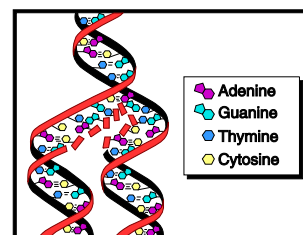


INVESTIGATION # 14

DNA

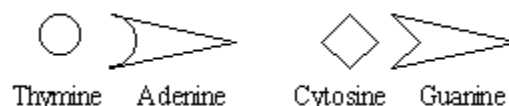


Deoxyribonucleic acid (DNA) is a molecule found in all life forms that determines the inherited characteristics of that life form. How the DNA is put together dictates the colour of a persons hair or the height of a tree.



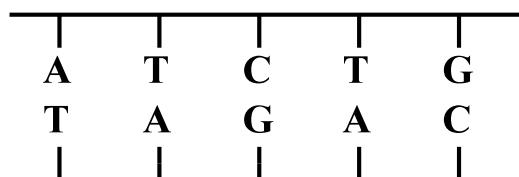
As the diagram here shows, a DNA molecule is a spiralling structure consisting of two strands (made up of sugar and phosphate) connected by what are known as nucleotides.

Each nucleotide is made up of two matching bases. There are four bases; thymine (T), adenine (A), cytosine (C) and guanine (G). The bases can only be matched A with T (or T with A) and C with G (or G with C) as shown in this diagram.



The order that the nucleotides are arranged determines the inherited characteristics.

This diagram shows one sequence of 5 nucleotides:



By investigating possibilities, find the answer to these questions:

- How many possible sequences of 5 nucleotides are there? (Note that AT is different from TA and that GC is different from CG).
- How many different sequences of 10 nucleotides are possible?
- Develop a function that gives the number of sequences from the number of nucleotides.
- What is the least number of nucleotides in sequence to give more than 1 million different possible structures?

ASSESSMENT TASK

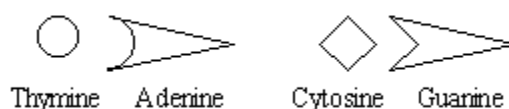
DNA

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The order that the nucleotides are arranged determines the inherited characteristics.

Answer the following questions:

1. How many different sequences of 6 nucleotides are possible?
2. How many different sequences of n nucleotides are possible?
3. What is the minimum number of nucleotides necessary to give 7 billion sequences (7×10^9) so that every human on the planet could have a different one?
4. Agent Scully discovers that the Greys (an alien race) have an extra two bases, Danine (D) and Foxine (F) which can only go together.
 - (a) How many different sequences of 6 nucleotides are now possible?
 - (b) What is the minimum number of nucleotides necessary to give 12 trillion sequences (1.2×10^{13}) so that every Grey in the universe could have a different one?
5. If the human nucleotides can only go in alphabetic order, ie. A-T and C-G how does this alter the answer to question 2.