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

- Shortest translations, $\tau_v$ and $\tau_w$, in two different directions, that preserve the pattern and form the boundary of a fundamental region $T$ for $\mathcal{T}$.
- All $n$-centers for each possible $n$.
- All lines of symmetry.
- A fundamental region, $T$, for $\mathcal{T}$. If $\mathcal{W}$ 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 $\mathcal{W}$.

1.

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

b) Which wallpaper group is $\mathcal{W}$?

2.

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

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

b) Which wallpaper group is $W$?

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

b) Which wallpaper group is $W$?
5.

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

b) Which wallpaper group is $W$?