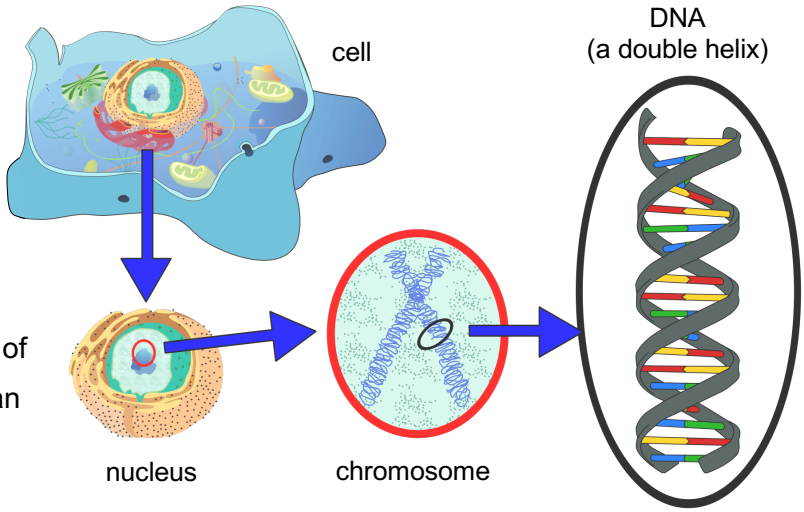
11 DNA, RNA & COVID-19

Links:
- *Exploring Science* 9Ac
- *Edexcel 9-1* CB3b, SB3c/d

DNA



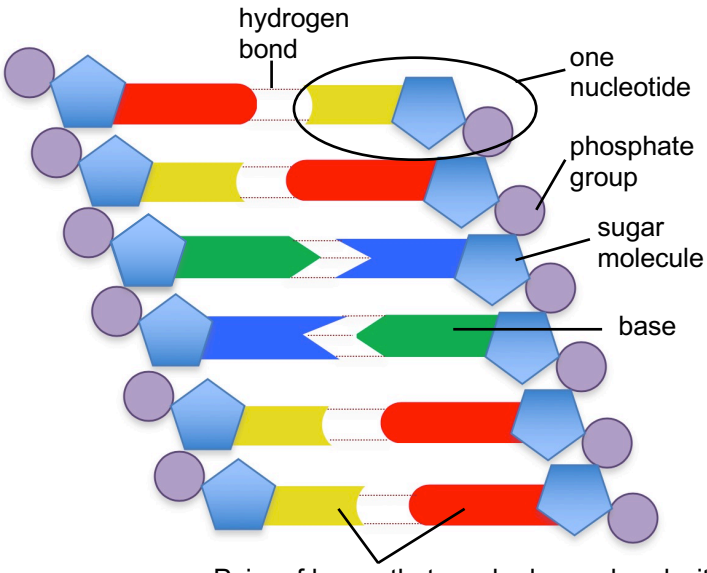
All organisms contain **genetic material** – a substance that contains the instructions for making the organism. These instructions are in the form of a code, usually written into molecules of **DNA** (deoxyribonucleic acid). All the DNA in an organism is its **genome**. In many organisms, each DNA molecule is packed up with proteins to form a **chromosome**. Human cell nuclei contain 46 chromosomes.

Bases

A DNA molecule has two strands and looks like a ladder twisted into a double helix. The rungs of the 'ladder' are made of **nucleotides**. Each consists of a phosphate group, a molecule of deoxyribose (a sugar) and a **base**. There are four bases: **adenine** (A), **thymine** (T), **cytosine** (C), **guanine** (G).

The bases have tiny electrical charges. Negatively charged parts of one base attract positively charged parts of another. These attractions (called **hydrogen bonds**) hold the DNA molecule together. The positions of the charges mean that A only pairs with T and C only pairs with G.

The order of the As, Ts, Cs and Gs forms the coded instructions for an organism. Apart from identical twins, all humans have slightly different orders of bases in their genomes, which makes us all slightly different.



Pairs of bases that can hydrogen bond with one another are **complementary base pairs**. They hold the strands together.

RNA

The SARS-CoV-2 virus genome is made of RNA (ribonucleic acid), which is slightly different to DNA and only has one strand. The order of bases in the RNA contains the instructions for making copies of the virus, including copies of its RNA. Giving people artificially altered versions of a base may help to treat COVID-19. One drug being tested at the moment is remdesivir, which is an altered form of adenine. The altered adenine stops the RNA copying process.

Find out

I. 1. a. Aciclovir treats cold sores. Find out which base it is an altered form of. _____

b. What is different about the bases in RNA compared to DNA? _____

_____

c. What else is different between RNA and DNA nucleotides? _____

_____

d. How many bases does the SARS-CoV-2 virus RNA contain? _____

2. Two tests have been developed for COVID-19. One finds out if a person has the disease. The other finds out if a person has ever had it. Complete the table to compare the tests.

	Test for disease currently	**Test for disease previously**
Name of test		
Body fluid tested		
What is looked for		

Test yourself

3. In a human body cell, state the number of: a. nuclei _____

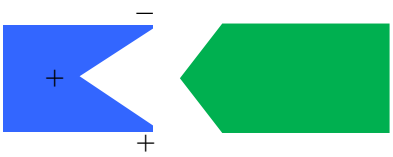
b. chromosomes _____ c. DNA molecules. _____

4. In the diagrams above, thymine is red, and guanine is blue. What do the other colours show? _____

5. A strand of DNA has the base sequence shown. Write in the complementary bases.

A	T	G	G	A	C	C	T

6. a. The diagram shows a base pair. Three electrical charges are shown on the base on the left. Write in the positions of the charges on the other base.



b. Name the bonds formed by the charges.

_____

Check-up

I. Check your answers.

II. Build a model of DNA. You might use plastic modelling bricks (e.g. LEGO®), sweets and toothpicks, or cardboard.

Answers

Note to home educators

The worksheet is designed to support understanding of genomes and DNA. You may wish to share these objectives with students:

- Recall where DNA is found in a eukaryotic cell, and in what form
- Recall what an organism's genome is. (GCSE)
- Recall the names of the bases in DNA and how they pair. (GCSE)
- Describe how DNA strands are held together. (GCSE)
- Describe the overall structure of DNA. (GCSE)

To access this sheet, students will need a knowledge of cells, and an understanding of what DNA is. Other sheets in the series are available: https://shwca.se/covid19science

It is suggested that students complete the worksheet independently, using the internet for questions 1 & 2. Questions 3 - 6 should be completed without help from additional sources.

This sheet is designed for students in Years 10 and 11, and the material is drawn from the GCSE 9-1 Science specifications.

If you wish to check the answers, keep this part of the sheet away from the questions!

I. 1. a. guanine (you can accept 'guanosine' as correct, but this is guanine + sugar)
   b. RNA has uracil instead of thymine.
   c. The sugar in RNA is ribose (it is deoxyribose in DNA).
   d. 29 811 bases

2.

	Test for disease currently	**Test for disease previously**
Name of test	PCR test	ELISA or antibody test
Body fluid tested	saliva/mucus	blood
What is looked for	virus RNA	antibodies to the virus

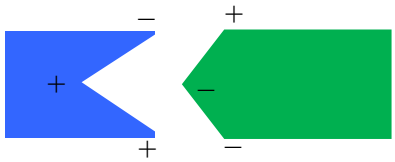
3. a. 1 b. 47 c. 46

4. green = cytosine, yellow = adenine

5.

A	T	G	G	A	C	C	T
T	A	C	C	T	G	G	A

6. a.
   b. hydrogen bonds



II. Models of DNA. This should include different colours to represent the bases, and their correct base pairing. Better models will show the phosphate groups and sugars (which form the backbones of the strands) and make some attempt to show the double helix shape of the molecule (although this is very difficult to achieve).