The probability of the empty set is always 0.

Know that $P(S) = 1$.

Know that $S, \emptyset$ (even multiple copies of the empty set) are disjoint. I.e.,

$$S \cup \emptyset \cup \emptyset \cup \emptyset \cup \emptyset \cup \cdots = S$$

So we see that

$$P(S \cup \emptyset \cup \emptyset \cup \emptyset \cup \emptyset \cup \cdots) = P(S) = 1$$

Since the events are disjoint, we can sum the probability of the individual events to get the probability of the union of the events. I.e.,

$$P(S) + P(\emptyset) + P(\emptyset) + P(\emptyset) + \cdots = 1$$

but again $P(S) = 1$ so

$$1 + P(\emptyset) + P(\emptyset) + P(\emptyset) + \cdots = 1$$

So the only possibility is that

$$P(\emptyset) = 0.$$