Section A

1.

(b) Secondary consumers
Explanation:
Secondary consumers

2.

(c) Gibberllic acid
Explanation:
Gibberllic acid

3. **(a)** Rice
Explanation:
Rice

4.

(c) tertiary consumer
Explanation:
Green plants occupy the first trophic level(producers). Primary consumers(herbivores) feed on producers. Secondary consumers(primary carnivores) feed on herbivores. Tertiary consumers(secondary carnivores) feed on secondary consumers. If the carbon atoms fixed by producers already have passed through three species, the organisms of trophic level of the last species would be tertiary consumers.

5.

(c) Zygote is collected from a female donor and transferred to the fallopian tube.
Explanation:
The zygote or early embryos (with up to 8 blastomeres) could then be transferred into the fallopian tube (ZIFT–zygote intrafallopian transfer) and embryos with more than 8 blastomeres, into the uterus (IUT – intrauterine transfer), to complete its further development.

6. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
Both A and R are true and R is the correct explanation of A.

7.

(b) Green pod colour
Explanation:
Green pod colour

8.

(c) Eastern Himalaya and Western Ghats
Explanation:
Eastern Himalaya and Western Ghats

9.

(c) $4 \rightarrow 3 \rightarrow 2 \rightarrow 1$
Explanation:
$4 \rightarrow 3 \rightarrow 2 \rightarrow 1$

10.

(c) Methane(CH_4) v, ammonia(NH_3), hydrogen H_2 and water H_2O

Explanation:

the gases used in Urey and Miller experiment in chamber marked A are Methane (CH_4), ammonia (NH_3), hydrogen H_2, and water H_2O

11.

(b) Haemophilia and red green colour blindness

Explanation:

Haemophilia and red-green colour blindness both are a sex-linked recessive gene on X chromosome. Body height is an example of polygenic inheritance. Rhesus blood group is base on the presence or absence of Rh-protein on the surface of RBC, phenylketonuria (PKU) is a recessive autosomal variation.

12.

(c) PCR

Explanation:

Polymerase chain reaction (PCR) tests are used to detect HIV's genetic material, called RNA. These tests can be used to screen the donated blood supply and to detect very early infections before antibodies have been developed. This test may be performed just days or weeks after exposure to HIV.

Although these tests are the most accurate, they are not performed as often as the other HIV tests because they are expensive and also time- and labor-intensive.

13.

(d) GIFT

Explanation:

Gamete Intrafallopian Transfer (GIFT) is a technique where gametes (sperm and egg) are directly introduced into the oviduct (fallopian tube) for fertilization to occur naturally inside the body. This is different from in vitro fertilization (IVF), where fertilization occurs outside the body.

14. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

15. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation:

Assertion and reason both are correct statements and reason is the correct explanation for assertion.

16.

(b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

Explanation:

Both (A) and (R) are true, but (R) is not the correct explanation of (A).

Section B

17. Amendments to the patent bill have empowered India to prevent unauthorized exploitation of our bio-resources and traditional knowledge by other countries. This bill also considers patent terms and initiated research development in this field.

18. a. The given diagram is representing "Messelson and Stahl's experiment". It is proven that DNA replicates semi conservatively.
    b. The strands of DNA are of intermediate density. The double-stranded DNA is $\frac{1}{2}$ Heavy and $\frac{1}{2}$ Light.

19. A- Leydig's cell
    B- Sertoli cell
    C- Spermatogenesis (Formation of sperms)
    D- Spermiogenesis (Transformation of spermatid into sperm)

20. Methanogens are anaerobic unicellular organisms, that release methane as a waste product of cellular metabolism.
Substrate: Cellulosic materials / cow dung.

OR

Common yeast is employed in the fermentation of -
(i) dough, used for making bread, cakes in bakeries.
(ii) Fruit juices and malt in breweries for the production of alcoholic beverages,
hence it is known as both as baker's and brewer's yeast.

21. i. A - Thalamus, B - Seed, C - Endocarp.
ii. In apple, along with the ovary the thalamus also contributes to fruit formation. So, apple is called false fruit.

Section C

22. a. Amoebiasis; an infection of the large intestine caused by a protozoan, Entamoeba histolytica
b. Source of infection:
i. Cysts from the faeces of infected person
ii. Contaminated raw vegetables, fruits and other food stuffs.
iii. Through contaminated water.
c. The infection can be avoided by
i. Proper sanitary disposal of faecal matter.
ii. Perfect sanitation and protection of water and vegetables from pollution.
iii. Washing hands regularly.

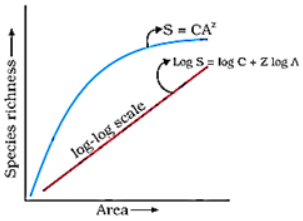
23. a. DNA molecule
b. mRNA transcript
c. RNA polymers
d. Rho factor

24. In West Bengal and Andhra Pradesh, freshwater is released from the Ganges and some other rivers. Due to this, coral reefs are not found in regions from West Bengal to Andhra Pradesh. From Tamil Nadu to the southern tip of the east coast, coral reefs are present because of no interference from freshwater.

25. Sickle cell anaemia and Down's syndrome Symptoms of Sickle cell anaemia: the RBCs of the sufferer become elongated (sickle shaped) and curved under low O_2 tension. The sickled RBCs are destroyed more rapidly than the normal ones leading to anaemia.

Symptoms of Downs Syndrome: The affected individual is short stature with small round head, furrowed tongue and partially open mouth. Physical and mental development is retarded.

26. a. The given equation's graphical representation of the relationship between species and area is as follows:



b. The species richness is represented by S in the given equation.
c. The regression coefficient Z is the slope of the line. The slope is found to be 1.15 for frugivorous (fruit-eating) birds and mammals in tropical woods on various continents.

OR

Rivet Popper Hypothesis

i. The hypothesis was proposed by Paul Ehrlich.
ii. In an airplane (ecosystem), all parts are joined together using thousands of rivets (species).
iii. If every passenger travelling in it, starts popping a rivet to take home (causing a species to become extinct), it may not affect the flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak after some time.
iv. Further, which rivet is removed may also be critical loss of rivets on the wings. (Key species that drive major ecosystem function) is obviously a more serious threat to flight safety than the loss of a few rivets on the seats or windows inside the plane.

27. Biopesticide is a pesticide which is
i. Not chemical in nature.

ii. More specific in action against the pest.

iii. Safer for the environment than chemical pesticides.

A popularly known bio-pesticide is Bt toxin, which is produced by a bacterium called Bacillus thuringiensis. Bt toxin gene has been cloned from this bacterium and expressed in plants. Bt-toxin protein when ingested by the insect, gets converted to its active form due to the alkaline pH of the gut. The activated toxin binds to the surface of midgut epithelial cells and creates pores that cause cell swelling and lysis and eventually kills the insect.

28. Industrial Melanism is an adaptation, where the moths living in the industrial area developed melanin pigments to match their body to the tree trunk that were covered with black soot. Before industrialization, in Great Britain, it was observed that there were more white winged moths. However after industrialization the white coloured lichen covered the tree trunks. In that background the white winged moths survived but the dark coloured moths were eaten by predators. During the post industrialization periods the tree trunks became dark due to industrial smoke and soots. Under such conditions, the white winged moths did not survive due to predators and dark winged moths survived. In areas where industrialization did not occur, the count of moths were low. Thus, industrial melanism supports evolution by natural selection.

Section D

29. a. Macrophages, virus replication (RNA genome)

b. Enzyme-linked immuno-sorbent assay (ELISA)/Polymerase Chain Reaction (PCR)

Treatment available - Antiviral drugs that are only partially effective as they only prolong the life of the patient.

c. Making blood HIV safe in blood banks, use of only disposable needles and syringes in hospitals, free distribution of condoms, controlling drug abuse, advocating safe sex, regular check-ups for HIV susceptible population.

OR

A patient suffering from AIDS does not die of this disease but from some other infection because of drastic reduction of helper T-lymphocytes that are responsible to fight infections, person become immune-deficient, unable to protect oneself from other bacterial or viral or fungal or parasitic infection

30. i. Stage 'g' represents the developing corpus luteum. Luteinising hormone (LH) secreted by pituitary help in its formation.

ii. The corpus luteum secretes a large amount of hormone progesterone. It is essential for the maintenance of endometrium of the uterus. It is a necessity for implantation and for pregnancy.

iii. Stage ‘d’ represents the tertiary follicle with a small cavity-antrum. It is surrounded by many layers of granulosa cells. It contains primary oocyte (meiosis-I arrested at prophase-I) stage V represents the mature follicle called Graafian follicle with a fluid-filled cavity antrum. It contains secondary Oocyte and a tiny first polar body.

The mature follicle is surrounded by theca externa and theca interna. It bursts to release secondary oocyte (Ovulation)

OR

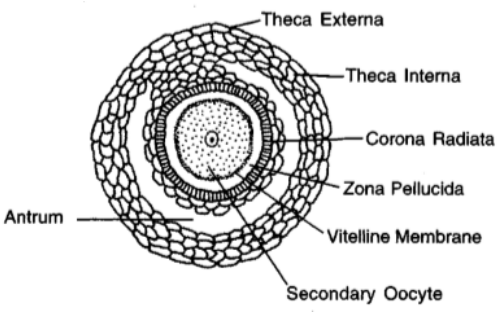
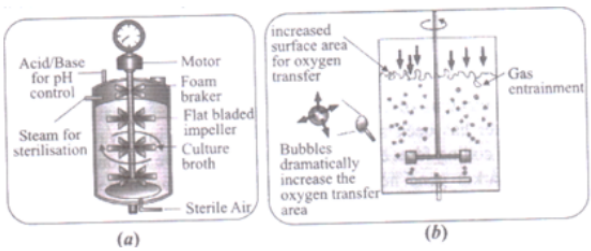


Figure: Structure of a mature oocyte

Section E

31.



a. Simple stirred-tank bioreactor;

b. Sparged stirred-tank bioreactor through which sterile air bubbles are sparged.

Structure of Bioreactor:

i. It is a cylindrical structure with a curved base.

ii. A stirrer is present for even mixing and oxygen availability throughout the reactor.

iii. There is an agitator system, an oxygen delivery system, a foam control system, a temperature control system, etc.
iv. There is a sampling port through which small volumes of culture can be taken out periodically.

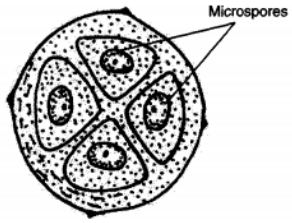
A flask in a laboratory cannot be used for producing recombinant DNA on a large scale. Unlike a bioreactor; a flask can not be used to grow culture continuously.

OR

i. DNA is a hydrophilic molecule and cannot pass through the cell membrane.
A bacterial cell is made competent by treating the bacterial cell with a specific concentration of a divalent cation such as calcium, which increases efficiency with which the DNA enters through pores in its cell wall/This creates certain transient pores in its cell and increases the efficiency of the cell to take up DNA.

ii. 1. Separation of DNA fragments.
2. DNA fragments are negatively charged molecules, they can be separated according to their size by forcing them to move toward the anode under an electric field through agarose gel.
3. Ethidium bromide is used in this technique to stain the DNA to visualize by exposure to UV radiation.

32. **Microsporogenesis**: Sporogenous cells fill the whole interior of a microsporangium. They divide with the growth of another and increase their number. Ultimately they are transformed into microspore mother cells which are diploid (possess two genomes or double set of chromosomes). The microspore mother cells or microsporocytes develop an internal layer of callose which breaks the plasmodesmal connections among themselves. The separated mother cells round off and undergo meiosis to produce tetrads of haploid microspores or pollen grains. The phenomena is called microsporogenesis. The pollen grains of a tetrad grow and separate from one another. However, they remain attached forming compound pollen grains in Typha. In Calotropis and related plants, all the pollen grains of another lobe remain united in a single sac called pollinium. Two pollinia of adjacent another are attached to produce a translator.



OR

i. Seeds of legumes are non-albuminous that implies that endosperm in such seeds is completely used up in providing nutrition to developing the embryo. The endosperm is formed as a result of triploid fusion, i.e. between a male gamete and two polar nuclei. This making it obvious that it cannot be formed in the absence of double fertilization. Therefore, though the seeds of legumes are non-albuminous, it clearly states the occurrence of double fertilization in them.

ii. The differences between the embryos of pea and grass can be summarised as follows

Dicot embryo (Pea)	**Monocot embryo (Grass)**
The basal cell forms a 6-10 celled suspension.	Basal cell produces a single-celled suspension.
The terminal cell produces an embryo, except the radicle.	Forms the whole of the embryo.
The first division of terminal cell is longitudinal	The first division is transverse.
It possesses two cotyledons.	It possesses one cotyledon.
Plumule is terminal and is present between the elongated cotyledons.	Plumule is laterally present to excessive growth of single cotyledon.

33. a. Some of the important purposes of the Human Genome Project were as follows:
i. Identify all the approximately 20000-25000 genes In human DNA,
ii. Determine the sequences of the 3 billion chemical base pairs that make up human DNA,
iii. Stole this Information in databases,
iv. Improve tools for data analysis,
v. Address the ethical legal and social issues (ELSI) that may arise from the project

b. Four ways the knowledge from HGP is of significance for humans are:
i. agricultural production
ii. environmental remediation
iii. prevents disorders

iv. diagnosed disorder

c. BAC- bacterial artificial chromosomes
It is used for the cloning of DNA fragments.

OR

a. Radioactive phosphorus (^{32}P) to make the DNA of the bacteriophage radioactive
Radioactive Sulphur (^{35}S) to make the protein of the bacteriophage radioactive.

b. Blending- Radioactive phages allowed to attach to E.coli, as the infection proceeded the viral coats were removed from bacteria by blending.
Centrifugation- the virus particles were separated from bacteria by (spinning them in a centrifuge) centrifugation.

c. Bacteria that were infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. DNA is, therefore, the genetic material that is passed from virus to bacteria.

Note: This guess paper has been prepared with the aim of helping students score good marks; however, it does not guarantee that the Board examination will contain exactly the same questions.