

Tuesday 5 June 2018

9 to 12

BIOLOGY OF CELLS - THEORY

Answer **Question 1** (Section A) **and three questions** from Section B.

Section A carries 33% of the marks and Section B carries 67% of the marks for this paper.

Write your examination number on each answer booklet cover.

Section A: put all short question answers from Question 1 into one or more 20 page answer booklets, tied up in a single bundle.

Section B: start a new 8 page answer booklet for each question and write the question number clearly on its cover. When using more than one answer booklet for a question, tie together the answer booklets containing parts of the same answer.

Yellow coversheet: enter the numbers of the 3 essay questions you answered from Section B and leave this loose on top of your pile of answer booklets.

STATIONERY REQUIREMENTS

Answer booklets (1 x 20 page and 3 x 8 page)
Yellow coversheet
Tags

SPECIAL REQUIREMENTS

Approved calculators allowed

<p>You may not start to read the questions printed on the subsequent pages of this question paper until instructed that you may do so by the invigilator.</p>
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SECTION A

(Answer all parts of Question 1. Each part carries equal marks. Suggested total time: not more than one hour. Lengthy answers are not required.)

Question 1

- (a) How can fluorescence microscopy be used to study the mobility of proteins in membranes?
- (b) Distinguish the roles of the cell membrane and the cell wall.
- (c) The directionality of nucleic acids is defined by their 5' and 3' ends. What do these numbers refer to, and how is this directionality important for the biological functions of polynucleotides?
- (d) Describe the structural differences between a β -strand and an α -helix, including the forces that stabilise these protein secondary structures.
- (e) Construct an annotated diagram of a channel protein to describe how its structure determines its function.
- (f) How do protein-pigment complexes in photosynthetic membranes allow efficient harvesting of light energy?
- (g) Discuss the importance of the fact that the hydrolysis of acetyl CoA has a standard Gibbs Free energy (ΔG°) of -31.4 kJ/mol.
- (h) Briefly discuss why the conversion of glucose to glucose 6-phosphate is an important regulatory step in glycolysis.
- (i) By reference to the results of Mendel's single factor crosses, justify his assertion that adult plants carry two copies of each gene.
- (j) Using a simple annotated sketch draw a bacterial DNA promoter region. Label and explain the location and function of the key elements within the promoter region.
- (k) Using a diagram to illustrate your answer, describe how to construct a genomic library of DNA from a higher eukaryote in bacteriophage lambda.
- (l) Explain the principle behind di-deoxy chain termination DNA sequencing (Sanger sequencing). Use diagrams to illustrate your answer.
- (m) Name the cyclin/CDK complexes involved in cell cycle progression in humans and state which stage they control.
- (n) What is quorum sensing?

- (o) Briefly describe an experiment that would address whether or not information, in the form of DNA, is lost as an embryo develops.

(TURN OVER)