

PRIMARY EXAMINATION

**BIOCHEMISTRY**

Tuesday, 4 December 2001

Time allowed: Two hours

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INSTRUCTIONS TO CANDIDATES

Question 1 in Section A is compulsory.

Answer **three** of the questions in Section B, including one from questions 5 & 6.

Use diagrams and formulae wherever possible.

Maximum marks: 80.

Please answer each of your four questions in a **separate** book.

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**Section A (20 marks)**

**This question is compulsory.**

1. Write short explanatory answers to **THREE** of the following questions:
  - (a) Describe the mechanism which causes oxyhaemoglobin to have a sigmoidal oxygen dissociation curve allowing tissues to be well supplied with oxygen under a variety of metabolic demands.
  - (b) A medically healthy patient announces that he is in the middle of a 72 hour charity fast. Explain what his metabolic state would be. Would it be safe to proceed with simple dental procedures?
  - (c) Another patient with a science background is concerned about the reactive oxygen species (ROS) which can be produced by a dental x-ray. Reassure her by describing the mechanisms which tissues use to protect themselves from these molecules.
  - (d) Saliva contains a variety of molecules which play a vital role in preserving dental health. Discuss three of these molecules.
  - (e) Which lipoprotein is considered protective against heart disease? Justify your answer by describing the biological function of this class of lipoproteins.

**Section B (60 marks)**

**Answer THREE of the following FIVE questions.**

**This MUST include at least one from questions 5 and 6**

2. Describe the structure, properties and biosynthesis of collagen, the main protein found in dentine. Describe briefly one of the other (non-collagenous) dentine proteins.
3. Methotrexate (MTX) is a potent inhibitor of the enzyme dihydrofolate reductase and is used in combination chemotherapy for the treatment of acute lymphoblastic leukaemia and breast cancer.



Write notes on 5 of the following 6 points.

- (a) How does MTX enter human cells and why is it retained inside?
  - (b) Why does MTX bind more tightly to the target enzyme, dihydrofolate reductase, than does the natural substrate, dihydrofolate?
  - (c) When MTX binds to dihydrofolate reductase, is the immediate effect accumulation of DHF or depletion of THF, or both? Provide a reason for your answer-
  - (d) Which reactions of purine and pyrimidine biosyntheses are inhibited in cells treated with MTX?
  - (e) What are the effects on the pools of deoxynucleotides (dNTPs)?
  - (f) Why do cells treated with MTX die?
4. Nutrition guidelines are put forward by various national health organisations. These may differ slightly between countries but the main messages are consistent. List 4 examples of dietary guidelines and explain the scientific basis behind each of them.
  5. It is now possible to chemically synthesis short pieces of DNA of around 20 nucleotides that can be used as "primers" and "probes". Discuss the uses of these reagents.
  6. What are monoclonal and polyclonal antibodies and what are their uses?

End of Paper