QUEEN'S UNIVERSITY

FACULTY OF ARTS AND SCIENCE

SCHOOL OF KINESIOLOGY AND HEALTH SCIENCE

KNPE 225

FINAL EXAMINATION

DEC 18, 2010

PROF. Brendon Gurd

INSTRUCTIONS: This examination is THREE HOURS in length. No aids are allowed. Please answer all questions in the space provided on the exam paper.

Answer booklets have been provided for the purposes of rough work and must be handed in with your finished exam.

Put your student number on **all pages** of your exam. GOOD LUCK!

PLEASE NOTE: "Proctors are unable to respond to queries about the interpretation of exam questions. Do your best to answer exam questions as written."

1. a) What is the generic equation for flow? (2 marks)

b) Re-write the equation for flow as it applies to each of the following: (6 marks)

i. blood flow from an artery to a vein

ii. the reaction catalyzed by pyruvate dehydrogenase

iii. fatty acid transport into a muscle

2. Cardiac output is controlled by a combination of heart rate (HR) and stroke volume (SV).

a) List the factors that control HR. (2 marks)

b) SV is determined by preload, afterload and cardiac muscle contractility.

i. List the factors that determine preload (3 marks)

ii. What is the primary determinant of cardiac muscle contractility? (1 mark)

3. Following space flight astronauts suffer from orthostatic intolerance. With regards to acute control of MAP what are the 2 main causes of this intolerance? (2 marks)

4. HR is controlled by feedback and feedforward control. Answer the following questions VERY BRIEFLY using point form.

i. Name a drug that could be used to prove the existence of feedforward control of HR. (1 mark)

ii. Explain why this drug would effectively demonstrate feedforward control. (2 marks)

iii. Provide a bar graph that demonstrates the existence of feedfoward control of HR (2 marks)

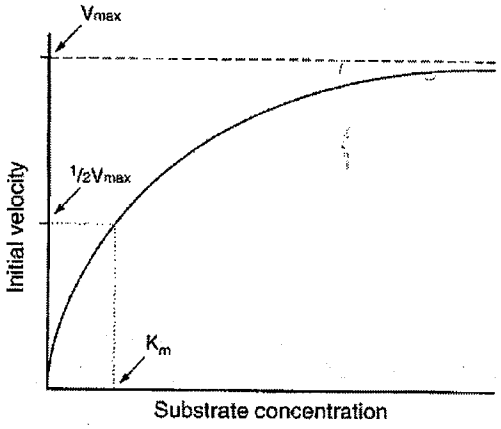
5. Ventilation is controlled by 3 main groups of neurons located in the respiratory centre. List these three groups of neurons providing the main role of each in the control of ventilation. (6 marks)

6. List the three factors that control renal sodium excretion. (3 marks)

7. List the 4 main types of hypertension discussed in class. (4 marks)

8. List any enzymes that were discussed in class and that would demonstrate an increase in activity following an increase in intracellular Ca^{2+} concentration. (4 marks)

9. A Michaelis-Menton Kinetic plot for a given enzymatic reaction demonstrates the rate that the reaction will proceed at for a given substrate concentration. An example of plotted michaelis-menten kinetics is given below.



i. Provide a graph that demonstrates the effects of enzyme activation on michaelis-menten kinetics. (2 marks)

ii. Provide a graph that demonstrates the effect a competitive inhibitor would have on michaelis-menton kinetics. (2 marks)

10. List the 3 potential rate limiting steps in fatty acid metabolism. (3 marks)

11. List the 4 causes of fatigue discussed in lecture that are improved during exercise following training. (4 marks)

12. Following the start of muscle contraction there is an immediate fall in MAP. Provide a flow chart that demonstrates the sequence of events that leads from increased oxygen consumption within the mitochondria of contracting muscle to a fall in MAP. (6 marks)

13. An increase in HR is an important step in maintaining MAP following the disturbance outlined above. Provide a flow chart that demonstrates the events leading from a decrease in MAP to an increase in HR. Also include in your flow chart how an increase in HR would contribute to a return of MAP to homeostatic levels. (6 marks)

14. CO_2 is a potent stimulant of ventilation. Provide a flow chart that demonstrates how an increase in CO_2 content in the blood would lead to stimulation of central chemoreceptors and ventilation and a subsequent return of blood CO_2 content to homeostatic concentrations. (8 marks)

15. A high salt diet is a leading cause of hypertention. Provide a flow chart demonstrating how a single high salt meal would lead to an acute increase in MAP. (8 marks)

16. A transition from high intensity exercise to low intensity exercise is accompanied by a decrease in acetyl CoA concentration. Provide a flow chart that demonstrates why a decrease in exercise intensity leads to a decrease in acetyl CoA. (7 marks)

17. Accompanying a decrease in acetyl CoA there would also be an increase in fatty acid metabolism following the transition from high to low intensity exercise. Provide a flow chart that demonstrates how a decrease in acetyl CoA would lead to an increase in fatty acid metabolism. (4 marks)

18. Following an acute bout of exercise transcription is elevated following activation of PGC-1α by both feed forward (Ca^{2+}) and feedback (AMP) control. Provide a flow chart that illustrates how both Ca^{2+} and AMP lead to an activation of PGC-1α and what happens to PGC-1α following activation that leads to increased transcription. (6 marks)

19. Regulation of blood glucose is accomplished through storage and mobilization of fuel in response to increased concentrations of specific hormones in blood.

a) Following ingestion of carbohydrate there is an increase in uptake of blood glucose in several tissues of the body. Provide a flow chart that demonstrates the events that lead to an increase in glucose uptake being sure to indicate which tissues are involved during the post-ingestion period. (6 marks)

b) During periods of starvation stored fuel is mobilized resulting in maintenance of blood glucose. Provide a flow chart that demonstrates the events triggered by a fall in blood glucose that result in mobilization of stored fuels. Be sure to indicate the tissue(s) that are important for increasing blood glucose and the metabolic pathways responsible for increased mobilization. (5 marks)