Hillcrest High School

Life Sciences Examination Grade 12

June 2014

Time: 2½Hrs

Marks: 150

READ THE FOLLOWING INSTRUCTIONS VERY CAREFULLY:

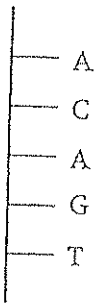
1. Answer all questions in the answer booklet provided.
2. Rule off after every section
3. Write neatly and legibly
4. Write your name and name of your Life Sciences teacher on your answer booklet
5. Calculators and protractors are permitted
6. All diagrams to be drawn in pencil and labeled in ink
7. Read all instructions carefully before answering the questions.

SECTION A

Question 1

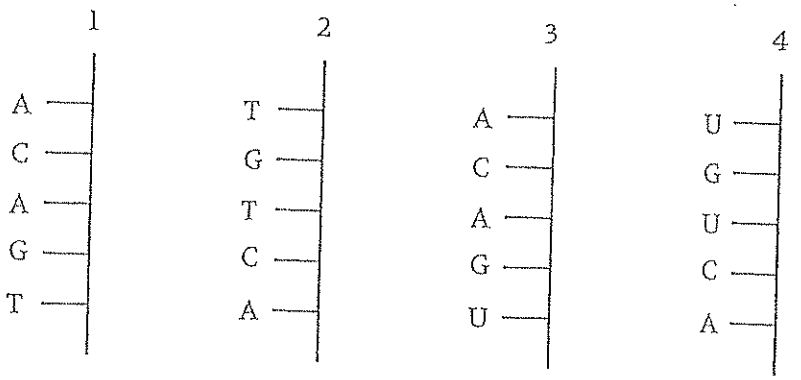
1.1 In each of the following cases, write down only the question number and the LETTER of the most correct alternative:

1.1.1 The strand in the diagram shows a small part of a nucleic acid molecule.



Which pair of the following strands is complementary to it?

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



1.1.2 Each somatic cell in the human has.

A. 23 different chromosomes
B. 46 similar chromosomes
C. 23 pairs of chromosomes
D. 46 pairs of different chromosomes

1.1.3 A pregnant woman was told by a genetic counselor that her baby had equal chances of having blood type A or blood type AB. This means that the genotypes of the woman and her husband must have been ...

A $I^A\ I^A$ and $I^B\ i$
B $I^A\ I^B$ and $I^B\ i$
C $I^A\ i$ and $I^B\ I^B$
D $I^A\ I^B$ and $I^A\ i$

1.1.4 In humans, brown eye color is dominant over blue eye colour. A mother with blue eyes had two children, a boy with brown eyes and a girl with blue eyes. The eye colour of the father is ...

A. brown because the allele for brown eye color is sex-linked.
B. brown because at least one of the parents must have brown eyes.
C. blue because at least two other members of the family have blue eyes.
D. blue because at least one of the parents must be heterozygous for eye colour

1.1.5 Neurons are specialized body cells that

A. can easily be replaced if they are damaged or die
B. do not live for a very long time
C. can go without oxygen for a very long time
D. have a very high respiration rate.

1.1.6 Vivipary is a form of development of the embryo where
A. the embryo develops within the females' body and the young are born alive
B. the young hatch within the females body and are then born
C. the young hatch from an egg outside the females' body
D. the young are always born in water

1.1.7 Below is a set of events following fertilisation in humans.

A. The embryo is embedded in the uterine wall in humans.
B. A zygote is formed in the Fallopian tube.
C. Cell division occurs to form a ball of several hundred cells.
D. The blastocyst remains free for several days in the uterus.

1.1.8 When a mouse with white fur was crossed with a mouse with black fur, the F1 generation had grey fur. What ratios of phenotypes could be expected in the F2 generations.

A. 50% grey, 25% white, 25% black
B. 75% white, 25% black
C. All grey
D. 50% white, 50% black

1.1.9 Which feature of the DNA molecule listed below is NOT always the same?

A. The order of the bases on a single chain of the molecule
B. The arrangement of the sugar-phosphate groups
C. The pairing of adenine with thymine and guanine with cystosine
D. The weak hydrogen bonds between the bases (9 x 2) (18)

1.2. Give the correct biological term for each of the following descriptions. Write only the term next to the question number.

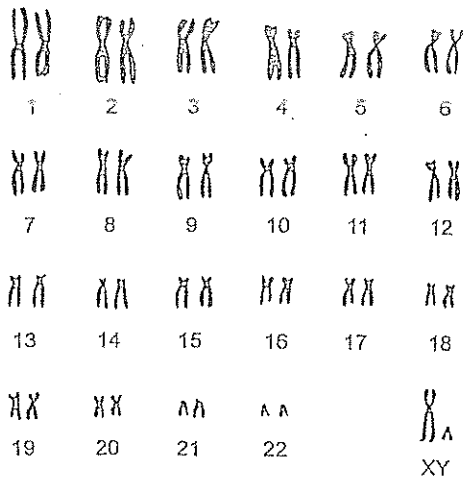
1.2.1 A pair of homologous chromosomes involved in crossing over
1.2.2 Non separation of chromosomes or chromatids during meiosis
1.2.3 Production of offspring that are born helpless, unable to move or feed by themselves
1.2.4 Chromosome condition describing the presence of two sets of chromosomes in each cell
1.2.5 Undifferentiated cells that have the potential to differentiate to form any tissue or organ in the body
1.2.6 The production of genetically identical offspring, using biotechnology
1.2.7 Nervous system made up of the brain and the spinal cord
1.2.8 The formation of sperm cells
1.2.9 The structure at the tip of a sperm cell containing enzymes and which makes contact with the egg cell during fertilization (9 x 1) (9)

1.3 Indicate whether each of the statements in COLUMN 1 applies to A only, B only, both A and B or none of the items in COLUMN II. Write A only, B only, both A and B, or none next to the question number. (1.3.1 to 1.3.6)

	COLUMN I	COLUMN II
1.3.1	Used to artificially produce organisms with characteristics that are useful to humans	A Biotechnology B Selective Breeding
1.3.2	A genetic disorder that is sex-linked	A Haemophilia B Albinism
1.3.3	Results when a diploid cell divides during meiosis	A Four diploid cells B Four haploid cells
1.3.4	Whole chromosomes move towards the poles of the cell	A Anaphase I B Telophase I
1.3.5	Two different alleles of a gene are equally expressed in the phenotype	A Incomplete dominance B Complete dominance
1.3.6	An organisms complete set of DNA	A Genotype B Genome

(6 x 2) (12)

1.4 The diagram below represents a karyotype of human cell.



1.4.1 How many chromosomes are present in the karyotype? (1)

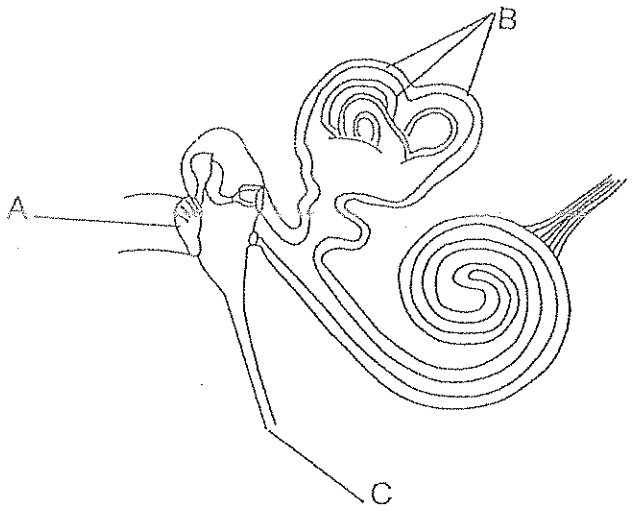
1.4.2 Is this karyotype that of a man or a woman? (1)

1.4.3 Give a reason for your answer to QUESTION 1.4.2. (2)

1.4.4 State how the karyotype of a person with Down syndrome would be different from that of the Karyotype shown in the diagram above. (2)

[6]

1.5 Study the following diagrams and answer the questions that follow:



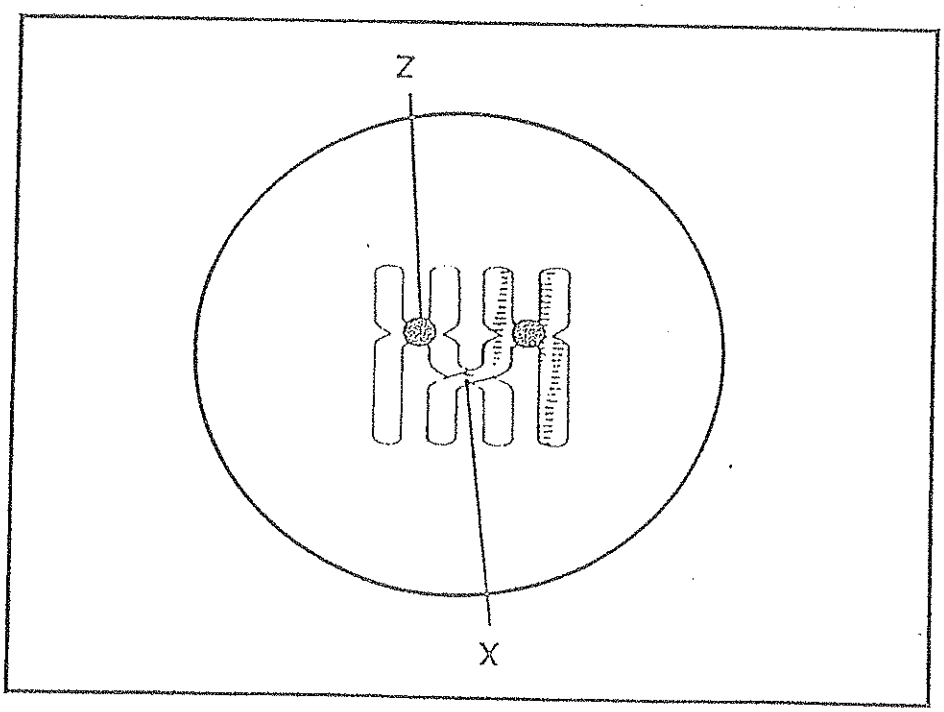
1.5.1. Identify Parts A, B and C. (3)
1.5.2. Explain fully the function of part B. (2)
[5]

TOTAL SECTION A: 50 MARKS

SECTION B

QUESTION 2

2.1 The diagram below shows crossing over in a pair of homologous chromosomes.

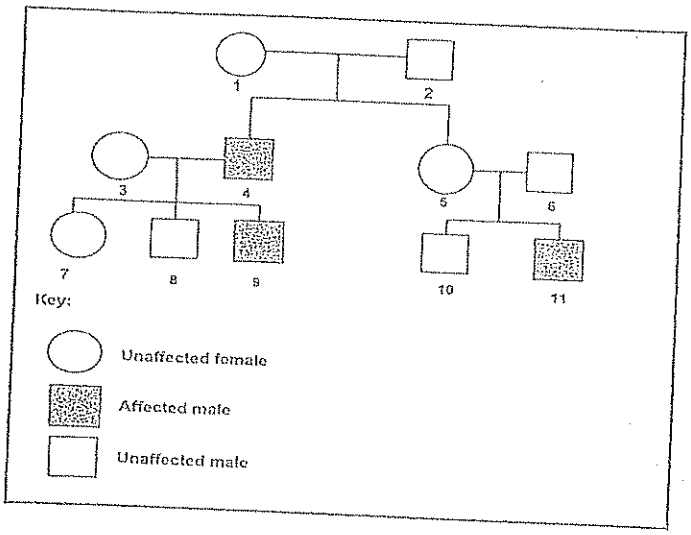


2.1.1 Identify the point X and part Z respectively. (2)
2.1.2 Give ONE observable reason why the chromosomes above are regarded as homologous. (1)
2.1.3 Give ONE reason why crossing over is important. (1)
2.1.4 If a mouse egg cell contains 20 chromosomes, how many chromosomes will there be in its skin cell. (1)
[5]

2.2 In guinea pigs black coat colour (B) and short hair(S) are dominant alleles. White coats and long hair are recessive. Show in a dihybrid genetic cross the result of a cross between a homozygous male black guinea pig with short hair and a homozygous white female guinea pig with long hair. You must use a punnet square.

(9)

2.3 Use the pedigree diagram below and answer the questions that follow:



2.3.1 How many family members not affected by haemophillia are carriers? (1)

2.3.2 Explain why this disorder affects mostly males in the family (3)

2.3.3 Use the possible alleles X^h, X^h and Y to determine the genotype of the following:

(a) individual 1

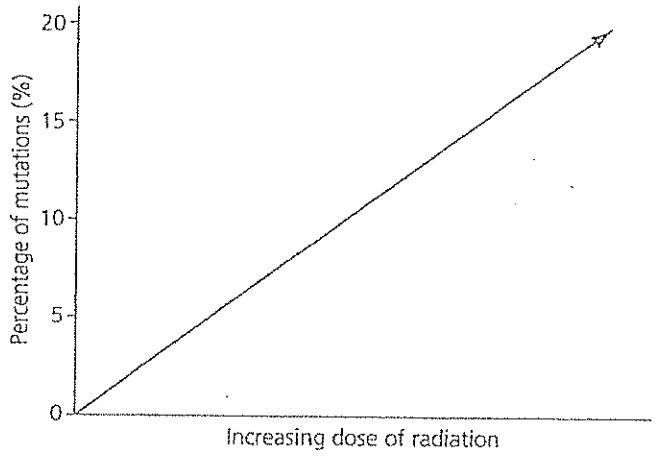
(b) individual 4 (2)

2.3.4 What are the chances of individual 10 and his wife, who is a carrier (not shown in pedigree) , having a Child who is a boy and who is affected? (2)

2.3.5 Give TWO reasons why individual 9 and his partner should undergo genetic counseling before starting a Family. (2)

[12]

2.4. Study the graph below and answer the questions that follow:
Some scientists have investigated mutations in a species of blackfly. They exposed the blackfly to X-ray Radiation. The graph represents the result obtained.



2.4.1 What is a mutation? (2)
2.4.2 Refer to the graph above. What is the connection between the does of X-ray radiation and the Percentage of mutations (1)
2.4.3 Name two other causes of mutations. (2)
[5]