

Becoming an Essay examiner: Task 1:

Essay title: How does the structure of proteins relate to their function.

Read through this essay example then answer the questions to help you understand how the examiner will apply the mark scheme.

Essay:

Proteins are really important to lots of different parts of biology, they are used in transport, enzymes, growth, repair and have different structures to match their functions. They are found in cells, enzymes inside cells, or can be found on the surface of cells, receptors or transport proteins. They are produced by the DNA in the nucleus and the information sent to the ER to be made.

- 1. Our DNA contains the code for our primary structure. The DNA is split into genes, a short section of DNA that codes for a protein. The DNA is arranged into triplets, 1 triplet codes for 1 amino-acid and the code can be degenerate which means more than 1 triplet code codes for 1 amino-acid. The triplets are converted into codons on the mRNA in a process called transcription which occurs in the nucleus. The mRNA then leaves the nucleus via the nuclear pore and attached to the ribosomes on the RER attracting the anti-codon on the tRNA to the codons on the mRNA. tRNA molecules carry specific amino-acid, when 2 amino-acids are brought together a condensation reaction occurs and a peptide bond is formed. The sequence of amino-acids are known as the primary structure.
The primary structure can then be sent from the ribosomes to the Golgi apparatus to be modified and packaged into a functional protein. The primary structure can be folded into a B-pleated sheet or an alpha helix which is held by hydrogen bonds.
The secondary structure can then be further folded into a specific 3D shape held by hydrogen, ionic and disulphide bridges between the R groups of the amino-acid. An amino-acid also contains an amine group and a carboxylic acid group.
The tertiary structure can then be joined to other protein chains to make a quaternary protein. An example of a quaternary protein is haemoglobin which is a 4 protein chains held in 3D shape and joined with an iron ion to which oxygen binds.*
- 2. Most enzymes are in the tertiary structure; their function is to reduce activation energy so metabolic reactions like condensation and hydrolysis can happen faster. This is known as the induced fit theory. When the substrate binds to the specific and complementary active site of the enzyme forming an ESC, the active site puts a strain on the bonds in the substrate meaning it will require less energy to break or make the bond converting the substrate into the product, an EPC. The product is no longer specific and complementary to the active site so is released. An example of this is in digestion. In the mouth the enzyme amylase is released from salivary glands to hydrolyse starch into maltose. Sometimes people are unable to digest lactose, which is a disaccharide, this can be because the enzyme doesn't have a specific and complementary active site shape to the lactose molecule. This may have occurred because of a mutation in the gene which has changed the primary structure, the folding of the secondary and tertiary structure.*
- 3. Proteins are also really important in the transport of large or soluble molecules (these are known as hydrophobic molecules), examples include ions, glucose and sucrose. If the molecule is small and polar, like ions, they can move through a channel protein from a high to a low concentration down a concentration gradient. Channel proteins have water through their middle which ions can travel down; this is an example of facilitated diffusion. If the molecule is polar and large they use carrier proteins. These are specific to 1 type of molecule and are also used in active transport. The large molecule binds to specific active site of the carrier protein which allows the carrier protein to change shape pulling the molecule from 1 side to the other side of the membrane. An example of this is glucose. This is an example of active transport as the molecules are moved from a low to a high concentration against a concentration gradient.*
- 4. Proteins are also really important in growth and repair. An organism grows or repairs itself using mitosis. There are 4 stages in mitosis- Prophase, metaphase, anaphase and telophase. In prophase the chromosomes appear because the DNA has supercoiled around histones and the 2 chromatids are held by the centromere. In metaphase the chromosomes line up along the equator, centrioles are producing spindle fibres which are attached to the*

centromere. In Anaphase the spindle fibres contract pulling the chromosomes apart to either pole of the cell. In telophase, the chromosomes uncoil and becomes invisible again. The cell splits into 2 cells.

Proteins are really important molecules because they are coded for by our DNA, their different structures mean they have different functions and makeup most of the structures in the cell and our bodies, like muscles.

Questions:

Tick which statement you think is most appropriate, use the marking grid to help you:

A01/Content:

Paragraph 1: Protein structure.

Contains some points which are detailed with appropriate use of terminology, perhaps 1 significant error/irrelevant detail.

Contains A-level content though lacks detail, generally uses A-level terms with some significant errors/irrelevant detail.

Contains superficial a-level terms but poorly explained and lacking in detail with significant errors/irrelevant detail.

Paragraph 2: Enzymes and digestion

Contains some points which are detailed with appropriate use of terminology, perhaps 1 significant error/irrelevant detail.

Contains A-level content though lacks detail, generally uses A-level terms with some significant errors/irrelevant detail.

Contains superficial a-level terms but poorly explained and lacking in detail with significant errors/irrelevant detail.

Paragraph 3: Membranes

Contains some points which are detailed with appropriate use of terminology, perhaps 1 significant error/irrelevant detail.

Contains A-level content though lacks detail, generally uses A-level terms with some significant errors/irrelevant detail.

Contains superficial a-level terms but poorly explained and lacking in detail with significant errors/irrelevant detail.

Paragraph 4: Mitosis

Contains some points which are detailed with appropriate use of terminology, perhaps 1 significant error/irrelevant detail.

Contains A-level content though lacks detail, generally uses A-level terms with some significant errors/irrelevant detail.

Contains superficial a-level terms but poorly explained and lacking in detail with significant errors/irrelevant detail.

Breadth: Overall the essay:

Essay contains several topics related to the question

Essay contains mostly suitable topics related to the question

Essay contains 1 or 2 topics related to the question

Flow: Overall essay:

Each paragraph makes clear links between topics

Essay links several topics to the question and forms a series of interrelated points between each paragraph which are clearly explained

Paragraphs are not interrelated.

A02/Application Linking to the theme of the question:

Each paragraph make clear links to the theme of the questions

Several of the topics are clearly linked o the main theme of the question

No links are made to the them of the question.

Read through which statements you have picked.

Decide which band this essay fits into. Decide which range of marks this essay would be awarded.

Remember this is a hierarchy so if you are ticking a statement in the lower groups eg unfocused, then this essay cannot be awarded any higher than this group.

21 – 25	Extended abstract Generalised beyond specific context	Response shows holistic approach to the question with a fully integrated answer which makes clear links between several different topics and the theme of the question. Biology is detailed and comprehensive A-level content, uses appropriate terminology, and is very well written and always clearly explained. No significant errors or irrelevant material. For top marks in the band, the answer shows evidence of reading beyond specification requirements.
16 – 20	Relational Integrated into a whole	Response links several topics to the main theme of the question, to form a series of interrelated points which are clearly explained. Biology is fundamentally correct A-level content and contains some points which are detailed, though there may be some which are less well developed, with appropriate use of terminology. Perhaps one significant error and, or, one irrelevant topic which detracts from the overall quality of the answer.
11 – 15	Multistructural Several aspects covered but they are unrelated	Response mostly deals with suitable topics but they are not interrelated and links are not made to the theme of the question. Biology is usually correct A-level content, though it lacks detail. It is usually clearly explained and generally uses appropriate terminology. Some significant errors and, or, more than one irrelevant topic.

6 – 10	Unistructural Only one or few aspects covered	Response predominantly deals with only one or two topics that relate to the question. Biology presented shows some superficial A-level content that may be poorly explained, lacking in detail, or show limited use of appropriate terminology. May contain a number of significant errors and, or, irrelevant topics.
1 – 5	Unfocused	Response only indirectly addresses the theme of the question and merely presents a series of biological facts which are usually descriptive in nature or poorly explained and at times may be factually incorrect. Content and terminology is generally below A-level. May contain a large number of errors and, or, irrelevant topics.
0		Nothing of relevance or no response.