



counting the favourable cases against all the equally likely ones, and the traps in the counting

The vocabulary, fixed before anything else

- a **random experiment** has more than one possible result and none of them can be predicted with certainty
- the **sample space S** is the set of every possible outcome, and $n(S)$ is how many there are
- an **event A** is any subset of the sample space, and $n(A)$ is the count of outcomes favourable to it
- outcomes must be **equally likely** for the formula below to apply, which is why we speak of a fair coin and an unbiased die
- an **elementary event** has exactly one outcome, and a **certain event** is the whole sample space
- two events are **mutually exclusive** when they cannot both happen, such as a die showing 2 and showing 5 on one throw

The standard sample spaces, worth knowing cold

Experiment	$n(S)$	Worth remembering
one coin	2	H, T
two coins	4	HH, HT, TH, TT
three coins	8	$2 \times 2 \times 2$
one die	6	1 to 6
two dice	36	ordered pairs, 6×6
a pack of cards	52	4 suits of 13

for two coins HT and TH are two different outcomes, which is why $n(S)$ is 4 and not 3. The same ordering applies to two dice, giving 36 rather than 21

The results this chapter needs

probability of an event	$P(A) = \frac{n(A)}{n(S)}$
the range every probability lies in	$0 \leq P(A) \leq 1$
the complement, A not happening	$P(\bar{A}) = 1 - P(A)$
all elementary probabilities add to one	$\sum P = 1$
an impossible event, then a certain one	$P = 0, P = 1$



the whole range a probability may occupy, running from 0 at one end to 1 at the other: impossible sits hard against 0, certain against 1, and an even chance exactly halfway. Any answer landing off this line is a counting error, not a rare event

a probability can be written as a fraction, a decimal or a percentage, but it can never be negative and never exceed 1. An answer outside that range means the counting went wrong

The pack of cards, in the detail questions use



- 52 cards in **four suits** of 13 each: spades, clubs, hearts and diamonds
- spades and clubs are black**, hearts and diamonds are red, so 26 of each colour
- each suit runs ace, 2 to 10, then jack, queen and king, so there are **4 of every rank**
- the **face cards** are jack, queen and king, giving 3 per suit and **12 in the pack**
- an ace is **not** a face card, which is a distinction questions deliberately test
- so there are 12 face cards, 6 of them red, and 16 cards that are either an ace or a face card

