

Model Answers: Easy

1

The correct answer is **D** because:

- The diagram shows the complementary base pairing in DNA.
- All pairings are correct, adenine with thymine and cytosine with guanine.
- However, the size of the nucleotides shown in D are wrong:
- **Guanine** is a **purine**, which means it has a **double ring structure** that should be represented by a bigger shape.
- **Cytosine** is a **pyrimidine**, which means it has a **single ring structure** and therefore should be a smaller shape.

2

The correct answer is **A** because:

- DNA, **deoxyribose nucleic acid**, and RNA, **ribose nucleic acid**, both contain a **5-carbon ribose sugar**. Deoxyribose is missing an **OH group** on carbon 2
- Both DNA and RNA contain **purine** and **pyrimidine** bases:
 - In DNA the purine bases are **guanine** (G) and **adenine** (A) and the pyrimidine bases are thymine (T) and **cytosine** (C).
 - In RNA the purine bases are the same as in DNA but instead of thymine (T), RNA contains a different pyrimidine base called **uracil** (U)
- Both DNA and RNA form **hydrogen bonds** with RNA bases:
 - DNA forms hydrogen bonds with free **RNA nucleotides** during the formation of messenger RNA in protein synthesis
 - Hydrogen bonds are formed between RNA bases in **tRNA** molecules and **rRNA** molecules to form their structures

3

The correct answer is **D** because:

- The **sequence of nucleotides** is **specific** to each organism and it what makes the organism what it is
- The sequence of nucleotides relates to the sequence of amino acids (**primary protein structure**) made during protein synthesis
- The proteins in each organism are therefore different which is what results in different **phenotypes** (physical characteristics)

A is incorrect as **guanine** and **cytosine** are **complementary bases** and therefore the ratio between them will always be equal.

B is incorrect as DNA in **all** organisms contains the pentose sugar **deoxyribose**.

C is incorrect as the types of DNA nucleotides are the **same** in all organisms: cytosine, guanine, adenine and thymine.

4

The correct answer is **A** because:

- **Guanine** is a **purine** base (which have double ring structures)
- Guanine binds to **cytosine** (a pyrimidine / single ring structured base)
- In all nucleic acids, the base binds to the **pentose sugar** which is attached to the phosphate group

B is incorrect as **guanine** is attached to the pentose sugar, not the phosphate, in nucleotide

C is incorrect as guanine is a **purine** base and therefore has a **double** ring structure.

D is incorrect as guanine's complementary base is **cytosine**.

5

The correct answer is **C** because:

- The **minimum** amount of hydrogen bonds between base pairs is **2**, between **adenine** and **thymine**.
- There are 3 hydrogen bonds between cytosine and guanine.
- **2 x 900 = 1800**

6

The correct answer is **B** because:

- A nucleotide is formed from a phosphate group (the circle), a deoxyribose sugar (the pentagon) and a base (the other shape).
- Nucleotides are the monomers (building blocks) that form a strand of DNA.

A is incorrect as this shows the **phosphate-sugar backbone**.

C is incorrect as this shows a **base pair** which is two nucleotides bonded by **hydrogen bonds** formed between bases.

D is incorrect as this shows a **nitrogenous base**, which is part of a nucleotide.

7

The correct answer is **B** because conservative **DNA** replication maintains the **two original** template DNA strands **together** in a double helix (black) and produces a **complete copy** composed of two new strands containing all new DNA nucleotides (grey).

A is incorrect as this cannot exist because it shows two DNA molecules completely newly synthesised and the original DNA molecule disappears.

C is incorrect as this shows the **semi-conservative model** of DNA replication. This is when the original DNA molecule (black) splits in two and new free nucleotides are attached to make a complementary strand (grey). Both DNA molecules produced are **hybrid**. This is what occurs in nature.

D is incorrect as this shows the **dispersive model** of DNA replication. This is when the original DNA molecule breaks apart and recombines randomly with newly synthesised sections of DNA. This does not occur in nature.

8

The correct answer is **C** because X illustrates a DNA base which has a complementary shape to adenine and is therefore **thymine**.

- **Y** is a **deoxyribose sugar**
- **Z** is a **phosphate group**
- **W** is **guanine** and it is the only other purine, the larger of the two types of bases

9

The correct answer is **A** because:

- **Two** hydrogen bonds form between **adenine** (A) and **thymine** (T).
- **Three** hydrogen bonds form between **guanine** (G) and **cytosine** (C).
- There are two sets of each pair and therefore: $(2 \times 2) + (2 \times 3) = 10$

10

The correct answer is **A** because:

- **Adenine** is a **purine** base (purines have a double ring structure)
- Purine bases form **hydrogen bonds** with **pyrimidine** bases (which have a single ring structure)
- In DNA the nucleotide bases are attached to **deoxyribose sugars** whereas in RNA the nucleotide bases are attached to **ribose sugars**
- In DNA adenine binds to **thymine**
- During transcription, adenine would bind with uracil (an RNA molecule)

Therefore, if adenine is attached to deoxyribose then its complementary base will be uracil on an RNA molecule.