

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

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ANSWER BOOKLET

There are (xi) pages in this Answer Booklet. Please write your examination number in the blocks above.

QUESTION 1

1.1 Select the term in Column B that best matches a description in Column A. Write the letter of the term in the corresponding space provided between the brackets. Each letter may be used only once.

COLUMN A

COLUMN B

- [] Characterised by a high birth rate and a high death rate.
- [] Number of organisms per cubic metre.
- [] An ecological relationship where one organism hunts and kills another organism for food.
- [] Growth curve characterised by rapid increases in number usually followed by extinction phase.
- [] The maximum number of individuals an environment can sustain.
- [] Flora and fauna in an ecosystem.
- [] Development of new vegetation after a fire.
- [] Organisms sharing an ecosystem in such a way that they reduce competition.
- [] A method of population estimation.
- [] A population parameter that has no effect in a closed population.

- A Predation
- B Primary succession
- C Carrying capacity
- D Resource partitioning
- E Less-developed country
- F Population density
- G Emigration
- H Geometric
- I Community
- J More-developed country
- K Quadrat
- L Secondary succession

1.2 Six multiple-choice questions are given below. Choose the most correct option for each question and write the letter of your choice in the space provided in the table below.

Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6
Answer						

1.2.1 Which row correctly identifies features of DNA and RNA molecules?
(x = false; ✓ = true)

	DNA & RNA contain sugar, phosphate and nitrogenous bases	DNA & RNA both contain hydrogen bonds between bases	RNA is the only nucleic acid involved in protein synthesis
A	x	✓	✓
B	✓	x	x
C	✓	x	✓
D	x	x	✓

(2)

1.2.2 The following events occur during DNA replication:

1. Adjacent nucleotides join by linking sugar-phosphate backbones.
2. DNA uncoils.
3. New nucleotides join onto exposed nitrogenous bases.
4. Weak hydrogen bonds between nitrogenous bases break.

Which of the options A–D below indicate the correct order of this process?

- A 3 ; 1 ; 4 ; 2
- B 1 ; 2 ; 3 ; 4
- C 2 ; 1 ; 4 ; 3
- D 2 ; 4 ; 3 ; 1

(2)

1.2.3 The following feature makes mitochondrial DNA suitable for studying ancestry:

- A It remains unaltered from generation to generation.
- B It is only passed down through the paternal lineage.
- C It mutates easily.
- D It is found in all living organisms.

(1)

1.2.4 The following sequence of events in protein synthesis is correct:

- A Translation → Transcription → Peptide bond formation
 - B Peptide bond formation → Translation → Transcription
 - C Transcription → Translation → Peptide bond formation
 - D Transcription → Peptide bond formation → Translation
- (1)

1.2.5 The role of Polymerase Chain Reaction (PCR) is to:

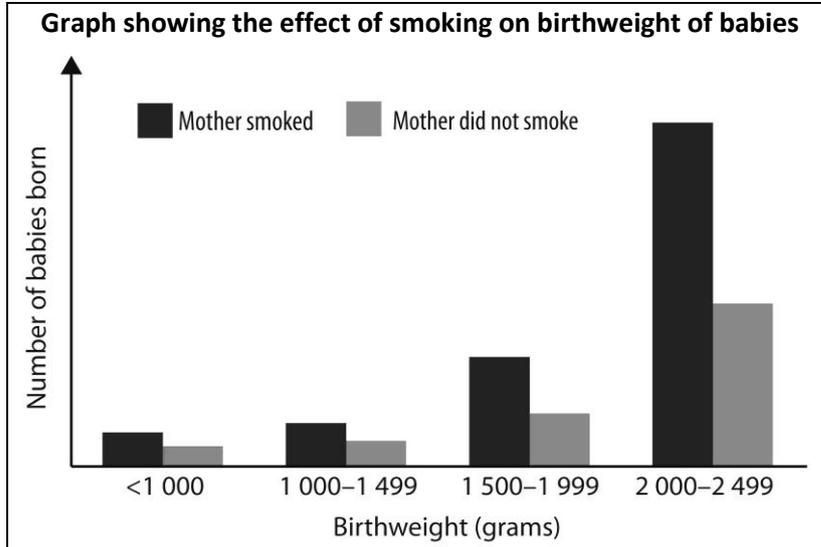
- A make large quantities of DNA in short time periods.
 - B separate the bands in "DNA Fingerprinting".
 - C cut out relevant sections of DNA.
 - D modify crops to increase yields.
- (1)

1.2.6 If a leaf cell of a plant contains 28 chromosomes, what is the diploid and haploid number for this species?

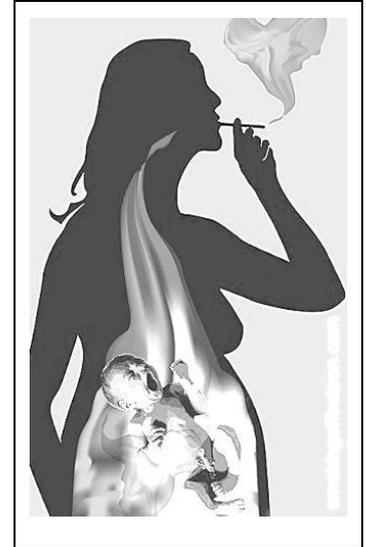
	Diploid	Haploid
A	14	28
B	28	14
C	28	56
D	56	28

(1)

1.3 A study was done to determine whether there is a link between cigarette smoking by a pregnant woman and the birthweight of her child. Lower than 2,5 kg is considered low birthweight. The graph below shows low birthweight children in relation to whether or not their mothers smoked during pregnancy.



[Adapted from: <http://www.aihw.gov.au/>]



[Source: <https://za.pinterest.com/>]

The five statements in the table below refer to the graph above. For each statement decide whether:

- A** the statement is supported by the information in the graph.
- B** the statement is contradicted by the information in the graph.
- C** the statement is neither supported nor contradicted by the information in the graph.

	Statement	A, B or C
1.3.1	Alcohol is also responsible for low birthweight in newborn babies.	
1.3.2	Smoking during pregnancy increases the chance of low birthweight babies.	
1.3.3	All low birthweight babies have mothers who smoke.	
1.3.4	There are more babies born whose birthweight is 2 000–2 499 g than babies whose birthweight is 1 000–1 499 g.	
1.3.5	Smoking during pregnancy can cause brain damage to the child.	

(5)

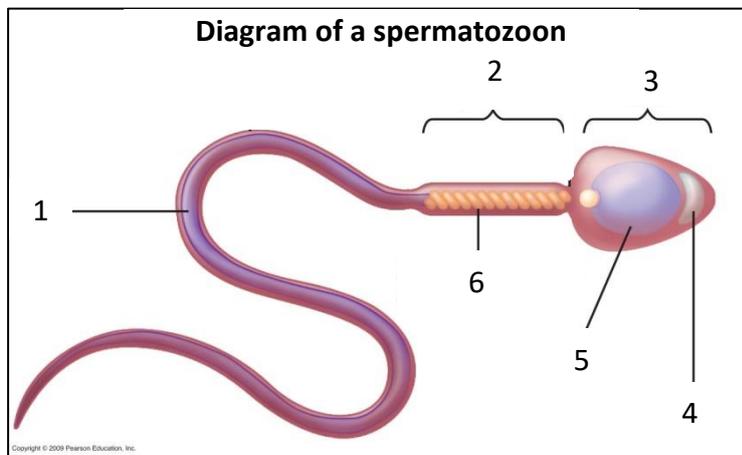
1.4 Read the text below and answer the questions that follow:

Sperm motility is one of the factors contributing to successful fertilisation.

- When sperm is directly exposed to caffeine in a laboratory, sperm motility is increased. Doses of 3 mM/ml and 6 mM/ml of caffeine increased sperm motility as seen in laboratory experiments in a petri dish.
- Smoking marijuana not only reduces the number of sperm and sperm volume produced by a man, it also causes sperm to speed up temporarily and then "burn-out". This premature "burn-out" may mean a sperm is not active enough to fertilise an ovum (egg) when it reaches it.

[Adapted from: <www.newscientist.com & www.sciencedirect.com>]

1.4.1 Provide labels for structures 1–6 in the diagram below:



[Adapted from <http://keywordsuggest.org/>]

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

(6)

1.4.2 Give the numbers of the two structures responsible for the motility of the spermatozoon.

(2)

1.4.3 Why do you think sperm motility would contribute to successful fertilisation?

(2)

1.4.4 The scientist performing the caffeine experiment referred to in the text above would have had to set up a control for his experiment.

(a) What would have been in the petri dish with the sperm in the control?

(1)

(b) Why is a control necessary in this experiment?

(2)

1.4.5 List the variables referred to below in respect of the caffeine experiment:

(a) Independent variable: _____

(2)

(b) Dependent variable: _____

(2)

(c) TWO fixed variables: _____

(2)

1.4.6 One of the effects of smoking marijuana (dagga) is that sperm "burn out" prematurely. This implies that a sperm is not active enough to fertilise an ovum when it reaches it.

Explain why energy is needed at the point of fertilisation.

(2)

- 1.5 1.5.1 Study the following table which consists of two items (numbered 1 and 2) in the first column and a term in the second column. **Decide which item(s) relate to the term.**

Write down your choice in the space provided in the "answer" column, making use of the following codes:

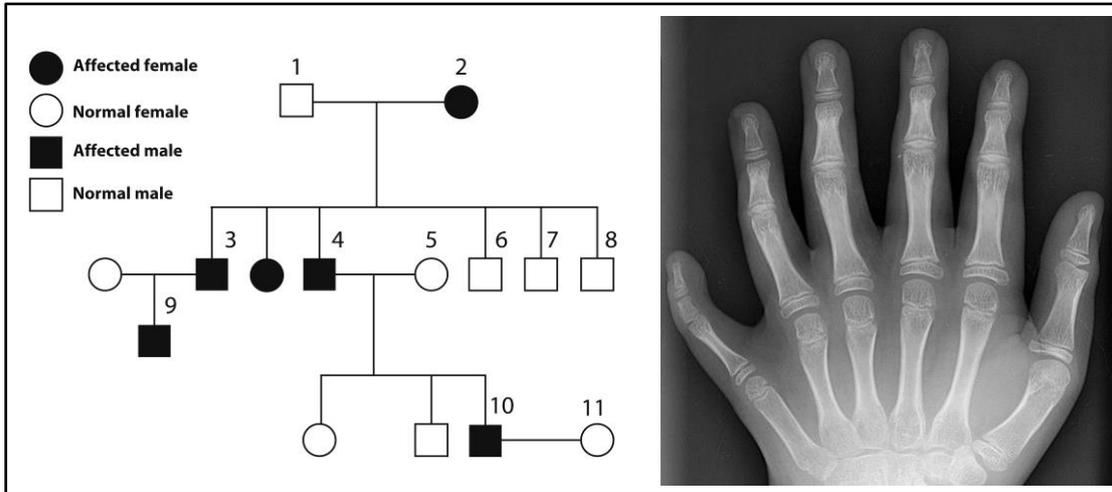
- A** only item 1 relates to the term
- B** only item 2 relates to the term
- C** both item 1 and 2 relate to the term
- D** neither item 1 or 2 relates to the term

Item	Term	Answer
1. TT 2. Tt	Heterozygous	
1. Different forms of the same gene 2. Identical forms of a gene	Alleles	
1. Non-coding DNA of an organism 2. Photograph of all the chromosomes	Genome	
1. Homologous chromosomes are different in size 2. Homologous chromosomes are the same size	Autosome	
1. Only expressed in phenotype if in homozygous form 2. Suppressed by a dominant gene	Recessive	

(5)

1.5.2 Polydactyly is a medical term used to describe extra fingers on the hands and toes on the feet. It is caused by an **autosomal dominant** gene mutation.

Study the family pedigree below and answer the questions that follow:



[Source: <<http://www.brighthub.com/>>]

(a) Provide a key to express the alleles for normal condition and Polydactyly.

_____ (1)

(b) What is the genotype of the following individuals?

Individual	Genotype
1	
2	
4	

(3)

(c) What is the gender and phenotype of the following individuals?

Individual	Gender	Phenotype
3		
5		

(4)

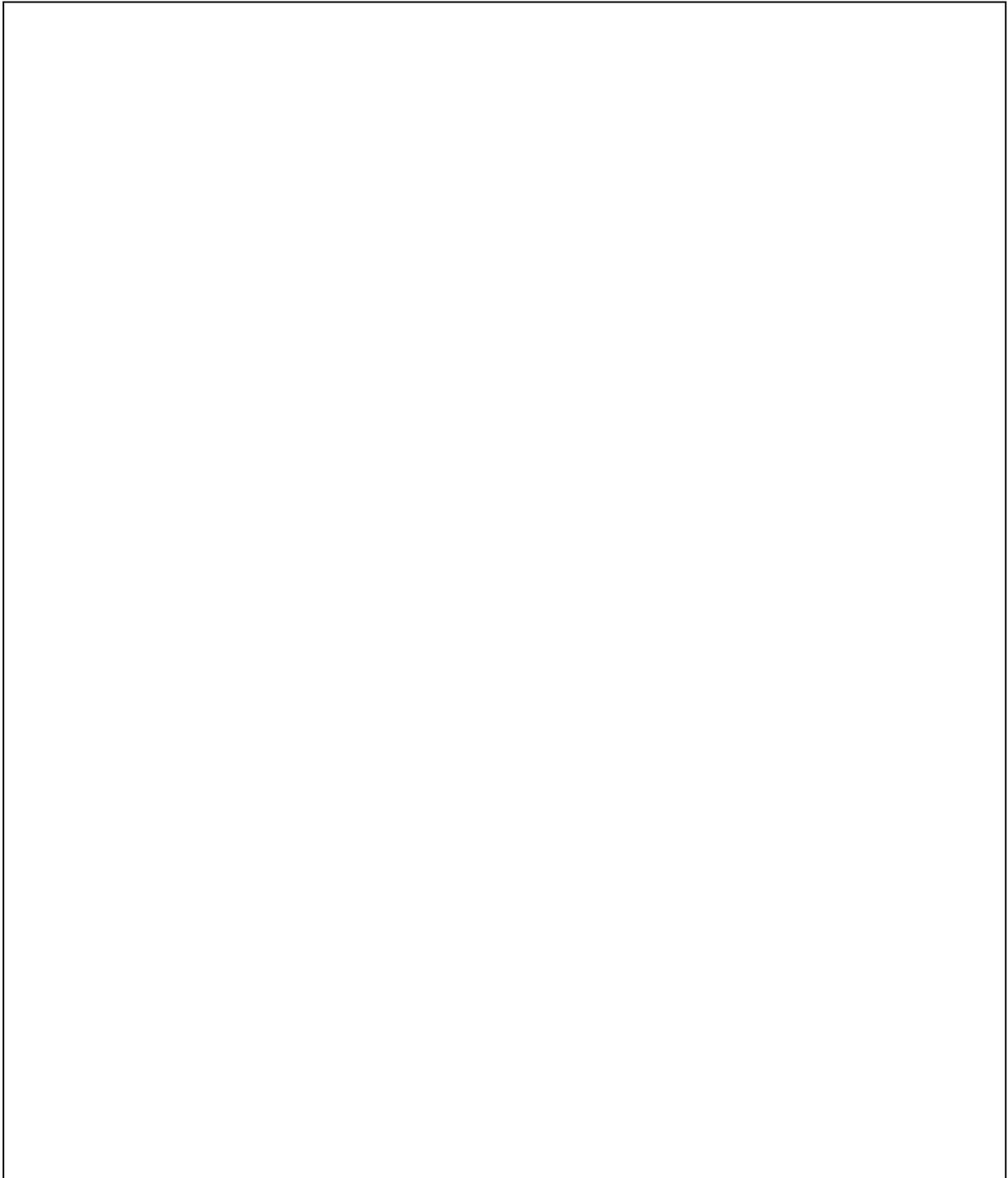
(d) Explain what is meant by the term "Autosomal dominant gene mutation".

(2)

- (e) In the space below, draw a genetic diagram to show the probability that individuals 10 and 11 will have a child with Polydactyly. Use the key chosen in Question 1.5.2 (a).

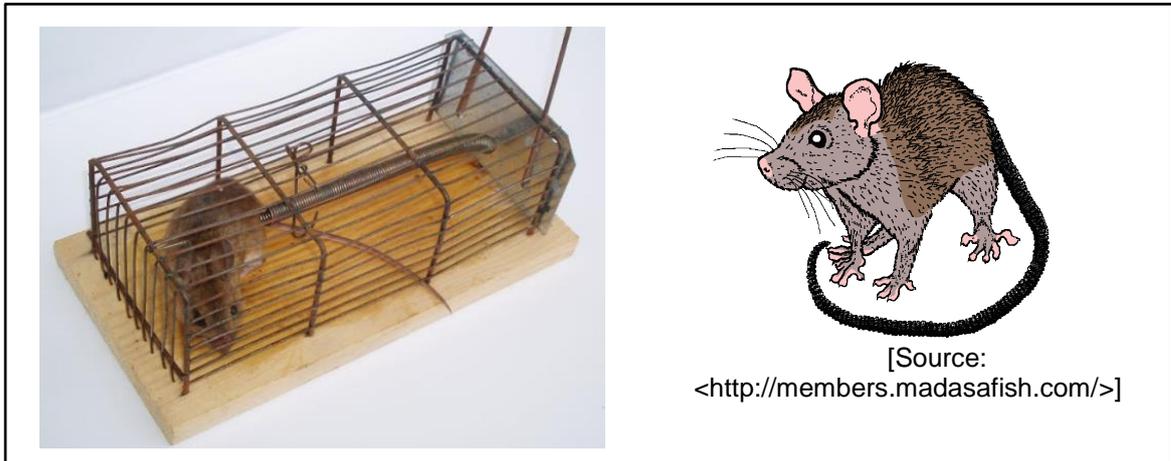
Include the following in your answer:

- parental genotypes,
- a genetic cross or Punnet diagram,
- the ratio of the possible genotypes and phenotypes of the offspring.



(7)

1.6 The owner of a factory discovers rat faeces and chewed electric wires in his factory. He suspects that there is a rat problem and so he calls in the pest control technician to determine the extent of the problem. In order to do this, the technician sets a number of traps (which do not harm the rats) in the factory and leaves them for three nights. When he returns, he finds 23 rats in his traps. He applies ear tags to these rats which he then releases. A week later he sets the traps again and this time he traps 29 rats, 11 of which have ear tags.



[Source: <http://bestpestcontrolexterminators.blogspot.co.za/>]

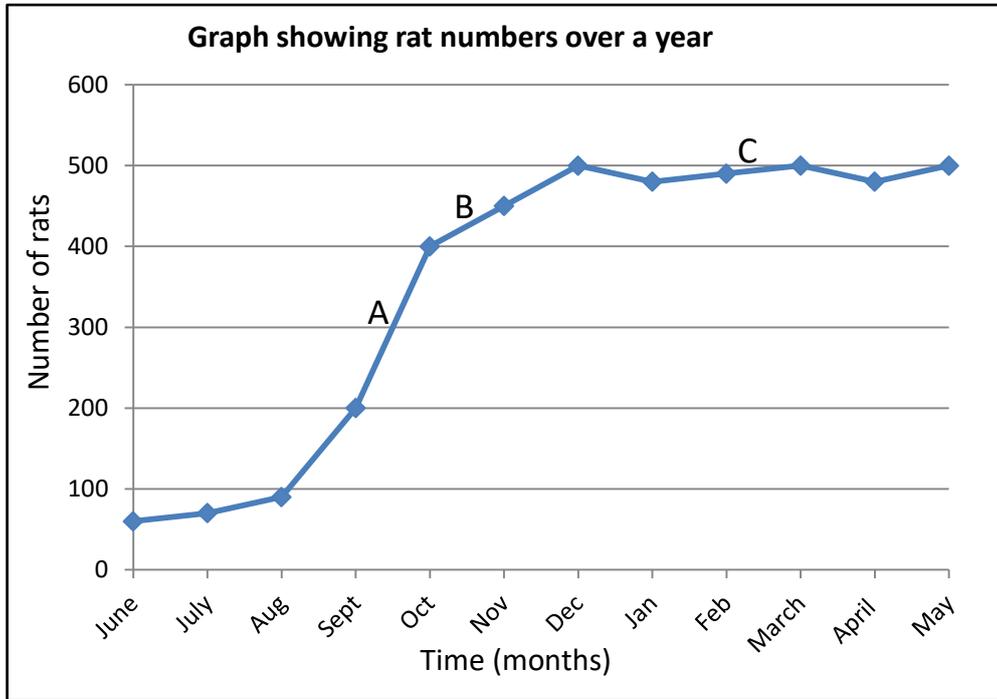
1.6.1 What is the estimate of the total population of rats in the factory? (Show all working).

(4)

1.6.2 List THREE precautions that the technician needed to take when applying the tags.

(3)

1.6.3 After the population estimation, the technician decided to set traps every night for 2 weeks to get rid of the rats, but he did not want to hurt the rats so he found a forest outside of town where he released the rats. Over the next few months he kept track of the rat numbers in the forest to see how the population was doing. He plotted his results on a graph (shown below).



(a) Describe and explain the rate of population growth at A and B.

(4)

(b) List THREE density-dependent factors that controlled the rat population at C.

(3)
[80]