FACULTY OF SCIENCE

DEPARTMENT OF ZOOLOGY

MODULE	**ZOO3B01 / ZOO33B3** (COMPARATIVE ANIMAL PHYSIOLOGY)
CAMPUS	**APK**
EXAM	**THEORY EXAM PAPER 1**

ASSESSOR(S)	**Dr M. Bird / Mrs S. Dahms-Verster**
INTERNAL MODERATOR:	**Prof B. Jansen van Vuuren**
EXTERNAL MODERATOR:	**Prof C. Simon**
DURATION:	**3 Hours**
MARKS:	**100**

NUMBER OF PAGES: SEVEN (including cover page)

INSTRUCTIONS:

- **Answer ALL questions from sections A, B and C.**
- **<u>Please answer SECTION C in a separate booklet</u>**

SECTION A: Multiple Choice [15 marks]

1) While working outside on a hot day the wind blows against the sweat on your skin making you feel cooler. This is most likely due to heat loss through…

a. conduction.
b. convection.
c. evaporation.
d. radiation.
e. metabolism.

2) Heat shock proteins…

a. are also known as stress proteins.
b. are hydrophobic proteins.
c. are attracted to hydrophobic amino acids normally located on the inside of folded proteins.
d. are also called molecular chaperones.
e. all of these.

3) Vasoconstriction helps an animal retain heat by…

a. generating heat through the metabolic activity of the vascular musculature.
b. causing piloerection, which increases the amount of air (a poor thermal conductor) trapped next to the skin.
c. directing blood away from the body surface, avoiding the transfer of heat from the blood to the environment.
d. causing the skin of the animal to blanch, increasing the ability of radiant energy to penetrate to the animal's core.
e. none of these.

4) The advantage of shivering over other forms of muscle activity (like running) as a means of thermogenesis is that…

a. shivering increases ATP use and heat production without increasing heat loss due to convection.
b. with shivering all the energy expended is released as heat since no work is done.
c. shivering increases ATP use and heat production without increasing heat loss due to conduction.
d. shivering increases ATP use and heat production without increasing heat loss by either convection or conduction.
e. all of these.

5) The hematocrit is…

a. the packed hemocytes found in hemolymph.
b. the packed red blood cells only.
c. the packed white blood cells only.
d. the total packed cell volume of blood.
e. the total volume of oxygen carried in the blood.

6) The middle, muscular portion of the heart wall is referred to as the…

a. endocardium.
b. myocardium.
c. myometrium.
d. endometrium.
e. myoma.

7) Which statement about desmosomes is NOT true?

a. They hold cells together under high mechanical stress.
b. They are located in intercalated discs.
c. They are found in vertebrate hearts.
d. They conduct electrical impulses between cardiac cells.
e. all of these are true.

8) The problem of electrical discontinuity caused in the normal heart by the connective tissue separating the atria from the ventricles is solved by…

a. having the A-V node function as a secondary pacemaker.
b. having an ectopic pacemaker.
c. coordinating electrical activity in the atria with electrical activity in the ventricles by connecting them via the vagus nerve.
d. coordinating electrical activity in the atria with electrical activity in the ventricles by connecting them via the bundle of His.
e. coordinating electrical activity in the atria with electrical activity in the ventricles by connecting them via the Purkinje fibers.

9) The movement of which two ions is responsible for maintaining the plateau phase of the action potential of contractile cardiac muscle cells?

a. Na^+ and Cl^-
b. Na^+ and K^+
c. K^+ and Cl^-
d. Ca^{2+} and Na^+
e. Ca^{2+} and K^+

10) Which of the following normally functions as the main pacemaker of the heart?

a. the atrioventricular node
b. the sinoatrial node
c. the Purkinje fibers
d. the node of Ranvier
e. the bundle fibers

11) An increase in heart rate is accompanied by…

a. an increase in L-type Ca^{2+} channel activity.
b. an increase in K^+ flux through voltage-gated K^+ channels.
c. an increase in the passive movement of Na^+ into cells of the SA node.
d. an increase in the passive movement of K^+ out of cells of the SA node.
e. a combined increase in passive movement of Na^+ and K^+ out of the cells of the SA node.

12) The P wave of an ECG represents…

a. the contraction of the atria.
b. the contraction of the ventricles.
c. the depolarization of the ventricles.
d. the depolarization of the atria.
e. the repolarization of the ventricles.

13) In a normal ECG, no separate wave is detected for atrial repolarization because…

a. the amount of atrial tissue is too little for the current to be detected by the ECG electrodes.
b. the time period between atrial depolarization and repolarization occurs too rapidly.
c. atrial repolarization and ventricular depolarization are simultaneous, and the expected wave is masked by the QRS complex.
d. none of these.
e. all of these.

14) At the onset of ventricular diastole, the A-V valves close as a result of…

a. higher pressure in the atria relative to the ventricles.
b. higher pressure in the ventricles relative to the atria.
c. higher pressure in the arteries (pulmonary and aorta) relative to the ventricles.
d. higher pressure in the venae cavae relative to the atria.
e. contraction of the small muscles which attach to the valves.

15) Ventricular systole includes the periods of…

a. isometric contraction and ventricular ejection.
b. isovolumetric contraction and ventricular ejection.
c. isometric contraction and end-systolic volume.
d. isovolumetric contraction and end-systolic volume.
e. none of these

SECTION B [35 marks]

Question 1

Discuss the digestion and absorption of fats by the vertebrate small intestine.

[12 marks]

Question 2

Describe the process followed by the intrinsic and extrinsic clotting pathways to achieve blood clotting (for a generalised mammal), with a brief description of the roles of the key factors and enzymes (i.e. you do not need to list every single factor, but explain the noteworthy ones).

[10 marks]

Question 3

Discuss the role of the spleen, kidneys and bone marrow in erythrocyte regulation in mammals.

[7 marks]

Question 4

Describe three types of heterothermy and provide an example of each.

[6 marks]

SECTION C [50 marks]

Question 1

How does the endocrine control of metamorphosis differ between frogs and insects?

[10 marks]

Question 2

Compare the contraction of skeletal and smooth muscle on a molecular level.

[8 marks]

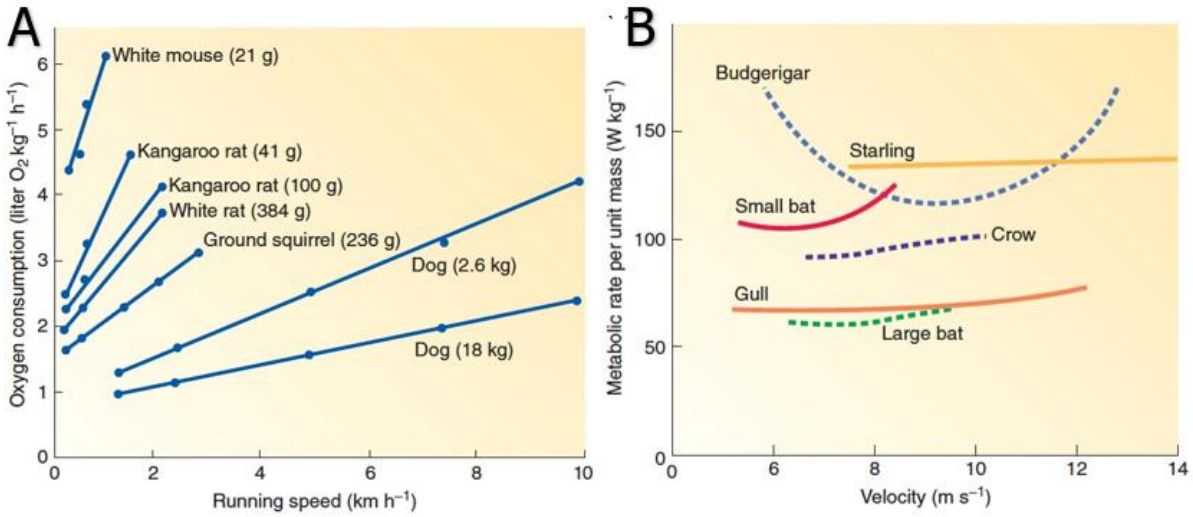
Question 3

Comprehensively discuss the differences between graded potentials and action potentials in the nervous system of a kangaroo rat.

[16 marks]

Question 4

Discuss the metabolic rates of the running terrestrial mammals (A) and flying birds and bats (B) depicted in the figures below as they pertain to locomotion speed.



[6 marks]

Question 5

Aquaman is a superhero that can live in both a terrestrial and marine environment. He can breathe underwater, is well adapted for swimming and can maintain marine and terrestrial diets. Discuss the hypothetical physiology of the superhero Aquaman from a metabolic and fluid balance perspective.

[10 marks]

—100 MARKS—

TOTAL