

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI - HYDERABAD CAMPUS

FIRST SEMESTER 2022-23

GENERAL BIOLOGY (BIO F111)

COMPREHENSIVE EXAMINATION: PART-II (OPEN BOOK)

DATE: 13-02-2023

MARKS: 40 (WEIGHTAGE: 20%)

TIME (PART-II): 2 HOURS

Read the following instructions carefully: 1. Write your **NAME, ID, TUTORIAL SECTION NO.** and **TUTORIAL INSTRUCTOR'S NAME** on the answersheet. 2. This question paper has a total of 8 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. (A) When making pineapple yoghurt dip, if freshly cut pineapple is added to the sweetened yoghurt, the dip starts to turn bitter within a few minutes. However, when the pineapple pieces are boiled before adding to the yoghurt, no bitterness develops. As a student of General Biology, briefly describe the biochemical reason behind this phenomenon. **(2M)**

(B) What is the fate of lactate produced in muscle cells in anaerobic conditions? **(2M)**

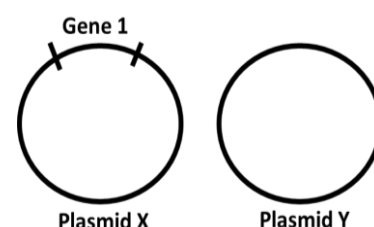
Q2. (A) 'Water gushing through the gates of a dam is used for energy production'. Explain how a similar process is used inside the eukaryotic cells to produce energy. **(4M)**

(B) You would have often seen in old Bollywood movies, that very often when chased by a police officer, the villain would consume cyanide and die within a few minutes. As a student of General Biology, describe briefly the mechanism by which cyanide causes death. **(2M)**

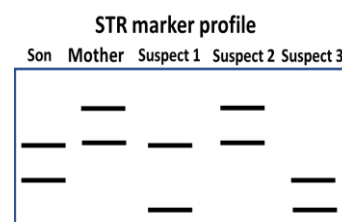
Q3. ATGGGCCGATTACATAGTGGGTAACCCGAG

The above given DNA sequence is coding strand of a gene. Read the sequence from left to right direction. For this: **(A)** Write mRNA sequence. **(B)** Write the amino acid sequence. **(2+2=4M)**

Q4. (A) In the given figure, plasmid X is shown to have Gene 1 which needs to be transferred to plasmid Y. Write down the steps and the enzymes involved in transferring Gene 1 from plasmid X to Y. Assume that the plasmids have all the DNA sequence features that are required for transferring Gene 1. **(3M)**



(B) Assume that you carried out a forensic analysis of three suspects to find the biological father of a son using short tandem repeat (STR) analysis. The diagram given on the right side shows the STR marker profile of the son, the mother and three suspects. Based on the given data, identify the biological father of the son supported by justification. **(3M)**



Q5. This is a classic data set on wing coloration in the scarlet tiger moth (*Panaxia dominula*). Coloration in this species had been previously shown to behave as a single-locus, two-allele system with incomplete dominance. Data for 1612 individuals are given below:

White-spotted (AA) = 1469; Intermediate (Aa) = 138; Little spotting (aa) = 5

Calculate the allele frequencies (p and q). **(2M)**

Q6. An interesting multiple allelic system is encountered in the coat colors of rabbits; 'A' allows full colour to be produced (typical gray rabbit); 'a^{ch}' when homozygous results in a silver-gray color called chinchilla; 'a^{ch}' when heterozygous with alleles lower in the dominance hierarchy, produces light gray fur; 'a^h' produces a white rabbit with black extremities called 'Himalayan'; 'a' fails to produce pigment and lack of any pigment results in albino. The dominance hierarchy may be symbolized as follows: **A > a^{ch} > a^h > a.**

(A) In the table below, mention all the possible genotypes for the given phenotypes. Similarly for the given genotypes, write the phenotype. (Please draw the table in the answer sheet) **(5M)**

#	Phenotype	All possible genotypes
i.	Full color	
ii.		a ^{ch} a ^{ch}
iii.	Light Gray	
iv.	Himalayan	
v.		aa

(B) Determine the genotypic and phenotypic ratios expected in the progenies obtained from mating a full-coloured male 'Aa^{ch}' to light gray female of the genotype 'a^{ch}a'. Draw a Punnet square to derive your answer. **(3M)**

Q7. Person "A" working in a broad day light with surrounding temperature at 37°C, tends to sweat relatively higher compared to a person "B" performing same amount of work in a shade with surrounding temperature at 27°C. All other conditions are same between the two persons.

(i) Among these two, identify the person that produces higher concentration of urea in the urine (amount/unit volume). Justify your answer. **(1+1=2M)**

(ii) Name the two human organs involved in water homeostasis. **(1+1=2M)**

(iii) Name the most appropriate hormone that connects the two human organs in the above and precisely describe its function in the current scenario. **(1+1=2M)**

Q8. (A) Development of immune response to infection/pathogen by adaptive immune cells differ significantly at the initial stage of interaction. Failure of these interactions compromises effective long lasting adaptive immune responses. Name the adaptive immune cell type involved in these functions. **(0.5x4=2M)** (Please draw the table in the answer sheet)

Cell Type	Feature/Function/Outcome
	Antibody generation
	Unique shape of antigen
	Only a fragment of antigen on a body cell
	Three-part interaction

(B) Assume that a patient visited your clinic with the below given symptom.

Symptom: Impaired digestion and absorption of lipid portion of the diet. (Note: Lack of lipid digestive enzymes is ruled out). Identify the potential reason (at least one) for such clinal outcome, based on your understanding of digestive system. **(1+1=2M)**

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