

BIOLOGY

Paper & Solution

Code: 57/1

Max. Marks: 70

Time: 3 Hrs.

General Instructions:

- (i) All questions are compulsory.
- (ii) Section **A** contains questions number **1 to 5**, very short-answer type questions of **1** mark each.
- (iii) Section **B** contains questions number **6 to 10**, short-answer type **I** questions of **2** mark each.
- (iv) Section **C** contains questions number **11 to 22**, short-answer type **II** questions of **3** mark each.
- (v) Section **D** contains questions number **23**, value-based question of **4** marks
- (vi) Section **E** contains questions number **24 to 26**, long-answer type questions of **5** marks each.
- (vii) There is no overall choice in the question paper; however, an internal choice is provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any one of the two given alternatives.

SECTION – A**Q. Nos. 1 - 5 are of one marks each**

1. A male honeybee has 16 chromosomes whereas its female has 32 chromosomes. Give one reason.

Answer:

Male Honey bee develops from unfertilized female gamete / unfertilised egg / Parthenogenesis of female gamete (16 chromosomes), female develops by fertilization / fertilised egg (32 chromosomes)

2. Mention the role of 'genetic mother' in MOET.

Answer:

Genetic mother is used to produce many eggs / for superovulation // 6-8 eggs (under the influence of FSH)

3. What is biopiracy ?

Answer:

Biopiracy is the use of bioresources by multinational companies and other organization without proper authorization/compensation payment to the concern country /organisation.

4. Mention two advantages for preferring CNG over diesel as an automobile fuel.

Answer:

Advantages of CNGi)

burns efficiently / less unburnt residues.

ii) Cheaper than petrol / diesel.

iii) Causes less pollution.

iv) cannot be adulterated.

v) cannot be siphoned by thieves. (any two)

5. Write the probable differences in eating habits of Homo habilis and Homo erectus.

Answer:

Homo habilis did not eat meat / vegetarian

Homo erectus ate meat (meat eater)

SECTION - B**Q Nos. 6-10 are of two marks each**

6. A single pea plant in your kitchen garden produces pods with viable seeds, but the individual papaya plant does not. Explain.

Answer:

Pea- flowers of pea plants are bisexual , monoecious / self pollinated (to produce pods with viable seeds)
Papaya-Dioecious plant / unisexual plant bearing male and female flowers on separate plants, unable to produce viable seeds as there is no cross pollination / it could be a male plant which is unable to produce fruit and seeds

7. Following are the features of genetic codes. What does each one indicate ? Stop codon; Unambiguous codon; Degenerate codon; Universal codon.

Answer:

Stop codon - does not code for any amino acid / terminates the synthesis of polypeptide chain
Unambiguous codon - one codon codes for one amino acid only
Degenerate codon - some amino acid are coded by more than one codon
Universal codon - genetic code is same for all organisms (bacteria to humans)

8. Suggest four important steps to produce a disease resistant plant through conventional plant breeding technology.

Answer:

Steps for producing disease resistant plantsi)
Screening of germplasm (for resistance sources)
ii) Hybridization of selected parents
iii) Selection and evaluation of hybrids
iv) Testing and release of new varieties

9. Name a genus of baculovirus. Why are they considered good biocontrol agents ?

Answer:

Nucleopolyhedrovirus

Species specific, narrow spectrum insecticidal application , no negative impact on non target organisms

10. Explain the relationship between CFC's and Ozone in the stratosphere.

Answer:

UV rays act on CFC's , release Cl atom ,which act on ozone to release O_2 , resulting in ozone layer depletion / causing ozone hole

OR

Why are sacred groves highly protected ?

Answer:

Sacred groves are highly protected - because of religious and cultural traditions , refuges for large number of rare and threatened plants / ecologically unique and biodiversity rich regions

SECTION - C**Q Nos. 11-22 are of three marks each**

11. (a) Name the organic material exine of the pollen grain is made up of. How is this material advantageous to pollen grain ?

(b) Still it is observed that it does not form a continuous layer around the pollen grain.

Give reason.

(c) How are 'pollen banks' useful ?.

Answer:

(a) Sporopollenin

Most resistant to high temperature / strong acids / alkali / no enzymes can degrade it

(b) (Germs pores) to allow pollen tube to emerge out / pollen germination

(c) Helps in storing pollen grains for years / for crop breeding programmes

OR

(a) Mention the problems that are taken care of by Reproduction and Child Health Care programme.

(b) What is amniocentesis and why there is a statutory ban on it ?

Answer:

(a) Uncontrolled population growth / social evil like sex abuse / sex related crime / STDs

(b) Foetal sex determination tests based on chromosomal pattern in the amniotic fluid / to study chromosomal abnormalities in the foetus

Banned to legally check female foeticide

12. What is a test cross ? How can it decipher the heterozygosity of a plant ?

Answer:

- A cross to analyse whether genotype of dominant individual is homozygous or heterozygous

- On crossing with a recessive parent, if 50% of progeny have dominant trait and 50% have recessive trait then the plant is said to be heterozygous

The above value points can be considered with the help of a test cross

13. (a) What do 'Y' and 'B' stand for in 'YAC' and 'BAC' used in Human Genome Project (HGP). Mention their role in the project.

(b) Write the percentage of the total human genome that codes for proteins and the percentage of discovered genes whose functions are known as observed during HGP.

(c) Expand 'SNPs' identified by scientists in HGP.

Answer:

(a) Y = Yeast

B = Bacterial

- Used as vector for cloning foreign DNA

(b) (<) 2% , (<) 50%

(c) Single Nucleotide Polymorphism

14. Differentiate between homology and analogy. Give one example of each.

Answer:

Homology	Analogy
<ul style="list-style-type: none"> Organisms having the same structure developed along different directions due to adaptations / different functions 	<ul style="list-style-type: none"> Different structures having the same function (in different organisms)
<ul style="list-style-type: none"> Result of divergent evolution 	<ul style="list-style-type: none"> Result of convergent evolution
<ul style="list-style-type: none"> Indicates common ancestry 	<ul style="list-style-type: none"> Does not indicate common ancestry

• Anatomically same structures	• Anatomically different structures
Example	Example
Forelimbs of whale - bats - cheetah - human	Wings of butterfly and birds
Thorns of Bougainvillea - tendrils of cucurbits	Sweet potato and potato

15. (a) It is generally observed that the children who had suffered from chicken - pox in their childhood may not contract the same disease in their adulthood. Explain giving reasons the basis of such an immunity in an individual. Name this kind of immunity.

(b) What are interferons ? Mention their role.

Answer:

(a) The first infection of chicken pox produce a primary response and antibodies are generated against chicken pox virus , subsequent encounter with the same virus elicits a highly intensified secondary response , due to the memory cells formed during the first encounter , active immunity

(b) Proteins secreted by viral infected cells , which protects non infected cells from viral infection / when α - interferon is given to cancer patient (it activates immune system) , destroys tumour

16. (a) Write the two limitations of traditional breeding technique that led to promotion of micro propagation.

(b) Mention two advantages of micro propagation.

(c) Give two examples where it is commercially adopted.

Answer:

(a) Failed to keep pace with demand , failed to provide fast and efficient system of crop improvement

(b) Large number of plants can be developed in a short duration / production of genetically identical plants / somaclones / healthy plants can be recovered from diseased plants

(c) Tomato / banana / apple

17. (a) How do organic farmers control pests ? Give two examples.

(b) State the difference in their approach from that of conventional pest control methods.

Answer:

(a) Natural predation / biological control

Examples - lady bird used to kill aphids // dragon flies used to kill mosquitoes // *Bacillus thuringiensis* used to kill cotton bollworm / caterpillar / butterfly caterpillar

(b)

Conventional Pest Control	Organic farming based pest control
use of chemical insecticides & pesticides	No chemical used
Harmful to non target organisms	Not harmful to non target organisms
Cause environmental pollution	No adverse impact on environment

18. (a) Name the selectable markers in the cloning vector pBR322 ? Mention the role they play.

(b) Why is the coding sequence of an enzyme (β -galactosidase) a preferred selectable marker in comparison to the ones named above ?

Answer:

(a) ampR / ampicillin resistance genes , tetR/ tetracycline resistance gene

They help in identifying and eliminating non-transformants / non recombinants and selectively permitting the growth of the transformants / recombinants

(b) Simpler process / less cumbersome , in the presence of chromogenic substrate recombinants are colourless and non recombinants are blue in colour

19. (a) Why must a cell be made 'competent' in biotechnology experiments ? How does calcium ion help in doing so ?

(b) State the role of 'biolistic gun' in biotechnology experiments.

Answer:

(a) - To take up the (hydrophilic) DNA from the external medium

- Divalent calcium ions increase the efficiency of DNA entering the cell through pores in the cell wall

(b) To introduce alien DNA into the plant cell by bombarding them with high velocity microparticles (gold or tungsten coated with DNA)

20. Explain enzyme-replacement therapy to treat adenosine deaminase deficiency. Mention two disadvantages of this procedure.

Answer:

Functional adenosine deaminase is given to the patient by injection Disadvantages

- Therapy is not completely curative , periodic infusion of enzyme required

21. Name and explain the type of interaction that exists in mycorrhizae and between cattle egret and cattle.

Answer:

- Mutualism

Association between fungi and the root of higher plants , fungus absorbs essential nutrients from the soil and plant provides the fungi with energy yielding carbohydrates (both benefitted)

- Commensalism

Cattle stir up and flush out insects from the vegetation on which the egret feed , cattle is neither harmed nor benefitted / not effected

22. Differentiate between primary and secondary succession. Provide one example of each.

Answer:

Primary Succession

- It begins with areas where no living organisms ever existed

- Establishment of a biotic community - is very slow

Example

Newly cooled lava / bare rocks / newly - created ponds or reservoir

Secondary Succession

It begins in areas where natural

biotic communities have been destroyed

Establishment of a biotic community is faster

Example

Abandoned farm lands / burnt or cut forests / lands that have been flooded

SECTION - D

Q No. 23 is of four mark

23. A large number of married couples the world over are childless. It is shocking to know that in India the female partner is often blamed for the couple being childless.

(a) Why in your opinion the female partner is often blamed for such situations in India ?

Mention any two values that you as a biology student can promote to check this social evil.

(b) State any two reasons responsible for the cause of infertility.

(c) Suggest a technique that can help the couple to have a child where the problem is with the male partner.

Answer:

(a) Female partner is blamed due to social mind set / inequality of sexes / lack of awareness / male dominated society / any other relevant point

- Awareness to be created that abnormality can occur in both male and females and infertility issues with suitable examples

- Mutual respect towards both the partners in case of the problem and to find the remedy from medical experts instead of visiting quacks

- Educate them to find the reason and not believe in superstitions

(b) Physical (abnormality in reproductive system) , congenital , immunological or psychological

(c) Intra cytoplasmic sperm injection (ICSI) / artificial insemination (AI) / Intra uterine insemination (IUI) =

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SECTION - E

Q Nos. 24-26 are of five marks each

24. (a) Explain the menstrual phase in a human female. State the levels of ovarian and pituitary hormones during this phase.

(b) Why is follicular phase in the menstrual cycle also referred as proliferative phase ? Explain.

(c) Explain the events that occur in a graafian follicle at the time of ovulation and thereafter.

(d) Draw a graafian follicle and label antrum and secondary oocyte.

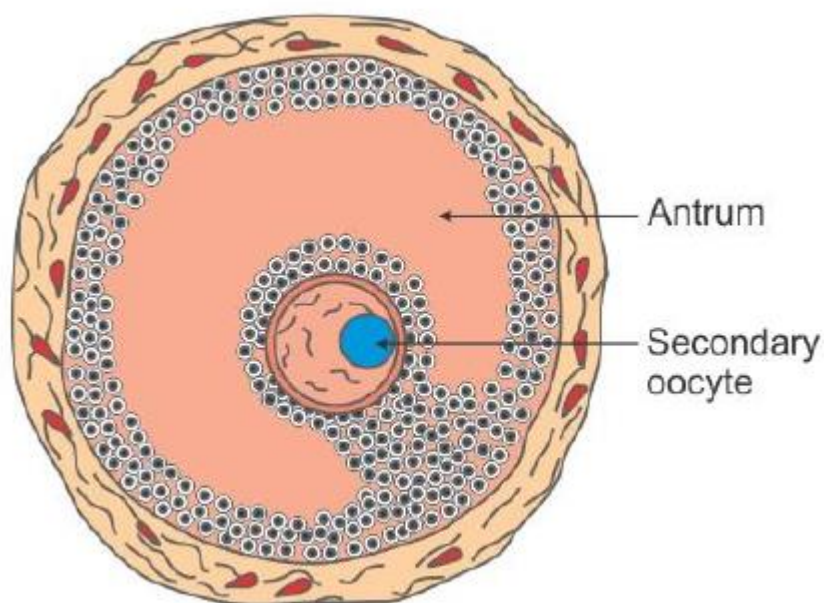
Answer:

(a) Menstrual phase occurs when released ovum not fertilised , break down of endometrial lining (of the uterus) and its blood vessel form the liquid that comes out through the vagina , lasts for 3 to 5 days

Level of ovarian and pituitary hormones fall graphically represented

(b) Primary follicle grows into graafian follicle under the influence of LH & FSH , regeneration of endometrium (under the influence of estrogen)

(c) Graafian follicle ruptures to release the ovum (secondary oocyte) , remaining parts of the Graafian follicle transform into corpus luteum



OR

(a) As a senior biology student you have been asked to demonstrate to the students of secondary level in your school, the procedure(s) that shall ensure cross-pollination in a hermaphrodite flower. List the different steps that you would suggest and provide reasons for each one of them.

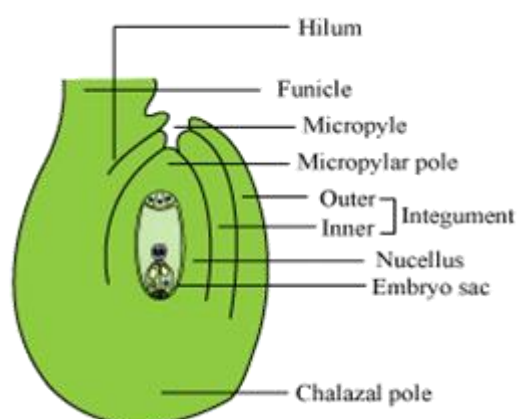
(b) Draw a diagram of a section of a megasporangium of an angiosperm and label funiculus, micropyle, embryo sac and nucellus.

Answer:

(a) Emasculation , removal of anthers from the flower bud before the anther dehisce to avoid self pollination
Bagging , to prevent contamination of its stigma with unwanted pollen grains

Rebagging , the stigma of the mature ovary are dusted with desired pollen grains and rebagged to allow the fruit to develop

(b)

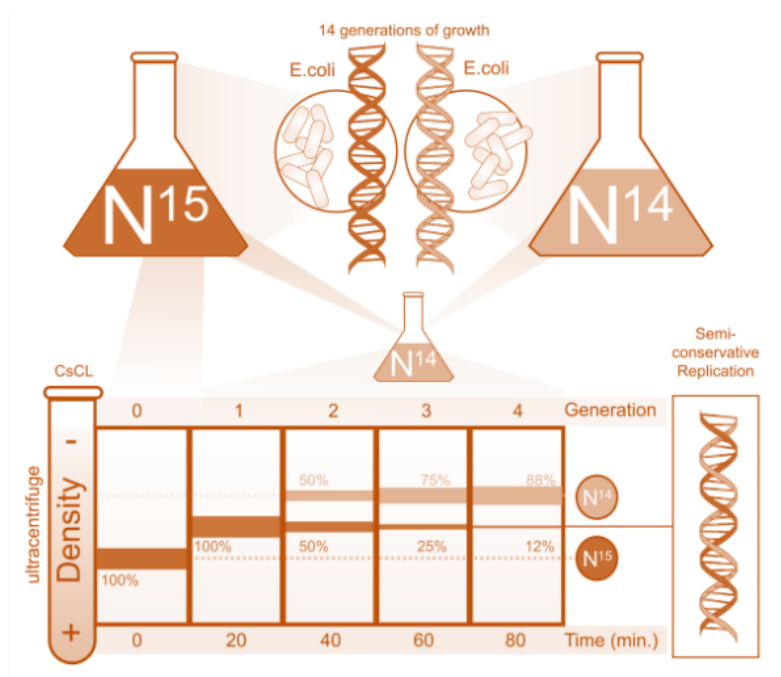


25. Describe Meselson and Stahl's experiment that was carried in 1958 on E.Coli. Write the conclusion they arrived at after the experiment.

Answer:

They grew E.coli , in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA , then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$, the extracted DNA are centrifuged in CsCl and measured to get their densities ,

DNA extracted from the culture after one generation (20 minutes) , showed intermediate hybrid density , DNA extracted after two generations (40 minutes) showed light DNA , and hybrid DNA



A correctly labelled diagrammatic representation in lieu of the explanation of experiment DNA replication is semi conservative in nature

OR

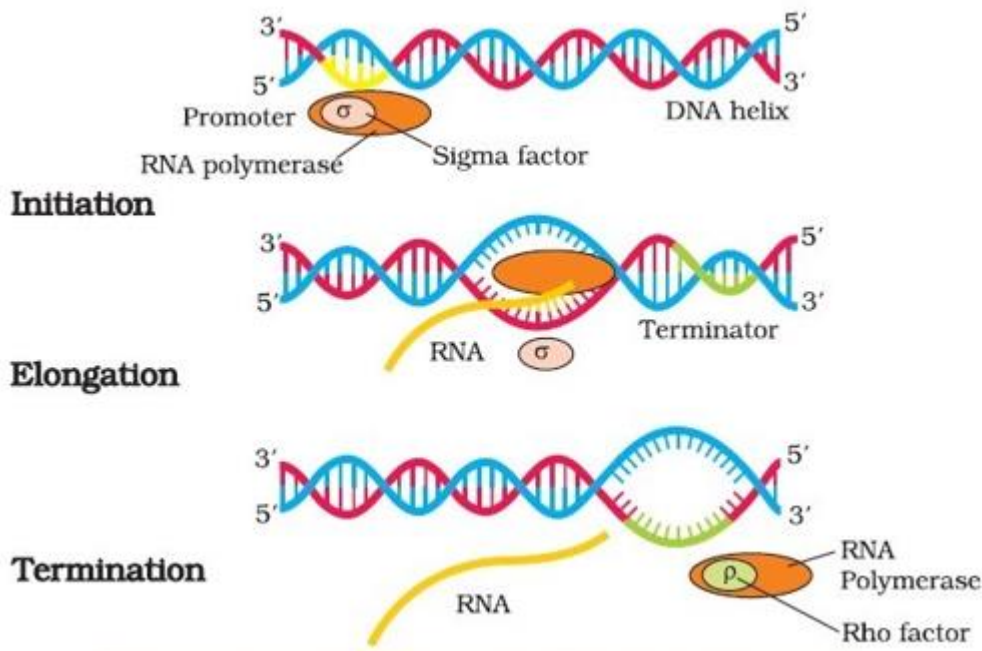
(a) Describe the process of transcription in bacteria.

(b) Explain the processing the hnRNA needs to undergo before becoming functional mRNA in eukaryotes.

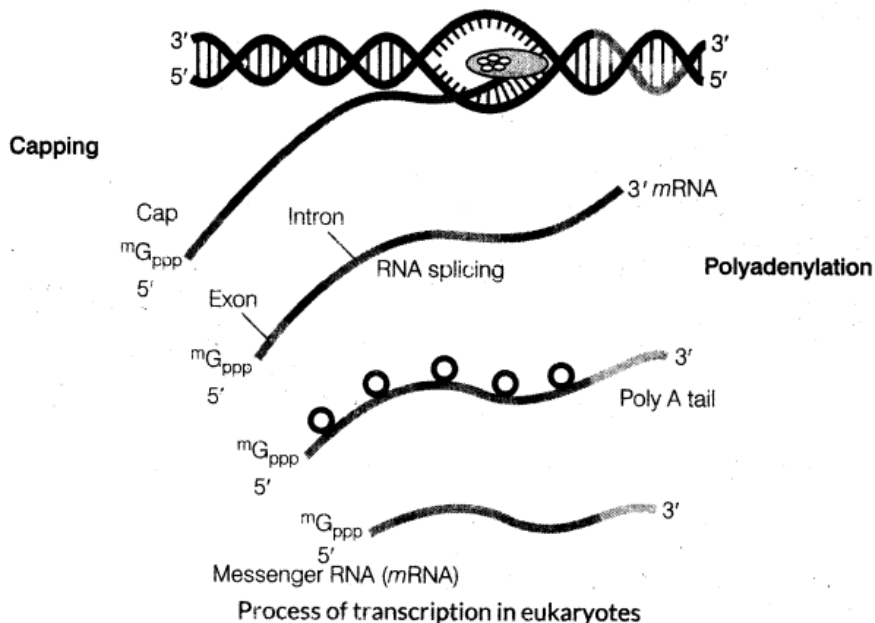
Answer:

(a) Initiation : Enzyme(DNA dependent RNA polymerase)RNA polymerase binds with sigma factor (σ) and attaches to the promoter site ie 5' site of the DNA Elongation : When RNA polymerase moves from promoter to the terminator site it causes the polymerisation of nucleoside triphosphates / Nucleotides resulting in the formation of RNA (in the 5'-3' direction)

Termination : RNA Polymerase on reaching the terminator site binds to ρ factor and the (nascent transcribed) RNA falls off along with RNA polymerase



(b) hnRNA undergoes splicing where introns are removed and exons are joined in a defined order hnRNA undergoes additional processing i.e capping (addition of methyl guanosine triphosphate to the 5'end) , tailing (200-300 poly adenylate residue are added to the 3' end.)



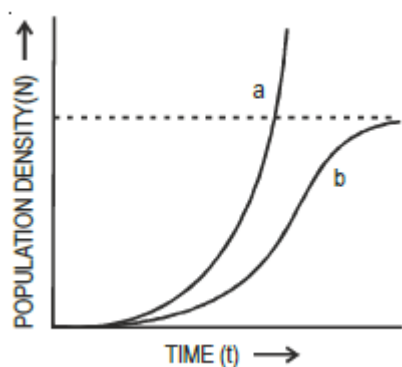
26. (a) Name the two growth models that represent population growth and draw the respective growth curves they represent.

(b) State the basis for the difference in the shape of these curves.

(c) Which one of the curves represent the human population growth at present ? Do you think such a curve is sustainable ? Give reason in support of your answer.

Answer:

(a) Exponential growth curve , logistics growth curve



a - exponential growth curve b - logistic growth curve

(b) Exponential growth - food resources and space unlimited ,

Logistic growth - food resources and space limited

(c) Exponential growth not sustainable , as resources are limited / carrying capacity.

OR

(a) Taking an example of a small pond, explain how the four components of an ecosystem function as a unit.

(b) Name the type of food chain that exists in a pond.

(a) Productivity - conversion of inorganic substances into organic material with the help of radiant energy / sunlight by the autotrophs / producers (phytoplankton , algae , floating ,submerged plants)

Decomposition - decomposers (fungi , bacteria , flagellates) breakdown dead decayed organic matter into simpler compounds

Energy Flow - Unidirectional movement of energy towards higher trophic levels (producer to consumer) and its dissipation and loss as heat to the environment

Nutrient cycle- Mineralisation of dead matter to release them back for reuse of autotrophs

(b) Grazing food chain / detritus food chain