eduresourceza.com

Downloaded from eduresourceza.com

SECONDARY SCHOOL IMPROVEMENT PROGRAMME (SSIP) 2020

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GRADE 12

SUBJECT: LIFE SCIENCES

EXAM KIT

Compiled by Susan Wiese

DCES: Life Sciences, GDE

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

INDEX

TOPIC	PAGE
PAPER 1	
Meiosis	4
Reproduction in Vertebrates	14
Human Reproduction	21
Responding to the environment (Humans)	36
Human endocrine system	57
Homeostasis in humans	65
Responding to the environment (Plants)	72
Human impact on the environment (Gr.11)	82
PAPER 2	
DNA: Code of life	96
Genetics and Inheritance	108
Evolution	124

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

PAPER 1

TOPIC	MARK
Meiosis	11
Reproduction in Vertebrates	6
Human Reproduction	31
Responding to the environment (Humans)	40
Human endocrine system	15
Homeostasis in humans	11
Responding to the environment (Plants)	11
Human impact on the environment (Gr.11)	25
TOTAL	**150**

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

MEIOSIS (11 MARKS)

EXAM GUIDELINES

What to study:

- The structure of a cell with an emphasis on the parts of the nucleus, the centrosome and the cytoplasm

- The structure of chromosomes:

- Differences between:
  - Haploid(n) and diploid(2n) cells in terms of chromosome number
  - Sex cells (gametes) and somatic cells (body cells)
  - Sex chromosomes (gonosomes) and Autosomes

- Definition of meiosis

- Site of meiosis in plants and in animals

- Meiosis is a continuous process but the events are divided into different phases for convenience

- Events of **interphase**:
  - DNA replication takes place
  - Chromosomes which are single threads, become double
  - Each chromosome will now consist of two chromatids joined by a centromere
  - DNA replication helps to double the genetic material so that it can be shared equally by
    the new cells arising from cell division

- The events of the following phases of Meiosis I, using diagrams:
  - Prophase I
    - including a description of crossing-over
  - Metaphase I
    - including the random arrangement of chromosomes
  - Anaphase I
  - Telophase I

- The events of each phase of Meiosis II, using diagrams:
  - Prophase II
  - Metaphase II
  - Anaphase II
  - Telophase II

- The differences between the following processes:

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- Random arrangement of chromosomes
  - This is characteristic of Metaphase I and II of meiosis.
  - The chromosomes could come to lay at the equator randomly/in different combinations.
  - In humans, where the diploid number of chromosomes is 46, there are more than 8 million combinations.
  - This will result in genetic variation in the gametes produced at the end of meiosis.
- Random assortment of chromosomes
  - The chromosomes or chromatids move away from the equator during Anaphase I and II until they reach the poles during Telophase I and II respectively.
  - The combination in which the chromosomes or chromatids move to the poles depends on the random arrangement of chromosomes at the equator during Metaphase I or II.
  - The random segregation of chromosomes in itself is not a source of variation since it is dependent on the random arrangement of chromosomes at the equator.
- Independent assortment
  - A pair of alleles of a gene, which controls each characteristic, is found on homologous chromosomes.
  - Each pair of chromosomes arranges at the equator independently of another pair because of the random arrangement of chromosomes.
  - The way in which one pair of chromosome therefore assorts into the resulting gametes will not influence the way in which another pair assorts into the gametes.
  - The inheritance of any characteristic therefore occurs independently of any other characteristic.
  - This is independent assortment and is due to random assortment of chromosomes.

- The importance of meiosis:
- Production of haploid gametes
- The halving effect of meiosis overcomes the doubling effect of fertilisation, thus maintaining a constant chromosome number from one generation to the next.
- Mechanism to introduce genetic variation through:
  - Crossing-over
  - The random arrangement of chromosomes at the equator

- Non-disjunction and its consequences

- Non-disjunction of chromosome pair 21 during anaphase I in humans to form abnormal gametes with an extra copy of chromosome 21

- The fusion between an abnormal gamete (24 chromosomes) and a normal gamete (23 chromosomes) may lead to Down syndrome

- Similarities in mitosis and meiosis

- Differences between mitosis and meiosis

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

TERMINOLOGY

Autosomes:	Chromosomes that are not sex chromosome. There are 22 pairs of autosomes in a diploid cell of a human.
Centriole:	An organelle in the cytoplasm of the cell, which gives rise to spindle fibres during meiosis and mitosis.
Centromere:	Structure that holds two chromatids together to form a chromosome.
Chiasma:	Point where crossing over takes place between chromatids of the homologous chromosome during prophase 1.
Chromatid:	It is a single thread of a double stranded chromosome. Two chromatids are joined by a centromere to form a replicated chromosome.
Chromosome:	A structure made up of two chromatids joined by a centromere that carries the hereditary characteristics within the DNA.
Diploid number (2n):	Complete chromosomal number represented in pairs, which is characteristic of an organism.
Daughter chromosome:	This refers to each chromatid after it splits from its sister chromatid during anaphase II and is moving towards the poles.
Gametes:	Haploid cells (n) which contain half the chromosome number of the diploid generation. Ova and sperm cells are the gametes necessary in sexual reproduction where the fusion of the two gametes results in a new individual.
Gene:	The unit of heredity transmitted in the chromosome, which controls the development of the characteristics.
Gonosomes:	Sex chromosomes. There is one pair of sex chromosomes in a diploid cell: the XX chromosomes in females and XY chromosomes in males.
Haploid number (n):	Half the number of chromosomes present in gametes after meiosis has occurred.
Homologous chromosomes	Maternal and paternal chromosomes having the same shape and size which are paired but differs in genetic material.
Bivalent:	A pair of homologous chromosomes physically held together by at least one DNA crossover.
Maternal:	From the mother / female parent.
Meiosis:	A process of cell division whereby the chromosomal number is halved for the production of haploid gametes (sperm cells and ova).

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Mitosis:	A process of cell division where the resulting daughter cells have the same chromosomal number as the original parent cell.
Non-disjunction:	The homologous chromosomes do not separate due to failure of the centromere to divide during meiosis I & II. The resulting gametes will have either an extra chromosome/copy or another gamete will have one less chromosome.
Paternal:	From the father / male parent.
Replicated chromosome:	This refers to a chromosome as it appears after DNA replication takes place. Hence each replicated chromosome is made up of two chromatids, joined by a centromere.
Somatic cells:	Normal diploid body cells.
Spindle fibres:	Micro-tubules that form during cell division which radiate out from the centrosomes and draw the chromosomes to the poles.
Unreplicated chromosome:	This refers to a chromosome as it appears before DNA replication takes place. Because of DNA replication all chromosome material is doubled.
Variation:	The morphological and physiological differences that can be seen between members of the same species.
Zygote:	The resulting diploid cell after fertilization has occurred

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.4) in your ANSWER BOOK, for example 1.5 D.

1.1 Which ONE of the following is most likely the chromosome compliment of a person with Down Syndrome?

A 46 and XX
B 46 and XY
C 45 and XX
D 44 and XY

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

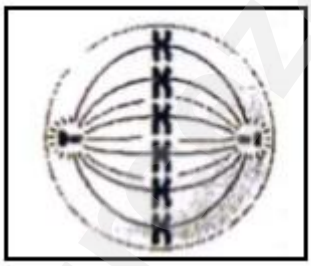
1.2 How many chromatids are found in a pair of homologous chromosomes?

A One
B Two
C Four
D Eight

1.3 The biological significance of meiosis is to …

A produce diploid gametes.
B produce identical daughter cells.
C double the chromosome number in the gametes.
D produce haploid gametes.

1.4 Which type of cell division and phase are illustrated in the following diagram?



A Metaphase I of meiosis
B Metaphase II of mitosis
C Metaphase II of meiosis
D Metaphase of mitosis II **(8)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.5) in your ANSWER BOOK.

2.1 Structure that holds two chromatids together to form a chromosome.
2.2 Point where crossing over takes place between chromatids of the homologous chromosome during prophase 1.
2.3 A process of cell division whereby the chromosomal number is halved for the production of haploid gametes (sperm cells and ova).
2.4 An organelle in the cytoplasm of the cell, which gives rise to spindle fibres during meiosis and mitosis.
2.5 Maternal and paternal chromosomes having the same shape and size which are paired but differs in genetic material. **(5)**

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 3 *(Questions taken from various sources)*

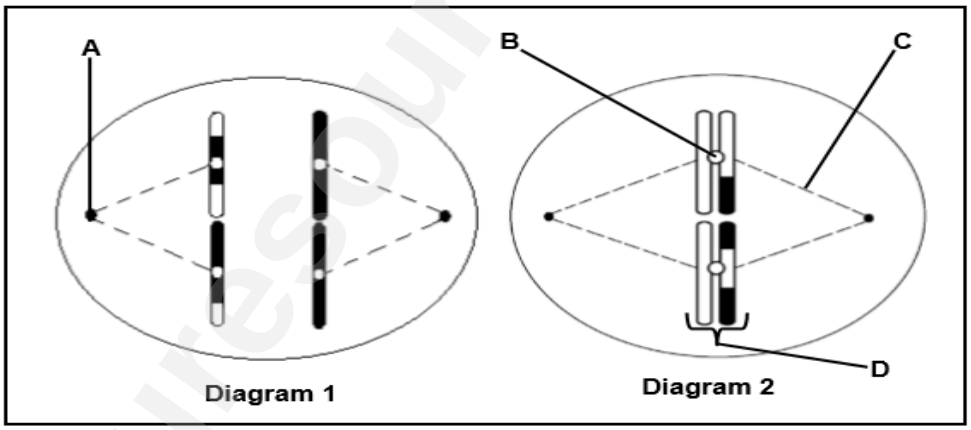
Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B,** or **none** next to the question number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	A process that lead to genetic variation in cells	A	Random arrangement of chromosomes
		B	Crossing over
3.2	The importance of meiosis	A	Production of gametes
		B	Halving of the chromosome number
3.3	Cytokinesis takes place	A	Telophase I
		B	Telophase II

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

QUESTION 4 *(DBE, Jun. 2018, Paper 1)*

The diagrams below represent two phases of meiosis in an organism.



4.1 Identify the phase of meiosis represented in Diagram 1 (1)

4.2 Identify part:

(a) A (1)

(b) B (1)

(c) C (1)

4.3 State what happens to structure D in the next phase of meiosis (1)

4.4 Name the process during which genetic material was exchanged, as shown in the diagrams above. (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

4.5 State the consequence if the process named in QUESTION 4.4 does not occur. (1)

4.6 Give the number of chromosomes present in:

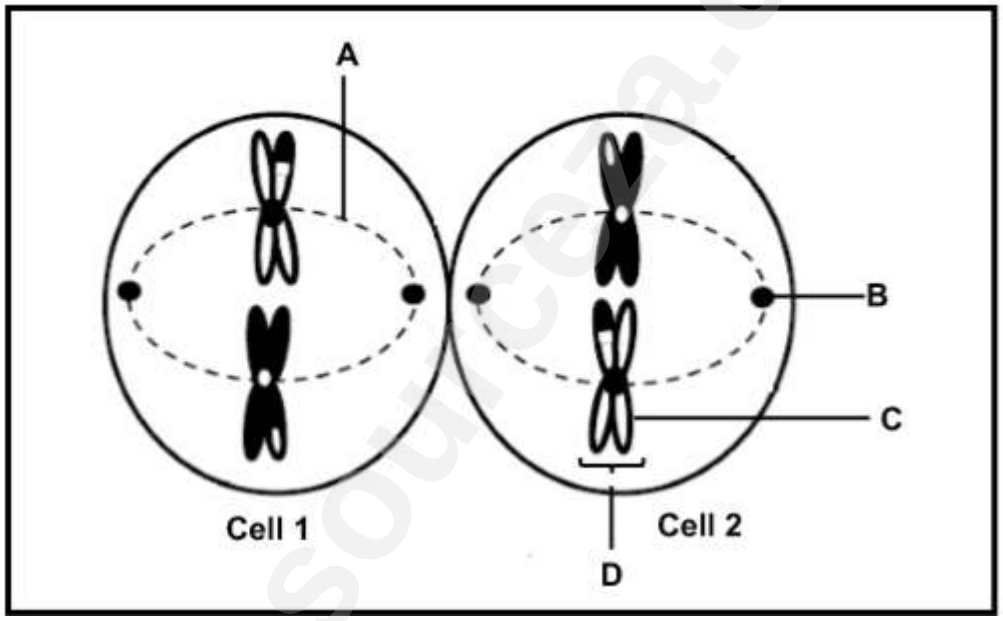
(a) The original parent cell in this organism (1)

(b) A human cell in the same phase as that shown in Diagram 2 (1)

(9)

QUESTION 5 *KZN, Prelim 2019, Paper 1)*

The diagram below represents a phase during meiosis in an animal cell.



5.1 Identify the phase represented in the diagram. (1)

5.2 Name the process that led to the chromosomes having different shadings. (1)

5.3 Identify part:

(a) **A** (1)
(b) **B** (1)
(c) **C** (1)
(d) **D** (1)

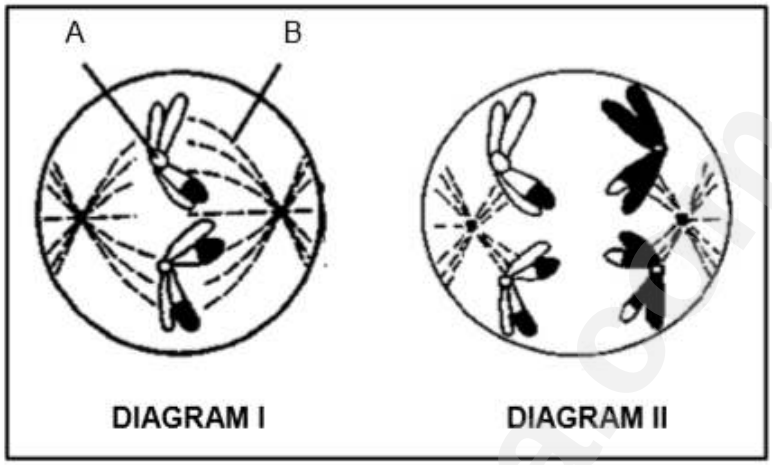
(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 6 (*FS, Prelim 2018, Paper 1)*

The diagrams below represent two phases of meiosis in a cell. The diagrams are not drawn to scale.



6.1 Identify the following parts in **Diagram I:**

(a) **A** (1)

(b) **B** (1)

6.2 Identify the phase represented by **Diagram II**. (1)

6.3 State the number of:

(a) Chromatids in **Diagram I** (1)

(b) Chromosomes in the original mother cell (1)

6.4 What evidence is visible in Diagram I that meiosis is responsible for genetic variation? (1)

6.5 Name and describe the process which is responsible for the evidence mentioned in QUESTION 6.4 (3)

6.6 Name the organ in a woman where meiosis occurs. (1)

(10)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

MEIOSIS ANSWERS

QUESTION 1

1.1 C ✓✓
1.2 C ✓✓
1.3 D ✓✓
1.4 C ✓✓ **(8)**

QUESTION 2

2.1 Centromere ✓

2.2 Chiasma ✓

2.3 Meiosis ✓

2.4 Centriole ✓

2.5 Homologous chromosomes ✓ **(5)**

QUESTION 3

3.1 Both A and B ✓✓

3.2 Both A and B ✓✓

3.3 B only✓✓

(6)

QUESTION 4

4.1 Anaphase II✓ (1)

4.2 (a) Centriole✓ (1)
(b) Centromere✓ (1)
(c) Spindle fibre✓ (1)

4.3 The chromatids separate✓/centromere splits (1)

4.4 Crossing over✓ (1)

4.5 Reduces genetic variation✓ (1)

4.6 (a) Four✓/4 (1)
(b) 23✓ (1)
(9)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 5

5.1 Metaphase II ✓ (1)

5.2 Crossing over ✓ (1)

5.3 (a) Spindle fibre ✓ (1)

(b) Centriole ✓ (1)

(c) Chromatid ✓ (1)

(d) Chromosome ✓ (1)

(6)

QUESTION 6

6.1 A – Centromere✓ (1)

B – Spindle fibre✓ (1)

6.2 Anaphase **I**✓ (1)

6.3 (a) 4✓ (1)

(b) 4✓ (1)

6.4 Chromatids contains different segments✓ (1)

6.5 - Crossing over✓*

- Non-sister chromatids from each homologous chromosome pair overlap/cross✓

- The point where they touch is called a chiasma✓

- DNA is crossed over ✓ (swopped) at the chiasmata

(*Compulsory+ any 2) (3)

6.6 Ovary✓ (1)

(10)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

REPRODUCTION IN VERTEBRATES (6 MARKS)

EXAM GUIDELINES

What to study:

- The role of the following reproductive strategies in animals in maximizing reproductive success in different environments (using relevant examples):
- External or internal fertilisation
- Ovipary, ovovivipary, vivipary
- Amniotic egg
- Precocial and altricial development
  Precocial development: Development in birds that is complete such that the young are born independent, with eyes open, with down feathers and able to move or feed independently. This is due to the large quantity of yolk in the egg which lasts longer, allowing more time for development.
  Altricial development: Development in birds that is incomplete such that the young are born helpless, with eyes closed, without down feathers and unable to move or feed independently. This is due to the small quantity of yolk in the egg which restricts the time available for full development.
- Parental care

TERMINOLOGY

Biological term	Description
Allantois	The structure in the amniotic egg that stores wastes
Altricial development	The reproductive strategy when offspring are not able to move and feed themselves
Amniotic egg	A type of egg where the embryo develops inside a fluid-filled sac which is surrounded by a shell
Asexual reproduction	Type of reproduction of organisms from parts or the whole parent body form – no gametes involved
External fertilisation	A type of fertilisation in which the nucleus of a sperm fuses with the nucleus of an ovum outside the body of the female
Internal fertilisation	A type of fertilisation in which the nucleus of a sperm fuses with the nucleus of an ovum **inside the reproductive system of the female**
Ovipary	The reproductive strategy involving the laying of eggs
Ovovivipary	Producing young by means of eggs which are hatched/retained within the body of the parent and the young are born live
Precocial development	The reproductive strategy when offspring are able to move and feed themselves

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Sexual reproduction	Type of reproduction that involves the fusion of motile (male) and stationary (female) gametes.
Vivipary	A type of reproduction where the foetus develops inside the uterus
Zygote	The diploid cell formed by the process of fertilisation

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.4) in your ANSWER BOOK, for example 1.5 D.

1.1 An advantage of internal fertilisation is that …

A sperm and ova are protected within the female's body.
B there is better parental care.
C more gametes will be produced.
D the foetus receives food directly from the mother.

1.2 Which ONE of the following involves the development of the young inside the uterus of the mother and where it receives nutrients through the placenta?

A Ovipary
B Vivipary
C Ovovivipary
D Amniotic egg

1.3 Below is a list of terms relating to reproduction:

(i) Precocial development
(ii) Altricial development
(iii) Amniotic egg
(iv) Parental care

Which of the terms above refer to strategies used by birds that incubate their eggs in a nest and feed their young until they are able to fly?

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

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

1.4 Which ONE of the following involves the hatching of fertilised eggs in the body of a female, such that the young are born alive?

A External fertilisation
B Ovipary
C Vivipary
D Ovovivipary

(8)

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.6) in your ANSWER BOOK.

2.1 The structure that provides nutrients to the developing embryo in oviparous organisms

2.2 The type of fertilisation where the ovum is fertilised inside the female reproductive organs

2.3 A behavioural pattern of animals feeding their young and protecting them from predators

2.4 Happens mostly in aquatic habitats when eggs are released from the female's body and are sprayed with sperm

2.5 The type of development in birds where the young are incapable of moving around on their own

2.6 The type of fertilisation associated with vivipary **(6)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.3) in the ANSWER BOOK.

	COLUMN I		COLUMN II
3.1	A structure involved in gaseous exchange in the amniotic egg	A B	Allantois Amnion
3.2	Advantage(s) of the amniotic egg	A B	Provides nutrition Allows gaseous exchange
3.3	Embryo nourished from yolk found in the egg	A B	Ovipary Ovovivipary

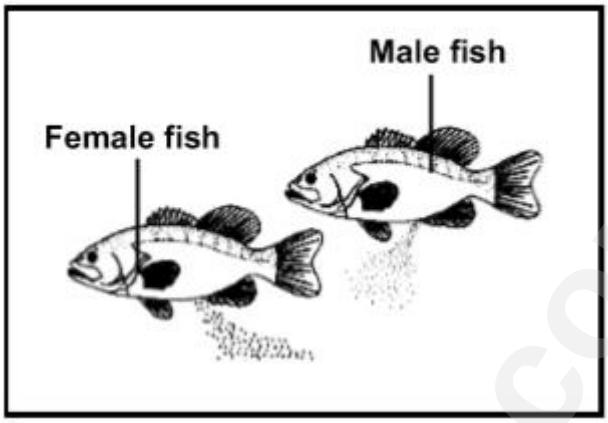
(3 x 2) **(6)**

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 4 *(KZN, Prelim 2018, Paper 1)*

The diagram below shows a certain species of fish mating.



4.1 Identify the type of fertilization displayed by the fish species. (1)

4.2 State TWO visible ways in which the chances of fertilisation in these fish are increased. (2)

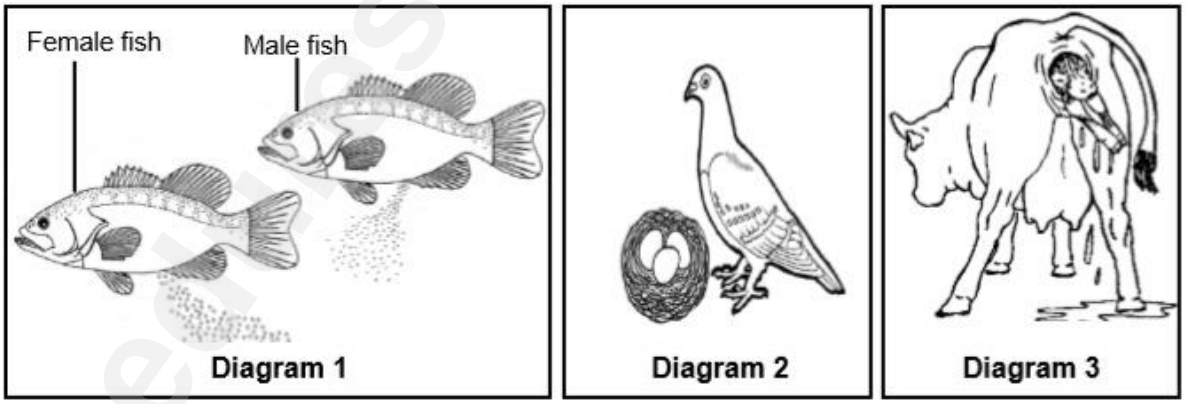
4.3 Name the reproductive strategy used by these fish that involves the production of eggs. (1)

4.4 Give TWO reasons why there is no need for the eggs of these fish to be covered by a hard or leathery shell. (2)

(6)

QUESTION 5 *(DBE, Feb/March. 2018, Paper 1)*

The diagrams below represent organisms with different reproductive strategies.



5.1 Which diagram(s) (1, 2 or 3) represent(s) organism(s):

(a) Where external fertilisation takes place (1)

(b) Where extra-embryonic membranes develop to assist with the protection and nutrition of the embryo (2)

(c) Which is/are oviparous (2)

Name the type of egg produced by the organism represented in **Diagram 2** (1)

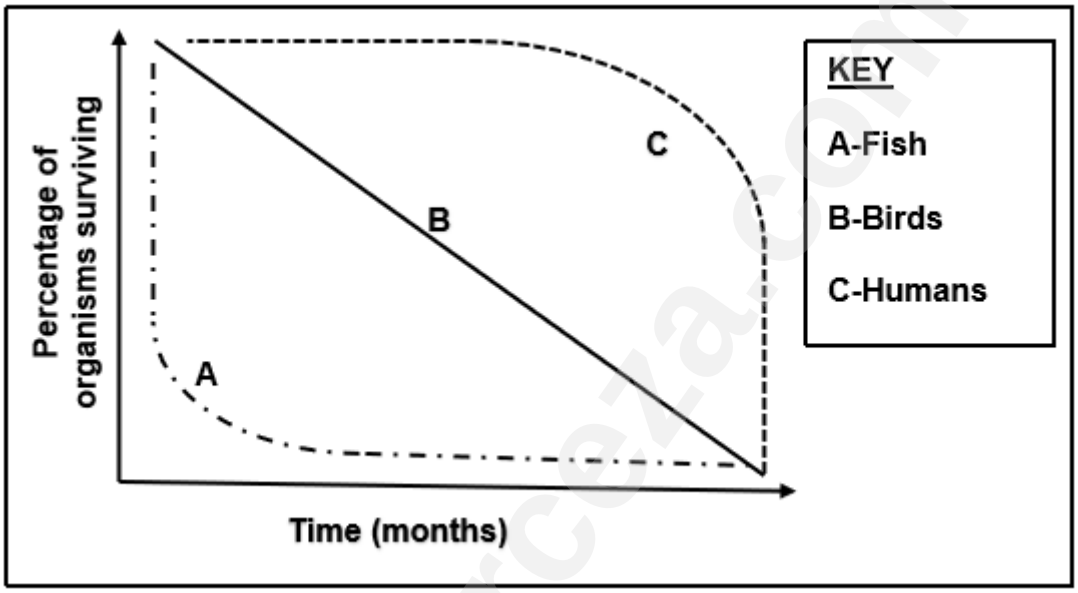
Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

5.2 **(6)**

QUESTION 6 *(LIMPOPO, Prelim 2018, Paper 1)*

The following graph shows the percentage of survivors in three different vertebrate populations over a period of time.



- Curve A shows that many offspring die when they are young and that few survive to be adults.
- Curve B shows that the offspring gradually died over time.
- Curve C shows that most of the offspring survive and that death occurs mainly among older organisms

6.1 Both organisms of population **A** and **B** are oviparous. Explain the difference in the two survivorship curves **A** and **B** by referring to parental care. (2)

6.2 Fish **(curve A)** produce very large amounts of offspring while humans **(curve C)** in comparison only produce a very small amount of offspring.

Explain this phenomenon as a survival strategy by referring to the type of fertilization (4)
(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

REPRODUCTION IN VERTEBRATES ANSWERS

QUESTION 1

1.1 A ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 D ✓✓ **(8)**

QUESTION 2

2.1 Yolk sac✓/Yolk

2.2 Internal✓ fertilisation

2.3 Parental care ✓

2.4 External fertilisation ✓

2.5 Altricial ✓

2.6 Internal ✓ fertilisation **(6)**

QUESTION 3

3.1 A only ✓✓

3.2 Both A and B ✓✓

3.3 Both A and B ✓✓

(6)

QUESTION 4

4.1 External ✓ fertilization (1)

4.2 - A large amount of sperm is released ✓
- A large amount of eggs is released ✓
- The male and female swim close to each other ✓/the sperm is released close to the eggs (Any 2)

(Mark first TWO only) (2)

4.3 Ovipary ✓ (1)

4.4 - No danger of drying out ✓

(2)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- Water provides support ✓ **(Mark first TWO only)** **(6)**

QUESTION 5

5.1 (a) Diagram 1 ✓ (1)

(b) Diagram 2 ✓ and Diagram 3 ✓ (2)

(c) Diagram 1 ✓ and Diagram 2 ✓ (2)

5.2 Amniotic ✓ egg (1)

(6)

QUESTION 6

6.1 Because fish does not have parental care predators feed on the eggs and young and therefore very few survive✓.
In birds, parental care is offered through protecting the eggs and young and increases the chances of survival ✓ (2)

6.2 Internal fertilization in humans is more certain as external fertilization✓
Because the male deposits the sperm inside the reproductive organs of the female✓
In fish fertilization is external, ✓ where predators and environmental factors can kill large amounts of eggs✓ (4)

(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HUMAN REPRODUCTION (31 MARKS)

EXAM GUIDELINES

What to study:

- Revision of the schematic outline of the human life cycle to show the role of meiosis, mitosis and fertilisation
- Structure of the male reproductive system, using a diagram
- Functions of the testis, epididymis, vas deferens, seminal vesicle, prostate gland, Cowper's gland and the urethra
- Structure of the female reproductive system, using a diagram
- Functions of the ovary; Fallopian tubes; uterus lined by endometrium; cervix; vagina and its external opening; and the vulva
- Structure of the ovary, using a diagram - showing the primary follicles, the Graafian follicle and the corpus luteum
- The main changes that occur in male characteristics during puberty under the influence of testosterone
- Main changes that occur in female characteristics during puberty under the influence of oestrogen
- Formation of gametes (gametogenesis) by meiosis.
  - Male gametes formed by spermatogenesis
  - Female gametes formed by oogenesis
- Spermatogenesis:
  - Under the influence of testosterone diploid cells in the seminiferous tubules of the testes undergo meiosis to form haploid sperm cells
- Structure of a sperm, using a diagram
- Functions of the parts of a sperm cell (acrosome, head with haploid nucleus, middle portion/neck with mitochondria, and a tail)
  - The front of the head of the sperm cell contains an acrosome which carries enzymes to dissolve a path into the ovum
  - The nucleus of the sperm carries genetic material of the male into the ovum during fertilization
  - The middle piece of the sperm contains mitochondria which release energy so that sperms could swim
  - The presence of a long tail enables sperm cells to swim towards the ovum
- Oogenesis:

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- Under the influence of FSH diploid cells in the ovary undergo mitosis to form numerous follicles
- One cell inside a follicle enlarges and undergoes meiosis
- Of the four cells that are produced, only one survives to form a mature, haploid ovum

- Structure of an ovum, using a diagram

- Functions of the different parts of an ovum (layer of jelly, haploid nucleus, cytoplasm)

- Menstrual Cycle:
  (The menstrual cycle includes the uterine and ovarian cycles)

- The events in the ovarian cycle
- Development of the Graafian follicle
- Ovulation
- Formation of the corpus luteum

- The events in the uterine cycle
- Changes that take place in the thickness of the endometrium
- Menstruation

- Hormonal control of the menstrual cycle (ovarian and uterine cycles) with reference to the action of FSH, oestrogen, LH and progesterone

- Negative feedback mechanism involving FSH and progesterone in controlling the production of ova

- Definition of copulation and fertilisation

- Process of fertilisation

- Development of zygote → embryo (morula and blastula/blastocyst) → foetus

- Definition of implantation

- The role of oestrogen and progesterone in maintaining pregnancy

- Structure of the developing foetus in the uterus, using a diagram

- Functions of the following parts:
- Chorion and chorionic villi
- Amnion, amniotic cavity and amniotic fluid
- Umbilical cord (including umbilical artery and umbilical vein)
- Placenta

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

TERMINOLOGY

Biological term	Description
Acrosome	The vesicle which contains enzymes found in the head of a sperm cell
Amniotic fluid	A fluid that protects the human embryo against injuries and large-scale temperature changes
Blastocyst/blastula	A hollow ball of cells formed from the zygote
Chorion	The outermost membrane found around the embryo/foetus
Copulation	The introduction of the male sex organ into the female sex canal, followed by a discharge of semen.
Endometrium	The inner lining of the uterus where implantation of the embryo occurs
Fallopian tube	Part of the female reproductive system where fertilisation occurs
Fertilization	When the nucleus of the sperm cell fuses with the nucleus of the ovum
Follicle stimulating hormone/FSH	The hormone responsible for the development of follicles in the ovary
Gestation	The period between fertilization and birth when the foetus develops in the womb
Implantation	The attachment of the fertilized ovum or blastocyst to the wall of the uterus at the start of pregnancy.
Luteinising hormone/LH	The hormone responsible for ovulation and the formation of the corpus luteum
Oestrogen	The hormone that causes the thickening of the endometrium and is produced by the Graafian follicle
Oogenesis	The production of female gametes through meiosis
Prolactin	A hormone produced by the pituitary gland/hypophysis that stimulates milk production in human females
Puberty	The stage in humans when sexual maturity is reached in males and females
Spermatogenesis	The production of male gametes through meiosis
Testosterone	A hormone that stimulates the maturation of sperm and stimulates puberty in males
Vas deferens	The male reproductive tube that connects the testis with the urethra
Zygote	The diploid cell formed by the process of fertilisation

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.6) in your ANSWER BOOK, for example 1.7 D.

1.1 The hormone that stimulates the production of milk in a mother after the birth of a baby.

A oestrogen
B progesterone
C prolactin
D FSH

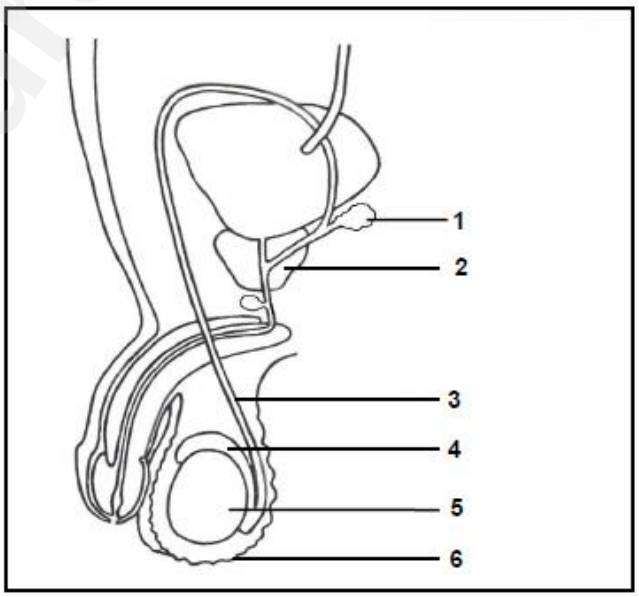
1.2 A healthy sperm that will be able to fertilise an ovum is produced by the …

A prostate glands at a temperature of about 35°C.
B prostate glands at a temperature of about 37°C.
C testis at a temperature of about 35°C.
D testis at a temperature of about 37°C.

1.3 The tube in the male reproductive system that connects the epididymis with the urethra is the …

A fallopian tube.
B vas deferens.
C vulva.
D seminal vesicle.

QUESTIONS 1.4 AND 1.5 ARE BASED ON THE DIAGRAM OF THE HUMAN MALE REPRODUCTIVE SYSTEM BELOW.



Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

1.4 Which part stores sperm until maturation?

A 3
B 4
C 5
D 6

1.5 A man who had cancer underwent surgery to remove part **1** and part **2**. The man …

A will be able to release semen not containing sperm and therefore cannot reproduce.
B cannot reproduce because he will produce abnormal sperm.
C cannot reproduce as his sperm will not be able to survive the acidic conditions of the vagina.
D will be able to reproduce but his sperm will not be able to move fast as they will not have energy.

1.6 Which ONE of the following is a function of amniotic fluid?

A Transports oxygen to the developing foetus
B Protects the foetus from temperature changes
C Produces progesterone and oestrogen
D Protects the foetus from disease **(12)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.9) in your ANSWER BOOK.

2.1 A hormone that stimulates the maturation of sperm
2.2 The outermost extra-embryonic membrane surrounding the embryo
2.3 The outer most extra-embryonic membrane in an embryo that plays a role in the formation of the placenta
2.4 A process when an embryo embeds itself into the endometrium
2.5 The finger-like projections that develop from the outer extra- embryonic membrane
2.6 A structure in the female reproductive system where semen is deposited during copulation
2.7 The period of development of the foetus in the uterus
2.8 A structure in the female reproductive system where fertilisation takes place
2.9

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

The stage when secondary sexual characteristics develop in males and females **(9)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	A structure that is formed after fertilisation	A B	Blastocyst Morula
3.2	The blood vessel that transports oxygenated blood from the placenta to the foetus	A B	Umbilical vein Umbilical artery
3.3	The period of development of an embryo in the uterus until birth	A B	Copulation Gestation

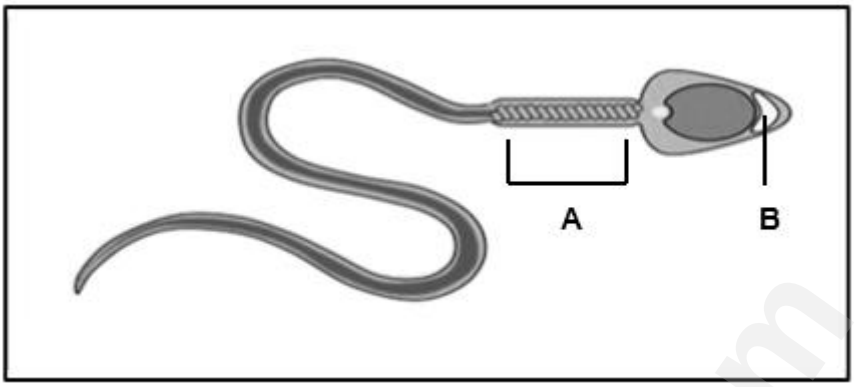
(3 x 2) **(6)**

QUESTION 4 *(NW, Prelim 2019, Paper 1)*

The diagram below represents a sperm.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



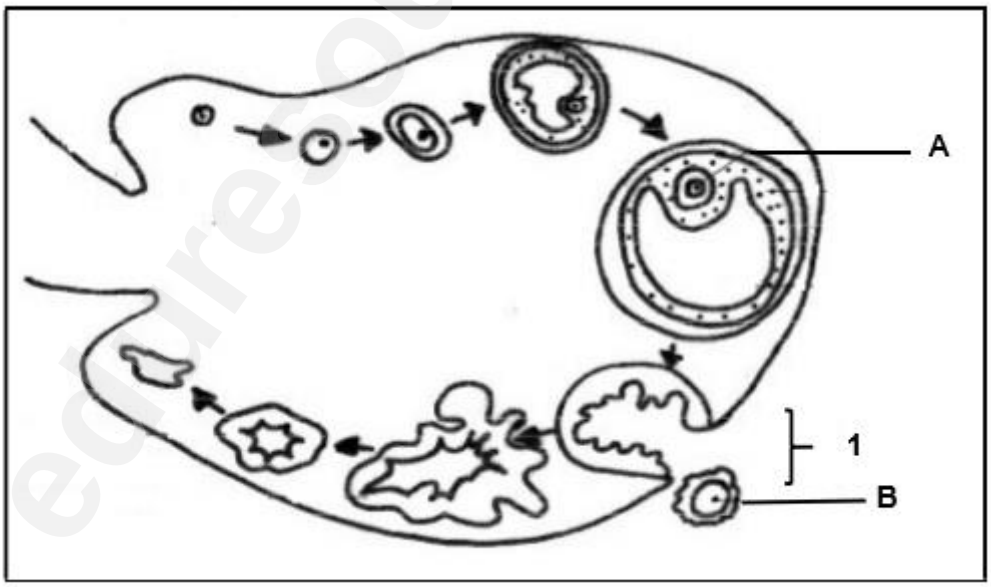
4.1 Give a label for part A. (1)

4.2 Explain TWO ways in which the sperm is adapted to ensure effective movement towards the Fallopian tubes. (4)

4.3 Name part **B** and explain the consequences for reproduction if a sperm does not have it. (4)
(9)

QUESTION 5 *(MP, Prelim 2019, Paper 1)*

The diagram below shows events in the ovary during the menstrual cycle in a 28-day cycle.



5.1 Identify:
(a) Structure **A** (1)
(b) Process 1 (1)

5.2 Name the hormone responsible for process **1**. (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

5.3 A woman was given medication with high concentration of progesterone.

Explain the effect of this medication on the ovarian cycle. (3)

5.4 Give an observable reason which suggest that fertilisation did not take place after the process numbered **1.** (2)

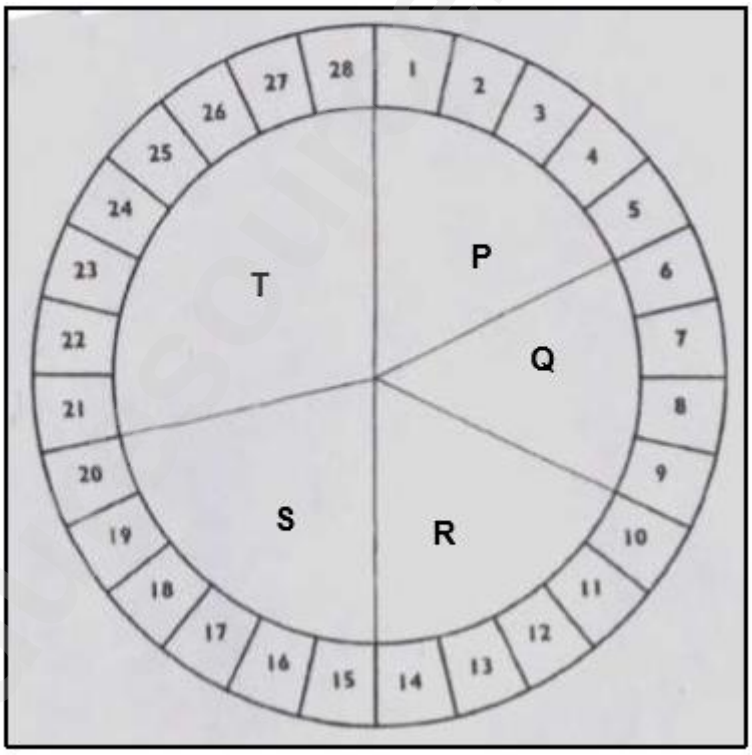
5.5 Ovariotomy is a term used to describe the surgical removal of only the ovaries. They can be removed due to certain illnesses such as cancer.

Explain why a female who have done ovariotomy will not undergo menstruation (4)

5.6 Draw a labelled diagram of the structure **B**. (3)
(15)

QUESTION 6 *(LIMPOPO, Prelim 2019, Paper 1)*

The following diagram represents a menstrual cycle of a woman, starting at day one.



6.1 Indicate the LETTER of the phase when:

(a) Menstruation is likely to occur. (1)

(b) The levels of progesterone and oestrogen are the highest. (1)

6.2 The birth control pill is one of the most commonly used contraceptive products. It contains oestrogen and progesterone and is taken daily except for the last 5

Downloaded from eduresourceza.com

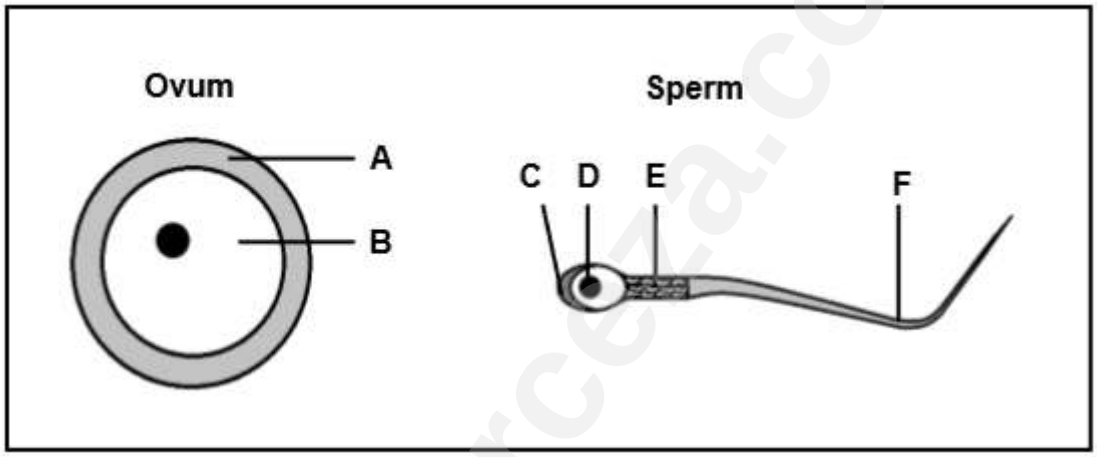
Downloaded from eduresourceza.com

days of the 28-day menstrual cycle. Explain how the presence of high levels of these hormones prevents pregnancy. (5)

6.3 Draw a labelled diagram of an ovary with only the follicles indicated at stages **P** and **S** on the diagram. (4)
(11)

QUESTION 7 *(DBE, Nov. 2019, Paper 1)*

The diagrams below represent the structures of an ovum and a sperm.



7.1 Identify part:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

7.2 Name the process involving meiosis that leads to the formation of an ovum. (1)

7.3 Write down only the LETTER of the part of the sperm that enters the ovum. (1)

7.4 Write down only the LETTERS of TWO parts that enable the sperm to move towards the ovum. (2)
(7)

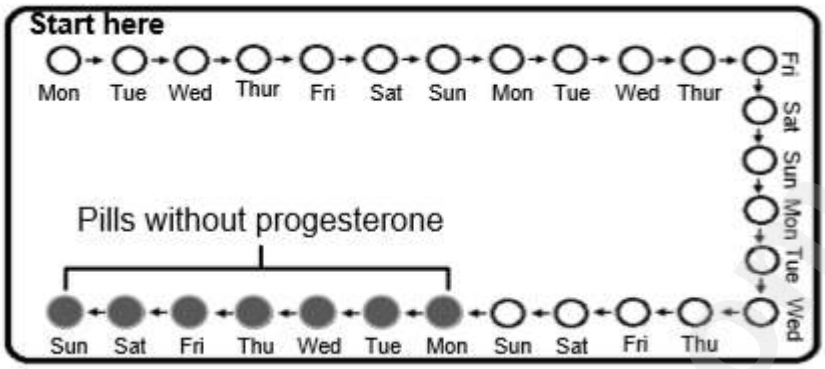
QUESTION 8 *(DBE, Nov. 2019, Paper 1)*

Contraceptives are used to prevent pregnancy. Some females use pills that contain progesterone. In one packet there would be 28 pills, of which 21 contain different concentrations of progesterone according to the day in the cycle and the remaining 7

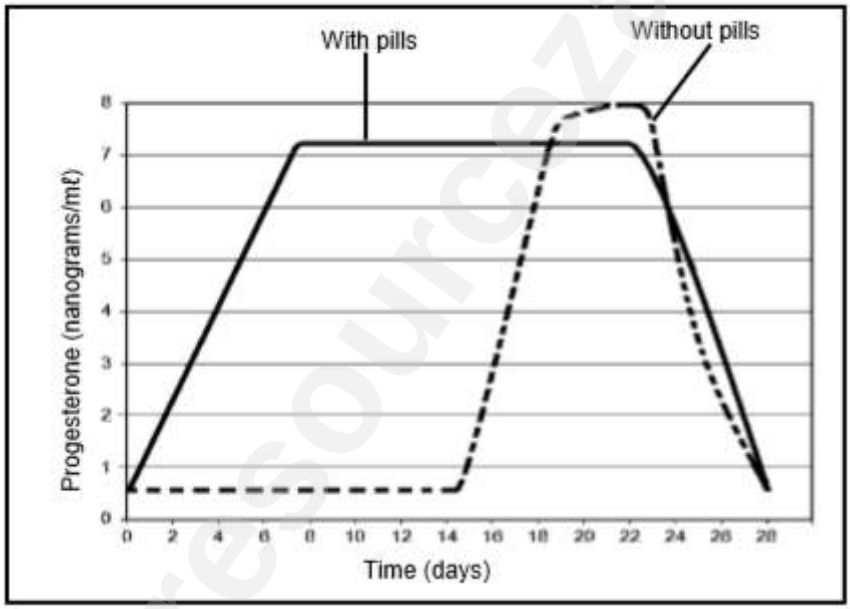
Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

will contain no progesterone. A female has to take one pill daily at the same time in a given sequence, as shown below.



The graph below shows the difference in the progesterone levels during a menstrual cycle of a woman taking contraceptive pills and a woman not taking contraceptive pills.



8.1 The oestrogen levels between days **8** and **22** will remain low in the woman who takes contraceptive pills. Explain why this is the case. (4)

8.2 Ovulation took place on day **14** in the woman not taking contraceptive pills. Explain the evidence in the graph that supports this conclusion (2)

8.3 Suggest ONE reason for including pills with no hormones in the contraceptive pill packet. (1)

(7)

QUESTION 9 *(DBE, Nov. 2019, Paper 1)*

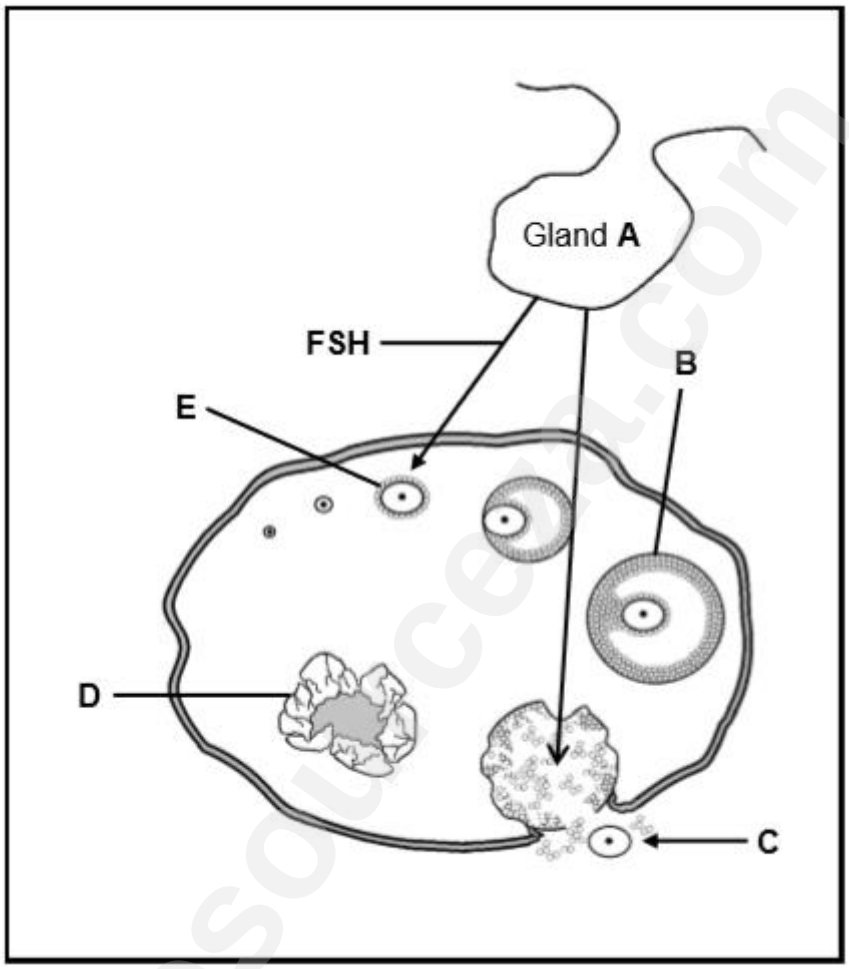
Describe the development of a zygote until implantation occurs. (4)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 10 *(DBE, Feb/March 2019, Paper 1)*

The diagram below represents an endocrine gland A and the events that take place in the ovary during the menstrual cycle in humans.



10.1 Identify:

(a) Gland **A** (1)

(b) Structure **B** (1)

(c) Process **C** (1)

(d) Structure **D** (1)

10.2 State the effect on the oestrogen levels in the blood if gland A stops secreting FSH. (1)

10.3 State ONE function of LH. (1)
(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HUMAN REPRODUCTION ANSWERS

QUESTION 1

1.1 C ✓✓
1.2 C ✓✓
1.3 B ✓✓
1.4 B ✓✓
1.5 C ✓✓
1.6 B ✓✓ **(12)**

QUESTION 2

2.1 Testosterone ✓
2.2 Chorion ✓
2.3 Chorion ✓
2.4 Implantation ✓
2.5 Chorionic villi ✓
2.6 Vagina ✓
2.7 Gestation ✓
2.8 Fallopian tube/Oviduct ✓
2.9 Puberty ✓ **(9)**

QUESTION 3

3.1 None ✓✓

3.2 A only ✓✓

3.3 B only ✓✓

(6)

QUESTION 4

4.1 A – Middle piece ✓ (1)

4.2 Mitochondria ✓: supplies energy ✓ for locomotion of the sperm cell

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Tail ✓: can propel forward ✓ for swimming/locomotion of the sperm cell
Torpedo shape ✓: reducing friction ✓ **(MARK FIRST TWO ONLY)** (4)
Any 2 x 2

4.3 - Acrosome* ✓

- therefore will be no enzymes ✓

- Sperm will be unable to penetrate the ovum ✓

- therefore no fertilisation will occur ✓ **1 * compulsory + 3** (4)
(9)

QUESTION 5

5.1 (a) Graafian follicle ✓ (1)
(b) Ovulation ✓ (1)

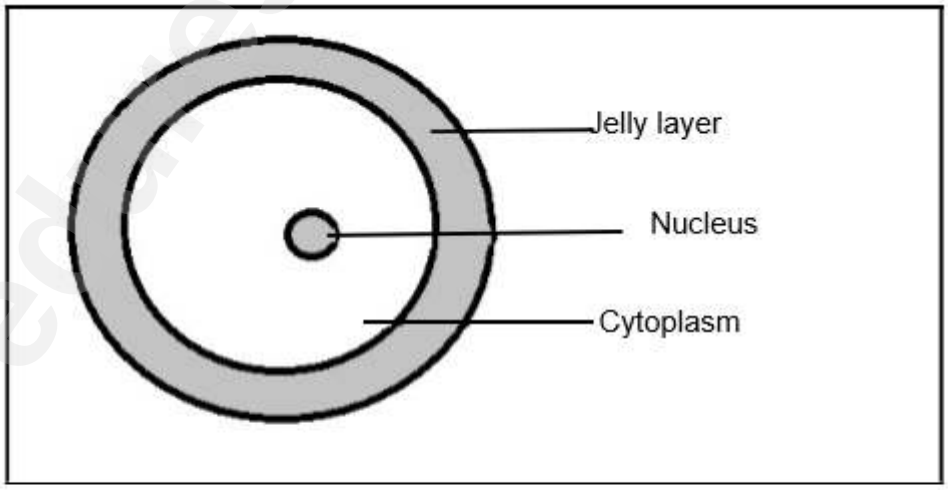
5.2 LH✓/Luteinising hormone (1)

5.3 - High level of progesterone will inhibit the secretion of FSH✓
- by the pituitary gland ✓/hypophysis
- No follicle development will occur✓
- and therefore, no ovulation✓ Any (3)

5.4 The corpus luteum✓has degenerated✓ (2)

5.5 - No follicle will develop✓
- No oestrogen✓
- to thickening of the endometrium✓
- which is shed✓ during menstruation (4)

5.6 (3)
(15)



Criteria for marking diagram

Criteria	Marks
Correct diagram (ovum)	1
Any 2 correct labels	2

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 6

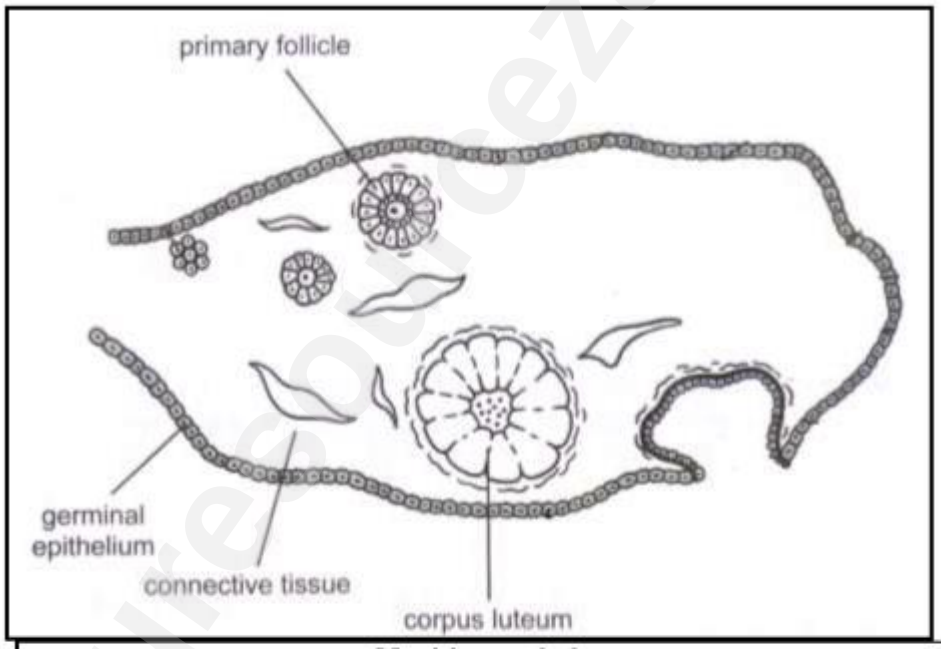
6.1 (a) P ✓ (1)
(b) S ✓ (1)

6.2 Increased progesterone and oestrogen concentrations

- Stops the pituitary gland✓
- Secreting FSH✓
- and LH✓
- This prevents the development of a Graafian follicle✓
- And ovulation is impaired ✓
- No ova no fertilisation✓

Any (5)

6.3 Ovary



Marking rubric		
Code		**Mark**
D	Correct sketch of ovary with only primary follicle and corpus luteum	1
L	3 Correct labels	3
	Total	**4**

(4)
(11)

QUESTION 7

7.1 (a) Jelly layer ✓/Zona pellucida (1)
(b) Cytoplasm ✓/cytosol (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

(c) Acrosome ✓ (1)

7.2 Oogenesis ✓ (1)

7.3 D ✓ (1)

7.4 E ✓
F ✓ **(Mark first TWO only)** (2)
(7)

QUESTION 8

8.1 - The high levels of progesterone ✓ in the pills
- will inhibit the secretion of FSH ✓ pituitary gland
- No follicle will develop ✓
- and hence no oestrogen will be secreted ✓ (4)

8.2 - The increase in the progesterone level ✓
- indicates that the corpus luteum has been formed ✓ (2)

8.3 - Women will stay in the habit of taking a pill every day ✓/ will not forget to take the progesterone containing pills
- To allow menstruation to occur ✓ **Any** (1)
(Mark first ONE only) **(7)**

QUESTION 9

- Zygote divides by mitosis ✓
- to form a ball of cells ✓
- called the morula ✓
- which further divides to form a hollow ball of cells ✓
- called the blastula/blastocyst ✓ **Any** (4)

QUESTION 10

10.1 (a) Pituitary✓ gland/hypophysis (1)
(b) Graafian follicle ✓ (1)
(c) Ovulation ✓ (1)
(d) Corpus luteum ✓ (1)
10.2 Remains low ✓/decreases (1)

10.3 - Stimulates ovulation ✓
- Stimulates the development of the corpus luteum ✓
(Mark first ONE only) **Any** (1)
(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

RESPONDING TO THE ENVIRONMENT – HUMANS (40 MARKS)

EXAM GUIDELINES

What to study:

Human nervous system

- The need for a nervous system in humans:
  - Reaction to stimuli (stimuli can be external and internal)
  - Co-ordination of the various activities of the body

Central Nervous System:

- The brain and spinal cord are protected by meninges

- Location and functions of the following parts:
  - Brain
    - Cerebrum
    - Cerebellum
    - Corpus callosum
    - Medulla oblongata
  - Spinal cord

Autonomic Nervous System:

- Location and functions of the autonomic nervous system (sympathetic and parasympathetic sections)
  - Every organ and gland is controlled by two sets of nerves; that act antagonistically to each other; to control involuntary events.
  - Sympathetic nerves generally stimulates a response; whereas the parasympathetic nerves generally inhibits a response

Structure and functioning of a nerve:

- Functions of sensory and motor neurons
- Structure and functions of parts of sensory and motor neurons, using diagrams: nucleus, cell body, cytoplasm, myelin sheath, axon and dendrites

Reflex arc:

- Definition of reflex action and a reflex arc
- Structure of a reflex arc and functions of each part, using a diagram: receptor, sensory neuron, dorsal root of spinal nerve, spinal cord, inter-neuron, motor neuron, ventral root of spinal nerve, effector
- Functioning of a simple reflex action, using an example
- Significance of a reflex action
- Significance of synapses

Disorders of the CNS

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- ❑ Causes and symptoms of the following disorders of the nervous system:
  - Alzheimer's disease
  - Multiple sclerosis

Receptors

- ❑ Functions of receptors, neurons and effectors in responding to the environment

- ❑ The body responds to a variety of different stimuli such as light, sound, touch, temperature, pressure, pain and chemicals (taste and smell). (No structure and names necessary except for names of the receptors in the eye and ear).

- ❑

Human eye

- ❑ Structure and functions of the parts of the human eye, using a diagram

- ❑ Binocular vision and its importance

- ❑ The changes that occur in the human eye for each of the following, using diagrams:
- ❑ Accommodation
- ❑ Pupillary mechanism

- ❑ The nature and treatment of the following visual defects, using diagrams:
  - Short-sightedness
  - Long-sightedness
  - Astigmatism
  - Cataracts

Human Ear

- ❑ Structure of the human ear and the functions of the different parts, using a diagram

- ❑ Amplification of sound:
  - Parts involved: tympanic membrane, ossicles and oval window
  - The sound vibrations move from the large tympanic membrane to the smaller oval window.
  - The ossicles that transmit the vibrations decrease in size from the hammer to the anvil to the stirrup.
  - The above features concentrate/intensify

- ❑ Functioning of the human ear in:
  - Hearing (include the role of the organ of Corti without details of its structure)
  - *Sound* coming from a source is the *stimulus.* The stimulus moves as *sound waves* from the source through the auditory canal until it reaches the tympanic membrane. From here the stimulus of sound waves moves as *vibrations* through the tympanic membrane, ossicles and oval window. When the vibrations pass into the endolymph of the inner ear then the stimulus is in the form of *pressure waves* which then stimulate the organ of Corti. This is when the stimulus is converted into an *impulse* which can be transmitted to the cerebrum.
  - *Fusion of the ossicles:*
    The ossicles
    - will not be able to vibrate
    - and hence no vibrations will be passed to the inner ear
    - and no amplification will occur

  - Balance (include the role of maculae and cristae without details of their structure)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Part of ear	Receptors	Stimulus
Semicircular canals	Cristae	Changes in speed and direction
Sacculus and utriculus	Maculae	Changes in the position of the body

- When the above receptors are stimulated the stimulus is converted into an impulse that is transmitted through the vestibular branch of the auditory nerve to the cerebellum. Here the impulse is interpreted and impulses are sent to the muscles of the body (the effectors) to restore balance.

❑ Cause and treatment of the following hearing defects:
- Middle ear infections (Use of grommets)
- Deafness (Use of hearing aids and cochlear implants)

TERMINOLOGY

The human nervous system

Biological term	Description
Afferent neuron	Neuron that carries impulses to the Central Nervous System
Alzheimer's Disease	Progressive mental deterioration that can occur in middle or old age, due to generalized degeneration of the brain
Autonomic nervous system	The part of the peripheral nervous system that controls involuntary actions
Axon	The long threadlike part of a nerve cell along which impulses are conducted from the cell body to other cells
Central nervous system (CNS)	The part of the nervous system that consist of the brain and spinal cord
Cerebrospinal fluid	A watery *fluid*, continuously produced and absorbed, which flows in the ventricles (cavities) within the brain and around the surface of the brain and spinal cord
Corpus callosum	The structure that connects the left and right hemispheres of the brain, allowing communication between them
Dementia	A general term used for memory loss and loss of other intellectual abilities
Dendrite	A part of the neuron that conducts impulses towards the cell body
Efferent neuron	Neuron that carries impulses to the CNS
Effectors	Are muscles or glands that respond to the message from the nervous system (brain and spinal cord)
Medulla oblongata	The part of the brain that controls the heart rate
Meninges	A collective name for the membranes that protect the brain

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Multiple sclerosis	A disorder of the nervous system that is characterised by the breakdown of the myelin sheath of neurons
Myelin sheath	A fatty layer wrapped around the axon, which acts as insulation
Nerve	Bundle of neurons
Neuron	One nerve cell
Neurotransmitter	Chemical that is released from a nerve cell which thereby transmits an impulse from a nerve cell to another nerve, muscle, organ, or other tissue
Peripheral nervous system	The part of the nervous system made up of cranial and spinal nerves
Receptors	Structures located in the sense organs. They convert a stimulus into an impulse
Stimulus	A detectable change (e.g. pain, heat, light, sound) that will be received by a receptor and converted into an impulse
Synapse	A junction between two nerve cells, consisting of a minute gap across which impulses pass by diffusion of a neurotransmitter

The human eye

Biological term	**Description**
Accommodation	The ability to change the focal length of the object by changing the convex shape of the lens to assist with focussing on a near or distant object
Astigmatism	Uneven curvature of the lens or cornea resulting in distorted images
Aqueous humour	The watery fluid that supports the cornea and the front chamber of the eye
Long-sightedness	Disorder of the eye where a person can see objects far away but not objects close by; this is caused by a lens that cannot become rounded enough to refract light, so the image falls behind the retina
Short-sightedness	Disorder of the eye where a person can see objects close by but not objects that are far away; this is caused by a lens that is too rounded, so the image falls short of the retina
Optic nerve	The nerve that carries impulses from the retina to the brain
Photoreceptors	Specialized receptors to receive the stimulus of light and convert it to an impulse. Photoreceptors in the retina of the eye are called rod and cone cells
Refraction	To bend light – refraction takes place when light passes through a lens that is bent by a **convex** [**()**] shape or a **concave** [**)(**] shape
Retina	Innermost membrane in the eye that contains photoreceptors
Stereoscopic vision	Also known as binocular vision - to see with **two** eyes, where each eye will produce a slightly different image of the same object and allows us to judge distance, depth and size of an object

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

The human ear

Biological term	Description
Auditory Canal	The open passage through which sound waves travel to the middle ear.
Auditory Nerve	Bundle of nerve cells that carry signals from the sensory fibres to the brain.
Cochlea	Coiled, fluid-filled structure of the inner ear that contains hair cells called cilia. Cilia sway in response to sound waves, transmitting signals toward the brain.
Eardrum/Tympanum	A taut, circular piece of skin that vibrates when hit by sound waves.
Eustachian Tube	The passageway that connects the ear to the back of the nose to maintain equal air pressure on both sides of the eardrum.
Grommets	Small tubes placed in the tympanum to drain moisture from the middle ear
Mechanoreceptors	The Organs of Corti are receptors located in the cochlea of the ear, which are stimulated by sound waves and convert the sound waves into impulses.
Ossicles	Three little bones called the hammer, anvil and stirrup located in the middle ear and that function to amplify sound.
Otis media	Inflammation and infection of the middle ear which causes pressure on the eardrum.
Pinna	The outer portion of the external ear: sound travels through the outer ear to the ear canal.
Semi-circular Canals	Fluid-filled structures in the inner ear that detect movement and function as balance organs.

TYPICAL EXAM QUESTIONS

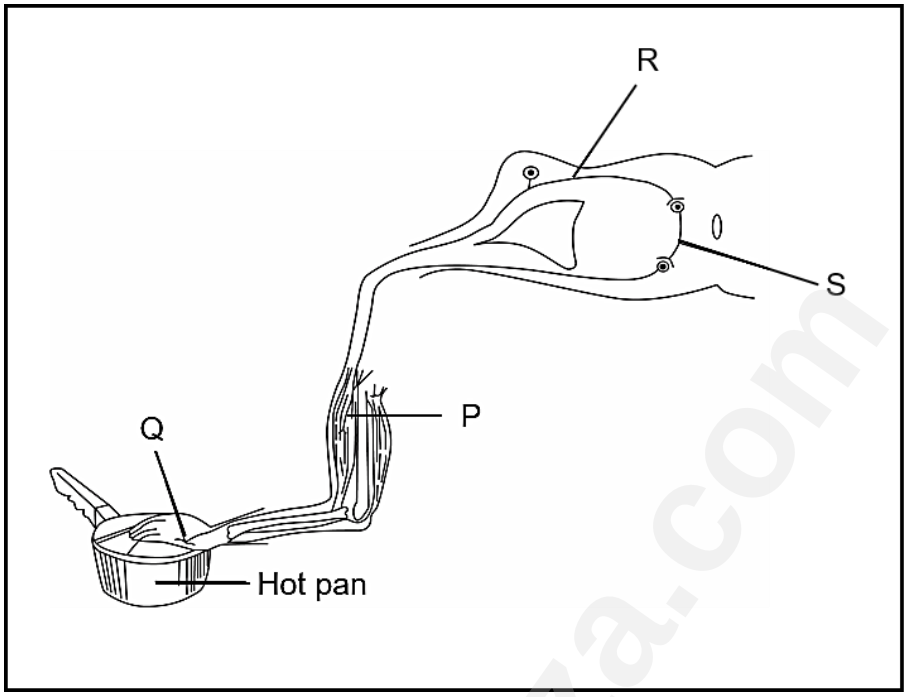
QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.16) in your ANSWER BOOK, for example 1.17 D.

1.1 The diagram below shows the structures involved in a reflex action.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



What is the sequence in which these structures become involved?

A P → Q → R → S
B P → S → R → Q
C Q → R → S → P
D Q → S → P → R

1.2 Which of the following pairs of body functions are normally involuntary actions but can be controlled voluntarily for short periods of time?

A Heartbeat and blood pressure
B Blinking of the eye and the mechanism of breathing
C Contraction of skeletal muscles and pupil size
D Control of body temperature and shivering

1.3 A function of the medulla oblongata is to …

A control higher thought processes.
B regulate blood glucose levels.
C regulate breathing.
D inhibit voluntary movement.

1.4 A disorder of the brain that is characterised by memory loss and confusion is …

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

A Alzheimer's disease.
B haemophilia.
C multiple sclerosis.
D Down syndrome.

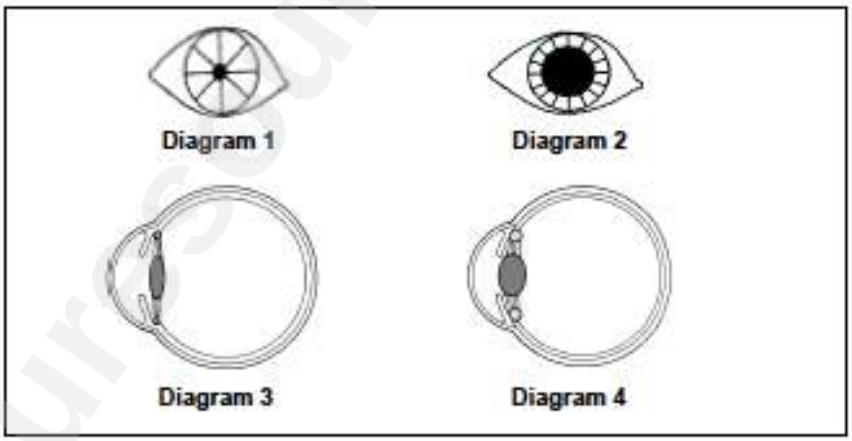
1.5 The nerve impulse in the axon of a sensory neuron is transmitted …

A towards the dendrite of the sensory neuron.
B towards the cell body of the sensory neuron.
C away from the effector organ.
D away from the cell body

1.6 Which ONE of the following CORRECTLY matches a visual defect and its corrective treatment?

A Cataracts – concave lens
B Short-sightedness – convex lens
C Astigmatism – concave lens
D Long-sightedness – convex lens

1.7 The diagrams below show the human eye under different conditions.



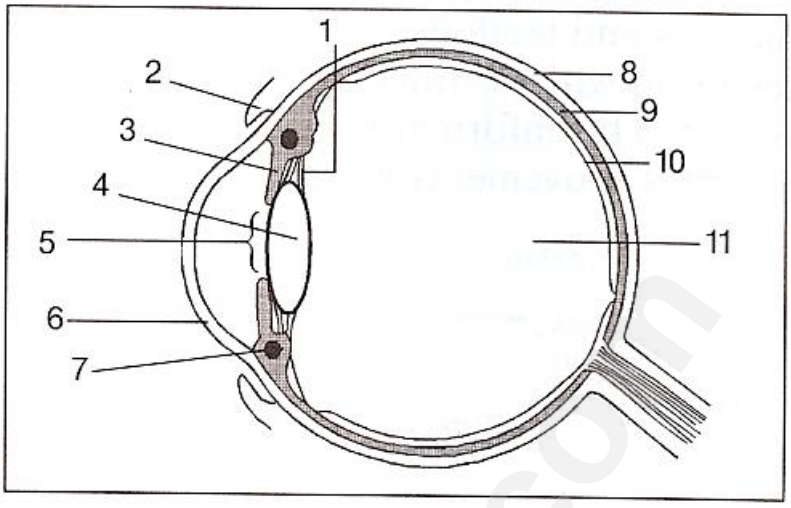
Which TWO diagrams above show the result when the ciliary muscles contract and the circular muscles of the iris relax?

A 1 and 3
B 3 and 2
C 1 and 4
D 4 and 2

Refer to the diagram of the human eye below for Questions 1.8 to 1.10

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



1.8 The parts that control the amount of light rays that enter the eye are…

A 1 and 2
B 1 and 3
C 2 and 3
D 3 and 4

1.9 The greatest convergence takes place when light rays pass through the part numbered…

A 4
B 5
C 6
D 11

1.10 The function of part numbered 9 is to:

1. reflect light
2. change the shape of the eyeball
3. refract light rays
4. prevent reflection
5. supply the retina with nutrients and oxygen
6. absorb excess light

Choose the correct options for the function of part no.9

A 1, 2, 3
B 4, 5, 6
C 2, 4, 6
D 1, 3, 5

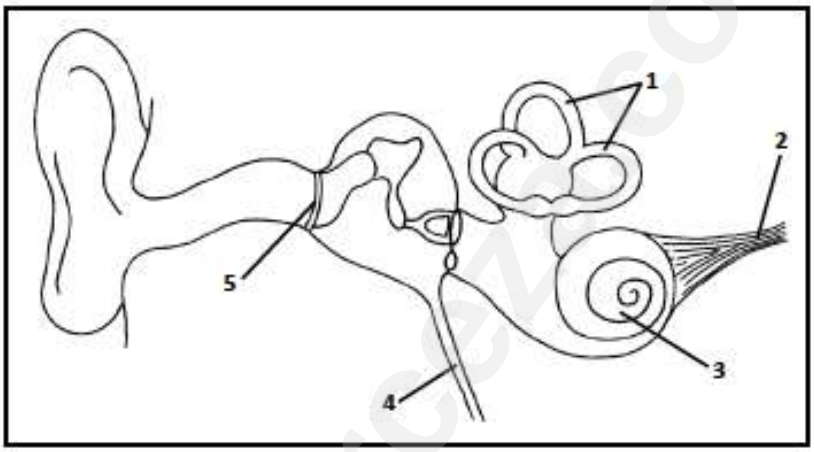
Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

1.11 Which ONE of the following occurs when you look up from reading a book on a clear, sunny day to focus on a mountain more than 100 metres away?

A Radial muscles of the iris contract.
B Pupil becomes dilated.
C Ciliary muscles relax.
D Lens becomes more convex

QUESTIONS 1.12 AND 1.13 REFER TO THE DIAGRAM BELOW SHOWING THE STRUCTURE OF THE HUMAN EAR.



1.12 Which part sends vibrations to the ossicles?

A 3
B 1
C 4
D 5

1.13 Which part maintains equal pressure on either side of the tympanic membrane?

A 4
B 3
C 2
D 1

1.14 Grommets may be used in the treatment of …

A astigmatism
B cataracts.
C middle ear infections.
D long-sightedness.

1.15 The vibrations on the tympanic membrane are transferred to the …

A ossicles and then the oval window.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

B oval window and then the ossicles.
C ossicles and then the round window.
D cochlea and then the ossicles.

1.16 Which part of the ear converts pressure waves into nerve impulses?

A Auditory nerve
B Organ of Corti
C Eustachian tube
D Auditory canal **(32)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.13) in your ANSWER BOOK.

2.1	The structure that connects the left and right hemispheres of the brain, allowing communication between them
2.2	The part of the brain that controls the heart rate
2.3	The part of the nervous system made up of cranial and spinal nerves
2.4	A disorder of the nervous system that is characterised by the breakdown of the myelin sheath of neurons
2.5	A single nerve cell
2.6	Uneven curvature of the lens or cornea resulting in distorted images
2.7	The nerve that carries impulses from the retina to the brain
2.8	The watery fluid that supports the cornea and the front chamber of the eye
2.9	The open passage through which sound waves travel to the middle ear
2.10	Inflammation and infection of the middle ear which causes pressure on the eardrum
2.11	The outer portion of the external ear: sound travels through the outer ear to the ear canal
2.12	Fluid-filled structures in the inner ear that detect movement and function as balance organs
2.13	A taut, circular piece of skin that vibrates when hit by sound waves **(13)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.5) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Components of the autonomic nervous system	A	Peripheral nervous system
		B	Somatic nervous system

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

3.2	A part of the brain that receive impulses from the sense organs	A B	Cerebrum Cerebellum
3.3	A structure in the neuron that insulates the axon	A B	Cell body Myelin sheath
3.4	A disorder caused by the degeneration of the myelin sheath of motor neurons	A B	Multiple sclerosis Alzheimer's disease
3.5	The part of the nervous system which is concerned with voluntary action	A B	Sympathetic Parasympathetic

(5 x 2) **(10)**

QUESTION 4 *(LP, Sept. 2019, Paper 1)*

The frequency of sound is measured in units called Hertz (Hz) Three learner's hearing were tested by testing their range of sound that they can hear. The results are recorded in the following table:

	Lowest frequency of sound heard	**Highest frequency of sound heard**
Pabalelo	19 Hz	20300 Hz
Nkazi	18 Hz	20100 Hz
Hazel	320 Hz	1000 Hz

4.1 Which learner most probably needs a hearing-aid? (1)

4.2 Explain your answer in QUESTION 4.1. (2)

4.3 Bats produce sounds between 30 000 and 80 000 Hz. Explain why humans are not able to hear sound produced by bats. (2)

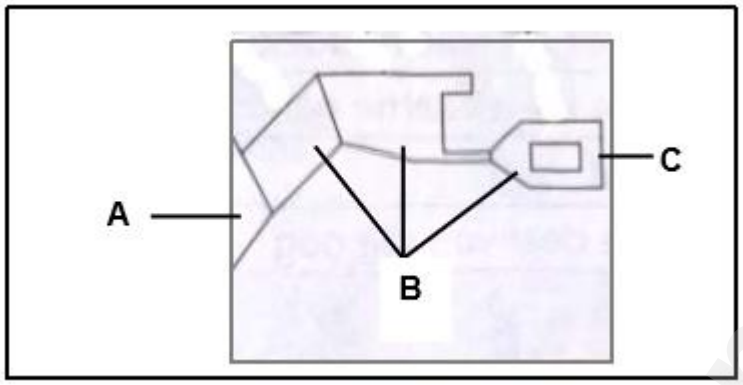
(5)

QUESTION 5 *(LP, Sept. 2019, Paper 1)*

The following diagram is a simplified diagram of structures in the middle ear of a human.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



5.1 Give the NAMES and the FUNCTIONS of the membranes labelled:

(a) **A** (2)

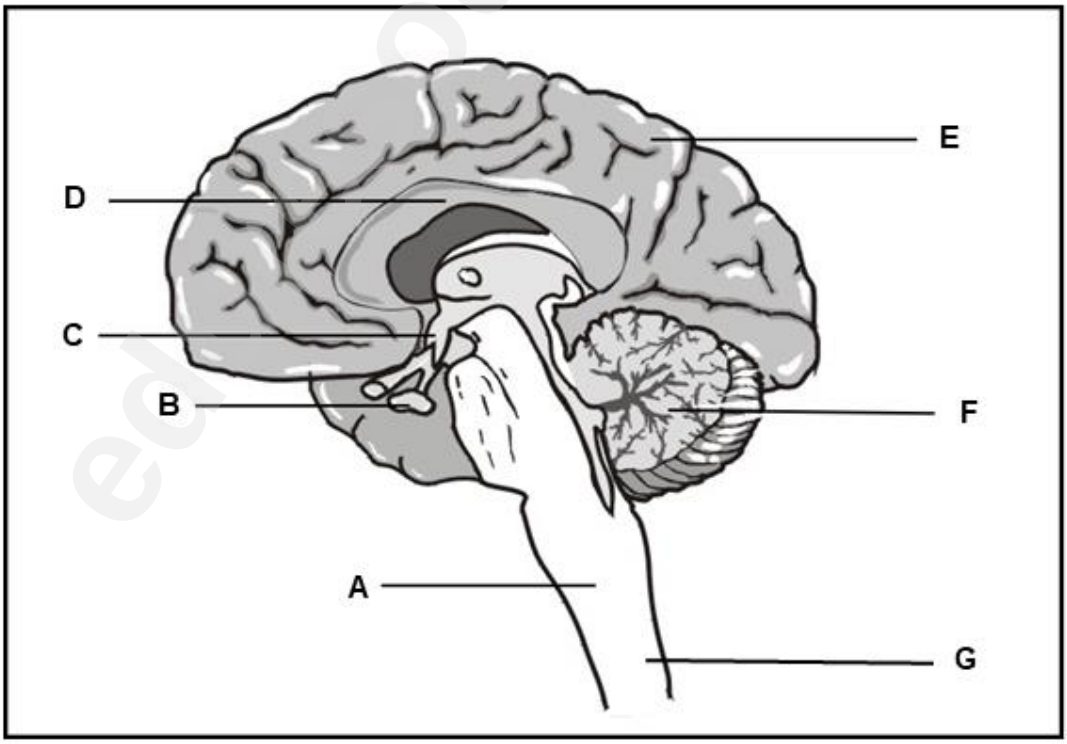
(b) **C** (2)

5.2 Explain how parts **B** are structurally suited to amplify sound waves (2)

5.3 Describe the role of the sacculus and utriculus in maintaining balance (5)
(11)

QUESTION 6 *(GDE, Sept. 2019, Paper 1)*

Study the diagram below.



6.1 Identify part:

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

(a) **D** (1)
(b) **G** (1)

6.2 Name the system of membranes that surround the brain. (1)

6.3 Identify only the **LETTER** of the part of the brain that:

(a) Controls body temperature

(b) Produces prolactin

(c) Controls involuntary activities such as heartbeat

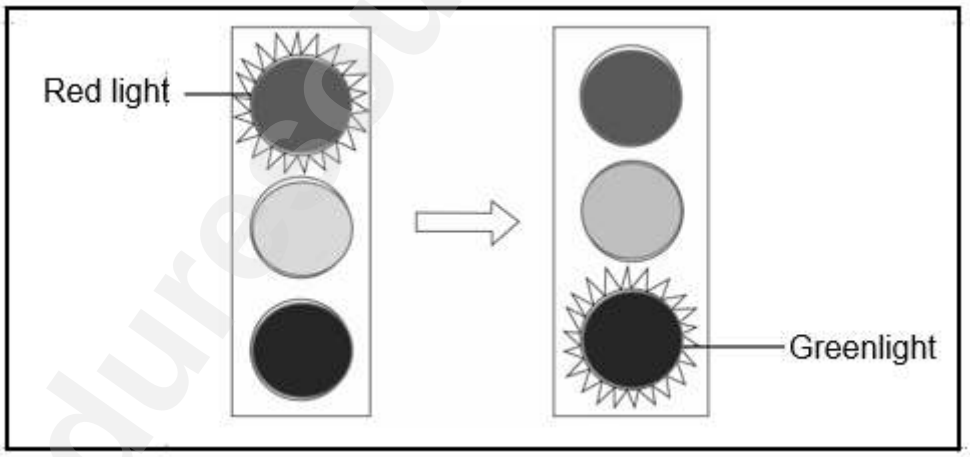
(d) Controls memory storage and voluntary actions (4)

(7)

QUESTION 7 *(GDE, Sept. 2019, Paper 1)*

7.1 Describe how accommodation takes place in the eye for distant vision. (5)

7.2 Car drivers need quick reactions to avoid accidents. A learner uses a computer to measure reaction time. The computer screen shows a traffic light on red. The traffic light then changes to green. The diagram below shows the change the person sees on the computer screen.



When the traffic light changes to green the person has to click the computer mouse as quickly as possible. The computer programme works out the time taken to react to the light changing colour.

The learner used three measurements to calculate the average reaction time. The table below shows the results.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Age in years	Average reaction time (milliseconds)
30	182
45	221
60	258
75	364
90	526

7.2.1 Plot a line graph of the results shown in the table in your ANSWER BOOK. (6)

7.2.2 Some people think that people in the age group 75 – 90 should not be allowed to drive a car.

Use the information from the table to explain why it is more dangerous for old people to drive cars. (2)

7.2.3 State ONE way in which the learner increased the reliability of the results. (1)
(14)

QUESTION 8 *(EC, Sept. 2019, Paper 1)*

Read the following extract about motor neuron disease.

> Motor neuron diseases (MNDs) refers to a group of conditions that cause the motor neurons in the nerves of the spinal cord and brain to progressively lose function. MNDs are rare but serious and incurable forms of progressive neurodegeneration. Motor neurons are nerve cells that send impulses to the muscles.
>
> Genetic, viral and environmental issues may play a role in causing MNDs. Motor neuron diseases (MNDs) can appear at any age, but most patients are over 40 years old at diagnosis. It affects men more than women.
>
> [Adapted from www.medicalnewstoday.com]

8.1 According to the extract, what is the definition of motor neuron disease? (1)

8.2 From the extract, list TWO factors that can cause motor neuron disease. (2)

8.3 Explain the possible effect that this disease will have on the reflex action if a person was to step on a thorn. (3)

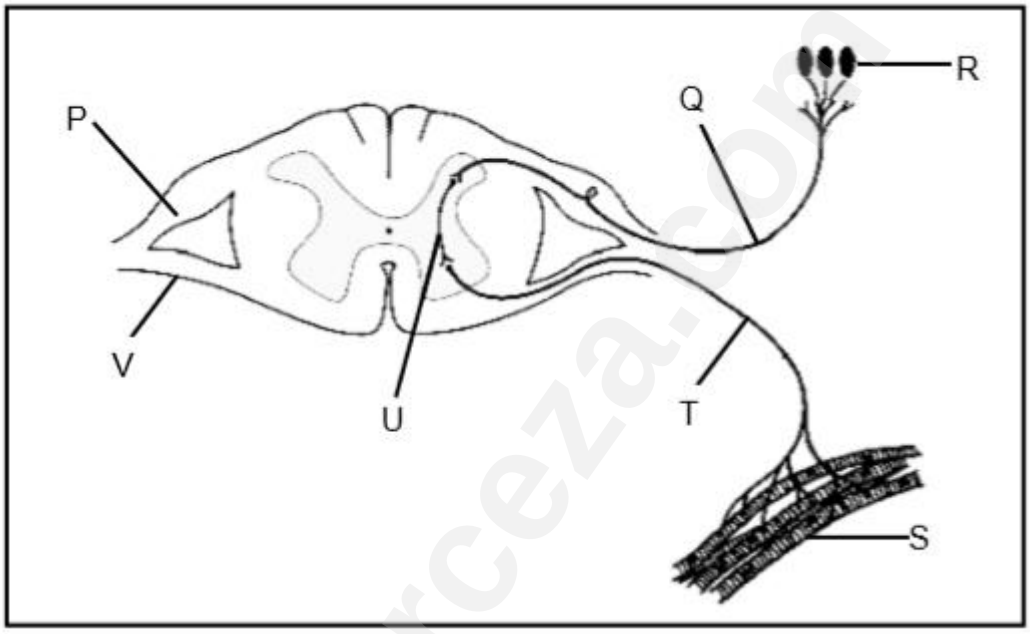
Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

8.4 Draw a labelled diagram of a motor neuron. (4)
(10)

QUESTION 9 *(FS, Sept. 2018, Paper 1)*

The diagram below shows a section of the human nervous system.



9.1 What impulse pathway is represented in the diagram? (1)

9.2 Write the LETTERS of the neurons involved in the process mentioned in QUESTION 9.1 in the correct order. (3)

9.3 Give the LETTER of the following:

(a) An effector (1)

(b) Dorsal root of the spinal nerve (1)

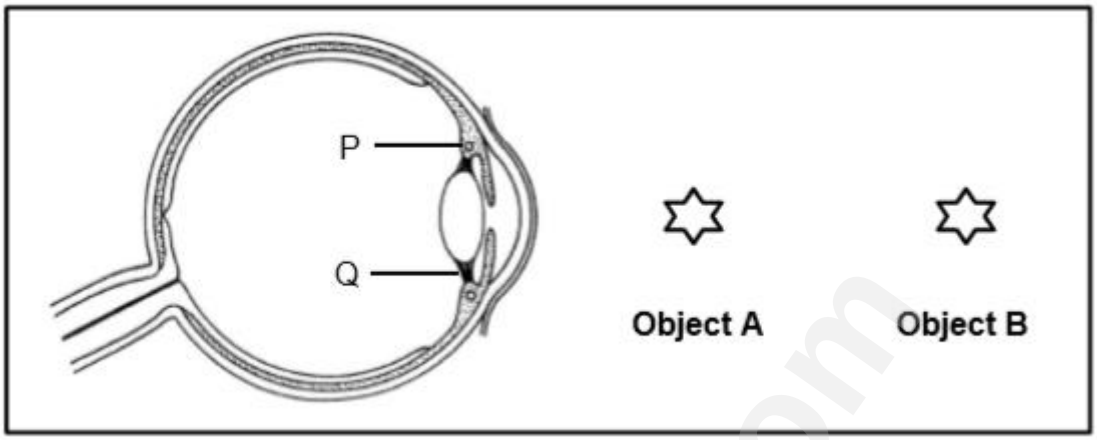
9.4 After an accident a person is able to feel stimuli but not respond. Give the LETTER of the part that is damaged. (1)
(7)

QUESTION 10 *(FS, Sept. 2018, Paper 1)*

The diagram below represents a human eye when the person is looking at an object that is 6 meters away.
Object A is placed 3 meters away and Object B is placed 8 meters away.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



10.1 Name the following on the retina of the eye:
(a) The area that is responsible for forming the clearest image (1)
(b) The photoreceptors that are stimulated in low light intensity (1)

10.2 Name the disorder that results in the inability of the eye to focus on object **A** (1)

10.3 Name the type of lens that should be used to correct the disorder mentioned in QUESTION 10.2 (1)

10.4 Explain the role of structures **P** and **Q** to ensure a clear image if the person moves his focus from object **B** to object **A.** (6)
(10)

RESPONDING TO THE ENVIRONMENT – HUMANS: ANSWERS

QUESTION 1

1.1	C	✓✓
1.2	B	✓✓
1.3	C	✓✓
1.4	A	✓✓
1.5	D	✓✓
1.6	D	✓✓
1.7	D	✓✓
1.8	C	✓✓
1.9	C	✓✓
1.10	B	✓✓
1.11	C	✓✓
1.12	D	✓✓
1.13	A	✓✓
1.14	C	✓✓
1.15	A	✓✓
1.16		

(32)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

B ✓✓

QUESTION 2

2.1 Corpus callosum ✓

2.2 Medulla oblongata ✓

2.3 Peripheral (nervous system) ✓

2.4 Multiple sclerosis ✓

2.5 Neuron ✓

2.6 Astigmatism ✓

2.7 Optic nerve ✓

2.8 Aqueous humour ✓

2.9 Auditory Canal ✓

2.10 Otis media ✓

2.11 Pinna ✓

2.12 Semi-circular Canals ✓

2.13 Tympanum ✓/ Eardrum

(13)

QUESTION 3

3.1 None ✓✓

3.2 Both A and B ✓✓

3.3 B only✓✓

3.4 A only ✓✓

3.5 None ✓✓

(10)

QUESTION 4

4.1 Hazel✓ (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

4.2 Hazel has the smallest range of sound✓ And won't be able to hear most of the frequencies of sound✓ like other learners (2)

4.3 The sound bats make range of frequency of sound is much higher✓ than what can be heard by humans✓/than the hearable range of frequencies of humans. (2)
(5)

QUESTION 5

5.1 (a) Tympanum✓ - converts sound waves to vibrations which are transmitted to the ossicles✓ (2)

(b) Oval window✓– transfer vibrations as pressure waves to the inner ear ✓ (2)

5.2 The ossicles are arranged from big to small✓ which concentrate the soundwaves✓ (2)

5.3
- The maculae are stimulated ✓
- by changes in the position of the head✓
- the maculae convert the stimulus into nerve impulses✓
- which are transported via the auditory nerve✓
- to the cerebellum to be interpreted ✓ (5)

(11)

QUESTION 6

6.1 (a) Corpus callosum ✓ (1)

(b) Spinal cord ✓ (1)

6.2 Meninges ✓ (1)

6.3 (a) C ✓ (1)

(b) B ✓ (1)

(c) A ✓ (1)

(d) E ✓ (1)

(7)

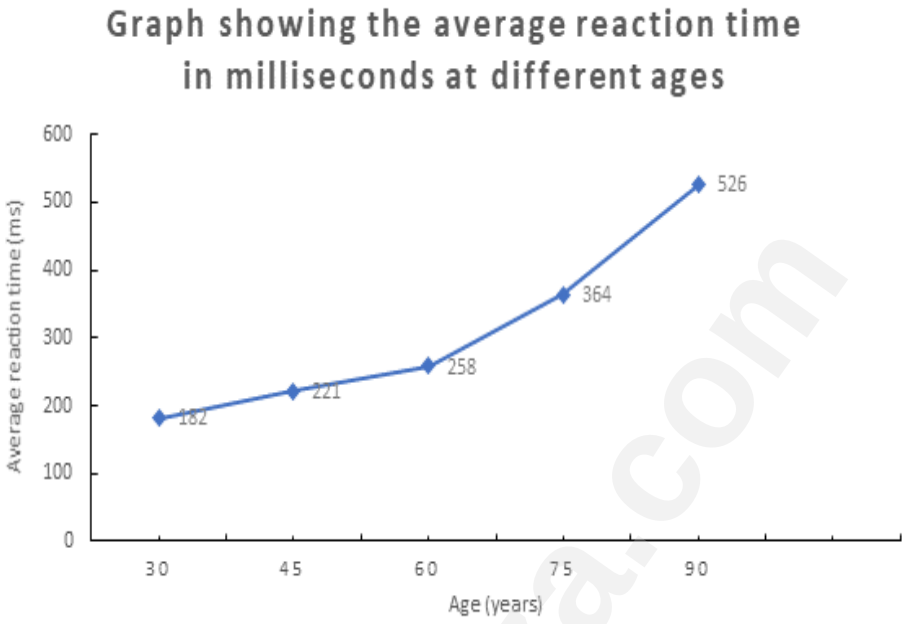
QUESTION 7

7.1
- Ciliary muscles relax ✓
- Suspensory ligaments tighten (become taut) ✓
- Tension on the lens increases ✓
- Lens is less convex (flatter) ✓
- Light rays are refracted (bent) less ✓
- Light rays are focused onto the retina ✓ Any (5)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

7.2.
1



Rubric for assessment of the graph

Correct type of graph (T)	**1**
Caption for graph (C)	**1**
Correct label for X-axis (including unit) and Y-axis (including unit) (L)	**1**
Correct scale for X-axis and Y-axis (S)	**1**
Plotting of points **1 to 4 points correct** **All 5 points correct**	 **1** **2**
	6

(6)

7.2.
2
- There is a rapid increase in the reaction time in older people ✓
- A slower reaction is more likely to result in accidents ✓ (2)

7.2.
3
- The learners did the measurements three times ✓
- The average was used ✓

(Mark first ONE only) Any (1)
(14)

QUESTION 8

8.1 A group of conditions that cause the motor neurons in the nerves in the spine and brain to progressively lose function ✓ (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

8.2 - Genetic issues ✓

- Viruses ✓

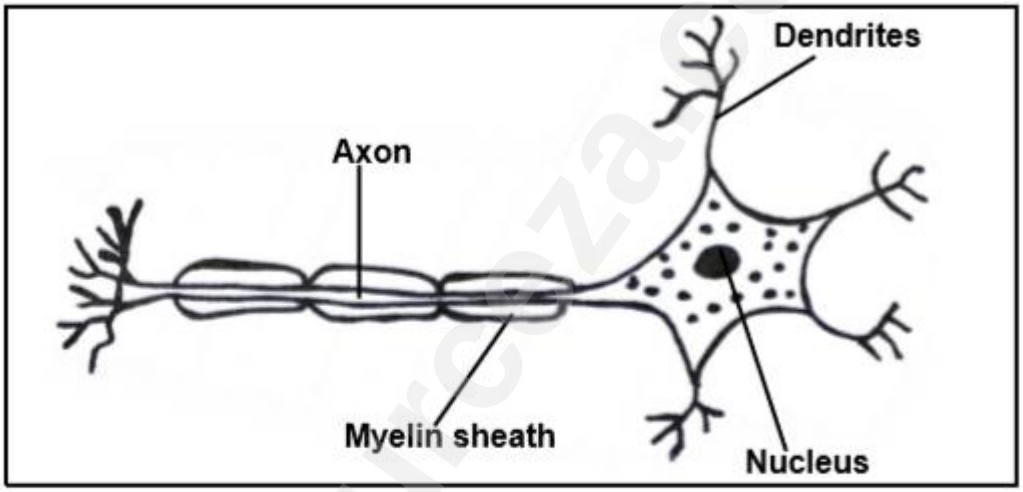
- Environmental issues ✓ **(Mark first TWO only** (Any 2) (2)

8.3 - The person would feel the pain ✓

- but would not be able to react ✓

- The motor neuron is not functioning; therefore the muscles would not be stimulated ✓ (3)

8.4



Criteria	Mark allocation
Correct neuron drawn	1
Any THREE correct labels	3

(4)
(10)

QUESTION 9

9.1 Reflex arc✓ (1)

9.2 Q✓ U✓ T✓ (in the correct order) (3)

If the letter U is in the middle with Q and T incorrectly swopped give 1 mark for U

9.3 (a) S✓ (1)
(b) P✓ (1)

9.4 T✓ or V (1)
(7)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 10

10.1 (a) Yellow spot✓/fovea centralis/fovea (1)

(b) Rods✓ (1)

10.2 Long-sightedness✓/hypermetropia (1)

10.3 Convex✓ lenses (1)

10.4 - P/Ciliary muscles contract✓

- Ciliary body moves closer to lens✓
- Q/Suspensory ligaments slacken✓
- Tension on the lens decreases✓
- Convexity of lens increases✓
- Incoming light rays are refracted more✓

(6)
(10)

eduresourceza.com

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HUMAN ENDOCRINE SYSTEM (15 MARKS)

EXAM GUIDELINES

What to study:

- Difference between an endocrine and an exocrine gland
- Definition of a hormone
- Location of each of the following glands, using a diagram, the hormones they secrete and function/s of each hormone:
  - Hypothalamus (ADH)
  - Pituitary/hypophysis (GH, TSH, FSH, LH, prolactin)
  - Thyroid glands (thyroxin)
  - islets of Langerhans in the pancreas (insulin, glucagon)
  - Adrenal glands (adrenalin, aldosterone)
  - Ovary (oestrogen, progesterone)
  - Testis (testosterone)
- Negative feedback mechanism involving:
  - TSH and thyroxin (and the result of an imbalance: thyroid disorders)
  - Insulin and glucagon (and the result of an imbalance: diabetes mellitus)

TERMINOLOGY

Biological term	Description
Endocrine glands	Ductless glands secreting hormones directly into bloodstream.
Exocrine glands	Secrete substances into **ducts** that lead **into cavities** in the body or lead directly to the external environment. (Examples: sweat glands, mammary glands, the liver, salivary glands and the pancreas.)
Hormones	Organic chemical messengers secreted directly into the blood by an endocrine gland.
Homeostasis	It is the process of **maintaining a constant internal environment** within narrow limits, despite changes that take place internally and externally.
Negative feedback mechanism	When there is an increase from normal, a corrective mechanism causes a decrease and vice versa to maintain a balanced system.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.5) in your ANSWER BOOK, for example 1.6 D.

1.1 Which ONE of the following hormones controls metabolic rate?

A Testosterone
B Thyroxin
C Growth hormone
D Insulin

1.2 An investigation was carried out to determine the effect of growth hormone on children with a particular disorder that causes their height to be below the average height expected for their age and sex.

The following procedure was followed:

- 740 children with the disorder were included in the investigation.
- Their initial heights were measured.
- They were divided into two groups (**A** and **B**).
- Group **A** was given a growth hormone injection every day for 3 years.
- Group **B** did not receive the treatment.

The height of each child in each group was then measured.

The following is a list of variables in the investigation:

(i) Children of the same age and sex with the same disorder
(ii) The nutrition given to the children
(iii) The type of growth hormone used
(iv) The height of the children at the end of the investigation

Which ONE of the following combinations are factors that should have been kept constant during this investigation?

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

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

1.3 An extract from a gland of an adult monkey was injected into the bloodstream of a young monkey. It caused the young monkey to grow abnormally tall. From which gland was the extract obtained?

A Hypothalamus
B Adrenal gland
C Hypophysis/Pituitary gland
D Pancreas

1.4 The following are effects of the secretion of different hormones.

1. An increase in the blood glucose level
2. An increase in the heart rate
3. An increase in the amount of digestive enzymes
4. An increase in blood flow to the skeletal muscles

Which one of the following combinations of the above effects is due to adrenalin?

A 1, 3 and 4
B 2, 3 and 4
C 1, 2 and 4
D 1, 2, 3 and 4

1.5 The level of thyroxin in the body is controlled by the ...

A hypothalamus and the pituitary.
B thyroid and the hypothalamus.
C thyroid and the adrenal gland.
D pituitary and the thyroid gland. **(10)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.5) in your ANSWER BOOK.

2.1 A hormone that stimulates the mammary glands to produce milk
2.2 Organic chemical messengers secreted directly into the blood by an endocrine gland.
2.3 Ductless glands secreting hormones directly into bloodstream
2.4 The hormone that regulates the amount of salt in the blood
2.5 Secrete substances into ducts that lead into cavities in the body or lead directly to the external environment. **(5)**

QUESTION 3 *(Questions taken from various sources)*

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Hormone secreted by the pituitary gland	A B	Aldosterone Growth hormone
3.2	Promotes reabsorption of salt in the kidneys	A B	ADH Aldosterone
3.3	Hormones secreted by the pituitary gland	A B	Prolactin Growth hormone

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

QUESTION 4 *(EC, Sept. 2019, Paper 1)*

An investigation was conducted by scientists to determine the effect of a low GI breakfast and a high GI breakfast on the average blood glucose concentration of women.

NOTE:

- High GI food is quickly digested and absorbed.
- Low GI food is slowly digested and absorbed.
- GI is the Glycaemic Index of a person. Glycaemic Index is a figure representing the relative ability of a carbohydrate food to increase the level of glucose in the blood.

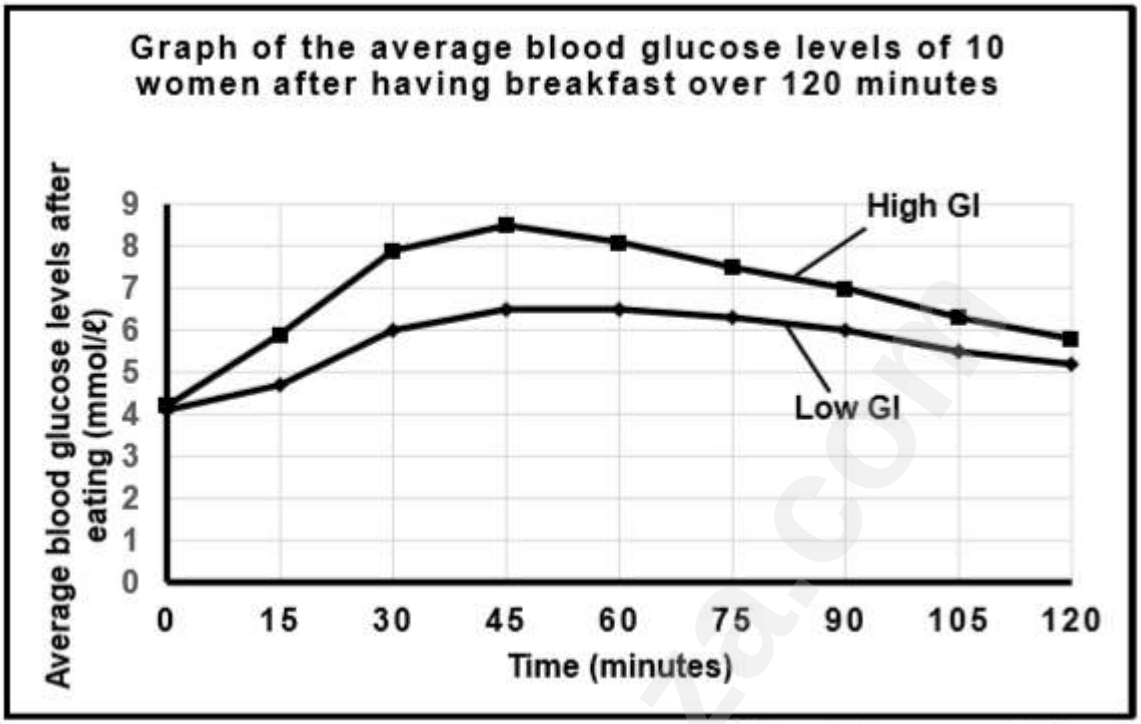
The following steps were followed during the investigation:

- Ten women who were between the ages of 28 and 30 volunteered to participate.
- The blood glucose concentration of each female was measured before eating breakfast.
- After eating breakfast, the blood glucose concentration was measured at 15-minute intervals over a period of 120 minutes.

The results of this investigation are shown in the graph below.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



[Adapted from www.ncbi.nih.gov]

4.1 Explain ONE possible reason why blood samples were taken before breakfast was eaten. (2)

4.2 Give the independent variable for this investigation. (1)

4.3 Give the blood glucose concentration at 45 minutes after eating a high GI breakfast in mmol/ℓ (1)

4.4 With reference to the graph, describe the difference between the effect of eating low GI food compared to eating high GI food on the blood glucose levels of the women. (2)

4.5 Name the hormone secreted by the pancreas that will cause the effects on blood glucose levels as seen in the graph from 45 to 120 minutes (1)

4.6 Explain the effect of a high GI breakfast on the secretion of the hormone named in QUESTION 4.5. (2)

4.7 Six months later the scientists decided to repeat the investigation. Five additional women joined the investigation and were not given breakfast at all as a control group.

(a) Give ONE reason why the scientists decided to repeat the investigation. (1)

(b) Explain the significance of having a control group for this investigation (2)

4.8 Give TWO ways in which the scientists ensured the validity of the original investigation. (2)

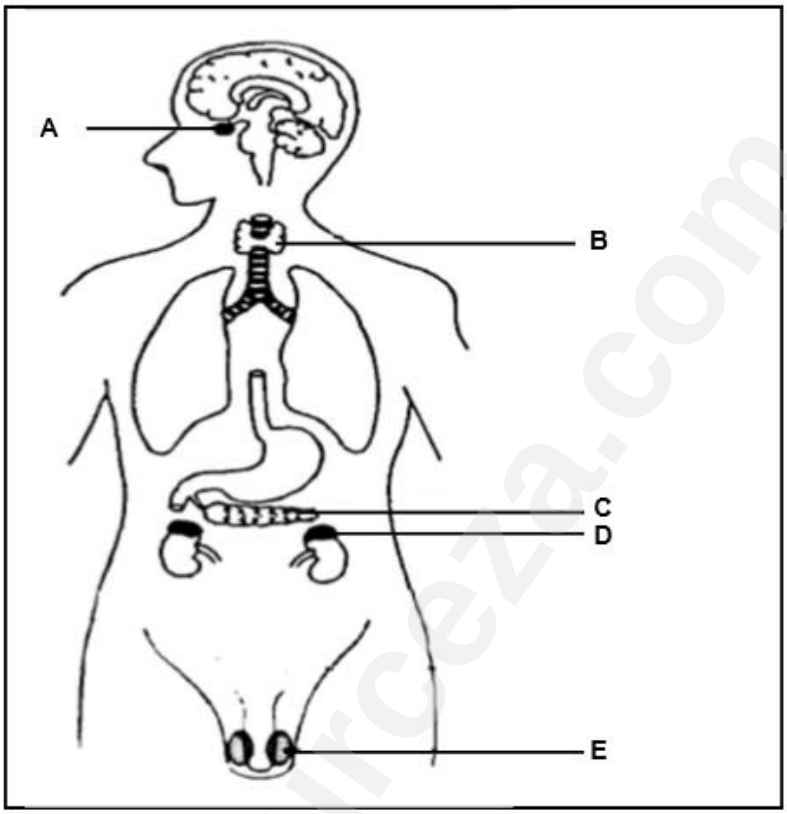
(14)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 5 *(MP, Sept. 2019, Paper 1)*

The diagram below shows the position of the endocrine glands found in a male human body.



5.1 Identify the NAME and LETTER of the gland that secrete a hormone that:

(a) Stimulates the growth of long bones (2)

(b) Regulate salt balance (2)

5.2 Explain the consequence if gland **E**, found only in males, cannot secrete its hormone. (2)

5.3 Explain the consequences to the weight of a person if the hormone secreted by gland **B** remain abnormally high for extended periods of time. (3)

(9)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HUMAN ENDOCRINE SYSTEM ANSWERS

QUESTION 1

1.1 B ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 C ✓✓
1.5 D ✓✓ **(10)**

QUESTION 2

2.1 Prolactin ✓

2.2 Hormones ✓

2.3 Endocrine ✓ glands

2.4 Aldosterone ✓

2.5 Exocrine gland ✓ **(5)**

QUESTION 3

3.1 B only ✓✓

3.2 B only ✓✓

3.3 Both A and B ✓✓

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

QUESTION 4

4.1 - To establish a baseline/starting point for the investigation from where the glucose levels will increase ✓✓

OR

- To compare the change in the blood glucose levels to what it was before breakfast was eaten ✓ (2)

4.2 The type of breakfast ✓ /Low or high GI food (1)

4.3 8,0 ✓ – 8,2 mmol/ℓ (1)

4.4 - Low GI food causes a smaller increase in the blood glucose levels than high

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

GI food ✓✓/ High GI food causes a larger increase in the blood glucose levels than low GI food

OR

- Eating Low GI food causes the blood glucose levels to increase closer to normal after 120 minutes (4 mmol/ℓ to 5,2 mmol/ℓ) than high GI food (4 mmol/ℓ to 5,8 mmol/ℓ) ✓✓ (2)

4.5 Insulin ✓ (1)

4.6 - A high GI breakfast causes a sharp increase in the blood glucose level ✓

- This will cause a large ✓/rapid increase in the blood insulin levels (2)

4.7 (a) - To improve reliability ✓ of the investigation (1)

(b) - To ensure the results were caused by the breakfast only ✓✓/ low and high GI food and not any other factor (2)

4.8 - Only females were used✓/same sex

- Females of the same age ✓/28–30 years old were used

- Same time intervals for measuring blood glucose concentration✓

(Mark first TWO only) (Any 2) (2)

(14)

QUESTION 5 *(MP, Sept. 2019, Paper 1)*

5.1 (a) A✓ – Pituitary gland ✓/ hypophysis (2)

(b) D✓ – Adrenal gland ✓ (2)

5.2 - Secondary sexual characteristics✓

- may not develop✓

OR

- Sperm production✓

- will stop✓ Any (1 x 2) (2)

5.3 - Metabolism will be higher than normal✓/cellular respiration increases

- The energy from food eaten will be used✓

- leaving nothing for storage✓

- therefore, a person could be under-weight✓ Any (3)

(9)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HOMEOSTASIS IN HUMANS (11 MARKS)

EXAM GUIDELINES

What to study:

Homeostasis through negative feedback:

- Negative feedback mechanism controlling the concentration of:
  - Glucose
  - Carbon dioxide
  - Water
  - Salts

Thermoregulation:

- Structure of the skin, using a diagram, with an emphasis on the parts involved in thermoregulation
- Role of the following in negative feedback mechanism for controlling temperature/ thermoregulation:
  - Sweating
  - Vasodilation
  - Vasoconstriction

TERMINOLOGY

Biological term	Description
Homeostasis	It is the process of **maintaining a constant internal environment** within narrow limits, despite changes that take place internally and externally.
Negative feedback mechanism	When there is an increase from normal, a corrective mechanism causes a decrease and vice versa to maintain a balanced system.
Vasoconstriction	The narrowing of the blood vessels in the skin that decreases the amount of blood flowing to the skin in humans when the environmental temperature is low
Vasodilation	The widening of the blood vessels in the skin that increases the amount of blood flowing to the skin in humans when the environmental temperature is high

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.4) in your ANSWER BOOK, for example 1.5 D.

1.1 Which ONE of the following will occur in the human body on a cold day?

A Vasodilation in the skin
B Increase in the activity of sweat glands
C Decrease in evaporation of sweat from the surface of the skin
D Increase in blood flow to the surface of the skin

1.2 During an investigation a man was placed in an airtight room. Sensors were used to monitor his breathing and heart rate. The investigators were able to change the environmental conditions in the room.

After 30 minutes the man's breathing, and heart rate had increased.

The investigators changed the environmental conditions in the room by …

A decreasing the light intensity.
B increasing the amount of carbon dioxide in the air.
C decreasing the humidity.
D increasing the amount of oxygen in the air.

1.3 Negative feedback control involves the following four stages:

(i) Effectors bring about corrective responses.

(ii) A receptor detects a change in the internal environment.

(iii) Factor brought back to normal levels.

(iv) Nervous or hormonal messages are sent to effectors.

The order in which these stages occur is:

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

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

1.4 Which ONE of the following is controlled by a negative feedback mechanism in the human body?

A Changes in the speed and direction of the body
B Colour vision
C Water concentration
D The activities of the right side of the body being controlled by the left hemisphere **(8)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.5) in your ANSWER BOOK.

2.1 When there is an increase from normal, a corrective mechanism causes a decrease and vice versa to maintain a balanced system.
2.2 The widening of the blood vessels in the skin that increases the amount of blood flowing to the skin in humans when the environmental temperature is high.
2.3 It is the process of maintaining a constant internal environment within narrow limits, despite changes that take place internally and externally.
2.4 The narrowing of the blood vessels in the skin that decreases the amount of blood flowing to the skin in humans when the environmental temperature is low
2.5 The regulation of the body temperature of an organism **(5)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Reduces heat loss from the blood	A B	Vasoconstriction Vasodilation
3.2	Hormone that maintains the salt balance in the body	A B	ADH Aldosterone
3.3	Regulation of water in the body	A B	Hypothalamus Corpus callosum

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

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 4 *(NC, Sept. 2017, Paper 1)*

The mammalian reflex is most prominent in aquatic animals, but is also present in humans. It allows mammals to stay underwater for longer periods of time by slowing down the heart rate and blood circulation.

In humans a way to trigger the reflex is to submerge the face in ice-water.

A group of grade 12 learners designed and performed an experiment under supervision to test the effect on heart rate when the face is submerged in ice-water.

Their procedure was as follows:

- They took a large cooler box and filled it with ice-water.
- They strapped a heart rate monitor to the forearm of each of 3 participants.
- Each person submerged/plunged their face into the ice-water and held their breath for 15 seconds.
- After removing their face from the ice-water, their heart rate was measured and recorded.

The table below shows the results of their investigation:

	HEART RATE (BEATS PER MINUTE)			
PARTICIPANT	**CONTROL**	**PLUNGE 1**	**PLUNGE 2**	**PLUNGE 3**
John	73	69	70	65
Katlego	69	62	63	61
Sandra	98	85	88	86

4.1 Formulate a hypothesis for this investigation. (2)

4.2 In this investigation, identify the:

(a) Dependent variable (1)

(b) Independent variable (1)

4.3 Name what their control for the experiment might have been. (2)

4.4 The ice-water slows down the heart rate and blood circulation.

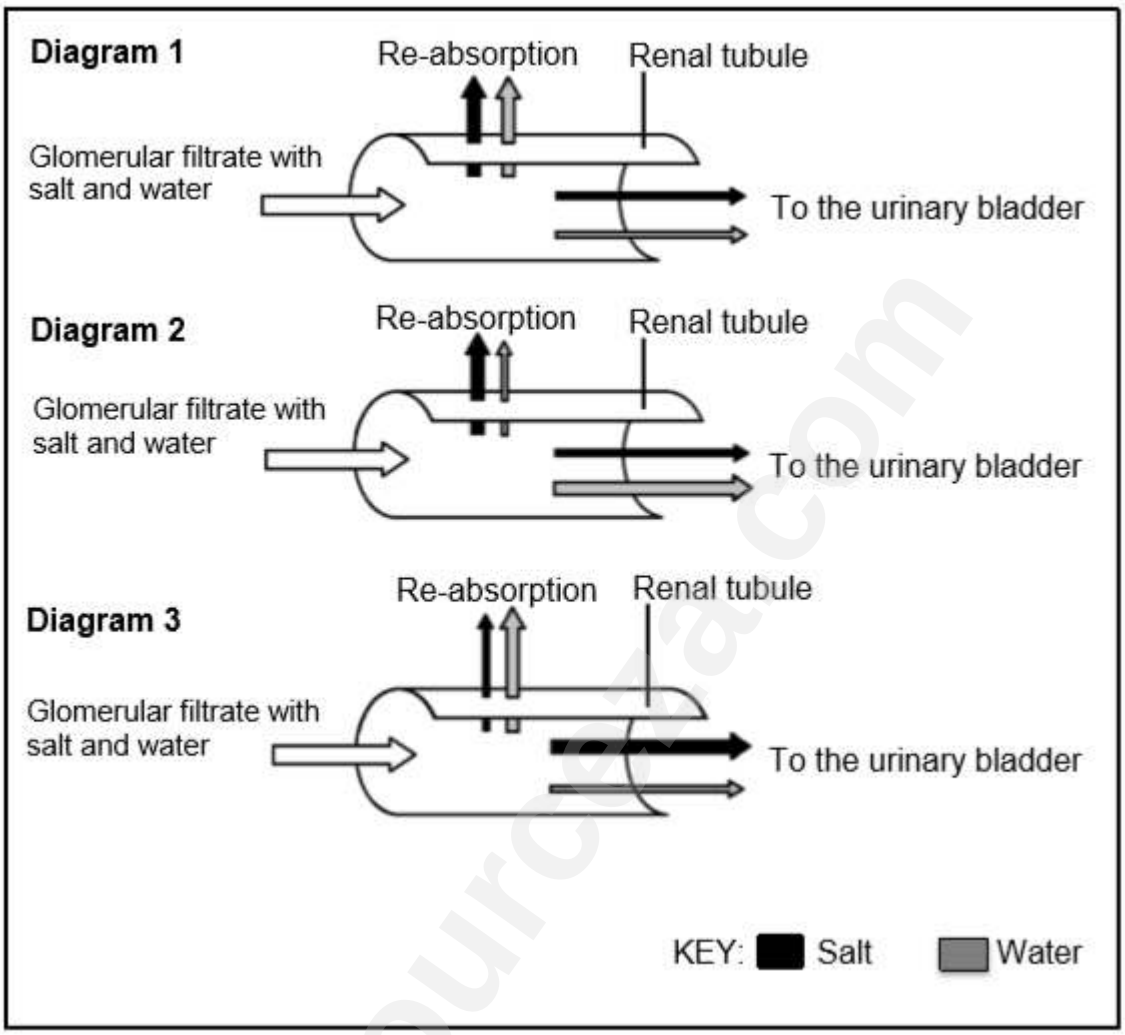
Explain how this can be an advantage when a person is drowning in icy waters. (4)
(10)

QUESTION 5 *(DBE, Nov. 2019, Paper 1)*

The diagrams below show the re-absorption of salt and water through the tubules of a nephron in the kidney under three different conditions. The width of the arrows represents the amounts of salt and water.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



5.1 Name the hormone in a human body that is responsible for controlling the:

(a) Water content (1)

(b) Salt content (1)

5.2 Name the gland that secretes the hormone in QUESTION 5.1(b). (1)

5.3 Which diagram (**1, 2** or **3**) would represent a person who had eaten salty chips on a hot day without any intake of water? (1)

5.4 Explain your answer to QUESTION 5.3. (5)
(9)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HOMEOSTASIS IN HUMANS ANSWERS

QUESTION 1

1.1 C ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 C ✓✓ **(8)**

QUESTION 2

2.1 Negative feedback mechanism ✓

2.2 Vasodilation ✓

2.3 Homeostasis ✓

2.4 Vasoconstriction ✓

2.5 Thermoregulation✓ **(5)**

QUESTION 3

3.1 A only ✓✓

3.2 B only ✓✓

3.3 A only B ✓✓

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

QUESTION 4

4.1 Submerging the face in ice-water will slow down the heart rate✓✓

OR

Submerging the face in ice-water will have no effect on the heart rate✓✓

OR

Submerging the face in ice-water will increase the heart rate✓✓ (2)

4.2 (a) Heart rate✓ (in bpm) (1)

(b) The temperature of the water✓/ice-water (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

4.3 - Heart rate after holding their breaths for 15 seconds✓

- without being in ice-water✓ (2)

4.4 - Less blood flows to the skin✓

- decreasing heat loss✓
- and thus more energy is conserved✓
- causing the metabolism to drop✓
- Less oxygen is therefore required✓
- The need to inhale decreases✓
- making it possible to stay alive for longer✓ (Any 4) (4)

(10)

QUESTION 5

5.1 (a) ADH ✓/ antidiuretic hormone/ vasopressin (1)

(b) Aldosterone ✓ (1)

5.2 Adrenal ✓ gland (1)

5.3 3 ✓ (1)

5.4 - The blood will have a high salt content ✓
- and therefore less/no aldosterone will be secreted ✓
- resulting in less salt reabsorbed into the blood ✓/more salt excreted in the urine

- The blood will have less water than normal ✓
- and therefore more ADH will be secreted ✓
- making the kidney tubules more permeable ✓
- resulting in more water reabsorbed into the blood ✓/less water will leave the body with the urine **Any** (5)

(9)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

RESPONDING TO THE ENVIRONMENT – PLANTS (11 MARKS)

EXAM GUIDELINES

What to study:

Plant hormones

- General functions of the following:
  - Auxins
  - Gibberellins
  - Abscisic acid

- The control of weeds using plant hormones

- The role of auxins in:
  - Geotropism
  - Phototropism
    - Unilateral light: A plant receives light from one direction only.
    - Uniform light: A plant receives light of the same quality from all directions.

Tropism should be defined as a growth movement of plant organs in response to an external stimulus.

Plant Defense mechanisms

- Role of the following as plant defense mechanisms:
  - Chemicals
  - Thorns

TERMINOLOGY

Biological term	Description
Abscisic acid	The plant hormone that promotes seed dormancy/ A plant hormone that causes leaves to fall off trees in autumn.
Apical dominance	Is the phenomenon whereby the main, central stem of the plant is dominant over other side stems
Auxins	The plant hormone that promotes root and stem growth
Geotropism	The growth of part of a plant in response to gravity.
Gibberellins	A plant growth hormone that stimulates seed germination.
Herbicide	Chemical used to kill weeds
Hormone	Chemicals that allow a plant to respond to some stimulus in the environment
Phototropism	The growth of a plant in response to light

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

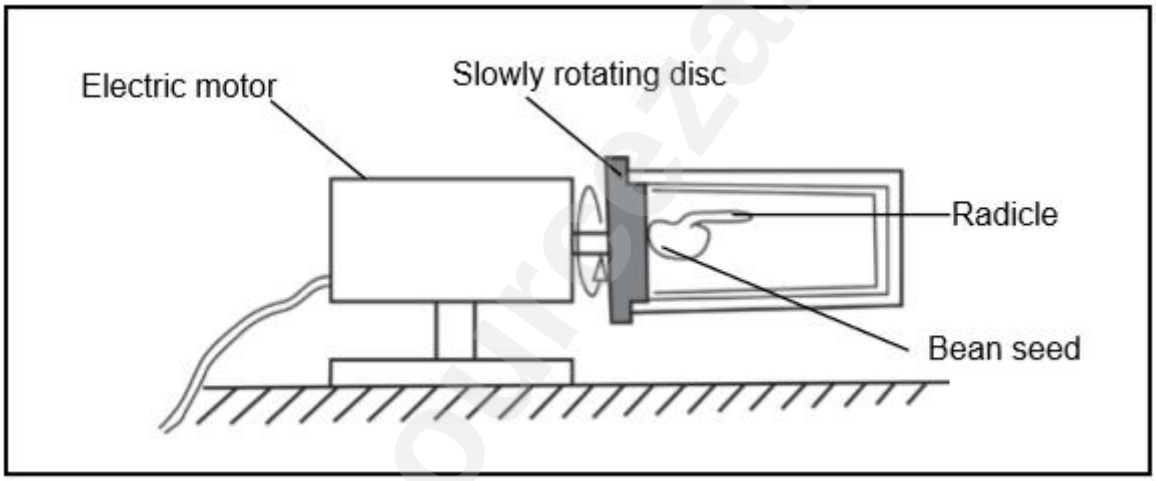
Tropism	The growth movement of a plant or part of a plant in response to an environmental stimulus

TYPICAL EXAM QUESTIONS

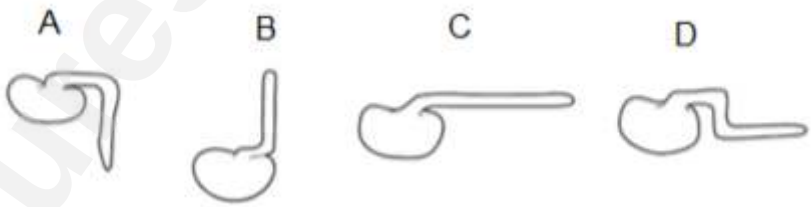
QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.4) in your ANSWER BOOK, for example 1.5 D.

1.1 The diagram below shows a germinating bean seed with a horizontal radicle. This is placed on a slowly rotating disc and is left for three days.



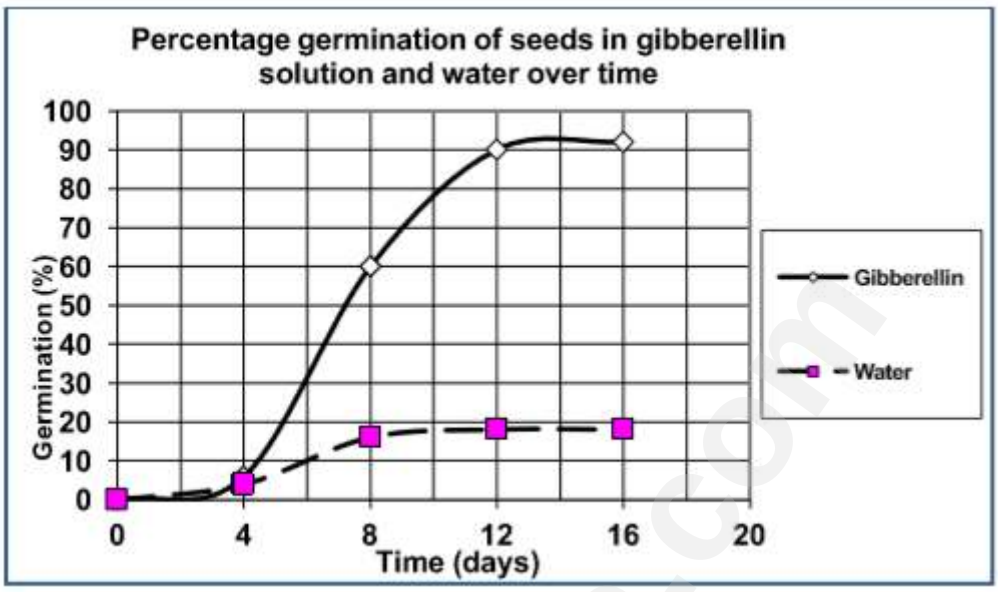
Which diagram shows the appearance of the radicle after three days?



1.2 A group of Grade 12 learners carried out an investigation to determine the effect of gibberellins on the germination of seeds.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



Which ONE of the following is a CORRECT conclusion for the above investigation?

A Gibberellins show a greater increase in the rate of germination of seeds than water
B Water shows a greater increase in the rate of germination of seeds than gibberellins
C There is no difference in the rate of germination of seeds placed in gibberellins and water
D Gibberellins decrease the rate of germination of seeds

1.3 Which ONE of the following is a function of gibberellins?

A Apical growth
B Stimulation of seed germination
C Inhibition of side branches
D Dropping of leaves in winter

1.4 Which of the following are plant growth hormones?

A Prolactin and abscisic acid
B Abscisic acid and glucagon
C Gibberellins and abscisic acid
D ADH and gibberellins **(8)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.5) in your ANSWER BOOK.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

2.1 The growth of a plant in response to light
2.2 The growth movement of a plant or part of a plant in response to an environmental stimulus
2.3 The growth of part of a plant in response to gravity.
2.4 Chemical used to kill weeds
2.5 A sharp structure found on plants for protection against herbivores **(5)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Inhibits the growth of lateral branches	A B	Abscisic acid Auxins
3.2	Defence mechanism in plants	A B	Thorns Sunken stomata
3.3	Plant hormone that helps plant seeds to survive unfavourable conditions, e.g. droughts	A B	Gibberellins Abscisic acid

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

QUESTION 4 *(MP, Sept. 2019, Paper 1)*

An investigation was conducted to determine the effect of gravity on the direction of root growth in germinating seeds.

The procedure was as follows:
- A glass jar was lined with a layer of thick blotting paper
- 12 germinating bean seeds were placed between the glass jar and the blotting paper as follows:

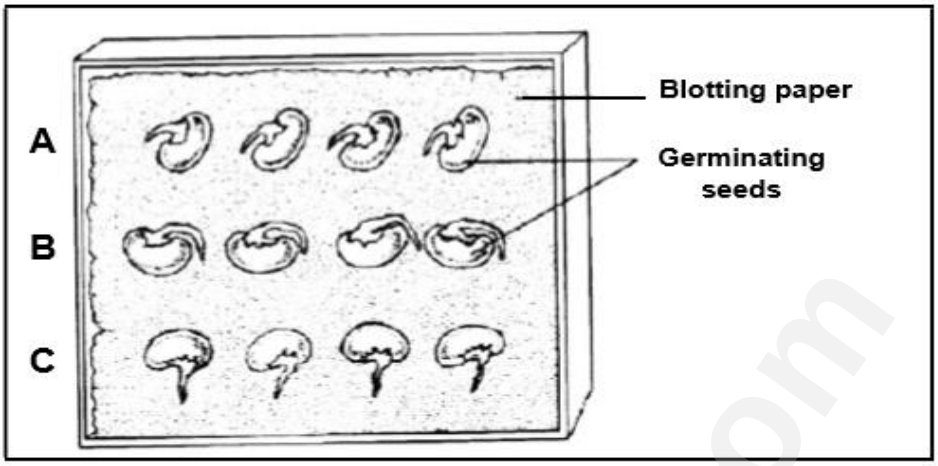
A. 4 seedlings with their root tips pointing horizontal
B. 4 seedlings with their root tips pointing upwards
C. 4 seedlings with their root tips pointing downwards

- The glass jar received light from all directions
- The growth response of the root tips was observed

The diagram below shows the observation made after a week

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



4.1 In this investigation, identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

4.2 Mention TWO ways in which the validity of the investigation could have been improved. (2)

4.3 Give the name of the growth in response to gravity as observed in this investigation. (1)

4.4 Why did the investigator use 4 bean seeds for each group? (1)

4.5 Explain the results of the investigation as observed in group A. (5)
(11)

QUESTION 5 *(GDE, Sept. 2019, Paper 1)*

Maria wanted to investigate the effect of light coming from one direction on the growth of shoots. She planted some bean seeds in two seed trays and allowed them to germinate. When the young shoots appeared above the soil level, the shoots were exposed to light from all directions for three days.

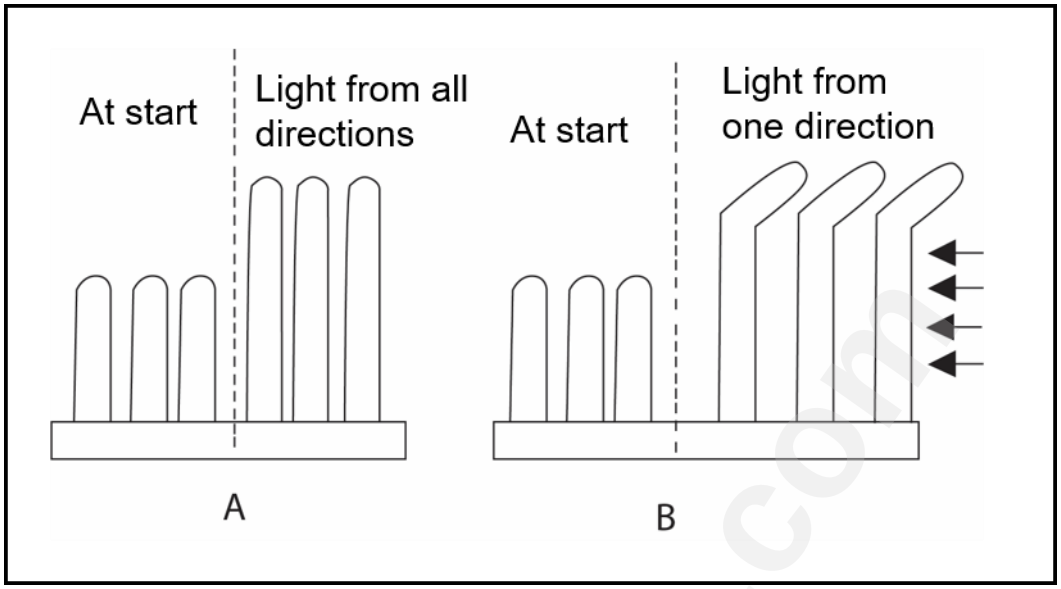
After three days, the trays received the following different treatments:

- Tray **A**: The shoots were exposed to light from all directions.
- Tray **B**: The shoots were exposed to light from one direction only.

The diagram below shows the effects of these treatments.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



5.1 Explain why it is important to include Tray **A** as part of this investigation. (2)

5.2 Explain the results obtained in Tray **B** in terms of the role of auxins. (6)

5.3 State TWO factors that should be kept constant in this investigation. (2)

(10)

QUESTION 6 *(DBE, Jun. 2019, Paper 1)*

A clinostat is a device used to investigate plant growth responses. It has a disc that rotates very slowly when the clinostat is switched on.

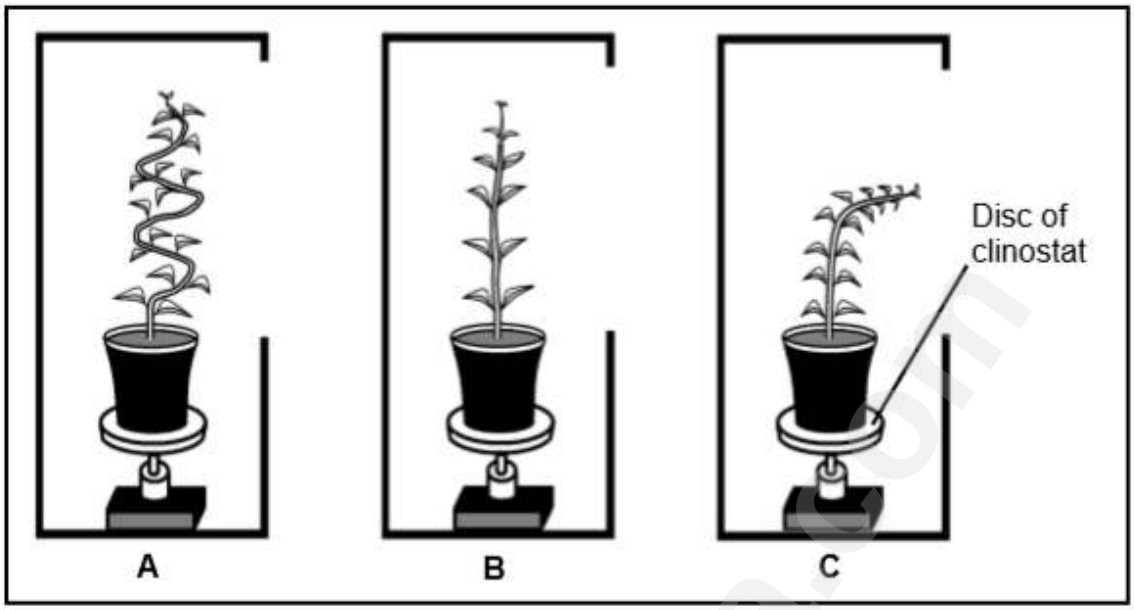
During an investigation on plant responses to light, the procedure below was followed:

- Three pot plants of the same species were used.
- Each pot plant was placed on one of three identical clinostats.
- Each set of apparatus**, A, B** and **C**, was placed in a box with a single opening.
- Each clinostat was treated in a different way over a period of five weeks.

The results of the investigation are represented in the diagrams below.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



Name the plant growth response to light. (1)

State TWO factors that were kept constant during the investigation. (2)

Give ONE reason why the results of this investigation may be considered to be unreliable. (1)

In which apparatus (**A, B** or **C**) was the clinostat:

(a) Switched on and rotating slowly (1)

(b) Switched off, but manually rotated through 180° once a week (1)

Explain the effect of the unilateral light on the distribution of auxins in the plant in apparatus C. (3)

(9)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

RESPONDING TO THE ENVIRONMENT- PLANTS: ANSWERS

QUESTION 1

1.1 C ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 C ✓✓ **(8)**

QUESTION 2

2.1 Negative feedback mechanism ✓

2.2 Vasodilation ✓

2.3 Homeostasis ✓

2.4 Vasoconstriction ✓

2.5 Thermoregulation✓ **(5)**

QUESTION 3

3.1 A only ✓✓

3.2 B only ✓✓

3.3 A only B ✓✓

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

QUESTION 4

4.1 (a) Gravity ✓ (1)

(b) Direction of root growth ✓ (1)

4.2 - Use beans of the same species✓
- Expose seeds to the same environmental conditions✓/ light/ temperature
(Mark first TWO only) Any (2)

4.3 Geotropism ✓ (1)

4.4 To improve the reliability✓ of the results (1)

4.5 - Auxins✓
- moved to the lower side of the root✓
- because gravity attracts auxins✓
- Therefore, there was high concentration on the lower side of the root✓

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- There will be a low concentration of auxins on the upper side of the root✓
- More growth occurs on the upper side of the root✓
- on the lower side the high concentration inhibits/slows down growth✓
- Uneven growth will result with the root bending downwards✓ towards gravity.

Any (5)

(11)

QUESTION 5

5.1
- It is the control ✓
- to verify the results of the experiment ✓ / to allow for one variable only

(2)

5.2 As a result of receiving light from one side only:

- Auxins produced in the tip of the stem ✓
- are unequally distributed ✓
- auxins moved to the shaded side of the stem✓
- where the concentration increased ✓
- thus promoting growth ✓
- whilst the brightly lit side with the lower concentration✓
- inhibited growth ✓
- resulting in the stem bending and growing towards the light ✓

Any (6)

5.3
- Use same type / species of plant ✓ / seeds
- Use same type and amount of soil in the trays ✓
- Watering at the same time of day ✓
- Same amount of water given when watering shoots ✓
- Same environmental conditions ✓ / temperature / humidity
- Same nutrients ✓

(Mark first TWO only) Any (2)

(10)

QUESTION 6

6.1 Phototropism✓ (1)

6.2
- The same species✓ of plant was used in each set-up
- Identical clinostats✓ were used in each set-up
- The same period of time✓/5 weeks was used for each set-up
- Each apparatus was placed in a box with a single opening✓
- The opening on each box was in the same position✓/was the same size

(Mark first TWO only) Any (2)

6.3
- The investigation was only done once✓/not repeated
- Only one plant was used in each set-up✓/the sample size was too small

(Mark first ONE only) Any (1)

6.4 (a) B✓ (1)
(b) A✓ (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

6.5 - The auxins moved away from the light✓/were destroyed by the light (3)
- so that the darker side had a higher concentration of auxins✓
- and the lighted side had a lower concentration of auxins✓

(9)

eduresourceza.com

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HUMAN IMPACT ON THE ENVIRONMENT (25 MARKS)

EXAM GUIDELINES

What to study:

Causes and consequences of the following (relate to conditions and circumstances in South Africa):

The atmosphere and climate change
-carbon dioxide emissions
-concept of 'carbon footprint' and the need to reduce the carbon footprint
-deforestation
-greenhouse effect and global warming; desertification, drought and floods
-methane emissions
-ozone depletion

Water
Availability
-construction of dams
The immediate outcome of building a dam and the negative impacts on the environment:
Habitats are destroyed which will lead to a loss in biodiversity
When flood gates are opened, flooding may occur in the areas downstream from the dam resulting in erosion/loss of top soil.
-destruction of wetlands
-poor farming practices
-drought and floods
-exotic plantations and depletion of water table
-boreholes and effects on aquifers
-wastage
-cost of water
Quality of water
-water for domestic use, industry, agriculture and mining; pollution, diseases, eutrophication
and algal bloom
-the effect of mining on the quality of water
-thermal pollution
-the need for water purification and recycling
-alien plants, e.g. *Eichornia*

Food security
Definition: Access by all people to good quality food in sufficient quantities at all times.
-human exponential population growth
-droughts and floods (climate change)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

-poor farming practices: monoculture; pest control, loss of topsoil and the need for fertilizers
-alien plants and reduction of agricultural land
-the loss of wild varieties: impact on gene pools
-genetically engineered foods
-wastage

Loss of biodiversity
-habitat destruction: farming methods, e.g. overgrazing and monoculture, golf estates, mining, urbanization, deforestation; loss of wetlands and grassland
-poaching e.g. for rhino horn, ivory and bush meat
-alien plant invasions, control using mechanical, chemical and biological methods and
-indigenous knowledge systems and the sustainable use of environment e.g. devils claw, rooibos, fynbos, the African potato (*Hypoxis*) and *Hoodia*

Solid waste disposal
-managing dumpsites for rehabilitation and prevention of soil and water pollution
-the need for recycling
-using methane from dumpsites for domestic use;
-Heating and lighting and
-safe disposal of nuclear waste

TERMINOLOGY

Biological term	Description
Biodiversity	The variety of plant and animal species on earth
Biological control	The killing of pests by using their natural predators or parasites
Carbon footprint	Measurement of the total amount of carbon dioxide emissions of an individual per year
Deforestation	Removal of large numbers of trees from an area
Eutrophication	The accumulation of nutrients in water bodies from the overuse of fertilisers on land, stimulating excessive plant growth
Food security	The access, by all people at all times, to adequate, safe and nutritious food
Greenhouse effect/Enhanced greenhouse effect	Trapping of heat by a layer of greenhouse gases (e.g. carbon dioxide, methane) surrounding the earth. The enhanced greenhouse effect is caused by the large scale release of greenhouse gases surrounding the earth and thereby causing global warming
Monoculture	Growing the same species of crop on a farm year after year
Ozone/O_3	A layer in the atmosphere that is damaged by chlorofluorocarbons (CFCs)
Poaching	The illegal killing or removal of organisms from their environments
Thermal pollution	The type of pollution caused when water is released into a river after being heated in power stations or industries

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.10) in your ANSWER BOOK, for example 1.11 D.

1.1 The following gases are found in the atmosphere:

(i) Carbon dioxide
(ii) Methane
(iii) Oxygen
(iv) Ozone

Which ONE of the following combinations represents greenhouse gases?

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

1.2 Alien plants flourish in a new habitat because they …

A do not have natural enemies and therefore they are able to outcompete the indigenous species.
B are able to photosynthesise better than indigenous species.
C are able to defend themselves from diseases.
D are able to survive with limited resources

1.3 An increased growth of algae due to too many nutrients in the water is known as …

A bleaching.
B eutrophication.
C ionisation.
D leaching.

QUESTIONS 1.4 AND 1.5 are based on the information in the table below. It shows the amount of waste products dumped in landfills each year and the time taken for each type of product to break down (decompose).

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Type of product	Amount of waste (in tons)	Time to break down waste (in years)
Plastic bags	200	300
Leather shoes	30	20
Batteries	20	100
Nylon fibre	100	50
Aluminium cans	50	75

1.4 What is the percentage contribution of aluminium cans to the total amount of waste generated from the products listed?

A 12,5%
B 75%
C 50%
D 18,8%

1.5 The statements below refer to the information given in the table above.

(i) Plastic bags take 250 years more than nylon fibre to decompose
(ii) Aluminium cans decompose faster than nylon fibre
(iii) Leather shoes decompose fastest
(iv) Batteries are responsible for the largest proportion of waste produced.

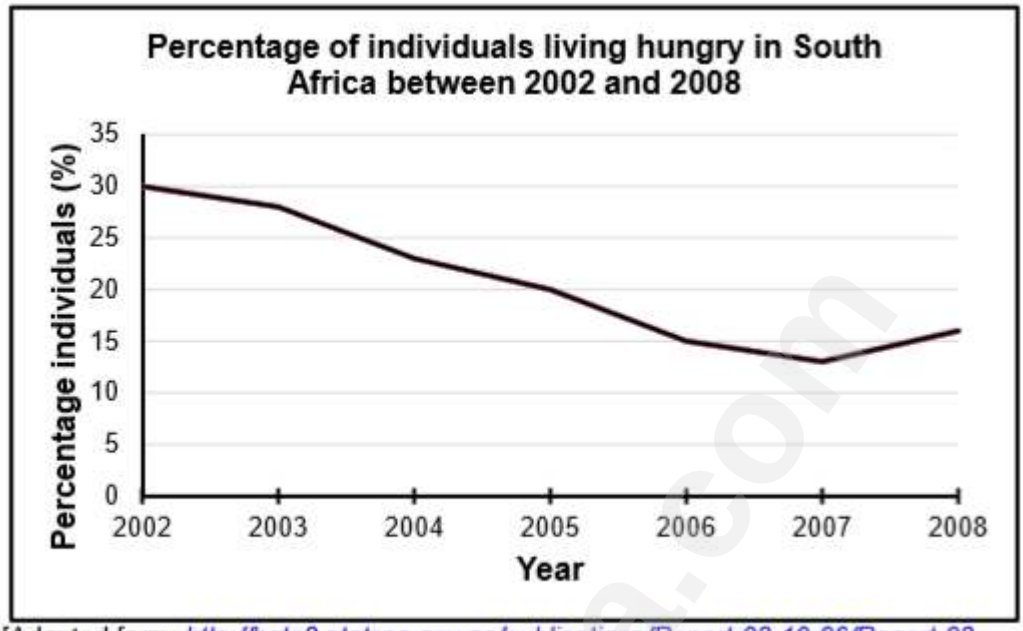
Which of these statement(s) is/are correct?

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

1.6 The graph below gives information about the number of hungry people in South Africa from 2002 to 2008. Living below the food poverty line expresses itself most basically as hunger.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



[Adapted form: http://beta2.statssa.gov.za/publications/Report-03-10-06/Report-03-10-06March2014]

The graph shows that …

A food insecurity in the country decreased from 2002 to 2008.
B food security in the country increased from 2007 to 2008.
C food insecurity in the country decreased from 2002 to 2007.
D food security in the country decreased from 30% to 13%.

1.7 Eutrophication in dams is caused by …

A excess nitrates and phosphates from rivers.
B increased numbers of fish species in the dam.
C hot water released into rivers.
D the reduction in the availability of water supply from the rivers.

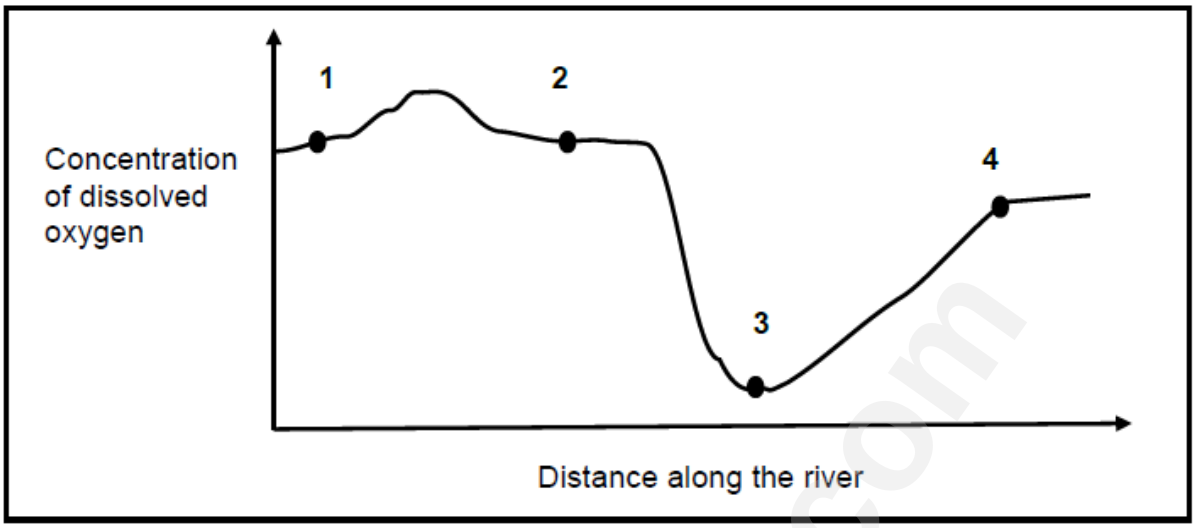
1.8 The correct way of disposing nuclear waste must be by …

A burying it deep underground in sealed containers.
B dumping it in landfill sites.
C burning it in large incinerators.
D dumping it in the sea.

1.9 The graph below shows the concentration of dissolved oxygen at different points along a river.

Downloaded from eduresourceza.com

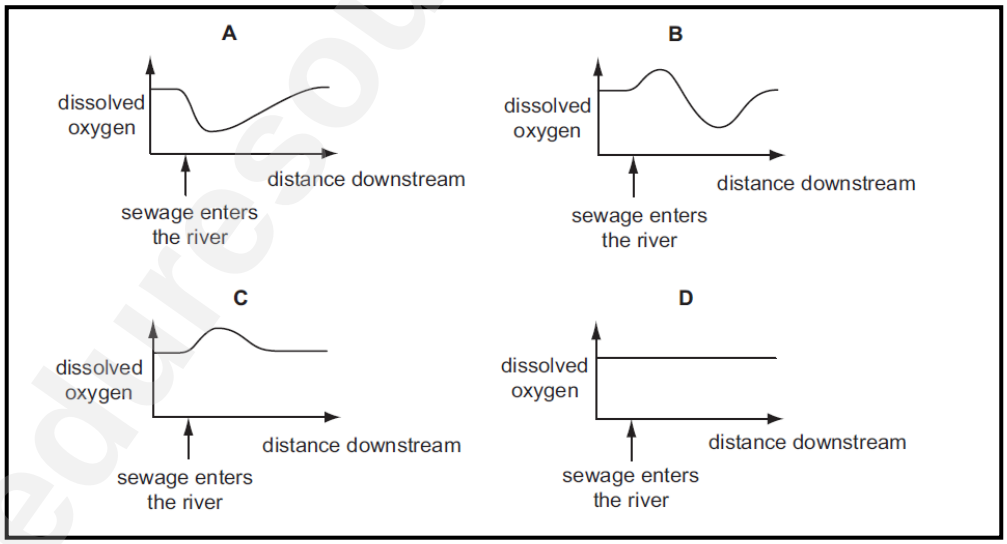
Downloaded from eduresourceza.com



At which point on the graph is sewage most likely to have been poured into the river?

A 1
B 2
C 3
D 4

1.10 Which graph shows the effect of pollution by sewage on the amount of dissolved oxygen in a river?



(20)

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.10) in your ANSWER BOOK.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

2.1 The farming practice of growing a crop of a single species only
2.2 A measure of the total amount of carbon dioxide emissions of a person/population/company per year
2.3 The permanent destruction of forests
2.4 The replanting of trees and shrubs in a forest
2.5 A layer of earth or rock that holds water
2.6 Process by which a region becomes progressively drier and drier
2.7 The process that traps heat in the Earth's atmosphere by gases such as carbon dioxide
2.8 Species that no longer exist on Earth
2.9 Refers to the long-term prevalent weather conditions of an area
2.10 A gas produced in waste disposal sites that can be used for cooking, heating and lighting. **(10)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.5) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Decreases food security	A B	Alien plant invasion Exponential growth of the human population
3.2	A gas consisting of three atoms of oxygen and that shields the earth from ultraviolet light.	A B	Ozone Methane
3.3	Greenhouse gas	A B	Methane Carbon dioxide
3.4	Having access to enough food of good quality at all times	A B	Monoculture Eutrophication
3.5	Sustainable use of medicinal plants	A B	Banning all sales of medicinal plants Collecting plants only from mountainous areas

(5 x 2) **(10)**

QUESTION 4 *(NW, Sept. 2019, Paper 1)*

The table below shows the gasses that contribute to the Greenhouse effect.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Greenhouse Gas	Contribution to the Greenhouse Effect
Carbon dioxide	53%
Methane(CH_4)	**B**
Nitrous oxide (N_2O)	5%
Ozone (O_3)	13%
CFC's	12%

[Adapted from www.globalwarming.org]

4.1 Calculate the value of B. Show all calculations. (2)

4.2 Draw a pie chart to represent the gasses that contribute to the Green House effect (6)

(8)

QUESTION 5 *(MP, Sept. 2019, Paper 1)*

Read the extract below.

> Water scarcity has a huge impact on agriculture. The Water Project attempt to fix this problem by helping build water collection systems such as sand dams in some rural areas.
>
> A sand dam is a cement wall built across a seasonal sandy river. This cement wall retains rainwater and recharges ground water.
>
> By recharging the aquifer, sand dams provide enough water to establish vegetable gardens and crop fields.

5.1 State what is meant by an 'aquifer' (1)

5.2 Explain how the building of sand dams' impact on food security. (3)

5.3 Describe the impact of sand dams on biodiversity in the river beyond. (3)

(7)

QUESTION 6 *(LP, Sept. 2019, Paper 1)*

Read the following extract.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

South Africa has 3 000 km of coastline with ±10 000 marine species. This is 15% of all coastal marine species in the world. One area of spectacular beauty is the iSimangaliso Wetland Park, previously known as the Greater St Lucia Wetland Park.

Two species of sea turtle come ashore here to lay their eggs on the beach. A higher tide line would mean there would not be enough beach for the turtles to lay their eggs. This would result in a reduction, if not the extinction, of the sea turtle population.

The predators of the sea turtles include seagulls. A drop in the turtle population may result in a drop in the seagull population too. This in turn would result in a much higher level of decaying animal matter on the beaches because seagulls eat that too.

6.1 Explain how climate change can result in a higher tide line. (3)

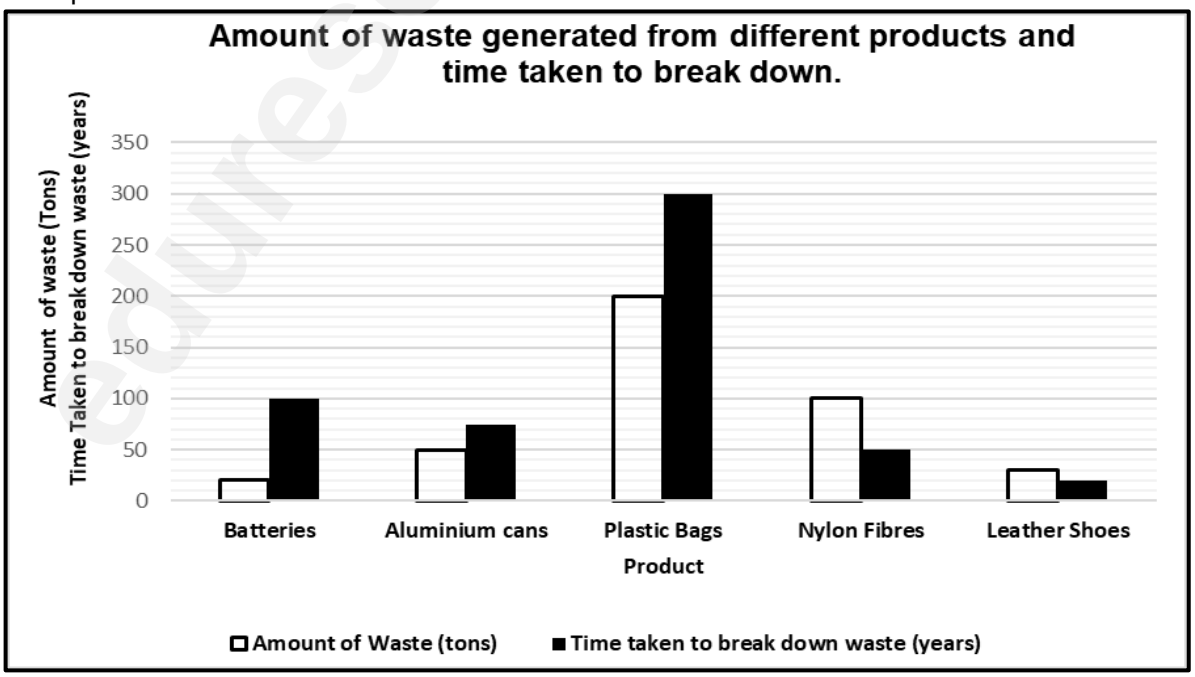
6.2 Sea turtles feed on jelly fish and jelly fish eat plankton. Suggest how the extinction of sea turtles may influence this food chain. (2)

6.3 Explain how a drop in the seagull population will influence food security in humans. (2)

(7)

QUESTION 7 *(GDE, Sept. 2019, Paper 1)*

The graph below shows the amount of waste generated from different products and the time taken for each product to break down.



7.1 From the graph identify ONE biodegradable product. (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

7.2 According to the graph, how long do plastic bags take to break down? (1)

7.3 Calculate the percentage contribution of plastic bags to the total amount of waste generated from the products shown. Show ALL working. (3)

(5)

eduresourceza.com

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

HUMAN IMPACT ON THE ENVIRONMENT ANSWERS

QUESTION 1

1.1	C	✓✓
1.2	A	✓✓
1.3	B	✓✓
1.4	A	✓✓
1.5	D	✓✓
1.6	C	✓✓
1.7	A	✓✓
1.8	A	✓✓
1.9	B	✓✓
1.10	A	✓✓

(20)

QUESTION 2

2.1 Monoculture ✓

2.2 Carbon footptint ✓

2.3 Deforestation ✓

2.4 Reforestation ✓

2.5 Aquifer ✓

2.6 Desertification ✓

2.7 Greenhouse effect ✓

2.8 Extinct ✓

2.9 Climate ✓

2.10 Methane ✓ **(10)**

QUESTION 3

3.1 Both A and B ✓✓

3.2 A only✓✓

3.3 Both A and B ✓✓

3.4 None ✓✓

3.5 None ✓✓

(10)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

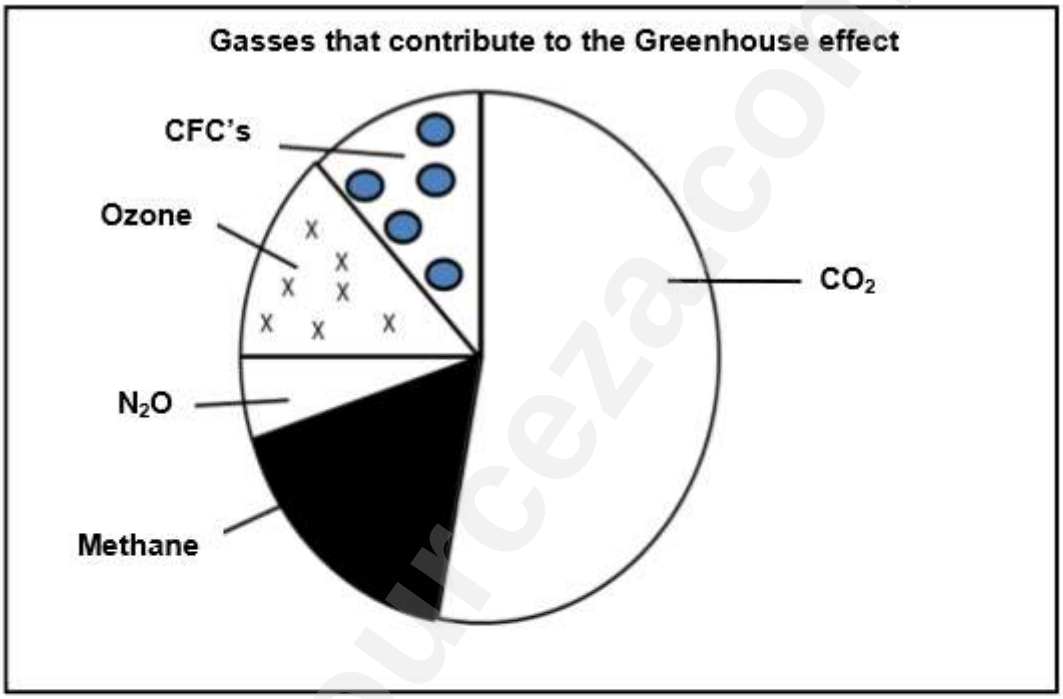
QUESTION 4

4.1 53 + 5 + 13 +12 = 83

= 100 - 83 ✓

= 17% ✓ (2)

4.2



MARK ALLOCATION FOR THE PIE CHART	
Title of graph □ both variables included	1
Pie chart drawn	1
1 □ 4 Sectors correctly indicated/labelled 5 Sectors correctly indicated/labelled	1 2
1 □ 4 Sectors correctly calculated 5 Sectors correctly calculated	1 2

NOTE: If wrong type of graph is drawn:
Mark will be lost for type of graph as well as for the drawing and labelling of sectors. (Max 4/6) (6)

(8)

QUESTION 5

5.1 Underground permeable rock saturated with water ✓ (1)

5.2 - Increase food security✓

- Because there will be more water✓

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- For irrigation of crops✓ (3)

5.3 - River downstream will dry up✓

- Plants and animals will die✓

- leading to loss of biodiversity✓ (3)

(7)

QUESTION 6

6.1
- Increased temperatures✓
- cause ice to melt in the glaciers✓
- which cause rising sea levels✓ (3)

6.2
- The numbers of the jelly-fish population is going to increase✓
- Causing the numbers of the plankton population to decrease✓ (2)

6.3 Decaying matter will pollute the sea water✓ which results in the dying of fish in the sea✓/Food security will decrease✓

OR

Decaying matter will increase global warming✓ which results in unstable weather patterns✓ which cause food crops to fail✓ (2)

(7)

QUESTION 7

7.1 Leather shoes ✓ (1)

7.2 300 years ✓ (1)

7.3 20 + 50 + 200 + 100 + 30 = 400 ✓

$\frac{200}{400}$ ✓ x $\frac{100}{1}$ = 50✓% (3)

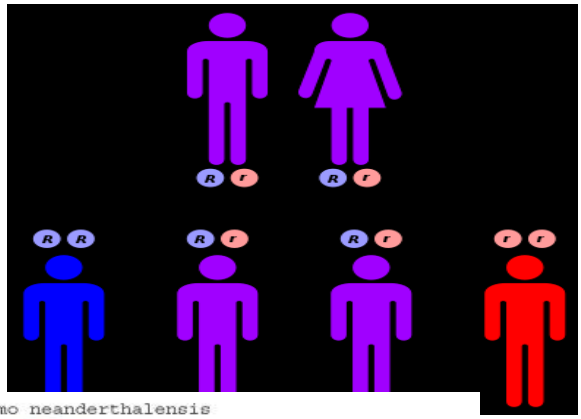
(5)

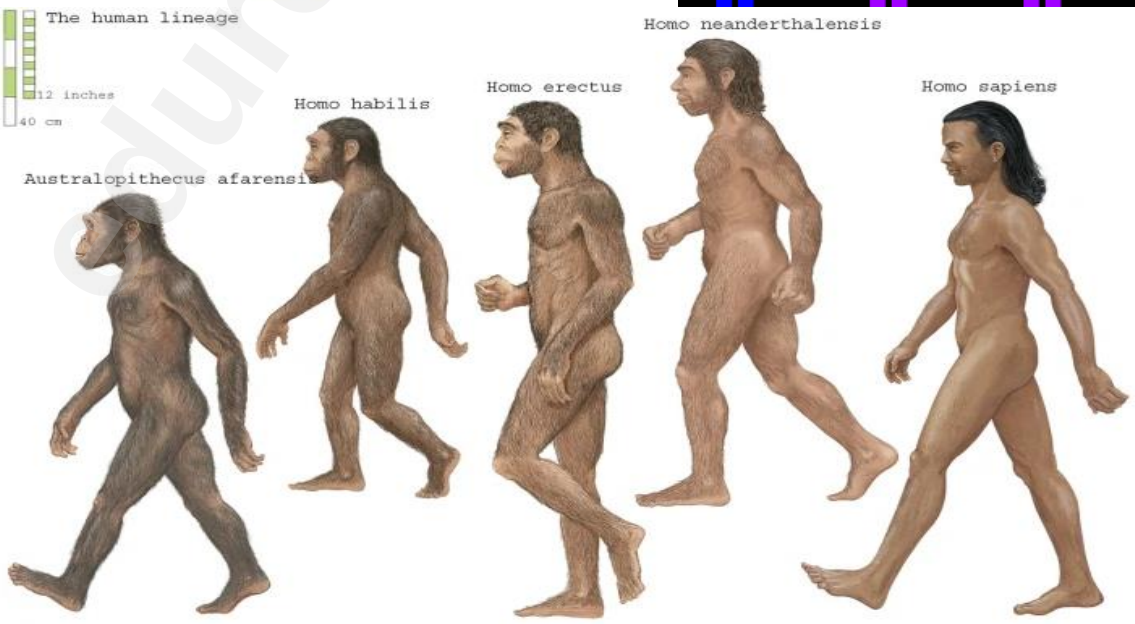
Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

PAPER 2

TOPIC	MARK
Meiosis	12
DNA: Code of life	27
Genetics and Inheritance	45
Evolution	66
TOTAL	**150**





Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

MEIOSIS (12 MARKS)

The topic 'MEIOSIS' is assessed in both papers. Please refer to p.3-9 of this booklet for questions on this topic.

DNA: CODE OF LIFE (27 MARKS)

EXAM GUIDELINES

What to study:

- The structure of the cell with an emphasis on the ribosome, cytoplasm and parts of the nucleus
- Nucleic acids consist of nucleotides
- Two types of nucleic acids are DNA and RNA
- Location of DNA
  - Makes up the genes on chromosomes (nuclear DNA)
  - Present in mitochondria (mitochondrial DNA)

- Brief history of the discovery of the structure of the DNA molecule (Watson & Crick, Franklin & Wilkins)

- Three components of a DNA nucleotide:
  - Nitrogenous bases linked by weak hydrogen bonds
    - 4 nitrogenous bases of DNA: adenine (A), thymine (T), cytosine (C), guanine (G)
    - Pairing of bases in DNA occur as follows A : T and G : C
  - Sugar portion (deoxyribose in DNA)
  - Phosphate portion

- The natural shape of the DNA molecule is a double helix

- Stick diagram of DNA molecule to illustrate its structure

- Functions of DNA:
  - Sections of DNA forming genes carry hereditary information
  - DNA contains coded information for protein synthesis

- Process of DNA replication:
  - When in the cell cycle it takes place
  - Where in the cell it takes place
  - How DNA replication takes place (names of enzymes not required)
  - The significance of DNA replication

- Definition of DNA profile

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- Uses of DNA profiles

- Interpretation of DNA profiles

- Location of RNA:
- mRNA is formed in the nucleus and functions at the ribosome
- tRNA is located in the cytoplasm

- RNA plays a role in protein synthesis

- Structure of RNA:
- A single stranded molecule consisting of nucleotides
- Each nucleotide is made up of a sugar (ribose), phosphate and a nitrogen base
- 4 nitrogenous bases of RNA are: adenine (A), uracil (U), cytosine (C), guanine (G)

- Stick diagram of mRNA and tRNA molecules to illustrate their structure

- The involvement of DNA and RNA in protein synthesis:
- Transcription
  - The double helix DNA unwinds
  - The double-stranded DNA unzips/weak hydrogen bonds break
  - to form two separate strands.
  - One strand is used as a template
  - to form mRNA
  - using free RNA nucleotides from the nucleoplasm.
  - The mRNA is complementary to the DNA.
  - mRNA now has the coded message for protein synthesis.
- mRNA moves from the nucleus to the cytoplasm and attaches to the ribosome.
- Translation
  - Each tRNA carries a specific amino acid.
  - When the anticodon on the tRNA
  - matches the codon on the mRNA
  - then tRNA brings the required amino acid to the ribosome. (Names of specific codons, anticodons and their amino acids are not to be memorised)
  - Amino acids become attached by peptide bonds
  - to form the required protein.

- Simple diagram to illustrate transcription and translation in protein synthesis

TERMINOLOGY

Biological term	Description
Deoxyribose	A sugar molecule found in a nucleotide of DNA
DNA profile	A bar code pattern formed from DNA which is unique to each person/organism
Hydrogen bond	The weak bond between nitrogenous bases in a DNA molecule

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Nuclear pores	Openings in the nuclear membrane that allow mRNA to leave the nucleus
Peptide bond	The name of the bond that forms between amino acids in a protein molecule
Replication	The process by which a DNA molecule makes identical copies of itself
Ribose	The type of sugar found in an RNA molecule
Ribosome	The organelle in the cytoplasm which is the site of protein synthesis
Transcription	The stage of protein synthesis during which mRNA forms from DNA
Translation	The stage of protein synthesis during which tRNA interprets the message on the mRNA to form a specific protein
tRNA/transfer RNA	The type of nucleic acid that carries a specific amino acid
Uracil	Nitrogenous base found only in RNA molecules

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.10) in your ANSWER BOOK, for example 1.11 D.

1.1 A dye stains a particular type of nucleic acid red. When this dye was used to identify which organelles in a cell contain this nucleic acid, only the nucleus and ribosomes stained red.
This result shows that the dye stains structures that contain …

A DNA.
B RNA.
C DNA and protein.
D both DNA and RNA.

1.2 During translation, the type of amino acid that is added to the growing polypeptide depends on the …

A codon on the mRNA only.
B anticodon on the tRNA to which the amino acid is attached only.
C codon on the mRNA and the anticodon on the tRNA to which the amino acid is attached.
D anticodon on the mRNA only.

1.3 How many nitrogenous bases form a codon?

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

A 9
B 12
C 3
D 6

1.4 In an investigation it was found that 10% of the nitrogenous bases in a molecule of DNA was thymine. What was the ratio of thymine to guanine in the same molecule?

A 1 : 1
B 1 : 2
C 1 : 3
D 1 : 4

1.5 Study the table below showing various amino acids coded for by various mRNA codons.

mRNA codons	Corresponding amino acids
GCG	Alanine
AUG	Methionine
AUA	Isoleucine
AGG	Arginine

Which amino acid is coded by the DNA triplet of nitrogenous bases TAC?

A Alanine
B Arginine
C Isoleucine
D Methionine

1.6 A codon is a sequence of three nucleotides on a molecule of …

A rRNA.
B mRNA.
C tRNA.
D DNA.

1.7 DNA was analysed and found to contain 14% T (thymine). What percentage of the molecule is cytosine?

A 14%
B 28%
C 36%
D 72%

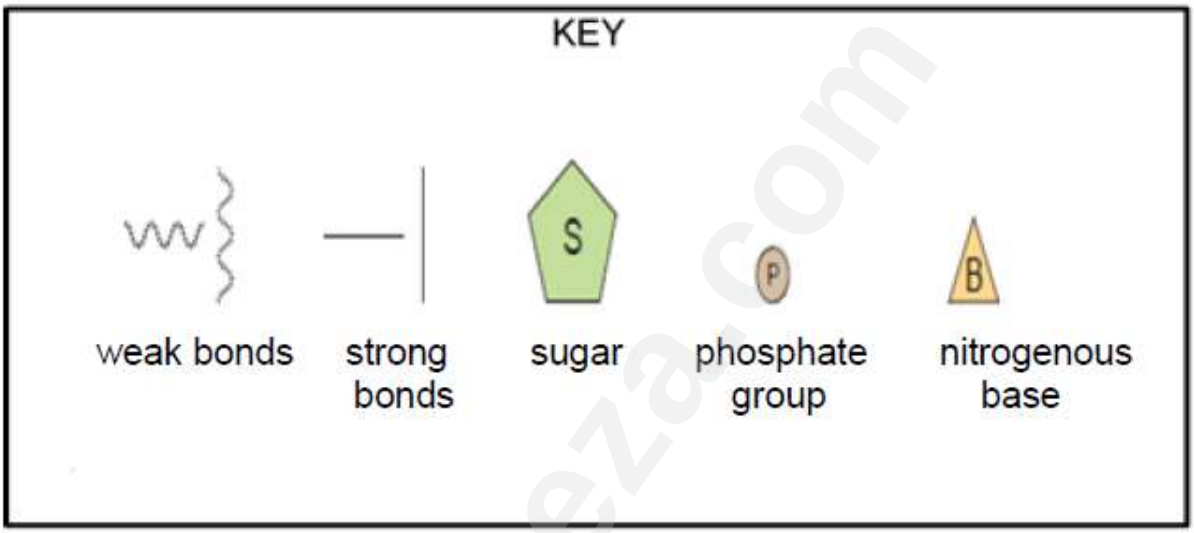
1.8 A gene in a bacterium codes for a protein that has 120 amino acids. How many mRNA nucleotides code for this protein?

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

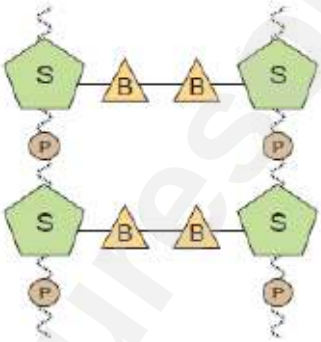
A 30
B 40
C 360
D 480

1.9 The key below shows the main components of a DNA molecule and the strength of the bonds that hold them together.

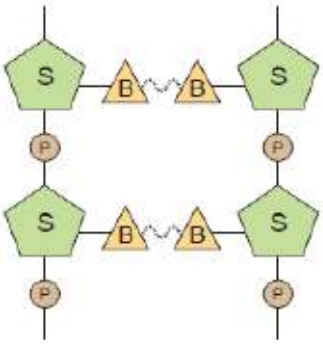


Which one of the following diagrams shows the correct combination of components of a DNA molecule?

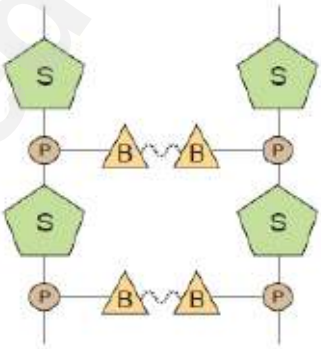
A



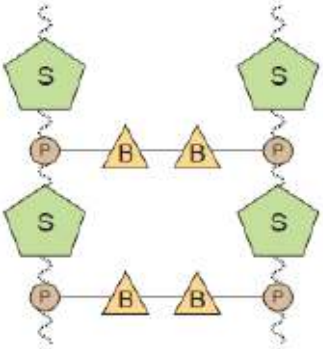
B



C



D



Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

1.10 The table below shows the anti-codons of tRNA that code for different amino acids found in human protein.

ANTI-CODONS OF tRNA	AMINO ACIDS
CAA	Valine
CCC	Glycine
CGU	Alanine
AAA	Phenylalanine
UCG	Asparagine
UAC	Methionine
GGU	Proline
AGC	Tryptophan
UCA	Serine

What is the corresponding amino acid for the DNA base triplet TCG?

A Alanine
B Tryptophan
C Serine
D Asparagine **(20)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.5) in your ANSWER BOOK.

2.1 The process whereby DNA makes an exact copy of itself
2.2 A segment of DNA coding for a particular characteristic
2.3 Bond joining amino acids in a protein
2.4 Synthesis of mRNA from DNA
2.5 The nitrogenous base found in RNA but not in DNA **(5)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Discovery of DNA	A B	Mendel Darwin

Downloaded from eduresourceza.com

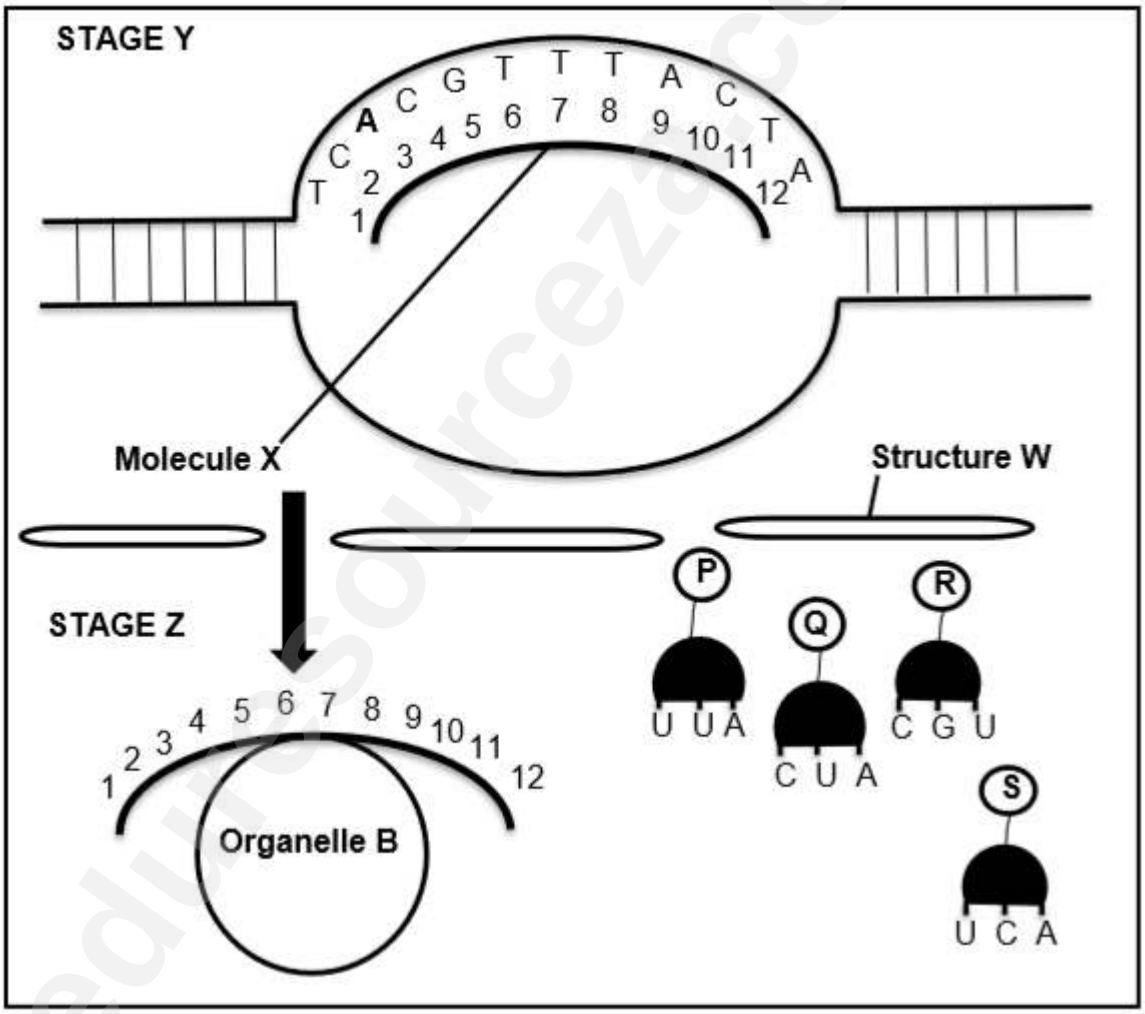
Downloaded from eduresourceza.com

3.2	Plays a role in paternity testing	A B	Blood grouping DNA profiles
3.3	Location of DNA	A B	Genes on chromosomes Mitochondria

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

QUESTION 4 *(EC, Sept. 2019, Paper 2)*

Study the diagram below.



4.1 Name the process represented in the diagram above. (1)

4.2 Identify:

(a) Molecule **X** (1)

(b) Organelle **B** (1)

(c) Structure **W** (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

4.3 Give the sequence of nitrogenous bases for the first codon on Molecule **X** (1, 2, 3) (1)

4.4 Give the correct order in which molecules **P, Q, R** and **S** would attach to molecule **X**. (From left to right). (2)

4.5 Where in a cell does stage **Z** occur? (1)

4.6 Describe the process of transcription as seen in stage **Y**. (5)

4.7 If the third nitrogenous base (**A**) of the DNA strand was replaced by **G** describe how this would affect the protein that will form. (4)

(17)

QUESTION 5 *(GDE, Sept. 2019, Paper 2)*

Study the DNA base triplets **1**, **2** and **3** below.

Base triplet 1	Base triplet 2	Base triplet 3
GTC	**AAG**	**CCT**

The table below shows the RNA codons that code for different amino acids.

CODON	AMINO ACID
UUC	Phenylalanine
AUC	Isoleucine
AAU	Asparagine
GAA	Glutamic acid
GUA	Valine
CAG	Glutamine
CAU	Histidine
GGA	Glycine

5.1 Write down the three bases of the DNA base triplet that codes for glycine. (1)

5.2 In base triplet 2 the **first** adenine was replaced by **T** as a result of a mutation.

Describe how this mutation will affect the protein that will be formed. (3)

5.3 State TWO ways in which the events of transcription in protein synthesis are different from that of DNA replication. (2 x 2) (4)

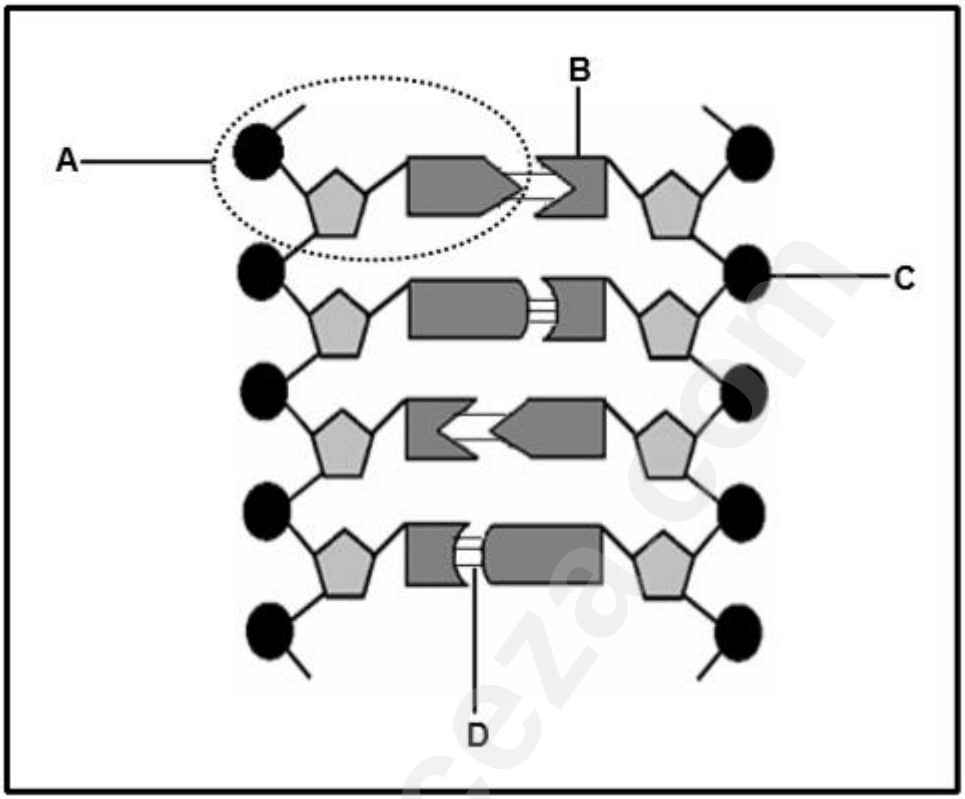
(8)

QUESTION 6 *(GDE, Jun. 2019, Paper 2)*

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

The diagram below represents a portion of a DNA molecule.



6.1 Identify **B** and **C.** (2)

6.2 Name:

(a) Monomer **A** (1)

(b) TWO scientists who received a Nobel prize for discovering the DNA molecule **(2)**

(c) ONE organelle in a cell where DNA is located (1)

6.3 Describe how a mutation on DNA may change the structure of a protein (4)

6.4 Tabulate TWO structural differences between a monomer of RNA and a monomer of DNA (5)

(15)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

DNA: CODE OF LIFE ANSWERS

QUESTION 1

1.1	B	✓✓
1.2	C	✓✓
1.3	C	✓✓
1.4	D	✓✓
1.5	D	✓✓
1.6	B	✓✓
1.7	C	✓✓
1.8	C	✓✓
1.9	B	✓✓
1.10	D	✓✓

(20)

QUESTION 2

2.1 (DNA) Replication ✓

2.2 Gene ✓

2.3 Peptide bond ✓

2.4 Transcription ✓

2.5 DNA profiling ✓ **(5)**

QUESTION 3

3.1 None ✓✓

3.2 Both A and B ✓✓

3.3 Both A and B ✓✓

(6)

QUESTION 4

4.1 Protein synthesis ✓ (1)

4.2 (a) mRNA ✓/ messenger RNA (1)

(b) Ribosome ✓ (1)

(c) Nuclear membrane ✓ (1)

4.3 A G U ✓ (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

4.4 S – R – P – Q ✓✓ (2)

4.5 Cytoplasm ✓ (1)

4.6 - The DNA molecule unwinds ✓

- and unzips / weak hydrogen bonds break ✓
- one side of the DNA molecule forms a template ✓
- free floating RNA nucleotides from the nucleolus ✓
- join to their complementary base pairs ✓ (T-A; C-G)
- to form a new strand of mRNA ✓ **(Any 5 x 1)** (5)

4.7 - If nitrogenous base A was replaced by G it would mean that the codon would change to AGC ✓

- which may code for a different anticodon ✓/UCA instead of AGU
- and a different the amino acid ✓
- which may change the protein formed ✓ (4)

(17)

QUESTION 5

5.1 CCT✓ (1)

5.2
- Amino acid isoleucine will be coded for✓
- instead of phenylalanine✓
- A different protein may form✓ / nonsense protein formed / protein's function may be affected (3)

5.3
- In replication DNA is formed✓
  and in transcription mRNA is formed✓
- In replication 2 strands of DNA act as a template✓
  and in transcription 1 strand of DNA is used as a template✓
- In replication thymine is complementary to adenine✓
  and in transcription uracil is complementary to adenine✓

(Mark first TWO only) Any 2 x 2 (4)

(8)

QUESTION 6

6.1 B – Nitrogenous base ✓

C – Phosphate ✓ (2)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

6.2 (a) Nucleotide ✓ (1)

(b) (James) Watson ✓
(Francis) Crick ✓
(Maurice) Wilkins ✓ (2)
(Mark first TWO only)

(c) Nucleus ✓/Mitochondrion/Chloroplast (1)
(Mark first ONE only)

6.3 - The DNA code will change ✓

- leading to different mRNA ✓/codons

- which will match with different tRNA ✓/anticodons

- resulting in different amino acids ✓ being brought to the ribosome leading to a different protein (4)

6.4

Monomer of RNA	Monomer of DNA
Contains the sugar ribose ✓	Contains the sugar deoxyribose ✓
Contains the nitrogenous base uracil ✓	Contains the nitrogenous base thymine ✓

(Mark first TWO only) ✓ **table** (5)

(15)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

GENETICS & INHERITANCE (45 MARKS)

EXAM GUIDELINES

What to study:

- Introduction: Mention of Mendel as the father of genetics

- Concepts in inheritance:
  - Chromatin and chromosomes
  - Genes and alleles
  - Dominant and recessive alleles
  - Phenotype and genotype
  - Homozygous and heterozygous

Monohybrid crosses:

- Format for representing a genetics cross
- Mendel's 'Principle of Segregation'
  - The pair of alleles on homologous chromosomes separate during meiosis, so that only one allele of each pair is found in each gamete.

- Types of Dominance
  - Complete dominance – one allele is dominant and the other is recessive, such that the effect of the recessive allele is masked by the dominant allele in the heterozygous condition
  - Incomplete dominance – none of the two alleles of a gene are dominant over one another resulting in an intermediate phenotype in the heterozygous condition
  - Co-dominance – both alleles of a gene are equally dominant whereby both alleles express themselves in the phenotype in the heterozygous condition

- Genetics problems involving each of the three types of dominance

- Proportion and ratio of genotypes and phenotypes

Sex determination

- 22 pairs of chromosomes in humans are autosomes and 1 pair of chromosomes are sex chromosomes/gonosomes

- Males have XY chromosomes and females have XX chromosomes

- Representation of a genetic cross to show the inheritance of sex

Sex-linked Inheritance

- Sex-linked alleles and sex-linked disorders

- Genetics problems involving the following sex-linked disorders:
  - Haemophilia
  - Colour blindness

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

The Y chromosome in males is shorter than the X chromosome and as such unable to carry the full complement of alleles found on its gonosome partner (X chromosome) and therefore the allele for some traits does not appear there. The Y chromosome therefore, has an absence of some alleles, especially in sex linked disorders studies.

Dihybrid crosses

- Mendel's 'Principle of Independent Assortment'
- Dihybrid genetics problems
- Determination of the proportion/ratio of genotypes and phenotypes

Genetic lineages/pedigree

- A genetic lineage/pedigree traces the the inheritance of characteristics over many generations
- Interpretation of pedigree diagrams

.**Blood grouping**

- Different blood groups are a result of multiple alleles
- The alleles I^A, I^B and **i** in different combinations, result in 4 blood groups
- Genetics problems involving the inheritance of blood type

Mutations

- Definition of a mutation
- Effects of mutations: harmful mutations, harmless mutations and useful mutations
- Mutations contribute to genetic variation
- Definition of gene mutation and chromosomal mutation
- Mutations lead to altered characteristics in each of the following genetic disorders:
  - Haemophilia – due to absence of blood clotting factors
  - Colour blindness – due to absence of the proteins that comprise either the red or green cones/photoreceptors in the eye
  - Down syndrome – due to an extra copy of chromosome 21 as a result of non-disjunction during meiosis

Genetic Engineering

- Genetic engineering uses biotechnology to satisfy human needs:
  - Stem cell research - sources and uses of stem cells
  - Genetically modified organisms – brief outline of process (names of enzymes involved are not required) and benefits of genetic modification
  - Cloning – brief outline of process and benefits of cloning
- Why people might be against genetic engineering:
  - The long-term effects of genetic engineering on the environment are not known so it could lead to health problems in the future
  - It is morally wrong to engage in genetic engineering since it is interfering with nature

Paternity testing

- The role of each of the following in paternity testing:
  - Blood grouping
    - The child received an allele for blood group from the mother and an allele from the father.
    - If the blood group of the mother and the possible father cannot lead to the blood group of the child, then the man is not the father.
    - If it can lead to the blood group of the child, then the man might be the father but this is not conclusive as many men have the same blood group.
  - DNA profiles

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- The mother's bands are compared to the child's bands to see which bands correlate.
- The remaining bands of the child are compared to the bands of the possible father.

Genetic Links

- Mutations in mitochondrial DNA used in tracing female ancestry

TERMINOLOGY

Biological term	Description
Albinism	The condition that results from the absence of skin pigmentation
Alleles	Two alternative forms of a gene at the same locus
Artificial selection/selective breading	The breeding of organisms over many generations in order to achieve a desirable phenotype
Biotechnology	The use of biological processes, organisms or systems to improve the quality of human life
Clone	A copy of an organism that is genetically identical to the original organism
Cloning	The process by which genetically identical organisms are formed using biotechnology
Co-dominance	The type of inheritance where both alleles are equally dominant and both express themselves equally in the phenotype. E.g. A white cow crossed with a black bull will produce a calf with black and white patches
Complete dominance	The type of inheritance where the dominant allele masks the expression of the recessive allele in the heterozygous condition
Continuous variation	Type of variation within a population in which there is a range of intermediate phenotypes
Chromatin network	Visible as thread-like structures in the nucleus of an inactive cell
Chromosome	A structure made up of two chromatids joined by a centromere that carries the hereditary characteristics within the DNA
Dihybrid cross	A genetic cross involving two different characteristics e.g. shape and colour of seeds
Dominant allele	An allele that masks or suppresses the expression of the allele partner on the chromosome pair and the dominant characteristic is seen in the homozygous (e.g.: TT) and heterozygous state (e.g.: Tt) in the phenotype.
Gene	A segment of DNA/a chromosome that codes for a particular characteristic
Gene mutation	A change of one or more N- bases in the nuclear DNA of an organism.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Genetic variation	This includes a variety of different genes that may differ from maternal and paternal genes resulting in new genotypes and phenotypes.
Genotype	This is the total **genetic composition** of an organism. It is the information present in the gene alleles, for example BB, Bb or bb.
Genome	The complete set of chromosomes in the cell of an organism
Haemophilia	A sex-linked genetic disorder characterised by the absence of a blood-clotting factor
Heterozygous	An individual having two non-identical alleles for a characteristic
Homozygous	When two alleles that control a single trait (on the same locus) are **identical**.
Hypothesis	A tentative explanation of a phenomenon that can be tested and may be accepted or rejected
Incomplete dominance	The type of inheritance where both alleles express themselves in such a way that an intermediate phenotype is formed. E.g. A white flowering plant crossed with a red flowering plant will produce a pink flowering plant.
Locus	The exact position or location of a gene on a chromosome.
Mendel's Law of Dominance	When two individuals with contrasting homozygous alleles are crossed, the individuals of the first generation (F_1) will **ALL** resemble the parent with the dominant characteristic.
Mendel's Law of Independent Assortment	Alleles of a gene for one characteristic segregate independently of the alleles of a gene of another characteristic. The alleles for the two different genes will therefore come together randomly during gamete formation. This is also known as random assortment.
Mendel's Principle of Segregation	During gametogenesis the two alleles of a gene separate so that each gamete will receive one allele of a gene for a specific characteristic/trait.
Monohybrid cross	A genetic cross involving one characteristic e.g. colour of seeds
Mutation	A sudden change in the sequence/order of nitrogenous bases of a nucleic acid
Multiple alleles	When there are more than two possible alleles for one gene locus. e.g. blood groups
Phenotype	This is the external, **physical appearance** of an organism. The phenotype is determined by the genotype.
Pedigree diagram	A diagram showing the inheritance of genetic disorders over many generations
Recessive allele	An allele that is suppressed when the allele partner is dominant. The recessive trait will only be expressed/seen if both alleles for the trait are homozygous recessive e.g.: tt
Stem cells/meristematic cells	Undifferentiated cells that can develop into any cell type
Theory	Explanation of an observation that is supported by facts, models and laws

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

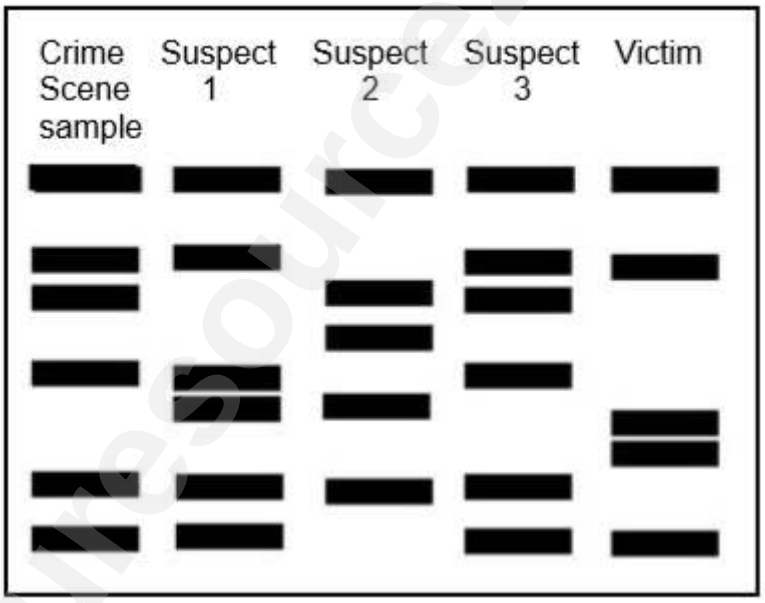
TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.10) in your ANSWER BOOK, for example 1.11 D.

1.1 The police were called to a scene where a man was seriously injured in a fight. They found blood on the man's hands that was not his own. The police took a sample of this blood as well as samples from the victim and three suspects (1 to 3) who were suspected of injuring the man.

The results are shown below:



Which suspect was definitely at the crime scene?

A 1
B 2
C 3
D None of the suspects

1.2 When a red horse (**RR**) is crossed with a white horse (**WW**), the offspring are all roan (**RW** = red and white hairs together). This type of inheritance is known as …

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

A codominance.
B polygenic inheritance.
C multiple alleles.
D incomplete dominance.

1.3 In mice brown fur coat is dominant to white fur coat. If a heterozygous brown mouse is mated with a white mouse and 8 offspring are produced, how many would be expected to be white?

A 4
B 8
C 0
D 2

1.4 Which of the following is usually NOT possible for red-green colour blindness?

A A carrier mother passes the allele on to her daughter.
B A colour-blind father passes the allele on to his daughter.
C A colour-blind father passes the allele on to his son.
D A carrier mother passes the allele on to her son.

1.5 An extra finger in humans is rare but is due to a dominant gene. When one parent is normal and the other parent has an extra finger but is homozygous for the trait, what is the chance that their children will be normal?

A 0%
B 25%
C 50%
D 75%

1.6 Which statement concerning a pair of alleles for a gene controlling a single characteristic in humans is true?

A Both alleles come from the father.
B Both alleles come from the mother.
C One allele comes from the mother and another allele comes from the father.
D The alleles come randomly in pairs from either the mother or father

1.7 Haemophilia is a sex-linked recessive trait in humans. What will the result of mating between normal (non-carrier) female and a male with haemophilia be?

A Half of the daughters are normal and half of the sons have haemophilia.
B All daughters are carriers and all sons are normal.
C All daughters are normal and all sons are carriers.
D

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Half of the sons are normal, half have haemophilia and all daughters are carriers.

1.8 The diagram below shows the nucleus of a diploid cell with two pairs of homologous chromosomes.

Due to independent assortment, what is the possible genetic makeup of gametes produced by this organism?

A RrTt
B Rr, Tt
C R, r, T, t
D RT, Rt, rT, rt

1.9 A gene in cattle controls whether horns develop or not. When cattle without horns are mated together, none of the offspring ever have horns.

A male with horns is mated with a female without horns.

If half of the offspring have horns and half do not, what is the conclusion?

A The male is homozygous dominant
B The male is homozygous recessive
C The male is heterozygous
D Only males have horns

1.10 If the mother has blood group AB and the father blood group O the possible blood groups of the offspring will be ...

A A or B only.
B AB only.
C O only.
D A, B, AB or O. **(20)**

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.5) in your ANSWER BOOK.

2.1 Organisms that have two identical alleles for a particular characteristic
2.2 Undifferentiated animal cells that have the ability to change into any cell type
2.3 The physical / functional expression of an organism's genes
2.4 Allele that is only expressed in the homozygous state
2.5 Having more than two different alleles for the same gene **(5)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Blood types	A B	Incomplete dominance Multiple alleles
3.2	Heterozygous condition expresses both alleles in gene pair	A B	Co-dominance Incomplete dominance
3.3	All the genes in all the chromosomes of a species	A B	Genome Genotype

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

QUESTION 4 *(EC, Sept. 2019, Paper 2)*

In sheep, the allele for black wool (**B**) is dominant over the allele for white wool (**b**). Similarly, the allele for horns (**H**) is dominant over the allele for being hornless (**h**). A horned sheep with black wool was crossed with a pure breeding hornless sheep with white wool.

The punnett diagram below shows the result of this cross.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

SHEEP 1 → / SHEEP 2 ↓	BH	Bh	bH	bh
bh	Y			
bh		X		
bh				
bh				

4.1 State why the example above represents a dihybrid cross. (1)

4.2 Give the genotype for the horned sheep with black wool used in this cross. (1)

4.3 Give the:

(a) Genotype of offspring **X** (1)

(b) Phenotype of offspring **Y** (1)

4.4 If 32 offspring are produced, how many offspring are expected to have horns and white wool. (2)

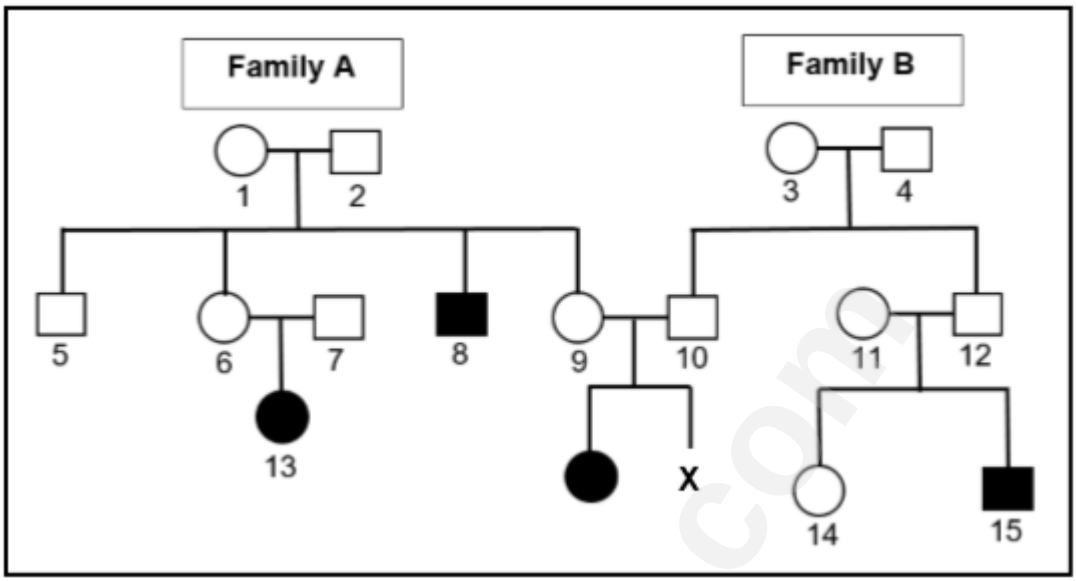
(6)

QUESTION 5 *(EC, Sept. 2019, Paper 2)*

Cystic fibrosis is a genetic condition that causes a build-up of thick sticky mucus in the lungs, pancreas, liver and intestines.
Study the diagram below of two families that carry the cystic fibrosis gene. The letters **N** and **n** are used to represent the two alleles.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



5.1 Define a *gene mutation*. (1)

5.2 Name the type of diagram shown above. (1)

5.3 How many generations are shown in the diagram? (1)

5.4 Using evidence from the diagram, explain why the gene for cystic fibrosis is a recessive allele. (3)

5.5 Individual **9** and individual **10** are expecting their second child **X.**

Use a genetic cross to show the percentage chance of them having a child with cystic fibrosis (6)

(12)

QUESTION 6 *(EC, Sept. 2019, Paper 2)*

Read the following extract.

> Duchenne's muscular dystrophy is a genetic disorder in which the skeletal muscles progressively weaken. It is a sex-linked disorder. The recessive mutated gene codes for a weak form of protein which cause the muscle fibres to weaken and break down.
> Duchenne's muscular dystrophy mostly affects boys and causes their muscles to weaken from the age of about 3. By the time they are teenagers they will be using a wheelchair and eventually their heart and respiratory muscles will also be affected.

6.1 Define a sex-linked disorder. (1)

6.2 According to the extract, when will parents first notice the changes in the muscles of their child? (1)

6.3 Explain why it is more common for boys to suffer from Duchenne's muscular dystrophy than girls? (4)

(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 7 *(KZN, Sept. 2018, Paper 2)*

A group of Grade 12 learners in a school were asked to conduct a survey to determine whether right handedness or left handedness is more common amongst learners in the FET phase.

Handedness is the dominance of one hand over the other.

As part of planning, the learners did the following:
- Asked permission from the principal
- Collected recording material
- Decided on the recording method

The results of the investigation are shown in the table below.

	Handedness			
	Right handedness		Left handedness	
Gender	BOYS	GIRLS	BOYS	GIRLS
Number of learners	120	160	80	40

7.1 State any other TWO planning steps for this investigation. (2)

7.2 State a conclusion for this investigation. (2)

7.3 Draw a bar graph to represent the information in the table. (6)

(10)

QUESTION 8 *(KZN, Sept. 2018, Paper 2)*

A female who is not colour blind but who has one allele for colour blindness marries a male who is not colour blind.
Use a genetic cross to show all possible genotypes and phenotypes of their children. Use the alleles **N** for normal and **n** for colour-blindness.

(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

GENETICS & INHERITANCE ANSWERS

QUESTION 1

1.1	C	✓✓
1.2	A	✓✓
1.3	A	✓✓
1.4	C	✓✓
1.5	A	✓✓
1.6	C	✓✓
1.7	C	✓✓
1.8	D	✓✓
1.9	C	✓✓
1.10	A	✓✓

(20)

QUESTION 2

2.1 Homozygous ✓

2.2 Stem cells ✓

2.3 Phenotype ✓

2.4 Recessive ✓

2.5 Multiple alleles ✓ **(5)**

QUESTION 3

3.1 B only ✓✓

3.2 A only ✓✓

3.3 B only ✓✓

(6)

QUESTION 4

4.1 Two characteristics ✓ are involved in the cross (1)

4.2 BbHh ✓ (1)

4.3 (a) Bbhh ✓ (1)

(b) Black, horned ✓ (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

4.4 8 ✓✓ (2)

(6)

QUESTION 5

5.1 A sudden change in the DNA sequence ✓/ structure of a gene leading to altered characteristics (1)

5.2 Pedigree ✓ diagram (1)

5.3 3 ✓ (1)

5.4 - Because individual 8/13/15 has the disease ✓

- therefore his/her parents must both be carriers of the disease ✓

- but they do not express the characteristic ✓

- therefore, it must be recessive (3)

5.5

P_1	Phenotype	Normal male	x	Normal female ✓
	Genotype	Nn	x	Nn ✓
Meiosis				
	G/gametes	N , n	x	N , n ✓
Fertilisation				
F_1	Genotype	NN ; Nn ;	Nn ;	nn ✓
	Phenotype	3 Normal and 1 cystic fibrosis		

They have a **25%**✓* chance of having a child with cystic fibrosis

P_1 and F_1 ✓
Meiosis and fertilisation ✓

(**1*** **compulsory +** Any 5)

OR

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

P_1	Phenotype	Normal male	x	Normal female ✓
	Genotype	Nn	x	Nn ✓
Meiosis				
	G/gametes	N , n	x	N , n ✓

Fertilisation
F_1

Gametes	**N**	**n**
N	NN	Nn
n	Nn	nn
Correct genotypes ✓		

(6)
(12)

Phenotype 3 Normal and 1 cystic fibrosis

They have a **25%** ✓* chance of having a child with cystic fibrosis

P_1 and F_1 ✓
Meiosis and fertilisation ✓

(**1* compulsory +** Any 5)

QUESTION 6

6.1 Any disease or abnormal condition that is determined by a gene/allele that is carried on the gonosomes ✓ /sex chromosomes/ X or Y chromosomes. (1)

6.2 At the age of 3 ✓ years old (1)

6.3 - The gene is found on the X chromosome ✓

- Boys only have one X chromosome ✓
- If that X chromosome carries the Duchenne's gene ✓
- the boy will have Duchenne's muscular dystrophy ✓
- as there is no other allele to mask it. ✓ (Any 4 x 1) (4)

(6)

QUESTION 7

7.1 - Ask for permission from participants✓ (2)
- Decide on the sample size✓
- Decide on the method to collect the information✓
- Decide on the venue to be used✓
- Decide on the date and time to conduct the investigation✓

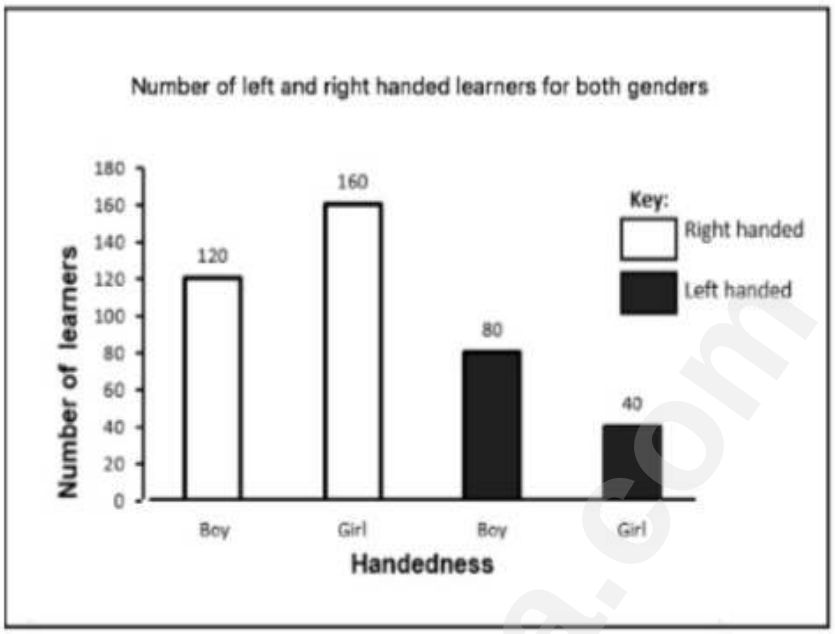
(Mark the first TWO only)

7.2 There are more right handed than left handed learners✓✓ (2)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

7.3



Mark allocation for the graph

Criteria	Mark allocation
Correct type of graph (bars not in contact)	1
Title/Caption of the graph	1
Correct scale for X-axis and Y-axis	1
Correct label for X-axis and Y-axis	1
Drawing of the graph	0: No bars plotted correctly 1: 1 to 3 bars plotted correctly 2: All 4 bars plotted correctly

(6)
(10)

QUESTION 8

P_1	Phenotype	Normal female	×	Normal male ✓	
	Genotype	X^NX^n	×	X^NY ✓	
Meiosis					
	G/Gametes	X^N, X^n	×	X^N, Y ✓	
Fertilisation					
F_1	Genotype	X^NX^N	X^NY	X^NX^n	X^nY ✓
	Phenotype	normal female	normal male	normal female	colour-blind male ✓

P_1 and F_1✓
Meiosis and fertilisation✓

Any 6

OR

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

P_1 Phenotype Normal female × Normal male ✓

Genotype X^NX^n × X^NY ✓

Meiosis

Fertilisation

F_1 Phenotype

Gametes	X^N	X^n
X^N	X^NX^N	X^NX^n
Y	X^NY	X^nY

✓(correct gametes)
✓ (correct genotype)

2 normal females, 1 normal male and 1 colour-blind male✓

P_1 and F_1✓
Meiosis and fertilisation✓

Any 6

(6)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

EVOLUTION (66 MARKS)

EXAM GUIDELINES

What to study:

Introduction
- Definition of biological evolution
- Difference between a hypothesis and a theory
- The Theory of Evolution is regarded as a scientific theory since various hypotheses relating to evolution have been tested and verified over time

Evidence for Evolution
- Role of the following as evidence for evolution:
  - Fossil record – Link to Grade 10
  - Biogeography – Link to Grade 10
  - Modification by descent (homologous structures)
  - Genetics

Variation
- Definition of a biological species and a population

- A review of the contribution of each of the following to variation that exists amongst individuals of the same species:
  - Meiosis
    - Crossing-over
    - Random arrangement of chromosomes
  - Mutations
  - Random fertilisation
  - Random mating

- Continuous and discontinuous variation

Origin of an idea about origins (A historical development)
- Ideas on evolution in the order of their origin are as follows:
  - Lamarckism
  - Darwinism
  - Punctuated Equilibrium

Lamarckism (Jean Baptiste de Lamarck – 1744 – 1829)
- Lamarck used two 'laws' to explain evolution
  - 'Law' of use and disuse
  - 'Law' of the inheritance of acquired characteristics
  - An inherited characteristic is a characteristic that an offspring is born with, having been inherited from one of the parents; a characteristic controlled by a gene.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- An acquired characteristic is a characteristic that an offspring is not born with but which develops/is acquired through the course of its lifetime; a characteristic not controlled by a gene.
- Guiding questions when Lamarck's theory is applied to a new situation:
  - What was the original characteristic?
  - What was the challenge?
  - What did the organism do/what characteristic was then acquired?
  - What was the result?
  - What happened to this acquired characteristic?
  - What was the result of this?

❑ Reasons for Lamarck's theory being rejected

Darwinism (Charles Darwin – 1809 – 1882)

❑ Darwin's theory of evolution by natural selection:

- Organisms produce a large number of offspring.
- There is a great deal of variation amongst the offspring.
- Some have favourable characteristics and some do not.
- When there is a change in the environmental conditions or if there is competition then organisms with favourable characteristics, which make them more suited, survive
  whilst organisms with unfavourable characteristics, which make them less suited, die.
- The organisms that survive, reproduce and thus pass on the allele for the favourable characteristic to their offspring.
- The next generation will therefore have a higher proportion of individuals with the favourable characteristic.
- In this way, the characteristics of a population gradually change over a long period of time

Punctuated Equilibrium (Eldredge and Gould – 1972)

❑ Punctuated Equilibrium explains the speed at which evolution takes place:

- Evolution involves long periods of time where species do not change or change gradually through natural selection (known as equilibrium)
- This alternates with (is punctuated by) short periods of time where rapid changes occur through natural selection during which new species may form in a short period of time

Artificial selection

❑ Artificial selection involving:

- A domesticated animal species
- A crop species

Formation of new species

❑ Biological species concept: Similar organisms that are capable of interbreeding to produce fertile offspring.

❑ Speciation and extinction and the effect of each on biodiversity

❑ Speciation through geographic isolation:

- If a population of a single species becomes separated by a geographical barrier (sea, river, mountain, lake), then the population splits into two.
- There is now no gene flow between the two populations.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- Since each population may be exposed to different environmental conditions/the selection pressure may be different
- Natural selection occurs independently in each of the two populations such that the individuals of the two populations become very different from each other genotypically and phenotypically.
- Even if the two populations were to mix again, they will not be able to interbreed.
- The two populations are now different species.

❑ Speciation through geographic isolation in ONE of the following:
- Galapagos finches
- Galapagos tortoises

- Plants on different land masses (link to continental drift)
  - Baobabs in Africa and Madagascar
  - Proteas in South Africa and Australia
- Any example of mammals on different land masses

Mechanisms of reproductive isolation

❑ A brief outline of reproductive isolation mechanisms that help to keep species separate:
- Breeding at different times of the year
- Species-specific courtship behaviour
- Adaptation to different pollinators
- Infertile offspring
- Prevention of fertilisation

Evolution in present times

❑ Any ONE example of natural selection and evolution in present times:
- Use of insecticides and consequent resistance to insecticides in insects
- Development of resistant strains of tuberculosis-causing bacteria (MDR and XDR) to antibiotics due to mutations (variations) in bacteria and failure to complete antibiotic courses
- HIV resistance to anti-retroviral medication
- Bill (beak) and body size of Galapagos finches

❑ Interpretation of a phylogenetic tree to show the place of the family Hominidae in the animal kingdom

❑ Characteristics that humans share with the African apes

❑ Anatomical differences between the African apes and humans, with the aid of diagrams, as it applies to the following characteristics:
- Bipedalism (foramen magnum (more forward position in humans to allow the spinal cord to enter vertically for bipedalism and more backward in the African Apes) , spine and pelvic girdle)
- Brain size
- Teeth (dentition)
- Prognathism
- Palate shape
- Cranial ridges
- Brow ridges

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- Lines of evidence that support the idea of common ancestors for living hominids including humans:
- Fossil evidence: Evidence from fossils of different ages show that the anatomical characteristics of organisms changed gradually over time.

  Emphasis on evolutionary trends provided by the anatomical features of fossils of the following three genera:
  - *Ardipithecus*
  - *Australopithecus*
  - *Homo*

    as well as:
  - The age of each fossil found / time-line for the existence of the three genera
  - The fossil sites where they were found: emphasis on the fossil sites that form a part of the Crade of Humankind
  - The scientists who discovered them
- Genetic evidence: Mitochondrial DNA

- Cultural evidence: Tool-making

Practical worksheet 12

Practical worksheet 13

- Evidence for the Out of Africa hypothesis:
- All modern humans/Homo sapiens originated in Africa and migrated to other parts of the world. The use of the concept 'modern humans' excludes *Homo neanderthalensis* which originated in Europe.
- Fossil Evidence: Information on each of the following fossils that serve as evidence for the Out of Africa hypothesis:

  - *Ardipithecus* (fossils found in Africa only)
  - *Australopithecus* (fossils found in Africa only)
  - *Homo* (Fossils of *Homo habilis* found in Africa only; oldest fossils of *Homo erectus* found in Africa, whilst the younger fossils were found in other parts of the world)
- Genetic evidence: Mitochondrial DNA
- Cultural Evidence – The oldest/most primitive artefacts were found in Africa.

- Timeline for the existence of different species of the genus *Homo* and the significant features of each type of fossil to illustrate the differences amongst them

- Interpretation of phylogenetic trees proposed by different scientists showing possible evolutionary relationships as it applies to hominid evolution

TERMINOLOGY

Biological term	Description
Australopithecus	The genus of the fossil 'Little Foot'
Biogeography	The distribution of species in different parts of the world
Bipedalism	The ability of an organism to walk on two limbs
Extinction	The permanent disappearance of a species from earth

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Foramen magnum	The opening at the base of the skull through which the spinal cord enters
Fossils	The mineralised remains of organisms that have lived in the past
Hominidae/Hominids	The family to which humans belong
Homo habilis	The first *Homo* species to use tools
Homologous structures	Similar structures on different organisms that suggest they have a common ancestor
Hypothesis	A tentative explanation of a phenomenon that can be tested and may be accepted or rejected
Natural selection	The process by which organisms best suited to survival in the environment achieve greater reproductive success, thereby passing advantageous characteristics onto future generations
Out of Africa hypothesis	The hypothesis that states that modern humans/*Homo sapiens* originated in Africa and migrated to other parts of the world
Palaeontology	Study of fossils
Phylogenetic tree/cladogram	A diagrammatic representation showing possible evolutionary relationships among different species
Population	A group of organisms of the same species living in the same habitat at the same time
Punctuated equilibrium	Type of evolution involving long periods of time when species do not change and short periods of rapid change
Quadrupedal	The ability of an organism to walk on four limbs
Speciation	Process whereby new species are formed from the original population
Species	A group of organisms which can interbreed to produce fertile offspring
Theory	Explanation of an observation that is supported by facts, models and laws

TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.15) in your ANSWER BOOK, for example 1.16 D.

1.1 The first primate to use tools consistently was …

A *Homo erectus.*
B *Homo habilis.*
C *Homo floresiensis.*
D *Homo neanderthalensis.*

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

1.2 Scientists recovered the body of a woolly mammoth from the frozen soil of Siberia. The DNA sequence of the woolly mammoth was very similar to the DNA sequence of the African elephant. Which of the following is a conclusion for this data?

A The woolly mammoth and African elephant have a common ancestor
B The woolly mammoth is not related to the African elephant
C The woolly mammoth has the same number of chromosomes as the African elephant
D The woolly mammoth and the African elephant should be classified as the same species

1.3 Which one of the following statements is a correct description of a hypothesis and a theory?

A An accepted theory becomes a hypothesis
B An accepted hypothesis becomes a theory
C Hypotheses and theories are different names for the same concept
D Theories can be tested experimentally, whereas hypotheses cannot

1.4 Scientists visiting a group of four islands **P**, **Q**, **R** and **S** found similar spiders on each island. They carried out investigations to see if the spiders from the different islands belonged to the same species.

The results are in the table below (✓ indicates successful interbreeding. **X** indicates unsuccessful interbreeding)

	Spiders from			
	P	Q	R	S
P	✓	✓	X	X
Q	✓	✓	X	X
R	X	X	✓	X
S	X	X	X	✓

Which two populations belong to the same species?

A Q and R
B R and S
C Q and S
D P and Q

1.5 What is *biogeography*?

A The study of fossil organisms in order to learn about earlier forms of life.
B The idea that worldwide disasters have caused the widespread extinction of species.
C The idea that Earth and all living things have been created in their present forms and are unchangeable.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

D The observed patterns of distribution of species.

1.6 Study the following list of concepts in evolution.

(i) Similarities in protein synthesis
(ii) Evidence for evolution
(iii) Common ancestry

Which ONE of the following combinations can be deduced by studying the percentage DNA between species?

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

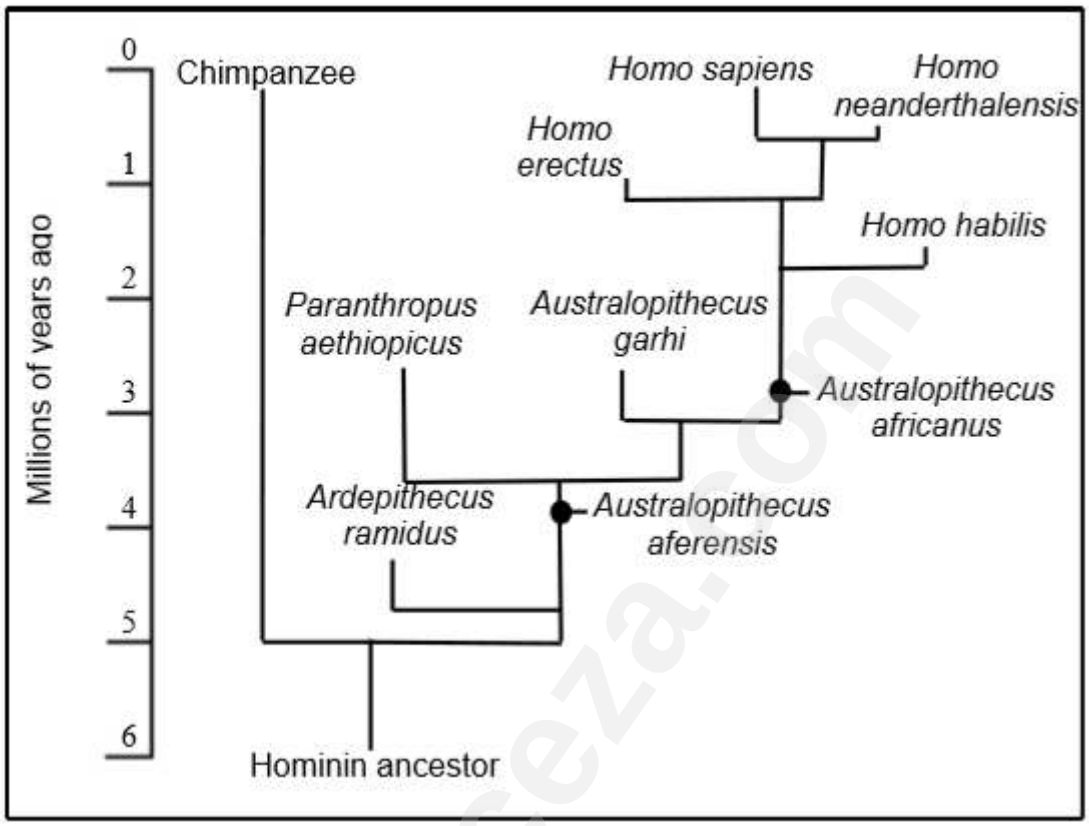
1.7 Which of the following supports the 'Out of Africa' theory?

A *Homo habilis* was the first hominin to use tools
B The African Apes share many characteristics with humans
C Comparing mutations on mitochondrial DNA
D *Homo erectus* fossils found in Europe

1.8
Study the diagram below.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



Which conclusion can be drawn from the above diagram?

A *Homo sapiens* is a direct descendant of *Ardipithecus ramidus*
B *Homo sapiens* evolved from chimpanzees
C *Australopithecus africanus* is a common ancestor of all *Homo* species
D *Homo sapiens* and *Homo erectus* have the most recent common ancestor

1.9 Two individuals are most likely members of the same species if they …

A have a different number of chromosomes.
B can mate and produce fertile offspring.
C breed at different times during the year.
D are phenotypically different.

1.10 Which ONE of the following involves short periods of time where rapid changes occur alternating with long periods of little or no change?

A Gradualism
B Punctuated equilibrium
C Speciation
D Natural selection

1.11 Study the list of processes below.

(i) Mutation
(ii) DNA replication
(iii) Meiosis
(iv) Random fertilisation

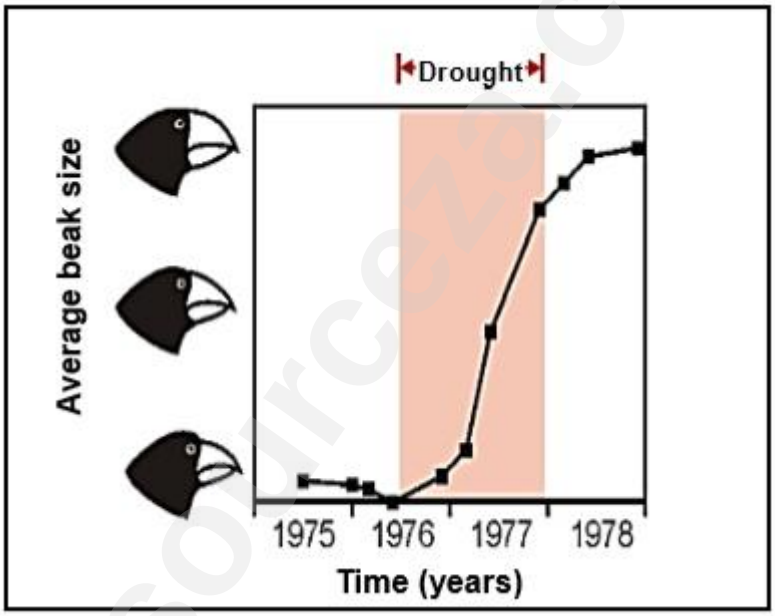
Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Which of the following processes are regarded as a source of variation for evolution?

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

1.12 During an investigation, researchers measured the beak size of a certain species of finch on the Galapagos Islands. The type of food available before and after a drought was a factor in the study of the evolution of the beaks of finches



Which factor is the dependent variable?

A The amount of rain
B The type of food available
C The beak size of finches
D The year

1.13 Which one of the following serves as evidence of cultural evolution in early *Homo* species?

A A skull of *Homo erectus* close to a *Homo sapiens* skeleton
B Remains of ancient tools
C Male and female skeletons in the same area
D Many *Homo* skeletons in an area

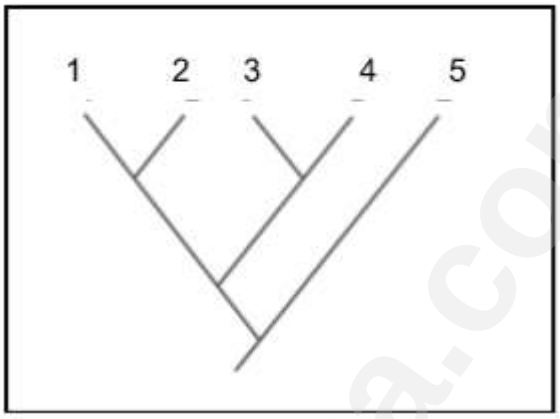
1.14 The wings of a bat and the human arm are examples of …

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

A vestigial structures.
B homologous structures.
C different ancestry.
D hindlimbs.

1.15 Study the phylogenetic tree below.



Which ONE of the following is a reasonable conclusion based on the phylogenetic tree?

A **1** and **2** belong to the same species
B **3** is more closely related to **4** than to **5**
C **1** and **5** do not have a common ancestor
D The DNA of **1** will be more similar to **4** than to **2** **(30)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.10) in your ANSWER BOOK.

2.1 The preserved remains of ancient organisms
2.2 The death of the last individual of a species
2.3 Having a face with protruding jaws
2.4 A diagram showing evolutionary relationships amongst species
2.5 An opening in primate skulls through which the spinal cord passes
2.6 Factors that prevent members of different species from producing fertile offspring
2.7 Having an upper or lower jaw that projects abnormally forward
2.8 Group of organisms of the same species occupying the same habitat
2.9 The theory involving the inheritance of acquired characteristics **(10)**
2.10 The first hominid that used stone tools for cutting meat

QUESTION 3 *(Questions taken from various sources)*

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Indicate whether each of the statements in COLUMN I applies 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 number (3.1 to 3.5) in the ANSWER BOOK.

COLUMN I		COLUMN II	
3.1	Evidence of evolution	A B	Biogeography Modification by descent
3.2	A possible explanation for an observation that can be tested by an experiment	A B	Hypothesis Theory
3.3	The scientist who discovered *Australopithecus sediba*	A B	Tim White Lee Berger
3.4	A difference between humans and African apes	A B	Opposable thumbs Flattened face
3.5	Introduces variation to a species	A B	Random mating Mutation

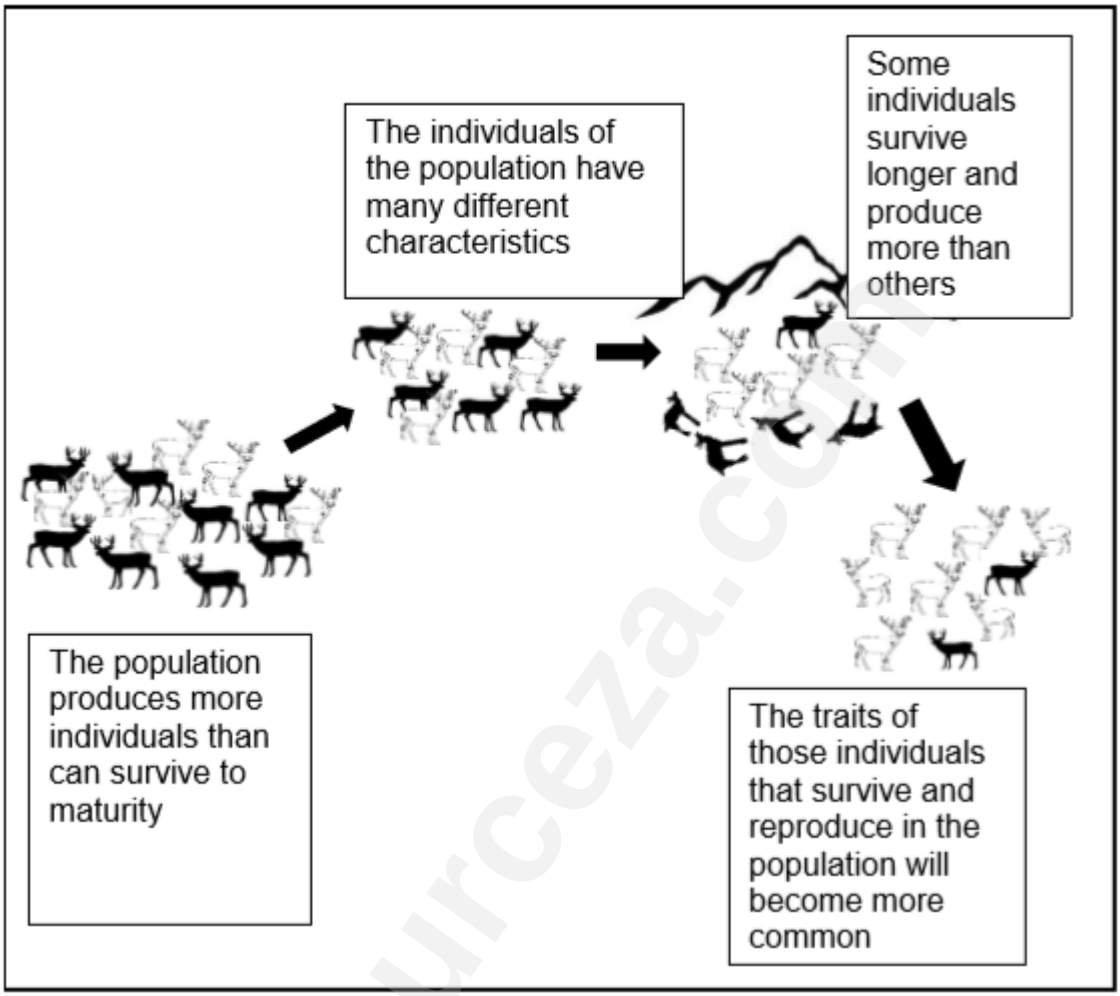
(5 x 2) **(10)**

QUESTION 4 *(EC, Sept. 2019, Paper 2)*

Study the diagram below showing evolution by natural selection in deer.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



4.1 List THREE sources of variation in a species. (3)

4.2 Explain why the above example represents discontinuous variation. (2)

4.3 Both Darwinism and Punctuated Equilibrium explains evolution in terms of natural selection. Tabulate TWO differences between Darwinism and Punctuated Equilibrium. (5)

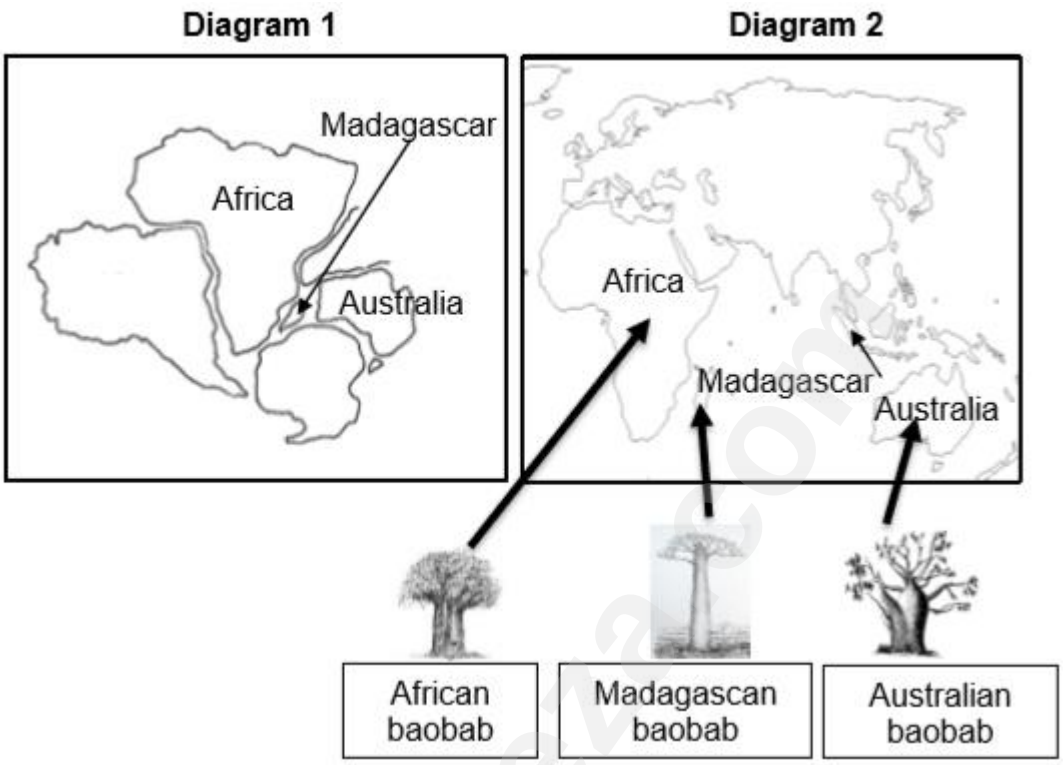
(10)

QUESTION 5 *(EC, Sept. 2019, Paper 2)*

The baobab tree belongs to the genus *Adansonia*. Different species are found in Madagascar, Africa and Australia as shown in the diagram below. Originally these three continents formed part of Gondwanaland as seen in diagram **1**. Today the continents are separated by large oceans as seen in diagram **2.**

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com



Explain how the different species of baobab could have evolved on the different continents. **(6)**

QUESTION 6 *(GDE, Sept. 2019, Paper 2)*

As a result of a mutation, bacteria with three varieties of cell wall exist as shown below.

An antibiotic destroys the bacteria by binding with it. The antibiotic has two binding sites, one triangular and the other square.

Use Darwin's theory of evolution through natural selection to explain why the bacteria with round spikes on their cell walls will increase in proportion in future generations. **(6)**

QUESTION 7 *(GDE, Sept. 2019, Paper 2)*

Read the following extract following a survey done by naturalist Colin Donihue on the effects of hurricane Irma on the populations of an endemic species of lizard on two islands in the West Indies.

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

Colin and his team visited the islands after hurricane Irma had struck. They captured as many as possible of the endemic lizards, *Anolis scriptus*.

The captured lizards all had the following features: Bigger toepads, longer arms and shorter hind legs. The first two observations made sense as these were known to increase clinging ability in *Anolis* but the third did not. Wouldn't longer hind legs cling to vegetation better? – So why did more lizards with shorter hind legs survive? Colin realized that the longer hind legs of the lizards, once they lost their grip on a branch, acted as 'sails', catching the wind, and thus carrying the lizard away into the sea.

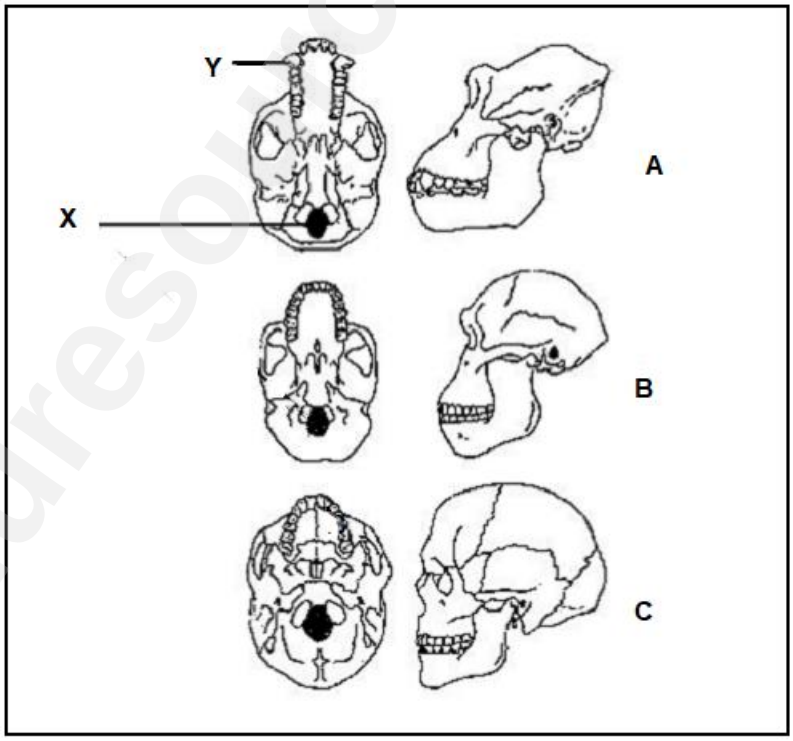
7.1 What is the scientific name of the lizard that was studied? (1)

7.2 Give TWO characteristics that were favourable for the survival of the lizard. (2)

7.3 Explain ONE characteristic that was unfavourable for the survival of the lizard. (2)
(5)

QUESTION 8 *(GDE, Sept. 2019, Paper 2)*

The diagram below shows the skulls of three organisms.



8.1 Label part **X** and the type of teeth at **Y.** (2)

8.2 Explain the significance of the location of structure **X** in organism **C**. (3)

8.3 Which of the skulls (**A**, **B** or **C**) belongs to:

(a) An australopithecine (1)
(b) A quadripedal primate (1)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

8.4 Explain how the change in the skull from **B** to **C** could indicate a change in intelligence. (3)

8.5 Describe the significance of the shape of each of the following as a trend in human evolution:

(a) Spine (2)
(b) Shape of the pelvis (2)

8.6 Describe the significance of *Homo erectus* to the 'Out of Africa' hypothesis. (2)

(16)

QUESTION 9 *(DBE, Jun. 2019, Paper 2)*

The table shows the evolution of cranial capacity in some species.

SPECIES	PERIOD OF EXISTENCE (MILLION YEARS AGO)	AVERAGE CRANIAL CAPACITY (cm^3)
Sahelanthropus	7,0–6,0	450
Australopithecus africanus	3,0–2,0	480
Homo habilis	2,2–1,6	650
Homo erectus	2,0–0,4	900
Homo neanderthalensis	0,4–0,04	1 500
Homo sapiens	0,2–0	1 450

9.1 Name:

(a) TWO hominid genera in the table above (2)

(b) TWO fossils of *A. africanus* that were found in South Africa (2)

(c) The genus that appeared first on Earth as shown in the table (1)

9.2 Which hominid had a cranial capacity closest to that of *Homo sapiens*? (1)

9.3 Give the smallest cranial capacity (in cm3) of a *Homo* species. (1)

9.4 When did *Australopithecus africanus* become extinct? (1)

9.5 Fossils are used as evidence of hominid evolution.

Name TWO other lines of evidence. (2)

(10)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 10 *(NW, Sept. 2018, Paper 2)*

Study the extracts and the graph given below.

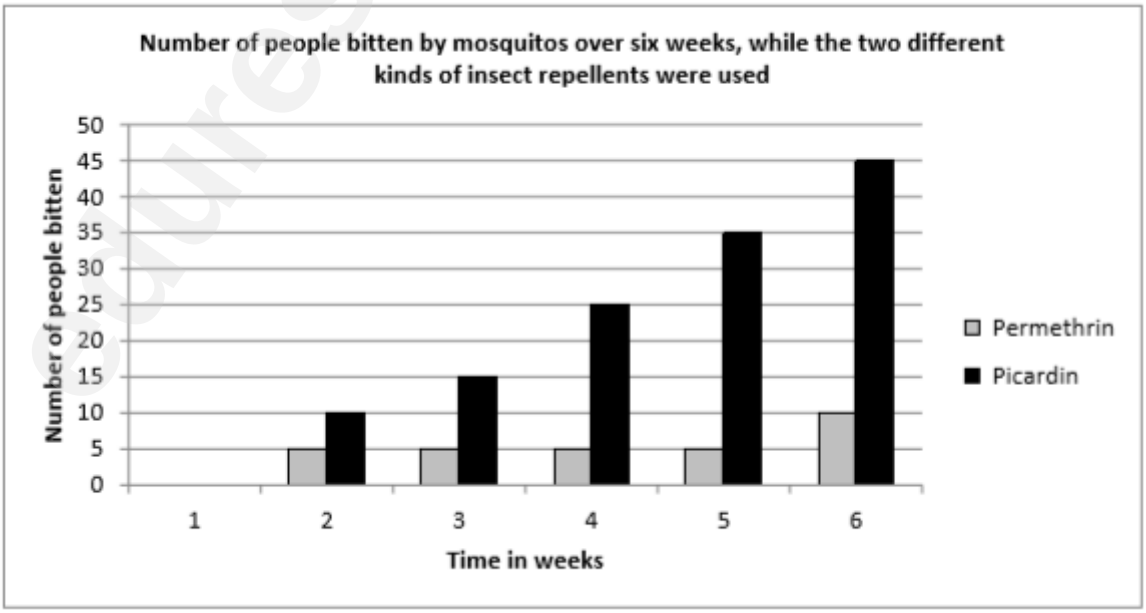
> Zika-fever is a mosquito-borne viral disease caused by the Zika virus which is suspected of leading to the birth of deformed babies. The virus is transmitted to humans when an infected *Aedes* mosquito stings a person. Direct human to human transmission through sex has also been reported.
>
> [Adapted from https://theconversation.com]

> Company A produces an insect repellent, called PICARDIN, that has been tested and proved affective against the *Aedes* mosquito species which transmits the Zika-virus.
>
> Company B produces a mosquito repellent, called PERMETHRIN.
>
> Both of them are designed for use on clothing and gear and may last for six weeks of washings.
>
> [Adapted from https://Google.com]

The graph below represents the results of an investigation conducted by a group of learners to test the long term effectiveness of the two types of insect repellents mentioned above.

- 60 people were given Permethrin to spray on their clothes
- 60 people were given Picardin to spray on their clothes

Both insect repellents were sprayed at the start of the investigation. Both these groups had to wear these clothes for 6 weeks, the duration of the investigation.



10.1 Formulate a hypothesis for this investigation. (2)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

10.2 State the independent variable. (1)

10.3 What percentage of people who participated in the survey were bitten by mosquitos during week **6**? Show all calculations. (3)

10.4 State TWO ways in which the learners could have improved the validity of the investigation. (2)

10.5 *Aedes* mosquitos may develop resistance towards Picardin and Permethrin. Explain this phenomenon in terms of evolution in present times. (5)

(13)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

EVOLUTION ANSWERS

QUESTION 1

1.1	B	✓✓
1.2	A	✓✓
1.3	B	✓✓
1.4	D	✓✓
1.5	D	✓✓
1.6	A	✓✓
1.7	C	✓✓
1.8	C	✓✓
1.9	B	✓✓
1.10	B	✓✓
1.11	B	✓✓
1.12	C	✓✓
1.13	B	✓✓
1.14	B	✓✓
1.15	B	✓✓

(30)

QUESTION 2

2.1 Fossils ✓

2.2 Extinction ✓

2.3 Prognathous ✓

2.4 Phylogenetic tree ✓

2.5 Foramen magnum ✓

2.6 Reproductive isolating mechanisms✓

2.7 Prognathous ✓

2.8 Population ✓

2.9 Lamarckism ✓

2.10 *Homo habailis* ✓ **(10)**

QUESTION 3

3.1 Both A and B ✓✓

3.2 A only ✓✓

3.3 B only ✓✓

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

3.4 B only ✓✓

3.5 Both A and B ✓✓

(10)

QUESTION 4

4.1 - Random arrangement of chromosomes ✓ } OR Meiosis ✓
- crossing over ✓
- random mating ✓
- random fertilisation ✓
- mutations ✓ **Mark first THREE only** (Any 3 x 1) (3)

4.2 - The deer are either black or white. ✓
- There is no intermediate characteristic ✓ /grey (2)

4.3

Darwinism	Punctuated Equilibrium
Gradual change ✓	Rapid change ✓
Takes place over a long period of time ✓	takes place with in a relatively short period of time ✓
Change is continuous ✓	Long periods of no change ✓

Mark first TWO only Table ✓ + Any 4 (5)

(10)

QUESTION 5

- The common ancestor ✓original baobab population
- was separated✓into different populations
- by the sea ✓*/due to continental drift
- There was no gene flow ✓between the populations
- Each population was exposed to different environmental conditions ✓/ different selection pressures.
- Natural selection occurred independently ✓in each population.
- the individuals in the two populations became different ✓from each other over time
- genotypically and phenotypically ✓
- Even if the two are to mix again ✓
- they will not be able to interbreed ✓
- forming different baobab species (1* compulsory + Any 5)

(6)

QUESTION 6

- There was variation in the spike shape of the cell wall✓ of the bacteria population.
- Bacteria with triangle spikes and square spikes✓
- were not antibiotic resistant✓/ antibiotics were able to bind to the surface
- and were killed by the antibiotics ✓/ did not survive
- The bacteria with the round spikes✓

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

- were resistant to the antibiotics✓/ antibiotics were unable to bind to the surface
- and they survived✓
- and reproduced, passing the characteristic of round spikes to the next generation✓ increasing the proportion of these bacteria

Any **(6)**

QUESTION 7

7.1 *Anolis scriptus*✓ (1)

7.2
- Short hind limbs✓
- Bigger toepads✓
- Longer arms✓

(Mark first TWO only) Any (2)

7.3 Longer hind legs acted as sails✓catching the wind✓ / carrying the lizard away into the sea (2)

(5)

QUESTION 8

8.1 **X** – foramen magnum✓
Y – canines✓ (2)

8.2
- The more forward position of the foramen magnum✓/ X
- allows the spinal cord to exit the skull directly downwards✓
- This acts as an axis for the skull✓
- making it favourable for bipedalism✓/ an upright position

Any (3)

8.3
(a) **B**✓ (1)
(b) **A**✓ (1)

8.4
- There is an increase✓
- in the cranium size✓from organism **B** to organism **C**
- This will allow it to house a larger brain✓/ cerebrum which suggests greater intelligence

(3)

8.5 (a)
- The spine changed from C-shaped to more curved ✓/ s-shape,
- which provides better support for bipedalism✓ (2)

(b)
- The pelvis changed from being long and narrow to shorter and wider✓, to support the body weight in an upright position✓

(2)

8.6
- The oldest fossils of *Homo erectus* were found in Africa✓,
- while the younger fossils were found in other parts of the world✓ suggesting that *Homo erectus* originated in Africa✓ Any (2)

(16)

Downloaded from eduresourceza.com

Downloaded from eduresourceza.com

QUESTION 9

9.1	(a) *Sahelanthropus* ✓ *Australopithecus* ✓ *Homo*✓ **(Mark first TWO only)**	Any 2	(2)
	(b) Taung child ✓ Mrs Ples ✓ (Little foot) ✓ **(Mark first TWO only)**	Any 2	(2)
	(c) *Sahelanthropus* ✓		(1)
9.2	*Homo neanderthalensis* ✓		(1)
9.3	650 ✓cm^3		(1)
9.4	2,0 mya✓/2 000 000 years ago		(1)
9.5	Genetic ✓ evidence Cultural ✓ evidence		(2)
			(10)

QUESTION 10

10.1 -Permethrin is more/less effective as a long-term mosquito repellent than Picardin✓✓.

OR

-Picardin and Permethrin are equally effective as long-term mosquito repellents. ✓✓ (2)

10.2 - Type of insect repellent✓ (1)

10.3 45 + 10=55✓ 55 /120 x 100✓ = 45,8 ✓% (3)

10.4 - People must be exposed to the same environmental conditions✓
- Same concentration/dose ✓of the insect repellents must be applied
- The clothes must be washed the same number of times. ✓
(Mark first TWO only (2)

10.5 - *Aedes* mosquitos show variation. ✓
- Some are resistant to insecticides and some are not ✓
- When insecticides are sprayed ✓ some will survive, and others will die✓
- The mosquitoes that survive will reproduce✓ thus
- pass on the allele for resistance ✓to their offspring.
- The next generation will have a higher proportion of individuals with the ability to survive insecticides✓ **Any 5** (5)

(13)

Downloaded from eduresourceza.com