1. An experimenter is studying the effects of temperature, pressure, and type of catalyst on yield from a certain chemical reaction. Three different temperatures, four different pressures, and five different catalysts are under consideration. If any particular experimental run involves the use of a single temperature, pressure, and catalyst, how many experimental runs are possible?

3 \times 4 \times 5 = 60 \text{ runs}

This is just an application of the basic law of counting where if there are $n$ ways of doing something and $m$ ways of doing something else there are $mn$ ways to do both things. This extends to any number of things.

2. Three married couples have purchased theater tickets and are seated in a row consisting of just six seats. If they take their seats in a completely random fashion (random order) what is the probability that Jim and Paula (husband and wife) sit in the two seats on the far left?

\[
\frac{2! \times 4!}{6!} = \frac{1}{15}
\]

There are $6!$ arrangements of the 6 people. Jim and Paula sit on the far left and can exchange places with one another. There are $4!$ arrangements of the remaining people. The result in the numerator is obtained by the basic law of counting.