

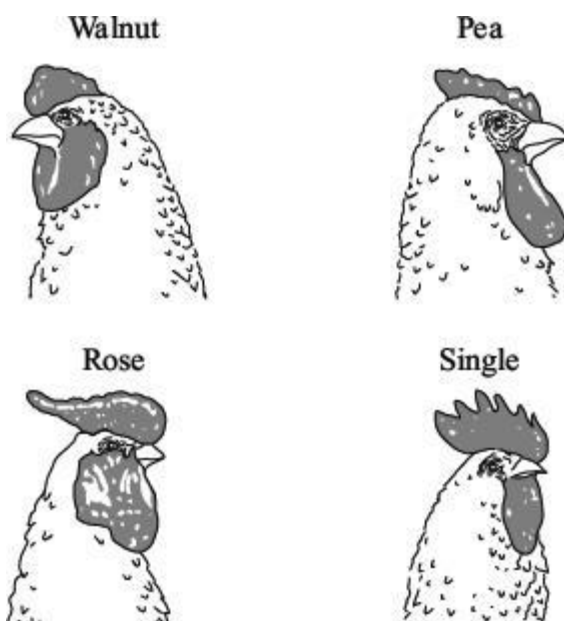
Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Q1.

Chickens have a structure on their heads called a comb. The diagram shows four types of comb: walnut, pea, rose and single.



Two genes control the type of comb; each gene has a dominant and a recessive allele. The two genes are inherited independently, but interact to produce the four types of comb.

Genotype	Phenotype
A- B-	Walnut
A- bb	Pea
aa B-	Rose
aa bb	Single

The symbol - indicates that either the dominant allele or recessive allele could be present

- (a) A male with a pea comb, heterozygous for gene A, was crossed with a rose-combed female, heterozygous for gene B. Complete the genetic diagram to show the offspring expected from this cross.

Phenotypes of parents

Pea comb

Rose comb

Genotypes of parents

Gametes formed

Offspring genotypes _____

Ratio of offspring phenotypes _____

(3)

- (b) Chickens with rose or single combs made up 36% of one population. Assuming the conditions of the Hardy-Weinberg equilibrium apply, calculate the frequency of allele **a** in this population. Show how you arrived at your answer.

Frequency of allele **a** = _____

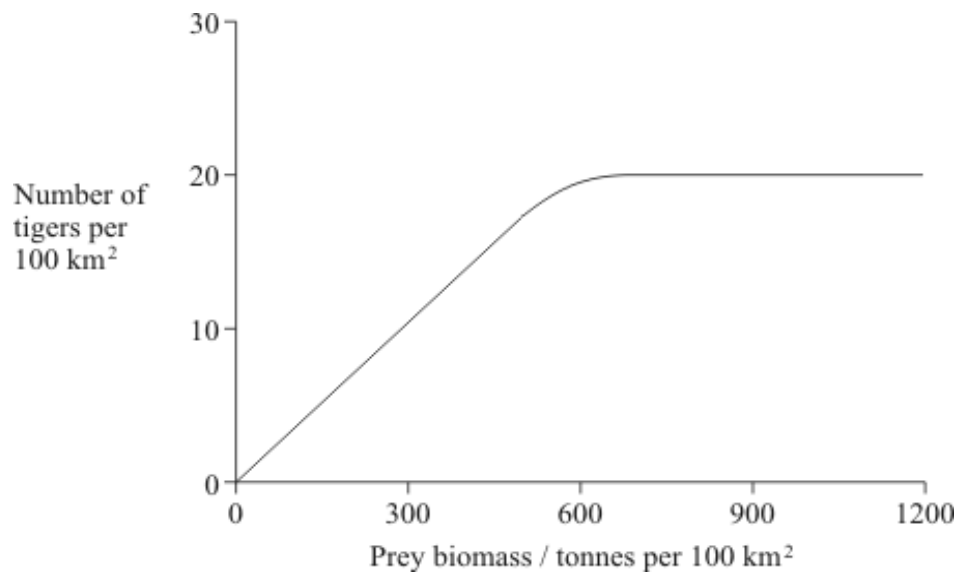
(2)

(Total 5 marks)

Q2.

Tigers inhabit forests where they feed mainly on large prey animals. Over the past fifty years, there has been extensive deforestation in many areas where tigers are found.

The graph shows the relationship between the prey biomass of an area and the tiger population that the area can support.



- (i) What is meant by the ecological term *population*?

(1)

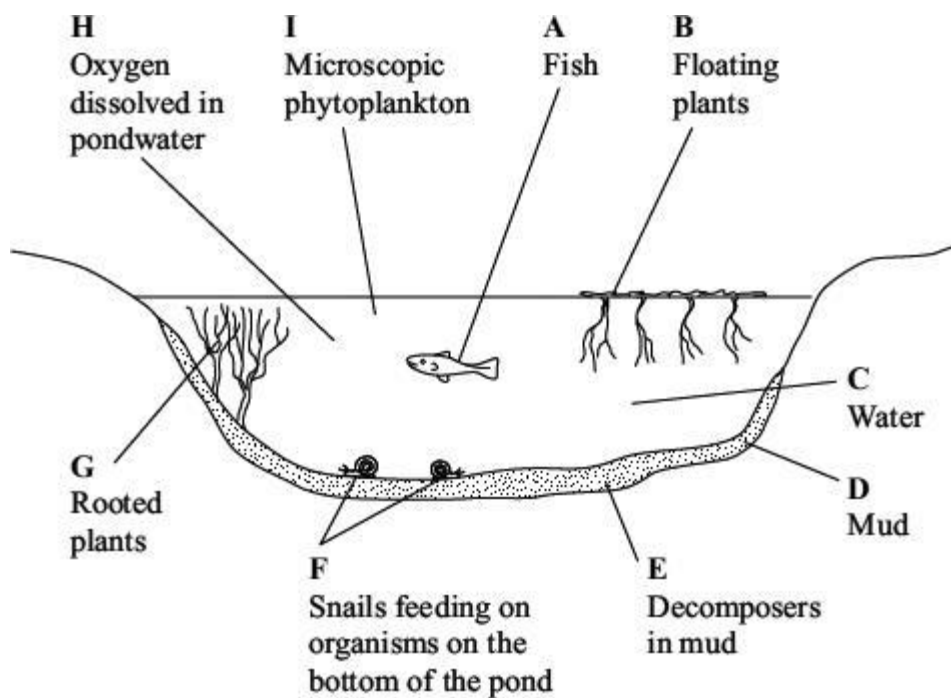
- (ii) Use the graph to explain how deforestation might cause a reduction in the number of tigers in an area.

(3)

(Total 4 marks)

Q3.

The diagram shows some of the components of a pond ecosystem.



- (a) (i) What is an ecosystem?

(1)

- (ii) List the letters that represent those components that are part of the pond community.

(1)

- (b) New Zealand pygmy weed has been introduced into many garden ponds and has spread to some natural ponds. Here, it competes with naturally occurring plants. Suggest how the introduction of pygmy weed may lead to a reduction in the diversity of the community in a natural pond.

(3)

(Total 5 marks)

Q4.

- (a) The guinea pig, *Cavia porcellus*, is a small mammal. Complete the table to show the classification of the guinea pig.

Kingdom	
	Chordata
	Mammalia
	Rodentia
Family	Caviidae
Genus	
Species	

(2)

- (b) In South America, there are several species of guinea pig. They are thought to have arisen by sympatric speciation. Explain how sympatric speciation may have occurred.

(3)

- (c) In guinea pigs, hair length and hair colour are controlled by two genes on different chromosomes. The hair may be either long or short and its colour either black or brown.

A male guinea pig and a female guinea pig both had short, black hair. The male was homozygous for hair length, and the female was homozygous for hair colour. Repeated crossings of these two guinea pigs resulted in offspring of four different genotypes, all of which had short, black hair.

Complete the genetic diagram to explain these results. Write in the box the symbols you will use to represent the alleles.

Allele for short hair = _____	Allele for long hair = _____
Allele for black hair = _____	Allele for brown hair = _____

Parental
phenotypes

Male
Short, black hair

Female
Short, black hair

Parental
genotypes

Gamete
genotypes

Offspring
genotypes

Offspring
phenotypes

Short, black hair

(4)

- (d) In another investigation, the same female guinea pig was twice mated with another male which had long, brown hair. Of the 14 offspring, 10 had short, black hair and 4 had long, black hair. The investigators expected equal numbers of offspring with these two phenotypes. They used a χ^2 test to determine whether the observed results fitted the expected 1:1 ratio.

Give a suitable null hypothesis for the investigation.

(1)

(Total 10 marks)