Simple, FCC, BCC, HCP (if slanted) Site Type: Octahedral (O) or Tetrahedral (T)