

Biology*Time Allowed: 3 hours**Maximum : 70***General Instructions:**

- (i) *All the questions are compulsory.*
- (ii) *Q. No. 1 to 5 are very short answer type, carrying 1 mark each.*
- (iii) *Q. No. 6 to 10 are short answer type, carrying 2 marks each.*
- (iv) *Q. No. 11 to 22 are short answer type, carrying 3 marks each.*
- (v) *Q.No.23 is a value based question carrying 4 marks.*
- (vi) *Q. No. 24 to 26 are long answer type, carrying 5 marks each.*
- (vii) *Use of calculators is not allowed, use log tables wherever required.*

SECTION A

- 1** A certain tissue, of a plant, infected with TMV was used to obtain a new plant using tissue culture technique. Identify the technique used and reason out the possibility of obtaining a new healthy plant.
- 2** State a method of cellular defense which works in all eukaryotic organisms.
- 3** In case of an infertile couple, the male partner can inseminate normally but the mobility of sperms is below 40 percent. Judge, which kind of ART is suitable in this situation to form an embryo in the laboratory, without involving a donor?
- 4** PCR requires very high temperature conditions where most of the enzymes get denatured. How was this problem resolved in a PCR?

- 5 If two genes are located far apart from each other on a chromosome, what will be its effect on the frequency of recombination?

SECTION B

- 6 The alarming population growth is leading to scarcity of basic requirements. Suggest with reason, any two population control measures other than contraception to address the situation.
- 7 Both Down's syndrome and Turner's syndrome are examples of chromosomal disorders. Cite the differences between the two, at the chromosomal level.
- 8 To reduce the percentage of population suffering from hunger and malnutrition, microbes are grown on a large scale to act as food supplements. Mention any two microbes used as food supplement and suggest their role.

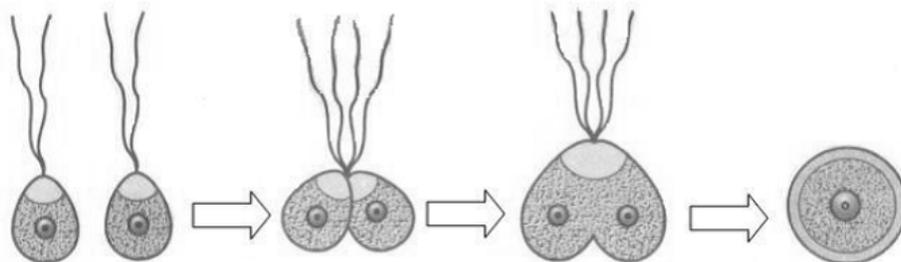
OR

- Success rate of artificial insemination in cattle is fairly low. Identify any other technique to improve the successful production of hybrids. State two advantages of this technique.
- 9 a) A patient who is suffering from myocardial infarction is given a clot buster as part of his treatment. Mention the clot buster administered and its microbial source.
b) A person recuperating from illness is advised to have curd regularly. Why?
- 10 Assess the effects of loss of biodiversity in a region. Mention any four such effects.

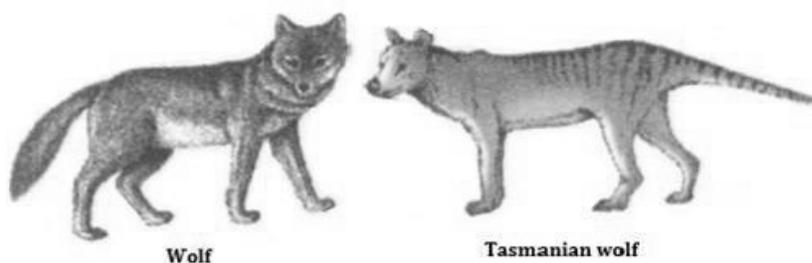
SECTION C

- 11 Draw and label the enlarged view of microsporangium of an Angiosperm. State the function of its innermost wall layer.

12



- a) State the type of gametes shown in the diagram above.
- b) Identify the process taking place and the resultant structure.
- c) Name an organism that reproduces in this manner.
- 13 Diagrammatically represent the experimental set up that proved Oparin - Haldane hypothesis.
- 14 True-breeding pea plants showing contrasting character for flower position were cross-bred.
- a) Mention the position of flowers in F1 generation.
- b) Work out the cross up to F2 generation.
- c) Compute the relative fraction of various genotypes in the F2 generation?
- 15 Refer to the figure given below and answer the questions that follow:

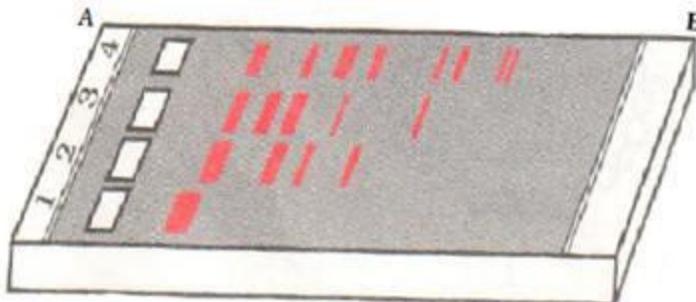


- a) Explain the process by which Tasmanian wolf evolved.
- b) Name the process that has resulted in evolution of wolf and

another similar animal such as Tasmanian wolf.

c) Compare and contrast the two animals shown?

- 16** Your classmate complains of headache and cough. The doctor confirms that he is suffering from Pneumonia and not common cold, on the basis of certain symptoms. List these symptoms. Mention any two precautions to be followed to prevent the spread of this disease.
- 17** Cow dung and water is mixed and this slurry is fed into the biogas plant for digestion by microbes. The person performing the process shares that there is no need to provide inoculum for it, why? What is the role of microbes at the source? Under which condition will they be most active and effective?
- 18** A person is born with a hereditary disease with a weakened immune system due to deficiency of an enzyme. Suggest a technique for complete cure for this disease, identify the deficient enzyme and explain the technique used for cure.
- 19** A doctor prescribed morphine as a sedative and pain killer to your cousin who had undergone surgery. Even after recovery, he craved for the prescribed medicine. What do you conclude about his condition, had he continued with the same medication? After appraising yourself, what measures will you suggest to him to overcome this problem? Briefly explain any two.
- 20** Given below is the diagram of agarose gel kept under UV light:



- Mark the positive and negative terminals.
- What is the charge carried by DNA molecule and how does it help in its separation?
- How are the separated DNA fragments finally isolated?

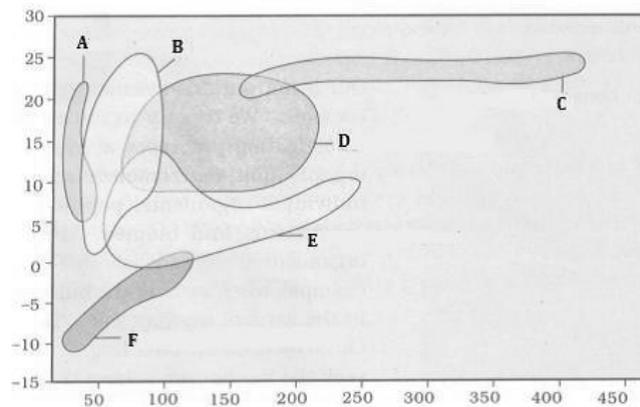
OR

CryIAbs introduced in a plant to prevent infestation by corn borer.

- What is the resultant plant referred as?
- Summarize the action of the gene introduced.

- 21** a) In pBR322, foreign DNA has to be introduced in tetR region. From the restriction enzymes given below, which one should be used and why:
PvuI, EcoRI, BamHI
- b) Give reasons, why the other two enzymes cannot be used.

- 22** The graph given below shows the distribution of biomes:



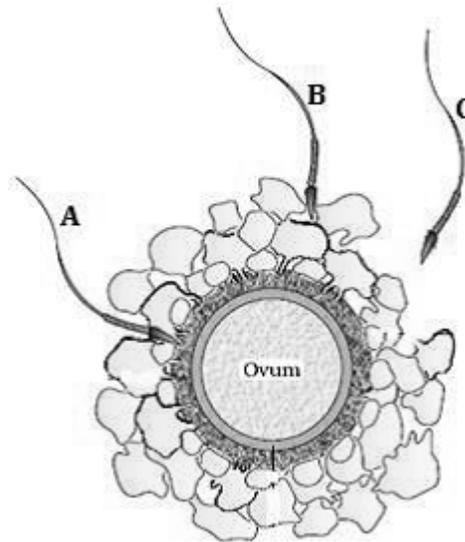
- What do the 'X' and 'Y' axes represent?
- Identify the 'grassland' and 'coniferous forest' biomes, from the above figure.
- Why is 'F' located at the given position in the graph?

SECTION D

- 23** A son persuades his father to replace his old mobile phone with the latest model launched in the market. He also shares the latest features it has and explains how it can be of a help to him in the modern technological world. Father is reluctant in buying a new one and tries to explain about its environmental impact. How do you think, the biologist father has tried to convince his son? Justify the arguments of father and son both, by mentioning positive aspects of the behavior displayed by both of them in the situation concerned (three each).

SECTION E

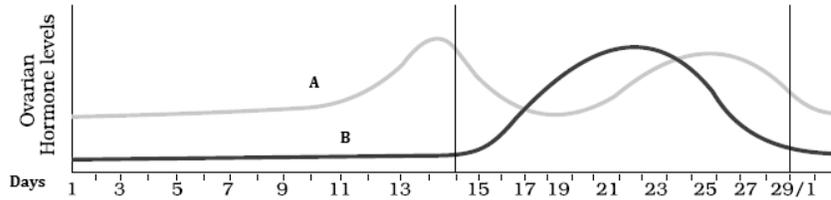
- 24** Given below is the diagram of a human ovum surrounded by a few sperms. Observe the diagram and answer the following questions:



- Compare the fate of sperms shown in the diagram.
- What is the role of zona pellucida in this process?
- Analyze the changes occurring in the ovum during the process.
- How is the entry of sperm into the ovum facilitated?
- Specify the region of female reproductive system where the event represented in the diagram takes place.

OR

The graph given below shows the variation in the levels of ovarian hormones during various phases of menstrual cycle:



- Identify 'A' and 'B'.
- Specify the source of the hormone marked in the diagram.
- Reason out why A peaks before B.
- Compare the role of A and B.
- Under which condition will the level of B continue to remain high on the 28th day?

- 25** Explain the process of protein synthesis from processed m-RNA.

OR

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

- 26** Citing lake as an example of a simple aquatic ecosystem, interpret how various functions of this ecosystem are carried out. Make a food chain that is functional in this ecosystem.

OR

- Colonization of a rocky terrain is a natural process. Mention the group of organisms which invade this area first. Give an example.
- Over the years, it has been observed that some of the lakes are disappearing due to urbanization. In absence of human interference, depict by making a flow chart, how do the successional series progress from hydric to mesic condition.
- Identify the climax community of hydrarch and xerarch succession.

Answer Key

SECTION A

- 1 Tissue culture using meristematic tissue as it is virus free
- 2 RNA interference
- 3 Intra Cytoplasmic Sperm Injection
(No marks for abbreviation - ICSI)
- 4 Answer:-The use of a thermostable DNA polymerase *Thermus aquaticus* which remain active during the high temperature induced denaturation of double stranded DNA.
- 5 Frequency of recombination will be higher

SECTION B

- 6 Population control measures other than contraception are:
 - Advertisements in the media, to generate awareness
 - Statutory raising of marriageable age of the female to 18 years and that of males to 21 years, to delay the number of births
 - Incentives given to couples with small families, to motivate others to comply(Any two of the above measures with explanation)
- 7 Down's syndrome is due to Trisomy of chromosome number 21, total number of chromosome is 47
Turner's syndrome is due to monosomy of the X -Chromosome, total number of chromosome is 45

- 8** Spirulina –
Produces large quantities of food rich in protein, minerals, fats, carbohydrates and vitamins. Methylophilus methylotrophus –
250 gm of this microorganism produces 25 tonnes of protein per day

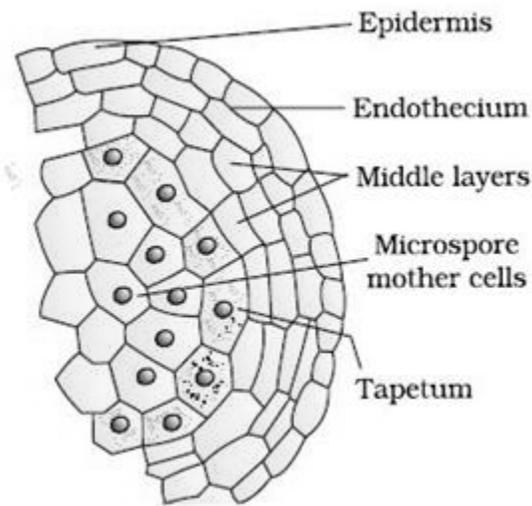
OR

Multiple Ovulation Embryo Transfer Technology 1
increases herd size, in a short time

- 9** a) Streptokinase, Streptococcus
b) Curd contains Lactic Acid Bacteria, which play beneficial role in checking disease causing microbes. It is a source of vitamin B₁₂ .
- 10**
- ❖ Decline in plant production/Decline in number of animal species
 - ❖ Lowered resistance to environmental perturbations such as drought
 - ❖ Increased variability in certain ecosystem processes such as plant productivity/ water use / pest & disease cycles
 - ❖ Species may become endangered/increased rate of species extinction

SECTION C

11



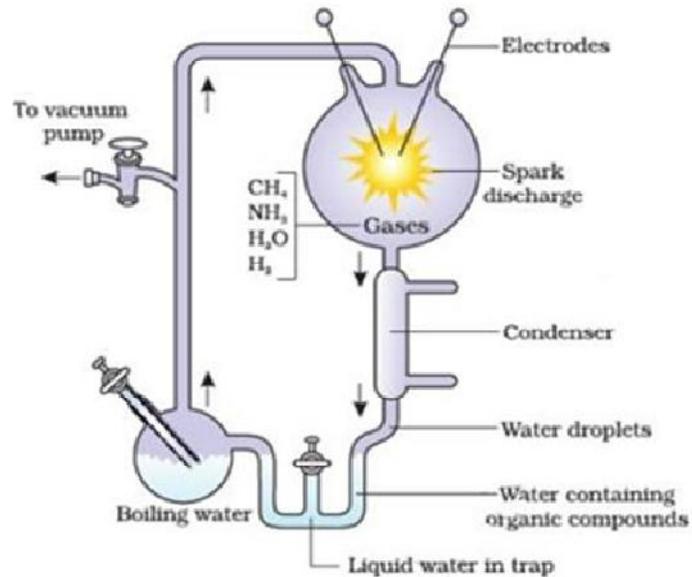
(Any four of the labels)

Tapetum nourishes the developing pollen grains

12

- a) Isogametes
- b) Fertilization and zygote
- c) Cladophora / Chlamydomonas

13

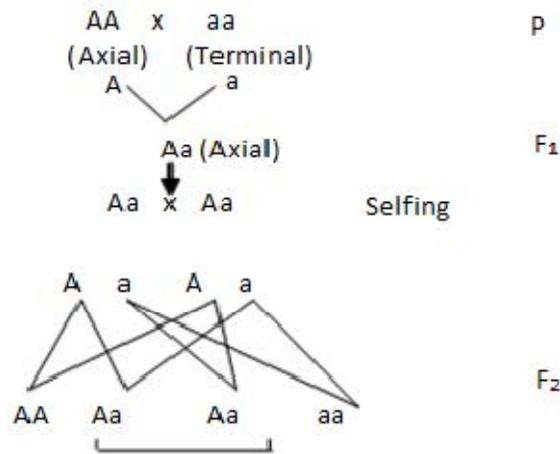


(Any six different labels)

14

- a) Axial position

b)



c) $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{4}$

15 a) Adaptive radiation - The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats).

b) Convergent evolution

c) Wolf is a placental mammal, whereas Tasmanian wolf is a marsupial mammal

16 Doctor confirms pneumonia on the basis of the following symptoms - fever/chills/grey - blue lips and finger nails (any two); and not common cold as the following symptoms are not observed - Nasal

congestion/sore throat/hoarseness (any two)

Precautions -

1) Cover the nose when near the patient

2) Do not share glasses and utensils / articles used by the infected person

17 Methanogens are present in Cow dung.

Breakdown of cellulose

Anaerobic condition

18 Gene Therapy

ADA (Adenosine deaminase) deficiency

Lymphocytes from the blood of the patient are grown in a culture, a functional ADA cDNA is introduced into these lymphocytes, which are subsequently returned to the patient. The permanent cure is done by introducing ADA cDNA into cells at early embryonic stages.

19 Drug dependence - is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs is abruptly discontinued / because of perceived benefits, drugs are frequently used repeatedly from which the person may not be able to get out.

Measures:

- Education and counseling - to face problems and stresses/ to channelize the energy into healthy pursuits like reading, music, yoga and other extracurricular activities

- Seeking help from parents - to guide the person appropriately and immediately

- Seeking professional and medical help – to help the person to get rid of the problem completely with sufficient efforts and will power
(any two)

20 a) Positive terminal - 'B'

Negative terminal - 'A'

b) DNA being negatively charged, moves towards the positive electrode (anode)

c) By elution - separated bands of DNA are cut out from the agarose gel and extracted from the gel piece

OR

a) Bt corn

b) Cry I Ab/ Bt toxin gene codes for crystal protein; the Bt toxin protein exists as an inactive protein, but once an insect ingests it, it

gets converted into an active form due to the alkaline pH of the gut which solubilizes the crystal. The activated toxin binds to the surface of mid gut and creates pores that cause swelling, lysis and eventually death of the insect.

- 21** a) Bam HI should be used, as restriction site for this enzyme is present in tet^R region
b) PvuI will not be used, as restriction site for this enzyme is present in amp^R region (not in tet^R)
EcoRI will not be used, as restriction site for this enzyme is not present in selectable marker tet^R
- 22** a) 'X' axis - Mean annual precipitation (cm)
'Y' axis - Mean annual temperature (°C)
b) Grassland - B
Coniferous forest - E
c) The mean annual temperature ranges from -12 to 20°C (error accepted ± 2) and mean annual precipitation ranges from 10 - 125 cm, these are the optimum conditions in tundra biome

SECTION D

- 23** Father explains that it will lead to generation of e - waste;
Difficulty in recycling e - waste / hazardous nature of recycling of e - waste / exposing workers to toxic substances present in e - waste
(Any one)
Son's wish to update his father with modern techniques, Awareness about trends and technologies, well versed with their applicability in daily life (any other similar / appropriate values)
Concern for environment, scientific thinking, inquisitive nature, social awareness, judicious use of money, sense of responsibility (any other similar /appropriate values)

SECTION E

- 24
- a) A is able to penetrate/ fertilize the ovum, whereas B and C are unable to penetrate/ fertilize // B and C will degenerate
 - b) Zona pellucida ensures the entry of only one sperm into the ovum
 - c) Induces completion of meiotic division of the secondary oocyte, formation of second polar body and a haploid ovum
 - d) Enzymes of acrosome help ($\frac{1}{2}$ mark if only 'acrosome' is written)
 - e) Ampullary - isthmic junction of the fallopian tube

OR

- a) A - Estrogen
B - Progesterone
- b) A - Maturing ovarian follicle / Graafian follicle
B - Corpus luteum
- c) Formation of Graafian follicle (releases estrogen) is followed by the formation of corpus luteum (releases progesterone)
- d) Role of A (Estrogen) - leads to changes in the ovary and uterus / regeneration of endometrium through proliferation
Role of B (Progesterone) - Maintenance of endometrium for implantation of the fertilized ovum/ maintenance of other events of pregnancy
- e) In case of pregnancy

- 25
- For initiation, the ribosome binds to the mature m RNA at the start codon (AUG) that is recognized by the initiator t - RNA. During elongation, charged t RNA sequentially binds to the appropriate codon in m- RNA with the anticodon present on tRNA. The ribosome moves from one codon to another adding amino acids one after the other to form polypeptide, i.e. translation. During termination, the release factor binds to stop codon (UAA, UAG, UGA), terminating translation and releasing the polypeptide chain.

OR

Methodology used -

Sequence Annotation - total DNA from a cell is isolated, converted into random fragments of relatively smaller sizes and cloned in suitable host using specialized vectors.

The cloning results in amplification of each piece of DNA fragment. The fragments are sequenced using automated DNA sequencers, these sequences are then arranged based on some overlapping regions (present in them).

This requires generation of overlapping fragments (for sequencing). Specialized computer based programmes are developed, and these sequences are subsequently annotated and assigned to each chromosome.

- 26**
- i) Productivity - conversion of inorganic into organic material with the help of solar energy by the autotrophs
 - ii) Energy flow - unidirectional movement of energy towards higher trophic level (and its dissipation and loss as heat to the environment)
 - iii) Decomposition - fragmentation, leaching, catabolism, humification, mineralization by bacteria, fungi and flagellates (abundant at the bottom of lake)
 - iv) Nutrient cycling - decomposition of dead matter to release the nutrients back to be re-used by the autotrophs
- Food chain in aquatic ecosystem (lake)
Phytoplanktons ⇒ Zooplanktons ⇒ Small fish ⇒ Big fish
(Any other appropriate example)

OR

a) Pioneer species, lichen

b) Phytoplankton - hydric

↓

Submerged plant stage



Submerged free floating plant stage



Reed swamp stage



Marsh - meadow stage



Scrub stage



Forest stage - Mesic

c) Forest