Student No. .....

JAMES RUSE AGRICULTURAL HIGH SCHOOL

HIGHER SCHOOL CERTIFICATE

ASSESSMENT TASK 2

TERM 1, 2003

THEORY

BIOLOGY

General Instructions

- Reading time – 5 minutes
- Working time – 40 minutes
- Write using black or blue pen

- Draw diagrams using pencil
- Write your Student Number on the Part A Answer Sheet and the Part B Question and Answer book

- Total marks for this paper – 30

This paper has two parts, Part A and Part B

Part A
Total marks 5
- Attempt all questions
- Allow about 8 minutes for this part

Part B
Total marks 25
- Attempt all questions
- Allow about 32 minutes for this part

PART A

Total marks 5

Attempt all questions

Each question is worth one mark.

1. The contribution of Beadle & Tatum in the 1940's to Biology can be summarized by which statement?

   A. They discovered the mechanism of sex linkage
   B. They made connections between genes and biochemical processes.
   C. They discovered the mechanism of co-dominance inheritance.
   D. They discovered the link between inheritance and the activity of chromosomes.

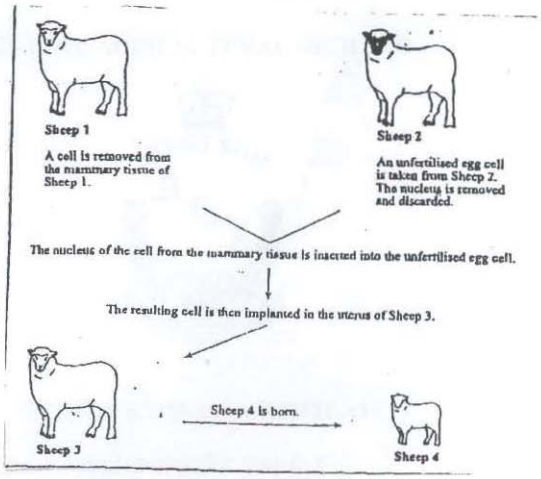
2. The fossil record of the horse is well documented and shows a transition from a small four-toed creature to a much larger hoofed creature which has diversified to fill a number of habitats. A number of intermediate fossil forms have been identified. This example would best fit which idea?

   A. convergent evolution
   B. biodiversity
   C. punctuated equilibrium in evolution
   D. gradualism as proposed by Darwin.

3. The work of Sutton and Boveri contributed to our understanding of

   A. protein synthesis
   B. genetic engineering
   C. Mendel's experiments
   D. Cloning

4. Refer to the following diagram, which shows a procedure being carried out on sheep.



Which sheep are genetically identical?

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

5. Here are some events that can take place in sex cells:

I pairing of homologous chromosomes
II crossing over of homologous chromosomes
III mutations
IV random segregation of homologous chromosomes
V cytokinesis
VI "unzipping" of DNA molecules

Which events listed above can contribute to the variability of offspring in sexually reproducing organisms?

(A) II, III and IV only
(B) II and III only
(C) I, II, III and IV only
(D) II, III, IV and VI only

Student Number .....

Part A Answer Sheet

Total marks (5)

There are 5 questions in this part. Attempt all questions.

Each question is worth one mark.

Write your Student Number at the top of this Part A Answer Sheet.

Allow about 8 minutes for this part.

*Select the alternative A, B, C or D that best answers the question and, using **ink**, place an X in the corresponding space in the table below.*

	1	2	3	4	5
(A)					
(B)					
(C)					
(D)					

Rough work area

PART B

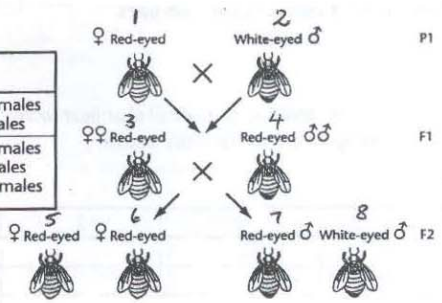
There are 5 questions in this part. Attempt all questions.
Marks vary for each question.
Answer the questions in the spaces provided in this Part B Question and Answer Book.

Question 1 (6 Marks)

Use the data below of crosses of Drosophila fruit fly showing the inheritance of eye colour.

Data

Cross	Parents	Offspring
Parent 1 (P1)	red-eyed female x white-eyed male	F1 183 red-eyed females 178 red-eyed males
Filial 1 (F1)	red-eyed female x red-eyed male (both offspring from P1 cross)	F2 204 red-eyed females 98 red-eyed males 105 white-eyed males



a) 2 Marks

Is eye colour inherited according to Mendelian ratios? Explain how eye colour is inherited.

.....

.....

.....

.....

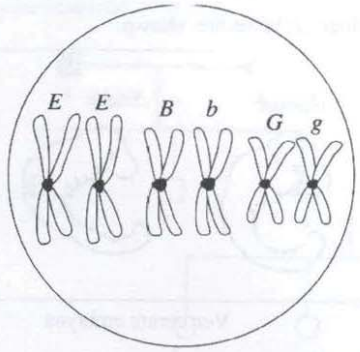
b) Record the possible genotypes of each fly in the above crosses. 2 Marks

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....
8. .....

c) Under what conditions might a white-eyed female be produced? Explain using a punnett square. 2 Marks

Question 2 (4 Marks)

The diagram shows a cell containing three pairs of chromosomes just prior to a meiotic division.



a) Draw diagrams of all possible gametes including the chromosomes and the "letters" present in that gamete. 2 Marks

b)

Using the example of this cell, distinguish between

(i) allele and gene 1 Mark

.....

.....

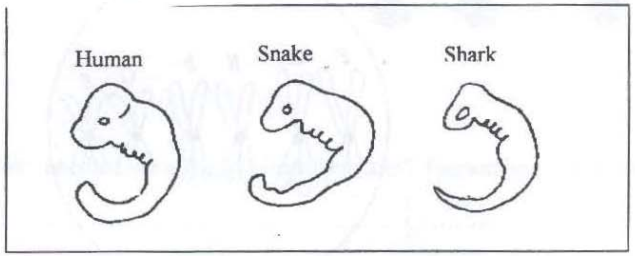
(ii) homozygous and heterozygous genotypes 1 Mark

.....

.....

Question 3. (6 Marks)

(a) Diagrams of three embryos are shown.



Vertebrate embryos

(i) Suggest a reason why the above embryos would be similar. 1 Mark

.....

(ii) Besides comparative embryology, outline two other sets of evidence that backs up the Darwin-Wallace Theory of Evolution. Choose the first piece of evidence available to 19th Century biologists and the second piece of evidence of modern scientific evidence (within the last 30 years). 2 Marks

Evidence 1 .....

.....

Evidence 2 .....

.....

(b) The concept of evolution from the beginning has created debate. Assess some of the social and political influences on the development of the various theories of evolution. 3 marks

.....

.....

.....

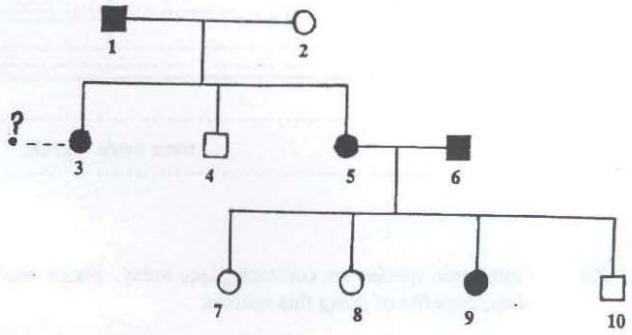
.....

.....

Question 4 (2 marks)

"Left-handedness" in humans is a recessive characteristic

Study the following human pedigree



(a) Is the left-handed phenotype in the above family tree shaded or clear? 1 mark

_____

(b) If individual 3 has children to a man with **NO** pedigree history of left-handedness, 1 mark what is the probability that any of their children will display the left-handed trait? (Show all working) 1 mark

.....

.....

.....

Question 5 (7 Marks)

(a) The following statement appears as a section heading in the new HSC Biology Syllabus:

"Current reproductive technologies and genetic engineering have the potential to alter the path of evolution" 4 Marks

Assess the validity of this statement.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Transgenic species are common place today. Name one transgenic species and outline some of the benefits of using this species. 3 Marks

.....

.....

.....

.....

End of Paper

Student Number ....STAFF....

Part A Answer Sheet

Total marks (5)

There are 5 questions in this part. Attempt all questions.

Each question is worth one mark.

Write your Student Number at the top of this Part A Answer Sheet.

Allow about 8 minutes for this part.

*Select the alternative A, B, C or D that best answers the question and, using **ink**, place an X in the corresponding space in the table below.*

	1	2	3	4	5
(A)				X	X
(B)	X				
(C)			X		
(D)		X			

Rough work area

PART B

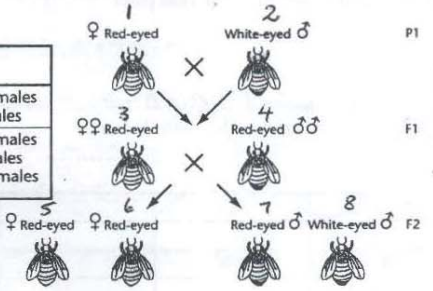
There are 5 questions in this part. Attempt all questions.
Marks vary for each question.
Answer the questions in the spaces provided in this Part B Question and Answer Book.

Question 1 (6 Marks)

Use the data below of crosses of Drosophila fruit fly showing the inheritance of eye colour.

Data

Cross	Parents	Offspring
Parent 1 (P1)	red-eyed female x white-eyed male	F1 183 red-eyed females 178 red-eyed males
Filial 1 (F1)	red-eyed female x red-eyed male (both offspring from P1 cross)	F2 204 red-eyed females 98 red-eyed males 105 white-eyed males



a) 2 Marks

Is eye colour inherited according to Mendelian ratios? Explain how eye colour is inherited.

Mendel would get similar results ie all red offspring in F_1 & 3:1 red : white in F_2. However as the characteristic is sex linked, according to data - only males white eyed ∴ This is not according to Mendelian inheritance

P: $X^R X^R \times X^r Y \rightarrow F_1$ $X^R X^r, X^R Y \rightarrow F_2$ $X^R X^R$ and $X^R X^r$ (all red ♀) : $X^r Y$ (white males) : $X^R Y$ (red males) 2 Marks

b) Record the possible genotypes of each fly in the above crosses.

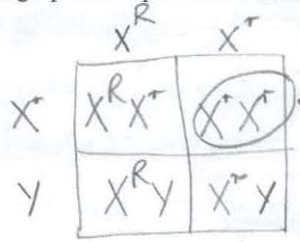
1. $X^R X^R$ ($X^R X^r$ possible, not likely)
2. $X^r Y$
3. $X^R X^r$
4. $X^R Y$
5. $X^R X^R$ or $X^R X^r$
6. $X^R X^R$ or $X^R X^r$
7. $X^R Y$
8. $X^r Y$

① if not both.

show codes! confusing

c) Under what conditions might a white-eyed female be produced? Explain using a punnett square. 2 Marks

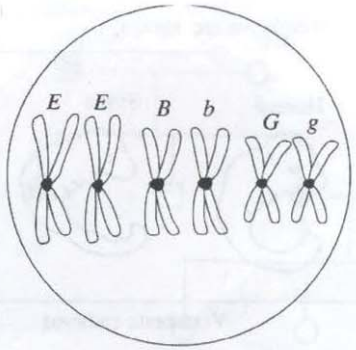
red-eyed female parent



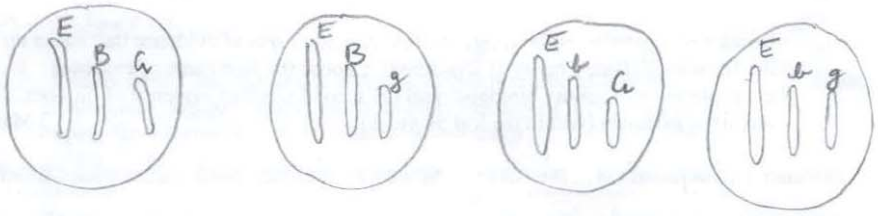
1/2

Question 2 (4 Marks)

The diagram shows a cell containing three pairs of chromosomes just prior to a meiotic division.



a) Draw diagrams of all possible gametes including the chromosomes and the "letters" present in that gamete. 2 Marks



1 mark

chromosomes must be 3 single stranded - different sizes

1 mark

4 different combinations EBG EbG EBg Ebg

b)

Using the example of this cell, distinguish between

(i) allele and gene 1 Mark

There a 3 genes labelled in the cell

(Gene - length of DNA codes for polypeptide) eg gene for eye colour - controlled by 2 alleles (cadematives of one gene) eg Bor b, G or g

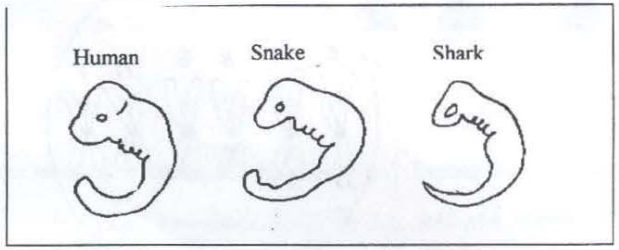
(ii) homozygous and heterozygous genotypes 1 Mark

homozygous - both alleles the same eg GG

heterozygous - both alleles different eg Bb, Gg

Question 3. (6 Marks)

(a) Diagrams of three embryos are shown.



Vertebrate embryos

(i) Suggest a reason why the above embryos would be similar. 1 Mark

shared a common ancestor

(ii) Besides comparative embryology, outline two other sets of evidence that backs up the Darwin-Wallace Theory of Evolution. Choose the first piece of evidence available to 19th Century biologists and the second piece of evidence of modern scientific evidence (within the last 30 years). 2 Marks

*Fossils Biogeography

Evidence 1 Comparative anatomy eg pentadactyl limb of many vertebrate - same basic skeletal structure for a range of uses - running, flying, swimming due to common ancestry

Evidence 2 Biochemistry - amino acid sequence in cytochrome c, haemoglobin DNA hybridisation - degree of pairing of DNA strands for different species - if a high degree of hybridisation (pairing) → diverged recently from common ancestor ie compares degree of relatedness

(b) The concept of evolution from the beginning has created debate. Assess some of the social and political influences on the development of the various theories of evolution. 3 marks

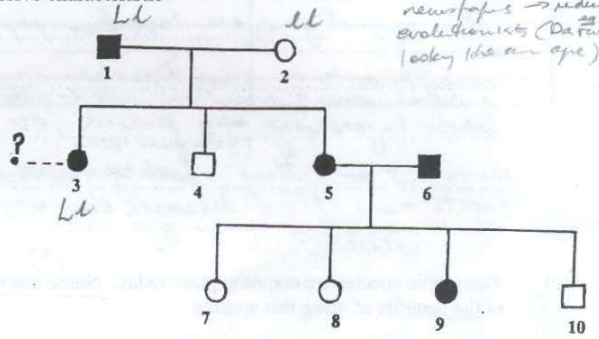
Politics was centred around beliefs of the church & theories of evolution were against the dogma of the church, there has been & still is a clash between science & religion. Political leaders such as Hitler have used the term 'unfit' not in a biological context but in a political sense.

A teacher - John Scopes was arrested for teaching evolution in the 1920's in America, there is still political forces which exert pressure on the schools to teach Creation ("created in the image of god" - contrary to origin of man from non-human animals)

Question 4 (2 marks)

"Left-handedness" in humans is a recessive characteristic

Study the following human pedigree



(a) Is the left-handed phenotype in the above family tree shaded or clear? 1 mark

clear.

(b) If individual 3 has children to a man with **NO** pedigree history of left-handedness, what is the probability that any of their children will display the left-handed trait? (Show all working) 1 mark

P: (3) Ll x LL

g: L or l L.

F: LL or Ll ∴ No chance that children will be left-handed

Question 5 (7 Marks)

(a) The following statement appears as a section heading in the new HSC Biology Syllabus:

"Current reproductive technologies and genetic engineering have the potential to alter the path of evolution" 4 Marks

Assess the validity of this statement.

Reproductive technologies like artificial insemination, artificial pollination & cloning may produce organisms that if successful may be produced at the expense of other varieties, thus decreasing genetic diversity. In a changing environment all members of species may be equally vulnerable. Evolution depends on variety. If the original genes are lost from population genes that provide resistance to a new disease may no longer exist in the population and the course of evolution will be altered. Variation makes evolution possible. Genetic engineering may produce less fit organisms for a changed environment or altering & pasting genes from one species to another may create new diseases organisms which may affect survival chances of species - be a 'celebrity gene'!

- Bt cotton - most resistant Helicoverpa caterpillar same - alters the evolution.

(b) Transgenic species are common place today. Name one transgenic species and outline some of the benefits of using this species. 3 Marks

Bt cotton - Benefits

- the Bt gene allows the cotton to produce it's own insecticide to kill insect pests - farmers spend less on pesticides.
- the environment is protected as it kills only Helicoverpa caterpillar & does not affect humans or other vertebrates & other insects
- this caterpillar devastates conventional cotton & develops resistance to chemicals.
- animals fed on cotton waste → chemical residues in meat industry.

transgenic bacteria → insulin
* increase production of human insulin
* less side effects

End of Paper