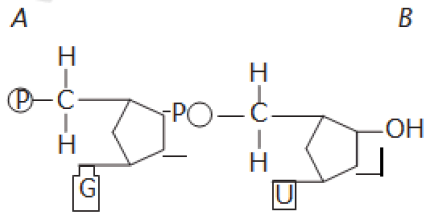
2 MARKS EACH

1. Answer the following questions based on the dinucleotide shown below

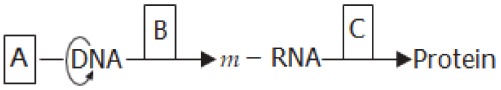


(a) Name the type of sugar guanine base is attached to.

(b) Name the linkage connecting the two nucleotides.

(c) Identify the 3' end of the dinucleotide.

2. Look at the sequence shown and mention the events A, B and C.



What does central dogma state in molecular biology? How does it differ in some viruses?

3. (a) Why is DNA a better genetic material when compared to RNA?

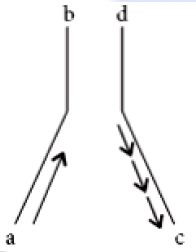
(b) List any four properties of a molecule to be able to act as a genetic material.

4. It is established that RNA is the first genetic material. Explain giving three reasons.

5. (a) Name the source of energy for the replication of DNA.

(b) Why is it not possible for an alien DNA to become part of chromosome anywhere along its length and replicate normally?

6. Mention the polarity of the DNA strands a □ b and c □ d shown in the given replicating fork.



7. (a) State the dual roles of deoxyribonucleoside triphosphates during DNA replication.

(b) State the difference between the structural genes in a transcription unit of prokaryotes and eukaryotes.

8. A template strand is given below. Write down the corresponding coding strand and the m-RNA strand that can be formed, along with their polarity.

3' ATGCATGCATGCATGCATGCATGC 5'

9. Following are the features of genetic codes. What does each one indicate?

(a) Stop codon;

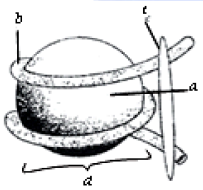
(b) Unambiguous codon;

(c) degenerate codon; (d) Universal codon.

10. (a) Name the scientist who suggested that the genetic code should be made of a combination of three nucleotides.
    (b) Explain the basis on which he arrived at this conclusion.
11. (a) Explain the structure of a tRNA and state why it is known as an adaptor molecule.
    (b) Differentiate between 'unambiguous' and 'degenerate' codons.
    (c) Write two functions of the codon AUG.
12. What is aminoacylation? State its significance.
13. State the functions of ribozyme and release factor in protein synthesis respectively.
14. Where does peptide bond formation occur in a bacterial ribosome and how?
15. What would happen if histones were to be mutated and made rich in amino acids aspartic acid and glutamic acid in place of basic amino acids such as lysine and arginine?
16. Recall the experiment done by Frederick Griffith. If RNA, instead of DNA was the genetic material, would the heat killed strain of Streptococcus have transformed the R- strain into virulent strain? Explain your answer
17. What are the functions of (a) methylated guanasine cap, (b) poly-A "tail" in a mature on RNA?

3 MARKS EACH

1. (a) A DNA segment has a total of 2,000 nucleotides, out of which 520 are adenine containing nucleotides. How many purine bases this DNA segment possesses?
    (b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer
2. The base sequence in one of the strands of DNA is TAGCATGAT.
    (a) Give the base sequence of its complementary strand.
    (b) How are these base pairs held together in a DNA molecule?
    (c) Explain the base complementarity rules. Name the scientist who framed this rule.
3. (a) What is this diagram representing for ?



    (b) Name the parts a, b and c.
    (c) In the eukaryotes the DNA molecules are organized within the nucleus.
    (d) How is the DNA molecule organised in a bacterial cell in absence of nucleus?
4. (a) How are the following formed and involved in DNA packaging in a nucleus of a cell?

    Histone octamer, Nucleosome, Chromatin

    (b) Differentiate between euchromatin and heterochromatin.
5. (a) Explain the chemical structure of a single stranded polynucleotide chain.

(b) Describe the salient features of the double- helix structure of DNA molecule.

6. (a) Mention the contributions of the following scientists:
   (i) Maurice Wilkins and Rosalind Franklin
   (ii) Erwin Chargaff
   (b) Draw a double-stranded dinucleotide chain with all the four nitrogen bases. Label the polarity and the components of the dinucleotide

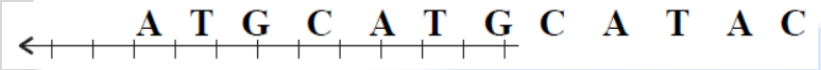
7. Answer the following questions based on Hershey and Chase experiments:
   (a) Name the kind of virus they worked with and why?
   (b) Why did they use two types of culture media to grow viruses in? Explain.
   (c) What was the need for using a blender and later a centrifuge during their experiments?
   (d) State the conclusion drawn by them after the experiments.

8. Write the help of a schematic diagram, explain the location and the role of the following in a transcription unit:

   Promoter, Structural gene, Terminator.

9. (a) What are the transcriptional products of RNA polymerase III?
   (b) Differentiate between 'Capping' and 'Tailing'.
   (c) Expand hnRNA.

10. (a) Construct a complete transcription unit with promotor and terminator on the basis of the hypothetical template strand given below:



   (b) Write the RNA strand transcribed from the above transcription unit along with its polarity.

11. Given below is a part of the template strand of a structural gene:

   TAC CAT TAG GAT

   (a) Write its transcribed mRNA strand with its polarity.
   (b) Explain the mechanism involved in initiation of transcription of this strand

12. (a) Name the enzyme responsible for the transcription of tRNA and the amino acid the initiator tRNA gets linked with.
   (b) Explain the role of initiator tRNA in initiation of protein synthesis.

13. Unambiguous, universal and degenerate are some of the terms used for the genetic code. Explain the salient features of each one of them.

14. (a) Name the scientist who called tRNA as an adaptor molecule.
   (b) Draw a clover leaf structure of tRNA showing the following:

   Tyrosine attached to its amino acid site. Anticodon for this amino acid in its correct site (codon for tyrosine is UAC).

15. Study the mRNA segment given above which is complete to be translated into a polypeptide chain.

(a) Write the codons 'a' and 'b'.

(b) What do they code for?

(c) How is peptide bond formed between two amino acids in the ribosome?

16. (a) List the two methodologies which were involved in human genome project. Mention how they were used.

(b) Expand YAC and BAC and mention what was it used in HGP.

17. (a) Expand 'SNPs'. What is its significance in HGP?

(b) Expand VNTR. How VNTR is different from 'probe'?

18. Compare the transcriptions in prokaryotes and eukaryotes.

5 MARKS EACH

1. (a) Write the conclusion drawn by Griffith at the end of his experiment with Streptococcus pneumoniae.

(b) How did O. Avery, C. MacLeod and M. McCarty prove that DNA was the genetic material? Explain.

2. How did Hershey and Chase prove that DNA is the hereditary material? Explain their experiment with suitable diagrams.

3. (a) What did Meselson and Stahl observe when they cultured E. coli in a medium containing $15NH_4Cl$ for a few generations and centrifuged the content?

(b) When they transferred one such bacterium to the normal medium of NH_4Cl and cultured for 2 generations?

4. What did Meselson and Stahl conclude from this experiment? Explain with the help of diagrams.

5. (a) Explain the process of DNA replication with the help of a schematic diagram.

(b) In which phase of the cell cycle does replication occur in eukaryotes? What would happen if cell-division is not followed after DNA replication?

6. (a) Describe the process of transcription in bacteria.

(b) Explain the processing the hnRNA needs to undergo before becoming functional mRNA of eukaryotes.

7. (a) Explain the process of Protein synthesis in prokaryotes?

(b) How the Protein synthesis in prokaryotes are different from eukaryotes.

8. Which methodology is used while sequencing the total DNA from a cell? Explain it in detail

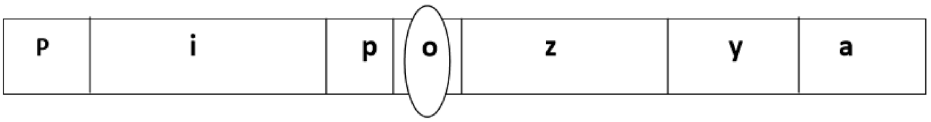
9. Write the different component of a lac –operon in E. coli .Explain its expression in presence and absence of lactose.

10. (a) How is DNA fingerprinting done? Name any two types of human samples which can be used for DNA fingerprinting. Explain the process sequentially?

(b) Mention any two situation when the technique is useful.

11. Observe the representation of genes involved in the lac operon given below -

(a) Identify the region where the repressor protein will attach normally.



(b) Under certain conditions repressor is unable to attach at this site. Explain.

(c) If repressor fails to attach to the said site what products will be formed by z, y and a?

(d) Analyze why this kind of regulation is called negative regulation.