



**ROYAL AUSTRALASIAN COLLEGE
OF
DENTAL SURGEONS**
INCORPORATED
ABN 97 343 369 579

PRIMARY EXAMINATION

CELL BIOLOGY AND BIOCHEMISTRY

**Time allowed: 2 hours
Wednesday 30 November 2005**

INSTRUCTIONS TO CANDIDATES

**There are five Sections in this paper. Each section is worth 30 marks.
Candidates are required to complete the compulsory Section 1 and THREE (3) of the other four Sections. Each section must be answered in a separate booklet.**

SECTION 1

This section is compulsory and must be completed by all candidates.

A middle-aged woman of 57 years comes to your surgery for a check-up after a gap of two years. You notice that her oral health has deteriorated and that she has put on weight. On enquiry you discover that she weighs 67.5 kg and is 1.5m in height.

1. Define BMI. What is her BMI? 4 marks
2. This figure categorises her as being 1 mark
3. List four medical diseases for which she is at increased risk. Are any of these conditions likely to effect oral health? 4 marks

She also tells you that she has been diagnosed with osteoporosis.
On examination of the soft tissues of her mouth you notice that she has a magenta tongue with papillary hypertrophy and angular cheilitis.

4. Briefly describe the hormonal control of calcium plasma concentration. 6 marks
5. What nutritional deficiency is she likely to be suffering from? What is the metabolic function of this deficient nutrient? 5 marks
6. What nutritional advice would you give her? Which of the Dietary Guidelines for Australians” would you emphasise? 10 marks



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Answer THREE (3) of the following four sections.

SECTION 2

7. List the four phases in the cell cycle and give a short description of each. 5 marks
8. List the five stages of mitosis and briefly describe the processes occurring at each stage. 6 marks
9. Describe one example of faulty regulation of the cell cycle which can be a contributing cause of cancer. 6 marks
10. Describe the main molecular steps in apoptosis. 7 marks
11. How does a defect in apoptosis contribute to cancer. 6 marks

SECTION 3

12. Draw a diagram to illustrate the mechanism of action of a typical G-protein linked receptor and describe how it applies to the hormone adrenaline. Which biochemical pathways are stimulated by adrenaline? What is the rationale for including adrenaline in many local anaesthetic preparations? 15 marks
13. Describe the insulin receptor and discuss the short-term effects of insulin. How does glucagon oppose these effects of insulin? What are the consequences of insulin resistance? 15 marks



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SECTION 4

14. Describe the metabolic changes, which occur immediately after a meal and as fasting progresses to starvation. [A table showing the five phases of glucose metabolism may assist in answering this.] Draw a diagram showing the metabolic situation in prolonged fasting. This should indicate glucose, fat and protein metabolism and the metabolic relationship between the major tissues. 20 marks
15. Describe how the pentose phosphate pathway plays a role in antioxidant defence and in phagocytosis. How are the reactive oxygen species produced and what protective mechanisms are present? 10 marks

SECTION 5

16. Draw a diagram of a typical human gene, indicating all the functional elements. 6 marks
17. Describe how a human gene is transcribed and processed to form mature and functional mRNA. Diagrams may be useful in your answer. 12 marks
18. Describe in general the processes involved in using a bacteria to produce therapeutic amounts of a human protein such as insulin. 12 marks

~End of paper~