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Stage 5 Science: Genetics and Evolutionary Change **Homework Sheet 1**

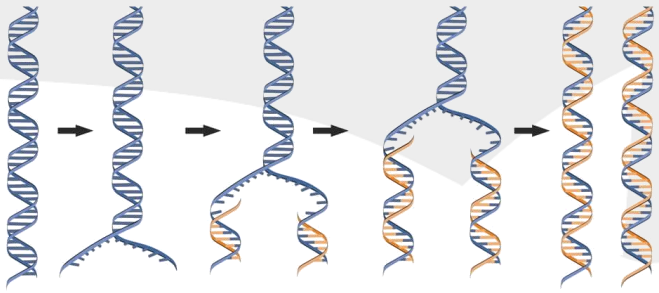
Multiple Choice

1. Which set of chemicals is required to synthesise a protein?
   (a) Nucleus, DNA, Codons
   (b) Codons, Cell membrane, DNA
   (c) DNA, Genes, Amino acids
   (d) Enzymes, Chromosomes, Muscles

2. A section of DNA molecule is 30 bases long. What is the maximum number of amino acids this would code for?
   (a) 6 amino acids
   (b) 15 amino acids
   (c) 20 amino acids
   (d) 10 amino acids

3. Which of the following statements is true?
   (a) The genes in homologous chromosomes are different
   (b) The diploid number for human skin cells is 46
   (c) A sperm cell carries two sex chromosomes
   (d) Chromosome 12 is a sex chromosome

4. Before a cell divides, each cell must duplicate its entire DNA sequence. The process of DNA replication is shown in the following diagram.



Four steps are listed below.
   i. Copies of each strand are generated to form two double-stranded DNA molecules
   ii. Each strand of the original molecule acts as a template to create a new complementary DNA
   iii. DNA molecule unravels into two strands
   iv. The rules of complementary base pairing are following adenine (A) to thymine (T) and guanine (G) to cytosine (C)

What is the correct sequence for these steps?
   (a) iv, ii, iii, i
   (b) i, iii, iv, ii
   (c) iii, iv, ii, i
   (d) iii, ii, iv, i

Fundamental Questions

1. Define the following terms:

a) DNA (1 mark)

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b) Gene (1 mark)

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c) Codon (1 mark)

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d) Chromosome (1 mark)

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e) Homologous pair (1 mark)

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f) Diploid cells (1 mark)

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g) Haploid cells (1 mark)

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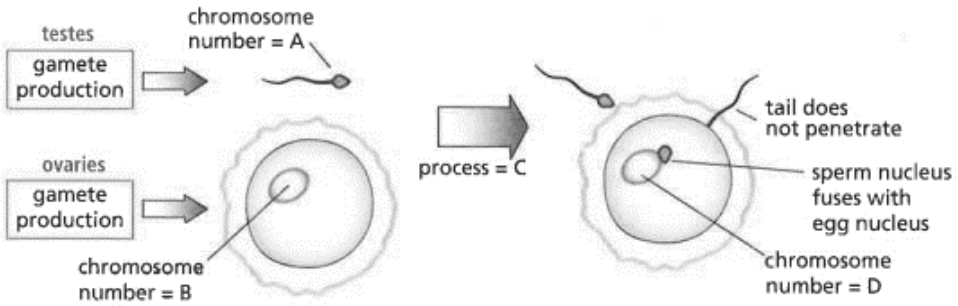
2. The following diagram summarises some of the stages in sexual reproduction in a fruit fly. The diploid chromosomal number of a fruit fly is 8. Process C is fertilisation which involves the union of sperm and egg to form a zygote.

a) Identify the numbers that will replace the letters A, B and D (3 marks)



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b) Justify your answer in part a) (3 marks)

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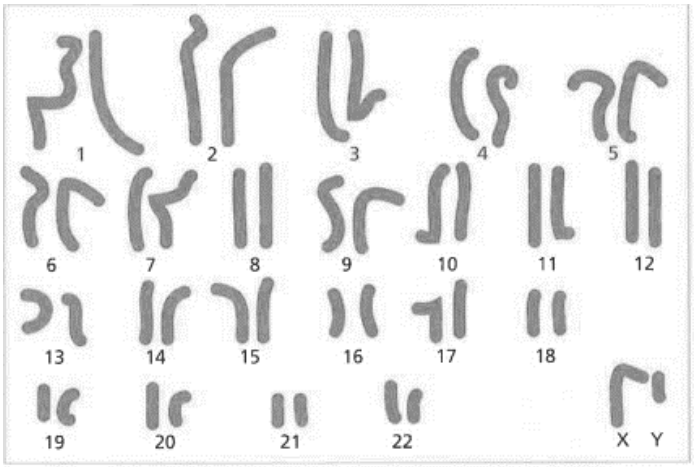
3. The following diagram shows the chromosomes present in the nucleus of an organism. They have been sorted into homologous pairs.



a) How can we determine that this karyotype is for a human being? (1 mark)

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Two chromosomes are labelled X and Y.

b) What type of chromosomes are these? (1 mark)

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c) Is this individual male or female? Explain (2 marks)

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d) What is the haploid number for humans? (1 mark)

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4. Describe 3 functions of DNA replication (3 marks)

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5. Proteins are made of long chains of amino acids. They join together like beads on a string. The order of the amino acids is determined by the order of groups of three nitrogenous bases on the DNA strand (codons). These nitrogenous bases are adenine (A), cytosine (C), guanine (G), and thymine (T). For example, three cytosine bases (CCC) codes for the amino acid proline. CCA and CCG also code for the same amino acid.
The table gives some amino acids coded by each group of three nitrogenous bases.

CCC CCA CCG	**Proline**	CAC	**Histidine**	CAA CAG	**Glutamine**
CGC CGA CGG	**Arginine**	ACA ACC ACG	**Threonine**	GGC GGA GGG	**Glycine**

Use the table to answer the following questions.

a) Which codon sequence codes for Histidine? (1 mark)

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b) A sequence of three nitrogenous bases is GGA. What amino acid does this code for? (1 mark)

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c) Jason: "As long as the three nitrogenous bases are there, the order in which they are found, doesn't matter; the same amino acid will be coded for"
Lisa: "No, it's not just the nitrogenous bases that are present, it's also their order that is important"

Assess the accuracy of Jason and Lisa's statements and determine who is correct with reference to the table to support your answer (3 marks)

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The sequence of nitrogenous bases found on a DNA strand is.

"CGC CCG ACA ACG CAG"

d) Determine the nitrogenous bases found on the complementary DNA strand (1 mark)

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e) Determine which amino acids are coded for by the original DNA strand (1 mark)

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Extension Questions

1. The table below shows the number of chromosomes in the body cells of some organisms.

Species of Living Things	Number of Chromosome in each body cell
Chimpanzee	48
Fruit Fly	8
Koala	16
Onion	16
Shrimp	254
Pig	40
Platypus	52
Sheep	54

a) Construct a column graph for the data in the table above. (4 marks)

b) Identify which species body cells have:

i) The highest number of chromosomes (1 mark)

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ii) The smallest number of chromosomes (1 mark)

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iii) The same number of chromosomes (1 mark)

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c) Does the number of chromosomes reflect the intelligence of an organism? Justify your answer with reference to the table (3 marks).

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2. Construct a flow chart to outline the discovery of DNA, making specific reference to FIVE scientists and their contributions (5 marks)

3. Construct a flowchart to outline the process of DNA replication (4 marks)