

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

ANSWER BOOKLET

QUESTION 1

- 1.1 Select the term in Column B which best matches the description in Column A. Write the letter of the matching term in the appropriate space provided between the brackets. Each letter may only be used once.

Column A	Column B
[] An entire set of genetic instructions required to create an organism.	A F ₁ generation
[] The X and Y chromosomes of a human.	B Red-green colour blindness/Haemophilia
[] The Austrian monk whose pea breeding experiments provided the foundation for modern genetics.	C Genome
[] The offspring of a first experimental genetic cross.	D Mendel
[] Continuous variation such as the range of skin colour in humans.	E Heterozygous
[] The process by which an identical copy is made of an existing chromosome.	F Darwin
[] A plant with a gene for smooth seeds and a gene for wrinkled seeds.	G Trisomy/Down Syndrome
[] Having identical alleles of a gene.	H Gonosomes/sex chromosomes
[] A sex-linked disorder.	I Polygenes
	J Homozygous
	K DNA replication

(9)

1.2 Seven multiple choice questions are given below. Choose the most correct alternative in each question and write only the letter of the most correct answer in the space provided in the table.

Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6	1.2.7
Answer							

1.2.1 The best scientific description of a 'gene' is:

- A a length of DNA that codes for a polypeptide or protein
 - B a section of one chromatid
 - C the alternate form of a single characteristic
 - D a piece of DNA made up of three single nucleotides
- (1)

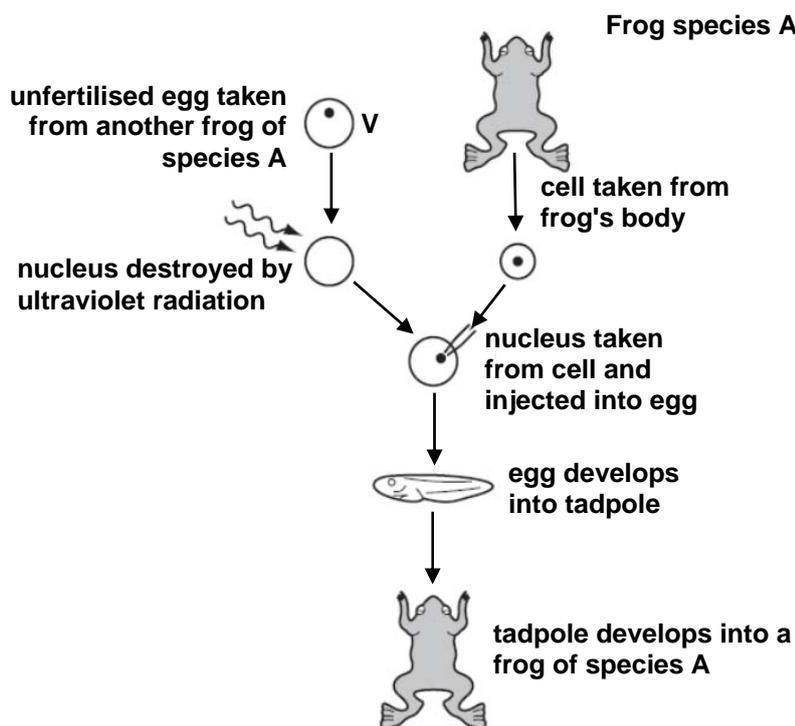
1.2.2 How are bacterial plasmids used in genetic engineering?

- A to act as viral vectors in gene therapy
 - B to control protein synthesis in bacteria
 - C to allow for asexual reproduction in bacteria
 - D to carry a foreign gene required for a specific protein
- (1)

1.2.3 PCR (polymerase chain reaction) is useful to scientists as it:

- A cuts genes from DNA to create a DNA fingerprint
 - B creates more DNA from a small sample
 - C lines up the different lengths of DNA in gel
 - D copies DNA to make RNA
- (1)

Questions 1.2.4 and 1.2.5 refer to the diagram below showing how genetically identical frogs can be made from unfertilised frog eggs.



1.2.4 If the diploid number (2n) for the frog is 26, what is the chromosome number of the cell at V?

- A 26
- B 52
- C 13
- D 2

(1)

1.2.5 The technological process in the diagram is known as:

- A therapeutic cloning
- B asexual reproduction
- C evolution
- D somatic cell nuclear transfer/SCNT

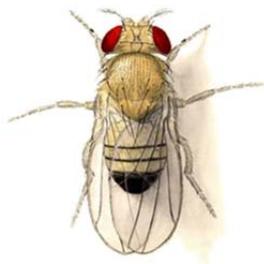
(1)

1.2.6 Which option best represents the chromosome number and the characteristics associated with polyploidy in fruit?

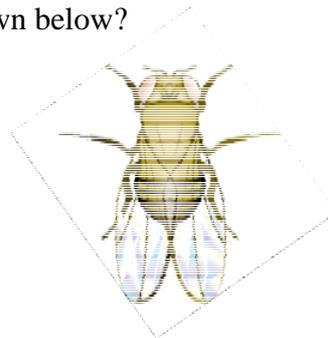
Option	Sets of chromosomes in cells	Characteristics of fruit
A	Haploid	Larger fruit; less flavour
B	More than diploid	Smaller fruit; decreased yield
C	More than diploid	Larger fruit; increased yield
D	Diploid	Smaller fruit; increased nutritional value

(2)

1.2.7 White eye colour in *Drosophila* fruit flies is caused by a recessive sex-linked allele. The dominant allele is for red-eyed flies. What is the most likely phenotype from the cross shown below?



Red-eyed male
($X^R Y$)



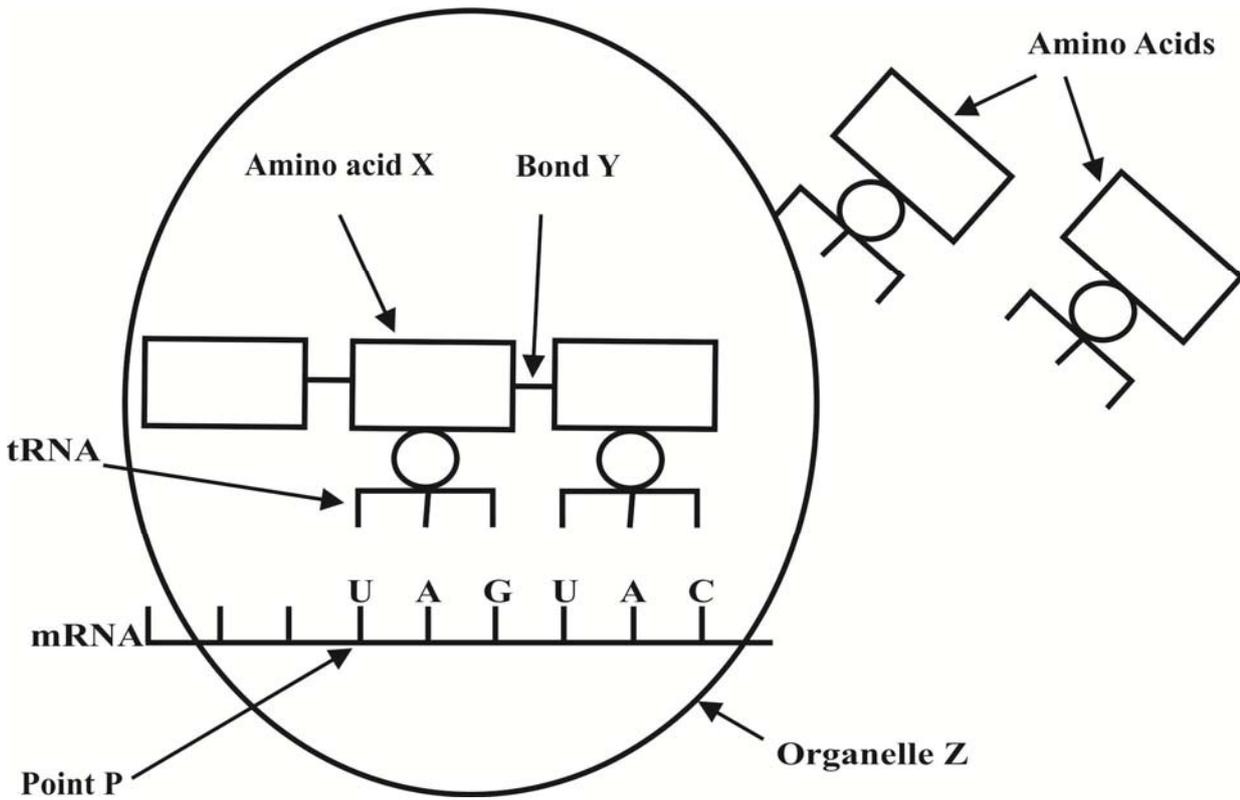
White-eyed female
($X^r X^r$)

[Adapted: <www.exploratorium.edu>]

- A 50% white-eyed and 50% red-eyed flies
- B 100% red-eyed flies
- C 75% red-eyed and 25% white-eyed flies
- D 100% white-eyed flies

(2)

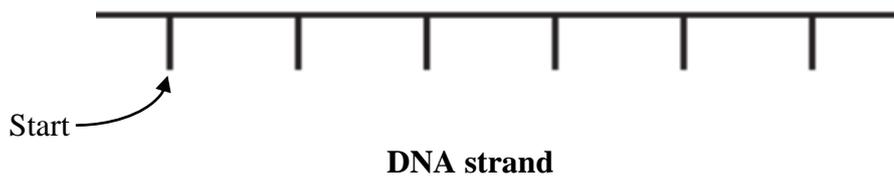
1.3 The diagram below shows a stage in the synthesis of a protein.



1.3.1 Name the stage of protein synthesis shown in the diagram above.

(1)

1.3.2 The diagram below represents the section of DNA from which the mRNA has been copied. Add the appropriate letters of the matching **six** nucleotide bases to the DNA strand below. Start at point P on the left hand side of mRNA.



(2)

1.3.3 State the anticodon on the tRNA molecule carrying amino acid X:

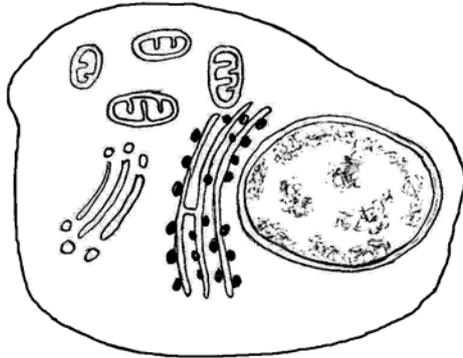
(1)

1.3.4 Name the bond at Y: _____

(1)

1.3.5 Organelle **Z** in the diagram on the previous page is shown in the diagram of a cell drawn below.

- Identify, name and label organelle **Z** on the diagram below.
- Identify, name and label the chromatin network on the diagram below.



(2)

1.3.6 The table below shows the tRNA anticodons for four amino acids. Use the information to determine which **TWO amino acids** are coded for by the mRNA shown below.

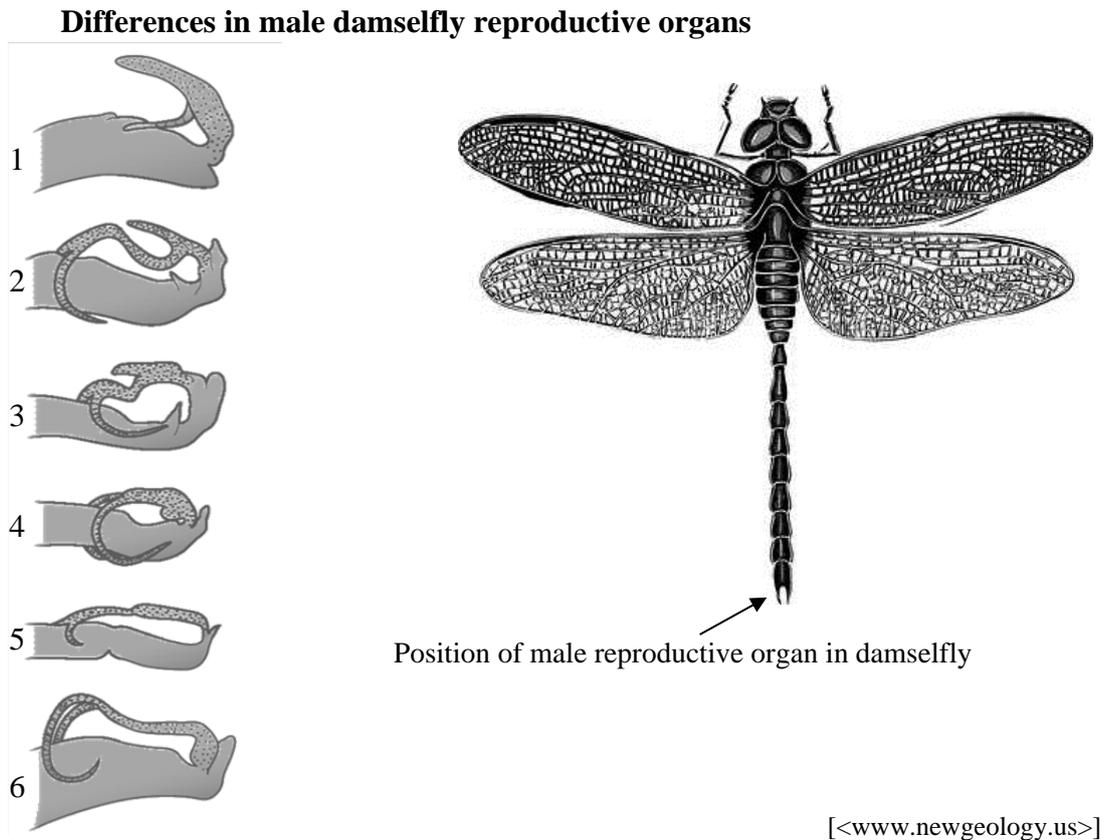
Amino Acid	Anticodon (tRNA)
asparagine	UUA
glutamic acid	CUU
proline	GGA
threonine	UGG

G }
A } Amino acid 1: _____
A }
C }
C } Amino acid 2: _____
U }

mRNA

(2)

1.4 The diagrams below show the male reproductive organs of six different damselfly species, 1 to 6.



1.4.1 How do the structures in the diagrams above show that reproductive isolation takes place in damselflies?

_____ (1)

1.4.2 Explain how this isolating mechanism you mentioned in Question 1.4.1 would ensure that the six species of damselflies remained separate in a particular ecosystem.

_____ (2)

1.4.3 Explain why this is an example of sympatric speciation.

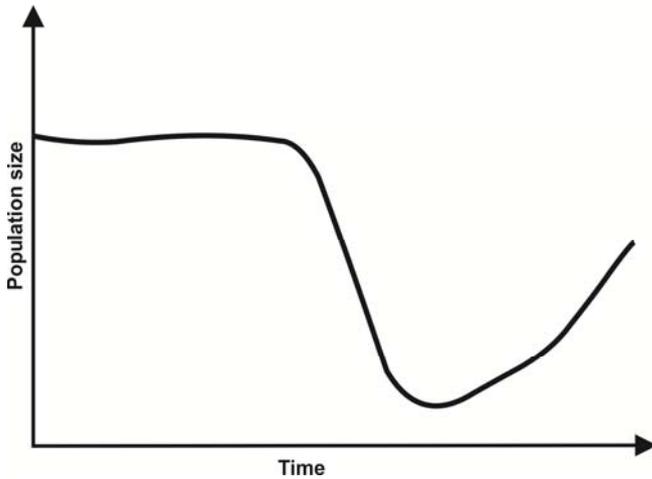
_____ (2)

1.5

A genetic bottleneck occurs when the genotypic variation of a population decreases so that the offspring are very similar and survival rates decrease.

The South African cheetah population has undergone a population bottleneck possibly caused by hunting pressures, human development and environmental pressures.

The graph below illustrates the changes in the size of the cheetah population over time



1.5.1 Place an **X** on the graph line/curve where you would expect the bottleneck event to have occurred. (1)

1.5.2 State whether the following statements regarding the cheetah bottleneck are likely to be True or False and place a ✓ in the correct box.

- (a) A bottleneck may be described as a catastrophic event or series of events which greatly reduces the numbers of a species. True False (1)
- (b) There is a large variety of genotypes displayed by the individuals of the population. True False (1)
- (c) The graph indicates that the cheetah recovered from a near extinction. True False (1)
- (d) Some of the problems resulting from a bottleneck could be abnormal sperm production and increased susceptibility to disease. True False (1)

1.5.3 Describe how South Africans can assist in the recovery of the cheetah population.

(3)
[40]