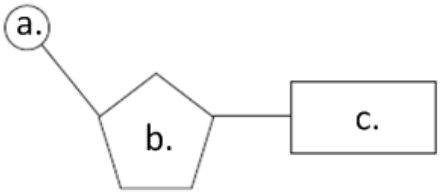
Name _____ Period _____ Date _____

Topic 2.6 Structure of DNA and RNA

2.6.U1 The nucleic acids DNA and RNA are polymers of nucleotides. (includes 2.6.S1 Drawing simple diagrams of the structure of single nucleotides of DNA and RNA, using circles, pentagons and rectangles to represent phosphates, pentoses and bases.)

1. Label and annotate the structures of this single nucleotide.

<table>
<tr><td rowspan="3"> 
</td><td>a.</td><td></td></tr>
<tr><td>b.</td><td></td></tr>
<tr><td>c.</td><td></td></tr>
</table>

2. State the type of bond that joins a to b and b to c.
3. Complete the table below to show the pairings of the bases in DNA and RNA.

Purine	**Pyramidine**

4. Draw a single strand of three nucleotides, name the bonds between them, and showing the correct relative position of these bonds.
5. Annotate your diagram to outline the process of polymerization of nucleotides to form a strand of DNA/RNA.

2.6.U2 DNA differs from RNA in the number of strands present, the base composition and the type of pentose.

6. Complete the table to distinguish between RNA and DNA.

	RNA	**DNA**
Bases	Adenine (A) Guanine (G) **Uracil (U)** Cytosine (C)	
Sugar		
Number of strands		**Two anti-parallel, complementary strands** form a double helix

2.6.U3 DNA is a double helix made of two antiparallel strands of nucleotides linked by hydrogen bonding between complementary base pairs. (includes 2.6.S1 Drawing simple diagrams of the structure of single nucleotides of DNA and RNA, using circles, pentagons and rectangles to represent phosphates, pentoses and bases.)

7. Draw a section of DNA, showing two anti-parallel strands of four nucleotides each.
   Label the bonds that hold the bases together as well as the correct complementary base pairs.
   Include the carbon numbering on the deoxyribose sugars and indicate the 5-prime and 3-prime ends of the molecule.
8. Define the term double helix.
9. Explain why the DNA helix is described as anti-parallel.
10. Explain the relevance of the following in the double-helix structure of DNA:
    a. Complementary base pairing
    b. Hydrogen bonds
    c. Relative positioning of the sugar-phosphate backbone and the bases

2.6.A1 Crick and Watson's elucidation of the structure of DNA using model making.

Nature of Science: Using models as representation of the real world - Crick and Watson used model making to discover the structure of DNA. (1.10)

11. Whilst others worked using an experimental basis Watson and Crick used stick-and-ball models to test their ideas on the possible structure of DNA.
    a. State two benefits of modelling over an experimental approach.
    b. Outline the reasons was their first model was rejected.
    c. Because of the visual nature of Watson and Crick's correct model of DNA led to other discoveries. List the two key discoveries concerning of DNA that were found quickly after the model was published.
    d. Modelling alone cannot lead to discoveries. Watson and Crick's work was based on the experiments and insight of others. Give an example of the work of other scientists that supported their discovery.

Topic 7.1 DNA Structure and Replication Part I

7.1.U2 DNA structure suggested a mechanism for DNA replication.

1. Mechanisms for DNA replication are implied by the presence of complementary base pairing in DNA. Explain why it is only possible for cytosine to pair with guanine and adenine to pair with thymine.

7.1.U1 Nucleosomes help to supercoil the DNA.

2. Explain why Prokaryotic DNA is described as being 'naked'.
3. In the space below, draw and label the structure of a simplified nucleosome, including the H1 linker and octamer (which consists of two copies of four different types of histone proteins).
4. Nucleosomes both protect DNA and allow it to be packaged, this in turn allows DNA to be supercoiled.
    a. Outline how the H1 linker aids supercoiling beyond the nucleosome structure.
    b. Review 1.6.U2 and briefly outline why it is essential to supercoil chromosomes.
    c. Outline how nucleosomes help regulate transcription.
    d. State the part of the cell cycle in which the most DNA would be supercoiled.