



# **Biomedical Admissions Test (BMAT)**

## Section 2: Biology

### Questions by Topic

#### B5 - DNA

This work by [PMT Education](https://www.pmt.education) is licensed under [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)



## B5: DNA - Questions by Topic

*(Mark Scheme and explanations at the end)*

1 The following statements are about DNA.

- 1 The DNA of a prokaryotic cell is in the nucleus
- 2 DNA in eukaryotic cells is in the nucleus and forms linear chromosomes with free ends
- 3 DNA of a prokaryotic cell contains more genes than DNA in an animal cell
- 4 Some prokaryotic cells have plasmids.
- 5 DNA in a prokaryotic cell is circular and has no free ends

Which of these statements are correct?

- A** 1, 2, 3 and 4
- B** 1, 2, 3 and 5
- C** 1, 2 and 4
- D** 1, 3 and 4
- E** 2, 4 and 5
- F** 2 and 4
- G** 1 and 4
- H** 2 and 5

2 The following are all correct statements about DNA, except one.

Which one is incorrect?

- A** There are four bases: adenosine, guanine, cytosine and thymine and each nucleotide will have one of these.
- B** Nucleotides pair together, A with T and C with G.
- C** There are 20 amino acids, and each codon codes for one amino acid.
- D** Different codons can code for the same amino acid, this is due to the degenerate nature of the genetic code.
- E** Each daughter cell has a full DNA set, as DNA is replicated before cell division.





3 The following questions are about DNA.

- 1 Eukaryotic animal cells contain a nucleus, unlike a eukaryotic plant cell.
- 2 DNA in a nucleus is stored in the form of chromosomes.
- 3 The DNA of eukaryotic and prokaryotic organism is always present in the nucleus.
- 4 An organism's genome is all the genetic information found in one cell of an organism.
- 5 Small monomer subunits joined together to form the DNA molecule.

Which of these statements are correct?

- A 1, 2, 3 and 4
- B 1, 2, 3 and 5
- C 1, 2 and 4
- D 1, 2 and 4
- E 1, 2 and 5
- F 1 and 2
- G 1 and 3
- H 2 and 5

4 DNA is unique for each individual however it has a specific structure that is the same for every individual.

- 1 The DNA molecule is a polynucleotide.
- 2 A nucleotide contains a sugar and phosphate and nitrogenous base.
- 3 The sugar and phosphate components in a DNA molecule are always the same.
- 4 There are four different bases in the DNA molecule that join to different positions on the sugar ring.
- 5 A DNA molecule is made from 3 polynucleotide chains.

Which of these statements are correct?

- A 1, 2, 3 and 4
- B 1, 2, 3 and 5
- C 1, 2 and 3
- D 1, 2 and 5
- E 1, 4 and 5
- F 1 and 2
- G 2 and 4
- H 2 and 5





**5** The following statements are about DNA.

- 1** Two strands of the DNA molecule are held together by hydrogen bonds.
- 2** DNA has a helical structure.
- 3** Adenine always pairs with thymine.
- 4** The hydrogen bonds holding the DNA strands together form between the sugars.
- 5** Two polynucleotide chains make up the DNA molecule.

Which of these statements are correct?

- A** 1, 2, 3 and 4
- B** 1, 2, 3 and 5
- C** 1, 2 and 4
- D** 1, 3 and 4
- E** 1, 2 and 5
- F** 1 and 2
- G** 1 and 4
- H** 2 and 3



## Answers and Explanations

### 1 The answer is E

- 1 is incorrect - both prokaryotic and eukaryotic cells have DNA, however **eukaryotic cells** (animal cells) have **membrane bound organelles** and prokaryotic cells do not. Therefore the DNA of a prokaryotic cell is not in a nucleus. The DNA of a eukaryotic cell is in a nucleus.
- 2 is correct - as stated before the DNA in a eukaryotic cell is in a nucleus. The chromosomes in a eukaryotic cell are linear and have free ends.
- 3 is incorrect - this is because the DNA of a prokaryotic cell has **fewer genes** than the DNA in an animal cell.
- 4 is correct - as a prokaryotic cell does have a plasmid. A plasmid is a **small circular double-stranded** piece of DNA, it contains **extra genetic information** for specialised cell functions.
- 5 is correct - as the DNA in a prokaryotic cell is circular, coiled and has no free ends, it contains information that enables most chemical processes to take place.

Since **2**, **4** and **5** are the only correct statements, **E** must be the correct answer.

### 2 The answer is A

- A** is incorrect - it is true that DNA is ultimately made up of nucleotides, and each nucleotide has one of four bases, these are: **adenine, guanine, cytosine or thymine**. Option 1 correctly states three of the four bases, however it says that one of the bases is adenosine, this is incorrect. Adenine is the base of a nucleotide, when a nucleotide which has a base of adenine **binds to a pentose sugar like ribose**, it creates adenosine.
- B** is correct - this is because each of the nucleotide bases always pairs to a nucleotide with a particular base - known as **complementary base pairing**. Adenine pairs with thymine and cytosine pairs with guanine.
- C** is correct - as each codon will only code for one amino acid, there are 20 amino acids, and a codon will never code for more than one amino acid.



- D** is correct - although each codon codes for one amino acid, an amino acid can be coded for by many codons, as there are only 20 amino acids but many more combinations of codons. This is the **degenerate nature of the genetic code**, this is the reason why certain mutations that may occur have no effect on the amino acid coded for, these are known as **silent mutations**.
- E** is correct - this is what occurs during mitosis, as the DNA present in the cell is replicated before the cell divides, thus any daughter cells resulting from the division will be **genetically identical**.

Since **B**, **C**, **D**, and **E** are the only correct statements, **A** must be the correct answer.

### 3 The answer is H.

- 1** is incorrect - both eukaryotic animal and plant cells contain a nucleus.
- 2** is correct - This is correct, DNA is **coiled** and stored in chromosomes, which are **long, thread-like** structures.
- 3** is incorrect - **Eukaryotic cells** contain **membrane bound organelles**, hence the DNA is always present in the nucleus. **Prokaryotic cells do not contain membrane bound organelles** and **no nucleus**, therefore the DNA is not present in the nucleus but it is **coiled into a loop** that floats in a cytoplasm in the **nucleoid**. So the area where the DNA is present in a prokaryotic cell is the nucleoid.
- 4** is incorrect - because the genome is **all the genetic material** that is found in **each and every cell of an organism**, not just the genetic information in one cell.
- 5** is correct - as DNA is an **extremely large polymer** and so it is made up of many **smaller subunits** that are called **monomers**, which are joined together by **chemical bonds**. The smaller subunit is a **single nucleotide** and the DNA molecule is a **polynucleotide**, made up of several nucleotides joined together.

Since **2** and **5** are the only correct statements, **H** must be the correct answer.



#### 4 The answer is C.

- 1 is correct - as DNA is made up of **several single nucleotides** joined together by chemical bonds, hence it is called a **polynucleotide**.
- 2 is correct - as a nucleotide is the single subunit that is used to make DNA. It contains **three components** and these are the: **a sugar (ribose), a phosphate and a nitrogenous base**.
- 3 is correct - the nucleotide subunit has three components, however the nitrogenous base can change and be either the **A, T, C or G** base. However the sugar and phosphate component of each nucleotide remains the same and a **sugar phosphate backbone** is formed.
- 4 is incorrect - it is true that there are **four different nitrogenous bases** in the DNA molecule however each nitrogenous base will always attach to the **same position on the sugar ring**, not different positions.
- 5 is incorrect - as a DNA molecule is made up of **two polynucleotide chains**, these are called **strands**.

Since **1, 2 and 3** are the only correct statements, **C** must be the correct answer.

#### 5 The answer is B

- 1 is correct - it is true that the DNA molecule is made up of **two strands** and these strands are held together by **hydrogen bonds between the nitrogenous bases**.
- 2 is correct - DNA has a **helical structure**, it is a **double helix**. This is because the two polynucleotide strands **twist** around each other in a helical/spiral shape. This allows the DNA to be **more compact**.
- 3 is correct - it is true that **adenine (A) always pairs with thymine (T)**, this is known as **complementary base pairing**. So whenever there is an adenine nitrogenous base on one strand it will bond with a thymine nitrogenous base on the other strand.
- 4 is incorrect - it is true that **hydrogen bonds** join the two strands together however they are **between the nitrogenous bases** not the sugars in the DNA molecule.
- 5 is correct - it is true that **two polynucleotide chains** will make up the DNA molecule.

Since **1, 2, 3 and 5** are the only correct statements, **B** must be the correct answer.

