

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI - HYDERABAD CAMPUS
FIRST SEMESTER 2022-23
General Biology (BIO F111)
Evaluation Component: Mid Semester Examination (Closed Book)

Date: 05-01-2023

Marks: 60 (Weightage: 30%)

Duration: 90 minutes

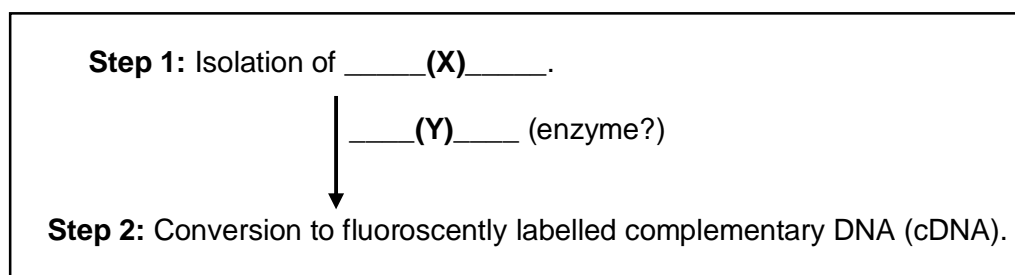
Instructions: 1. Write your **NAME, ID, TUTORIAL SECTION NO.** and **TUTORIAL INSTRUCTOR'S NAME** on the answersheet. 2. This question paper has a total of 10 questions on 2 printed pages. 3. Answer all questions. Parts of the same question should be answered together. Jumbled answers may not be evaluated. 4. Write your answers using a **PEN** only and do not scribble on the question paper. 5. Use the last page of your answersheet for rough work. 6. In questions requiring justification, marks would be awarded only if you give proper justification.

Q1. If the percent of 'cytosines' in a prokaryotic mRNA is 20%. Calculate the percentage of 'guanosines' in the template/non-coding strand of the gene. Justify your answer. **(2M)**

Q2. Scientists who study gene regulation often want to determine which genes in the entire genome are expressed in a cell under a particular condition or time.

(A). Name the technique (genome-wide) they often use to visualize gene expression. **(1M)**

(B). Steps involved in the above genome-wide technique are as follows:



Based on the information provided above, fill in the blanks:

(i). What is isolated from the cell **(X)** to study gene expression? **(1M)**

(ii). What is the enzyme **(Y)** used in the synthesis of fluorescently labeled cDNA? Also explain what else is used to synthesize fluorescent cDNA? **(1+1=2M)**

Q3. Certain small single-stranded RNA molecules bind to complementary sequences on mRNA to regulate the expression of genes.

(A). What are these small single-stranded RNA molecules called? **(1M)**

(B). What is their role in gene regulation and how do they execute their function? **(3M)**

(C). Explain how they can be used to control gene expression in human cells. **(2M)**

Q4. Mutation within the proto-oncogene gene makes it an oncogene.

(A). What is the normal role of proto-oncogene in healthy cells? **(2M)**

(B). Explain the consequence of having multiple copies of a proto-oncogene in a cell. **(1M)**

(C). What is the name of another group of genes, which are commonly mutated in cancer? What is the function of the protein encoded by this class of genes? **(1+1=2M)**

(D). Predict the consequence of a silent mutation in the proto-oncogene on the proliferation of a given cell. Justify your answer. (No marks will be awarded without justification). **(2M)**

Q5. Name the organic molecule produced as the end product of glycolysis. How many of them are produced per glucose molecule? **(2M)**

Q6. Chloroplast is the primary organelle responsible for photosynthesis in plants. Listed below are various steps/events of photosynthesis. For each step/event, mention where exactly in the chloroplast it takes place and the mechanism involved in the process. **[(1+2)x3=9M]**

Step/event	Site of occurrence in the chloroplast (1M)	Mechanism (2M)
ATP generation		
NADPH generation		
Carbon fixation		

Q7. Based on the information provided, fill in the gaps **(A to H)** in the table given below. **(1X8=8M)**

Organelle/Cell structure	Present in _____ cells. (Plant/Animal/Bacterial) Give all correct options. No marks for partial or incomplete answers.	Function
____(A)____	____(B)____	Protein synthesis (present on surface of rough ER)
____(C)____	Plant and animal	Citric Acid Cycle
Lysosome	____(D)____	____(E)____
____(F)____	All three	Regulates entry and exit of molecules into and out of the cell.
Flagella	____(G)____	____(H)____

Q8. (A). Explain the mechanism through which prions cause disease. **(3M)**

(B). Assume that evolution on earth has led to the increase in amino acid number to 147 instead of 20 and increase in types of nitrogenous bases to 12. The transcription and translation still occur in the same manner. If the number of nitrogenous bases per DNA codon in evolved species is 3, then will 12 nitrogenous bases be enough to code for the 147 amino acids? No marks without justification. **(5M)**

Q9. (A). A mRNA, whose coding sequence is 426 nucleotides in length, upon translation produces a protein named 'Z'. Calculate the number of amino acids present in the 'Z' protein. No marks without justification. **(3M)**

(B). Briefly describe in 2-3 sentences, the role of each of the following in the process of gene expression. Transcription factor; Anticodon; Silencer; Terminator; Promoter; Initiator tRNA **(1X6=6M)**

Q10. Answer the following questions. **(1x5=5M)**

(A). Name the monomeric unit of nucleic acid.

(B). What is the name of the bond between the monomeric units of a protein?

(C). Which organelle apart from nucleus, houses DNA in a yeast cell?

(D). Which type of cellular transport requires ATP?

(E). Where does glycolysis take place in a eukaryotic cell?

*****ALLTHE BEST*****