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Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2013

LIFE SCIENCES P1

MARKS: 150

TIME: 2½ hours



This paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

SECTION A

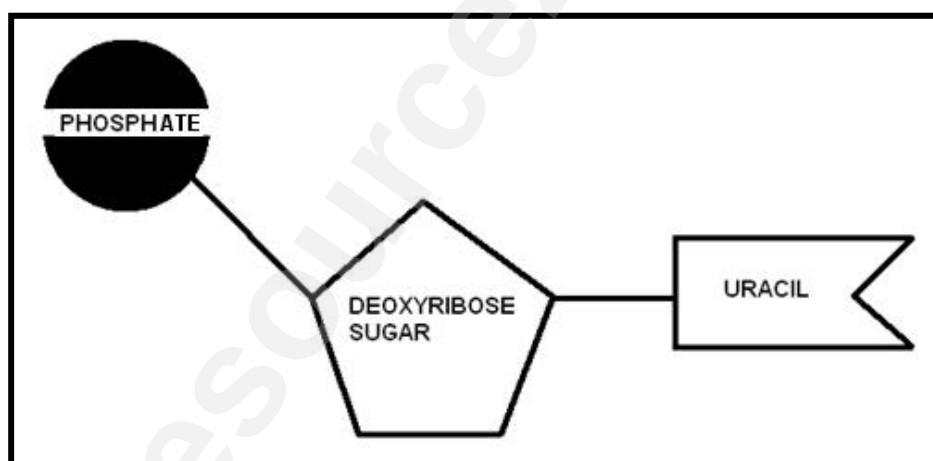
QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question numbers (1.1.1–1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following statements best describes a difference between a chromosome and a gene?

- A A gene is one section of a chromosome, and a chromosome may carry many genes
- B A chromosome and a gene are identical
- C A chromosome contains the entire DNA of a human; while a gene is a single portion of that DNA
- D A gene is larger than a chromosome

1.1.2 In order to make the following nucleotide a monomer of DNA, replace...



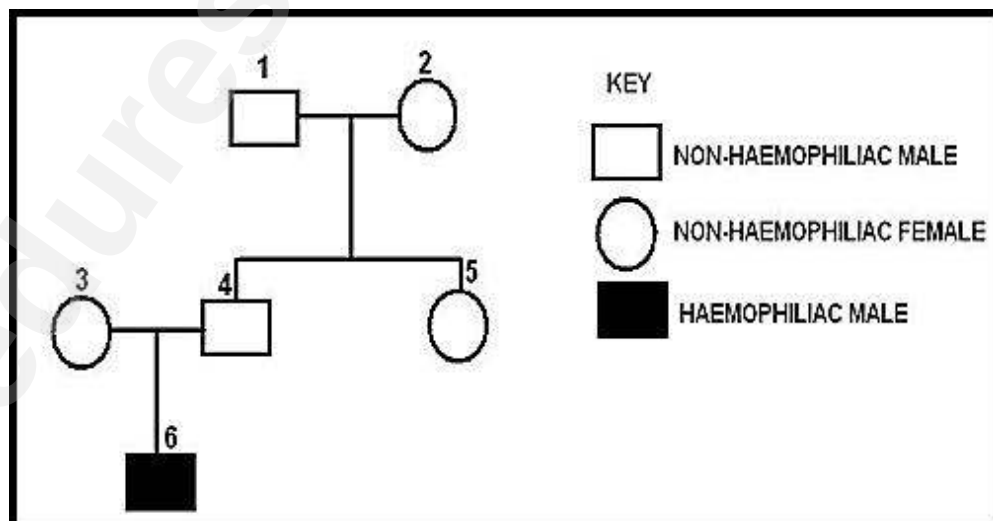
- A deoxyribose sugar with a ribose sugar.
- B phosphate with phosphorus.
- C uracil with a thymine.
- D dexyribose sugar with a hexose sugar.

1.1.3 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 conclusions is **best** supported by this information?

- A African elephants evolved directly from woolly mammoths
- B The woolly mammoth and the African elephant have a common ancestor
- 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

- 1.1.4 Lamarck's theory of evolution was rejected because he incorrectly proposed that ...
- A nature selects the best adapted organisms to survive.
 - B the acquired characteristics are inherited.
 - C the giraffes are the only organisms that are able to inherit acquired characteristics.
 - D the organisms have the ability to reverse the inherited characteristics according to changes in the environment.
- 1.1.5 Variation, which drives natural selection, is not caused by ...
- A mutation.
 - B fossilisation.
 - C chance fertilisation.
 - D random arrangement of chromosomes during meiosis.
- 1.1.6 One of the following is not an example of reproductive isolation mechanisms that prevents two species from producing viable, fertile offspring.
- A Habitat isolation
 - B Behaviour isolation
 - C Hybrid fertility
 - D Mechanical isolation
- 1.1.7 The pedigree diagram below shows the inheritance of haemophilia in a family [X^H – normal blood (dominant gene); X^h – recessive gene causing haemophilia].

What is the genotype of family member number 3?

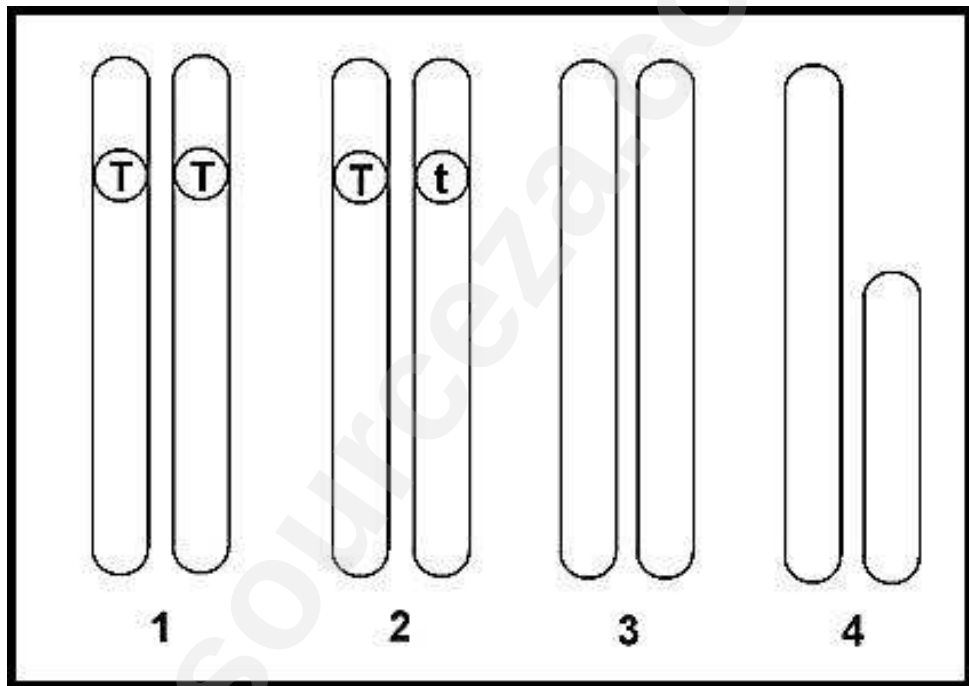


- A $X^H X^h$
- B $X^H X^H$
- C $X^h X^h$
- D $X^h Y$

1.1.8 The advantage of cloning is that it ...

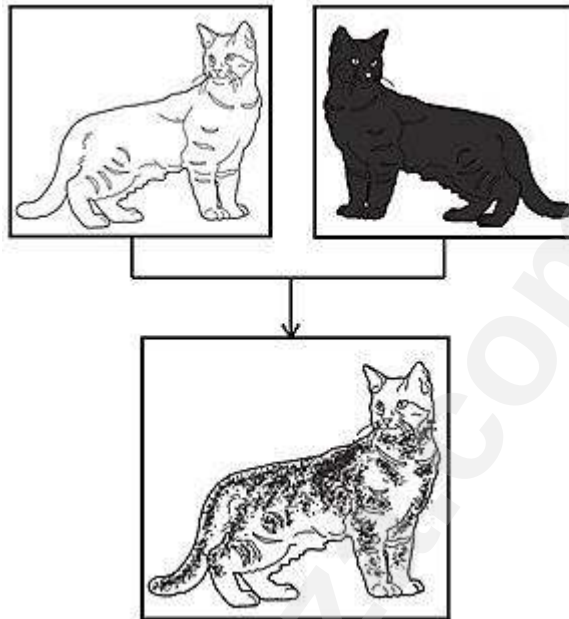
- A will reduce the variation within a population.
- B produces genetically identical individuals with desirable characteristics.
- C will enable offspring to survive under any unfavourable conditions.
- D is the only scientific technique that is accepted by all religious denominations and faiths.

1.1.9 1, 2, 3 and 4 in the diagram below represent a pair of chromosomes. The correct interpretation of the diagrams is that ...



- A 2 represents a homozygote.
- B 1 represents a heterozygote.
- C 4 represents an autosome.
- D 3 represents a homologous pair of chromosomes.

- 1.1.10 A cross between a white cat and a black cat produces a white cat with black patches. This example illustrates ...



- A incomplete dominance.
- B co-dominance.
- C complete dominance.
- D partial dominance.

(10 x 2) (20)

- 1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1–1.2.7) in the ANSWER BOOK.

- 1.2.1 Formation of two or more species as a result of separation of the original species into different groups by a geographic (physical) barrier
- 1.2.2 The process that enables organisms with desirable characteristics to survive and reproduce, whereas organisms with undesirable characteristics die
- 1.2.3 Chromosomes that determine the sex of the individuals
- 1.2.4 The physical appearance of an organism
- 1.2.5 A process that involves the insertion of a diploid nucleus from an embryonic somatic cell into the unfertilised egg which then becomes implanted on to the uterine wall
- 1.2.6 The point at which the chromatids of homologous chromosomes cross over during the first prophase of meiosis
- 1.2.7 An inheritance in which a particular trait is produced by the interaction of many genes

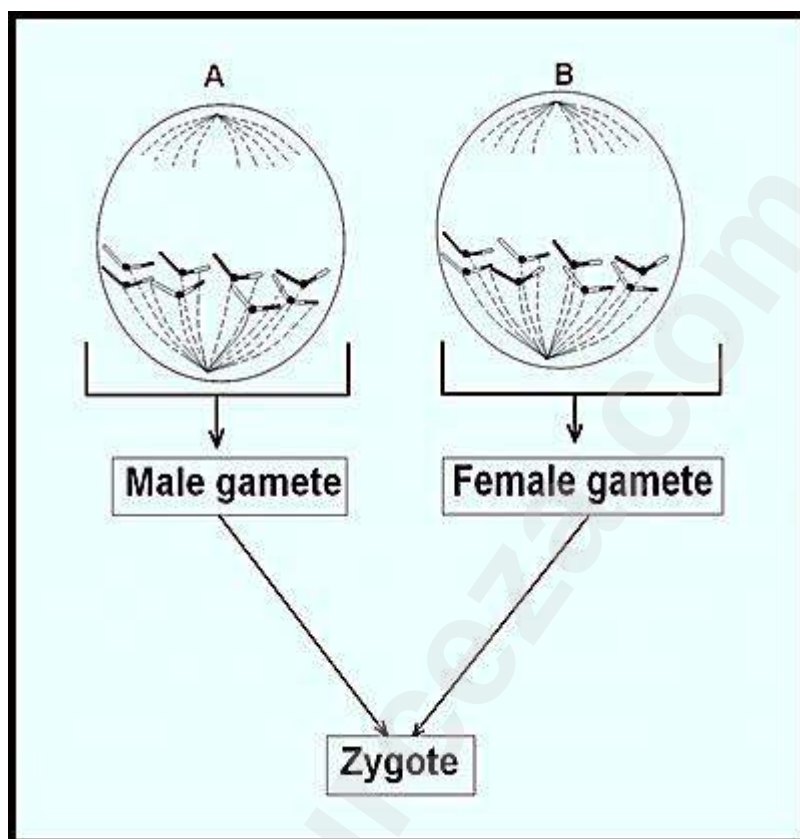
(7 x 1) (7)

- 1.3 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 numbers (1.3.1–1.3.7) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Different forms of a gene which occur at the same locus on a pair of homologous chromosomes	A	Alleles
		B	Anticodon
1.3.2	The process by which animals or plants are selected and allowed to interbreed with selected animals or plants to produce desirable characteristics	A	Natural selection
		B	Artificial selection
1.3.3	The number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell	A	Karyotype
		B	Genome
1.3.4	The process by which DNA makes copies of itself	A	Point mutation
		B	Frame shift mutation
1.3.5	The region at which chromatids are held together	A	Centromere
		B	Centriole
1.3.6	A cell that has only one set of chromosomes	A	Diploid
		B	Haploid
1.3.7	A specific pattern of bands that represents a unique sequence of nucleotides that resemble bar codes	A	DNA profiling
		B	DNA replication

(7 x 2) (14)

- 1.4 The diagram below represents meiotic division of two different cells. Both cell A and cell B undergo a certain unusual phenomenon and give rise to male and female gametes respectively.



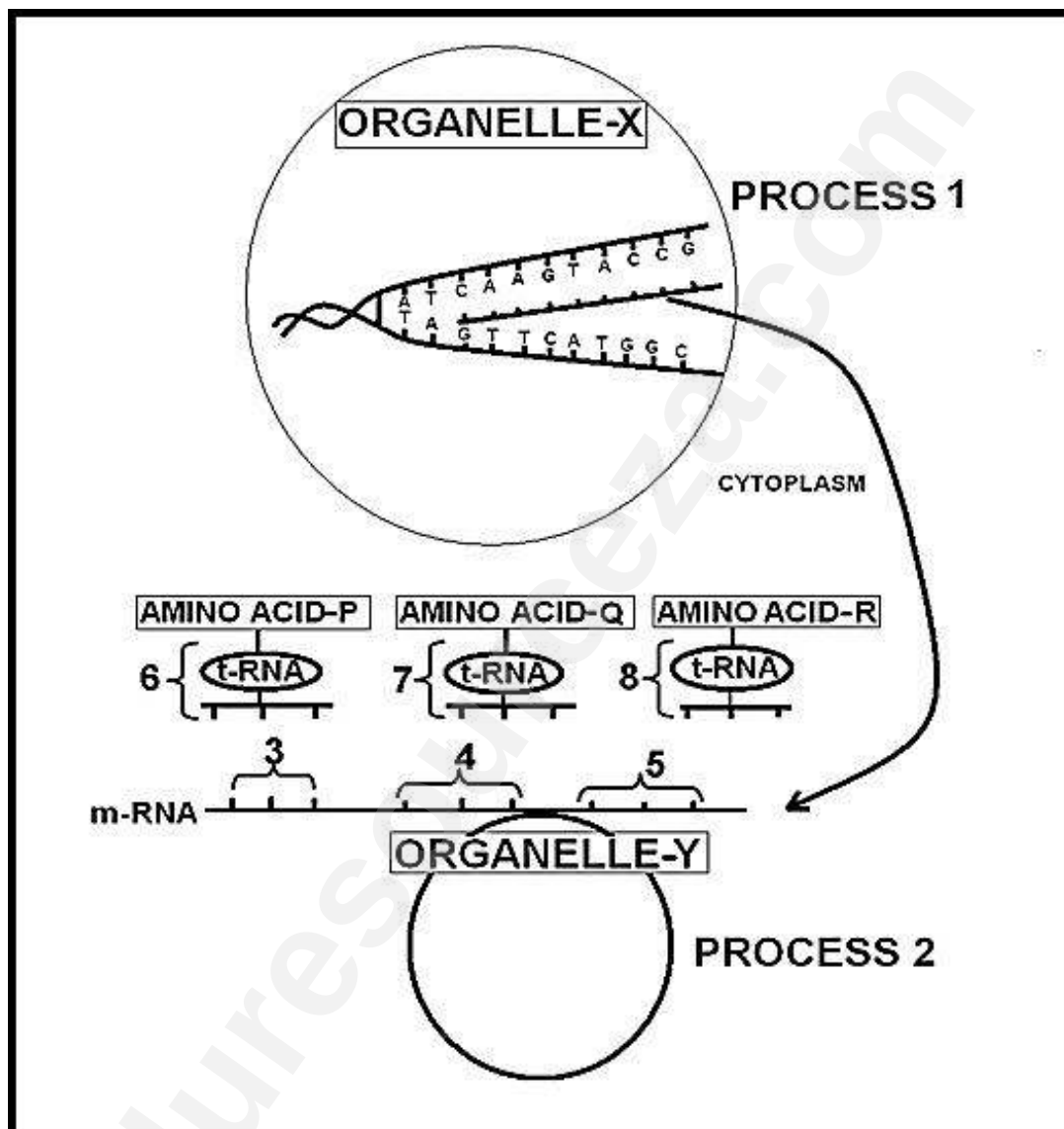
- 1.4.1 Identify the phenomenon depicted in cell A and cell B. (1)
- 1.4.2 In which organisms (plants or animals) does this phenomenon usually occur? (1)
- 1.4.3 What is this phenomenon generally known as? (1)
- 1.4.4 What would the chromosome number be in the: (1)
- (a) male gamete (1)
 - (b) female gamete (1)
 - (c) zygote (1)
- 1.4.5 What was the chromosome number shown in the diagram above of cell A and B before meiotic division took place? (1)
- 1.4.6 State TWO ways in which the phenomenon shown above is important to plant breeders. (2)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

- 2.1 The diagram below represents a metabolic process that takes place in a living cell. Study the diagram below and answer the following questions.



- 2.1.1 Name the process occurring in the diagram above. (1)
- 2.1.2 Identify the following from the above diagram:
- (a) Organelle X (1)
 - (b) Organelle Y (1)
 - (c) Process 1 (1)
 - (d) Process 2 (1)

2.1.3 Name the:

- (a) end-product of the metabolic activity mentioned in QUESTION 2.1.1. (1)
- (b) monomer units from which the complex molecule mentioned in QUESTION 2.1.3 (a) is formed. (1)
- (c) bond that binds the monomer units of the final product. (1)

2.1.4 Write, from the left to the right, the correct base sequences of:

- (a) codon labelled 4 (3)
- (b) anticodon labelled 8 (3)

2.1.5 How many nitrogenous base units form part of the codon? (1)

2.1.6 The table below shows the base triplets of DNA and the amino acid which each code for.

With reference to the diagram in QUESTION 2.1 and the table diagram below name the amino acids labelled P, Q and R respectively.

Base triplet of DNA	Amino acid coded for
AGT	Serine
CCG	Glycine
TGT	Threonine
GTA	Histidine
CAA	Valine
TCC	Arginine
ACA	Cysteine

 (3)

2.2 Study the newspaper article and answer the following questions.

Public consultations on 'threesome' fertility

BRITAIN launched a public consultation yesterday to ask whether controversial 'three-parent' fertility treatments should be available to families hoping to avoid the transfer of incurable diseases.

The technique has become known as three-parent *in vitro* fertilisation (IVF) because the offspring would have genes from a mother, a father and from a female donor.

The techniques are designed to help families with mitochondrial diseases – incurable inherited conditions passed down the maternal lines that affect around one in 6 500 children worldwide.

The new potential treatments involve intervening in the fertilisation process to remove faulty mitochondrial DNA, which can lead to a range of inherited conditions including fatal heart problems, liver failure, brain disorders, blindness and muscular weakness. The technique would effectively replace mitochondria, which act as tiny energy-generating batteries inside cells, so a baby does not inherit faults from its mother.

The Human Fertilisation and Embryology Authority (HFEA) said the critics may worry that modifying embryos to avoid disease could be the first step towards the creation of "designer babies", whose genetic makeup could be modified in embryos to change certain traits such as height or hair colour.

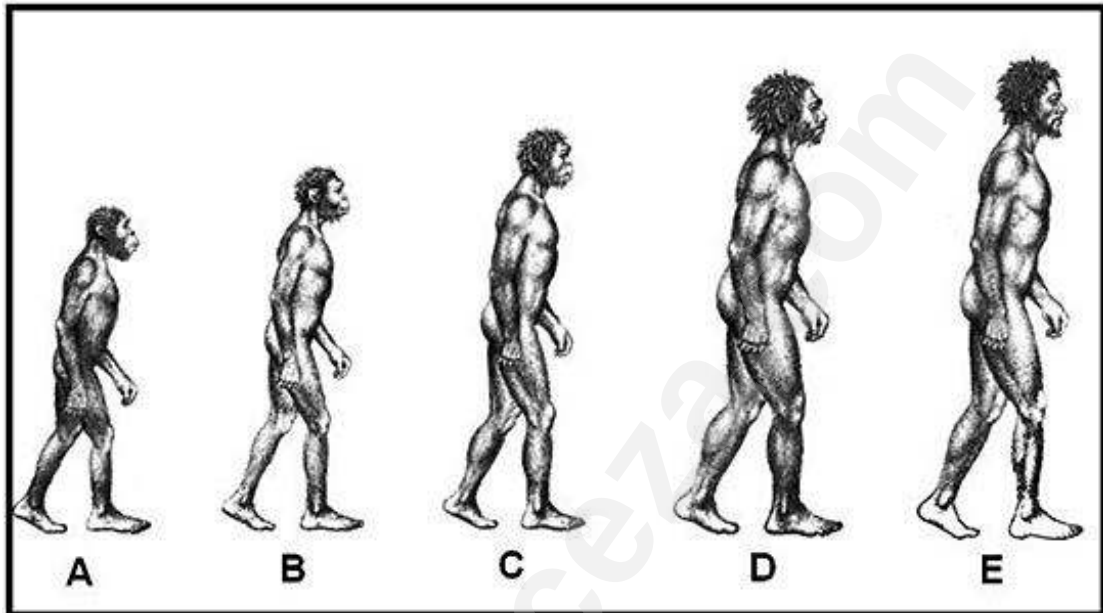
[Modified and adapted from *Daily Dispatch* newspaper, Tuesday, Sept 18, 2012]

- 2.2.1 Name the technique that has the potential of preventing the transfer of incurable diseases. (1)
- 2.2.2 What is the cause of the incurable diseases mentioned in the article? (1)
- 2.2.3 Give worldwide statistics regarding the number of sufferers of the above-mentioned genetic condition. (1)
- 2.2.4 Briefly explain how this technique is carried out. (3)
- 2.2.5 Name any THREE examples of the disease mentioned in the article. (3)
- 2.2.6 Supply any THREE responses, if you are asked to comment on the ethical concerns regarding this research programme. (3)

[30]

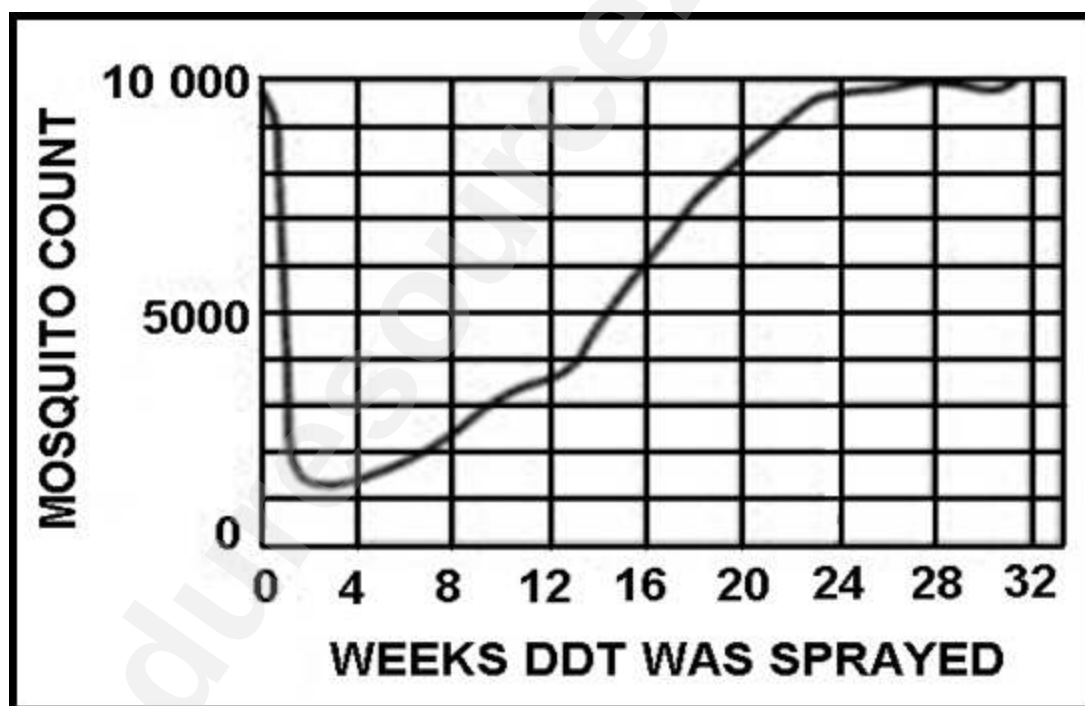
QUESTION 3

- 3.1 The diagram below shows the progression of human evolution. Study the diagram of some early hominids A, B, C, D and E which represent *Homo erectus*, *Homo sapiens*, *Australopithecus*, *Homo habilis* and *Homo neanderthalensis*, not stated in any particular order.



- 3.1.1 Identify each of the above hominid members (A–E) correctly from the list given above. (5)
- 3.1.2 Mention any FIVE common characteristics which are shared by the members represented in the above diagram. (5)
- 3.1.3 Name the family to which the above group belongs. (1)
- 3.1.4 Supply any THREE characteristics that make the organism, labelled E different from other primates. (3)

- 3.2 There are different alternative views with regard to the study of science and evolution. The two main alternatives are the scientific and the creationist view.
- 3.2.1 Distinguish between the scientific view of inquiry and the creationist view. (4)
- 3.2.2 State TWO ways in which the reliability of results which are obtained during scientific inquiry can be improved? (2)
- 3.2.3 Explain why the results of a scientific research are published in a scientific journal. (2)
- 3.2.4 Scientists base their theories of evolution on facts. Name any THREE other fields of study which provide evidence to support the theory of evolution. (3)
- 3.3 An investigation was conducted over a period of 32 weeks to test a hypothesis regarding the resistance of mosquitoes against DDT spraying. The hypothesis was rejected on the basis of the results obtained. The results of the investigation are given below. Study the graph below and answer the questions.



- 3.3.1 What was the hypothesis? (2)
- 3.3.2 What was the reason for the rejection of the hypothesis? (1)
- 3.3.3 What conclusion can be drawn from the graph with regard to the ability of mosquitoes to resist the effect of DDT? (2)

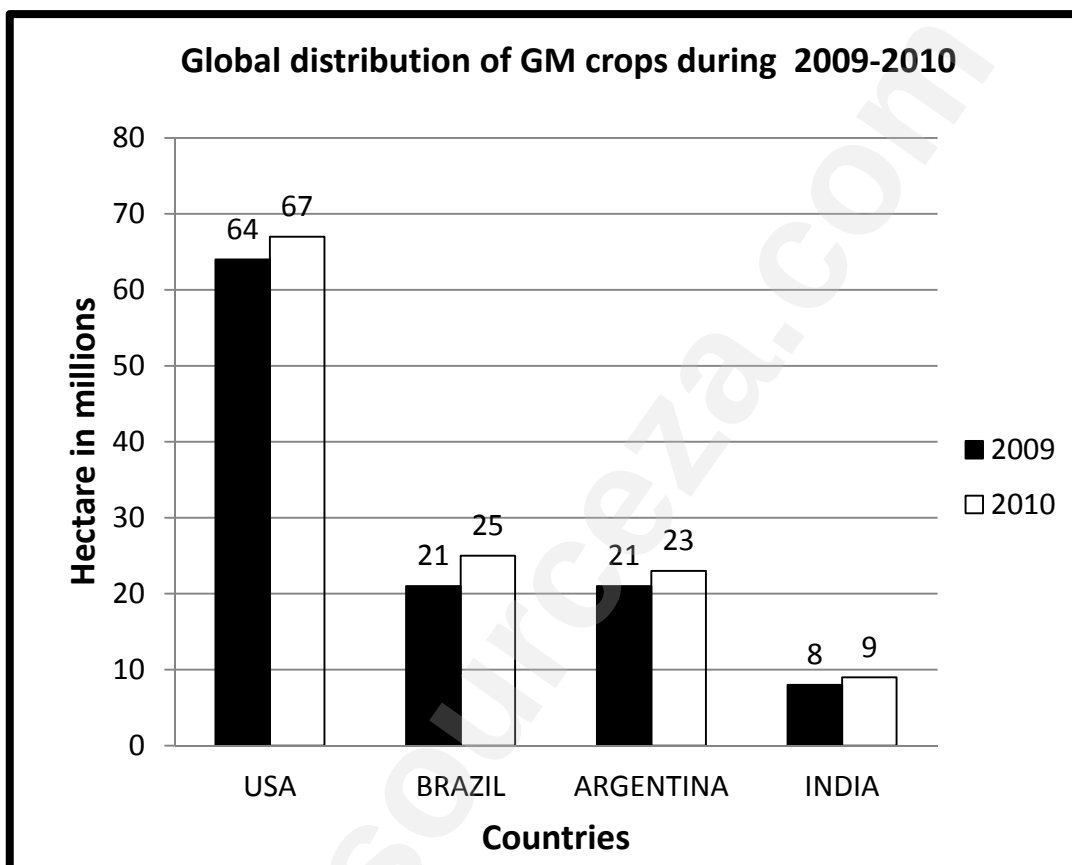
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TOTAL SECTION B: 60

SECTION C

QUESTION 4

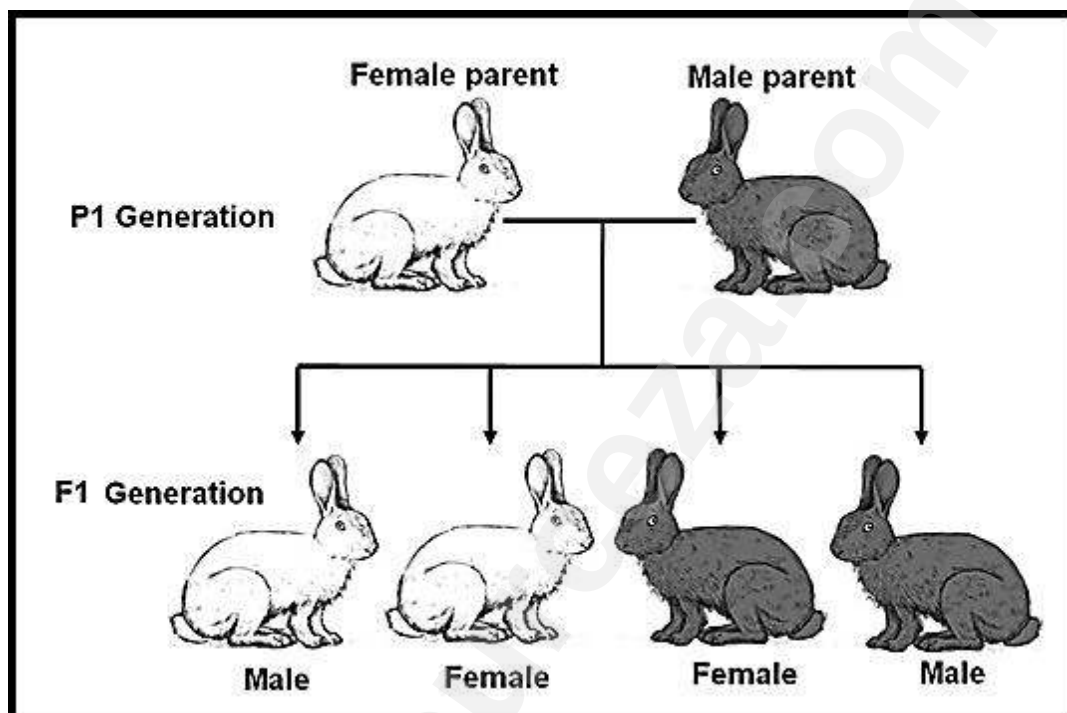
- 4.1 The graph below represents the global distribution of genetically modified crops during 2009–2010. Study the graph and answer the following questions.



- 4.1.1 Which is the leading country that is actively engaged in the production of genetically modified foods? (1)
- 4.1.2 What is the general trend observed in the production of genetically modified crops in those countries mentioned above? (1)
- 4.1.3 What is the percentage increase in land utilisation for the purpose of planting genetically modified crops in Brazil? Show all calculations. (3)
- 4.1.4 Recent studies show that herbicide use has increased with genetically modified (herbicide tolerant) crops, disproving claims by biotech proponents that genetically modified crops reduce herbicide use. Mention any ONE disadvantage with regard to the use of herbicide resistant genetically modified crops. (1)

- 4.1.5 Draw a pie chart illustrating the land utilisation with regard to genetically modified crops in the countries mentioned above during 2010. Show all calculations. (8)

- 4.2 The diagram below shows a genetic cross between rabbits. The white fur colour is dominant over the dark grey fur colour. Study the diagram and answer the following questions. Use the symbols **W** (dominant) and **w** (recessive) for the alleles of fur colour.



- 4.2.1 Represent a genetic cross to determine the possible genotypes and phenotypes of a cross between a white male rabbit in the (F1) generation and the white female parent with a genotype which is the same as that of the white female represented in the (P1) generation. (6)
- 4.3 Write a short essay explaining what the “out of Africa” hypothesis is and supply genetic evidence and fossil evidence to support the hypothesis.

Content: (17)
Synthesis: (3)

NOTE: No marks will be awarded for answers in the form of flow charts or diagrams.

TOTAL SECTION C: 40
GRAND TOTAL: 150