

Section A

1.

(d) Surrogate mother

Explanation:
Sometimes eggs of females and sperm of males are able to produce but a fallopian tube is either blocked or uterus is not capable of implantation. In this case, ovum collected from females and sperm collected from males is fertilized and transferred to another female called surrogate mother for further development.
2.

(b) move away from equator to poles

Explanation:
move away from equator to poles
3.

(d) net primary productivity

Explanation:
Net Primary Productivity (NPP) is the amount of carbon uptake after subtracting Plant Respiration (RES) from Gross Primary Productivity (GPP). GPP is the total rate at which the ecosystem capture and store carbon as plant biomass, for a given length of time. $NPP = GPP - RES$.
4.

(b) Day 10 to 17 of menstrual cycle

Explanation:
In day 10 to 17 of menstrual cycle periodic abstinence by couple for family planing.
5.

(b) Salmonella typhimurium

Explanation:
Salmonella typhimurium
6.

(b) Glomus

Explanation:
The genus Glomus exhibits symbiotic association with higher plants.
7.

(b) Haemophilia

Explanation:
The inheritance pattern of a certain type of trait in humans shown above is haemophilia.
A son cannot inherit the defective gene from his father. This is a recessive trait and can be passed on if cases are more severe with the carrier. Genetic testing and genetic counselling are recommended for families with haemophilia. The disease is X-linked and the father cannot pass haemophilia through the Y-chromosome.
8.

(c) Some amino acids as glycine and alanine

Explanation:

In Urey and Miller's experiment, the product formed after the continuous sparking in the mixture of gases at high temperature were some amino acids like glycine and alanine. Sugar and nitrogenous base were also obtained from the same set up by some other scientist.

9. **(b)** Directional selection as giraffes with longer neck lengths are selected.
Explanation:
Directional selection as giraffes with longer neck lengths are selected.
10. **(a)** Autotrophs
Explanation:
Autotrophs
11. **(a)** *Propionibacterium sharmanii*
Explanation:
Propionibacterium sharmanii
12. **(c)** *Thermus aquaticus*
Explanation:
Taq polymerase is a thermostable DNA polymerase named after the thermophilic bacterium *Thermus aquaticus* from which it was originally isolated by Chien et al. in 1976. Its name is often abbreviated to Taq Pol or simply Taq. It is frequently used in the polymerase chain reaction (PCR), a method for greatly amplifying the quantity of short segments of DNA. It remains active during high temperature-induced denaturation of double-stranded DNA.
13. **(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 correct explanation for assertion.
14. **(c)** Assertion is true but Reason is false.
Explanation:
Assertion is true but Reason is false.
15. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation:
Depending upon the changes that pheromones bring about in the receivers, they are of three types - primer, releaser and informer. Primer pheromones bring about physiological changes in the receivers. There is no immediate structural or behavioural effect. Pheromone present in the faeces of the adult locust is locustrol. It stimulates development in nymph locust. Releaser pheromones cause immediate change in the receiver animal, e.g., alarm pheromone of harvester ant, trail making pheromone of leaf cutter ants.
16. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation:
Progressive evolution is the formation of more complex specialized organisms from simple and less elaborate forms. Examples: evolution of amphibians from fish like ancestors and evolution of birds and mammals from reptile-like ancestors. Retrogressive evolution is the formation of simple and less elaborate forms from more complex and specialized ones. Example: evolution of many parasitic organisms like tapeworm which does not have digestive system. It absorbs food through body surface.

Section B

17. Flocs are masses of bacteria held together by slime and fungal filaments to form mesh like structures. They are formed during the secondary treatment of sewage.

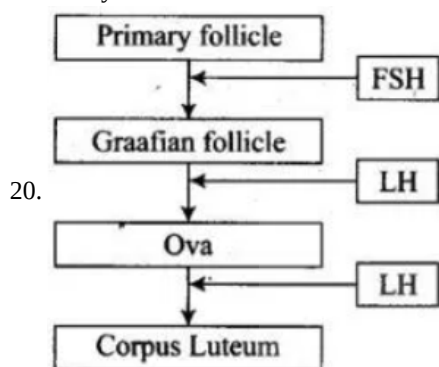
Consume major part of organic matter in the effluent/lower BOD significantly/reduces polluting potential.

18. i. When the inducer is present, it combines with the repressor, coded by i gene.

- After reacting with repressor it inactivates the repressor.
 - The repressor now cannot bind to the operator, hence the pathway for RA polymerase is open.
- The structural genes (z, y, a) are transcribed and the metabolism continues.

ii. Lactose is inducer.

19. One of the male gametes fuses with the female gamete and forms the embryo. The embryo subsequently develops into a new plant. Another male gamete fuses with polar nuclei and eventually forms endosperm. Endosperm supplies food to the developing embryo.



21. a. Cattle excreta is known for producing Biogas (Gobar Gas), which has main components such as **Methane, CO₂, H₂, N₂ and**

O. b.)

b. The biological process for fuel production involves microbial fermentation, where microorganisms convert organic materials like biomass or waste into biofuels like bioethanol or biodiesel.

OR

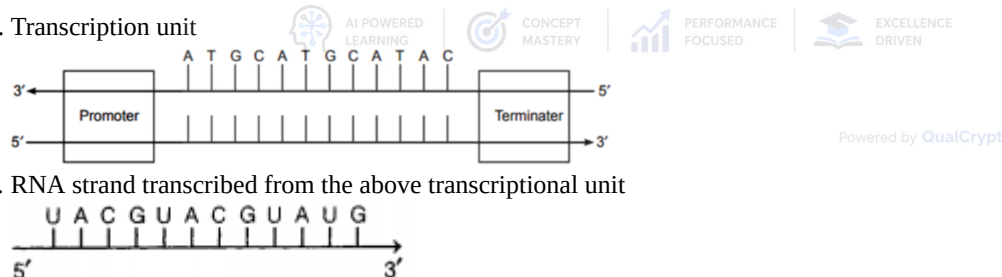
(I) Streptokinase is used to dissolve blood clots that have formed in the blood vessels. It is used immediately after symptoms of a heart attack occur to improve patient survival. This medicine may also be used to treat blood clots in the lungs (pulmonary embolism) and in the legs (deep venous thrombosis).

(ii) Lactic acid is used as a food preservative, curing agent, and flavoring agent. It is an ingredient in processed foods and is used as a decontaminant during meat processing.

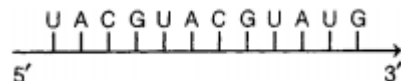
(iii) Ethanol fermentation, also called alcoholic fermentation, is a biological process which converts sugars such as glucose, fructose, and sucrose into cellular energy, producing ethanol and carbon dioxide as a side-effect.

Section C

22. i. Transcription unit



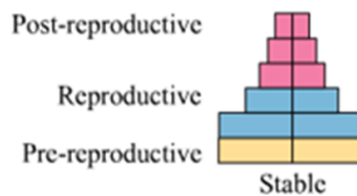
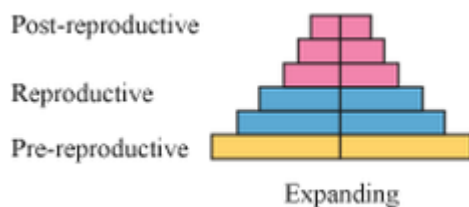
ii. RNA strand transcribed from the above transcriptional unit



23. Mendel's Laws of inheritance: The offspring always exhibits a dominant trait from the two alleles received from parents, the only dominant allele is expressed and other will be suppressed.

In a cross between tall (TT) plant and dwarf (tt) plant, the tall trait appears in F₁, tallness and dwarfness appear in F₂, In the ratio of 3 : 1.

24.	Expanding age pyramid	Stable age pyramid
	The population of pre-reproductive age is greater than population of reproductive age	The population of pre-reproductive age equals to population of reproductive age



25. Insulin production in human body:

- Synthesised naturally in the form of proinsulin consisting of polypeptide chain A and polypeptide chain B, linked together by disulphide bonds and an extra stretch called C-peptide
- The C-peptide is removed during processing and proinsulin matures into functional insulin.

Insulin production by rDNA technology

- Two DNA sequences corresponding to chain A and chain B of human insulin are synthesised
 - They are introduced into two different plasmids of E.coli
 - Chain A and chain B are produced separately
 - extracted and combined by disulphide bond to form human insulin.
26.
 o In situ conservation will help the larger number of species to survive because this method involves protection and conservation of the whole ecosystem and its biodiversity. Regions with very high levels of species richness and high degree of endemism is identified and then it is marked off as a protected area. Thus in situ method helps to conserve species without disturbing their natural habitat. Hotspots, protected areas and National parks are some of the methods used in situ conservation.
- o On the other hand, ex situ involves taking threatened animals and plants out from their natural habitat and placing them in special settings such as Zoological parks or botanical gardens where they can be given protection. However, this method is not ideal to conserve large variety of species.

OR

The broadly utilitarian argument described as biodiversity plays a major role in many ecosystem services that nature provides.

- Broadly utilitarian mainly explains the broad and general use of biodiversities like **oxygen**,
 - pollination**, and
 - aesthetic value** which is not limited to particular species.
27.
 i. Parasites have evolved with special adaptations to co-exist with their hosts in an ecosystem in the following ways:
 Loss of unnecessary sense organs
 Presence of adhesive organs or suckers to cling on to the host
 iii. Loss of digestive system and high reproductive capacity.
- ii. If the host evolves special mechanisms for rejecting or resisting the parasite, the parasite also evolves mechanisms to counteract and neutralise them, in order to be successful with the same host species. In accordance with their life styles, parasites evolve special adaptations and co-evolve with the host.
28. There are two immune response.
- The primary immune response occurs when an antigen comes in contact with the immune system for the first time. During this time the immune system has to learn to recognize the antigen and how to make an antibody against it and eventually produce memory lymphocytes.
 - The secondary immune response occurs when the second time (3rd, 4th, etc.) the person is exposed to the same antigen. At this point, immunological memory has been established and the immune system can start making antibodies immediately.

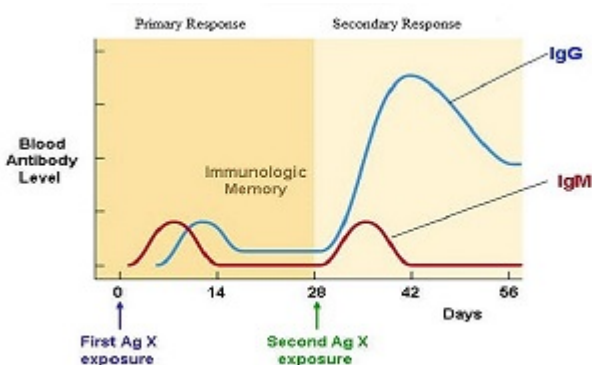


Fig. Immune Response and Secretion of antibodies

Section D

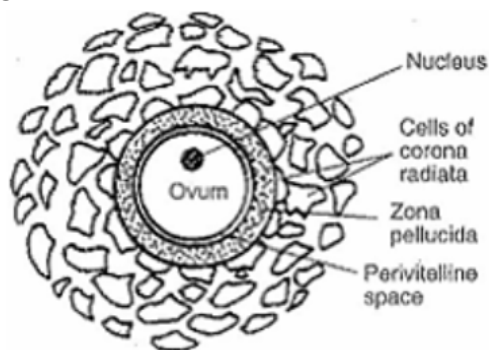
29.
 i. Figure f illustrates ovulation.

ii. It represents secondary oocyte stage of oogenesis.

-Pituitary hormone -LH

iii. Endometrium proliferates and becomes thicker by rapid cell multiplication development and maturation of ovum is in progress, while the figure 'h' shows that corpus luteum going towards degeneration.

OR



30. i. In autoimmune diseases, certain body cells undergo degeneration that's why these are called as degenerative diseases.

ii. Myasthenia gravis is an autoimmune disease of body muscles.

iii. Cell-mediated immunity is provided by T-lymphocytes.

OR

B-lymphocytes cells form the humoral immune system.

Section E

31. The similarity between geitonogamy and xenogamy is that both pollinations take place by pollinating agencies, pollinating agencies transfer the pollen from anther of one flower to the receptive stigma of another plant in case of xenogamy and another flower of the same plant in geitonogamy.

The difference between the two is that in geitonogamy the pollen and stigma are genetically similar because they both belong to the same plant but in xenogamy, they are genetically different as they belong to different plants of same species. Geitonogamy is functionally cross-pollination but genetically self-pollination.

As cleistogamous flowers are the flowers which remain closed and never open, so in these flowers anther and stigma are in close association. So these flowers do not require pollinating agencies for pollination and thus produce assured seed set even in absence of pollinating agencies.

OR

a. Microsporangium located in the anther lobe in an angiosperm.

Tapetum- nourishes the developing pollen grain

Epidermis, Endothecium, middle layers- protection and dehiscence (of microsporangium)

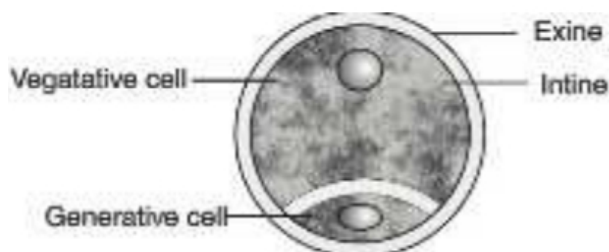
b. Structure of Pollen grain / male gametophyte

i. Outer wall layer - Exine

ii. Inner wall layer - Intine

iii. Vegetative cell

iv. Generative cell



c. Function of each part of male gametophyte are

i. Exine and Intine - Protection

ii. Vegetative cell - reserve food material / formation of pollen tube

iii. Generative cell - formation of two male gametes

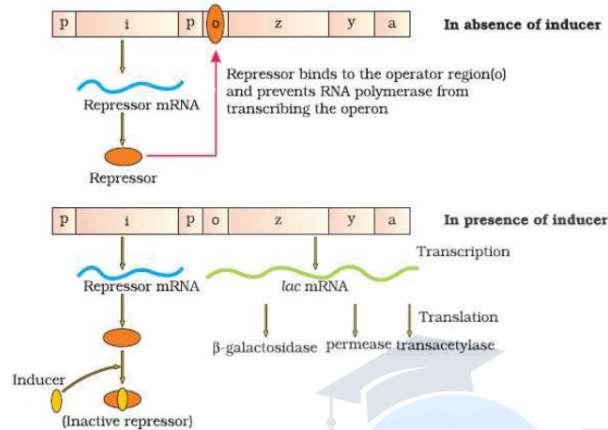
32. DNA fingerprinting is used in forensic.

Steps which are involved in DNA fingerprinting are as follows:

- i. Isolation of DNA
- ii. Digestion of DNA by restriction endonuclease enzyme
- iii. Separation of DNA fragments, by electrophoresis
- iv. Transferring of separated DNA fragments to synthetic membrane such as nitrocellulose or nylon.
- v. Hybridization, using labelled VNTR probe.
- vi. Detection of hybridized DNA fragments by autoradiography

OR

- a. In the absence of an inducer - The repressor of the Lac-operon is synthesised from the i gene, The repressor protein binds to the operator region of the operon in absence of the inducer, and prevents RNA polymerase from transcribing the operon.
- b. In the presence of an inducer, (lactose) the repressor is inactivated by interaction with the inducer, This allows RNA polymerase access to the promoter and transcription proceeds.



33. Polymerase Chain Reaction (PCR) is a technique to obtaining multiple copies of a gene of interest in vitro. This technique amplifies DNA through a simple enzymatic reaction. This technique was developed by Kary Mullis in 1965.

The basic requirements of a PCR are the following:

- i. DNA template
- ii. Primers
- iii. Enzyme-Taq polymerase

Amplification of recombinant DNA gene is done using Polymerase Chain Reaction (PCR). It is carried out in the following steps:

- i. **Denaturation** - The double-stranded DNA is denatured by applying high temperature of 95°C for 15 seconds. Each separated strand acts as a template.
- ii. **Annealing** - Two sets of primers are added, which anneal to the 3' end of each separated strand.
- iii. **Extension** - DNA polymerase extends the primers by adding nucleotides complementary to the template provided in the reaction. Taq polymerase is used in the reaction, which can tolerate heat. All these steps are repeated many times to get several copies of the desired DNA.

OR

- i. The insertion of recombinant DNA within the coding sequence of enzyme α-galactosidase results in the inactivation of the enzyme called insertional inactivation. The colonies do not produce a blue colour in the presence of chromogenic substrate and are identified as recombinant colonies whereas non-recombinant colonies produce blue colour from the chromogenic substrate, due to the presence of the activated enzyme.
- ii. The method is referred as "insertional inactivation" because the enzyme α-galactosidase produced is inactivated due to insertion of alien DNA within the coding sequence of the enzyme, which acts as a selectable marker to differentiate recombinant colonies from non-recombinant one.