# DNA, inheritance & evolution

## Maths—Permutations

There are four 'bases' in a DNA molecule - adenine, thymine, guanine & cytosine (A, T, G, C). They are read by the cell in groups of 3, called codons. How many possible different codons are there? Order does matter, ie CAA, ACA & AAC are different.

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## Maths—ratio

Gregor Mendel's pea experiment famously produced results in the ratio of 3:1 in the second generation. In all of the questions below, assume that all answers relate to this ratio of 3 dominant to 1 recessive.

1. Green seeds are dominant to yellow. If there were 12 plants with green seeds, how many had yellow?

   _____

2. Tall plants are dominant to short. If there were 210 tall plants, how many were short?

   _____

3. Purple flowers are dominant to white flowers. What fraction of the plants would have purple flowers?

   _____

4. Smooth seeds are dominant to wrinkled seeds. If there were 10 plants with wrinkled seeds, how many had smooth seeds?

   _____

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Permutations answer—**64**

There are four possible letters for the 1st position
Then 4 possible letters for the 2nd position.
And 4 possible letters for the 3rd position.
So it's **4 x 4 x 4 = 64**

| 2nd / 1st | A | T | C | G |
|---|---|---|---|---|
| **A** | AAA<br>AAT<br>AAC<br>AAG | ATA<br>ATT<br>ATC<br>ATG | ACA<br>ACT<br>ACC<br>ACG | AGA<br>AGT<br>AGC<br>AGG |
| **T** | TAA<br>TAT<br>TAC<br>TAG | TTA<br>TTT<br>TTC<br>TTG | TCA<br>TCT<br>TCC<br>TCG | TGA<br>TGT<br>TGC<br>TGG |
| **C** | CAA<br>CAT<br>CAC<br>CAG | CTA<br>CTT<br>CTC<br>CTG | CCA<br>CCT<br>CCC<br>CCG | CGA<br>CGT<br>CGC<br>CGG |
| **G** | GAA<br>GAT<br>GAC<br>GAG | GTA<br>GTT<br>GTC<br>GTG | GCA<br>GCT<br>GCC<br>GCG | GGA<br>GGT<br>GGC<br>GGG |

*Biology note—In the 'reading of the DNA code in the cell, the code has been copied into an **RNA** molecule, where Thymine is replaced by **Uracil**, so it's actually A,**U**,C&G... but that's for KS5!*

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## Maths—ratio

Gregor Mendel's pea experiment famously produced results in the ratio of 3:1 in the second generation. In all of the questions below, assume that all answers relate to this ratio of 3 dominant to 1 recessive.

1. Green seeds are dominant to yellow. If there were 12 plants with green seeds, how many had yellow? 12 ÷ 3 = **4 plants** with yellow seeds
2. Tall plants are dominant to short. If there were 210 tall plants, how many were short?

210 ÷ 3 = **70 plants** are short

3. Purple flowers are dominant to white flowers. What fraction of the plants would have purple flowers?

3:1 is equivalent to 3/4 : 1/4 (because 3+1=4 parts altogether), so **3/4** have purple flowers

4. Smooth seeds are dominant to wrinkled seeds. If there were 10 plants with wrinkled seeds, how many had smooth seeds?

Read the question carefully: we're asking for the dominant part this time! 10 x 3 = **30 plants** with smooth seeds