1. $H = \{\alpha_1, \alpha_2, \alpha_3, \alpha_4\}$, $\alpha_5 H = \{\alpha_5, \alpha_8, \alpha_6, \alpha_7\}$, $\alpha_9 H = \{\alpha_9, \alpha_{11}, \alpha_{12}, \alpha_{10}\}$.

3. $H, 1+H, 2+H$. To see that there are no others notice that for any integer n we can write $n = 3q + r$ where $0 \leq r < 3$. So, $n + H = r + 3q + H = r + H$, where $r = 0, 1$ or 2.

5. **a.** $11 + H = 17 + H$ because $17 - 11 = 6$ is in H;

   b. $-1 + H = 5 + H$ because $5 - (-1) = 6$ is in H;

   c. $7 + H \neq 23 + H$ because $23 - 7 = 16$ is not in H.

24. Let h be any element in H. By assumption there is a $k \in K$ so that $ah = bk$. From $aH \subseteq bK$ we have that $b^{-1}aH \subseteq K$. In particular, $b^{-1}a = b^{-1}ae \in K$. Since K is a group we have that $a^{-1}b = (b^{-1}a)^{-1} \in K$. Then $h = a^{-1}bk \in K$.

39. In D_3, let $H = \{R_0, F\}$, and $a = b = R_{120}$. Then $R_{120}H = \{R_{120}, F'\}, HR_{120} = \{R_{120}, F''\}$, and $R_{120}H \cap HR_{120} = \{R_{120}\}$. (See the Cayley Table for D_3 on the inside back cover.)