



X-Sheet 1

The Nucleus and DNA

The Nucleus and DNA

Key Concepts:

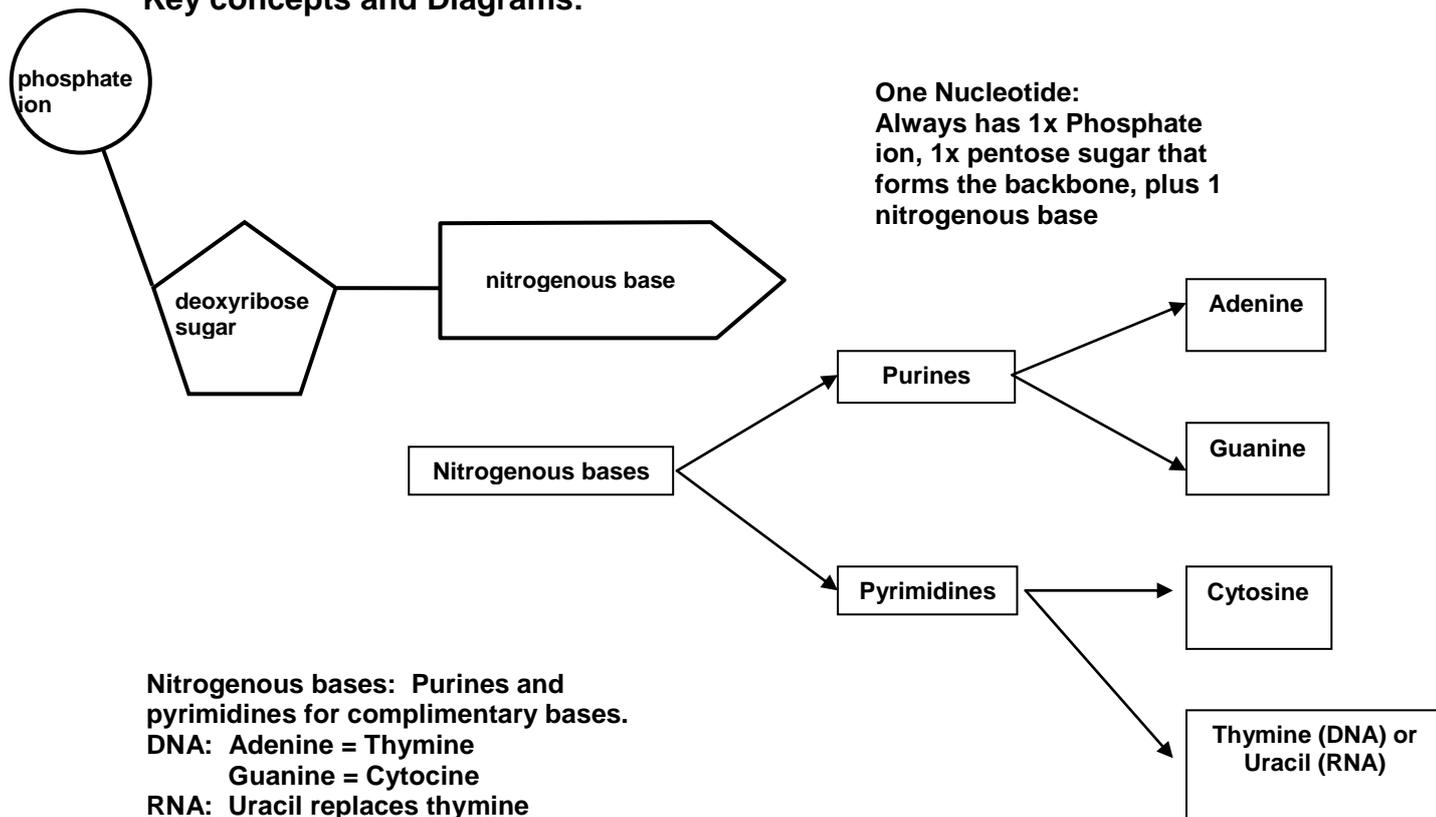
In this session we will focus on summarising what you need to know about: the Nucleus, genes, nucleic acids, RNA, DNA

Terminology & definitions:

- **Chromatin network:** visible as thread-like structures in the nucleus of an inactive cell.
- **Chromosome:** a structure made up of two chromatids joined by a centromere that carries the hereditary characteristics within the DNA.
- **Chromatid:** one half of a chromosome consisting of a protein core surrounded by DNA that carries the hereditary characteristics. Two chromatids are joined by a centromere to form a chromosome.
- **Gene:** the unit of heredity transmitted in the chromosome which controls the development of the characteristics.
- **Chromosome mapping:** plotting of the relative positions of certain genes with respect to the positions of the other genes in the same linkage group.
- **Nucleotide:** the building block of nucleic acids RNA and DNA, consisting of a pentose sugar, a phosphate group and a purine or pyrimidine nitrogenous base.
- **Nitrogenous bases:** a nitrogen containing molecule which has the properties of a base e.g.: purines and pyrimidines and which forms the main part of the nucleotide
- **DNA:** (deoxyribonucleic acid), located on the chromosomes in the nuclei of all living cells and carries the hereditary information of the organism.
- **Messenger RNA (mRNA):** responsible for carrying the genetic code transcribed from DNA to specialized sites of the ribosomes where the information is translated for protein synthesis
- **Transfer RNA:** carries specific amino acids to the mRNA codon in the production of proteins
- **Ribosomal RNA (rRNA):** form the ribosomes and produce the proteins based on the information from the tRNA.
- **Base pairing:** Purines pair with Pyrimidines - adenine (A) always bonds to thymine (T) and guanine (G) with cytosine (C) in DNA molecule to ensures the precision of DNA replication
- **Codon:** the corresponding three-base sequence on the mRNA required to specify one amino acid in a protein chain on the DNA template
- **Anticodon:** a set of three bases on the transfer RNA that correspond with the codon on the messenger RNA
- **DNA Replication:** takes place to produce two new identical DNA molecules. (DNA unspirals; weak hydrogen bonds break; each separate strand of DNA attracts a new complementary nucleotide partner; results in DNA containing half the original molecule and a new complimentary half and is an exact copy of the original DNA – process occurs during Mitosis

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Key concepts and Diagrams:



Difference between DNA and RNA

RNA	DNA
Ribose pentose sugar	Deoxyribose pentose sugar
Single unwound strand of nucleotides	Double helix strand of nucleotides
Strand is short – codons and anticodons = 3 bases only	Strands are long and contain many triplets
Contains Uracil	Contains Thymine

X-Planation:

Learn the structure of the nucleotide and remember the combinations of the nitrogenous base complimentary pairs – always **A to T** and **G to C** in DNA. In RNA, Uracilrelaced Thymine.

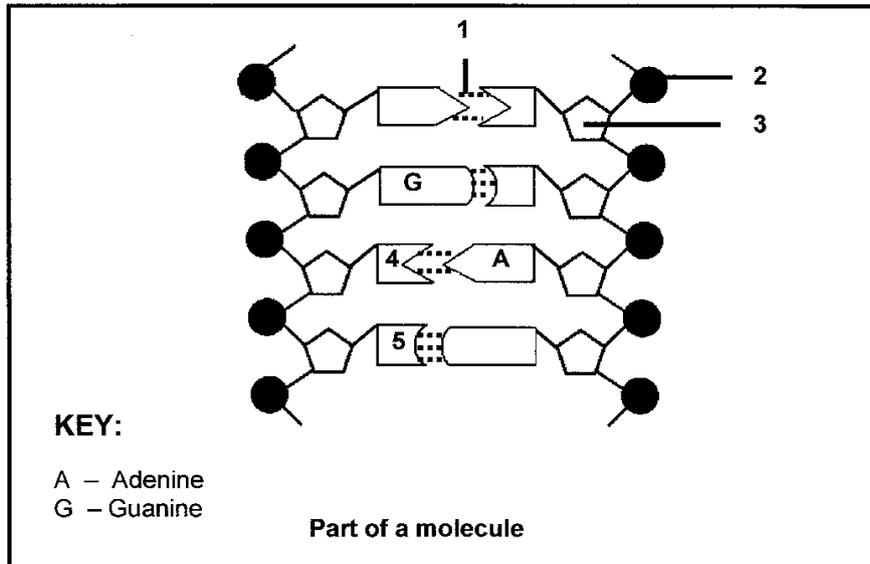
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X-ample Questions:

Question 1

(Adapted from the National Senior Certificate Exemplar Paper 1 2008, question 3.1)

1.1 The diagram below represents part of a molecule. Study the diagram and answer the questions that follow:



- 1.1.1. Identify the molecule in the above diagram. (1) (Clue word is 'molecule')
- 1.1.2. Label the parts numbered 1 and 5 respectively. (2)
(Check the key. If A is Adenine then 4 is the complimentary base)
- 1.1.3. What is the collective name for the parts numbered 2, 3 and 4? (1)
- 1.1.4. What is the significance of this molecule being able to replicate itself? (2)
(Refer to the basics on DNA replication – Mitosis)

Question 2:

- 2.1. Where is DNA found?
- 2.2. What are the constituent groups of molecules that form nucleotides?
- 2.3. Name the purine and pyrimidines of DNA and RNA.
- 2.4. Name the mRNA produced by each of the following strands of DNA:
(Remember the complementary bases and grouping)
 - a) AACGGCTAT
 - b) CCGTAACGAATT
 - c) GCGAATTCA

X-ercise:

1. Tabulate 3 differences between RNA and DNA.
2. Which of the following is NOT part of a DNA molecule?
 - A Adenine
 - B Uracil
 - C Guanine
 - D Cytosine

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3. Two complementary bases in a DNA strand are held together ...
 - A. by strong nitrogen bonds
 - B. by weak nitrogen bonds
 - C. because they are coiled around each other
 - D. by weak hydrogen bonds

4. In DNA, if the sequence of bases on one strand is AGG, the corresponding bases on the complementary strand are ...
 - A. ACC.
 - B. TAA.
 - C. CTT.
 - D. TCC.

5. A Codon is...
 - A. the corresponding three-base sequence on the mRNA required to specify one amino acid in a protein chain on the DNA template
 - B. the corresponding three-base sequence on the DNA required to specify one amino acid in a protein chain on the DNA template
 - C. The corresponding three base sequence on the mRNA required to specify one amino acid in a protein chain on the ribosome template
 - D. A set of three bases on the tRNA that correspond with the codon on the mRNA

Answers to X-ercises:

1.

RNA	DNA
Ribose pentose sugar	Deoxyribose pentose sugar
Single unwound strand of nucleotides	Double helix strand of nucleotides
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(Any 3 points. RNA and DNA points to correspond)

2. B. Uracil is only found on RNA
3. D
4. D. (Always remember: A=T and G=C)
5. A. (check the Terminology & Definitions section on the X-Sheet)