

**PHYSICS 425: Spring 2013: HomeWork #1**

**Due: Monday 28th January 2013**

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- **Q-1** 10 points

Figure out the two-dimensional Bravais lattice type of the following decorative patterns. Mark the Bravais Lattice in the diagram.



- **Q-2** 10 points

Explain in words:

- Primitive Unit Cell
- Conventional Cell
- Crystal Lattice and the Basis
- Primitive Translation Vectors

- **Q-3** 10 points

Copper has an atomic radius of  $0.128\text{nm}$  an FCC crystal structure. The atomic weight of Copper is  $63.5\text{g/mol}$ . Compute its theoretical density. (*In the literature, the measured density of Copper is found as  $8.98\text{g/cm}^3$* )

(Hint: First decide the type of the conventional unit cell and evaluate its volume. Then evaluate how many Cu atoms contain in the conventional cell )

- **Q-4** 10 points

In class, we showed that the honeycomb lattice comes in hexagonal Bravais

lattice with two-atomic unit cell. If the  $C - C$  bond length in graphene is found to be 1.41 Angstroms, What is the length of the primitive unit cell of this lattice. (Use the details of the geometry to analyze this problem)

- **Q-5** 10 points

Calculate the radius of a Vanadium atom given that  $V$  has a BCC structure, a density of  $5.96g/cm^3$ , and an atomic weight of  $50.9g/mol$ .

- **Q-6** 10 points

Rhodium has an atomic radius of  $0.1345nm$  and a density  $12.41g/cm^3$ . Determine if it comes in FCC or BCC structure.