**Extended Response: DNA**

1. **a) What is DNA? How does it form chromosomes? Describe the structure of DNA in as much detail as possible. (14 marks)**

**b) List the differences between DNA and RNA. (4 marks)**

1. **In cells containing DNA, most of the DNA is found within the nucleus.**
2. **What other organelle contains DNA? Where is this organelle found? (1 mark)**

1. **What is this DNA called? What abbreviation is given to this type of DNA? (2 marks)**
2. **How does this form of DNA differ from DNA found in the nucleus? (3 marks)**

**3) a) Protein synthesis involves two stages, transcription and translation. Describe the main steps in transcription. (6 marks)**

**b) Briefly explain the term gene expression, discuss its modifications and list two changes that can affect the likelihood of gene expression. (7 marks)**

1a. What is DNA?

(1)Deoxyribonucleic acid

1a. How does it form chromosomes?

(1) consists of strands that bind to proteins called histones

(1) DNA + histones create chromatin

(1) Chromatin super coiled to form chromosomes

1a. What is the structure of DNA?

(1) 2-3 meters in length, 0.000 002mm thick

(1) Shaped as a double helix

(1) Made of building blocks called nucleotides

(3) Nucleotides are made of a **phosphate molecule, sugar molecule (deoxyribose)** and a **nitrogen base**

(2) Base pairs of adenine and thymine, cytosine and guanine

(2) Pairs held together by hydrogen bonds

(A-T 2 Hydrogen, G-C 3 Hydrogen)

1b. Difference between DNA and RNA

(4)

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| **DNA** | **RNA** |
| Double stranded | Single stranded |
| Thymine binds to Adenine | Uracil binds to Adenine |
| Deoxyribose sugar molecule in backbone | Ribose sugar in backbone |
| Function: storage of genetic material | Function: transfer genetic code to make proteins |

2a. OTHER ORGANELLE CONTAINING DNA

(1) Mitochondria found in cytoplasm

2b. NAME OF DNA

(1) Mitochondrial DNA

(1) mtDNA

2c. DIFFERENCES IN DNA AND mtDNA

(3)

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| **DNA** | **mtDNA** |
| Very long strands bound to proteins (histones) | Small circular molecules not bound to proteins |
| 46 molecules in each cell | 5-10 molecules in each mitochondrion |
| 19,000 – 20,000 in the human genome | 37 genes, all essential for the mitochondrion to function properly  (24 for making tRNA, 13 for enzymes) |

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| 3a. TRANSCRIPTION |
| (1)DNA – transcribed to mRNA  (1)mRNA is able to move out of the nucleus (DNA is too big) |
| (1)Helicase unzips DNA |
| (1)RNA Polymerase copies base pairs |
| (1)Mention examples of base pairs – AT and CG (accept AU) |
| (1)Strand copied is known as the template strand |
|  |
| 3b. GENE EXPRESSION |
| 1. Gene expression:   Process of copying DNA into mRNA and then translating the message at the ribosome to produce a series of amino acids of which are determined by the mRNA sequence. This amino acid sequence forms a protein |
| 1. Chromatin – Acetylation is the addition of an acetyl group which activates genes (1) – Methylation – Cytosine adjacent to guanine inhibits genes (1) |
| 1. Environmental agents / stimuli – Stress, nutritional factors, toxins/drugs (any two) (1 each) |