SENIOR CERTIFICATE EXAMINATION

FEBRUARY / MARCH

2007

PHYSIOLOGY

HG

307-1/0 E

PHYSIOLOGY HG

307 1 0E HG

20 pages

X05

GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

PHYSIOLOGY HG

TIME: 3 hours

MARKS: 300

INSTRUCTIONS:

- The question paper consists of THREE Sections:

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

- In Sections **A** and **B,** all questions are COMPULSORY.
- Answer ONE question from Section **C**.
- Answer Question 1 (multiple-choice questions) on the **answer sheet** on the **inside cover** of your **answer book**.
- Provide all labels with corresponding numbers.
- Number your answers in accordance with the question paper.

SECTION A
COMPULSORY

QUESTION 1
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:

X A	B	C	D

1.1 The outer ear can become chronically infected by bacteria. If this happens, a sticky liquid may ooze from the ear. This liquid is called _____ .

A. sebum
B. cerumen
C. perilymph
D. pus

1.2 Which of the following glands will be active if a person is under situations of sudden stress or danger?

A. Pancreas
B. Thyroid
C. Adrenal gland
D. Pituitary gland

1.3 Which of the following is a secretion of the epithelial cells in the renal tubule?

A. Ammonia
B. Urea
C. Sodium chloride
D. Albumin

1.4 The receptors that receive information from the body, e.g. from muscles and tendons are _____ .

A. corpuscles
B. proprioceptors
C. free nerve endings
D. pain receptors

1.5 Which one of the following organs interprets a specific impulse from the taste buds as sweet or sour?

A. Association area of the cerebrum
B. Cerebellum
C. Medulla oblongata
D. Temporal lobe in the sensory area

1.6 An unknown object touches the conjunctiva of the eye. Which one of the following will be the correct pathway of the impulse?

A. Motor neuron → synapse → sensory neuron → effector → receptor
B. Receptor → sensory neuron → synapse → motor neuron → effector
C. Sensory neuron → receptor → motor neuron → effector → synapse
D. Effector → sensory neuron → synapse → motor neuron → receptor

1.7 TSH is produced by the _____ to stimulate the cells of the _____ to secrete more thyroxine.

A. neurohypophysis; thyroid
B. hypothalamus; thyroid
C. adenohypophysis; thyroid
D. adenohypophysis; parathyroid

1.8 The control system for thermoregulation is situated in the _____.

A. corpus callosum
B. hypothalamus
C. medulla oblongata
D. Varolii pons

1.9 The functional structure of the kidney is the _____.

A. nephron
B. neuron
C. axon
D. reflex arc

1.10 In which of the following structures will you find endocrine tissue?

(i) Medulla of the kidney
(ii) Islets of Langerhans
(iii) Liver
(iv) Testis

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

1.11 When entering a dark room from a brighter outside, you won't be able to focus on specific objects. Only after a while you will be able to identify objects in the dark. This is a result of the time it needs for the _____ .

A. pupil to dilate more
B. rhodopsin in the rod cells to form again
C. accommodation of the eye
D. impulse to reach centre of sight in the brain

1.12 A reflex action is an action that _____ .

A. is automatic and a reaction on an external stimulus
B. is caused by hormones
C. is controlled by the brain
D. can only be acquired by repetition and learning

1.13 Which of the following is NOT an effector organ?

A. Skeletal muscles
B. Meisner's corpuscles
C. Salivary glands
D. The iris of the eye

1.14 Which one of the following will occur when you read a book and then look up to focus on a mountain in the distance on a bright sunny day?

A. The radial muscles of the iris contract
B. The pupil dilates
C. The ciliary muscles relax
D. The lens becomes thicker and more convex

1.15 To remove a nail from your foot, you need to balance yourself on your other foot. You will be able to do this through the work of the following structures:

(i) Cerebellum
(ii) Hypothalamus
(iii) Semi-circular canals
(iv) Proprioceptors

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

1.16 With which of the following is the term **afferent** associated?

A. Venule
B. Axon
C. Uretra
D. Arteriole

1.17 Active reabsorption usually occurs _____.

A. in the Malpighian body
B. against a concentration gradient
C. without using energy
D. as a result of high pressure in the capillaries

1.18 The hormone secretin stimulates the _____.

A. stomach to release gastric juice
B. duodenum to release intestinal juice (succus entericus)
C. pancreas to release pancreatic juice
D. salivary glands to release saliva

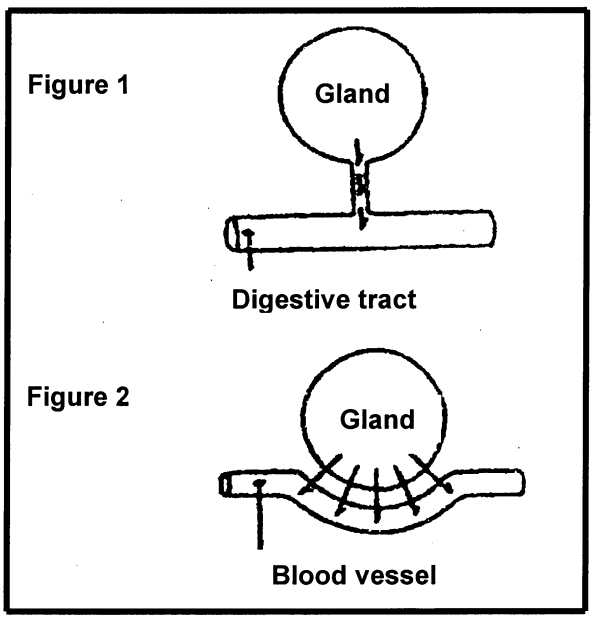
Questions 1.19 and 1.20 refer to the following diagrams.

1.19 **Figure 1** is an example of _____.

A. a salivary gland
B. a pituitary gland
C. an adrenal gland
D. the hypothalamus

1.20 **Figure 2** is an example of _____ gland.

A. an intestinal
B. lymph
C. an exocrine
D. an endocrine



1.21 Urochrome is a waste product in the urine. It is formed from the _____.

A. deamination of amino acids
B. deamination of glutamine
C. haemolysis of erythrocytes
D. breakdown of nucleic acids

1.22 In the diagram below of the umbilical cord, the diagram is _____.

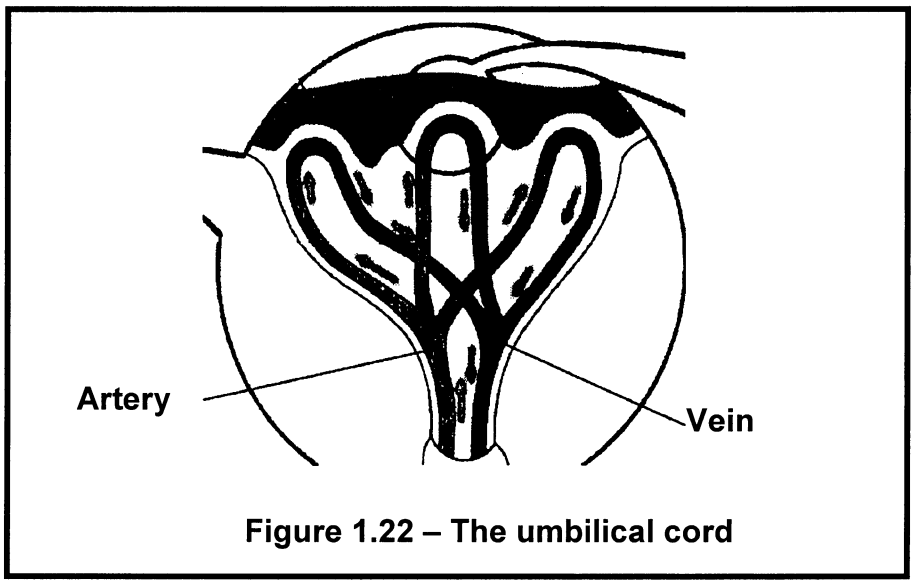


Figure 1.22 – The umbilical cord

A. correct because it is made up of one vein and one artery
B. false because it should be made up of one vein and two arteries
C. false because it should be made up of two veins and one artery
D. false because it should be made up of two veins and two arteries

1.23 Gray matter consists of _____.

A. cell bodies of neurons
B. axons of neurons
C. nissl granules
D. receptors

1.24 During which stage in a woman's life will the secondary oocytes **develop** in the ovaries?

A. Menopause
B. Puberty
C. Foetal life
D. After fertilization

1.25 Which sexually transmitted disease has the following symptoms? Yellowish discharge drip from the penis and vagina, burning sensation during urination, genital pains and an abdominal uneasiness.

A. Syphilis
B. Genital herpes
C. Chlamydia
D. Gonorrhoea

2x25= **(50)**

QUESTION 2

Each of the following statements is FALSE but can be correct by changing **one WORD**. Redraw the following table in your answer book and write down the incorrect word in **Column A** and the corrected word in **Column B.**

	Column A (incorrect word)	Column B (correct word)
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		
2.10		

2.1 The renal artery contains the purest blood in the body.

2.2 Sweat is considered to be a secretion as it cools our bodies by radiation of sweat.

2.3 The cells of Schwann secrete a fatty substance called myosin.

2.4 The outer, cornified layer of the epidermis of the skin contains the protein melanin.

2.5 Deamination is the breakdown of the enzyme structure.

2.6 Motor neurons are unipolar neurons which conduct impulses towards effectors.

2.7 The unconscious activities of the body are controlled by the somatic nervous system.

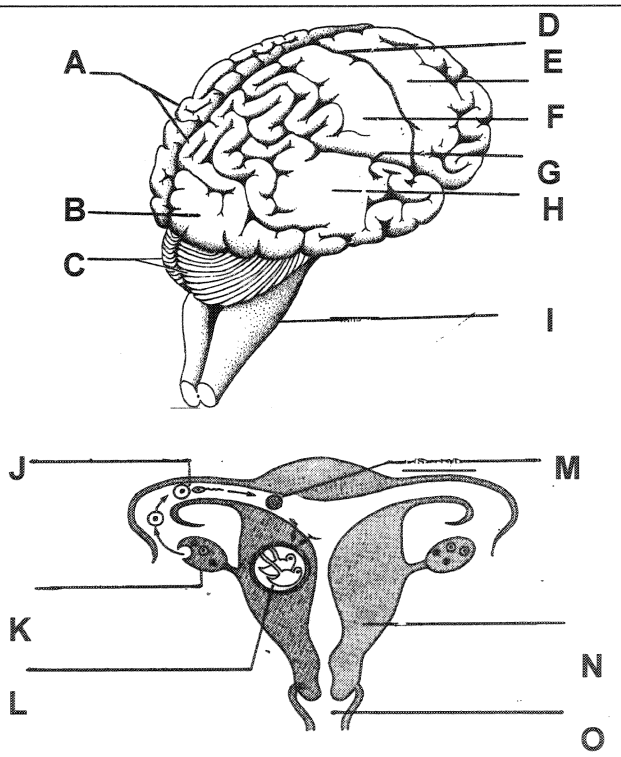
2.8 Impulses are able to travel across synapses as neurotransmitters are secreted by the dendrites.

2.9 Alcohol is anti-diuretic, resulting in the excretion of increased amounts of diluted urine.

2.10 The nitrogenous waste compound, urea, is formed in the kidneys. 10x2= **(20)**

QUESTION 3

Match the **characteristic/function/label** in **Column A** with the **numbered parts** in the diagrams in **Column B**. Write **ONLY** the correct letter next to the corresponding number in your answer book, e.g. 3.6 P. Write each answer on a new line.

COLUMN A	COLUMN B
3.1 Impulses from the dendrites of the vestibular nerve are sent to this **part** of the brain 3.2 Impulses from the olfactory nerve cells are processed below this **fissure** 3.3 Enlarges the surface of the brain 3.4 This **structure** is stimulated by prostaglandins of semen that cause reverse peristalsis 3.5 The morula	

5x2= **(10)**

QUESTION 4

Study the diagram below.

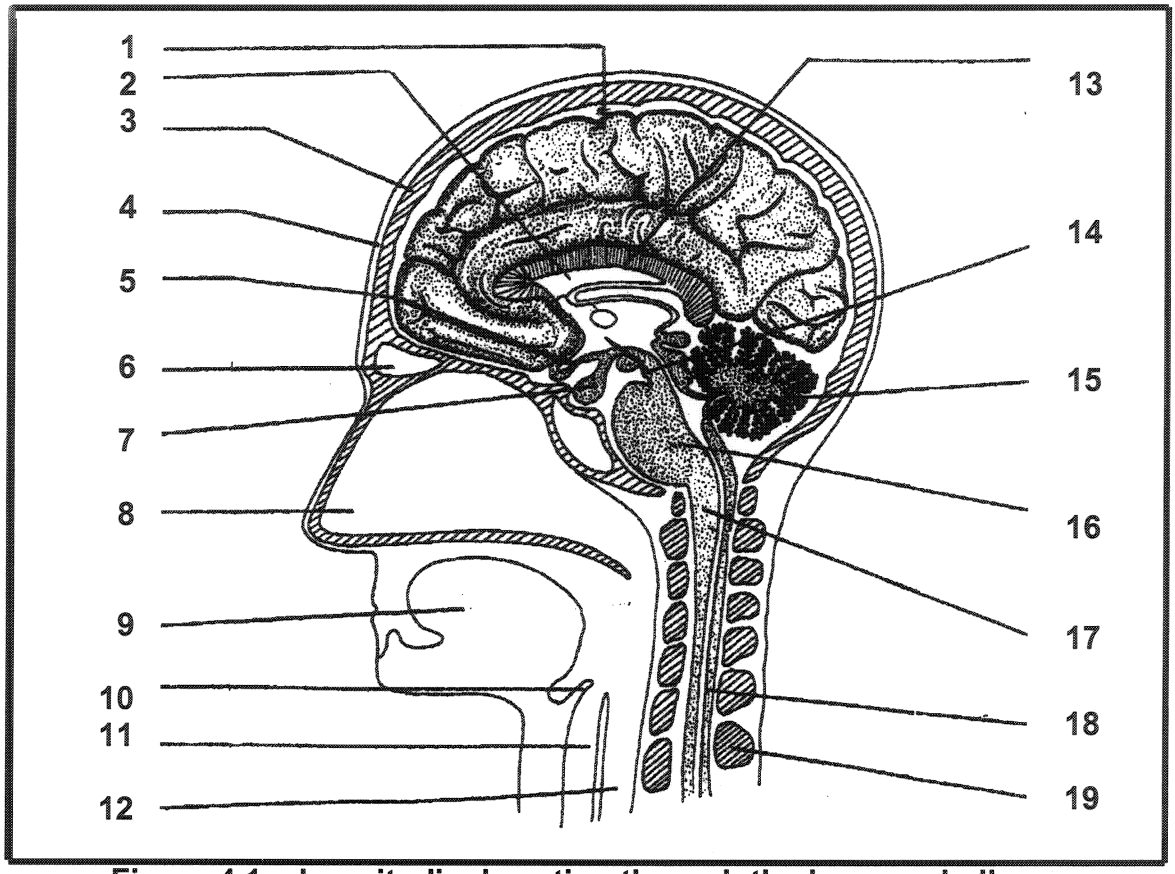


Figure 4.1 – Longitudinal section through the human skull

Write only the **number** from the diagram next to the corresponding description in your answer book, e.g. 4.11 – 20.

4.1 Connects the two hemispheres with one another.

4.2 The central canal

4.3 The Eustachian tube opens here.

4.4 The section around the brain in which we find cerebrospinal fluid (CSF).

4.5 This part is infected during meningitis.

4.6 The third brain ventricle

4.7 If this part is damaged, one will be connected to a heart and lung machine.

4.8 Interpret the impulses from the maculae and cristae

4.9 Chemoreceptors are found in this area.

4.10 Controls the secretion of the luteinizing hormone

(10)

TOTAL FOR SECTION A: [90]

SECTION B
COMPULSORY

QUESTION 5

5.1 Study the following diagram and answer the questions that follow.

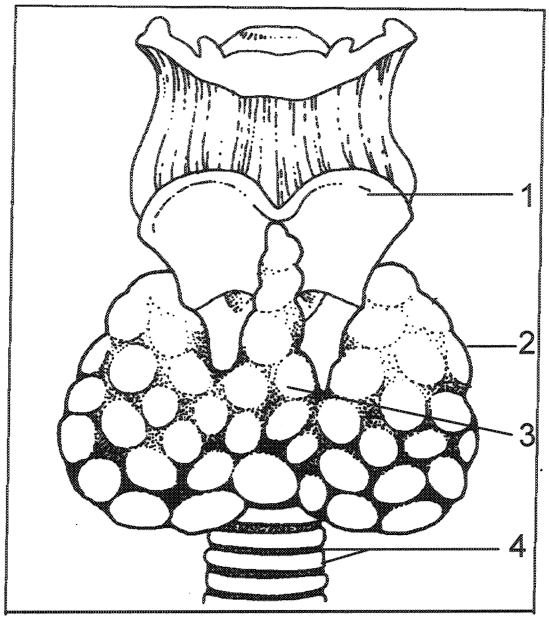


Figure 5.1 – An endocrine gland

5.1.1 Identify the endocrine gland numbered **2**. (1)

5.1.2 Identify the **structures** numbered **1**, **3** and **4**. (3)

5.1.3 Draw a neat, labelled diagram of the **internal structure** of the thyroid gland. (5)

5.1.4 Name TWO hormones secreted by this gland as well as their functions. (4)

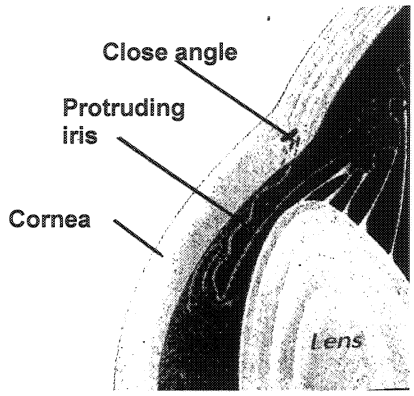
5.1.5 Discuss **hypothyroidism** in children and adults. (8)

5.2 Read the following paragraph on closed angle glaucoma then answer the questions that follow.

Close Angle Glaucoma

Angle-closure glaucoma is a much rare, but very severe, acute form of glaucoma, since it can cause blindness in 12 to 48 hours if not treated. It results from poor access to the drainage system in the eye because the angle between the iris and the cornea narrows, blocking the drainage of the aqueous humor.

This sudden increase in pressure inside the eye causes intense pain, nausea, haloes and rainbows around lights and blurred vision. If your opthalmologist suspects that you have glaucoma, you should go for a pressure measurement. An increase in the pressure of the aqueous humor can damage the retina and optic disc.



From: *The Eastern*, May 2004.

5.2.1 What causes closed angle glaucoma? (4)

5.2.2 Name TWO symptoms of this eye disease. (2)

5.2.3 Give the term for an eye specialist. (1)

5.2.4 Give a synonym for **optic disc** in the last line. (1)

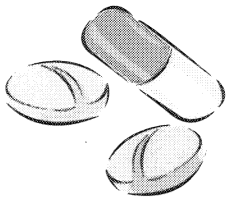
5.2.5 Which other liquid is found in the inside of the eye? (1)

5.2.6 Draw a neat, labelled diagram of a cross-section of the front part of the eye and include the LENS. (10)
(40)

QUESTION 6

6.1 Read the text below and answer the questions that follow.

ECSTASY USE IN SOUTH AFRICA
"DANCE WITH DEATH"



Worldwide, an estimated 4,5 million people use Ecstasy.

Ecstasy was used as an eating suppressor for soldiers during World War I. In 1993 it was illegally imported to South Africa from the Netherlands and Great Britain.

Thousands of young South Africans use this stimulant and it is available as a white tablet or a speckled tablet or a multi-coloured capsule. It is sold under the names, "Love", "Dove", "Smarties", "Disco Biscuit" and they are freely available at night clubs, bars and "rave" parties.

- Ecstasy is usually administered orally and less frequently inhaled or inserted anally. It is rarely used intravenously.
- Ecstasy stimulates the release of the neurotransmitters serotonin and dopamine, resulting in a "high" that can last between four to six hours.

This amphetamine drug has severe effects: An increase in heart rate, body temperature and blood pressure, nausea, jaw clenching and a dry mouth.

People that suffer from diabetes, seizures, asthma and depression and use Ecstasy will enhance these diseases. Large doses can lead to hallucinations in teenagers.

No alcohol is allowed at many raves – FANTASTIC – it seems – but they sell "smart drinks" that are supposed to replace lost minerals and liquids in the body. These drinks actually only increases the Ecstasy-high because it is fruit juice or mineral water with vitamins and caffeine (also a stimulant).

This stimulant causes chronic dehydration and therefore the user will drink lots of these energy drinks that lead to further kidney damage.

Freely translated and adapted from: *http://www.sahealthinfo.org/admodule/ecstasy.htm.*

6.1.1 Why was **Ecstasy** used for the first time? (1)

6.1.2 (a) Name THREE harmful effects of Ecstasy on humans. (3)

(b) Where in the brain are the above effects controlled? (2)

6.1.3 After using Ecstasy, "ravers" will have lots of ENERGY as a result of the effect of this drug on the endocrine function of the pancreas. Explain. (5)

6.1.4 (a) What is the meaning of **intravenous**? (1)

(b) Name TWO other neurotransmitters that you know and which are not mentioned in this article. (2)

(c) One often sees ravers with lollipops or dummies in their mouths while dancing at a "rave" party. This is to prevent one of the effects of Ecstasy. What word from the article, confirms this statement? (1)

6.1.5 (a) How does a doctor know a person is a diabetic? (1)

(b) With what does such a person injects himself? (1)

(c) What is the purpose of the injection? (1)

6.1.6 Explain the homeostatic control in the kidney when a "raver" loses too much water through sweating. (10)

6.2 6.2.1 Define **puberty**. (1)

6.2.2 Discuss in detail the endocrine function of the **adenohypophysis** to initiate puberty in girls as well as in boys. (7)

6.3 Differentiate between the main functions of the **sympathetic** and **parasympathetic** nervous systems. No examples are necessary. (4)
(40)

QUESTION 7

7.1 Urine is formed by the nephrons from blood, and sweat is excreted from the blood by the sweat glands. The table below compares the concentrations of different substances of a person's normal blood plasma, urine and sweat. The average urine production is 1,5 litres per day and the average sweat produced is 0,5 litres per day. In hot conditions, as much as 5 litres sweat can be lost in a day.

Table 7.1 – Substances in the blood plasma, urine and sweat

Substance	(A) Blood plasma (g/100 ml)	(B) Urine (g/100 ml)	(C) Sweat (g/100 ml)
Water	95	92	60
Protein	9,0	0	0
Glucose	0,1	0	0
Urea	0,03	2,0	0,3
Sodium chloride	0,6	1,2	0,3

7.1.1 Why is protein not a substance in the urine and sweat? (2)

7.1.2 Name the substance in urine and sweat that contains nitrogen. (1)

7.1.3 Briefly explain the difference in concentrations of the urea in **A** and **C**. (2)

7.1.4 What conclusion can you make if the figure for glucose in **B** was 0.03ml? (2)

7.1.5 When the glomerular membrane is damaged, which substance's concentration will increase? (1)

7.1.6 (a) What percentages of the water in the blood plasma will be excreted by the urine and sweat respectively? (2)

(b) What conclusion, on environmental temperature, can you make as a result of your answer in Question 7.1.6 (a)? (1)

7.2 *Celanie is washing dishes. A very slippery plate slides from her hands; just before it falls and breaks, she catches the plate with a sigh of relief.*

7.2.1 Name and define the action that took place here. (3)

7.2.2 Draw a neat, labelled diagram of a cross-section through the spinal cord and show the pathway of Celanie's reflex arc. (14)

7.3 The hypophysis is under the control of the hypothalamus of the brain. Discuss the connection and communication between the hypothalamus and both lobes of the hypophysis. (8)

7.4 Name TWO hormones and their functions that play a role in the body's calcium metabolism. (4)
(40)

QUESTION 8

8.1 Read the following passage on renal failure and answer the questions that follow.

Renal failure and treatment

Some children are born with diseased kidneys or their kidneys stop functioning when they are older due to a genetic weakness. Very often however, a person's kidneys are damaged by disease or injury. Kidneys can become so damaged that they can no longer function properly and we say the person is in renal failure. Symptoms of kidney damage include oedema (swelling of tissues) and a rise in blood pressure caused by excess salt and water in the body. The blood pH will also drop if urea and other excretory substances cannot leave the body. If untreated, complete renal failure is fatal within 8 to 14 days. People with severe renal failure can be treated by **dialysis**, using an artificial kidney. An artificial kidney is a machine that uses the process of dialysis to purify the blood.

From: Buckley L e.a. 2001: *Focus on Biology*

8.1.1 What is **renal failure**? (1)

8.1.2 Name THREE reasons, from the article, for renal failure. (3)

8.1.3 Name THREE symptoms of a person with kidney damage. (3)

8.1.4 (a) What waste product, formed by cellular respiration, will also lower the blood pH? (1)

(b) Discuss how the waste product in Question 8.1.4 (a) lowers the blood pH. (5)

(c) Discuss the regulating function of ammonia in the kidney when the blood pH drops. (5)

8.2 It is very important for people with renal failure to be treated by dialysis, using an artificial kidney. Name FIVE important functions of the kidney that makes dialysis necessary. (5)

8.3 Study the following diagram of a part of the male reproductive system and answer the questions that follow.

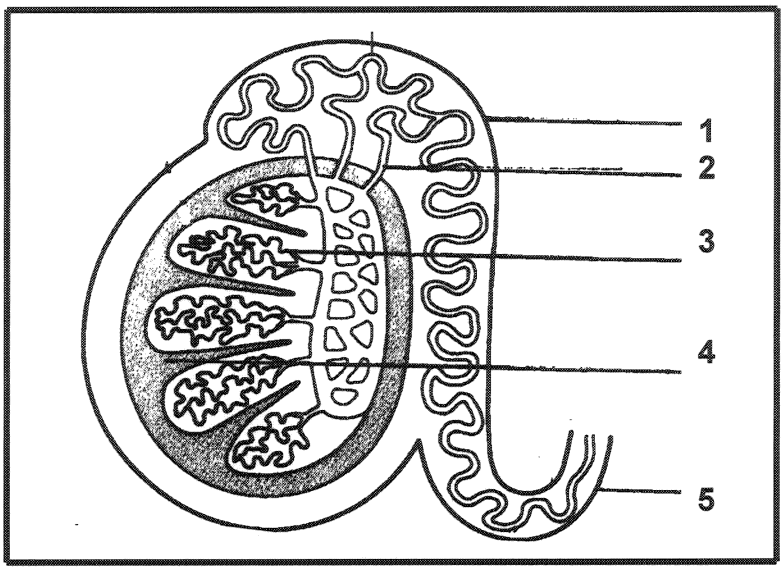


Figure 8.3 – Part of the male reproductive system

8.3.1 Give a suitable heading for the diagram. (1)

8.3.2 Identify the structures numbered **1** to **5**. (5)

8.3.3 Draw a neat, labelled diagram of a cross-section through number **3** and show all the cells present during spermatogenesis. (8)

8.4 Name all the methods that are available to men to practice birth control. (3)
(40)

TOTAL FOR SECTION B: [160]

SECTION C

Answer ONE question from this section. Choose either **Question 9** or **Question 10**. If you answer both questions, only the first one will be marked.

QUESTION 9

9.1 Study the following diagram of the skin and answer the questions that follow.

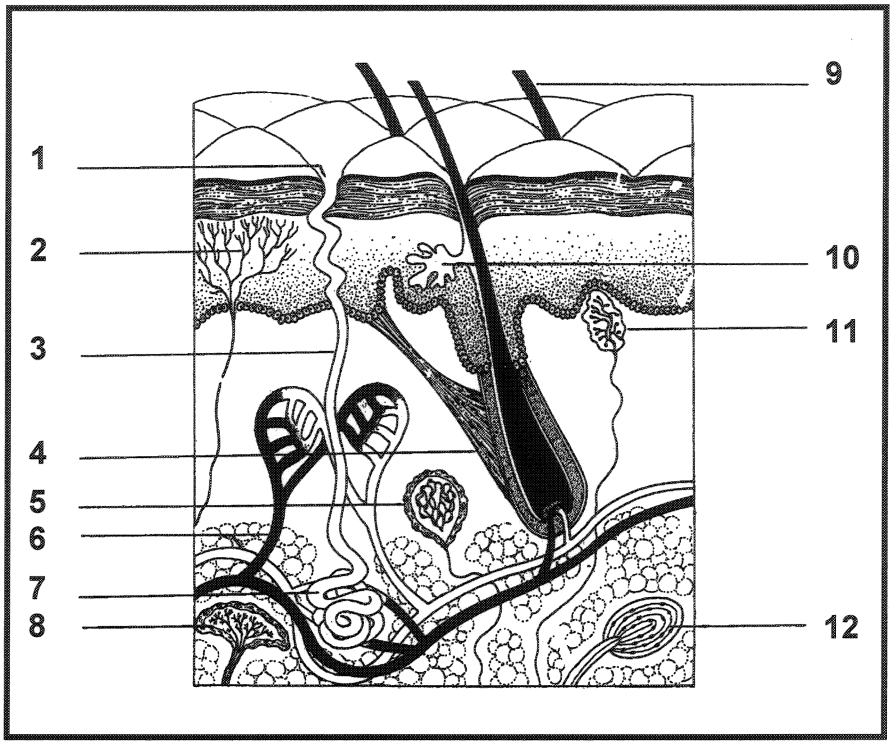


Figure 9.1 – The skin

9.1.1 Identify structures **2, 8, 10, 11 and 12**. (5)

9.1.2 Describe the role of the structure numbered **7** during osmoregulation on a hot day. (5)

9.1.3 Which FOUR numbers will play a role when the temperature suddenly drops? (4)

9.2 Read the passage and answer the questions that follow.

THE SKIN AND MEDICINE

Oil-based medicines and other fat-soluble carriers can move through the epidermis. The movement is slow, especially through the layers of the stratum corneum (cornified layer). As soon as the medication reaches the tissue beneath, it is immediately absorbed by the circulation.
A handy technique to administer medicine over a long period is to use a sticker or a type of plaster. This is then stuck onto a thin part of the skin and contains high concentrations of the medicine. Every plaster can work for days on end without one having to drink pills daily.

These plasters are also used for people who want to quit smoking or for hormone replacement therapy in menopausal women.
Nicotine (the drug in tobacco) is released over a long period by the plaster. The nicotine of the plaster ought to decrease the craving for cigarettes.
From: Malan L and Schutte AE, 2003. *Menslike Fisiologie Gr.12*

9.2.1 How is medication administered through the skin? (3)

9.2.2 Explain how the medication ends up in the circulation of the skin and also discuss the blood supply to the epidermis. (5)

9.3 Name the different parts of the female reproductive system that are responsible for reproduction and discuss the most important functions thereof. (8)

9.4 Describe the following:

9.4.1 The function of a receptor. (3)
9.4.2 How an "action potential" arises (2)
9.4.3 The types of receptors and the stimuli on which they react (Sensory coding) (15)
(50)

OR

QUESTION 10

10.1 Read the passage below and answer the questions that follow.

COCHLEAR IMPLANTS

Diseases, injury or medical poisoning sometimes damage the cochlea so severely that deafness can not be treated by a hearing aid. Cochlear implants can be used to restore some hearing in people whose own **cochleas** are not functioning, only if some of the nerve fibres are not damaged. These fibres are then electronically stimulated. These small electronic devices bypass the cochlea and send tiny electrical signals directly to the brain.

How does a cochlear implant work? The implant is made up of a microphone (worn behind the ear) that detects a sound in the environment; it sends the sound to the speech processor. The speech processor amplifies and filters the sound, and turns it into electrical signals that it sends to the transmitting coil. The transmitting coil passes the signals to the receiver / stimulator. The receiver / stimulator stimulates electrodes in the electrode array implanted in the cochlea. The electrodes stimulate the auditory nerve. The auditory nerve transmits the signals to the auditory centre in the brain, as in normal hearing.

The person is able to hear medium and loud sounds; some are able to hear well enough to use the telephone.

From: Ballard, C. 2004. *Ears: Injury, Illness and Health*

10.1.1 Draw a neat, labelled diagram of the inner ear, showing the membranous labyrinth of which the cochlea is a part. (8)

10.1.2 Name THREE ways how the cochlea can be damaged? (3)

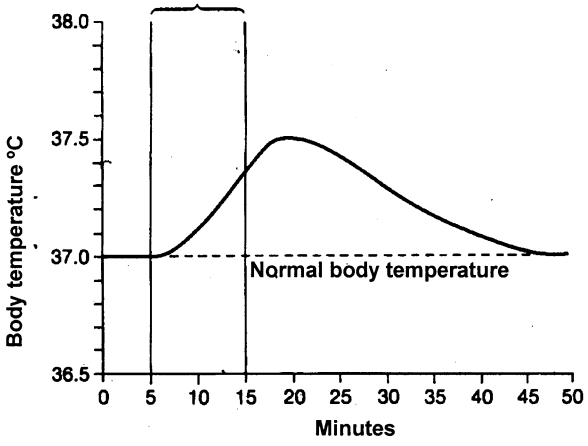
10.1.3 Discuss the structure of the cochlea in detail. (13)

10.1.4 Study the functions below and state which part of the human ear and brain, makes it possible for us to hear:

(a) Receive sound waves.
(b) Increase the strength of the vibration.
(c) Receives the sound stimuli and generates a nerve impulse.
(d) Conducts impulses to the brain.
(e) Receives the sensation of sound and interprets it. (5)

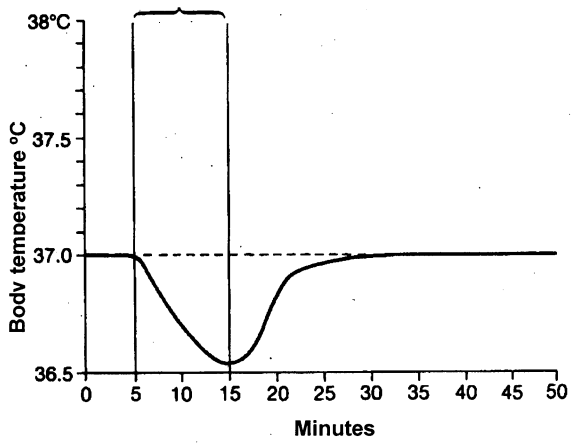
10.2 The following graphs show the effect of exercise and immersion in cold water on human body temperature.

Exercise



Graph A

Cold bath (18,5°C)



Graph B

10.2.1 What was the body temperature after

(a) 10 minutes exercise?
(b) 10 minutes immersion in cold water? (2)

10.2.2 How long did it take for the body temperature to return to normal after

(a) exercise?
(b) the cold bath? (2)

10.2.3 What causes body temperature to rise during exercise? (2)

10.2.4 Why is a high body temperature very dangerous? (1)

10.2.5 (a) Define the term **homeostasis**. (2)

(b) Define **negative feedback** as a mechanism to maintain homeostasis. (5)

10.3 The kidney is one of the important organs helping us to maintain homeostasis. Briefly discuss the adaptations of the proximal convoluted tubule to perform its function of re-absorption. (7)

(50)

TOTAL FOR SECTION C: [50]

TOTAL: 300

END