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Level: HL IB in Biology
Subject: Biology
Topic: IB HL Biology
Type: Mark Scheme

All International Baccalaureate IB Topic Questions HL Biology

BIOLOGY

HL - IB

Key skills

Answer 1

C is correct because in a globular protein the hydrophobic amino acids are forced to the middle of the 3D structure because they are repelled by the surrounding water, whereas the hydrophilic amino acids are positioned so that they are outward facing, allowing the protein to be soluble in water.

A is incorrect because the water from peptide bond formation can form hydrogen bonds with amino acids but this wouldn't have a direct impact on the 3D shape of the protein.

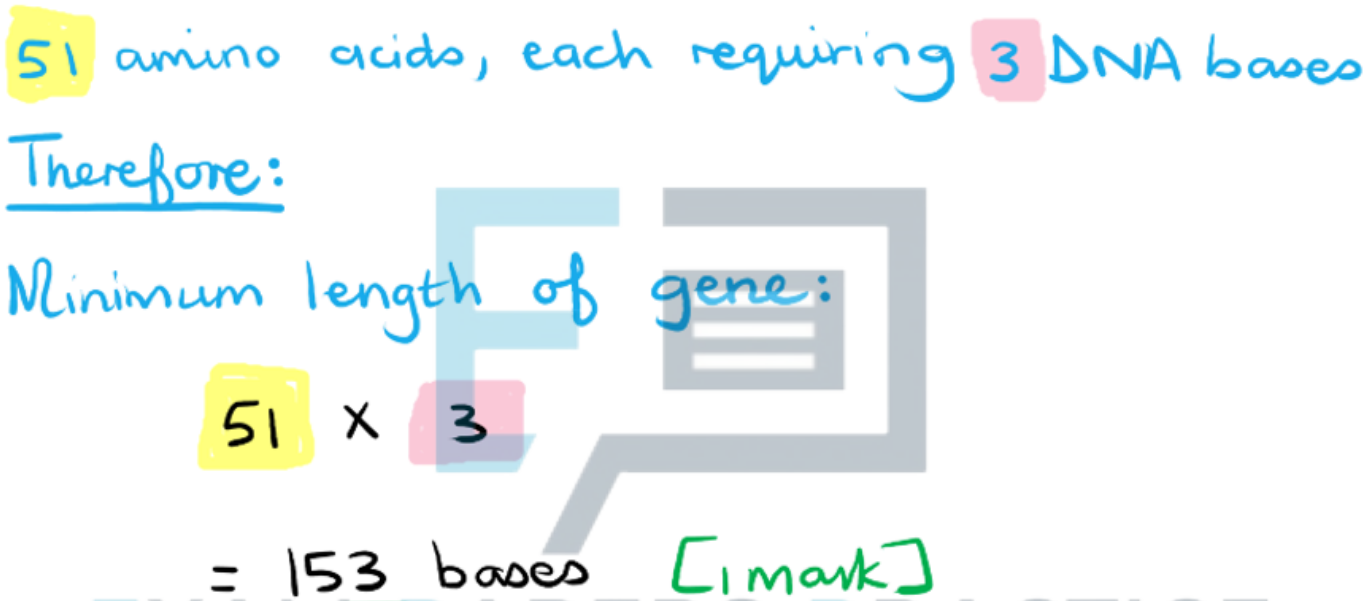
B is incorrect because bonding with other proteins doesn't affect how the globular protein initially forms. Bonding with other proteins may come later but also may not necessarily affect the 3D shape of the protein.

D is incorrect because the hydrophilic R groups are not repelled by the water, hydrophobic ones are.

Answer 2

The correct answer is D.

Each amino acid is coded for by three DNA bases. Therefore, if a polypeptide such as insulin consists of 51 amino acids, then it would require a minimum of 153 DNA bases.



Answer 3

The correct answer is A. Enzymes are functional proteins which will be folded into a specific shape with hydrophilic R-groups facing towards the outside (watery) environment.

B and D are incorrect as hydrophobic R-groups will tend to face towards the inside of the protein, away from the watery surrounding environment, while hydrophilic R-groups will face towards the outside of the protein.

C is incorrect as enzymes are not structural proteins.

Answer 4

The correct answer is D. Statement II, III and IV all describe changes that will occur when proteins denature due to the extremely low pH of the stomach contents.

Statement I is not correct for this example since body temperature is not high enough to cause the protein molecule to vibrate fast enough to break the intermolecular bonds.

Answer 5

The correct answer is B.

The more unfolded/denatured a protein is, the more unstable the molecule becomes. It is clear that protein R was less denatured (and therefore more stable) above 70°C compared to protein Q. The line representing protein R had a less steep gradient than that of protein Q, indicating a lower rate of denaturation (unfolding). It is clear that protein P was the least heat tolerant as it started to denature first and it was fully denatured before any of the other proteins.

Below 70°C protein R was more denatured (and therefore less stable) compared to protein Q. Since the line representing protein R had a less steep gradient than that of protein Q it indicated that protein R was denaturing at a lower rate than protein Q.

Answer 6

The correct answer is B. Proteins are essential for the survival of cells but cannot be expressed without the presence of a genome that contain the genes coding for proteins. Both the proteome and genome show slight variations between individuals of a species, which make it unique to each organism.

Statement II and IV only applies to the proteome, since the genome contains many genes that are not expressed in every cell at every moment in time. The proteins that are expressed provides a glimpse into the actual cell activity occurring at that moment. The genome of an organism will not change over time, while the proteome may vary depending on cell activities.

Answer 7

The correct answer is D. The diagram clearly shows the presence of α-helices and β-pleated sheets, which indicates that this is the secondary structure of proteins. These structures are stabilised by the presence of weak hydrogen bonds that form between the carboxyl group of one R-group and the amino group of another.

A is incorrect as the hydrogen bonds in the tertiary structure of a protein will form between amino acids with polar R-groups.

B is incorrect as triple helices form the structure of certain protein molecules such as collagen. They do not represent one of the levels of protein structure however, so do not confuse these with α-helices.

C is incorrect because this diagram does not represent the quaternary structure of proteins since only one of the polypeptide chains are shown and the question asks specifically about the structure of that chain.