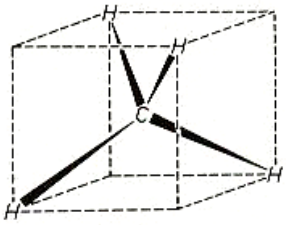
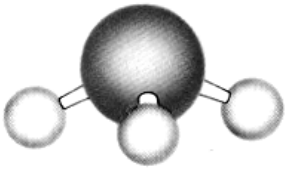
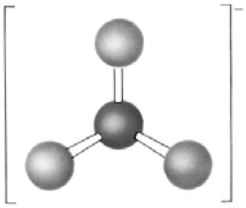
결정학개론
445.206 003
2006년 11월 6일 **2nd Quiz** Prof. Seong-Hyeon Hong

1. (15점) Determine the point group of the following molecules.

(a) CH_4 (b) NH_3 (c) CO_3^{2-}(planar)

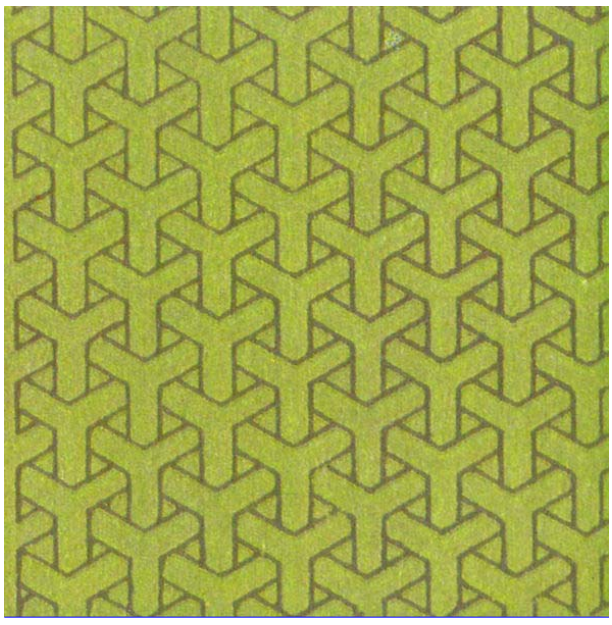






2. (35점) Figure is a painted porcelain in China.

a) (5점) Outline the unit mesh.
b) (5점) Indicate the positions of all the symmetry elements within the unit mesh.
c) (5점) Work out the plane lattice symbol
d) (10점) Enter on separate place a point in a general site x, y and allow the symmetry to operate on it (use the asymmetric symbol **q**). Give the coordinates of the points equivalent to x, y. What is the multiplicity of the general position?
e) (10점) Indicate a special position-if there are any-and give its multiplicity.



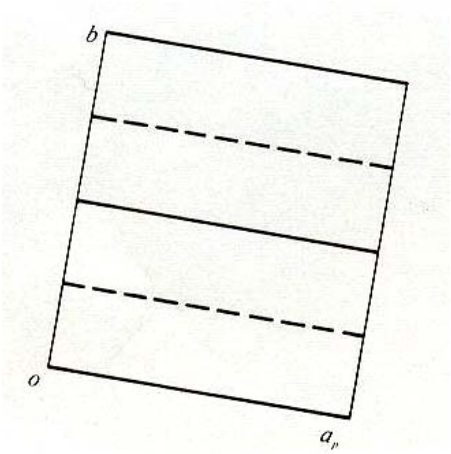
3. (20점) The symmetry diagrams for a space group is given below as projection on x, y, 0.

a) (5점) Work out the space group symbol.

b) (5점) What is crystal system this space group belongs to?

c) (5점) Draw the x, 0, z projection of symmetry elements.

d) (5점) Enter on the diagram (x,0,z projection) in a general site x, y, z, and allow the symmetry to operate on it (use the symbol in the International Tables for X-ray Crystallography).



4. (25점) The space group of graphite (C) is $P6_3/m\ 2/m\ 2/c$

a) (5점) Define each symbol.

P

$6_3/m$

$2/m$

$2/c$

b) (5점) What is crystal system?

c) (5점) Indicate the crystallographic directions for 6_3, $2(/m)$, and $2(/c)$.

d) (5점) What is the point group?

e) (5점) How many independent coefficients are required to describe the second rank tensor properties such as electrical conductivity in this material?

5. (5점) There are 5 plane lattices and 10 plane point groups along with glide plane. What criterion is applied to combine these two for the plane groups?

(5점) (보너스) State Neumann's principle in English.