GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

PHYSIOLOGY HG

TIME: 3 hours

FEB / MAR 2006

MARKS: 300

INSTRUCTIONS:

- The question paper consists of THREE Sections.

  SECTION **A**: 90
  SECTION **B**: 160
  SECTION **C**: 50

- Answer ALL questions in Sections **A** and **B**.
- You have a choice in Section **C**: Answer **either** Question 6 **or** Question 7.
- Answer Question **1A** (multiple-choice questions) on the **answer sheet** on the **inside cover** of your **answer book**.
- Number your answers in accordance with the question paper.

SECTION A

Answer ALL the questions in this section.

QUESTION 1A
MULTIPLE-CHOICE QUESTIONS

Four possibilities are given as answers to each of the following questions. Indicate the correct answer, by marking the relevant letter with a cross (**X**) on the **answer sheet** on the **inside cover** of your **answer book**.

EXAMPLE: Saliva is secreted in the _____ .

A. mouth
B. oesophagus
C. stomach
D. duodenum

ANSWER:

A	**B**	**C**	**D**

1.1 Which one of the following statements is true?

A. There is an unlimited amount of ova.
B. Both ovaries secrete an ovum during the menstrual cycle.
C. The primary oocyte is already present in a girl at birth.
D. Ova are secreted during the lifetime of a woman.

1.2 There is no glucose in the urine of a healthy person but still the amount of glucose that leaves the kidney is less than the amount that enters the kidney. This can be explained because some of the glucose is _____ .

A. converted to urea in the kidney
B. reabsorbed by the wall of the bladder
C. converted to glycogen by the kidney and stored
D. used by the cuboidal epithelial cells during cellular respiration

1.3 Damage to the dendrites of a motor neuron in the reflex arc will likely prevent the _____ .

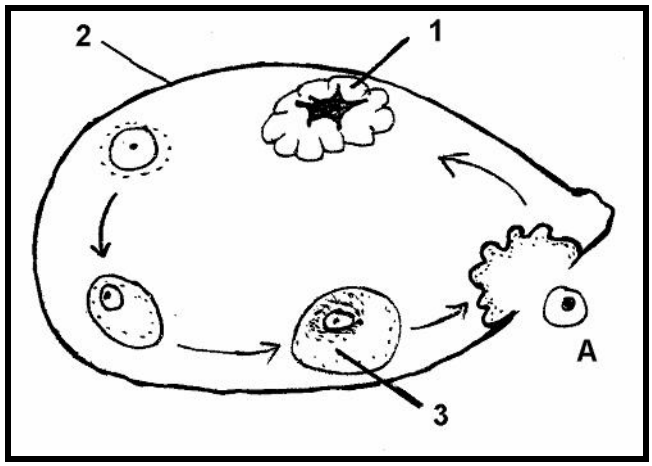
A. conduction of an impulse to the central nervous system
B. conduction of an impulse to the effector organ
C. synaptic connection with a sensory neuron
D. receptor from receiving a stimulus

1.4 A blind person who reads Braille, is dependant on the sensitivity of his _____ .

(i) Nociceptors
(ii) Meissner's corpuscles
(iii) thermoreceptors
(iv) proprioceptors

A. Only (ii)
B. Only (i)
C. (ii), (iii) and (iv)
D. (iii) and (iv)

Questions 1.5 and 1.6 refer to the diagram below.



1.5 The process that occurs at **A** is _____ .

A. spermatogenesis
B. degeneration
C. ovulation
D. menstruation

1.6 Which one of the following combinations is correct?

A.	1 = Primary oocyte	2 = Graafian follicle	3 = Ovary
B.	1 = Corpus luteum	2 = ovary	3 = Graafian follicle
C.	1 = Corpus luteum	2 = Fallopian tube	3 = Blastocyst
D.	1 = Antral cavity	2 = ovary	3 = Corpus luteum

1.7 Which one of the following is **NOT** an endocrine gland?

A. Testis
B. Liver
C. Pancreas
D. Neuro hypophysis

1.8 Which of the following homeostatic processes restore homeostatic balance when an athlete sweats excessively during strenuous physical activity?

A. Insulin is secreted which converts glucose to glycogen.
B. The loop of Henlé reabsorbs more salt.
C. The kidneys excrete diluted urine.
D. ADH is secreted which promotes reabsorption of water.

1.9 The presence of myelin allows an axon to _____ .

A. produce more frequent action potentials
B. conduct impulses more rapidly
C. slow down conduction of impulses
D. use more energy while conducting impulses

1.10 The Malpighian body, gland of Bowman, Malpighian Layer and capsule of Bowman are found respectively in the _____ .

A. skin, nephron, skin and nephron
B. nephron, nephron, skin and skin
C. nephron, nose, skin and kidney
D. kidney, ear, nephron and kidney

1.11 One of the most important factors that determines the influence of tissue fluid in cells, is _____ .

A. temperature
B. active enzymes
C. a shortage of cholesterol
D. the hormonal balance

1.12 Which one of the following does not have a stimulating effect on the sweat glands?

A. Fever
B. Oxidation during cellular respiration
C. High humidity
D. Stress

1.13 The primary pigments contained in the epidermis is/are _____ .

A. creatine and melanin
B. melanin
C. sebum and cerumen
D. vitamin D and melanin

1.14 Reduced fluid secretion by the kidneys due to the retention of **Na^+** and water is a result of the action of _____ .

A. the antidiuretic hormone
B. calcitonin
C. aldosterone
D. cortisone

1.15 Table 1.15: The concentration (in g/100 cm^3 fluid) of urea, glucose and protein of blood plasma in the renal artery and in urine.

	UREA	GLUCOSE	PROTEIN
Blood plasma of Renal artery	0,03	0,10	8,00
Urine	3,00	0,00	0,00

The concentration (in g/100 cm^3 fluid) of the three components in the blood plasma of the renal vein would be:

	UREA	GLUCOSE	PROTEIN
A.	0,03	0,10	8,00
B.	0,00	0,10	8,00
C.	0,00	0,00	8,00
D.	3,00	0,00	0,00

Questions 1.16 and 1.17 are based on the following diagram:

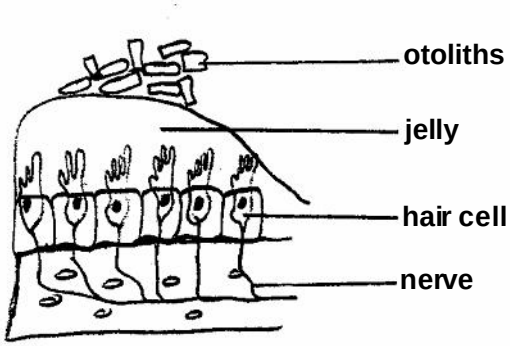


Figure 1.16: Receptors in the inner ear.

1.16 In which part of the human body can these receptors be found?

A. In the mucus membrane of the turbinate bone.
B. In the ampulla of a semicircular canal.
C. In the utriculus and sacculus of the inner ear.
D. In the V-formation at the back of the tongue.

1.17 For which stimulus is the receptor sensitive?

A. Movement of the head
B. Position of the head
C. Tastes in soluble form
D. Odours in a gas form

1.18 Which one of the following is found in the dorsal root ganglion?

A. A connector neuron
B. Dendrites of the motor neuron
C. Cell body of the motor neuron
D. Cell body of the sensory neuron

1.19 Which statement regarding the peripheral nervous system is correct?

(i) The peripheral nerves originate in pairs from the brain and spinal cord.
(ii) One has 12 pairs of cranial nerves.
(iii) One has 33 pairs of spinal nerves.
(iv) The spinal nerves are mixed nerves.

A. (i), (ii) and (iii)
B. (i), (ii) and (iv)
C. (i), (iii) and (iv)
D. (ii), (iii) and (iv)

1.20 Which ONE of the following in the human body is **not** under homeostatic control?

A. pH
B. Colour vision
C. Body temperature
D. Blood pressure

1.21 What is the physical process called that takes place when someone warms his/her hands by holding a steaming cup of coffee?

A. Radiation
B. Convection
C. Conduction
D. Evaporation

1.22 The arbor vitae is found in the _____ .

A. cerebellum
B. cerebrum
C. medulla oblongata
D. hypothalamus

1.23 The last ten spinal nerves that originate from the spine at lumbar 4 level and proceed down as a bunch of nerves in the vertebral canal, are called _____ .

A. Macula lutea
B. Helikotrema
C. Cauda equina
D. Arbor vitae

1.24 An important element in the forming of thyroxine is _____ .

A. water
B. sodium
C. calcium
D. iodine

1.25 One of the following statements is **not** a possible cause of conductive deafness.

A. Excessive cerumen
B. Chronic middle ear infection
C. Degeneration of auditory nerve
D. Immobility of auditory ossicles

1.26 When the adenohypophysis of a growing child is underdeveloped, the child will more or less have symptons of _____ .

A. acromegaly
B. a dwarf with retarded sexual development
C. reaching puberty earlier than normal children
D. possible constant dehydration

1.27 The phenomenon that the eye can adapt in bright light, is best explained by the fact that _____ .

A. rhodopsin does not function in dim light
B. bright light stimulates the iris to contract
C. the splitting of rhodopsin takes place slowly
D. rod cells that were exposed to bright light, takes a while to form rhodopsin again

1.28 The graph below shows the urine volume excreted by a person who drank 1 000 cm^3 distilled water. The person's urine was collected before drinking water and thereafter every half an hour over a period of four hours.

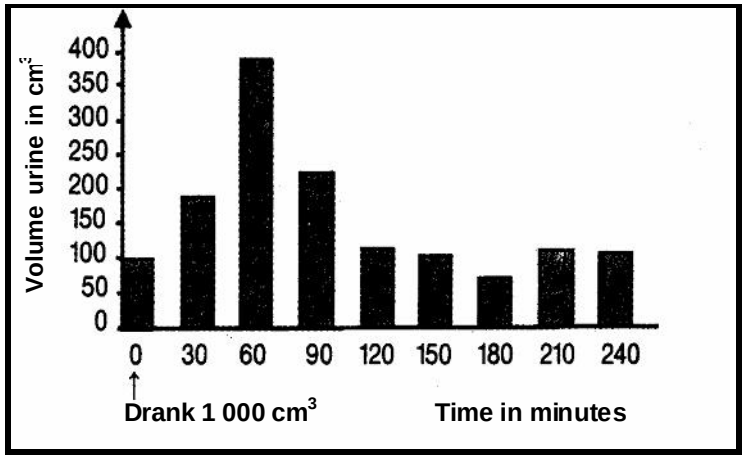


Figure 1.28: Graphic representation of the urine volume excreted over a period of 4 hours.

How long did it take the production of urine to reach the normal volume for this person?

A. 1 hour
B. 2 ½ hours
C. 3 ½ hours
D. 4 hours

1.29 Which one of the following is a secretion of the epithelial cells lining the kidney tubules?

A. Ammonia
B. Ammonium
C. Urea
D. Creatinine

1.30 Which two of the following substances are regulated to remain constant in tissue fluid during osmoregulation?

(i) Proteins
(ii) Water
(iii) Salts
(iv) Lipids
(v) Blood sugar

A. (i) and (ii)
B. (ii) and (iii)
C. (iii) and (iv)
D. (ii) and (v)

30x2= **(60)**

QUESTION 1B

Give the correct **physiological** term for each of the following descriptions.

1.31 The protective membrane lining the eyelids

1.32 A self-regulating control mechanism whereby a deviation from the norm of any factor is corrected by bringing about a change in the opposite direction

1.33 The heat regulating centre in the brain

1.34 The process when the circular muscles of the dermal arterioles widen

1.35 An eye defect that leads to wearing glasses with lenses specially grounded to eliminate the irregularities of the cornea or lens

1.36 The enlarged, upper end of the ureter that divides into calyces

1.37 Cells that sense changes in the environment.

1.38 Groups of ribosomes in the cytoplasm of the cell body of a neuron, which are involved with protein synthesis

1.39 Lack of muscle co-ordination due to damage to the cerebellum

1.40 The centre of the yellow spot in the retina of the eye (10)

QUESTION 1C

Each of the following questions consists of two items in the first column (numbered 1 and 2) and a statement in the second column.

Consider which item(s) relate to the statement.

A = if only item **1** relates to the statement.
B = if only item **2** relates to the statement.
C = if both items **1** and **2** relate to the statement.
D = if neither item **1** nor **2** relate to the statement.

	ITEMS	STATEMENTS
1.41	1. Pancreas 2. Testis	Endocrine and exocrine function
1.42	1. Iodopsin 2. Rhodopsin	Pigments in the choroids of the eye
1.43	1. Cochlea 2. Vestibular apparatus	Are found in the inner ear
1.44	1. Krause's end bulbs 2. Meissner's corpuscles	Mechanoreceptors

1.45	1. Ethmoïd bone 2. Turkish saddle	Are found in the nose
1.46	1. Cretinism 2. Acromegaly	Hypersecretion of somatotropic hormone in adults
1.47	1. Hypersecretion of cortisone 2. Hyposecretion of insulin	Leads to high blood sugar levels and glucose in the urine
1.48	1. Gastrin 2. Cholecystokinin	Hormone that stimulates the pancreas
1.49	1. Corpus luteum 2. Corpus spongium	Special spongy tissue in the penis
1.50	1. Muscular tissue 2. Sense organs	Differentiate from the mesoderm during embryonic development

(10)

QUESTION 1D

Study the table below. Write the question numbers, one below the other, in your **answer book**. Indicate with arrows (?, ?) the effect of these hormones in the **blood plasma level** of the mentioned substances, e.g. 1.61 ?.

? = level in blood plasma increases ? = level in blood plasma decreases (10)

Hormone	Ca	Na	H_20	Amino acids	Glucose
Somatotropin				1.51	
Cortisone				1.52	1.53
Parathormone	1.54				
Insulin					1.55
Aldosterone		1.56	1.57		
Vasopressin (ADH)			1.58		
Adrenalin			1.59		1.60

TOTAL FOR SECTION A: [90]

SECTION B

Answer ALL questions in this section.

QUESTION 2

2.1 Study the graph below and answer the questions that follow.

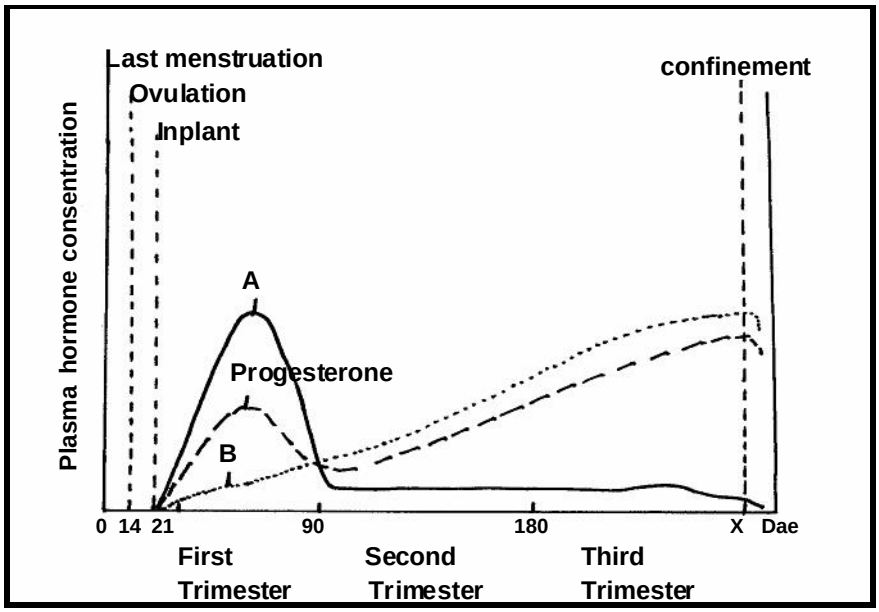


Figure 2.1 Hormone levels during pregnancy

2.1.1 How many days is represented by **X**? (1)

2.1.2 What do you understand by the term **trimester**? (1)

2.1.3 Name hormone **A** that is secreted during the early stages of pregnancy. (1)

2.1.4 Hormone **B** functions with progesterone to promote cyclic changes in the endometrium.

a) Give the name of hormone **B**. (1)
b) How will the build-up of hormone **B** during pregnancy affect the hypophysis? (2)

2.1.5 Explain the progesterone-curve on the graph from implantation till delivery. Indicate the effect on the rest of the body. (6)

2.1.6 Which other hormone, also secreted by the placenta, is **not** shown on the graph? (1)

2.2 Draw a neat, labelled diagram of a cross-section through the part of the inner ear that is responsible for converting sound stimuli to nerve impulses. (12)

2.3 In the table below, the human eye is compared to a camera. Complete the table by only writing down the numbers with their corresponding answers, e.g. (i) – protects the eye.

Table 2.3: Comparison between an eye and a camera

Camera	Eye	Functions
Opening	Pupil	(i)
Diaphragm	(ii)	Regulates the amount of light
Lens	(iii)	(iv)
Film	(v)	(vi)
Camera box (inside camera)	(vii)	(viii)

(8)

2.4 Draw a neat, labelled schematic representation of the phase of oogenesis **from birth to fertilization**. (7)

(40)

QUESTION 3

3.1 What are the following called?

a) Structural unit of the nervous system
b) Functional unit of the nervous system
c) Tissue binding and supporting the nervous system (3)

3.2 Name functional differences between the afferent and efferent fibre of a unipolar neuron. (2)

3.3 The delicate tissues of the brain are protected by various structures, the fluid in the ventricles, among others.

3.3.1 Discuss the different brain ventricles and their relation to one another. (10)

3.3.2 Name the fluid present in the ventricles. (1)

3.3.3 Briefly discuss the functions of the fluid mentioned in Question 3.3.2. (5)

3.4 Draw a neat, labelled diagram of the cerebrum to show the different lobes with their functional areas. (14)

3.5 Briefly describe how an excessive amount of CO_2 can influence the pH of the blood. (5)

(40)

QUESTION 4

4.1 Study **Figure 4.1** and answer the questions that follow.

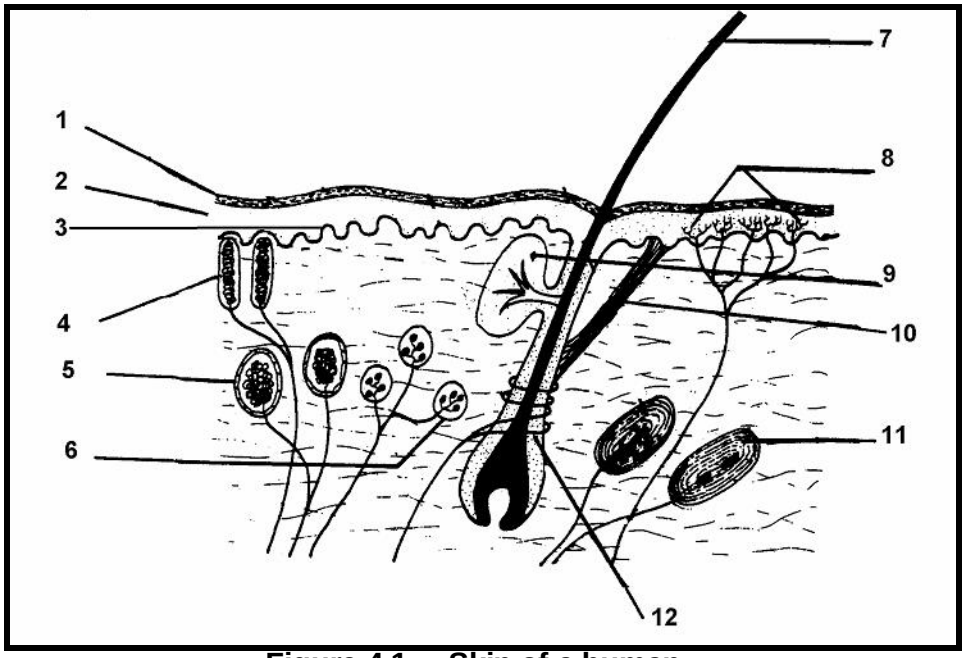


Figure 4.1 Skin of a human

4.1.1 Label structures **3**, **5**, **6** and **9**. (4)

4.1.2 Which number contains the protein keratin and what is the main function of this layer? (3)

4.1.3 Why is the Malpighian layer important? (3)

4.1.4 Give the number and name of the receptor organs which are sensitive to ____ .

a) a paper cut
b) a big hug from a loved one
c) tickling (6)

4.1.5 Describe the action that will occur at number **10**, when there is a sudden fall in external temperature. (5)

4.1.6 Name the protein present in number **7**. (1)

4.1.7 Which number if blocked, can result in a so-called black head? (1)

4.1.8 What is normal body temperature and what will happen if this temperature decreases too much? (3)

4.2 List ONE function of the skin that was not mentioned in Question 4.1. (1)

4.3 Study the graph below and answer the questions that follow.

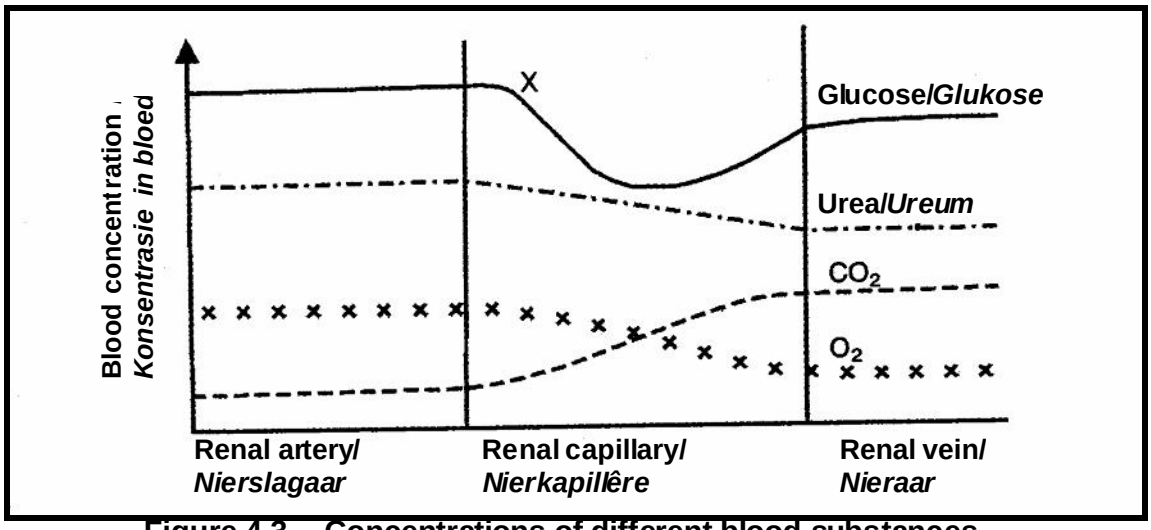


Figure 4.3 Concentrations of different blood substances

4.3.1 The concentration of blood glucose lowers at **X** and recovers later in the renal vein. Explain this curve completely by referring to the function of the nephron. (10)

4.3.2 During which process, in the nephron, will there be a lowering in the oxygen concentration and a rise of the carbon dioxide (CO_2)-concentration, as seen in the renal vein? (1)

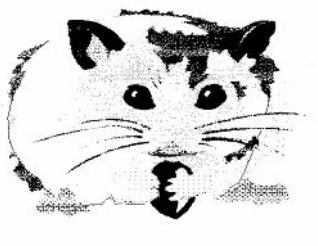
4.3.3 Why is the urea concentration lower in the renal vein? (2)

(40)

QUESTION 5

5.1 The effects of medicine or the absence of certain substances in the human body is frequently monitored by the use of laboratory rats subjected to similar circumstances.

The effect of thyroxine from a thyroid gland on white laboratory rats with similar mass and age is experimentally tested. Three groups of three rats each were used. These groups were treated as follows:



Group A: This group received a normal diet **plus** thyroid extract.
Group B: This group received a normal diet.
Group C: This group received a normal diet but their drink water contained a diluted solution of "thiourasil" which **inhibits** thyroxine production.

The oxygen consumption of each rat was measured while sleeping. The results are projected in the table below.

Table 5.1 Oxygen consumption of three groups of rats		
Oxygen Consumption (cm^3g^{-1} body mass u^{-1})		
Group A	**Group B**	**Group C**
2,86	1,85	1,36
2,93	1,86	1,31
2,74	1,68	1,42

5.1.1 Name THREE functions of thyroxine which are also present in humans. (3)

5.1.2 Why was each group's oxygen consumption monitored? (1)

5.1.3 Name another substance consumed together with 0_2. (1)

5.1.4 Is the process that takes place during this experiment, catabolic or anabolic? Substantiate your answer. (4)

5.1.5 Which group's oxygen consumption was the lowest? (1)

5.1.6 Explain the oxygen consumption between groups **A** and **C**. (6)

5.1.7 If the rats in each group consumed the same quantity of food, which group will, according to you, increase in weight? Give a reason for your answer. (4)

5.1.8 If a similar situation is found among children

(i) what is this abnormality called? (1)
(ii) what are the symptoms of such a child? (2)

5.1.9 Which group of rats will produce the smallest amount of thyroid stimulating hormone (TSH)? (1)

5.1.10 The appearance and behaviour of the rats also differed. Rats from group **A** were stretched out and their ears and feet were pink. Explain this phenomenon. (4)

5.2 Discuss briefly the journey of a nerve impulse from the breakdown of photo-pigments in the retina of the eye by light energy, until the sensation of vision is experienced. (10)

5.3 What do you understand by the term **acromatosis**? (2)

(40)

TOTAL FOR SECTION B: [160]

SECTION C

Answer Question 6 **or** Question 7.
If both questions are answered, only the first one will be marked.

QUESTION 6

"About 400 million sperm are formed daily in the body of a healthy adult male. Various liquids feed, transport and ensure that the sperm reaches the ovum, fertilize it and results in a successful pregnancy."

Discuss the above statement under the following headings:

6.1 The human being has the most advanced reproductive system (5)
6.2 Spermatogenesis (15)
6.3 Journey of the sperm from the testes to the Fallopian tube including transport and feeding of it (25)
6.4 Feeding of the zygote till the second month of pregnancy (5)
(50)

OR

QUESTION 7

7.1 Carefully read the following article and answer the questions that follow.

PROMOTION: PROSIT

Winter is synonymous with aches, mostly a nasty cold, and a time of year during which one's body feels tired. Prosit contains more than 250 active biological components which cleanse and build up the body to a higher level.

Contrary to other products which are either an anti-oxidant or a detoxin, Prosit is a unique combination of both. Free radicals are unstable molecules that are formed in the body during metabolism. In the past, our food provided us with more anti-free radicals or anti-oxidants that provide protection, than is the case today in our modern society, thus the ideal antidote for viruses, causing colds, is lacking. Vegetables and fruit normally provide more protection. The sun causes external photochemical-formed free radicals in the skin, which can cause cancer.

Free radicals or oxidants can be responsible for a multitude of illnesses which cause damage to the immune system and then resistance against infections and germs is broken down completely. With the use of Prosit capsules, the body is first cleansed and then built up. Prosit has shown fantastic results during the last few years, concerning the following conditions: circulation problems, spastic colon, constipation, digestion problems, osteo-arthritis, stress, low libido, cholesterol, high blood sugar, low blood pressure, ulcers, winter feet, sinus, headaches, lower back pain and haemorrhoids.

Prosit fights cholesterol by lowering the presence of it in the blood. It prevents the hardening of the blood vessels which cause heart-related illnesses. It is very effective for bad blood circulation, therefore the chances for varicose veins and winters feet are slimmer.

Many cases of lowering of blood sugar have also been reported. Many women with low blood pressure now have normal blood pressure while using Prosit.

Prosit is available at chemists, selected health stores and wholesale dealers.

Adapted from: *Beeld Plus* Friday 27 June 2003

7.1.1 What do you understand by the term **free radicals**? Mention TWO ways in which free radicals originate in the human body. (3)

7.1.2 How were these free radicals eliminated in the past? (1)

7.1.3 What is the effect of free radicals on the immune system? (1)

7.1.4 Mention THREE results from using Prosit capsules in the last few years. (3)

7.1.5 Under normal circumstances, which part of the brain controls the libido? (1)

7.1.6 Mention another FOUR functions of this part of the brain. (4)

7.1.7 Prosit helps to stabilise low blood pressure in women.

a) What do you understand by **low blood pressure**? (1)

b) Explain the role of the nephron during the regulation process of low blood pressure. (12)

7.1.8 Discuss how the proximal convoluted tubule of the nephron is adjusted for tubular reabsorption. (8)

7.2 Mention TWO sexually transmitted diseases to which a person with a weakened immune system is susceptible. (2)

7.3 Give TWO functions of acquired reflexes. (2)

7.4 Explain briefly how the body regulates high blood sugar in the blood plasma. (12)
(50)

TOTAL FOR SECTION C: [50]

TOTAL: 300

END