The following are wallpaper patterns. On each one, indicate the following with colored ink:

- All \( n \)-centers for each possible \( n \).
- All lines of symmetry.
- If there are glide reflections but no reflections, give the axes for the glide reflections.
- A fundamental region, \( R \), for \( T \). If \( W \) is a \( W_3 \)-group that contains lines of symmetry, base it at a 3-center on a line of symmetry. Otherwise base it at an \( n \)-center for the largest possible \( n \).
- A fundamental region, \( S \) for \( W \).

1. (a) How many \( T \)-orbits are there of \( n \)-centers for each possible \( n \) and what is their isotropy?
(b) Which wallpaper group is \( \beta W \)?
2. (a) How many $T$-orbits are there of $n$-centers for each possible $n$ and what is their isotropy? 
(b) Which wallpaper group is $W$?

3. (a) How many $T$-orbits are there of $n$-centers for each possible $n$ and what is their isotropy? 
(b) Which wallpaper group is $W$?
4. The brick pattern at Druthers in Saratoga.

(a) How many $T$-orbits are there of $n$-centers for each possible $n$ and what is their isotropy?

(b) Which wallpaper group is $W$?
5. (a) How many \( T \)-orbits are there of \( n \)-centers for each possible \( n \) and what is their isotropy?
(b) Which wallpaper group is \( W \)?

6. (a) Describe the orbit space for Problem 5 in terms of identifications made on \( S \). Draw the picture and indicate the identifications with arrow heads and also describe the orbit space in words.

(b) (Extra credit) Again in Problem 5, how many \( W \)-orbits of \( n \)-centers are there for each \( n \)? Indicate them on your picture of the orbit space.