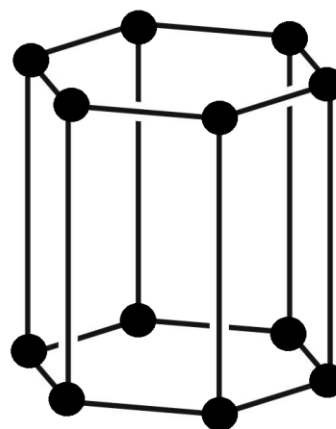
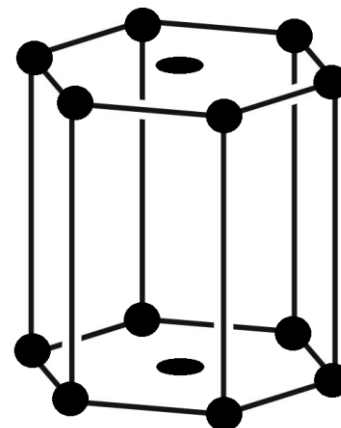


Directions: Per usual – 40 minutes without notes; with your partner and non-programmable calculator; 10 minutes with notes; 25 minutes on the board.

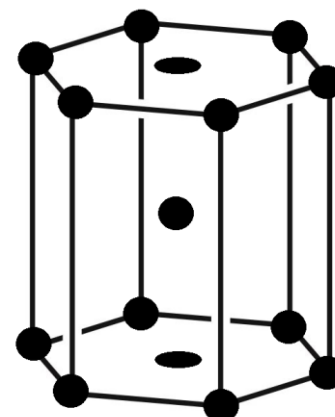
- 1) How many atoms are in the simple hexagonal unit cell?



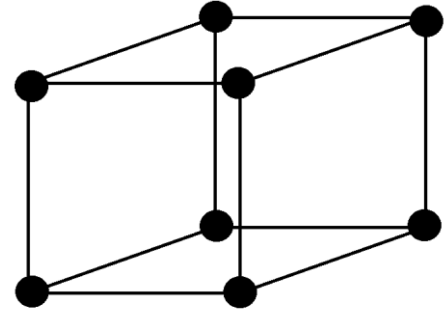
- 2) How many atoms are in the base centered hexagonal unit cell?



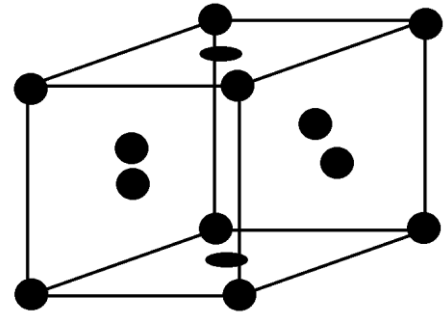
- 3) How many atoms are in the body centered, base centered hexagonal unit cell?



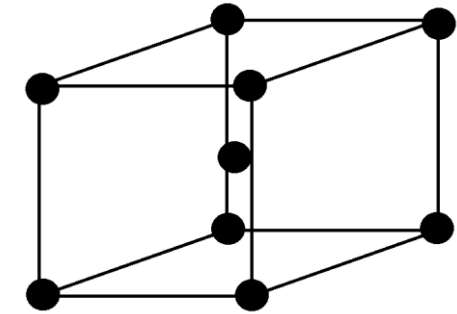
4) How many atoms are in the simple cubic unit cell?



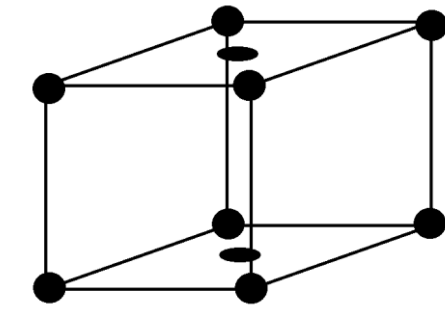
5) How many atoms are in the face centered unit cell?



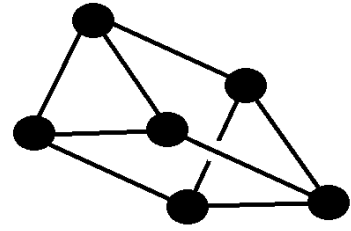
6) How many atoms are in the body centered unit cell?



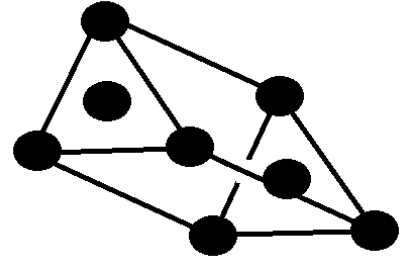
7) How many atoms are in the base centered cubic unit cell?



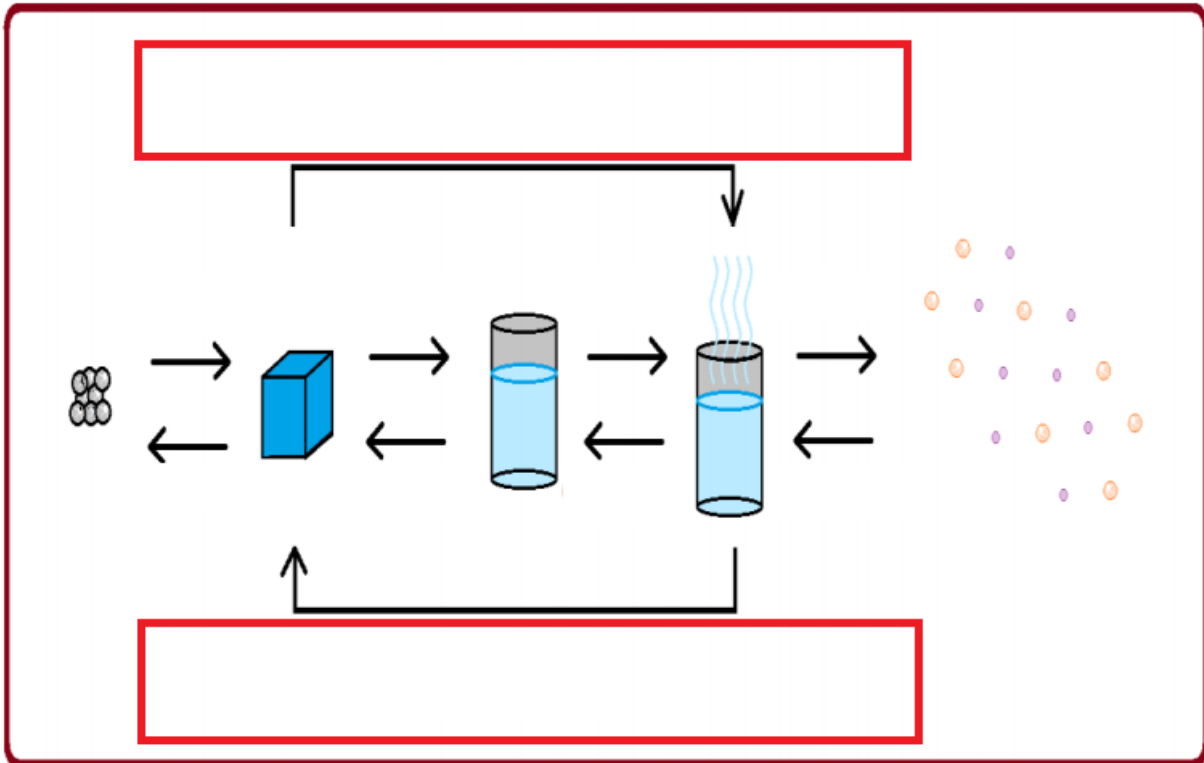
8) If the following triangular unit cell existed, use what you know to determine how many atoms are in the unit cell.



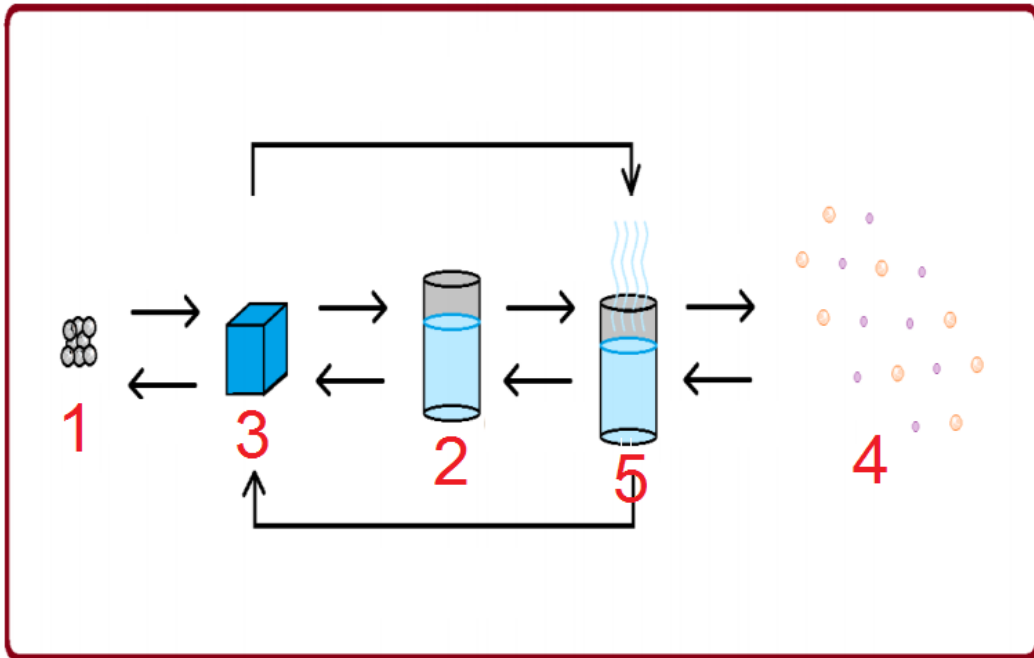
9) If the following base centered triangular unit cell existed, use what you know to determine how many atoms are in the unit cell.



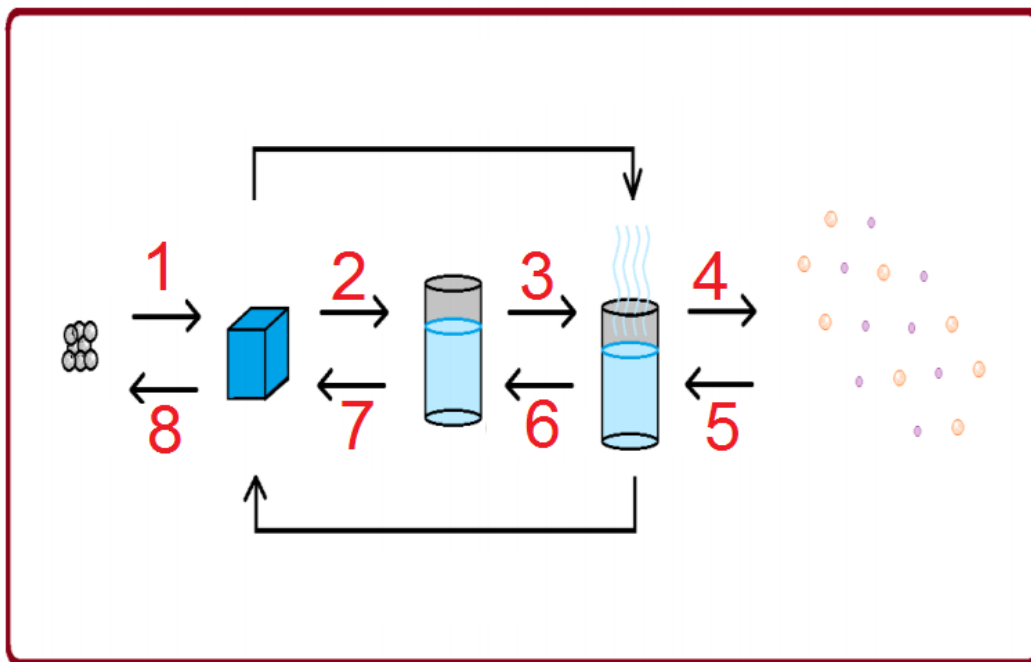
10) Fill in the red boxes in the diagram.



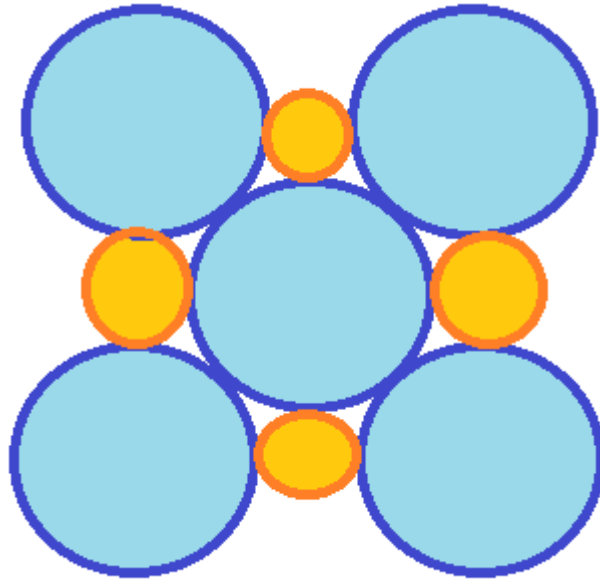
11) Label the 5 phases of matter in the image.



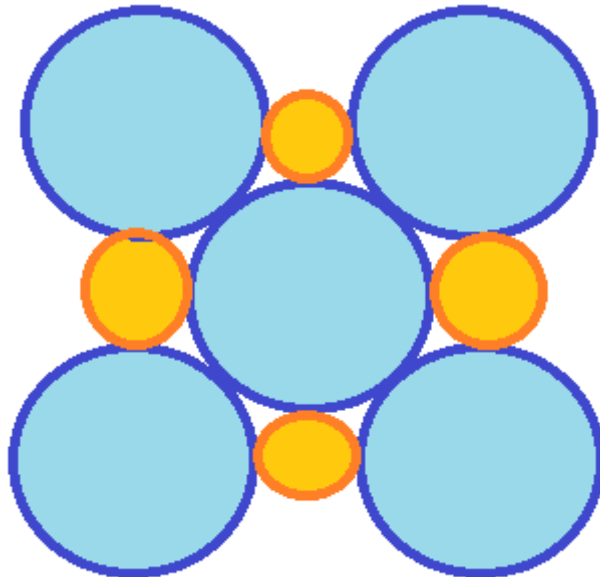
12) Label the 8 phase changes of matter in the image.



- 13) Using the diagram, draw on it how you would determine the edge length of a face centered cubic unit cell of NaCl (blue is the chloride ion; orange is the sodium ion; ions are atoms that have gained or lost electrons; negatively charged ions [anions] have an excess of electrons [due to electron gain] for the negative charge; positively charged ions [cations] have an excess of protons [due to electron loss] for the positive charge).



- 14) Using the diagram, draw on it how you would mark it up to determine the length of the ionic radius of either the cation or anion (legend is as in #13).



15) If the edge length of a NaCl face centered cubic unit cell is 0.5628 nm, calculate the ionic radius of the chloride ion (Cl^-) (use the diagrams you drew on in #'s 13 and 14).

16) Using your information from #15, calculate the ionic radius of the sodium ion (Na^+) in the face centered NaCl unit cell.

17) Give two examples of fermions.

18) Give two examples of bosons.

19) Define superconductivity.

20) Define superfluidity.