ESO 205T

# Nature and Properties of Materials

Interaction session: 11-12 Monday
Tutorial: 11-12 Thursday

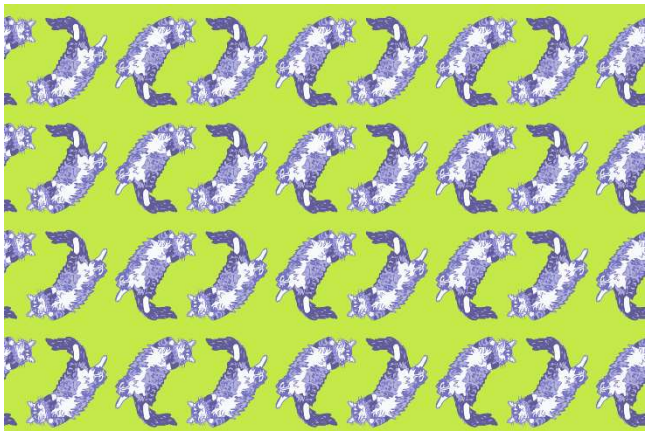
## Assignment 2

**Due by 17 September 2020 11 am**

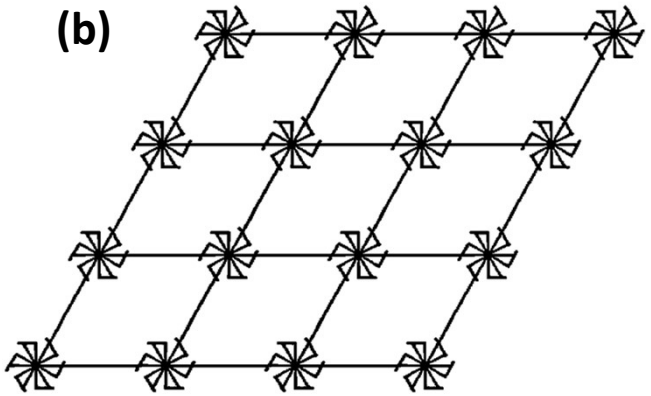
# Question 1

Identify the plane group for the following and show all the symmetry elements in the unit cell of the plane group [5 *4 = 20]

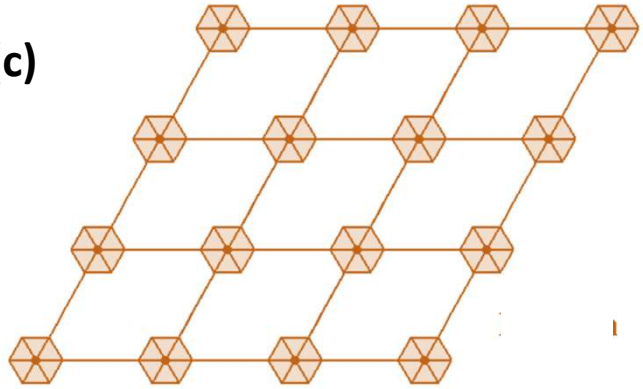
(a)



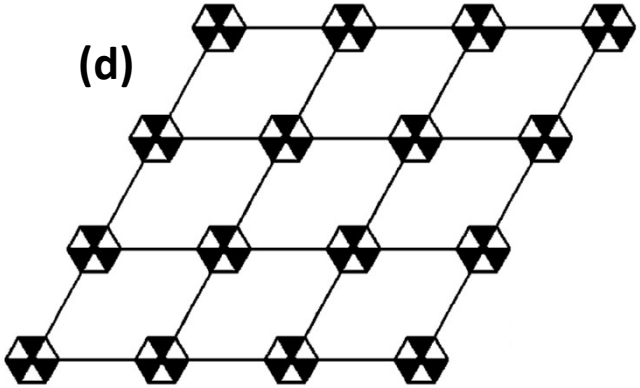
(b)



(c)

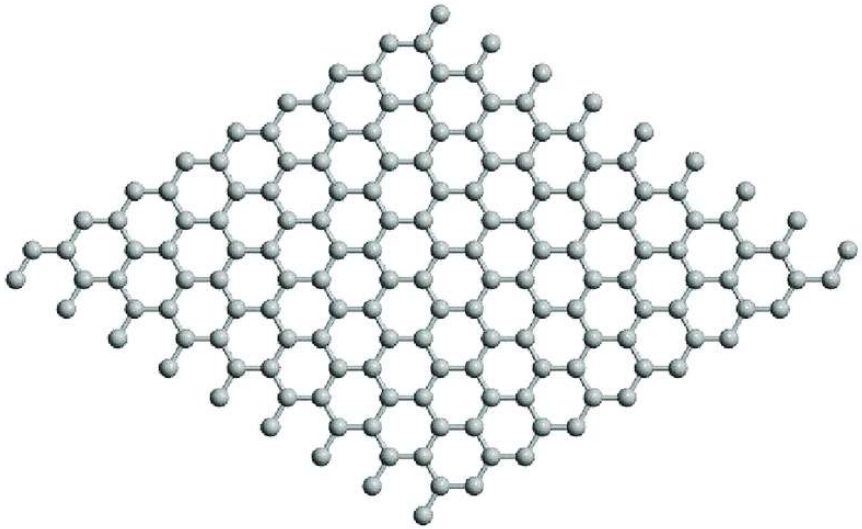


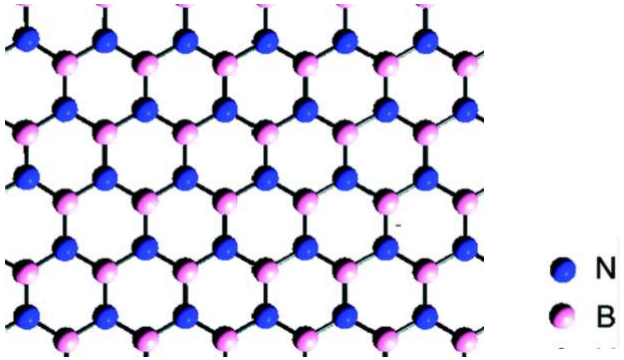
(d)



# Question 2

2D materials are generating a lot of interest in for a wide variety of applications so much so that there is research going on in almost every department at IIT Kanpur and elsewhere. A single layer of graphene (left) and 2D boron nitride (right) is provided below. Mark the lattice, motif, unit cell and mention the point and plane group symmetry. [10]





# Question 3

Construct a centered rectangular lattice. This lattice has a conventional cell that has two lattice points per cell that is it is doubly primitive. Construct another doubly primitive cell and two distinct primitive cells in the lattice. Comment on the reasons for opting a doubly primitive cell over a primitive cell. [10]

# Question 4

Face centered cubic lattice has 4 lattice points per unit cell. Construct a primitive unit cell for the FCC lattice. Is the reason for opting the non primitive cell over primitive cell same for 2D and 3D ? [10]