
BIOLOGY - SOLUTION
SECTION 'A'

Ans :- 1 Fill in the blank and write :-

- a. Two
- b. Dominant
- c. Folded / circular
- d. 45
- e. Erythrocytes
- f. Food web
- g. Prolactin

Ans :- 2 Choose the correct option :-

1. 2 :- Typhoid
2. 2 :- Secondary Treatment
3. 4 :- Bacterial and fungi
4. 3 :- Both (1) and (2)
5. 3 :- Ernst Haeckel
6. 3 :- Random and Directionless
7. 4 :- Natural selection

Ans :- 3 Write answer of each question in one sentence :-

- (i) The connection between embryo and uterus is known as placenta.
- (ii) Ovary
- (iii) Nucleotide
- (iv) DNA polymerase - I, II, III (main)
- (v) The eyes of octopuses and mammals are an example of convergent evolution.
- (vi) Progesterone hormone is responsible for maintaining pregnancy.
- (vii) Multiload 375 is copper releasing IUD

Ans :- 4 Match the column :-

- i Typhoid - widal test
- ii. vasectomy - male
- iii. Cellular - WBC
- iv. IUD - phagocytosis of sperm
- v. Klinefelters syndrome- Additional sex chromosome
- vi. condom prevents sperm reaching in cervix
- vii Filariasis - Wuchereria

Ans :- 5 Hardy-Weinberg principle describes a theoretical situation in which a population is undergoing no evolutionary change. It states that allele frequencies in a population are stable and constant from generation to generation. There are five factors that affect Hardy-Weinberg Principle. These are - mutation, gene flow, genetic drift, genetic recombination and natural selection.

OR

Hugo de Vries studied the inheritance of flower colour in evening primrose and proposed mutation theory. The theory says that mutations are sudden, random, and inheritable and discontinuous variations which serve as raw material for evolution. The mutations are irreversible and are passed on to the next generations.

Ans :- 6 Bear and wine.

OR

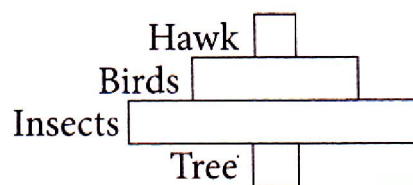
(a) The relationship between the sequence of amino acids in a polypeptide and nucleotide sequence of DNA or mRNA is called genetic code.

(b) (i) Degenerate codon: More than one codons code for a single amino acid. In degenerate codons, generally the first two nitrogen bases are similar while the third one is different. E.g., UUU and UUC code for phenylalanine.

(ii) Unambiguous codon: Codons that specify only one amino acid and not any other. E.g., AUG codes for methionine.

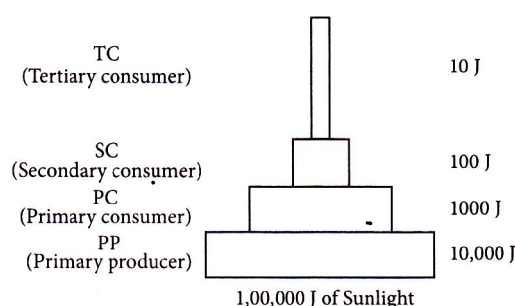
(iii) Initiator codons: The start codon is the first codon of mRNA transcript. It initiates the process of translation. E.g., AUG

Ans :- 7 In the given case, pyramid of numbers will be spindle shaped as shown here.



OR

An ideal pyramid of energy with primary producers when 100000 J of sunlight available is shown below:

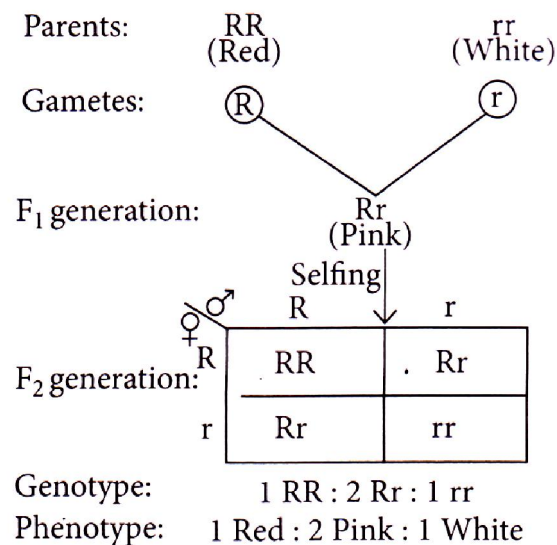


- Ans :- 8 (a) The molecule 'X' is repressor. It gets inactivated when lactose (inducer) binds with it.
(b) z-gene codes for-galactosidase.
(c) Transcription of the gene stops when lactose is absent and thus repressor is free to bind with the operator.

OR

In the absence of fertilisation, the corpus luteum degenerates. Degeneration of the corpus luteum leads to decrease in the production of progesterone. As progesterone is needed for the maintenance of the endometrium, its reduction leads to disintegration of endometrium thus causing menstruation.

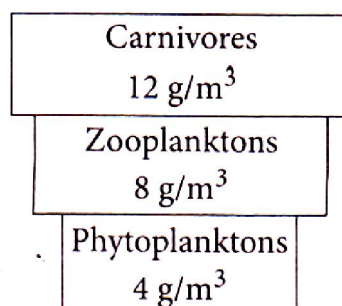
- Ans :- 9 Neither of the two alleles of a gene is completely dominant over the other, hence the phenomenon is known as incomplete dominance. Incomplete dominance in *Antirrhinum* is explained below.



OR

Standing refers to mass of living material at a particular trophic level at a particular time. It is measured as biomass or the number in a unit area.

Pyramid of biomass in sea is inverted as shown here.



Ans :- 10 When lactose is present in the culture medium, then the lac operon in *E. coli* is switched on. It is because the inducer (lactose) binds to the repressor protein F thereby inactivating it. It prevents binding of repressor E to the operator. Consequently, RNA polymerase gets E access to the promoter and transcription of structural genes proceeds.

OR

There are a number of reasons to conserve biodiversity which can be grouped as: Narrow utilitarian : Human derive a major part of their requirement from organisms. Their direct benefits are countless. For example:

- (i) Food cereals: Pulses, fruits and vegetables are derived from plants and milk, egg and meat are derived from animals
- (ii) Fats and oils are obtained from plants and animals.
- (iii) Firewood as a source of energy for cooking and heating.
- (iv) Fibres, e.g., cotton, flax silk, wool.
- (v) Industrial products like tannins, lubricant, dyes, resins, and perfumes.
- (vi) Drugs: Nearly 25% of drugs being used by us are directly coming from plants.

Broadly utilitarian : Biodiversity is fundamental to ecosystem services of nature. For example,

- (i) Oxygen: Through their photosynthetic activity plants are replenishing oxygen of the atmosphere. Amazon rainforest is estimated to contribute 20% of it.
- (ii) Pollination: Bees, bumble bees, butterflies, moths, beetles, birds and bats are engaged in pollination of plants which is essential for formation of fruits and seeds.
- (iii) Climate regulation: Forest and oceanic systems regulate global climate.
- (iv) Aquifers: Plant cover is essential for retention of rain water, its percolation and storage in aquifers and reservoirs.
- (v) Flood and erosion control: Plant cover protects the soil from wind and water erosion. Run off of rain water is reduced so that flood water is rarely formed.
- (vi) Nutrient cycling: It is essential for continued availability of nutrients to plants without which there would be no photosynthetic activity.

Ans :- 11 Down's syndrome is a chromosomal disorder. This condition happens because of an extra copy of chromosome 21.

A person suffering from Down's syndrome shows the following symptoms:

Short stature

Small round head

Furrowed tongue and partially open mouth

OR

Pituitary gland secretes two hormones, FSH and LH. LH acts on Leydig's cells of the testes to secrete testosterone. FSH acts on sertoli cells of the seminiferous tubules of the testes to secrete androgen binding protein (ABP) which concentrates testosterone in seminiferous tubules. FSH acts on spermatogonia to stimulate sperm production

Ans :- 12 Infective stage- sporozoites“Vector name- female anopheles mosquito.“The human infection begins when an infected female anopheles mosquito bites a person and injects infected with sporozoites saliva into the blood circulation. That is, the first life stage of plasmodium (stage of infection).

OR

Ovulatory phase: Mid-cycle phase, this is the phase in which ovulation takes place i.e., day 13-17. The end of the follicular phase along with the ovulation period defines the fertilisation period.

Ans :- 13 DNA replication-The duplication (copy formation) of DNA is known as its replication. In both the prokaryotic as well as eukaryotic cells, the replication of DNA takes place with the help of DNA dependent DNA polymerase.

DNA replication is semiconservative type. It means two double helical DNA molecules are formed from one double helical parental molecule. Each of the newly synthesized molecule has one parental (template) molecule and one newly synthesized molecule.

Method of DNA replication-

(i) Materials required-The process of replication requires DNA dependent DNA polymerase as the main enzyme, deoxyribonucleotide phosphates (as monomer substrate as well as source of energy-they are high energy phosphates same as in case of ATP). Along with DNA polymerase, helicases, topoisomerases, DNA ligase and RNA primers are also needed.

(ii) Various steps of replication are -

(a) Initiation of replication In a prokaryotic cell replication starts at a single initiation point while there are several such points in eukaryotic cells. These points are called origin of replication.

(b) Unwinding of DNA helix-Before replication unwinding of double helix is required that takes place in the presence of helicase enzymes. Separation of two strands leads to the formation of a Y shaped structure called replication fork. Topoisomerase enzyme cut and reseal DNA helix to check the recoiling.

(c) Formation of primer strand-A small segment of RNA acts as primary strand (RNA primer). It acts as a stepping stone for the synthesis of DNA strand.

(d) Elongation of the new strand Both the strands of the DNA take part in the process. DNA dependent DNA polymerase enzyme can polymerise DNA only in the 5' 3' direction. Therefore, in one strand with 3' 5' orientation the synthesis is continuous. It is called leading strand. In other strand with 5' 3' orientation

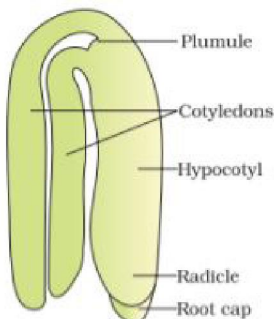
the DNA synthesis is discontinuous. This strand is called lagging strand. On this strand DNA is synthesized in the form of small fragments, called Okajaki fragments in 5' 3' direction only. It needs several RNA primers. Okajaki fragments are later joined by DNA ligase enzyme. Proof reading is done by DNA polymerase only.

OR

Transcription is carried out by RNA polymerase enzymes and a number of accessory proteins called transcription factors. These transcription factors bind to promoter/enhancer sequences and recruit RNA polymerase to an appropriate transcription site on the DNA sequence. Transcription of RNA requires the use of three polymerase enzymes:

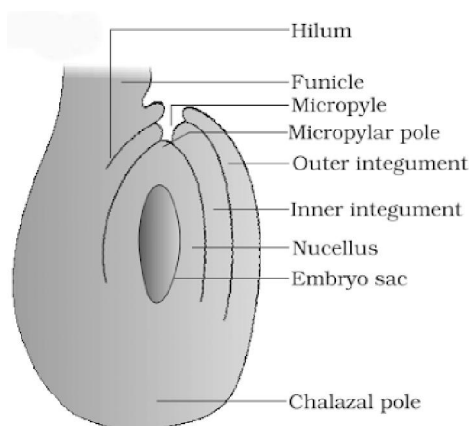
- 1) RNA polymerase I is responsible for the transcription of ribosomal RNA
- 2) RNA polymerase II is responsible for the transcription of mRNA
- 3) RNA polymerase III is responsible for the transcription of both ribosomal RNA and transfer RNA.

Ans :- 14



Dicot embryo

OR



Ans :- 15 Each testis contains about 250 compartments called testicular lobule and each lobule contains one to three highly coiled seminiferous tubules where sperms are produced. The stratified epithelium of seminiferous tubules is made up of two type of cells- Sertoli cells and Spermatogenic cells or male germ cells. Between the seminiferous tubules present the Leydig cells. These cells secrete testosterone hormone that controls spermatogenesis.

OR

“The female external genitalia includes mons pubis, labia majora, labia minora, hymen and clitoris” Mons pubis is a cushion of fatty tissue covered by skin and pubic hair. “The labia majora are fleshy folds of tissue, which extends down from mons pubis and surround the vaginal opening. “The labia minora are paired folds of tissue under the labia majora. “The opening of the vagina is often covered partially by a membrane called hymen. “The hymen is often torn during the first coitus. “However it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horseback riding, cycling etc. “In some women the hymen persists even after coitus. “In fact the presence or absence of hymen is not a reliable indicator of virginity of sexual experience. “The clitoris is a tiny finger like structure which lies at the upper junction of the two labia minora above the urethral opening.

Ans :- 16

Basis of Difference	Innate Immunity	Acquired Immunity
Line of Defense	Innate immunity presents the first line of defense .	It is the second line of defense .
Timeline	response . Innate immunity is a rapid	Acquired immunity is a delayed response .
Cellular components	Natural killer cells , macrophages , complement cells .	Lymphocytes - T and B

OR

1. Down syndrome: This syndrome is a type of trisomy as there is an extra copy of chromosome 21. The person is short and has a small and round head “-Physical and mental development is retarded” -Furrowed tongue and partially open mouth.

2. Klinefelter syndrome: This genetic disorder arises due to the presence of an additional X chromosome in males. Thus, resulting in a chromosome count of 47 (44 + XXY) instead of 46. The symptoms include: “Such a person has a masculine physique but has feminine development like the development of breasts” Such individuals are sterile, i.e.; they cannot reproduce.

3. Turner syndrome: Unlike Klinefelter syndrome, in this chromosomal disorder there is the absence of one X chromosome in females. Hence, decreasing the chromosomes count to 45 (44 + XO). The symptoms include the following: “Such females are sterile” Have rudimentary ovaries and there is the absence of secondary sexual characters.

Ans :- 17 (a) Dung and water enter the digester chamber from part A.

(b) Methanogens are the group of bacteria and these grow anaerobically. In anaerobic sludge digester, methanogens digest the flocs of bacteria and fungi in activated sludge and produce biogas.

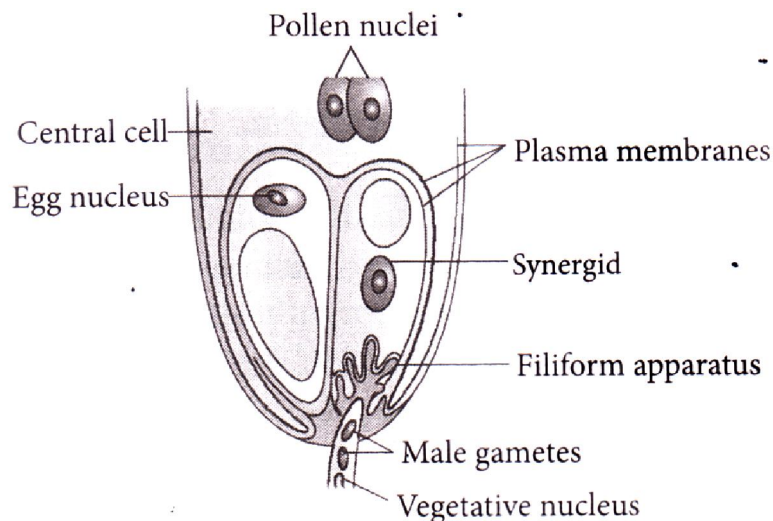
(c) Biogas is a methane rich fuel gas produced by anaerobic breakdown of biomass with the help of methanogenic bacteria. It is made up of methane (50-70%), carbon dioxide(30-40%) with traces of nitrogen, hydrogen sulphide and hydrogen.

OR

(i) The given figure represents discharge of malegametes and their movements, within embryo sac. Labelled part X is fusing polar nuclei and Y is male gametes.

(ii) Male gametes take part in double fertilisation. One male gamete fuses. with egg cell to form zygote. Polar nuclei fuse with male gamete to form endosperm.

(iii) Enlarged view of an egg apparatus showing entry of pollen tube into a synergid:



(b) In angiosperms, one of the male gametes fuses with the egg cell to form the zygote (syngamy). The other male gamete fuses with the two polar nuclei to produce a triploid primary endosperm nucleus (triple fusion). Since two types of fusions, syngamy and triple fusion take place in the same embryo sac, the phenomenon is termed as double fertilisation.

The ploidy of the cells involved in double fertilisation are as follows:

- (i) Male gamete - Haploid (n)
- (ii) Egg cell - Haploid (n)
- (iii) Central cell - Diploid (2n)

Ans :- 18

	Bacterial Diseases	Pathogen	Symptoms & Pathogenicity
(1)	Typhoid fever	Salmonella typhi	<ul style="list-style-type: none"> Enters small intestine through contaminated food and water and migrate to other organs through blood Sustained high fever (39-40° C) Weakness, constipation, stomach pain Headache, loss of appetite In severe cases intestinal perforation, death Widal test Mary Mallon, Nicknamed- Typhoid Mary (Carrier of typhoid)
(2)	Pneumonia	Streptococcus pneumoniae .Haemophilus influenzae	By droplet or aerosol infection or use of glass or utensils of infected person <ul style="list-style-type: none"> Infects alveoli of the lungs Alveoli get filled with fluid leading to severe problem in respiration Fever with chills, cough & headache In severe cases lips and nails turns gray to bluish in colour
(3)	Dysentery(Shigellosis)	Shigella dysenteriae	<ul style="list-style-type: none"> Abdominal pain Blood & mucus in the stool Transmits through faecal oral route
(4)	Plague(Black death)	Yersinia pestis Parasite of Xenopsyllacheopsis (Rat flea)	<ul style="list-style-type: none"> High fever, headache Enlargement of axillary lymph nodes
(5)	Diphtheria	Corynebacteriumdiphtheriae	<ul style="list-style-type: none"> High grade fever, affects throat Causes suffocation

OR

Viral Diseases	Pathogen	Symptoms & Pathogenicity
(1) Common cold	Rhino viruses(Group of viruses)	One of the most infectious human ailments Transmits through droplet resulting from cough , sneez etc. Infect nose and respiratory passage but not the lungs Nasal congestion and discharge , sore throat . hoarseness , cough , headache , tiredness Usually last for 3-7 days
(2) Chikun - gunya	Chikungunya virus (ss - RNA) (Vector :- Aedes - ageypti mosquito	Fever , joint pain , Lymphadenopathy
(3) Dengue fever or Break - bone - fever	Flavi - arbo virus (Vector : Aedes - ageypti mosquito)	Fever , severe - frontal - headache , muscle & joint pain Bleeding from nose , mouth , gums
(4) Hepatitis - B	HBV (ds DNA)	Severe liver damage , jaundice Recombinant DNA - vaccine Transmits - through parenteral and sexual - route Can cross placenta
(5) AIDS	HIV Virus	Swollen lymph nodes, bouts of fever, repeated episodes of diarrhoea, weight loss, prolonged cough, Pneumonia, Cancer of skin and lymphnodes

Ans :- 19 (a) In the given figure, 'A' represents sporogenous tissue and 'B' represents tapetum.

Functions of sporogenous tissue (A): It fills the whole Futerior of the microsporangium. Its cells divide with the growth of anther and increase their number. Ultimately, they are transformed into microspore or pollen mother cells (PMC). Microspore mother cells undergo meiosis to produce haploid microspores or pollen grains.

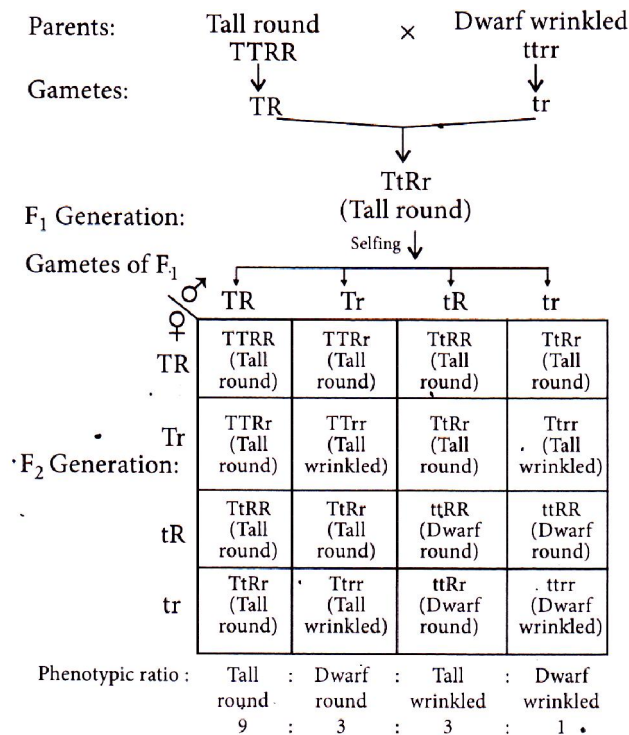
Functions of tapetum 'B' : It helps in nourishment of the developing microspore mother cells and pollen grains. It also produces lipid rich Ubisch granules containing sporopollenin for exine formation.

(b) The hard outer layer of pollen grains called exine is made up of a highly resistant fatty substance called sporopollenin. Sporopollenin is highly protective layer not degraded by any enzyme. It is not affected by high temperature, strong acid or strong alkali Because of sporopollenin, exine provides protection during the hazardous journey of pollen from anther to stigma. Also, pollen grains are well preserved as““microfossils and protected from external adversities due to the presence of sporopollenin.

(c) Pollen banks are used to store pollen grains for long time, which can be used in plant breeding programmes. In pollen banks, pollens are stored in liquid nitrogen at a temperature of -196°C.

OR

Cross between parents with two differnt contrasting traits is as follows :



- (i) Genotype and phenotype of F_1 progeny are TtRr and Tall and round seeded plant respectively.
- (ii) Gametes produced of F_1 progeny are TR, Tr, tR, tr.
- (iii) When F_1 seeds were grown into plants, F_2 seeds were obtained which showed all the four possible combinations, i.e.,
 - (a) tall and round seeds
 - (b) tall and wrinkled seeds,
 - (c) dwarf and round seeds and
 - (d) dwarf and wrinkled seeds in 9 : 3 : 3 : 1 ratio.