2-hour sample exam

Instructions

Section A is mandatory. You must answer all of question 1 in section A.

In Section B, please answer any 2 questions.

SECTION A

(You must answer all parts in question 1; worth 40 marks)

Question 1

Please answer all of the following questions. All questions carry equal marks.

(a) Explain the role of SDS (sodium dodecyl sulphate) in SDS-PAGE (sodium dodecyl sulphate polyacrylamide gel electrophoresis).

(b) How much NaCl is required to make 250mL of a 0.2M NaCl solution (MW NaCl: 58.44)?

(c) How many microlitres are there in 2.8mL?

(d) In enzyme kinetics, what does V_{max} represent?

(e) Which amino acid participates in forming disulphide bonds? With an example, outline the role/importance of these bonds in protein structure.

(f) Describe where in the cell the following processes take place: Glycolysis, The TCA cycle (tricarboxylic acid cycle/Krebs cycle) and Oxidative Phosphorylation. Be as specific as you can.

(g) Explain the difference between competitive and non-competitive inhibition of enzymes. Use diagrams as part of your answer.

(h) Describe the following three terms in the context of proteins: “Native”, “Stable” and “Prosthetic Group”.

(Total 8 x 5 = 40 marks)

SECTION B

(you must answer two questions in this section; (2 x 30 = 60 marks))

Question 2

Glucose can be converted to Pyruvate in the cell by **Glycolysis**.

Describe each of the following

(a) the pathway of Glycolysis (12 marks)
(b) the points of regulation in the pathway (9 marks)
(c) the role of the cellular ATP/AMP ratio in Glycolysis. (9 marks)

Please use diagrams as part of your answer.

(Total = 30 marks)

Question 3

Advances in the world of biochemistry are often based on implementing certain techniques or applications in the laboratory. The separation, purification and analysis of proteins has been central to our understanding of cellular processes.

(a) Describe in detail the technique Gel Filtration/Size Exclusion Chromatography and the principle behind it. Include diagram(s) as part of your answer. (15 marks)

(b) How do you record and interpret results from using this technique? (10 marks)

(c) As a biochemist, what can this technique do for you? What is the relevance of performing it? (5 marks)

(Total = 30 marks)

Question 4

In **protein secondary structure**, polypeptide chains can fold into regular structures such as the Alpha Helix, the Beta Sheet and Turns/Loops. Answer **ANY 15** of the following twenty questions in **your answer book** (*only your first 15 answers will be corrected; Short answers/diagrams are all that is required).*

(a) How many amino acid residues are there per turn of an alpha helix?

(b) What is the distance of a turn in an alpha helix?

(c) List certain features that can prevent/disrupt the formation of an alpha helix in a protein.

(d) Name the bonds used to stabilise the alpha helix.

(e) Describe where these bonds are present in the alpha helix?

(f) Name a protein that contains an alpha helix.

(g) What direction is the helix in a protein's alpha helix – right or left?

(h) Discuss the positioning of R groups with respect to alpha helices.

(i) Which scientists were involved in the discovery of the alpha helix?

(j) What features do an alpha helix normally provide to a protein.

(k) What is a beta strand/sheet?

(l) How are they held together?

(m) Beta strands can occur in different directions….what is the name of the types/directions of beta strands/sheets. Please provide diagrams of each type of beta strand/sheet.

(n) Comment on the R groups of amino acids in beta strands.

(o) A beta turn has a _____degree angle.

(p) There are _____ amino acids in a beta turn.

(q) Hydrogen bonds are present in a beta turn between the _____ and _____ amino acid.

(r) There are _____types of beta turns – which is more prevalent?

(s) Name two amino acids regularly found in beta turns.

(t) Draw a sketch of each type of secondary structure mentioned in the above questions.

(15 x 2 marks)

(Total = 30 marks)