PART A	PART B	TOTAL

NAME: ID

BITS PILANI, K K BIRLA GOA CAMPUS

1st SEMESTER 2024-2025 MID-SEMESTER EXAMINATION 4th-Oct-2024

GENERAL BIOLOGY (BIO F111) TOTAL MARKS: 50 (CLOSED BOOK) DURATION: 90min

Read the instructions for each question carefully. Final answers should be in the question paper itself.

PART A (Maximum time for PART A is 60 min)

Q1. Fill in the blanks **[5M]**

1. Major storage form of carbohydrates in animals_____Glycogen_____

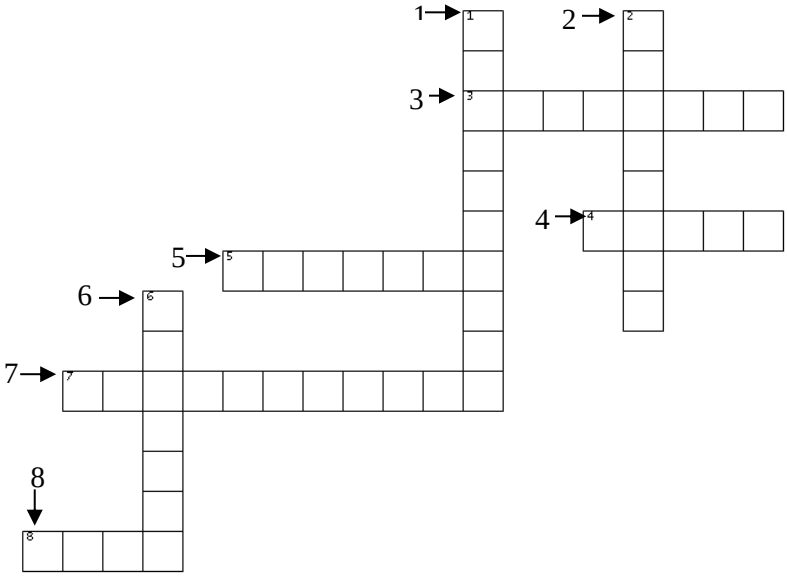
2. Amino acid capable of forming di-sulphide linkage_____Cysteine _____

3. With respect to interaction with water, Phospholipids are an example of_____Amphipathic _____

4. Baleen whales are migratory animals, traveling up to 3,000 miles from their feeding grounds in the cold waters of the Polar regions to their breeding grounds in the warmer waters of tropical regions. When these whales migrate back to the polar regions, in order to maintain the fluidity of the cell membranes, the whale will alter the lipid composition of its cell membranes. What type of changes in the fatty acid profile do you anticipate? _____Unsaturated FA/shorter FA chain_

5. The only polar part of cholesterol is _____OH_____

Q2. Solve the crossword **[4M]**



Clues:

ACROSS

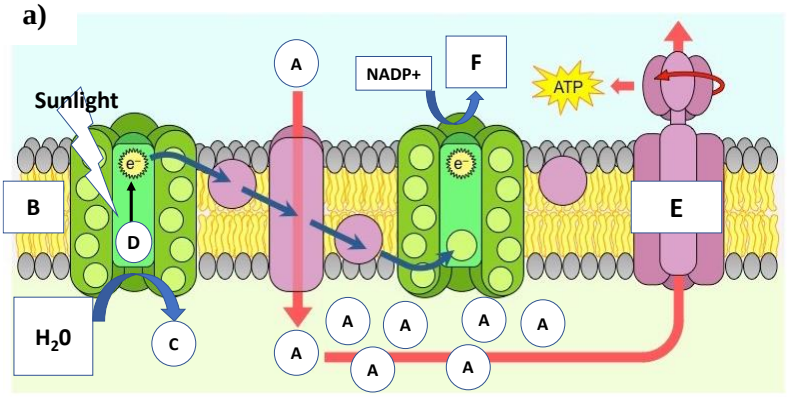
3. I contain both RNA and proteins: Ribosome
4. Barcoding of the proteins is my responsibility: Golgi
5. I am an organelle not present in bacteria Nucleus
7. The movement of cells is aided by me Microtubule
8. The working pH of a lysosome: Five

DOWN

1. Catalase is present inside of me: Peroxisome
2. I work as the recycling machine in the cell: Lysosome
6. I store any excess water cells may have: Vacuole

Q3. **a)** Identify from A-F and fill in the blanks. **b)** Fill in the blanks. **[6+2=8M]**

a)



A	H+/Proton
B	Thylakoid Membrane
C	O2
D	Chlorophyll/PSII/photosystem II
E	ATP synthase
F	NADPH

b) ___RuBisCo___ is the enzyme that fixes CO_2 in Calvin cycle, which takes place in _____Stroma_____ .

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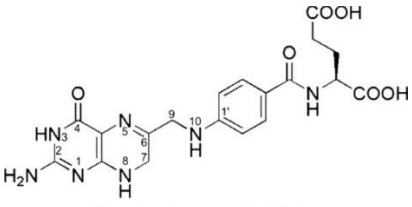
Q4. As a cell biologist, suppose you have isolated cells from the following organisms in your laboratory: Mushroom, Kangaroo, and *E. coli*. How will the shape of these cells be affected when Mushroom and *E. coli* cells are placed in seawater while Kangaroo cells are placed in distilled water? Answer in a tabulated format, as indicated below, giving one-line justification in each case. **[3M]**

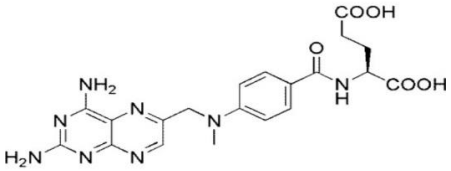
S. No.	Cell type	Cell shape	Justification
1	Mushroom	Cell will shrink	Water will move out by osmosis as sea water is hypertonic to the cell
2	Kangaroo	Cell will swell & burst	Water will move in by osmosis as distilled water is hypotonic to the cell; cell wall is absent so the cell will burst
3	*E. coli*	Cell will shrink	Water will move out by osmosis as sea water is hypertonic to the cell

Q5. **(a)** You have to engineer an enzyme that can work in a lipophilic environment. What kind of amino acids would you place on the outer surface of the protein? **[1M]** **Ans:**_____**Hydrophobic amino acids/examples/non-polar**_____

(b) Shown below are the chemical structures of folic acid (left) and methotrexate (right) that bind to Dihydrofolatereducatse (DHFR; converts dihydrofolate to tetrahydrofolate). While folic acid is the natural substrate for DHFR, methotrexate is an inhibitor and is used in treating cancer. Based on the given structures, what is the type of enzyme inhibition by methotrexate? **[1M]**



Dihydrofolate (DHF)



Methotrexate (MTX)

Ans: Competitive inhibition

(c) RNA molecules that can enhance the speed of reactions and act as enzymes are referred to as _____**Ribozyme**___ **[1M]**

Q6. Write the names of the enzymes **[6M]**

The enzyme that shows 5'-3' exonuclease activity in DNA replication	**DNA polymerase I**
The polymerase that does not need a primer to start synthesis	**RNA Polymerase/Primase**
The site on the ribosome where the first t-RNA arrives	**P-site**
The protein that helps RNA polymerase to enhance the rate of transcription	**Activator**
The point mutation that may cause abrupt shortening of the peptide	**Nonsense mutation**
The site (position on DNA) where DNA replication starts	**Origin of Replication/Ori**

Q7. Fill in the blanks with the most appropriate options given below: **[3M]**

[proto-oncogene, tumor suppressor, protein, DNA, RNA, cancer, apoptosis, down syndrome, nucleosome, mutation, duplication, cell cycle, loss, gain, progress, arrest, divide, multiply, cell survival.]

p53 gene is known as a _**tumor suppressor**___. ___**Loss**_____ of function of this gene due to ____**mutation**_____ may cause _____**cancer**_____. The main job of the protein product of this gene is to _____**arrest**_____cell cycle when _____**DNA**_____is damaged. However, in case the damage is beyond the scope of repairment, this protein triggers _____**apoptosis**_____.

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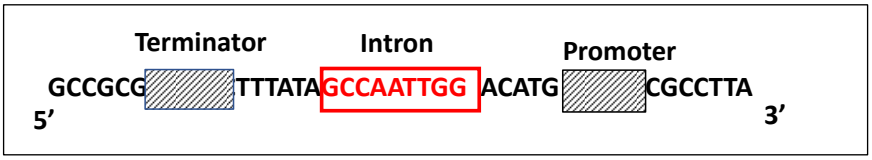
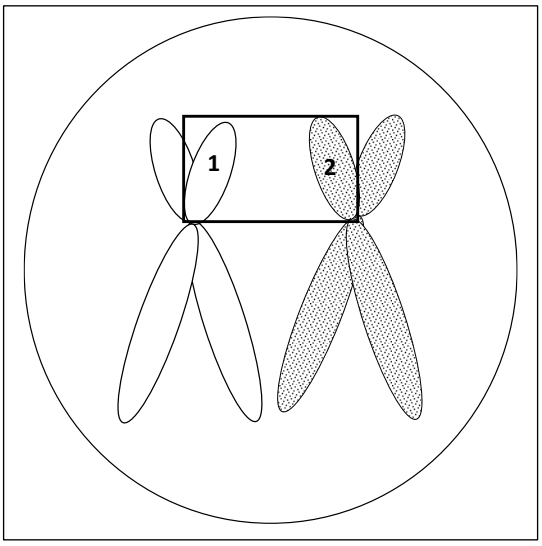
PART B

Q1. In the adjacent diagram, the sequence of a DNA strand is given. The shaded boxes represent a Promoter and a Terminator sequence. Answer the following with reference to the diagram **[9M]**



Product after replication (show only one strand; 5'-3')	 OR the reverse complement sequence
Pre-mRNA (5'-3')	5' CAUGUCCAAUUGGCUAUAAA 3'
Matured mRNA (5'-3') **[1.5 M]**	5' CAUGUUAUAAA 3'
Codons (5'-3'), starting from the initiation codon	5'AUG 3, 5' UUA 3', 5' UAA 3'
Anticodons on t-RNAs (5'-3') **[1.5M]**	5' CAU 3', 5'UAA 3'

Q2. A pair of homologous chromosomes are shown in a eukaryotic cell. Answer the following with reference to the diagram *(for the drawings clearly depict the microtubules and their chromosome attachment sites wherever applicable)* **[9M]**

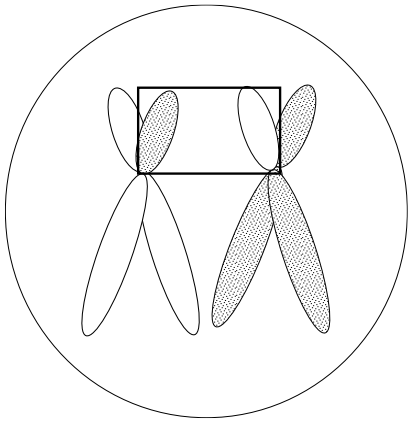


I. Imagine the cell is undergoing Mitosis. In which phase of Mitosis would chromosome numbers be 4? [**1M**]

Ans: _____Anaphase_____

II. Draw the outcome of crossing over between the regions depicted by the box in the diagram if the cell would undergo Meiosis. [**1M**]

Ans:



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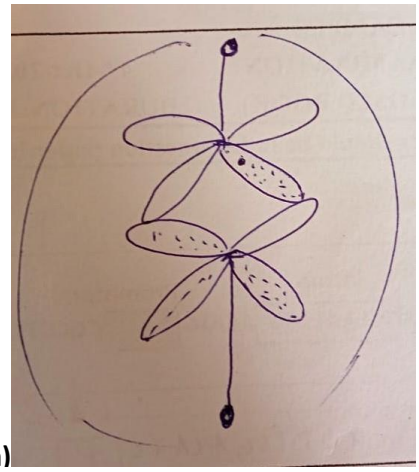
III. **a)** Draw Metaphase 1 of Meiosis with the crossed-over chromosomes. **b)** How many chromatids would be present at this stage? **[1.5 + 0.5 M]**

Ans. a)

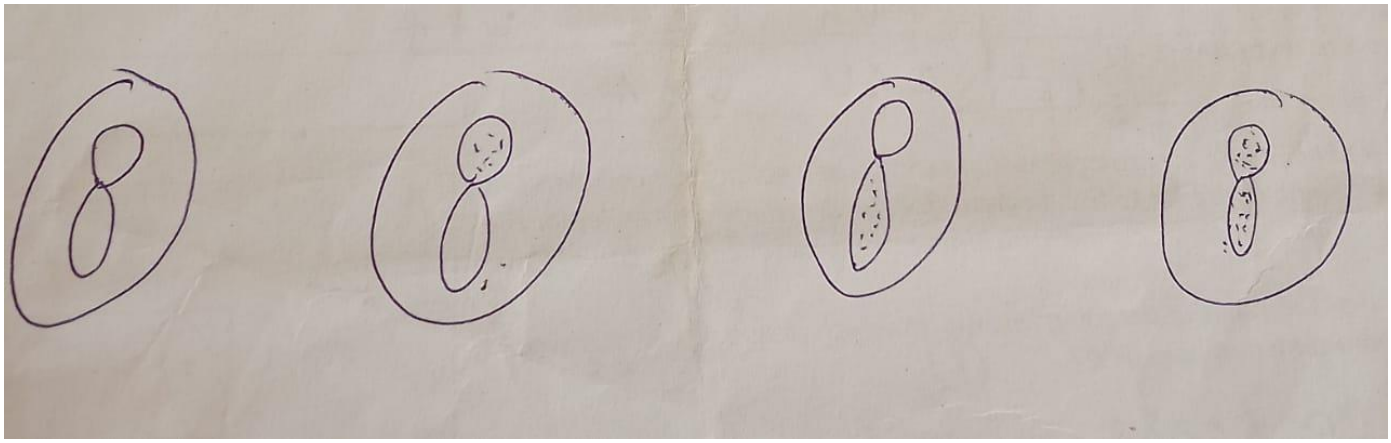


Ans b) 4

IV. How many chromosomes would be there after Anaphase I? **[1M] Ans:** 2

V. Draw the different gametes produced due to crossing over. **[2M]**

Ans:



VI. If 1 represents a normal and 2 represents a mutated version of a disease-causing gene in the diagram, and if this individual does not show the manifestation of the disease, what could be the reason that the offspring might develop the genetic disease? Describe in a maximum of 2 sentences. **[2M]**

Ans: __ Segregation of homologous chromosomes in anaphase I of meiosis followed by fertilization with a gamete from another parent who also carries at least one mutated allele of the same gene.

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