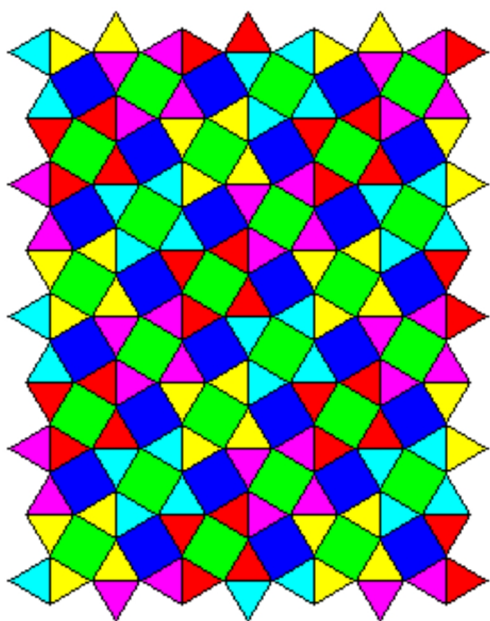


Crystallography (winter semester 2017)

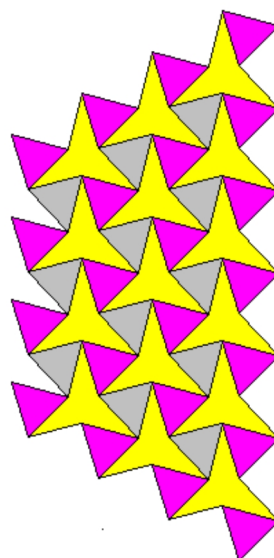
10. Homework Plane Space Groups

1. Define the space groups for the pictures below:

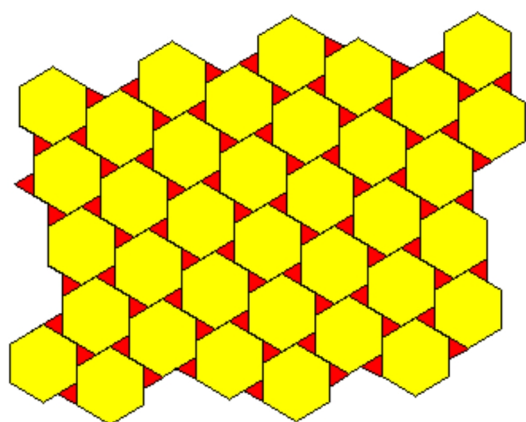
a.



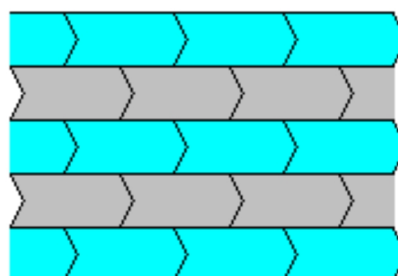
b.



c.



d.



2. Draw the diagrams to show the symmetry elements and general equivalent positions for the following plane groups:

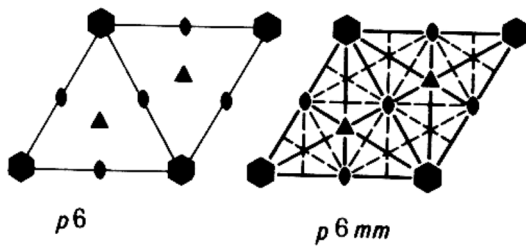
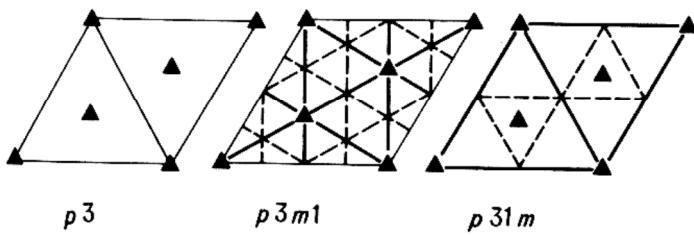
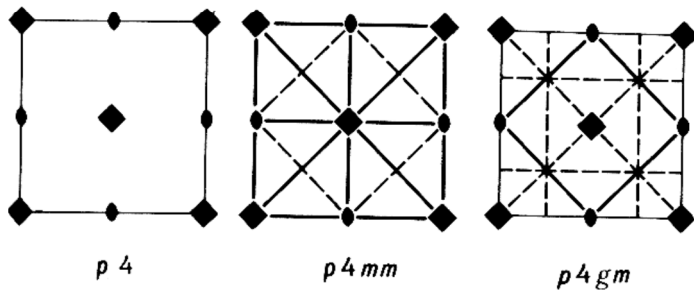
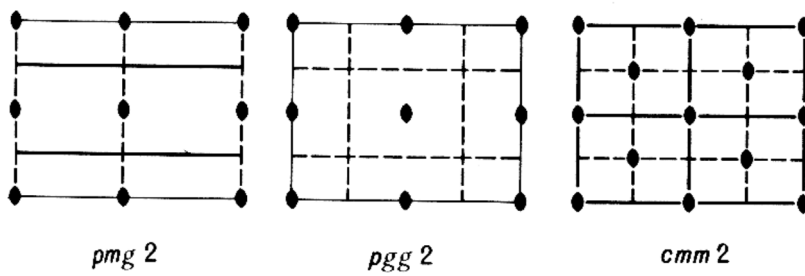
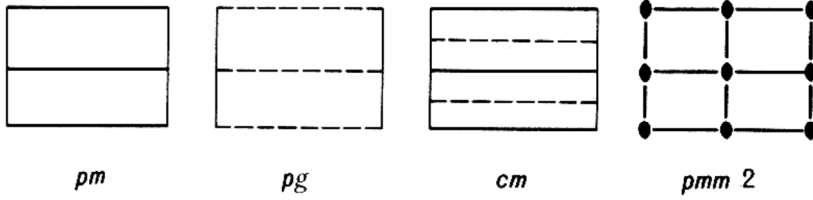
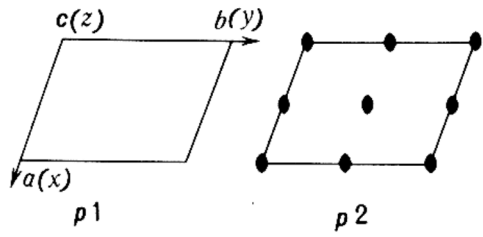
- a. $c2mm$
- b. $p2mg$
- c. $p4gm$

3. For each of the following space groups

- a. $p2g$
- b. $p4mm$
- c. $p3$
- d. $c2mm$
- e. $p2mm$
- f. pg

define the unit cell geometry, the highest order and the point group.

17 2D Space Groups



Useful sketch to define 2D space groups (M. Engel)

Size of smallest 1 rotation	2 Has reflection?			
	Yes		No	
360° / 6	<i>p6m</i>		<i>p6</i>	
360° / 4	3 Has mirrors at 45°?			<i>p4</i>
	Yes: <i>p4m</i>		No: <i>p4g</i>	
360° / 3	3 Has rot. centre off mirrors?			<i>p3</i>
	Yes: <i>p31m</i>		No: <i>p3m1</i>	
360° / 2	3 Has perpendicular reflections?			3 Has glide reflection?
	Yes		No	
	4 Has rot. centre off mirrors?			Yes: <i>pgg</i> No: <i>p2</i>
	Yes: <i>cmm</i> No: <i>pmm</i>		<i>pmg</i>	
none	3 Has glide axis off mirrors?			4 Has glide reflection?
	Yes: <i>cm</i>		No: <i>pm</i>	