Q1 §14.2 Problem 15.
(The Klein 4-group is a group isomorphic to $\mathbb{Z}/2\mathbb{Z} \times \mathbb{Z}/2\mathbb{Z} \cong D_4$.)

Q2 Let K/F be a separable finite extension. Show that K has finitely many subfields containing F.

Q3 Let K be the Galois closure of $\mathbb{Q}(\sqrt{1+\sqrt{3}})$.

(a) Show that $[K : \mathbb{Q}] = 8$.

(b) Show that $\mathrm{Gal}(K/\mathbb{Q})$ is not commutative.

(c) Show that $\mathrm{Gal}(K/\mathbb{Q})$ has a normal subgroup isomorphic to $\mathbb{Z}/2\mathbb{Z} \times \mathbb{Z}/2\mathbb{Z}$.

(d) Show that $\mathrm{Gal}(K/\mathbb{Q}) \cong D_8$.

Q4 Show that if $K/\mathbb{Q}$ is a finite Galois extension with $\mathrm{Gal}(K/\mathbb{Q}) \cong S_3$, then K is the splitting field for some irreducible cubic polynomial in $\mathbb{Q}[x]$.