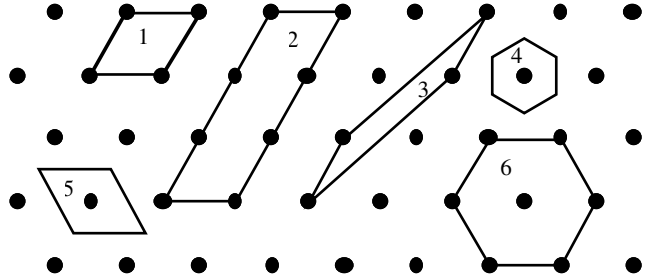


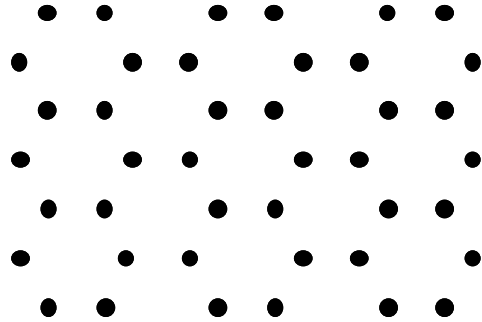
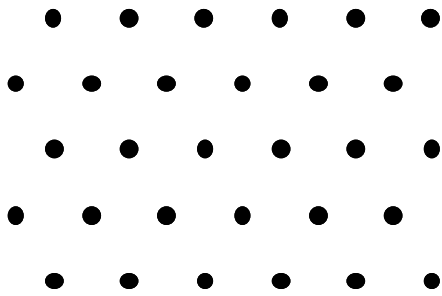
# PHY2009 Physics of Crystals:

## Problems Sheet for lectures 1 to 3

- 1) The diagram shows a portion of a 2D lattice. Which of the outlines represent (i) primitive unit cells, (ii) non-primitive unit cells; (iii) not unit cells at all.



- 2) Of the two regular arrays of points below, which does not form a lattice. How can you make it form one?



- 3) The diagram shows the conventional unit cell of a rectangular lattice (sides  $a$  and  $b$ ).
- Write down the fractional co-ordinates of all the lattice points.
  - Write down suitable primitive lattice vectors.
  - Calculate the area of a primitive unit cell.
  - Sketch the Wigner Seitz cell for this lattice.
  - What is the maximum packing fraction?



Hint for (v): first work out the maximum radius of circles which just touch one another when placed at nearest neighbour sites; then compare the area of such a circle with that of the primitive unit cell.

- 4) Repeat question (3) for a centred rectangular lattice (N.B. the primitive lattice vectors are not the same and there still must be only one lattice point per primitive unit cell).

