Basic Properties of Probability

S can't be empty; but A can be empty.

1. Sample Space: the set of all possible outcomes. (S).
   e.g. flip a coin: $S = \{Head, Tail\}$.
   1) Event A is 'any' subset $A \subseteq S$.
      ① $P(A)$: probability that A will occur.

2. Basic Properties of Probabilities
   1) If A is an event, $0 \le P(A) \le 1$.
   2). If $A = S$, $P(A) = P(S) = 1$
   3). If $A = \phi$, $P(A) = P(\phi) = 0$.
   4). Additivity: if $A_1, A_2, A_3, \ldots$ are any sequence (finite/infinite) of disjoint events. (i.e. $A_i \cap A_j = \phi$, whenever $i \neq j$), then
   $$P(\bigcup_i A_i) = \sum_i P(A_i).$$
   e.g. A = Heads. B = Tails. $P(A \cup B) = P(A) + P(B)$
   $= P(Head) + P(Tails)$.
   $= 0.5 + 0.5 = 1$.