

Student Name: \_\_\_\_\_



# **BIOLOGY 2020**

## **Unit 2**

### **Key Topic Test 3 – Genomes, genes, alleles and chromosomes**

Recommended writing time\*: 45 minutes

Total number of marks available: 45 marks

## **QUESTION BOOK**

\* The recommended writing time is a guide to the time students should take to complete this test. Teachers may wish to alter this time and can do so at their own discretion.

**Conditions and restrictions**

- Students are permitted to bring into the room for this test: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the room for this test: blank sheets of paper and/or white out liquid/tape.
- A calculator is not permitted in this test.

**Materials supplied**

- Question and answer book of 10 pages.

**Instructions**

- Print your name in the space provided on the top of the front page.
- All written responses must be in English.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the room for this test.**

**SECTION A – Multiple-choice questions**

**Instructions for Section A**

Select the response that is correct for the question. A correct answer scores 1 mark, and an incorrect answer scores 0. Marks are not deducted for incorrect answers. If more than one answer is selected for any question, no mark will be given for that question.

**Question 1**

Chromosomes are made of a substance called DNA. This DNA is a polymer molecule that consists of three main parts. These parts are:

- A. a deoxyribose sugar, a nitrogenous base and a phosphate group
- B. a ribose sugar, a nitrogenous base and a phosphate group
- C. a deoxyribose sugar, a nitrogenous base and a phospholipid
- D. a ribose sugar, a nitrogenous acid and a phosphate group

**Question 2**

DNA is a double stranded molecule. What enables the two strands to remain held together?

- A. ionic bonds
- B. base pairing
- C. peptide bonds
- D. hydrogen bonds

**Question 3**

A sequence of bases on a single strand of DNA is,

**A T T C G C**

What would the sequence on the complementary DNA strand be?

- A. U A A G C G
- B. T A A C G C
- C. U C C G C G
- D. T A A G C G

**Question 4**

A DNA molecule is a long sequence of bases. These bases define the characteristics that an organism will develop. The shorter sequences within the DNA molecule that define a particular characteristic is called a:

- A. allele
- B. gene
- C. chromosome
- D. genome

**Question 5**

A normal eukaryotic body (somatic) cell contains 2 copies of each chromosome. Such a cell would be called:

- A. haploid
- B. diploid
- C. polyploid
- D. aneuploid

**Question 6**

Genomics is best defined as:

- A. the study of all the chromosomes of an organism.
- B. the study of all the proteins and their interactions produced by an organism.
- C. the study of all the DNA in a haploid cell of an organism.
- D. the comparison of the DNA in two different species.

**Question 7**

A characteristic such as the ability to tongue roll is genetically controlled. There are two different forms of this characteristic, either you can tongue roll or you cannot tongue roll. The correct term for alternative forms of a characteristic such as this is,

- A. an allele
- B. a gene
- C. a chromosome
- D. a mutation

**Question 8**

A pair of homologous chromosomes have:

- A. the same DNA
- B. different numbers of genes
- C. the same alleles
- D. genetic information from each of the parents

**Question 9**

Non disjunction of the chromosomes during meiosis can lead to abnormal chromosome numbers in an individual. Which of the following is an example of this?

- A. Klinefelter's syndrome
- B. breast cancer
- C. traumatic stress disorder
- D. autism

**Question 10**

The banding that is typical to each chromosome helps:

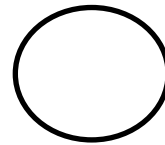
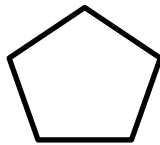
- A. indicate the structure of the chromosome
- B. locate the position of a gene
- C. determine if that chromosome is from the mother or father
- D. determine the number of cytosine bases in the chromosome

**SECTION B- Short-answer questions**

**Instructions for Section B**  
Answer all parts of the question in the space provided. Write using black or blue pen.

**Question 1**

The following images represent the three components of a nucleotide in a DNA molecule.



- a. Name what each shape represents and redraw them in the space below to show how they are arranged in a nucleotide.

4 marks

- b. Add to your drawing above, to show how the nucleotide on the opposite strand of DNA is attached.

1 mark

- c. Name the bases that are found in a DNA molecule (full name required).

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4 marks

**d.** Describe what is meant by complementary base pairing in relation to a DNA molecule.

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2 marks

**e.** What is a significance of complementary base pairing in terms of sequencing the DNA strands?

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1 mark

**f.** Which bases pair together? (Full names not required)

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1 mark

**g.** Compare and contrast the DNA in prokaryotes and eukaryotes.

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2 marks

Total 15 marks

**Question 2**

The Human Genome Project was a major global undertaking and was completed in 2000.

- a. Describe what you understand this project to be about.

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3 marks

- b. Give two examples of how the results of this project have been useful.

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2 marks

2020 BIOLOGY KEY TOPIC TEST

In recent years, the genomes of several organisms have been sequenced and studied as shown below.

Species and Common Name	Estimated Total Size of Genome (bp)*	Estimated Number of Protein-Encoding Genes*
<i>Saccharomyces cerevisiae</i> (unicellular budding yeast)	12 million	6,000
<i>Trichomonas vaginalis</i>	160 million	60,000
<i>Plasmodium falciparum</i> (unicellular malaria parasite)	23 million	5,000
<i>Caenorhabditis elegans</i> (nematode)	95.5 million	18,000
<i>Drosophila melanogaster</i> (fruit fly)	170 million	14,000
<i>Arabidopsis thaliana</i> (mustard; thale cress)	125 million	25,000
<i>Oryza sativa</i> (rice)	470 million	51,000
<i>Gallus gallus</i> (chicken)	1 billion	20,000-23,000
<i>Canis familiaris</i> (domestic dog)	2.4 billion	19,000
<i>Mus musculus</i> (laboratory mouse)	2.5 billion	30,000
<i>Homo sapiens</i> (human)	2.9 billion	20,000-25,000

c. What units are used to measure the sizes of these genomes?

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1 mark

d. Does a large genome indicate a large number of coding genes? Explain your response, providing evidence for your answer from the table.

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3 marks

Total 9 marks



**Question 3**

Read the following statement,

*All autosomes are chromosomes but not all chromosomes are autosomes.*

- a. Indicate if this statement is TRUE or FALSE. Circle your choice.

1 mark

- b. Explain the reasoning behind your choice.

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4 marks

Total 5 marks

**Question 4**

The following image is a karyotype produced during an antenatal test at 12 weeks on a foetus.



The mother was very keen to know if the gender of the foetus could be determined.

- a. Explain what you can tell the mother at this early stage about gender.

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2 marks

- b. Circle the information on the karyotype that enabled you to answer part a).

1 mark

- c. Explain what other information that you could give to the mother based on this karyotype.

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2 marks

- d. Circle the information on the karyotype that enabled you to answer part c).

1 mark

Total 6 marks

**END OF KEY TOPIC TEST**