



education

DEPARTMENT: EDUCATION  
MPUMALANGA PROVINCE

# Grade 12

## Supplementary Study Material

# Life Sciences



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FOR ALL

## Together Educating the Nation

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answer to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. ALL drawings should be done in pencil and labelled in blue or black ink.
7. ONLY draw diagrams or flow charts when asked to do so.
8. The diagrams in this question paper are NOT all drawn to scale.
9. Do NOT use graph paper.
10. Non-programmable calculators, protractors and compasses may be used.
11. Write neatly and legibly.

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- 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 – 1.2.8) in the ANSWER BOOK.

- 1.2.1 The remains of the Graafian follicle after ovulation
- 1.2.2 Genes in the same position on homologous chromosomes
- 1.2.3 The transfer of ripe pollen grains from an anther to a receptive stigma
- 1.2.4 The process by which amniotic fluid is withdrawn to test for abnormalities of the foetus
- 1.2.5 The organ in human males in which meiosis occurs
- 1.2.6 The meiotic process by which female gametes are formed in humans
- 1.2.7 Type of cell division during which the chromosome number does not change
- 1.2.8 A pair of identical chromosomes found in diploid cells

(8)

- 1.3 Choose an item from COLUMN II that matches a statement in COLUMN I. Write only the letter (A – H) next to the question number (1.3.1 – 1.3.5) in the ANSWER BOOK, for example 1.3.6 J.

COLUMN I	COLUMN II
1.3.1 The tube leading from the testes to the urethra	A syphilis
1.3.2 Sexually transmitted disease	B cells of Sertoli
1.3.3 Surgical method of contraception in males	C vas deferens
1.3.4 Plays a role in the nutrition of human spermatozoa	D diploid
1.3.5 The chromosome number in human somatic cells	E malaria
	F Fallopian tube
	G mastectomy
	H vasectomy

(5)

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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 number (1.1.1 – 1.1.5) in the ANSWER BOOK, for example 1.1.6 D.

- 1.1.1 The nitrogenous base which replaces thymine in an RNA molecule is ...
- A guanine.
  - B uracil.
  - C adenine.
  - D cytosine.

- 1.1.2 Menstruation starts when the production of ...

- A oestrogen and progesterone decreases.
- B progesterone is at its maximum.
- C oestrogen is at its maximum.
- D luteinising hormone is at its maximum.

- 1.1.3 Down's syndrome occurs when ...

- A a male sex cell undergoes mitosis.
- B every cell of an organism has an extra pair of chromosomes.
- C all somatic cells have an extra chromosome.
- D a female sex cell undergoes mitosis.

- 1.1.4 In DNA, if the sequence of bases on one strand is AGG, the corresponding bases on the complementary strand are ...

- A ACC.
- B TAA.
- C CTT.
- D TCC.

- 1.1.5 After the process of fertilisation in a flower, the ...

- A petals remain permanently attached to the flower.
- B ovules and ovary wall enlarge greatly.
- C whole flower dries and drops off.
- D ovary becomes a seed.

(5 x 2) (10)

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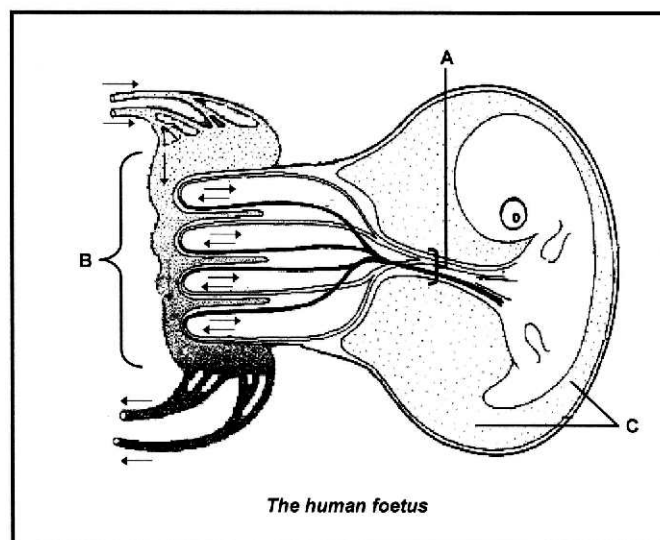
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- 1.4 Study the diagram below and answer the questions that follow.



- 1.4.1 Provide labels for A and B. (2)
- 1.4.2 Explain ONE way in which the part labelled B is structurally adapted for its function. (2)
- 1.4.3 Name TWO functions of the fluid found at C. (2)
- 1.4.4 Name the condition that might occur in the foetus if the mother consumes too much alcohol during the pregnancy. (1)
- 1.4.5 State what effect the condition named in QUESTION 1.4.4 would have on the child that is born. (1)

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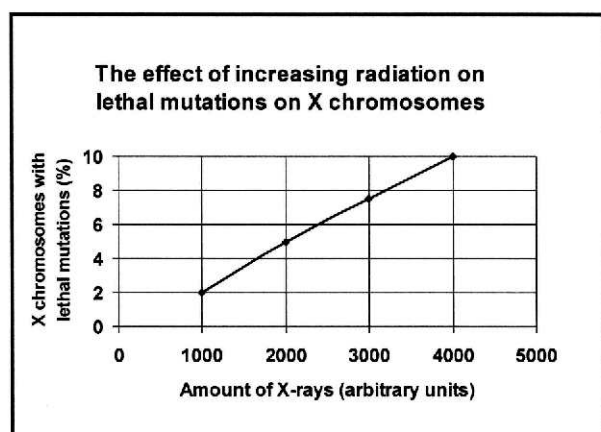
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- 1.5 An investigation to determine the effect of increasing radiation on lethal (deadly) mutations on X chromosomes in fruit flies was undertaken by scientists.

The results are shown in the graph below.



- 1.5.1 Formulate a possible hypothesis for this investigation. (2)
- 1.5.2 Name ONE factor that was varied by the scientists in this investigation. (1)
- 1.5.3 How many different values of the factor named in QUESTION 1.5.2 above were used? (1)
- 1.5.4 Name TWO factors that would have to be kept constant during this investigation. (2)
- 1.5.5 What conclusion can be drawn from the results presented in the graph? (2)
- 1.5.6 If you were carrying out this investigation, describe ONE way in which you would ensure that the results obtained are reliable. (2)

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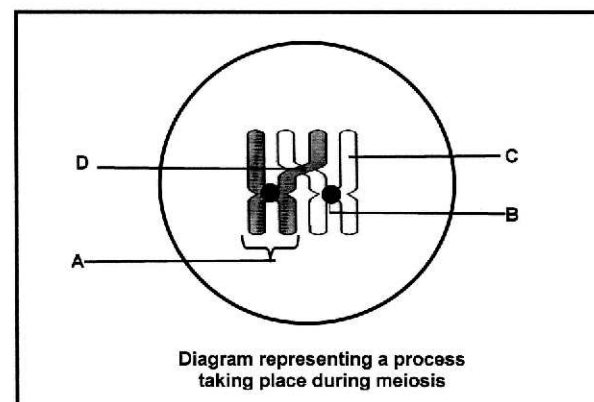
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## SECTION B

### QUESTION 2

- 2.1 The diagram below represents a process taking place during meiosis.



- 2.1.1 Provide labels for parts A, B, C and D. (4)
- 2.1.2 Name the process in meiosis that is illustrated in the diagram above. (1)
- 2.1.3 State ONE importance of the process named in QUESTION 2.1.2 (2)
- 2.1.4 During which phase of meiosis does the process named in QUESTION 2.1.2 occur? (1)
- 2.1.5 Draw a diagram of the structure labelled A to show its appearance immediately after the process named in QUESTION 2.1.2. (2)

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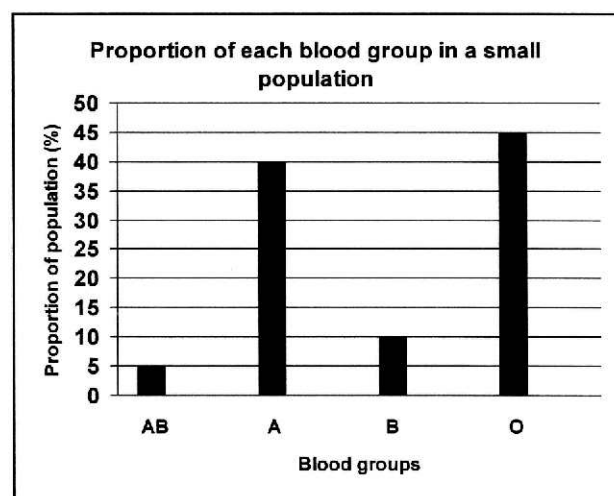
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- 1.6 The graph below shows the results of an investigation into the frequency of blood groups in a small human population.



- 1.6.1 Which blood group has the lowest frequency in the population investigated? (1)
- 1.6.2 State ONE reason why it is suitable for the results of this investigation to be represented in the above type of graph. (2)
- 1.6.3 Using the information provided, construct a table to show the data that was used to draw the graph. (6)

TOTAL SECTION A: 50

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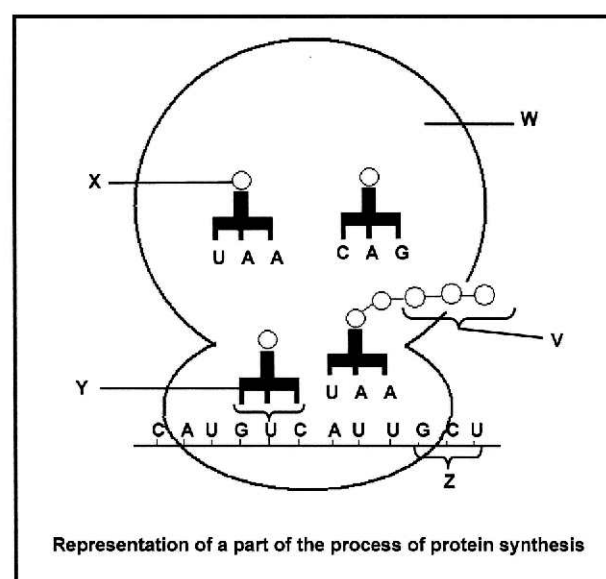
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- 2.2 The diagram below represents a part of the process of protein synthesis.



- 2.2.1 Name the part/stage of protein synthesis that is illustrated in the diagram above. (1)
- 2.2.2 Name the organelle labelled W. (1)

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- 2.2.3 The table below shows the base triplets of mRNA that correspond to the different amino acids.

mRNA	AMINO ACID
CAU	histidine
AUU	isoleucine
GUC	valine
CUU	leucine
GCU	alanine
CCU	proline
CGA	arginine

With reference to the diagram in QUESTION 2.2 and the table above:

- (a) Name the amino acid labelled X. (1)
- (b) State the base sequence of the molecule labelled Y. (1)
- (c) What collective name is given to the triplet of mRNA bases that correspond to each amino acid? (1)
- (d) How would the composition of the protein molecule change if the base sequence at Z was CGA instead of GCU? (2)
- 2.2.4 Use the information in the table to write the DNA base sequence that would correspond with the amino acid histidine. (2)

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- 2.4 A group of Grade 12 learners did a survey about the frequency of genetic disorders in a small human population. The results are shown in the table below. The number of people in the population is 1 200.

RESULTS OF THE SURVEY ON THE FREQUENCY OF GENETIC DISORDERS IN A POPULATION

GENETIC DISORDERS	FREQUENCY IN POPULATION (%)
Albinism	7
Down's syndrome	x
Sickle cell anaemia	10
Without any disorder	78

- 2.4.1 According to the table, which disorder is most common in this community? (1)
- 2.4.2 Calculate the number of people with Down's syndrome. Show ALL working. (3)
- 2.4.3 Give ONE reason why genetic counselling would be important for parents who are expecting children that may be sufferers of a disorder such as Down's syndrome. (1)
- [30]

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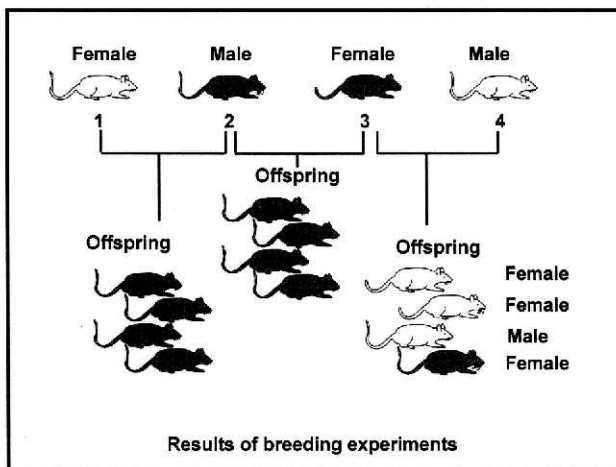
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- 2.3 Study the diagrams below that show some breeding experiments on mice. A single pair of alleles showing complete dominance controls coat colour (white or grey) in these mice.



- 2.3.1 State which sex chromosomes would be present in the gametes of parent mouse 2 and mouse 3, respectively. (2)
- 2.3.2 If mice 3 and 4 had a second set of offspring, what is the percentage chance that the first mouse born would be female? (1)
- 2.3.3 Which of the parent mice (1, 2, 3 or 4) is likely to be homozygous dominant for coat colour? (1)
- 2.3.4 State why mouse 3 can only be heterozygous for coat colour. (2)

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QUESTION 3

- 3.1 Read the passage below and answer the questions that follow.

**GENETICALLY MODIFIED PIG BRED WITH 'GOOD FAT'**

Scientists in the United States of America have produced genetically modified pigs with fat containing omega-3 fatty acids. These fatty acids, which are usually found in salmon, mackerel and fresh tuna, are thought to be responsible for a number of benefits, from combating heart disease to improving intelligence.

Researchers from the University of Pittsburgh – School of Medicine created piglets capable of converting less useful omega-6 fatty acids into omega-3 fatty acids. They implanted 1 800 embryos into 14 female pigs. Ten live offspring, which were able to make high levels of omega-3 fatty acids, were born.

[Adapted from: Cape Argus, 27 March 2006]

- 3.1.1 Name TWO health benefits of omega-3 fatty acids. (2)
- 3.1.2 What percentage success did the scientists have with the implanted embryos in forming a clone of pigs capable of producing omega-3 fatty acids? Show ALL working. (3)
- 3.1.3 To produce genetically modified pigs, the gene that produces omega-3 fatty acids is inserted into the pig embryos. Describe the steps in forming and introducing many copies of the desirable gene (using bacteria) into the pig embryos. (4)
- 3.1.4 Give TWO reasons why:
- (a) Some people may support the use of genetically modified pigs to produce omega-3 fatty acids (2)
- (b) Some people may be against the use of genetically modified pigs to produce omega-3 fatty acids (2)

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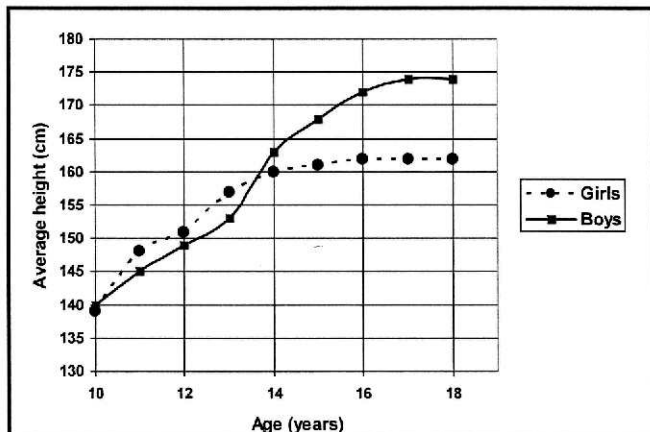
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- 3.2 A group of Grade 12 learners were asked to test the following hypothesis with regard to phenotypes:

**At each age group boys are taller than girls.**

- 3.2.1 Name any THREE steps in the planning process that must be considered in this investigation. (3)
- 3.2.2 The results of the learners' investigation are shown in the graph below.



- (a) At what age is the average height of the boys and the girls the same? (1)
- (b) Provide a caption for the graph. (2)
- (c) Should the Grade 12 learners accept the hypothesis as a possible explanation of the results? (1)
- (d) Give a reason for your answer to QUESTION 3.2.2(c) above. (2)

- 3.3 In humans, the allele for blue (b) eyes is recessive to the allele for brown (B) eyes. A man, heterozygous for brown eyes, marries a woman with blue eyes. Show how the possible genotypes, phenotypes and ratio of individuals with brown and blue eyes in the F<sub>2</sub>-generation, may be obtained. (8)

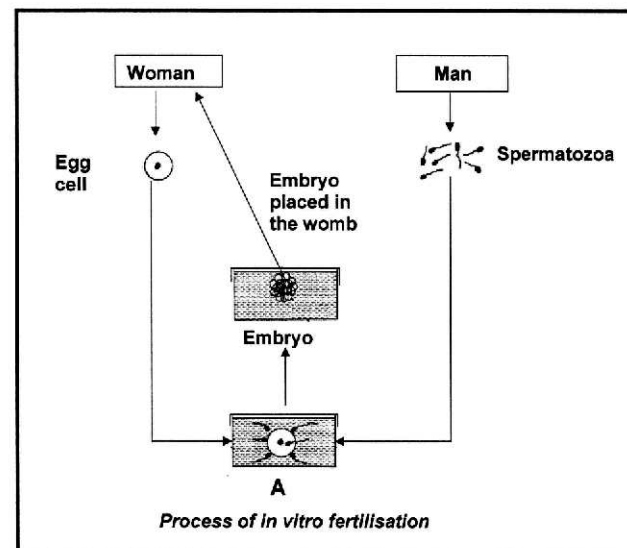
[30]

**TOTAL SECTION B: 60**

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- 4.2 The diagram below illustrates what happens during in vitro fertilisation (IVF).



- 4.2.1 What process takes place at A? (1)
- 4.2.2 Give TWO reasons why a couple may not be able to have children normally. (2)
- 4.2.3 In IVF more embryos are produced than can be implanted in the woman's uterus. Explain whether each of the following uses of the spare embryos is ethical or not: (15)
- (a) It could be sold to couples that cannot have children (2)
- (b) It could be used to enhance research in embryology (2)
- 4.2.4 State ONE way in which IVF differs from cloning. (2)

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**SECTION C**  
**QUESTION 4**

- 4.1 Records of human fertility for the period 1941 – 1990 have shown changes in the sperm counts of normal men. The table below summarises the changing percentages of men with high or low sperm counts over a period of 50 years.

TIME PERIOD	MEN WITH HIGH SPERM COUNTS (%)	MEN WITH LOW SPERM COUNTS (%)
1941 – 1950	50	4
1951 – 1960	45	5
1961 – 1970	28	11
1971 – 1980	21	14
1981 – 1990	15	18

- 4.1.1 By how much did the percentage of men with high sperm counts decrease in the period 1951 to 1970? (1)
- 4.1.2 On the same system of axes, draw TWO sets of bar graphs to compare the percentages of men with a high sperm count and a low sperm count from 1941 to 1990. (11)
- 4.1.3 Describe the trend for men with low sperm counts and compare it with those with high sperm counts over the 50-year period. (2)
- 4.1.4 Explain ONE reason why it is necessary for a large number of sperm to be produced when only one sperm is required to bring about fertilisation. (2)

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- 4.3 Write a mini-essay explaining how any THREE contraceptive methods affect human reproduction. You should also explain ONE way in which contraception can influence the quality of human life.

Content (12)

Synthesis (3)

**NOTE: NO marks will be awarded for answers in the form of flow charts or diagrams. (15)**

**TOTAL SECTION C: 40**  
**GRAND TOTAL: 150**

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# Life Sciences Paper 01

## February/March 2009

### Memorandum

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#### SECTION A

##### Question 1

- 1.1  
1.1.1 B✓✓  
1.1.2 A✓✓  
1.1.3 C✓✓  
1.1.4 D✓✓  
1.1.5 B✓✓

5 x 2 = (10)

- 1.2  
1.2.1 corpus luteum✓  
1.2.2 alleles✓  
1.2.3 pollination✓  
1.2.4 amniocentesis✓  
1.2.5 testis✓  
1.2.6 oogenesis✓  
1.2.7 mitosis✓  
1.2.8 homologous✓

(8)

- 1.3  
1.3.1 C✓  
1.3.2 A✓  
1.3.3 H✓  
1.3.4 B✓  
1.3.5 D✓

(5)

- 1.4  
1.4.1 A - Umbilical cord✓  
B - Placenta✓

(2)

- 1.4.2 - Has folds✓/villi to enlarge the surface area✓  
- Enriched with blood vessels✓ for transport of gases✓/nutrients/  
waste products  
- Selective permeable membranes✓ to promote diffusion of gases✓/  
substances  
- Contains blood sinuses✓ to bring blood of mother in close  
association with that of foetus✓  
- interdigitated✓ to anchor foetus✓  
(Mark first ONE only)

any 1 x 2 (2)

- 1.4.3 - acts as a shock absorber✓/prevents mechanical damage  
- prevent great variation in temperature✓  
- allows for movement of the foetus✓  
- passes out before birth to lubricate the birth canal✓  
(Mark first TWO only)

any (2)

- 1.4.4 Foetal alcohol syndrome✓

(1)

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1.6

1.6.1 AB✓

(1)

1.6.2 Represent separate/discrete/different✓ entities✓ /blood groups/units

OR

Discontinuous✓ variable✓

OR

No✓ intermediate groups✓

(2)

1.6.3 Frequency of blood groups in a small human population

Blood group	Percentage
AB	5
A	40
B	10
O	45

Caption✓  
Column headings✓  
Row headings✓  
3 or 4 correct percentages✓✓  
1 or 2 correct percentages✓  
Draw table✓

(6)

(9)

TOTAL QUESTION 1: 50  
TOTAL SECTION A: 50

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#### 1.4.5 Causes

- mental retardation✓
- slow growth✓
- abnormalities of skull and face✓
- organ malfunction✓

any (1)

(8)

#### 1.5

1.5.1 The percentage of X chromosomes with lethal mutations increases/  
decreases✓ when the dosage of X-rays increases/decreases✓

OR

A change in the amount of X-rays✓ has no effect on the percentage X  
chromosomes with lethal mutations✓

(2)

1.5.2 Radiation✓/Amount of X-rays  
(Mark first ONE only)

(1)

1.5.3 4✓

(1)

1.5.4 Use chromosomes from the same species✓

- Use X chromosomes only✓
- Time exposed to radiation✓
- Environmental conditions✓e.g. temperature, CO<sub>2</sub>, O<sub>2</sub> and humidity
- Ensure that no lethal mutations present before the investigation✓
- (Mark first TWO only)

any (2)

1.5.5 An increase in the amount of radiation of X-rays✓ leads to an increase  
in the percentage of X chromosomes showing lethal mutations✓

OR

A decrease in the amount of X-rays✓ leads to a decrease  
in the percentage of X chromosomes with lethal mutations✓

(2)

1.5.6 Take many readings✓ at each X-ray amount and find the average✓  
reading

(2)  
(10)

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#### SECTION B

##### QUESTION 2

2.1

- 2.1.1 A - Chromosome✓  
B - Centromere✓  
C - Chromatid✓  
D - Chiasma✓

(4)

2.1.2 Crossing over✓

(1)

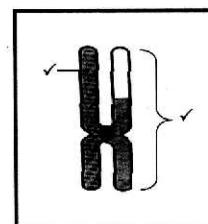
2.1.3 Mixing of genetic material✓/variation and gametes are different from  
each other✓  
(Mark first ONE only)

(2)

2.1.4 Prophase 1✓

(1)

2.1.5



Mark allocation:

- Chromosome drawn✓
- Chromosome has shaded and unshaded part in the correct proportion✓

(2)

(10)

2.2

2.2.1 Translation✓

(1)

2.2.2 Ribosome✓

(1)

2.2.3 (a) Isoleucine✓

(1)

(b) CAG✓/cytosine, adenine, guanine

(1)

(c) Codon✓

(1)

(d) Have arginine✓ instead of alanine✓/have different✓ amino  
acids✓

(2)

2.2.4 GTA✓✓

(2)

(9)

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# Life Sciences Paper 01

## February/March 2009

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- 2.3  
2.3.1 Mouse 2 - XY✓  
Mouse 3 - XX✓ (2)
- 2.3.2 50%✓ (1)
- 2.3.3 Mouse 2✓ (1)
- 2.3.4 A cross between mouse 3 and mouse 4✓ produced offspring with white✓/recessive coat colour and white colour will only show up if both parents have at least one recessive gene✓ any (2)
- 2.4  
2.4.1 Sickle cell anaemia✓ (1)
- 2.4.2  $100\% - (78+7+10)\% = 5\%\%$   
 $\frac{5}{100} \times \frac{1200}{1}$   
60✓ people (3)
- 2.4.3 - Parents can decide whether to abort foetus or not✓  
- Help prepare parents to manage with such a child✓ any (1)

TOTAL QUESTION 2: 30

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- (d) The girls are taller✓ than the boys at a younger age✓/ between 10 to 13 years  
OR  
The boys are shorter✓ than the girls at a younger age✓/ between 10 to 13 years  
OR  
The boys are not taller than the girls✓ at all age groups✓ (2)
- 3.3  
P<sub>1</sub>/parent phenotype Brown x blue eyes✓  
genotype Bb x bb✓
- Meiosis  
G/gametes B, b x b✓
- Fertilisation  
F<sub>1</sub>/offspring genotype Bb and bb✓  
phenotype Brown and Blue✓
- Ratio: 1:1 ✓  
Parents and offspring✓  
Meiosis and fertilization✓

TOTAL QUESTION 3: 30

TOTAL SECTION B: 60

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#### QUESTION 3

- 3.1  
3.1.1 - Combating heart diseases✓  
- Improving intelligence✓ (2)
- 3.1.2  $\left(\frac{10}{1800}\right) \times 100\%$   
= 0,55%✓ (3)
- 3.1.3 The gene responsible for producing omega-3 fatty acids is located✓ in the DNA of salmon✓/fresh mackerel/tuna  
This gene is cut✓ from the donor organism,  
inserted into a plasmid of a bacterium✓  
Bacteria replicates to form many copies of the gene✓  
These genes are then inserted into the cells of the zygote✓/embryo any (4)
- 3.1.4 (a) **Support**  
- Healthier for humans to eat✓/combating heart disease  
- Mass production of healthy fat✓  
- Improves intelligence✓ any (2)
- (b) **Against**  
- Cultural objection to eat meat from pigs✓  
- The success rate is very low✓  
- Expensive procedure✓  
- No value for vegetarians✓  
- Objection to eating any genetically modified food✓ any (2)
- 3.2  
3.2.1  
• Determine a sample size that would be large enough and manageable ✓  
• Keep the number of boys and girls the same✓ for every age group  
• Design a table to record the results✓  
• Set up accurate measuring equipment✓  
• Time span to be controlled✓/investigation to be completed in a short time  
• Same nutritional status✓/same socio-economic conditions any (3)
- (Mark first THREE only)
- 3.2.2 (a) 13,4 – 13,6 years✓ (1)
- (b) Average height of boys and girls✓ of different age groups✓ between ten and eighteen years (2)
- (c) No/not accept/reject✓ (1)

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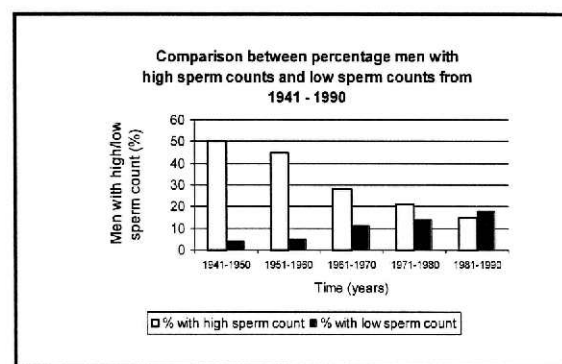
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#### SECTION C

##### Question 4

- 4.1  
4.1.1 17%✓ (1)
- 4.1.2



##### Rubric for the mark allocation of the graph

Correct type of graph	1
Title of graph	1
Correct label and units for X-axis	1
Graphs labelled/key provided for 2 graphs	1
Correct label and units for Y-axis	1
Appropriate width and interval of bars	1
Appropriate scale for Y-axis	1
Drawing of the graphs	1: 1 to 3 bars plotted correctly 2: 4 to 6 bars plotted correctly 3: 7 to 9 bars plotted correctly 4: all 10 bars plotted accurately

(11)

##### NOTE:

If the wrong type of graph is drawn: marks will be lost for 'correct type of graph'  
If graphs are not drawn on the same system of axes, mark the first graph only using the given criteria

- 4.1.3 The percentage of men with low sperm counts has increased✓ from 1941 - 1990  
The percentage of men with high sperm counts has decreased✓ from 1941 to 1990 (2)

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# Life Sciences Paper 01

## February/March 2009

### Memorandum

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- 4.1.4 To increase chance of fertilisation✓ since there is a reduced number of egg cells✓  
**OR**  
Many millions of sperms increase the chances of fertilization✓ since many sperms are destroyed✓/ get lost (2)
- 4.2  
4.2.1 Fertilisation✓ (1)
- 4.2.2 Couple could not conceive normally due to any of the following:  
Man has low sperm count/ infertile✓  
Blocked Fallopian tubes✓  
Irregular menstrual cycles✓  
Imbalance of the hormones concerned with ovulation✓  
Sexually transmitted diseases✓ any (2)  
**(Mark first TWO only)**
- 4.2.3 (a) Ethical since it allows couples to have children✓ if one of them might be infertile✓  
**OR**  
Unethical since only those that are rich✓ would be able to take advantage of the opportunity✓ any 1 x 2 (2)
- (b) Ethical since it can be used to develop treatment✓ for defects in fetuses✓  
**OR**  
Unethical since this is experimentation✓ with human life✓ any 1 x 2 (2)
- 4.2.4 IVF involves fusion of 2 haploid nuclei✓/gametes whereas in cloning no fusion takes place✓/diploid nucleus from a somatic cell is used.  
**OR**  
IVF can lead to variation✓ in the offspring whereas cloning produces identical✓ offspring  
**OR**  
IVF 'mimics' natural sexual reproduction✓ whereas cloning no sexual reproduction✓ (2)  
**(Mark first ONE only)**

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#### The influence on the quality of human life

Limits family size✓/unwanted pregnancies

- which allows better care for the children✓ higher standard of living✓/ less dependant on debt/ more psychologically stable children

Prevents the transfer of STD's✓

- the use of e.g. condoms can increase life span✓ and decrease✓ the spread of diseases to other people

Might cause conflict

- e.g. the use of IUD could be seen by some people as a form of abortion✓ which may not be acceptable to some religions ✓

**(Mark first ONE only)**

any 1 x 3 (3)

#### Synthesis

Description	Marks
Not attempted	0
Significant gaps in the logic and flow of the answer	1
Minor gaps in the logic and flow of the answer	2
Well structured – demonstrates insight and understanding	3

(3)

(15)

TOTAL QUESTION 4: 40

GRAND TOTAL: 150

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#### Possible answers for the mini essay

##### Contraceptive methods and the effect on human reproduction

Method	Affect on human reproduction
Condom✓	Acts as a barrier✓/stops sperm getting into the vagina✓
Loop/IUD✓	It prevents fertilised eggs✓/embryos from becoming attached to the uterine wall✓ and is highly effective
Femidom✓	Acts as a barrier✓ /stops sperm getting into the uterus✓/Fallopian tubes
Diaphragm✓	It covers the cervical opening✓ and prevents sperm from entering the uterus✓ and is fairly effective.
Contraceptive pill✓	Contains artificially produced hormones which prevents the production of eggs✓/ovulation/signalling the body that it is already pregnant. It changes the lining of the cervix✓/ womb. It is a very reliable method
Spermicides✓	It contains a chemical substance that kills sperm✓ and acts as a barrier✓/prevents sperm from entering the Fallopian tubes. They are not very reliable on their own.
Contraceptive injections✓	It contains progesterone✓/combination of oestrogen and progesterone which stops ovulation✓/ changes the lining of the womb and the cervix. It works for 2 to 3 months and are very effective.
Male sterilisation✓ - vasectomy	The sperm ducts are cut✓ and tied. Semen without sperm is produced✓ and is a very effective method of contraception.
Female Sterilisation✓ - tubal ligation	The fallopian tubes are cut✓ and tied during a small surgical operation preventing the fusion of sperm and egg. ✓
Withdrawal✓	The penis is removed✓ out of the vagina before ejaculation✓ but is not a safe method because many sperms are released during sexual intercourse
Rhythm✓	Sexual intercourse is avoided✓ during ovulation✓ but is not a safe method of contraception because it is impossible to be 100% sure when ovulation will occur

**(Mark first THREE only)**

any 3 x 3 (9)

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**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answer to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. ALL drawings should be done in pencil and labelled in blue or black ink.
7. Draw diagrams or flow charts ONLY when asked to do so.
8. The diagrams in this question paper are NOT all drawn to scale.
9. Do NOT use graph paper.
10. Non-programmable calculators, protractors and compasses may be used.
11. Write neatly and legibly.

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- 1.1.5 Common water-borne diseases are ...

- A asthma, typhoid and TB.
- B asbestosis, cholera and HIV/Aids.
- C bilharzia, malaria and emphysema.
- D typhoid, cholera and bilharzia.

(5 x 2) (10)

- 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 – 1.2.5) in the ANSWER BOOK.

- 1.2.1 A diagram that shows possible evolutionary relationships between groups of organisms
- 1.2.2 The non-living factors of an ecosystem
- 1.2.3 The control of a pest by using another kind of organism/species
- 1.2.4 Numerous interacting food chains that show the feeding relationships in an ecosystem
- 1.2.5 The study of ancient humans and their cultures

(5)

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**SECTION A**

**QUESTION 1**

- 1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question number (1.1.1 – 1.1.5), for example 1.1.6 D.

- 1.1.1 Most scientists agree that the number of mass extinctions that have occurred in the history of life on Earth is ...

- A 3.
- B 7.
- C 6.
- D 5.

- 1.1.2 According to the theory of continental drift, all the land masses were joined together to form one super-continent called ...

- A Gondwanaland.
- B Pangaea.
- C Eurasia.
- D Laurasia.

- 1.1.3 The following conditions are proposed as being most favourable for fossil formation:

- (i) Organisms should have a hard skeleton or shell
- (ii) Micro-organisms must be present
- (iii) The dead body must be covered by sediment fairly quickly
- (iv) Little or no oxygen must be present

Which of the following combinations is correct?

- A (i), (ii) and (iii)
- B (ii), (iii) and (iv)
- C (i), (iii) and (iv)
- D (ii) and (iv)

- 1.1.4 Possible measures for the reduction of air pollution would NOT include the following:

- A Providing subsidies for solar panels
- B Providing subsidies for truck drivers
- C Rewards for cleaner production by industries
- D Improving the public transport system

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- 1.3 Choose an item from COLUMN II that matches a description in COLUMN I. Write only the letter (A – J) next to the question number (1.3.1 – 1.3.6) in the ANSWER BOOK, for example 1.3.7 K.

COLUMN I		COLUMN II	
1.3.1	The appearance of new taxa such as genera, families and orders	A	analogous
1.3.2	A list of organisms that are threatened with extinction	B	non-biodegradable
1.3.3	Proposed the 'law' of use and disuse to support his theory of evolution	C	sustainability
1.3.4	Structures that have similar functions and appearance but have different origins	D	speciation
1.3.5	The use of resources in such a way that they are still available for future generations	E	biodegradable
1.3.6	Materials that do not decompose by the action of micro-organisms	F	Lamarck
		G	Darwin
		H	red data list
		I	homologous
		J	macro-evolution

(6 x 1) (6)

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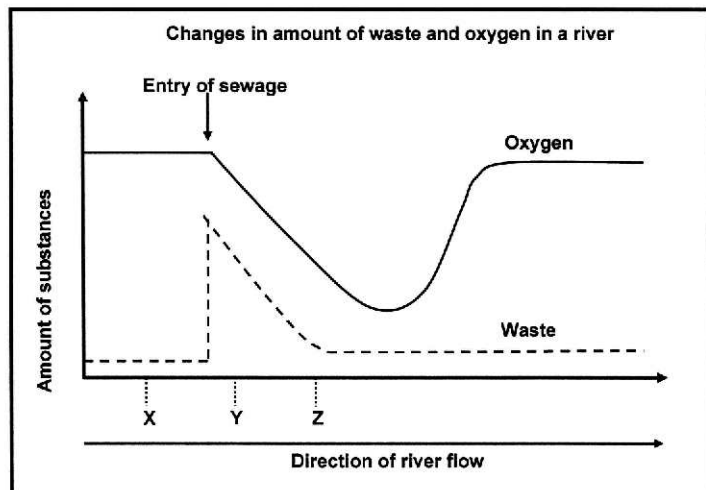
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- 1.4 A group of learners collected water samples at different places (X, Y and Z) along the same river to compare the level of substances (oxygen and waste) as well as the organisms present.

The graph below shows the changes in the amount of substances (waste and oxygen) in the water along the course of the river. The point at which sewage enters the river is indicated.



The presence or absence of certain animal species can be used as indicators of the degree of water pollution in a river, as shown below:

ORGANISM PRESENT	DEGREE OF WATER POLLUTION
Mayfly nymph	unpolluted
Leeches	moderately polluted
Sludge worms	severely polluted

- 1.4.1 Which organism (listed in the table) would most likely have been present at:

- (a) X (1)  
(b) Y (1)  
(c) Z (1)

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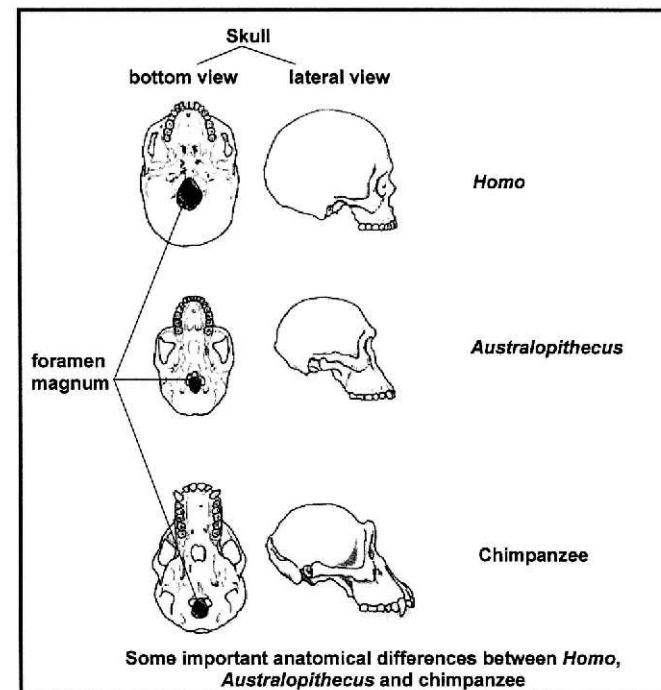
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- 1.5 A comparison of the anatomical features of organisms has helped scientists to propose evolutionary relationships.



- 1.5.1 Tabulate THREE observable differences between the side view of the skulls of *Homo* and the chimpanzee. (7)  
1.5.2 Which ONE of the organisms (*Australopithecus* or chimpanzee) is/was a quadruped? (1)  
1.5.3 Give ONE observable reason for your answer to QUESTION 1.5.2. (1)  
1.5.4 Name TWO fossils of *Australopithecus* found in South Africa. (2)

TOTAL SECTION A: 50

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- 1.4.2 State TWO factors that should be kept constant while collecting the water samples. (2)  
1.4.3 Explain TWO precautions that the learners should take to ensure their own safety while collecting the samples. (4)  
1.4.4 Name ONE dependent variable in this investigation. (1)  
1.4.5 Use the graph to describe the relationship between the amount of oxygen and the amount of waste from the point of entry of sewage. (4)  
1.4.6 Explain why the oxygen level is highest in region X. (2)  
1.4.7 State TWO ways in which the degree of water pollution caused by sewage can be reduced. (2)

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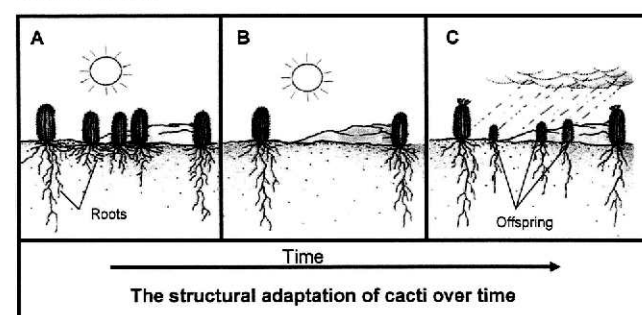
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## SECTION B

### QUESTION 2

- 2.1 Study the three diagrams (A, B and C) below that show a mechanism used to explain evolution.



- 2.1.1 From a comparison of pictures A and B, describe the feature of the cacti that have enabled them to survive long periods of hot, dry weather conditions. (1)  
2.1.2 Name the mechanism put forward by Darwin to explain his theory of evolution that is illustrated in these diagrams. (1)  
2.1.3 Use the three diagrams above to explain the mechanism mentioned in QUESTION 2.1.2. (5)  
2.2 Describe how each of the following contributes to genotypic variation within a species:  
2.2.1 Meiosis (6)  
2.2.2 Mutation (2)  
2.2.3 Sexual reproduction (4)  
2.3 Describe how speciation occurs when a population becomes separated by a geographical barrier. (5)

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- 2.4 The dinosaurs became extinct nearly 65 million years ago.
- 2.4.1 What evidence do scientists use to show that dinosaurs once existed on Earth? (1)
- 2.4.2 State how scientists have come to the conclusion that the period that dinosaurs existed was between 65 and 245 million years ago. (1)
- 2.4.3 Describe the extra-terrestrial theory that is proposed by scientists as a possible cause of the extinction of the dinosaurs. (4)  
[30]

QUESTION 3

- 3.1 The following table shows the total amount of solid waste and the amount of recyclable material dumped in a South African city landfill site over a number of years.

YEAR	TOTAL AMOUNT OF SOLID WASTE (MILLIONS OF TONS)	AMOUNT OF RECYCLABLE MATERIAL IN SOLID WASTE (MILLIONS OF TONS)
2003	1,49	0,78
2004	1,59	0,82
2005	1,80	1,20
2006	1,93	1,30

- 3.1.1 Describe the general trend in the total amount of waste produced and the amount of recyclable materials dumped from 2003 to 2006. (2)
- 3.1.2 Explain TWO advantages of recycling. (4)
- 3.2 The table below shows the composition of household waste from a community.
- | TYPE OF WASTE  | PERCENTAGE COMPOSITION |
|----------------|------------------------|
| Organic matter | 30                     |
| Plastic        | 25                     |
| Paper          | 15                     |
| Glass and tin  | 10                     |
| Other          | 20                     |
- Draw a pie chart to represent the data in the table above. Show ALL working. (12)
- 3.3 Modern farming techniques often include the use of fertilisers to increase crop production.
- 3.3.1 Name the mineral that is normally included in such fertilisers, which is needed by plants for the formation of all amino acids. (1)
- 3.3.2 Explain ONE danger of the excessive use of fertilisers to the environment. (3)

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- 3.4.2 Name TWO fields of study, other than embryology and biochemistry, that scientists may have used to propose the evolutionary relationships shown in the diagram. (2)
- 3.4.3 Explain why we cannot be sure that the evolutionary relationships displayed in the diagram in QUESTION 3.4 are absolutely correct. (2)  
[30]

TOTAL SECTION B: 60

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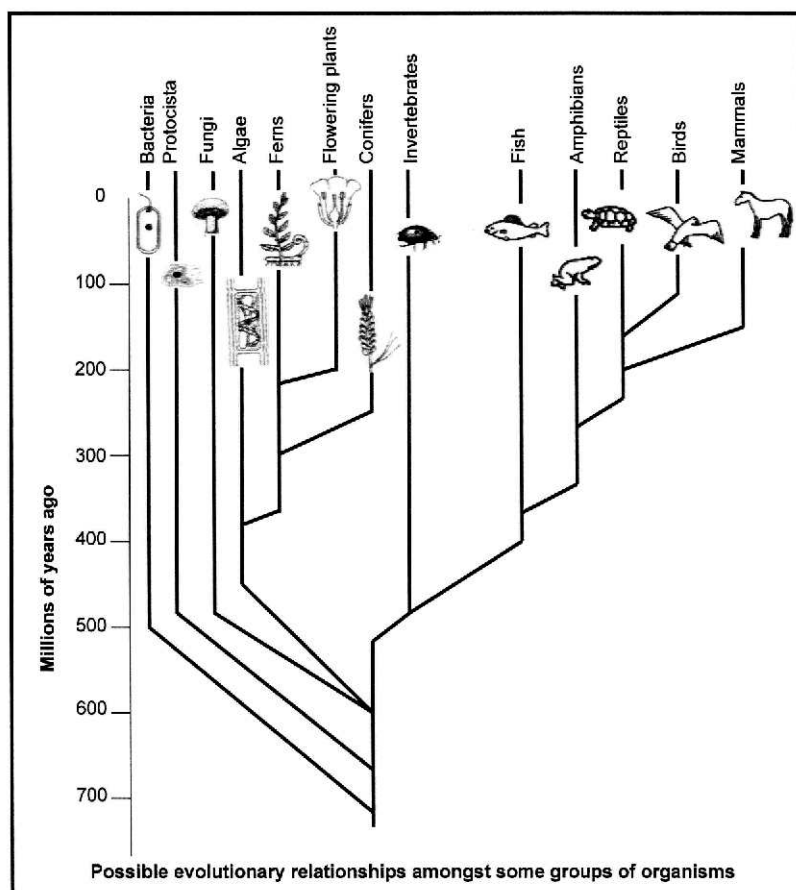
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- 3.4 Study the diagram showing possible evolutionary relationships amongst some groups of organisms.



- 3.4.1 According to the diagram:
- (a) How many million years ago did the conifers evolve? (1)
- (b) Which were the first organisms that lived on Earth? (1)
- (c) From which group of animals did the reptiles evolve? (1)
- (d) Which is the most recent group of animals to evolve? (1)

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SECTION C

QUESTION 4

- 4.1 Read the text below and answer the questions which follow.

OVER-FISHING OF COD

One of the most important species of fish caught for food in the North Sea is cod. They live in shoals, are active hunters and feed on other fish, such as herring, and on squid. Cod only begin to breed when they are about 3 to 4 years old. By this time they are about 50 cm long. Unfortunately over-fishing of cod is slowly reducing the cod population.

- 4.1.1 Explain TWO consequences to the ecosystem if the cod population becomes extinct. (4)
- 4.1.2 Explain THREE management strategies that could be employed by the countries around the North Sea to prevent the cod population from becoming extinct. (6)
- 4.1.3 Explain ONE problem that could result from any of the management strategies that you described in QUESTION 4.1.2. (2)
- 4.2 *Homo* species are characterised by having opposable thumbs and by being bipedal.
- 4.2.1 State ONE possible advantage of having an opposable thumb. (1)
- 4.2.2 Explain TWO possible advantages of bipedalism. (4)
- 4.3 Scientists have used information from various fields of science to provide evidence for evolution.
- 4.3.1 List THREE aspects of comparative biochemistry that provides evidence for evolution. (3)
- 4.3.2 State TWO pieces of evidence from comparative embryology that have led scientists to believe that all vertebrates may have a common ancestor. (2)

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- 4.4 Critically endangered cheetah populations are found in small remote areas in South Africa, East Africa, West Africa and Asia. This leads to inbreeding with its many associated problems.
- 4.4.1 Explain ONE way in which outbreeding would reduce the problems associated with inbreeding. (2)
- 4.4.2 State ONE advantage of inbreeding. (1)
- 4.5 The disposal of solid wastes is a major problem in most cities in South Africa.
- Write a mini-essay to describe any TWO disadvantages in disposing of solid waste in landfill sites as well as TWO advantages and TWO disadvantages of solid waste disposal by means of burning (incineration). (12)
- 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



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DEPARTMENT: EDUCATION  
MPUMALANGA PROVINCE

# Together Educating the Nation



# Life Sciences Paper 02

## February/March 2009

### Memorandum

Life Sciences/P2

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#### SECTION A

##### QUESTION 1

- 1.1  
1.1.1 D✓✓  
1.1.2 B✓✓  
1.1.3 C✓✓  
1.1.4 B✓✓  
1.1.5 D✓✓ (5 x 2) = (10)
- 1.2  
1.2.1 Phylogenetic tree✓/cladogram  
1.2.2 Abiotic✓  
1.2.3 Biological control✓  
1.2.4 Food web✓  
1.2.5 Archaeology✓ (5)
- 1.3  
1.3.1 J✓  
1.3.2 H✓  
1.3.3 F✓  
1.3.4 A✓  
1.3.5 C✓  
1.3.6 B✓ (6)
- 1.4  
1.4.1 (a) Mayfly nymph ✓ (1)  
(b) Sludge worms ✓ (1)  
(c) Leeches ✓ (1)
- 1.4.2 - The size/volume of the water samples must be the same✓  
- The samples must be taken at the same depth✓  
- Samples must be taken at the same time in all three areas✓  
- Use sterile containers✓  
(Mark first TWO only) any (2)
- 1.4.3 - Wear rubber gloves when taking the samples✓ so as not to get contaminated with germs✓  
- Samples should be taken by using a container/bottle attached to a string ✓ to avoid stepping too close to the river bank✓/prevent drowning/falling into water  
(Mark first TWO only) (4)
- 1.4.4 Oxygen✓/waste/amount of substances (1)  
(Mark first ONE only)

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#### SECTION B

##### QUESTION 2

- 2.1  
2.1.1 Long roots✓ (1)
- 2.1.2 Natural selection✓/survival of the fittest (1)
- 2.1.3 - There is variation✓ in the length of roots among the cacti plants  
- The cacti with the long roots have the desirable characteristic✓/are better adapted/ long roots absorb water from deep underground  
- for surviving under dry/unfavourable conditions✓  
- more of the cacti with long roots survive✓  
- most of the cacti with the short roots die✓  
- most of the offspring produced have long roots ✓ any (5)
- 2.2  
2.2.1 - During prophase 1✓  
- crossing over✓ takes place  
- and genetic material is exchanged✓/recombination occurs between chromatids of homologous chromosomes  
- which ensures that the gametes formed are different✓ from each other  
- During metaphase 1✓  
- Homologous chromosomes arrange themselves randomly✓/ independent assortment along the equator  
- which ensures that the gametes formed are different✓ from each other any (6)
- 2.2.2 - Sudden random changes✓  
- occur in the genetic code/gene/DNA✓ (2)
- 2.2.3 - Large number of gametes produced✓  
- Gametes are different because they are produced by meiosis✓  
- random fusion of gametes✓  
- therefore the offspring✓ produced  
- will be genetically different✓ any (4)

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- 1.4.5 The oxygen decreases✓ proportionally to the decrease in the waste✓ until the amount of waste reaches 'normal' level ✓when the amount of oxygen begins to increase✓ and stabilise/become constant✓ any (4)
- 1.4.6 Unpolluted water✓/less waste at X  
therefore more plants will be present✓  
producing more oxygen through photosynthesis✓ (any 2)
- OR
- Unpolluted water✓/less waste at X  
therefore fewer aerobic bacteria will be present✓  
hence using less oxygen✓ (any 2) (2)
- 1.4.7 Local government must provide proper sanitation✓  
Water must be purified before it enters the river✓  
Education✓ to make people aware of proper waste disposal measures  
(Mark first TWO only) any (2)
- 1.5  
1.5.1
- | Homo                                    | Chimpanzee                            |
|---|---------------------------------------|
| 1. Canines not well developed ✓         | 1. Canines well developed✓/form fangs |
| 2. Less protruding jaws✓/not prognathus | 2. Protruding jaws/prognathus✓        |
| 3. Brow-ridge less pronounced✓          | 3. Heavily pronounced brow-ridge✓     |
| 4. Proportionally large cranium✓        | 4. Proportionally smaller cranium✓    |
| 5. Proportionally shorter cheek bone✓   | 5. Proportionally larger cheek bone✓  |
| 6. No ridge at base/back of skull✓      | 6. Ridge at base/back of skull✓       |
- (Mark first THREE only) (any 3 x 2)  
1 mark for table (7)
- 1.5.2 Chimpanzee✓ (1)
- 1.5.3 The foramen magnum is towards the posterior/back of the skull✓ (1)
- 1.5.4 Taung child✓  
Mrs Ples✓  
Little-foot✓ any (2)  
(Mark first TWO only)

TOTAL SECTION A: 50

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- 2.3 - The population will split up into two groups✓  
- and each group adapts to the new environmental factors✓/ develops separately/each group undergoes natural selection independently  
- each group may become genotypically✓  
- and phenotypically different✓  
- which might prevent them from interbreeding✓/become reproductively isolated leading to the formation of a new species (5)
- 2.4  
2.4.1 Fossil✓/evidence/Paleontological studies (1)
- 2.4.2 Radiometric dating✓ of the fossils or the rocks in which the fossils were found (1)
- 2.4.3 - A comet, an asteroid or part of a star✓ from outer space struck the Earth/Gulf of Mexico which resulted in  
- large clouds of dust blocking out the sun✓  
- stopped photosynthesis✓  
- global cooling✓/dinosaurs might have been ectotherms and not able to live in the cold  
- world-wide fire✓  
- monstrous tsunamis✓  
These factors caused the dinosaurs to become extinct any (4)  
[30]

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QUESTION 3

- 3.1  
3.1.1 Both✓ the total amount of waste produced and the amount of recyclable material increased✓ from 2003 to 2006 (2)
- 3.1.2 - People collect and sell waste at buy-back centres✓ and benefits therefore economically✓/creates own jobs  
- People who collect waste and take it to recycling depots✓ contributes to sustainable use of materials✓  
- Recycling saves energy✓ and therefore reduces the amount of energy used to make new products✓  
(Mark first TWO only) (any 2 x 2) (4)

3.2 Calculations of sectors for pie chart.

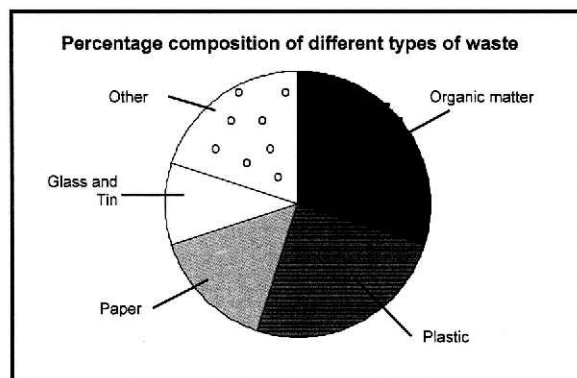
$$\text{Organic matter: } \frac{30}{100} \times \frac{360}{1} = 108^\circ$$

$$\text{Plastic: } \frac{25}{100} \times \frac{360}{1} = 90^\circ$$

$$\text{Paper: } \frac{15}{100} \times \frac{360}{1} = 54^\circ$$

$$\text{Glass and tin: } \frac{10}{100} \times \frac{360}{1} = 36^\circ$$

$$\text{Other: } \frac{20}{100} \times \frac{360}{1} = 72^\circ$$



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SECTION C

QUESTION 4

- 4.1  
4.1.1 - Increase✓ in numbers of the prey✓ that they feed on e.g. herring and squid  
- Decrease✓ in numbers of predators✓ that feed on them  
- Cause an imbalance✓ in the food chain/web✓  
- Lack of cod✓ for human consumption✓  
(Mark first TWO only) (any 2 x 2) (4)
- 4.1.2  
- Declare a fishing season✓ so that no fishing occurs during the breeding season✓  
- Have a bag limit✓ so that the breeding stock is not depleted✓  
- Limit size of fish caught✓ to allow fish to complete breeding✓  
- Ban catching of cod completely✓ to allow cod population to recover✓  
- Impose fines✓ to encourage adherence to fishing regulations✓  
(Mark first THREE only) (any 3 x 2) (6)
- 4.1.3 - Fishing methods are such that before the smaller cods (less than 50 cm in length) are thrown back✓ they would have already died✓  
- Policing the ban on the fishing of cod or a quota system✓ is expensive✓ to maintain  
- Illegal fishing will still take place✓ by unscrupulous people✓  
- Could have a negative impact on people✓ who rely on cod-fishing as an income✓  
(Mark first ONE only) (any 1 x 2) (2)
- 4.2  
4.2.1 Grasping things to obtain a power grip✓/ precision grip/using tools  
(Mark first ONE only) (1)
- 4.2.2 - Allows total awareness✓ of the environment in sensing danger✓/looking for food  
- Enables hands to be free✓ to use implements✓/carry objects or offspring/throw/protect  
- Exposes a large surface area✓ for thermo-regulation✓/lose body heat to surroundings in hot conditions/reduce overheating therefore reduce need for water  
- Display of male sex organs✓ as part of courtship behaviour✓  
(Mark first TWO only) (any 2 x 2) (4)

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Rubric for the mark allocation of the graph

Calculation/working to determine the correct proportions	1 mark for each calculation including the correct answer (5)
Correct type of graph	1
Title of graph	1
Correct proportions for each labelled sector/slice	1 mark for each sector/slice (5)
	(12)

Note:

If the wrong type of graph is drawn: marks will be lost for 'correct type of graph' as well as for drawing of sectors in correct proportion.

- 3.3  
3.3.1 Nitrogen✓ (1)
- 3.3.2 - Run-off of nitrates and phosphates✓ from excess use of fertilizers has greatly increased the nitrate and phosphate in rivers✓ and lakes  
- Leads to eutrophication✓  
- overgrowth of microscopic algae✓/algal bloom  
- Many algae and other organisms die✓ as the oxygen is used up  
- their bodies are broken down by bacteria✓  
- bacteria need oxygen therefore oxygen levels in water gets further depleted✓  
- Lack of oxygen causes animals to die✓  
any (3)
- 3.4  
3.4.1  
a) 300✓million years ago (1)  
b) Bacteria✓ (1)  
c) Amphibians✓ (1)  
d) Birds✓ (1)
- 3.4.2 Studying fossils✓/paleontology  
Anatomy✓  
Taxonomy✓  
Biogeography✓  
any (2)
- 3.4.3 We cannot observe these changes✓ because they took place millions of years ago✓  
Gaps✓ in the fossil records✓/comparative anatomy, biochemistry embryology  
(any 1 x 2) (2)

TOTAL SECTION B: 60

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- 4.3.1 - Identical DNA structure in different species✓  
- Similar protein synthesis✓ among different species  
- amino acid sequence of haemoglobin✓/similar /similar proteins✓  
- Similar metabolic pathways✓/ cellular respiration in many species  
- Similar sequence of genes✓ in different species also show close genetic relationship  
(Mark first THREE only) any (3)
- 4.3.2 - Similar structure✓  
- All vertebrate embryos have gill slits✓  
- All vertebrate embryos have a tail✓  
(Mark first TWO only) any (2)
- 4.4  
4.4.1 - Outbreeding increases variability✓ of alleles in the gene pool  
- making the population more resistant to disease✓  
- and breeding disorders✓  
any (2)
- 4.4.2 Desirable alleles can be selected and passed on to successive generations✓ (1)
- 4.5 Possible answers for the mini essay
- Disadvantages in disposal of solid waste in landfill sites
- The wastes in a landfill attract vermin✓ (rats, cockroaches etc) and these often harbour disease vectors✓
  - Landfills give off bad odours✓ /are ugly/presence leads to urban decay because only poor people are prepared to live near them✓
  - Wind blown litter✓ causes a pollution problem✓
  - Sites attract informal "pickers" ✓/poor people seeking food/ building materials often exposing themselves to health hazards✓/ risk/injury
  - Highly flammable methane gas✓ sometimes escapes from the decomposing wastes can cause health hazards✓
  - Streams near the landfill sites often become contaminated✓ with hazardous leachate/chemicals✓
  - Borehole water gets contaminated✓ by leachate/chemicals that percolates into the groundwater✓  
(Mark first TWO only) (any 2 x 2) (4)

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**Advantages of incineration**

- Incineration plant is quite small✓ so valuable land is not used✓
- No attraction to pests✓ so less risk of disease✓
- Heat generated can be used/incinerators built as part of housing projects✓ can save energy✓

(Mark first TWO only)

(any 2 x 2) (4)

**Disadvantages of Incineration**

- May generate toxic fumes✓ (especially from burning plastics) cause health hazards ✓
- Can be expensive to build✓ money can be used for other social interventions✓
- Seepage of wastes✓ may pollute groundwater✓
- Fuel is consumed✓ to begin the combustion process✓

(Mark first TWO only)

(any 2 x 2) (4)

Description	Marks
Not attempted	0
Significant gaps in the logic and flow of the answer (only described landfill or incineration)	1
Minor gaps in the logic and flow of the answer (answered both landfill and incineration but left out some points)	2
Well structured – demonstrates insight and understanding (answered both landfill and incineration fully)	3

Content: (12)  
Synthesis: (3)

TOTAL SECTION C: 40

GRAND TOTAL: 150



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