1. If Σ contains at least one element, then Σ^* is infinite. **true**

2. There are strings in Σ^* of infinite length. **false—The set Σ^* is the set of all finite-length strings over the alphabet Σ (K, Def. 2.1, p. 8). For example,**

$$\{a, b\}^* = \{\varepsilon, a, b, aa, ab, ba, bb, aaa, aab, aba, baa, abb, bab, bba, bbb, aaaa, aaab, \ldots\}.$$

   This set contains infinitely many strings and there is no finite bound on their length; nevertheless, every element is of finite length. The length of a string $x \in \Sigma^*$ is the number of letters in it and is denoted $|x|$. For example, $|aaab| = 4$.

3. Set intersection is associative. **true**

4. $A \cup \varnothing = \varnothing$. **false**

5. $A\varnothing = \varnothing$. **true—Formally, AB is defined to be the set of all strings xy obtained by concatenating a string x from A with a string y from B. If $B = \varnothing$, then there are no strings $y \in B$, so there are no possible such concatenations xy. Thus $A\varnothing = \varnothing$.**

6. The complement of $\{a\}^*$ in $\{a, b\}^*$ is $\{b\}^*$. **false—The set $\{a, b\}^*$ is the set of all strings of a's and b's. The set $\{a\}^*$ is the set of all strings consisting only of a's. A string does not consist only of a's iff it contains at least one b. The complement of $\{a\}^*$ in $\{a, b\}^*$ is therefore the set of strings of a's and b's containing at least one b. This is the set $\{a, b\}^*\{b\}\{a, b\}^*$.**

7. There is exactly one string in Σ^* of length 0. **true**

8. $\varnothing = \varepsilon$. **false—$\varnothing$ is a set, ε is a string. Type error!**

9. $\varnothing = \{\varepsilon\}$. **false—The set $\varnothing$ is the empty set. It containing no elements. The set $\{\varepsilon\}$ contains one element, namely ε, the null string.**

10. $\{ab, a\}\{ba, a\} = \{abba, aba, aa\}$. **true**