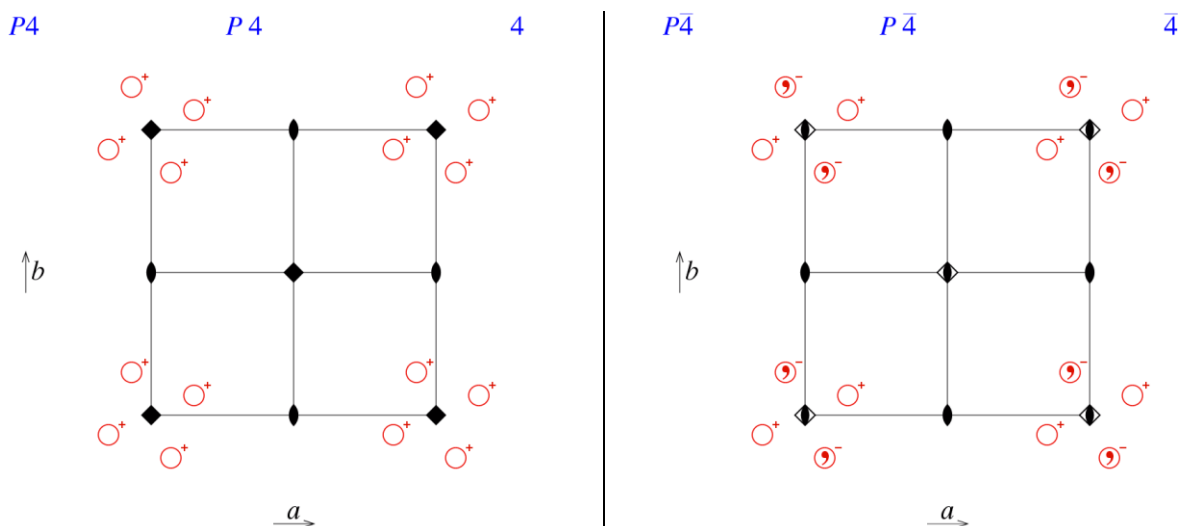


Question 1

The figure on the left below shows the tetragonal Space Group no. 75, $P4$. The figure on the right is space group no. 81, $P\bar{4}$. For both space groups, answer the following questions.

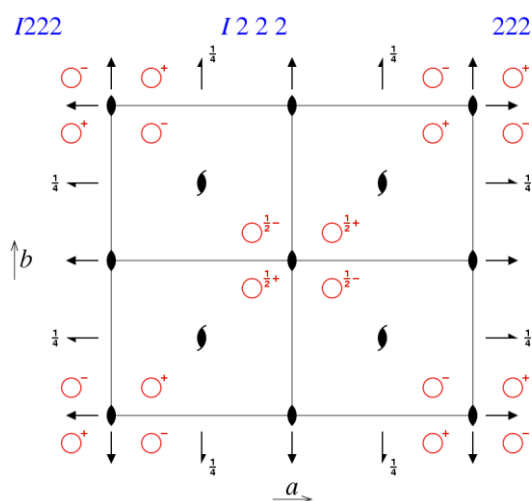


- What is the Bravais lattice for this space group?
- What is the point group for this space group?
- What is the (only) symmetry operation in the unit cell?
- What is the Wyckoff multiplicity of a molecule with generic coordinates (x,y,z) in the unit cell?
- Where are the special positions in the unit cell and what is their multiplicity?
- Is this space group enantiomorphic?

Question 2

The figure on the right shows the orthorhombic Space Group no. 23, $I222$

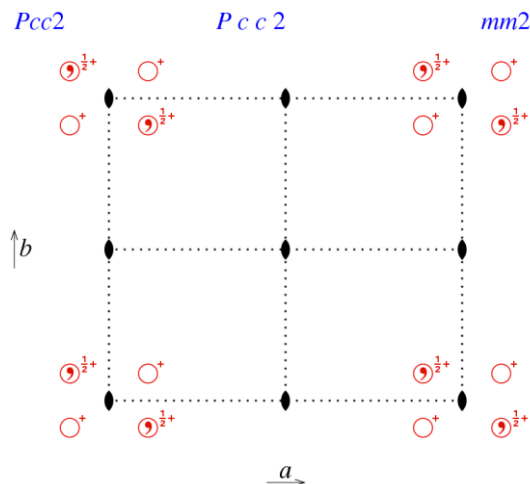
- What is the point group for this space group?
- What does the 'I' in the space group name signify?
- Can you spot the screw axes? In what directions are they and what are their Herman-Mauguin symbols?
- What is the Wyckoff multiplicity of a molecule with generic coordinates (x,y,z) in the unit cell?
- What is the multiplicity of a molecule at position $(\frac{1}{2}, y, \frac{1}{2})$?
- Is this space group enantiomorphic?



Question 3

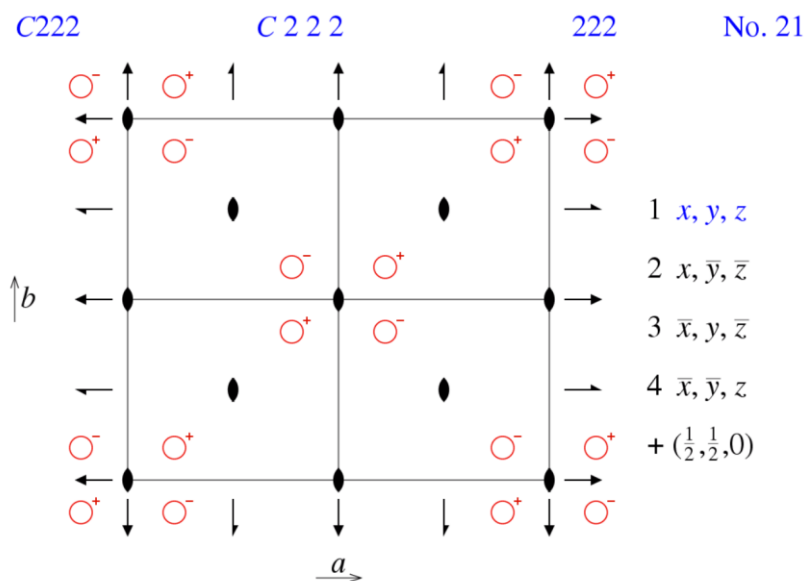
The figure below shows the orthorhombic Space Group no. 27, Pcc2



- What is the point group for this space group?
- What do the c's mean in the space group name?
- What is the Wyckoff multiplicity of a molecule with generic coordinates (x, y, z) in the unit cell?
- What is the Wyckoff multiplicity of a molecule with coordinates $(\frac{1}{2}, \frac{1}{2}, z)$ in the unit cell?
- Is this space group enantiomorphic?



Question 4

The diagram below shows the orthorhombic space group, C222



- What does orthorhombic mean in terms of the length of the three sides, a , b , c , and the angles between them, α , β , and γ ?
- Is this space group Primitive, Face Centred, Body Centred, or Base Centred?
- What does **222** mean in the space group title?
- Is there a centre of symmetry in the cell? Justify your answer.
- What is the multiplicity of the general position, (x, y, z) , for the space group?
- What kind of symmetry is denoted by the  symbol in the diagram above?
- What kind of symmetry is denoted by the  symbol in the diagram above?