SAMPLE Question Paper 1

Maximum Marks : 200 **Time : 45 Minutes**

General Instructions:

(i) *This paper consists of 50 MCQs, attempt any 40 out of 50 .*

(ii) *Correct answer or the most appropriate answer: Five marks (+5) .*

(iii) *Any incorrect option marked will be given minus one mark (– 1) .*

(iv) *Unanswered/Marked for Review will be given no mark (0) .*

(v) *If more than one option is found to be correct then Five marks (+5) will be awarded to only those who have marked any of the correct options .*

(vi) *If all options are found to be correct then Five marks (+5) will be awarded to all those who have attempted the question .*

(vii) *If none of the options is found correct or a Question is found to be wrong or a Question is dropped then all candidates who have appeared will be given five marks (+5).*

(viii) *Calculator / any electronic gadgets are not permitted .*

1. Flagellated, motile asexual reproductive structure are called :

(1) Megaspores **(2)** Aplanospores
(3) Zoospores **(4)** Microspores.

2. A cross between two tall plants resulted in offspring having few dwarf plants. What would be the genotypes of both the parents?

(1) TT and Tt **(2)** Tt and Tt
(3) TT and TT **(4)** Tt and tt

3. Opium is obtained from:

(1) *Papaver somniferum* **(2)** *Cannabis sativa*
(3) *Erythroxylum coca* **(4)** *Datura metel*

4. Which of the following bacteria is not a source of restriction endonuclease?

(1) *Haemophilus influenzae*
(2) *Escherichia coli*
(3) *Agrobacterium tumefaciens*
(4) *Bacillius amyloliquefaciens*

5. Amensalism is an association between two species where

(1) one species is harmed and other is benefitted.
(2) one species is harmed and other is unaffected.
(3) one species is benefitted and other is unaffected.
(4) both the species are harmed.

6. In an embryo sac, the cells that degenerate after fertilisation are:

(1) Synergids and primary endosperm cell
(2) Synergids and antipodals
(3) Antipodals and primary endosperm cell
(4) Egg and antipodals.

7. The promoter site and the terminator site for transcription are located at

(1) 3′ (downstream) end and 5′ (upstream) end, respectively of the transcription unit.
(2) 5′ (upstream) end and 3′ (downstream) end, respectively of the transcription unit.
(3) the 5′ (upstream) end.
(4) the 3′ (downstream) end.

Directions : In the following questions a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(1) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(2) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(3) Assertion (A) is true but reason (R) is false.
(4) Assertion (A) is false but reason (R) is true.

8. Assertion (A) : Hybrids result from a cross between two genetically unlike parents.

Reason (R) : Hybrid vigour is the superiority of hybrid over either of the parents.

9. A pro-toxin is

(1) a primitive toxin
(2) a denatured toxin
(3) toxin produced by protozoa
(4) inactive toxin

10. How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?
(1) 1% **(2)** 10%
(3) 40% **(4)** 90%

11. Which one of the following is not a male accessory gland?
(1) Seminal vesicle
(2) Ampulla
(3) Prostate
(4) Bulbo-urethral gland

12. Starting from the innermost part, the correct sequence of parts in an ovule is,
(1) egg, nucellus, embryo sac, integument.
(2) egg, embryo sac, nucellus, integument.
(3) embryo sac, nucellus, integument, egg.
(4) egg, integument, embryo sac, nucellus.

13. Which one of the following is not a nitrogen-fixing organism?
(1) *Anabaena* **(2)** *Nostoc*
(3) *Azotobacter* **(4)** *Pseudomonas*

14. An antibiotic resistance gene in a vector usually helps in the selection of
(1) competent cells **(2)** transformed cells
(3) recombinant cells **(4)** None of the above

15 Which one of the following shows maximum genetic diversity in India ?
(1) Rice **(2)** Maize
(3) Mango **(4)** Groundnut

16 In case of a couple where the male is having a very low sperm count which technique will be suitable for fertilisation ?
(1) Intrauterine transfer
(2) Gamete intracytoplasmic fallopian transfer
(3) Artificial Insemination
(4) Intracytoplasmic sperm injection

Directions : In the following questions a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :
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(4) Assertion (A) is false but reason (R) is true.

17 **Assertion (1) :** Sickle cell anaemia is an example of point mutation.

Reason (R) : It is caused by addition or deletion of nitrogenous bases in the DNA or mRNA.

18 The chemical test that is used for diagnosis of typhoid is
(1) ELISA-Test **(2)** ESR-Test
(3) PCR-Test **(4)** Widal-Test

19 Stirred-tank bioreactors have been designed for.
(1) ensuring anaerobic conditions in culture vessel
(2) purification of product
(3) addition of preservatives to product
(4) availability of oxygen throughout the process

20. Ecotone is
(1) a polluted area.
(2) the bottom of a lake.
(3) a zone of transition between two communities.
(4) a zone of developing community.

21. Which of the following statements does not support the view that elaborates sexual reproductive process appeared much later in the organic evolution.
(i) Lower groups of organisms have simpler body design.
(ii) Asexual reproduction is common in lower groups.
(iii) Asexual reproduction is common in higher groups of organisms.
(iv) The high incidence of sexual reproduction in angiosperms and vertebrates.

Choose the correct answer from the options given below.
(1) i, ii and iii **(2)** i, iii and iv
(3) i, ii and iv **(4)** ii, iii and iv

22. ZZ / ZW type of sex determination is seen in
(1) Platypus **(2)** snails.
(3) cockroach **(4)** peacock

23. Which of the following toxic substance is responsible for the malarial fever.
(1) Haemocyanin **(2)** Hemozoin
(3) Haemoglobin **(4)** Haemoriden

24. Who among the following was awarded the Nobel Prize for the development of PCR technique?
(1) Herbert Boyer **(2)** Hargovind Khurana
(3) Kary Mullis **(4)** Arthur Kornberg

25. Ecological niche is
(1) the surface area of the ocean.
(2) an ecologically adapted zone.
(3) the physical position and functional role of a species within the community.
(4) formed of all plants and animals living at the bottom of a lake.

26. A multicellular, filamentous alga exhibits a type of sexual life cycle in which the meiotic division occurs after the formation of zygote. The adult filament of this alga has

(1) haploid vegetative cells and diploid gametangia.
(2) diploid vegetative cells and diploid gametangia.
(3) diploid vegetative cells and haploid gametangia.
(4) haploid vegetative cells and haploid gametangia.

27. A human female with Turner's syndrome.
(1) has 45 chromosome with XO
(2) has one additional X chromosome
(3) exhibits male characters
(4) is able to produce children with normal husband

28. A collection of all the alleles of all the genes of a crop plant is called
(1) germplasm collection.
(2) protoplasm collection.
(3) herbarium.
(4) somaclonal collection.

29. …….. is a first transgenic cow.
(1) Dolly (2) Molly
(3) Shelly (4) Rosie

30. Which one of the cell in an embryo-sac produce endosperm after double fertilisation?
(1) Synergids cell (2) Antipodal cell
(3) Central Cell (4) Egg

31. Which one of the cell in an embryo-sac produce endosperm after double fertilisation?
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(3) Central Cell (4) Egg

32. The net electric charge on DNA and histone is
(1) both positive
(2) both negative
(3) negative and positive, respectively
(4) zero

33. Big holes in Swiss cheese are made by
(1) a machine
(2) a bacterium that produces methane gas
(3) a bacterium producing a large amount of carbon dioxide
(4) a fungus that releases a lot of gases during its metabolic activities

34. 'Restriction' in Restriction enzyme refers to
(1) cleaving of phosphodiester bond in DNA by the enzyme.
(2) cutting of DNA at specific position only.
(3) prevention of the multiplication of bacteriophage in bacteria.
(4) All of the above

35. Which one of the following is not a major characteristic feature of biodiversity hot-spots?
(1) Large number of species
(2) Abundance of endemic species
(3) Large number of exotic species
(4) Mostly located in polar regions

36. The correct surgical procedure as a contraceptive method is
(1) ovariectomy. (2) hysterectomy.
(3) vasectomy. (4) castration.

37. Synthetic drugs structurally related to adrenaline are
(1) Hallucinogens (2) Analgesics
(3) Amphetamines (4) Barbiturates

38. Protoplast is
(1) another name for protoplasm.
(2) an animal cell.
(3) a plant cell without a cell wall.
(4) a plant cell.

39. Which of the following is a post-fertilisation event in flowering plants?
(1) Transfer of pollen grains
(2) Embryo development
(3) Formation of flower
(4) Formation of pollen grains

40. From among the situations given below, choose the one that prevents both autogamy and geitonogamy.
(1) Monoecious plant bearing unisexual flowers.
(2) Dioecious plant bearing only male or female flowers.
(3) Monoecious plant with bisexual flowers.
(4) Dioecious plant with bisexual flowers.

41. Which type of immune response is responsible for the rejection of tissues/organs in the patient's body post transplantation ?
(1) auto-immune response
(2) humoral immune response
(3) physiological immune response
(4) cell-mediated immune response

42. A nitrogen-fixing microbe associated with *Azolla* in rice fields is :
(1) *Spirulina* (2) *Anabaena*
(3) *Frankia* (4) *Tolypothrix*

43. Non-biodegradable pollutants are created by
(1) nature
(2) excessive use of resources
(3) humans
(4) natural disasters

44. Which of the following is not a cause for loss of biodiversity?
(1) Destruction of habitat
(2) Invasion by alien species
(3) Keeping animals in zoological parks
(4) Over-exploitation of natural resources

45. **Pyramid of numbers is**

(1) always upright.
(2) always inverted.
(3) either upright or inverted.
(4) neither upright nor inverted.

Read the following text and answer the following questions on the basis of the same :

Down syndrome (sometimes called Down's syndrome) is a condition in which a child is born with an extra copy of their 21^{st} chromosome hence its other name, trisomy 21. The affected individual mental retarded, short statured with small round, head, furrowed tongue and partially open mouth, Physical, psychomotor and mental development is retarded.

46. The number of chromosomes a child with Down syndrome has is

(1) 45 **(2)** 46
(3) 47 **(4)** 48

47. Down syndrome is

(1) Sex-linked **(2)** Chromosomal
(3) dominant **(4)** recessive

48. One of this trait is seen in a person with Down syndrome

(1) Upward slant eye **(2)** Baldness
(3) Short stature **(4)** Long neck

49. Down Syndrome is an extra copy of which chromosome

(1) 22^{nd} chromosome **(2)** 21^{st} chromosome
(3) 45^{th} chromosome **(4)** 47^{th} chromosome

50. Down syndrome is caused due to

(1) bacterial infection
(2) lack of oxygen supply to the brain during birth
(3) Viral infection
(4) a chromosomal abnormality

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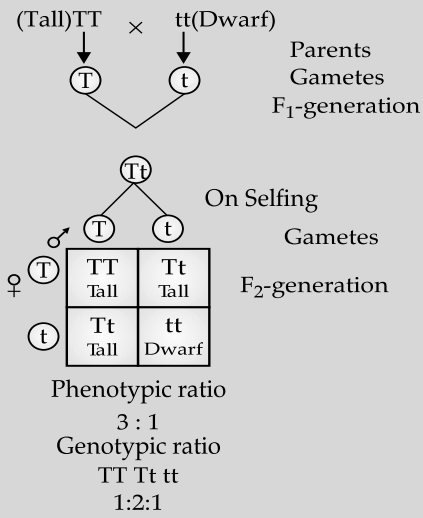
SOLUTIONS OF Question Paper 1

1. **Option (3) is correct.**

Explanation : Zoospore is a motile, a sexual spore, which uses its flagella for locomotion Example : *Euglena.*

2. **Option (2) is correct.**

Explanation : The genotypes of both the parents are Tt and Tt. Refer the given cross between true breeding tall plants and true breeding dwarf plants.



Phenotypic ratio
3 : 1
Genotypic ratio
TT Tt tt
1:2:1

When true breeding plants were crossed to each other, this is called a parental cross and offspring comprise the first filial or F_1 - generation. When the members of the F_1 - generation were crossed, this produced the F_2-generation or second filial generation. A cross between true breeding tall and dwarf plants of the parent generation yield phenotypically tall plants. The cross between TT and Tt is called back cross, which results into two homozygous and two heterozygous dominant gametes. The cross between Tt and tt is called test cross which results into 1 : 1 ratio of gametes.

3. **Option (1) is correct.**

Explanation : Opium, narcotic drug, is obtained from the unripe seedpods of the opium poppy (*Papaver somniferum*).

4. **Option (3) is correct.**

Explanation : *Agrobacterium tumefaciens* is a pathogen of several dicot plants. It delivers a piece of DNA known as T-DNA in the Ti plasmid which transforms normal plant cells into tumour cells to produce chemicals required by pathogens. The restriction enzyme EcoRl, is isolated from *E. coli* RY13. The first restriction enzymes Hind II was isolated from bacterium *Haemophilus influenzae*. The restriction enzyme Bam HI is isolated from *Bacillus amyloliquefaciens.*

5. **Option (2) is correct.**

Explanation : Amensalism is an association between two organisms in which one species is unaffected while the other organism is destroyed or inhibited.

6. **Option (2) is correct.**

Explanation : In an unfertilised embryo sac, the antipodals and synergids are distinctly present at chalazal end and micropylar end respectively while, in fertilised embryo sac, antipodals and synergids gradually degenerate after the formation of zygote.

7. **Option(2) is correct.**

Explanation : The promoter site and the terminator site for transcription are located at 5' (upstream) end and 3' (downstream) end, respectively of the transcription unit. The promoter is the binding site for RNA polymerase for initiation of transcription.

8. **Option(2) is correct.**

Explanation : Hybrid vigour is superior in characteristic such as size, growth rate, fertility, etc., of a hybrid organism over it's parents. Hybrid, on the other hand is a result of cross between parents of two different types.

9. **Option (4) is correct.**

Explanation : Bt toxin protein exist as inactive protoxins but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals.

10. **Option (2) is correct.**

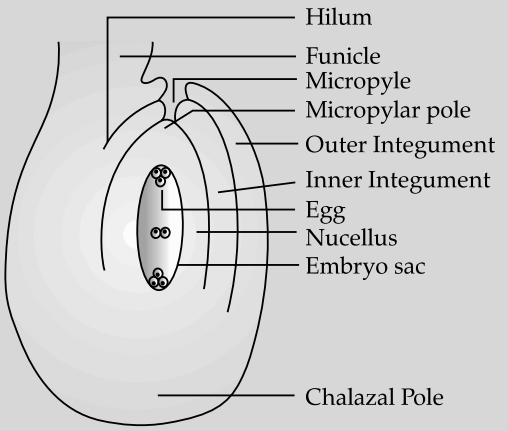
Explanation : About 10% of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores.

11. **Option (2) is correct.**

Explanation : Ampulla is a part of Fallopian tube where fertilisation occurs. Fallopian tube is part of female reproductive system.

12. **Option (2) is correct.**

Explanation : Starting from the innermost part, the correct sequence of parts in an ovule is egg, embryo sac, nucellus, and integument. This sequence can be seen in following diagrammatic view of an ovule.



13. **Option (4) is correct.**

Explanation : *Pseudomonas* is a denitrifying bacterium, which converts ammonia and nitrates into free nitrogen. These bacteria are responsible to release free nitrogen in the environment through nitrogen cycle.

Anabaena, Nostoc and *Azotobacter* are nitrogen fixing organisms. *Anabaena* and *Nostoc* are types of cyanobacteria which are widely distributed in aquatic and terrestrial environments and can fix atmospheric nitrogen. *Azotobacter* is free-living bacteria, which absorb free nitrogen from soil, air and convert it into salts of nitrogen like amino acids and enrich soil nutrients.

14. **Option (2) is correct.**

Explanation : Selectable markers help in identifying and eliminating non-transformants and selectively permitting the growth of the transformants. The normal *E. coli* cells do not carry resistance against any antibiotic. Competent bacterial cells are made capable to take foreign DNA with chemical treatment (e.g., calcium chloride).

15. **Option (1) is correct.**

Explanation : Rice has more than 50,000 genetically different strains while mango has 1500 varieties in India.

16. **Option (3) is correct.**

Explanation : Artificial insemination (AI) is a technique in which the semen collected from the husband or a healthy donor is artificially introduced either into the vagina or the uterus.

17. Option (3) is correct.

Explanation : Sickle-cell anaemia is caused by a single point mutation in the beta haemoglobin gene which converts a GAG, codon into GUG, which code for valine amino acid rather than glutamic acid.

18. **Option (4) is correct.**

Explanation : Widal test is used to help make a presumptive diagnosis of enteric fever, also known as typhoid fever. Typhoid is caused by *Salmonella typhi*. It is spread through food, milk, and water contaminated with intestinal discharges either directly or through flies and personal hygiene. Enzyme-linked immunosorbent assay (ELISA) is used in immunology to detect the presence of an antibody or an antigen in a sample. Erythrocyte sedimentation rate test (ESR) is used to detects inflammation that may be caused by infection and some autoimmune diseases. Polymerase chain reaction (PCR) test is used in molecular biology. It is used to make numerous copies of a specific segment of DNA quickly and accurately.

19. **Option (4) is correct.**

Explanation : The stirred tank bioreactor is well suited for large scale production of micro organism under aseptic condition for a number of days. It can be used easily in research laboratory and main advantage is an oxygen delivery system which provides oxygen without any interruption.

20. **Option (3) is correct.**

Explanation : Ecotone is a transition zone between two communities. The adjacent biotic (natural) communities generally do not possess a fine demarcation line between them. Therefore, the adjacent of two communities is represented by population of both the communities, and this transition zone between two communities is referred as ecotone.

21. **Option (3) is correct.**

Explanation : Statements (i), (ii) and (iv) support the view that elaborates sexual reproductive process, appeared much later in the organic evolution. Asexual reproduction is not common in higher group of organisms. It is common amongst single-celled organisms, and also in plants and animals with relatively simple organisations.

22. **Option (4) is correct.**

Explanation : Z Z/ ZW type of sex determination is seen in birds, reptiles and fish. Thus, peacock shows ZZ/ZW type sex determination. In this type, female has heteromorphic (ZW) sex chromosomes and the male has homomorphic (ZZ) sex chromosomes. In Platypus the sex determination is of XX-XY type in which both male and females has ten sex chromosome each. The male has XY, XY, XY, XY, XY and female has XX, XX, XX, XX, XX. In snails, the sex determination is environmentally induced, while in cockroaches it is of XX-XO types. In this type Y-chromosome is absent. In this the presence of unpaired X-chromosomes determines the masculine sex.

23. **Option (2) is correct.**

Explanation : The rupture of RBCs is associated with release of a toxic substance, haemozoin, which is responsible for the chill and high fever recurring every three to four days.

24. **Option (3) is correct.**

Explanation : Polymerase chain reaction technique was developed by Kary Mullis in 1985, and for this he received Nobel Prize for chemistry in 1993. It is a reaction in which amplification of specific DNA sequences is carried out *in vitro*.

25. **Option (3) is correct.**

Explanation : Ecological niche is ecologically adapted zone, that is, the particular place of habitat occupied by individual of a species within its ecosystem. Ecological niche have specific characteristics, such as availability of nutrients, temperature, terrain, sunlight, and predators, which influences how populations affect and are affected by resources and enemies.

26. **Option (4) is correct.**

Explanation : Adult filament of multicellular alga have haplontic life cycle in which the meiotic division occurs after the formation of zygote. So, the filament of this alga has haploid vegetative cells and haploid gametangia. A multicellular gametophyte or gametangia which is haploid (n) alternates with a multicellular sporophyte which is diploid (2n). A mature sporophyte produces spores (haploid cells) by meiosis, a process which reduces the number of chromosomes to half, from 2n to n.

27. **Option (1) is correct.**

Explanation : It is a disorder caused due to the absence of one of the X-chromosomes, i.e., 45 with XO.

28. **Option (1) is correct.**

Explanation : The entire collection of plants/ seeds which have all the diverse alleles for all genes in a given crop is called germplasm collection. Protoplasm collection refers to collection of protoplast (i.e., plant cell without cell wall). Herbarium is a museum of preserved plants that are used for botanical research, mainly in identification and classification of plants. Soma-clonal collection consists of those plants that are produced from a single cell which are genetically variable from their parents.

29. **Option (4) is correct.**

Explanation : In 1997, Rosie , the first transgenic cow produced human protein-enriched milk (2.4 gm per litre).

30. **Option (3) is correct.**

Explanation : Productivity refers to the rate of generation of biomass in an ecosystem. It is usually expressed in terms of g m^{-2} d^{-1} or kcal m^{-2} yr^{-1} to compare the different ecosystem.

31. **Option (3) is correct**

Explanation : In female gametophyte,central cell is involved in the double fertilisation that help in the endosperm development. While antipodal cells provides nourishment to the egg cell, and synergid cell help in pollen tube growth.

32. **Option (3) is correct.**

Explanation : DNA consists of a nitrogenous base, pentose sugar and a phosphate group. DNA has negative charge due to the presence of phosphate group. Histone is rich in the basic amino acids lysine and arginine, which carry positive charges in their side chains. Therefore, histone is positively charged.

33. **Option (3) is correct.**

Explanation : The large holes in 'Swiss cheese' are made due to production of a large amount of CO_2 by *Propionibacterium shermanii*. It releases carbon dioxide when it consumes the lactic acid and forms bubbles. These bubbles form little air pockets, resulting in the holes of the Swiss cheese.

34. **Option (2) is correct.**

Explanation : Restriction enzymes (also called molecular scissors) are responsible for cutting DNA. These enzymes belong to a class of enzymes called nucleases and are of two types : (i) Exonuclease which cut DNA at the ends and (ii) endonucleases which make cuts at specific positions within the DNA. The

term 'restriction' refers to the function of these enzymes in restricting the propagation of foreign DNA of bacteriophage in host bacterium, that is, cutting of DNA, at specific position only.

35. **Option (4) is correct.**

Explanation : Biodiversity hot-spots specifically refer to 25 biologically rich areas around the world that have lost at least 70% of their original habitat. They are characterised by large number of flora and fauna, abundance of endemic species and also large number of alien or exotic species. They are mostly found in tropical and temperate regions. There are no biodiversity hot-spots in polar regions.

36. **Option (3) is correct.**

Explanation : Vasectomy is the correct surgical procedure as a contraceptive method in male. During this procedure, vas deferens is cut down to prevent sperm from entering into the urethra and thereby preventing fertilisation. In female, this procedure is called tubectomy in which Fallopian tubes are held and blocked or severed and sealed, either of which prevents eggs from reaching the uterus for implantation. Removal of ovary, uterus and testes are called as ovariectomy, hysterectomy and castration respectively.

37. **Option (3) is correct.**

Explanation : Amphetamines (stimulants) mimic the effect of the naturally produced hormone adrenaline.

38. **Option (3) is correct.**

Explanation : A protoplast is a plant, bacterial or fungal cell whose cell wall is completely or partially removed using either mechanical or enzymatic means.

39. Option (2) is correct.

Explanation : During the sexual reproduction, the events which take place after the formation of zygote are called post-fertilisation events. The process of embryo development from the zygote (called embryogenesis) takes place after the fertilisation. In all flowering plants, the zygote is formed inside the ovule. In ovule, the zygote divides several times to form an embryo.

40. **Option (2) is correct.**

Explanation : Dioecious plants (bearing only male or female flowers) prevent both autogamy and geitonogamy. Autogamy is a method of self-pollination in which the transfer of pollen grains from anther to stigma of the same flower takes place. Geitonogamy is the transfer of pollen grains from anther to stigma of another flower of the same plant. It is ecologically cross - pollination which is supposed to be equivalent to self-pollination because all flowers on a plant are genetically identical.

41. **Option (4) is correct.**

Explanation : The body is able to differentiate self and non-self and the cell-mediated immune response is responsible for the graft rejection.

42. **Option (2) is correct.**

Explanation : The fern, *Azolla* and the blue-green alga *Anabaena azollae* maintain a symbiotic relationship. The alga provides nitrogen to the fern, and the fern provides a habitat for the alga. This property of nitrogen fixation has made *Azolla* extremely important economically in the cultivation of rice.

43. **Option (3) is correct.**

Explanation : Non-biodegradable pollutants are those pollutants which are not broken down into simpler substances by natural biological processes. These pollutants include plastics, tin container, heavy metals, radioactive substances, etc. These are created by human activities, like industrialisation.
Whereas biodegradable pollutant created by humans (for example paper, household waste like peel of vegetables fruits, etc.) are degraded or disposed quickly by biological processes.

44. **Option (3) is correct.**

Explanation : Keeping animals in zoological parks is not a cause for loss of biodiversity. The important factors causing loss of biodiversity are as follows :
(i) Destruction of natural habitat (primary cause)
(ii) Introduction of exotic (alien species) and indigenous species
(iii) Over-exploitation of natural resources
(iv) Co-extinction of species

45. **Option (3) is correct.**

Explanation : Number of producers is high in grassland or forest or pond and therefore, pyramid of number is upright in these ecosystems while it is inverted in a parasitic food chain.

46. **Option (3) is correct.**

Explanation : The affected person inherited with one extra copy of 21^{st} chromosome that forms trisomy condition.

47. **Option (2) is correct.**

> ***Explanation :*** Down syndrome is an autosomal recessive disorder which can be inherited through normal parents in the child.

48. **Option (3) is correct.**

> ***Explanation :*** The person affected with Down syndrome has symptoms like mental retarded, short statured with small round, head, furrowed tongue, etc.

49. **Option (2) is correct.**

> ***Explanation :*** Down Syndrome is due to extra copy of 21^{st} chromosome forming trisomy condition.

50. **Option (4) is correct.**

> ***Explanation :*** Down syndrome is due to autosomal chromosome abnormality.

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