DNA, RNA, TRANSCRIPTION, TRANSLATION AND DNA REPLICATION

DNA is a polymer of nucleotides.
   Each nucleotide is formed of 3 molecules:
   1 A Deoxyribose sugar
   2 A Phosphate
   3 One of any 4 N-bases
      a) Adenine b) Guanine c) Cytosine d) Thymine
DNA molecule has:
   a) The sides of the ladder are formed of sugar and phosphate molecules forming 2 anti-parallel
      chains 5→3
      3←5    Rungs are formed of N-bases held together by H-bonds.
            Adenine and thymine form 2 H-bonds. Cytosine and guanine form 3 H-bonds
   b) The 2 chains are twisted around each other, resulting into
   c) A double-helix

RNA is a single chain molecule. RNA is a polymer of nucleotides. Main chain is formed of Ribose sugar
and phosphates. Side-chains are formed of N-bases.
RNA has Uracil instead of Thymine. The other 3 N-bases, Adenine, Guanine and Cytosine are same.

3-kinds of RNA: 1 messenger RNA or m-RNA 2 ribosomal RNA or r-RNA 3 transfer RNA or t-RNA

m-RNA carries information from DNA (Gene) to ribosomes about the arrangement of amino-acids in
protein. A triplet of N-bases is called CODON.

r-RNA is formed inside nucleolus and combines with ribosomal proteins to form 2 halves of Ribosomes
called larger and smaller subunits.

t-RNA picks up specific amino-acid from cytoplasm and carries it to ribosomal—m-RNA complex. A
triplet of N-bases is called ANTI-CODON.

Transcription: Only one chain of DNA acts as template.
   AAT CGA CCC AAA TCT -------- DNA
   UUA GCU GGG UUU AGA -------- m-RNA
Translation: consists of 3 steps. 1 Initiation, 2 Elongation, 3 Termination.

Transcription                    Translation
DNA -----------------          m-RNA ------------------ → polypeptide (protein)
Initiation takes place when m-RNA, smaller subunit of ribosome and t-RNA with 1st amino-acid, combine with one another. Then larger subunit also combines to complete the complex. The chain initiator codon is AUG and 1st t-RNA carries amino-acid Methionine and has the anti-codon UAC.

Elongation consists of adding amino-acids to polypeptide chain. 2 t-RNA’s are attached to larger subunit. The first t-RNA carries the chain already synthesized. 2nd t-RNA, with complementary anti-codon to the next codon, carries the amino-acid to be added to the chain. A peptide bond is formed between last amino-acid, at the base of chain already formed, and the new amino-acid. The chain is shifted to new t-RNA and Ribosome now moves one codon forward. These steps are repeated till the complete chain is synthesized.

Termination is achieved by a releasing factor. It occupies the last codon, called terminator codon (UGA, or UAA or UAG). It causes the separation of 2 ribosomal subunits, m-RNA, releasing factor and polypeptide chain.

The polypeptide chain usually forms an alpha-helix and gets folded in a unique way to form 3 dimensional molecule called protein.

DNA-replication: Both chains separate from each other (Helicase enzyme) and act as template. 2 new chains are synthesized. Each daughter DNA molecule has one new and one old chain. This is called semi-conservative replication. DNA-polymerase is used to synthesize fragments of DNA from nucleotides. DNA-ligase seals the fragments together.