

## 2019 CHEM2C: Assignment 3

Ram Seshadri (seshadri@mrl.ucsb.edu)

**Due date: April 25 2019 (in class). Keep everything brief.**

1. The melting points (M.P.) and boiling points (B.P.) of some elements (units of Kelvin) is provided in the table below:

Element:	Na	K	Rb	Mg	Ca	Ba
M.P. (K):	371	337	313	922	1112	1002
B.P. (K):	1156	1033	961	1380	1757	2078

It is widely believed that the boiling points are better indicators than melting points for trends of the strength of binding between atoms in the metal. Explain.

2. (i) Why do the trends in boiling points of hydrides of the N, O, and F groups (Figure 16.4 in text) show a sudden dip between the second and third periods, with the order of B.P.:  $\text{NH}_3 > \text{PH}_3$ ;  $\text{H}_2\text{O} > \text{H}_2\text{S}$ ;  $\text{HF} > \text{HCl}$ . (ii) Why is this not seen for the C group, where B.P.:  $\text{CH}_4 < \text{SiH}_4$ .
3. Describe briefly why London dispersion forces increase with increasing size of the noble gas atom.
4. For *each*, the Simple Cubic (SC), Body-Centered Cubic (BCC), and Face-Centered Cubic (FCC) structures please do the following:
  - (a) Sketch the structures in single unit cells.
  - (b) Indicate how many atoms there are in the unit cell.
  - (c) Determine how many closest neighbors each atom has.
  - (d) What is the relationship between the atomic radius  $r$  and the length of the cell edge  $a$ ? Show with an appropriate sketch.
  - (e) Calculate the packing efficiency. Do you see a relationship with the number of closest neighbors?