basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

LIFE SCIENCES P1

2022

MARKS: 150

TIME: 2½ hours

This question paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question numbers (1.1.1 to 1.1.9) in the ANSWER BOOK, e.g. 1.1.10 D.

1.1.1 Which ONE of the following statements is CORRECT for oogenesis in humans?

A One diploid mature ovum is formed
B One haploid mature ovum is formed
C Four diploid mature ova are formed
D Four haploid mature ova are formed

1.1.2 A structure in the eye that contains a high concentration of blood vessels and provides oxygen and nutrients to the retina is the …

A sclera.
B choroid.
C conjunctiva.
D lens.

1.1.3 The vagina …

A transports urine to the outside.
B is the place where the foetus develops.
C produces progesterone.
D acts as a birth canal.

1.1.4 The list below gives the characteristics of some young birds immediately after hatching.

(i) Eyes are open
(ii) Can move around
(iii) Cannot feed themselves
(iv) No feathers

Which ONE of the following combinations represents the characteristics of precocial development?

A (ii) and (iii) only
B (iii) and (iv) only
C (i) and (ii) only
D (ii) and (iv) only

1.1.5 The cornea and the lens are both …

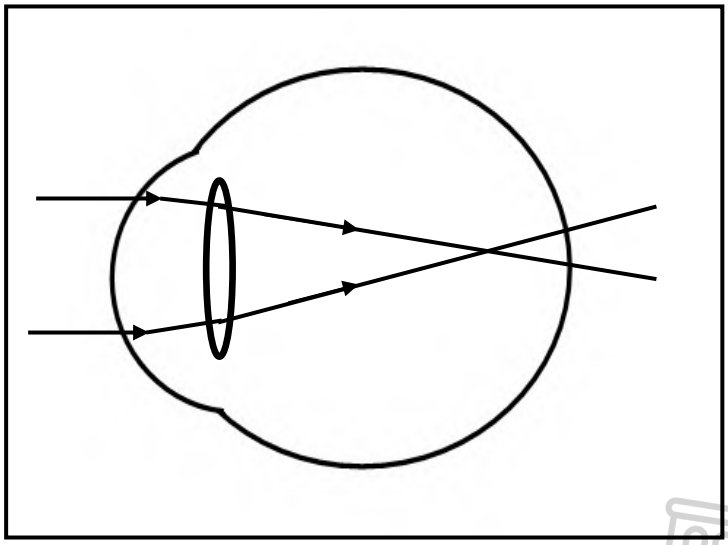
A opaque.
B transparent.
C elastic.
D inelastic.

1.1.6 Which ONE of the following is TRUE for a person who has an underactive thyroid gland?

The TSH levels will be …

A high and the metabolic rate low.
B high and the metabolic rate high.
C low and the metabolic rate low.
D low and the metabolic rate high.

1.1.7 The diagram below represents a visual defect.



Which ONE of the following is the correct treatment of the visual defect shown above?

A Glasses with biconvex lenses
B Glasses with biconcave lenses
C Surgery to replace the cornea
D Surgery to replace the retina

1.1.8 A list of some components of the nervous system is provided below.

(i) Brain
(ii) Cranial nerves
(iii) Spinal nerves
(iv) Spinal cord

Which ONE of the following combinations applies to the central nervous system?

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

1.1.9 Which ONE of the following is the part of the eye with the highest concentration of cones?

A Cornea
B Lens
C Yellow spot
D Iris

(9 x 2) **(18)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 A structure in the ear that absorbs excess pressure waves from the inner ear

1.2.2 The structure in a sperm that contains enzymes

1.2.3 The site of fertilisation in the human female

1.2.4 A visual defect caused by the uneven curvature of the cornea

1.2.5 The nerve that transmits impulses from the eye to the brain

1.2.6 A disease characterised by the degeneration of brain cells and memory loss

1.2.7 The inner layer of the uterus that thickens during the menstrual cycle

1.2.8 A hollow ball of cells that forms during embryonic development

1.2.9 The period of development of secondary sexual characteristics in humans

1.2.10 The type of vision where both eyes are used to focus on an object

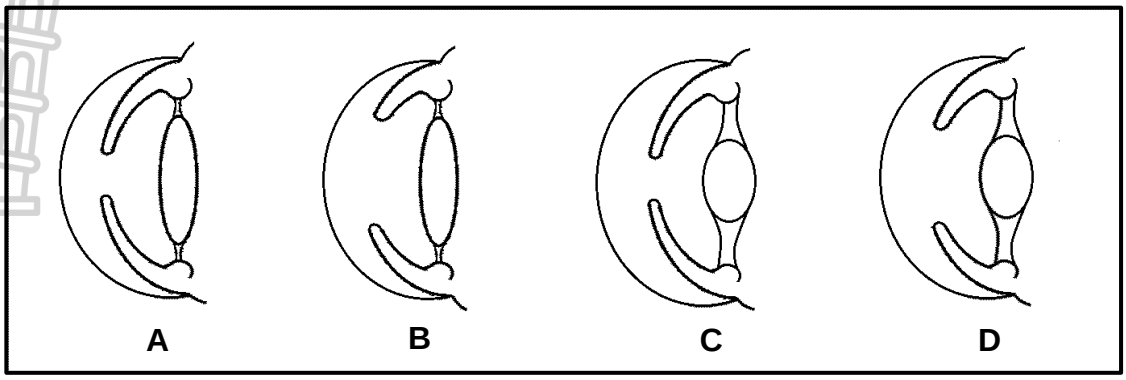
(10 x 1) **(10)**

1.3 Indicate whether each of the descriptions in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	The plant hormone that stimulates the germination of seeds	A: Gibberellins B: Abscisic acid
1.3.2	The part of the brain that connects the left and the right hemispheres	A: Corpus luteum B: Corpus callosum
1.3.3	The liquid found in front of the lens in the eye	A: Vitreous humor B: Aqueous humor

(3 x 2) **(6)**

1.4 The diagrams below show part of the eye under different conditions.



1.4.1 Name the process that occurs when the:

(a) Curvature of the lens changes to focus on a near or distant object (1)

(b) Pupil size changes to regulate the amount of light entering the eye (1)

1.4.2 Give the LETTERS of TWO diagrams (**A**, **B**, **C** or **D**) that represent the condition of the eye of a person:

(a) In dim light (2)

(b) Focusing on a distant object (2)

1.4.3 Give the LETTERS of TWO diagrams (**A**, **B**, **C** or **D**) that represent the eye of a person whose:

(a) Ciliary muscles are contracted (2)

(b) Radial muscles are relaxed (2)
(10)

1.5 Diagram **1** below represents part of a reflex arc and diagram **2** represents a neuron.

Diagram 1

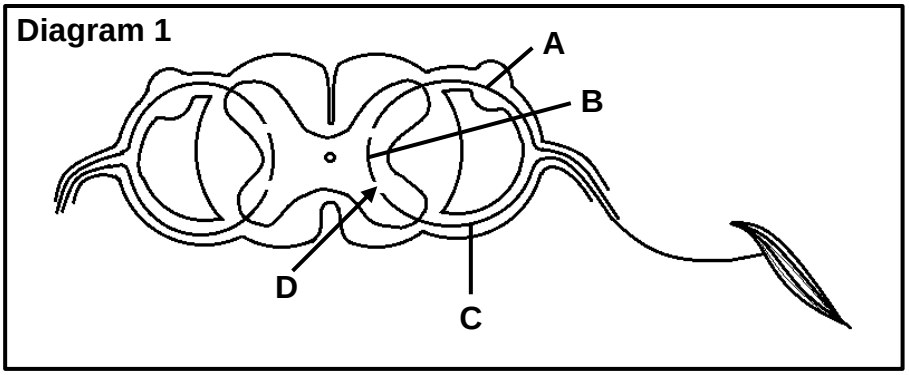
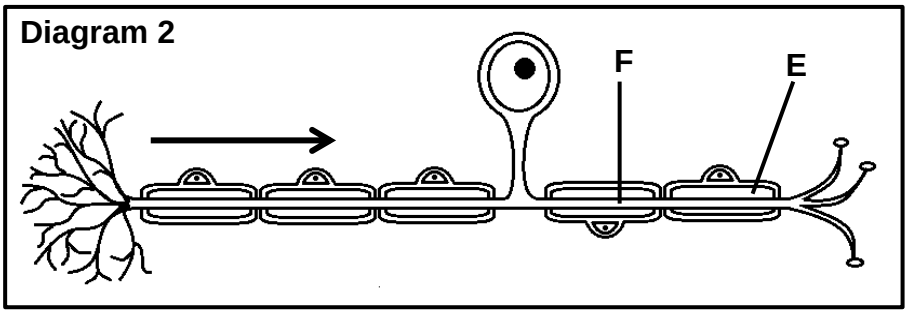


Diagram 2



1.5.1 Identify:

(a) Layer **E** (1)

(b) Structure **F** (1)

1.5.2 Which neuron (**A**, **B** or **C**):

(a) Represents the type of neuron shown in diagram **2** (1)

(b) Is damaged when a person can feel the stimulus but cannot respond to it (1)

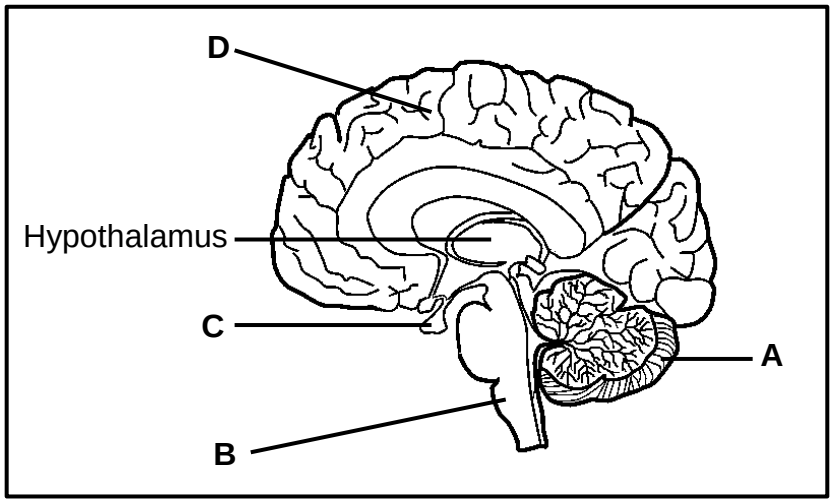
1.5.3 Give the LETTER and NAME of the part that ensures one-directional flow of the impulse. (2)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below shows part of the human brain.



2.1.1 Identify part **A**. (1)

2.1.2 State TWO functions of part **D**. (2)

2.1.3 Name the hormone secreted by gland **C** that has an effect on:

(a) Long bones (1)

(b) Mammary glands in the breasts (1)

2.1.4 State ONE way in which the brain is protected. (1)

2.1.5 Describe the role of the hypothalamus in thermoregulation. (4)

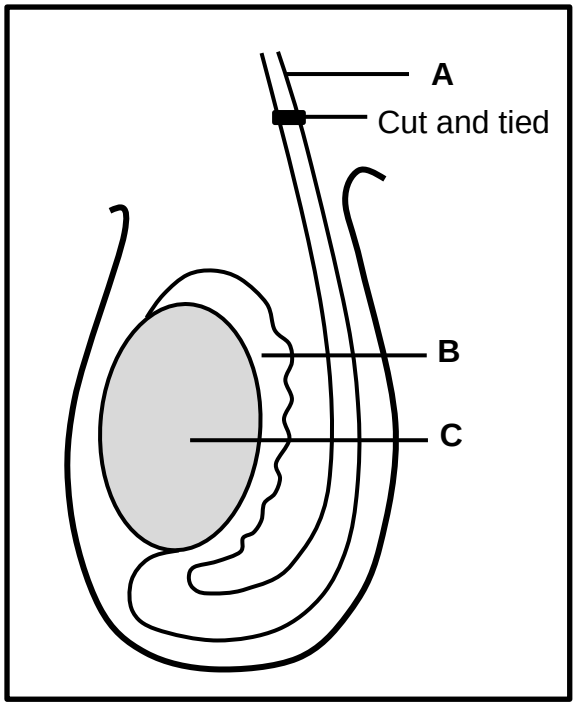
2.1.6 Part **B** is involved in the homeostatic control of the carbon dioxide concentration in the blood.

(a) State the location of the receptors that are stimulated by an increase in the carbon dioxide concentration in the blood. (1)

(b) Name the TWO effectors that part **B** sends impulses to. (2)

(13)

2.2 The diagram below shows part of the male reproductive system.



2.2.1 Identify part **A**. (1)

2.2.2 State ONE function of part **B**. (1)

2.2.3 During a vasectomy, part **A** is cut and tied as shown in the diagram. Semen will still be released during copulation.

Explain the composition of the semen after a vasectomy. (3)

2.2.4 In some rare cases, males are born with part **C** located inside the body because it failed to descend into the scrotum.

Explain how this condition may affect male fertility. (3)

2.2.5 Describe the process of spermatogenesis. (4)
(12)

2.3 Describe how the developing embryo is protected and nourished in ovoviviparous organisms. **(7)**

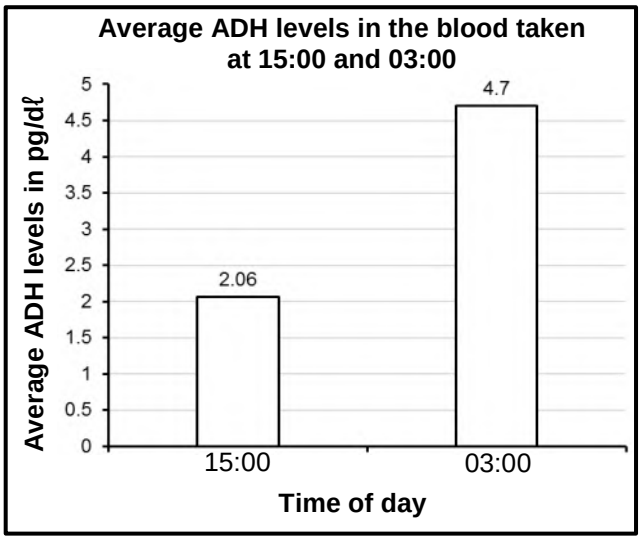
2.4 An investigation was conducted to determine the change in the ADH levels in the blood and the volume of urine produced over a 24-hour period.

The procedure was as follows:

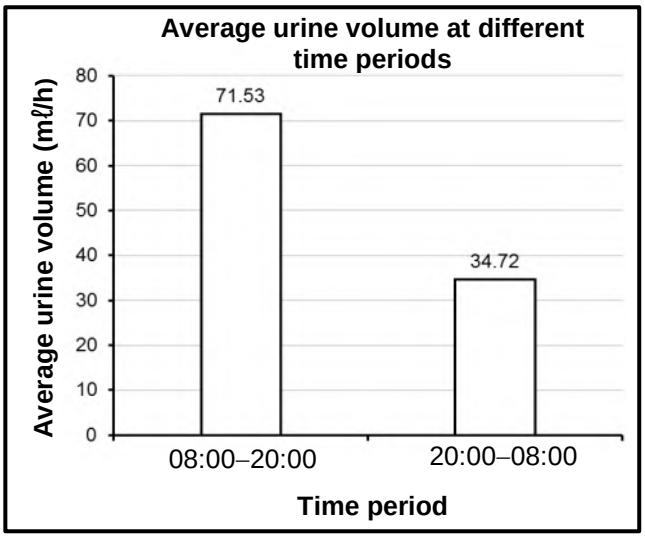
- One healthy adult participated in the investigation.
- The intake of food and liquids of this person was controlled for the duration of the investigation.
- The ADH levels in the blood were measured at 15:00 and 03:00 for 5 days and the average was calculated.
- The volume of urine produced from 08:00 to 20:00 was measured for 5 days and the average was calculated.
- The volume of urine produced from 20:00 to 08:00 was measured for 5 days and the average was calculated.

The results are shown in the graphs below.

GRAPH A



GRAPH B



2.4.1 Calculate the difference between the average volume of urine (mℓ/h) produced during the 2 time periods. Show ALL workings. (2)

2.4.2 Explain how the ADH levels in the blood at 03:00 affects the volume of urine produced between 20:00 and 08:00. (4)

2.4.3 Explain ONE advantage of the high ADH levels at 03:00. (2)

2.4.4 A patient whose renal tubules are impermeable to water, underwent the same investigation.

Explain why the ADH levels are expected to remain high all the time. (3)
(11)

2.5 Read the extract below.

> Some plants contain chemical substances such as alkaloids and cyanogenic glycosides. Alkaloids are bitter-tasting compounds while cyanogenic glycosides are toxic substances.
>
> Caffeine is an example of an alkaloid that occurs in plants like *Coffea arabica* (coffee), *Camelia sinensis* (tea) *and Theobroma cacao* (cocoa). Although harmless to humans, caffeine kills pathogenic fungi.
>
> Nicotine is another example of an alkaloid that is found in tobacco plants.

2.5.1 Name TWO alkaloids that are found in plants. (2)

2.5.2 Explain TWO ways in which caffeine production acts as a defence mechanism in plants. (4)

2.5.3 Name ONE other plant defence mechanism. (1)
(7)
[50]

QUESTION 3

3.1 Describe the role of auxins in phototropism when a plant is exposed to unilateral light. **(5)**

3.2 The FSH test is sometimes used to determine the cause of infertility in females. The levels of FSH usually indicate the number of follicles in the ovaries. If the number of follicles are low or depleted, the pituitary gland will secrete more FSH.

An investigation was conducted to compare the average FSH levels in 4 different age groups.

The procedure was done as follows:

- 1 000 females were asked to participate (250 in each of the four age groups).
- The females were all healthy and not using any hormone-based contraceptives.
- Their blood FSH levels were measured on day 3 of the menstrual cycle for 5 cycles.
- The average FSH levels in their blood were calculated per age group.

The results are shown in the table below.

AGE GROUP	AVERAGE FSH LEVELS
20–32	7,0
33–35	7,8
36–40	8,0
41–50	8,5

3.2.1 State TWO factors, regarding the females, that should have been kept constant during the investigation. (2)

3.2.2 State TWO ways in which the reliability of the results was ensured. (2)

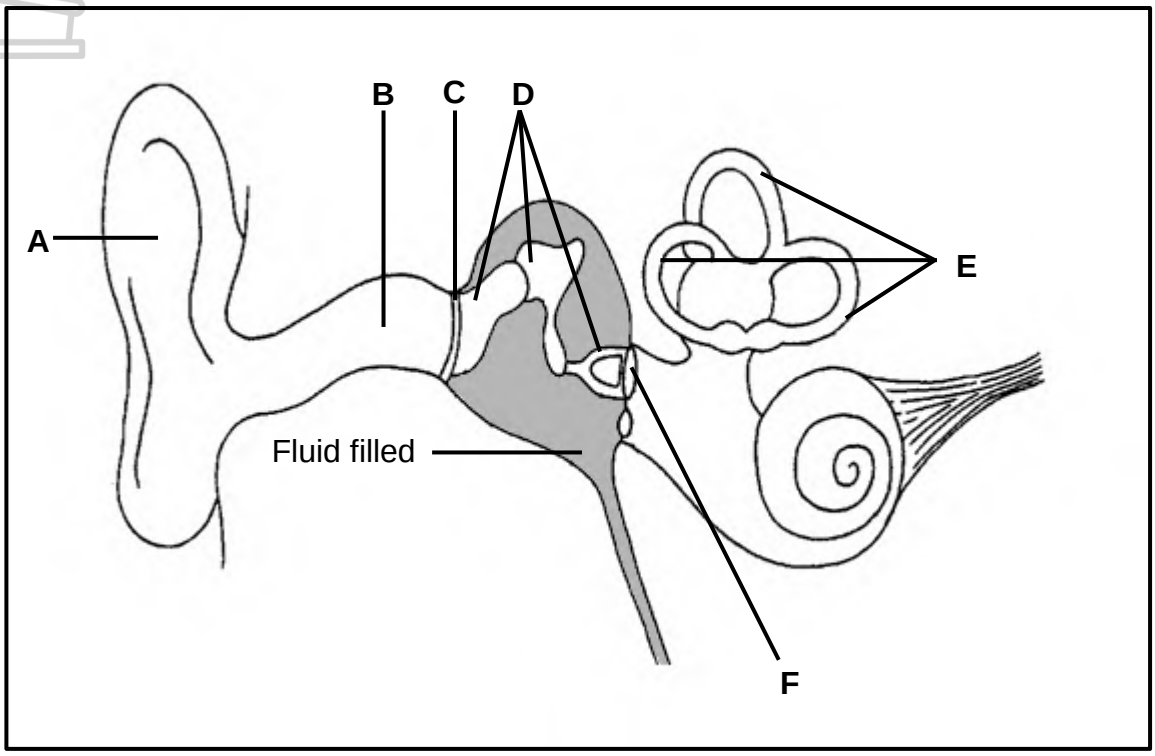
3.2.3 State ONE conclusion that can be drawn from the results. (2)

3.2.4 Explain why the oestrogen levels may remain low in the blood of the females in the 41–50 age group. (3)

3.2.5 Explain why females that were using progesterone-based pills were excluded from the investigation. (3)
(12)

3.3 Describe the development of the placenta and umbilical cord from the time of implantation. **(6)**

3.4 The diagram below represents part of the human ear with a middle-ear infection.



3.4.1 Identify part:

(a) **B** (1)

(b) **D** (1)

3.4.2 State ONE function of part **A**. (1)

3.4.3 Explain how middle-ear infection could affect hearing. (4)

3.4.4 Describe the role of the Eustachian tube. (2)

3.4.5 Name the small device that is used in the treatment of middle-ear infection. (1)

3.4.6 Write down the LETTER of the part where the small device, named in QUESTION 3.4.5, is inserted. (1)

3.4.7 Describe how part **E** is involved in maintaining balance when there is a change in the speed and direction of movement of the head. (4)
(15)

3.5 Type I diabetes mellitus is caused by pancreatic cells which cannot produce insulin.

In type II diabetes mellitus the pancreas does secrete insulin, but the body cells are resistant to the effect of insulin.

To diagnose if a person has type I or type II diabetes mellitus, the following tests may be conducted:

- The blood glucose level is tested after fasting (the person is not allowed to eat or drink for 6 hours before the test). If the blood glucose level is above 126 mg/dℓ, the person is diabetic.
- The person is then given a glucose solution to drink and the blood glucose level is tested after 2 hours.
- The blood is also tested for the presence of GAD antibodies. The presence of GAD antibodies would indicate that the body is destroying the insulin-producing pancreatic cells.
- The levels of C-peptide are measured. This is a substance produced by the same pancreatic cells that produce insulin. If the levels are below 0,3 ng/mℓ in the blood, the person is diabetic.

3.5.1 Name the cells in the pancreas that secrete insulin. (1)

3.5.2 Explain which type (I or II) of diabetes mellitus would be indicated by the:

(a) Presence of GAD antibodies in the blood (3)

(b) C-peptide levels at below 0,3 ng/mℓ (3)

3.5.3 Explain the insulin levels in the blood of a type II diabetic 2 hours after drinking the glucose solution. (3)

3.5.4 Give ONE reason why a person with untreated diabetes mellitus is expected to be tired all the time. (2)
(12)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150