

University of Canterbury

End of Year Examinations 2007

Prescription Number(s):	BCHM 201
Paper Title:	Biochemistry 1

Time Allowed: 2.5 HOURS

Number of pages: SIX
2 pages of diagrams

This paper is in **TWO** sections:

Section A: Answer **THREE**
questions out of **FOUR**;

Section B: Answer **ONE** question
out of **TWO**.

All questions are of equal value

TURN OVER

SECTION A

(Answer any **THREE** questions from this section.)

You should refer to the diagrams describing the Krebs' cycle and glycolytic pathway as appropriate (see separate sheet provided).

1. Suppose you are a biochemist working in a well equipped laboratory. You are supplied with a complete experimental system with which to culture bacteria, equipment to analyse their metabolites, and pyruvate labelled with ^{14}C at all 3 carbon atoms.
 - (a) (10 marks)

Describe how you would use the labelled pyruvate to discover the fate of the three carbon atoms. Include in your answer the structures of each of the metabolites that are labelled and the ratio of labelled to non-labelled compounds in each case.
 - (b) (5 marks)

Describe some of the metabolic fates of the labelled metabolites when they leave the Krebs' cycle.
 - (c) (5 marks)

How would your answer to (b) change if the experiment was carried out with plant cells rather than bacterial cells?

2.
 - (a) (5 marks)

Using your knowledge of the mechanism of triose phosphate isomerase, suggest a mechanism for the reaction catalysed by phosphoglucose isomerase.
 - (b) (10 marks)

Describe experiments that you would carry out to test your mechanistic proposal in part (a). You may assume that the X-ray crystal structure of the enzyme is available, with a substrate analogue bound.
 - (c) (5 marks)

Does triose phosphate isomerase catalyse a regulated step in the glycolytic pathway? Why (not)?

TURN OVER

3. Followers of the Atkins' diet produce different metabolites to those on a normal diet. Specifically, they enter a state known as ketosis and generate ketone bodies, including acetone, which can be found in the breath.

(a) (10 marks)

It has been suggested that generation of ketone bodies is related to weight loss. Briefly outline the metabolic principles on which this theory is based.

(b) (5 marks)

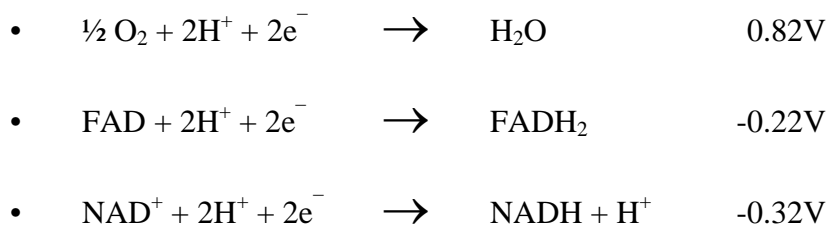
Other researchers claim that ketosis does not induce weight loss. Instead, they believe that weight loss is due to the appetite suppressing effects of protein. How would you test this theory? Make sure that you design an experiment with appropriate controls.

(c) (5 marks)

Proponents of the appetite suppression theory hypothesise that the mechanism of appetite suppression involves ammonia circulating in the bloodstream. Design an experiment to test this theory.

4. The respiration electron transport chain facilitates the transfer of electrons from NADH and FADH₂ to molecular oxygen.

Standard reduction potentials, ϵ_0' , for some relevant reactions are given below:



- (a) (5 marks)

What do the values tell you about the ΔG for the electron transfers? How relevant are these figures to *in vivo* conditions?

- (b) (5 marks)

Why does the cell invest in such complicated machinery to facilitate electron transfer, rather than transfer electrons directly?

- (c) (10 marks)

How does the cell convert energy from the electron transfer processes into a form useful for metabolism?

SECTION B

(Answer any **ONE** question from this section.)

5. (20 marks)

Describe, in detail, the mechanism by which electrons are transported through the cytochrome complex of the thylakoid membrane.

6 (20 marks)

Describe how the anatomy and biochemistry in C4 plants enables them to preserve water and thus grow in hot environments.

END OF PAPER

Diagrams for Section A

