2015

LIST OF PARTICIPANTS

S.No.	Name of Participants	Coordinator/Expert	Office	Residence
1.	Mrs. Rachna Gupta Vice Principal Delhi Public School Sec. C, Pocket 5, Vasant Kunj	Coordinator		9811345797
2.	Mr. Y.P. Purang Retd. ADE- C-2/113, Janak Puri New Delhi-110058	Subject-Expert		9810529809
3.	MS. RITA TALWAR 54, Khan Market New Delhi - 110 003	Subject-Expert Retd. Principal		9810443125
4.	MRS. SHIVANI GOSWAMI 563, Golf Vista Apptt. Sector Alpha-II, Greater Noida Gautam Budh Nagar, U.P.-201 308	Subject Expert		9958477758
5.	MS. SHIPRA SARCAR Principal Air Force Golden Jublee Institute Subroto Park, New Delhi	Expert	011-25694353	9958456081
6.	MS. RIMA DEY B-905, Plot B9/1B Sharmdeep Aptts, Sec. - 62 Noida (UP)	Expert		9891120671
7.	MRS. SUSHIL MALHOTRA D-46B/13 1ST Floor, Single Storey Vijay Nagar Delhi -09	Expert		9711032234
8.	MR. VIRENDRA SRIVASTAVA B - 3B/95 B, Janakpuri New Delhi- 110058	Subject Expert		9810377435
9.	MRS. NEETA RASTOGI Principal Sadhu Vaswani Intl. School for Girls 2nd Street, Shanti Niketan New Delhi-110021	Representative Delhi		9811778593
10.	MS. Poonam. Khurana DAV Model School, Sector - 15A Chandigarh	Panchkula		09876421755
11.	DR. Manoj Kumar Das Principal Jawahar Navidaya Vidyalaya Konark, Puri Odisha-752111	Bhubaneshwar		9437429291
12.	SH. R SANKAR Principal Kendriya Vidyalaya No. 2, Uppal Hyderabad, Telangana -500039	Chennai		040-27202031 9491073600

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13	SH. VALSALA NAIR Principal Kendriya Vidyalaya SAP Camp, Peroorkada, Trivandrum, Kerala -695005	Thiruvananthapuram		09496388999
14.	MRS. TOOLIKA GOEL Vice Principal Silver Bells Public School Shamli (UP) - 247776	Shamli		98737050093
15.	MRS. RAJINI YADAV Mayoor School Alwar-Gate Ajmer	Ajmer		09001967576
16.	MR. RANVEER SINGH D.O.E. GSBV Timarpur Delhi			9891069977
17.	Mr. R P Singh D.O.E. GSBV Ranapratab Bagh Delhi			9990081661
18.	MRS. ANURADHA RAY HOD DPS Vasant Kunj New Delhi-110070	Delhi	011-43261200	9899707132 011-25096658

Out-B-15 - 57/1, 2, 3 DPSVK/2

Senior School Certificate Examination

March 2015

Marking Scheme - Biology (Theory)

Expected Answers/Value Points

General Instructions :

The Marking Scheme and mechanics of marking

1 In the marking scheme the marking points are separated by commas, one oblique line (/) indicates acceptable alternative, two obliques (//) indicate complete acceptable alternative set of marking points.

2. Any words/phrases given within brackets do not have marks.

3. Allow spelling mistakes unless the misspelt word has another biological meaning. Ignore plurals unless otherwise stated in the marking scheme.

4. In any question exclusively on diagram no marks on any description. But in questions on descriptions, same value points may be marked on the diagrams as a subsitute.

5. All awarded marks are to be written in the left hand margin at the end of the question or its part.

6. Place a tick (✓) in red directly on the key/operative term or idea provided it is in correct context. Place "Half-tick" ½ wherever there is ½ mark in the marking scheme. (Do not place tick indiscriminately just to show that you have read the answer).

7. If no marks are awarded to any part or question put a cross (×) at incorrect value portion and mark it zero (in words only).

8. Add up ticks or the half ticks for a part of the question, do the calculation if any, and write the part total or the question total in the left hand margin.

9. Add part totals of the question and write the question total at the end. Count all the ticks for the entire question as a recheck and draw a circle around the question total to confirm correct addition.

10. If parts have been attempted at different places do the totalling at the end of the part attempted last.

11. If any extra part is attempted or any question is reattempted, score out the last one and write "extra".

12. In questions where only a certain number of items are asked evaluate only that many numbers in sequence as is asked ignoring all the extra ones even if otherwise correct.

13. Transcribe the marks on the cover page. Add up question totals. Recheck the script total by adding up circled marks in the script.

14. Points/answer given in brackets in marking scheme are not so important and may be ignored for marking.

Out-B-15 - 57/1, 2, 3 DPSVK/3

Question Paper Code 57/1

SECTION – A

Q. Nos. 1 - 5 are of one marks each

1. **How many chromosomes do drones of honeybee possess? Name the type of cell division involved in the production of sperms by them.**

Ans. 16, Mitosis = ½ + ½

[1 Mark]

2. **What is a cistron ?**

Ans. A segment of DNA , Coding for a polypeptide = ½ + ½

[1Mark]

3. **Retroviruses have no DNA. However, the DNA of the infected host cell does possess viral DNA. How is it possible?**

Ans. Reverse transcription of viral RNA into viral DNA, then integrates/ incorporates with the host DNA = ½ + ½

[1 Mark]

4. **Why do children cured by enzyme-replacement therapy for adenosine deaminase deficiency need periodic treatment ?**

Ans. As this therapy does not cure the disease completely = 1

[1 Mark]

5. **List two advantages of the use of unleaded petrol in automobiles as fuel .**

Ans. (i)   Allows the catalytic convertor to remain active = ½

(ii)   Reduces air pollution = ½

[1 Mark]

SECTION B

Q Nos. 6-10 are of two marks each

6. **Why do moss plant produce very large number of male gametes? Provide one reason. What are these gametes called ?**

Ans. To compensate the loss of male gametes during their transport(to the non-motile female gamete) through water/ to increase chances of fertilisation , antherozoids = 1 + 1

[2 Marks]

7. **(a)   Select the homologous structure from the combinations given below:**

(i)   Forelimbs of whales and bats

(ii)   Tuber of potato and sweet potato

(iii)   Eyes of octopus and mammals

(iv)   Thorns of *Bougainvillea* and tendrils of *Cucurbita*

(b)   State the kind of evolution they represent.

Out-B-15 - 57/1, 2, 3 DPSVK/4

Ans. (a) (i) Forelimbs of whales and bats $= \frac{1}{2}$

   (iv) Thorns of *Bougainvillea* and tendrils of *Cucurbita* $= \frac{1}{2}$

   (b) Divergent Evolution $= 1$

[2 Marks]

8. (a) Why are the plants raised through micropropagation termed as somaclones ?

   (b) Mention two advantages of this technique.

Ans. (a) Genetically identical $= 1$

   (b) Large number of plants in short duration, Virus free plants $= \frac{1}{2} + \frac{1}{2}$

[2 Marks]

9. Explain the different steps involved during primary treatment phase of sewage.

Ans. Physical removal of particles (large and small), by filtration and sedimentation, forming primary sludge/sedimented solids, forming effluent (supernatant) for secondary treatment $= \frac{1}{2} \times 4$

[2 Marks]

10. What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture.

Ans. Interaction between two species in which both are benefitted $=1$

   i. *Rhizobium* in the roots (nodules) of legumes $= \frac{1}{2}$

   ii. *Mycorrhiza / Glomus* with the roots of higher plants $= \frac{1}{2}$

[2 Marks]

OR

List any four techniques where the principle of ex-situ conservation of biodiversity has been employed.

Ans. Cryopreservation , in vitro fertilisation, micro propagation / tissue culture , sperm bank/ seed bank / gene bank $= \frac{1}{2} \times 4$

[2 Marks]

SECTION C

Q Nos. 11-22 are of three marks each

11. State what is apomixis. Comment on its significance. How can it be commercially used?
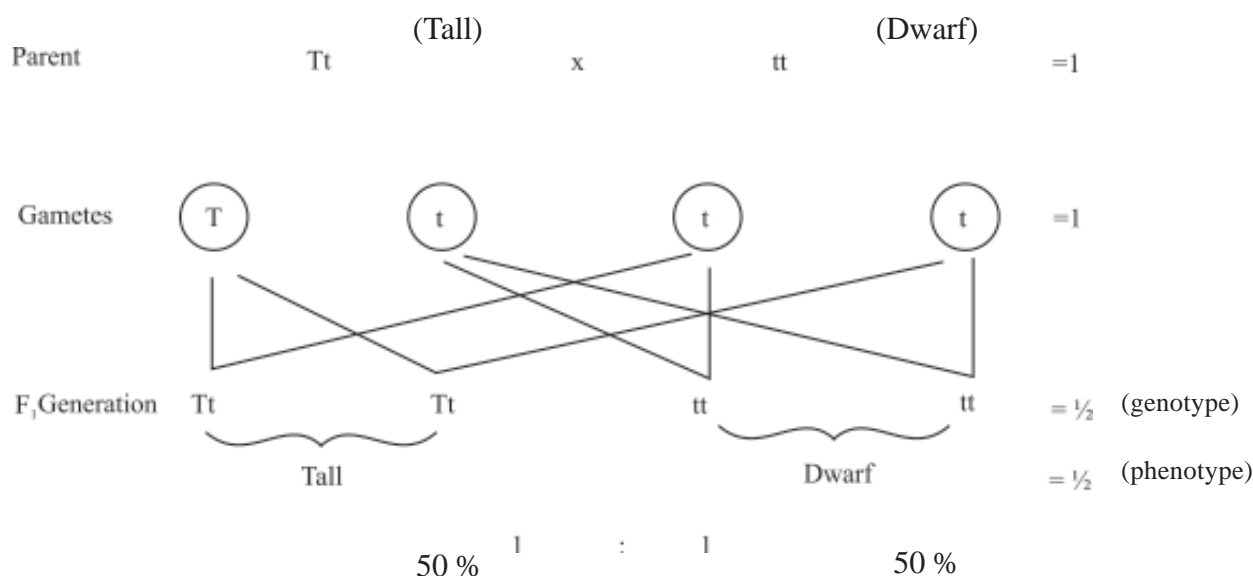
Ans. Form of asexual reproduction producing seeds without fertilisation/type of asexual reproduction that mimics sexual reproduction to form seeds without fertilisation $=1$

   Parental characters are maintained in the progeny/offspring (as there is no meiosis/segregation of characters) $=1$

   If desired hybrid seeds are made apomictics the farmers can keep on using the hybrid seeds to raise new crops year after year $=1$

[3 Marks]

12. During a monohybrid cross involving a tall pea plant with a dwarf pea plant, the offspring populations were tall and dwarf in equal ratio. Work out a cross to show how it is possible.

Out-B-15 - 57/1, 2, 3 DPSVK/5

	(Tall)		(Dwarf)	
Parent	Tt	x	tt	=1

Gametes (T) (t) (t) (t) =1

F₁ Generation   Tt   Tt   tt   tt   = ½ (genotype)

Tall   Dwarf   = ½ (phenotype)

50 %   1   :   1   50 %

Note: (Similar cross shown in a Punnett square to be accepted)

[3 Marks]

13. **Explain the significance of satellite DNA in DNA fingerprinting technique.**

Ans. (i)   They do not code for any proteins ,

(ii)   They form large part of the human genome ,

(iii)   They show high degree of polymorphism / Specific to each individual $=1 \times 3$

[3 Marks]

14. **What does the following equation represent ? Explain.**

$$p2 + 2\ pq + q2 = 1$$

Ans. Hardy Weinberg's Principle / allele frequencies in a population are stable and is constant from generation to generation, 1 represents stable allelic frequency in a population,indicating no evolution occuring, p^2 frequency of homozygous dominant /AA, 2 pq frequency of heterozygous/Aa,q^2 frequency of homozygous recessive /aa $= ½ \times 6$

Note : (if AA,Aa,aa have been indicated using any other alphabet correctly can be accepted)

[3 Marks]

15. **A heavily bleeding and bruised road accident victim was brought to a nursing home. The doctor immediately gave him an injection to protect him against a deadly disease.**

(a)   Write what did the doctor inject into the patient's body .

(b)   How do you think this injection would protect the patient against the disease ?

(c)   Name the disease against which this injection was given and the kind of immunity it provides.

Ans. (a)   Tetanus antitoxins/Tetanus toxoid =1

(b)   The preformed antibody injected , act on the pathogen immediately to provide protection $= ½ \times 2$

(c)   Tetanus, passive immunity $= ½ \times 2$

[3 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/6

16. Enumerate any six essentials of good, effective Dairy Farm Management Practices.

Ans. Selection of high yielding and diseases resistant breeds,housedwell,adequate water supply,maintained disease free,feeding in a scientific manner,regular visits by veterinary doctors,regular inspection and record keeping,cleanliness and hygiene while milking and transport

(any six) $= \frac{1}{2} \times 6$

[3 Marks]

17. State the medicinal value and the bioactive molecule produced by *Streptococcus, Monascus* and *Trichoderma.*

Ans. *Streptococcus* ; Streptokinase , clot buster / remove clot from the blood vessels $= \frac{1}{2} + \frac{1}{2}$

Monascus ; Statin , blood cholesterol lowering agent / it inhibits the enzymes responsible for synthesis of cholesterol $= \frac{1}{2} + \frac{1}{2}$

Trichoderma ; cyclosporin A , immunosuppressive agents used in organ transplantation $= \frac{1}{2} + \frac{1}{2}$

[3 Marks]

OR

What are methanogens? How do they help to generate biogas?

Ans. Anaerobic, methane producing bacteria $= \frac{1}{2} \times 2$

methanogens generate biogas, when act on cellulose rich biowaste (anerobically) $= 1 + 1$

[3 Marks]

18. Rearrange the following in the correct sequence to accomplish an important biotechnological reaction:

(a) *In vitro* **synthesis of copies of DNA of interest**

(b) **Chemically synthesized oligonucleotide**

(c) **Enzyme DNA-polymerase**

(d) **Complementary region of DNA**

(e) **Genomic DNA template**

(f) **Nucleotides provided**

(g) **Primers**

(h) **Thermostable DNA-ploymerase (from *Thermus aquaticus)***

(i) **Denaturation of ds-DNA**

Ans. Correct sequence is

$$i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d \rightarrow a$$

$$=1 \qquad\qquad =1 \qquad =1$$

//

$$a \rightarrow i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d$$

$$=1 \qquad\qquad =1 \qquad =1$$

Note: (Stop Marking where the sequence goes wrong)

[3 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/7

19. Describe any three potential applications of genetically modified plants.

Ans. More tolerant to abiotic stress, less dependence on chemical pesticides, reduces post harvest losses,increase efficiency of mineral usage by plants,enhance nutritional value of food. eg. Vitamin A enriched rice (any three) = 1+1+1

[3 Marks]

20. How did an American company ,Eli Lilly use the knowledge of r-DNA technology to produce human insulin ?

Ans. Two chains of DNA sequence corresponding to A & B chains of human insulin prepared, introduced them into plasmids of *E.coli* to produce separate A & B chains, A & B chains extracted combined by creating disulphide bonds = 1×3

[3 Marks]

21. How do snails, seeds, bears, zooplanktons, fungi and bacteria adapt to condition unfavorable for their survival ?

Ans. Snail-aestivation = ½

Seeds-dormancy/suspended metabolic activities = ½
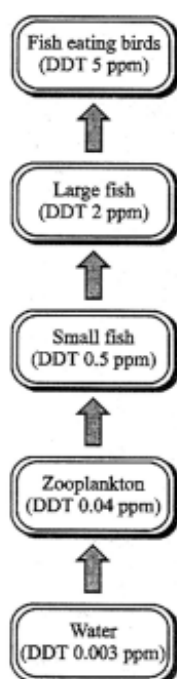
Bear-Hibernation = ½

Zooplankton- diapause/suspended development = ½

Fungi-Spore/Zygospore = ½

Bacteria-Cyst/spore = ½

[3 Marks]

22. With help of a flow chart ,show the phenomenon of biomagnifications of DDT in an aquatic food chain.

Ans.

5 stages- ½ Mark each (½ × 5) the flow chart should show arrows in correct direction with increasing levels of DDT = (½)

[3 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/8

SECTION D

Q No. 23 is of four mark

23. **Your School has been selected by the Department of Education to Organize and host an interschool seminar on "Reproductive Health-Problems and Practices". However, many parents are reluctant to permit their wards to attend it. Their argument is that the topic is "too embarrassing".**

Put forth four arguments with appropriate reasons and explanation to justify the topic to be very essential and timely.

Ans. 1. The issue of puberty and adolescence need to be addressed effectively with the respective age group because many changes take place in the body during adolescence of which they are supposed to be aware of = 1

2. To bring in awareness about their reproductive health and its effect on their physical, emotional and social being = 1

3. To address the increase in sex abuse and sex crimes in our country = 1

4. Myths and misconceptions related to reproductive issues = 1

Note: (any other related or relevant argument with reasons may be accepted)

[4 Marks]

SECTION E

Q Nos. 24-26 are of five marks each

24. **(a)** **Plan an experiment and prepare a flow chart of the steps that you would follow to ensure that the seeds are formed only from the desired sets of pollen grains. Name the type of experiment that you carried out.**

(b) **Write the importance of such experiments.**

Ans. (a) Selection of flowers from desired plants $\rightarrow$ emasculation $\rightarrow$ bagging $\rightarrow$ dusting of the pollens on the stigma of the flowers that were bagged $\rightarrow$ flower rebagged $\rightarrow$ fruit formed

= ½ × 6

Artificial Hybridisation = 1

(b) Production of superior/ improved varieties of plants = 1

[5 Marks]

OR

Describe the roles of pituitary and ovarian hormones during the menstrual cycle in a human female.

Ans. <u>Pituitary hormones :</u>

(When levels of FSH is high) FSH, induces follicular growth, secretion of estrogen by follicles, (when LH surge is there in the mid of the cycle) lutinising hormones/LH, along with FSH leads to ovulation , and then formation of corpus luteum = ½ × 6

<u>Ovarian hormone:</u>

Estrogen , repair/proliferation of endometrium,

Progesterone,maintains endometrium for implantation = ½ × 4

(Low level of progesterone leads to menstrual flow)

[5 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/9

25. (a) Why are thalassemia and haemophilia categorized as Mendelian disorders? Write the symptoms of these diseases .Explain their pattern of inheritance in humans.

(b) Write the genotypes of the normal parents producing a hemophilic son.

Ans. (a) Both are caused due to alteration/mutation, in a single gene and follow Mendelian pattern of inheritance $= ½ × 2$

symptoms

thalassemia -anaemia (caused due to defective/abnormal Hb),

haemophilia -non stop bleeding even in minor injury $= ½ × 2$

pattern of inheritance-

thalassemia autosomal recessive inheritance pattern, inherited from heterozygous/parent carrier
$= ½ × 2$

haemophilia- X linked recessive inheritance, inherited from a haemophilic father/carrier mother (females are rarely haemophilic) $= ½ × 2$

(b) $X^h X$-Mother $= ½$

XY-Father $= ½$ [5 Marks]

OR

How do m-RNA , t-RNA and ribosomes help in the process of translation?

Ans. mRNA provides a template,with codons for specific amino acids to be linked to form a polypeptide/ protein $= ½ + ½$

tRNA brings amino acid to the ribosomes, reads the genetic code with the help of its anti-codons, initiator tRNA is responsible for starting polypeptide formation in the ribosomes, tRNAs are specific for each amino acid $= ½ × 4$

Ribosomes-(Cellular factories for proteins synthesis) its smaller sub unit binds with mRNA to initiate protein synthesis at the start codon/AUG , in its larger sub unit there are two sites present which brings two amino acids close to each other helping them to form peptide bond, ribosomes moves from codon to codon along mRNA, amino acids are added one by one to form polypeptide/protein $= ½ × 4$

[5 Marks]

26. (a) List the different attributes that a population has and not an individual organism.

(b) What is population density? Explain any three different ways the population density can be measured, with the help of an example each.

(a) Attributes of population

Birth rate , Death Rate , sex ratio,age pyramids/age distribution (any two) $= ½ × 2$

(b) Population density -

Number of individuals per unit area at a given time / period $= 1$

1. Biomass / % Cover **,** e.g Hundred *Parthenium* plants and 1 huge banayan tree $= ½ × 2$

2. Relative Density , e.g Number of fish caught per trap from a lake $= ½ × 2$

3. Numbers , e.g Human population $= ½ × 2$

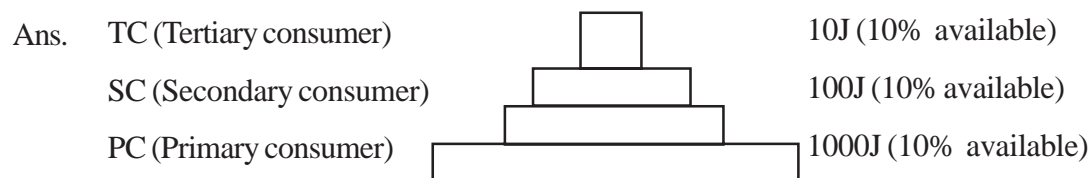Out-B-15 - 57/1, 2, 3 DPSVK/10

4. <u>Indirect estimation</u> , e.g without actually counting/seeing them e.g tiger census based on pugmarks and fecal pellets $= \frac{1}{2} \times 2$
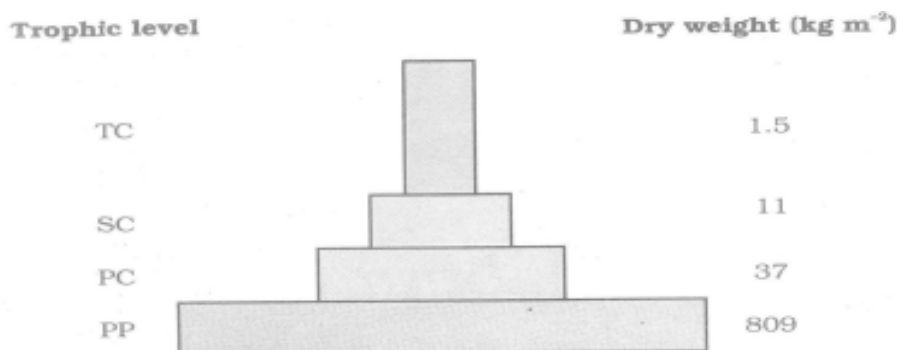
(Any three)

[5 Marks]

OR

"It is often said that the pyramid of energy is always upright .On the other hand , the pyramid of biomass can be both upright and inverted."Explain with the help of examples and sketches.

Ans. TC (Tertiary consumer)   10J (10% available)

SC (Secondary consumer)   100J (10% available)

PC (Primary consumer)   1000J (10% available)
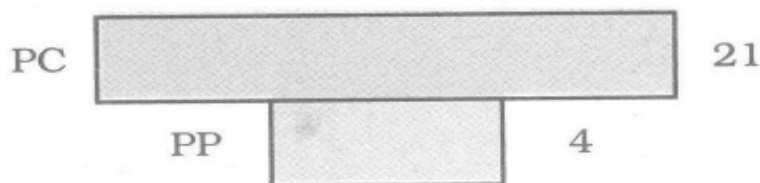
1,000,000 J of Sunlight

<u>Upright Pyramid of Energy</u> : e.g of any Grassland food chain depicting energy transfer at each trophic level $= 1+1$

<u>Upright Pyramid of Biomass :</u> e.g grassland food chain-grass $\longrightarrow$ rabbit $\longrightarrow$ fox $\longrightarrow$ Tiger

(Any other relevant example) $= 1$ for Diagram $+ \frac{1}{2}$ for example

Note:(If only two trophic levels are drawn with dry weight mentioned correctly can be accepted)

<u>Inverted Pyramid of Biomass:</u> e.g aquatic ecosystem where small standing crop of phytoplanktons supports large standing crop of zooplanktons $=1$ for Diagram $+ \frac{1}{2}$ for example

[5 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/11

Question Paper Code 57/2

SECTION – A

Q. Nos. 1 - 5 are of one marks each

1. **List two advantages of the use of unleaded petrol in automobiles as fuel.**

Ans. (i)   Allows the catalytic convertor to remain active $= \frac{1}{2}$

(ii)   Reduces air pollution $= \frac{1}{2}$

[1 Mark]

2. **Retroviruses have no DNA.However, the DNA of the infected host cell does possess viral DNA. How is it possible?**

Ans. Reverse transcription of viral RNA into viral DNA, then integrates/ incorporates with the host DNA $= \frac{1}{2} + \frac{1}{2}$

[1 Mark]

3. **State the cause of adenosine deaminase enzyme deficiency.**

Ans   Deletion of gene for adenosine deaminase $= 1$

[1 Mark]

4. **What is a cistron?**

Ans. A segment of DNA , Coding for a polypeptide $= \frac{1}{2} + \frac{1}{2}$

[1Mark]

5. **How many chromosomes do drones of honeybee possess? Name the type of cell division involved in the production of sperms by them.**

Ans. 16, Mitosis $= \frac{1}{2} + \frac{1}{2}$

[1 Mark]

SECTION B

Q. Nos. 6 - 10 are of two marks each

6. **What is mutualism?Mention any two examples where the organisms involved are commercially exploited in agriculture.**

Ans. Interaction between two species in which both are benefitted $=1$

i.   *Rhizobium* in the roots (nodules) of legumes $= \frac{1}{2}$

ii.   *Mycorrhiza / Glomus* with the roots of higher plants $= \frac{1}{2}$

[2 Marks]

OR

List any four techniques where the principle of ex-situ conservation of biodiversity has been employed.

Ans. Cryopreservation , in vitro fertilisation, micro propagation / tissue culture , sperm bank/ seed bank / gene bank $= \frac{1}{2} \times 4$

[2 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/12

7. (a) **Why are the plants raised through micropropagation termed as somaclones?**

    (b) **Mention two advantages of this technique.**

Ans. (a) Genetically identical = 1

    (b) Large number of plants in short duration, Virus free plants = ½ + ½

[2 Marks]

8. **Explain the process of secondary treatment given to the primary effluent up to the point it shows significant change in the level of biological oxygen demand (BOD) in it.**

Ans. The primary effluent is passed into large aeration tanks where it is constantly agitated, mechanically pumping air into it , this allows vigorous growth of useful aerobic microbes into flocs , these microbes consumes the major part of organic matter in the effluent (this significantly reduces the BOD of the effluent) = ½ × 4

9. (a) **Select the analogous structures from the combinations given below:**

    (i) **Forelimbs of whales and bats**

    (ii) **Eyes of octopus and mammals**

    (iii) **Tubar of sweet potato and potato**

    (iv) **Thorns of *Bougainvillea* and tendrils of *Cucurbita***

    (b) **State the kind of evolution they represent.**

Ans. (a) (ii)   & (iii) = ½ × 2

    (b) Convergent evolution = 1

[2 Marks]

10. **A moss plant is unable to complete its life-cycle in a dry environment. State two reasons.**

Ans. Needs water for transfer of male gamete/antherozoids to the stationary female gamete, spores need sufficient moisture for germination = 1 + 1

[2 Marks]

SECTION C

Q. Nos. 11 - 12 are of three marks each

11. **A heavily bleeding and bruised road accident victim was brought to a nursing home .The doctor immediately gave him an injection to protect him against a deadly disease.**

    (a) **Write what did the doctor inject into the patient's body.**

    (b) **How do you think this injection would protect the patient against the disease?**

    (c) **Name the disease against which this injection was given and the kind of immunity it provides.**

Ans. (a) Tetanus antitoxins/Tetanus toxoid = 1

    (b) The preformed antibody injected , act on the pathogen immediately to provide protection = ½ × 2

    (c) Tetanus, passive immunity = ½ × 2

[3 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/13

12. Explain the significance of satellite DNA in DNA fingerprinting technique.

Ans. (i)   They do not code for any proteins ,

(ii) They form large part of the human genome ,

(iii) They show high degree of polymorphism / Specific to each individual $=1 \times 3$

[3 Marks]

13. What does the following equation represent? Explain.

$$P^2+2pq+q^2=1$$

Ans. Hardy Weinberg's Principle / allele frequencies in a population are stable and is constant from generation to generation, 1 represents stable allelic frequency in a population,indicating no evolution occuring, p^2 frequency of homozygous dominant /AA, 2 pq frequency of heterozygous/Aa,q^2 frequency of homozygous recessive /aa $= ½ \times 6$

Note : (if AA,Aa,aa have been indicated using any other alphabet correctly can be accepted)

[3 Marks]

14. Two independent monohybrid crosses were carried out involving a tall pea plant with a dwarf pea plant. In the first cross, the offspring population had equal number of tall and dwarf plants, whereas in the second cross it was different .Work out the crosses,and explain giving reasons for the difference in the offspring populations.

Ans.   1st Cross   2nd Cross

parental generation   T t   ×   t t   parental generation   T T   ×   t t

gametes   (T)(t)   (t)(t)   gametes   (T)(T)   (t)(t)

F_1 - Tt : tt F_1 - Tt : Tt

1 : 1 (50 % Tall : 50% dwarf)   (Tall-100%) $= 1 + 1$

Reason- In the first cross the tall parent plant is heterozygous for the trait , in second cross tall parent plant is homozygous for the trait $= ½ + ½$

[3 Marks]

15. State what is apomixis . Comment on its significance. How can it be commercially used?

Ans. Form of asexual reproduction producing seeds without fertilisation/type of asexual reproduction that mimics sexual reproduction to form seeds without fertilisation $=1$

Parental characters are maintained in the progeny/offspring (as there is no meiosis/segregation of characters) $=1$

If desired hybrid seeds are made apomictics the farmers can keep on using the hybrid seeds to raise new crops year after year $=1$

[3 Marks]

16. State the medicinal value and the bioactive molecule produced by *Streptococcus, Monascus* and *Trichoderma*.

Ans. *Streptococcus* ; Streptokinase , clot buster / remove clot from the blood vessels $= ½ + ½$

Monascus ; Statin , blood cholesterol lowering agent / it inhibits the enzymes responsible for

Out-B-15 - 57/1, 2, 3 DPSVK/14

synthesis of cholesterol $= \frac{1}{2} + \frac{1}{2}$

Trichoderma ; cyclosporin A , immunosuppressive agents used in organ transplantation $= \frac{1}{2} + \frac{1}{2}$

[3 Marks]

OR

What are methanogens? How do they help to generate biogas?

Ans. Anaerobic, methane producing bacteria $= \frac{1}{2} \times 2$

methanogens generate biogas, when act on cellulose rich biowaste (anerobically) $= 1 + 1$

[3 Marks]

17. **Describe any three potential applications of genetically modified plants.**

Ans. More tolerant to abiotic stress, less dependence on chemical pesticides, reduces post harvest losses,increase efficiency of mineral usage by plants,enhance nutritional value of food. eg. Vitamin A enriched rice (any three) $= 1+1+1$

[3 Marks]

18. **How did an American Company, Eli Lilly use the knowledge of r-DNA technology to produce human insulin?**

Ans. Two chains of DNA sequence corresponding to A & B chains of human insulin prepared, introduced them into plasmids of *E.coli* to produce separate A & B chains, A & B chains extracted combined by creating disulphide bonds $= 1 \times 3$

[3 Marks]

19. **Explain co-evolution with reference to parasites and their hosts. Mention any four special adaptive features evolved in parasites for their parasitic mode of life.**

Ans. If the host evolves special mechanism for rejecting or resisting the parasite

the parasite has to (simultaneously)evolve / co-evolve the mechanism to counter act and neutralise them. $= 1$

  (a)   Parasitic adaptation in Animals:

  (i)   Loss of (unnecessary) sense organs in animals

  (ii)   Presence of adhesive organs/suckers

  (iii)   Loss of digestive system

  (iv)   High reproductive capacity

  (v)   Resemblance of eggs in the case of brood parasitism

  (b)   Parasitic adaptation in plants

  (vi)   Haustoria in *Cuscuta*

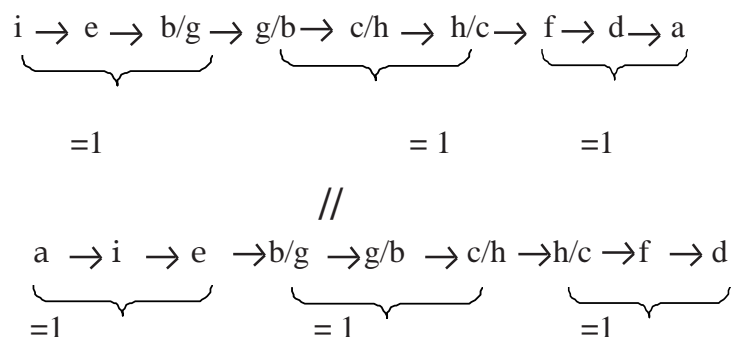 (vii)   Loss of chlorophyll

  (viii)   Loss of leaves / foliage

Note : (Any four adaptations with correct reference Animal or Plant can be alloted marks)

[3 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/15

20. **Rearrange the following in the correct sequence to accomplish an important biotechnological reactions :**

(a) *In vitro* **synthesis of copies of DNA of interest**

(b) **Chemically synthesized oligonucleotides**

(c) **Enzyme DNA-polymerase**

(d) **Complementary region of DNA**

(e) **Genomic DNA template**

(f) **Nucleotides provided**

(g) **Primers**

(h) **Thermostable DNA-polymerase (from *Thermus aquaticus*)**

(i) **Denaturation of ds-DNA**

Ans. Correct sequence is

$$i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d \rightarrow a$$

=1   = 1   =1

//

$$a \rightarrow i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d$$

=1   = 1   =1

Note: (Stop Marking where the sequence goes wrong)

[3 Marks]

21. **With the help of a flow- chart exhibit the events of eutrophication.**

Ans. Water in young lake is cold clear to support life

↓

With time water is enriched with nutrients such as nitrogen and phosphorus by streams draining into it

↓

As Lake's fertility increases plant and animal life increase/proliferates

↓

Organic matter begins to be deposited at the bottom of the lake Silt and organic debris pile up and makes the lake shallower and warmer

↓

Marsh plants develop roots and begin to fill the original lake basin

↓

Out-B-15 - 57/1, 2, 3 DPSVK/16

Eventually the lake gives way to large masses of floating plants finally converting it in to land (Natural aging) = ½×6

[3 Marks]

22. Enumerate any six essentials of good ,effective Dairy Farm Management Practices.

Ans. Selection of high yielding and diseases resistant breeds,housedwell,adequate water supply,maintained disease free,feeding in a scientific manner,regular visits by veteranary doctors,regular inspection and record keeping,cleanliness and hygiene while milking and transport

(any six) = ½×6   [3 Marks]

SECTION D

Q No. 23 is of four mark

23. Your school has been selected by the Department of Education to organize and host an interschool seminar on "Reproductive Health –Problems and Practices". However, many parents are reluctant to permit their wards to attend it. Their argument is that the topic is "too embarrassing".

Put forth four arguments with appropriate reasons and explanation to justify the topic to be very essential and timely.

Ans. 1. The issue of puberty and adolescence need to be addressed effectively with the respective age group because many changes take place in the body during adolescence of which they are supposed to be aware of = 1

2. To bring in awareness about their reproductive health and its effect on their physical, emotional and social being = 1

3. To address the increase in sex abuse and sex crimes in our country = 1

4. Myths and misconceptions related to reproductive issues =1

Note: (any other related or relevant argument with reasons may be accepted)

[4 Marks]

SECTION E

Q. Nos. 24 - 26 are of five marks each

24. (a) List the different attributes that a population has and not an individual organism.

(b) What is population density? Explain any three different ways the population density can be measured, with the help of an example each .

(a) Attributes of population

Birth rate , Death Rate , sex ratio,age pyramids/ age distribution (any two) = ½ × 2

(b) Population density -

Number of individuals per unit area at a given time / period = 1

1. Biomass / % Cover **,** e.g Hundred *Parthenium* plants and 1 huge banayan tree = ½×2

2. Relative Density , e.g Number of fish caught per trap from a lake =½×2

3. Numbers , e.g Human population = ½ × 2

4. Indirect estimation , e.g without actually counting/seeing them e.g tiger census based on
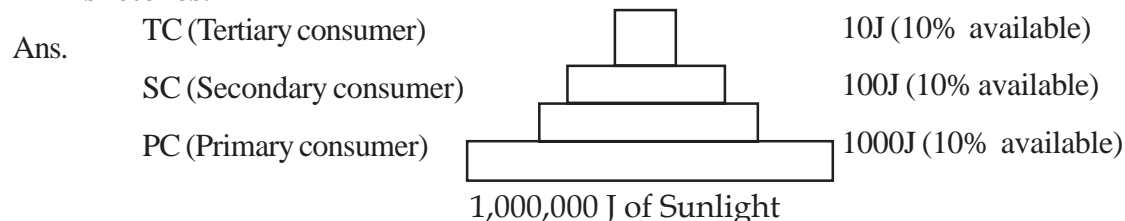
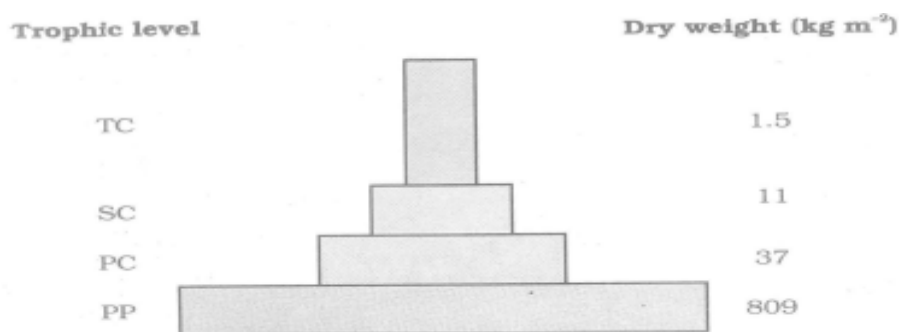pugmarks and fecal pellets $= \frac{1}{2} \times 2$

(Any three)

[5 Marks]

OR

"It is often said that the pyramid of energy is always upright. On the other hand the pyramid of biomass can be both upright and inverted." Explain with the help of examples and sketches.

Ans.

TC (Tertiary consumer)   10J (10% available)

SC (Secondary consumer)   100J (10% available)

PC (Primary consumer)   1000J (10% available)
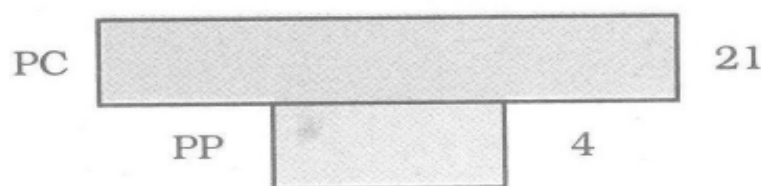
1,000,000 J of Sunlight

<u>Upright Pyramid of Energy</u> : e.g of any Grassland food chain depicting energy transfer at each trophic level = 1+1

<u>Upright Pyramid of Biomass :</u> e.g grassland food chain-grass $\longrightarrow$ rabbit $\longrightarrow$ fox $\longrightarrow$ Tiger

(Any other relevant example) = 1 for Diagram + ½ for example

Note:(If only two trophic levels are drawn with dry weight mentioned correctly can be accepted)

<u>Inverted Pyramid of Biomass:</u> e.g aquatic ecosystem where small standing crop of phytoplanktons supports large standing crop of zooplanktons =1 for Diagram + ½ for example

[5 Marks]

25. (a) **Plan an experiment and prepare a flow chart of the steps that you would follow to ensure that the seeds are formed only from the desired sets of pollen grains. Name the experiment that you carried out .**

(b) **Write the importance of such experiments.**

Ans. (a)   Selection of flowers from desired plants $\longrightarrow$ emasculation $\longrightarrow$ bagging $\longrightarrow$ dusting of the pollens on the stigma of the flowers that were bagged $\longrightarrow$ flower rebagged $\longrightarrow$ fruit formed

$= \frac{1}{2} \times 6$

Out-B-15 - 57/1, 2, 3 DPSVK/18

Artificial Hybridisation = 1

(b) Production of superior/ improved varieties of plants = 1

[5 Marks]

OR

Describe the roles of pituitary and ovarian hormones during the menstrual cycle in a human female.

Ans. Pituitary hormones :

(When levels of FSH is high) FSH, induces follicular growth, secretion of estrogen by follicles, (when LH surge is there in the mid of the cycle) lutinising hormones/LH, along with FSH leads to ovulation , and then formation of corpus luteum = ½ ×6

Ovarian hormone:

Estrogen , repair/proliferation of endometrium,

Progesterone,maintains endometrium for implantation = ½ ×4

(Low level of progesterone leads to menstrual flow)

[5 Marks]

26. (a) **Why are colourblindness and thalassemia categorised as Mendelian disorders? Write the symptoms of these diseases seen in people suffering from them.**

    (b) **About 8% of human male population suffers from colourblindness whereas only about 0.4% of human female population suffers from this disease. Write an explanation to show how it is possible.**

Ans. (a) Both are caused due to mutation /alteration in a single gene, and follow Mendelian inheritance = ½ × 2
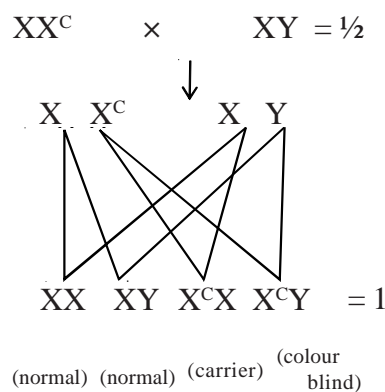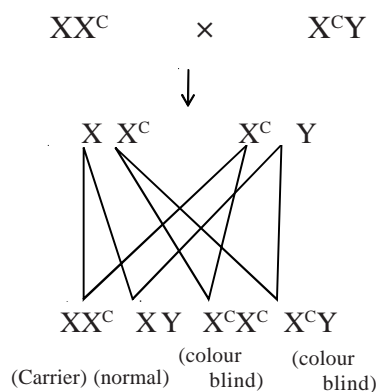
colour blindness -unable to discriminate between red and green colours =1

thalassemia - (formation of abnormal haemoglobin resulting in) Anaemia = 1

(b) it is due to a recessive mutation in the X chromosomes = ½

Males have only one X chromosome and females have two , female will be colour blind only in a homozygous recessive state/ both X chromosomes carry the defective gene/ $X^c X^c$, whereas male will be colour blind if they are X^cY/ heterozygous = ½ ×3

//

[5 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/19

OR

Explain the process of transcription in prokaryotes. How is the process different in eukaryotes ?

Ans. <u>Initiation</u> , DNA dependent RNA polymerase associates with the Initiation factor/σ factor , and binds to the promotor site of DNA thus initiates transcription $= \frac{1}{2} \times 3$

<u>Elongation</u> , The RNA polymerase using nucleoside triphosphates, polymerises in a template dependent fashion in 5' to 3' direction, following the rule of complimentarity $= \frac{1}{2} \times 3$

<u>Termination</u> , at the terminator region the enzyme associates with the rho (ρ) and both the enzymes and the newly formed/nascent RNA fall off from the DNA $= \frac{1}{2} \times 2$

Note : (Self Explanatory diagrams with correct labelling may be accepted)

<u>Difference-</u>

(i)   There are 3 different types of RNA polymerases in the nucleus of eukaryotes (polymerising the three different types of RNA molecules) but only 1 in prokaryotes

(ii)   Primary transcripts (hnRNA/precussor mRNA) undergoes splicing capping and tailing to give rise to functional RNA/mRNA (that moves out of the nucleus) this processing is absent in

prokaryotes $= \frac{1}{2} \times 2$

[5 Marks]

Question Paper Code 57/3

SECTION – A

Q. Nos. 1 - 5 are of one marks each

1. What is a cistron?

Ans. A segment of DNA , Coding for a polypeptide = ½ + ½

[1Mark]

2. How many chromosomes do drones of honeybee possess? Name the type of cell division involved in the production of sperm by them.

Ans. 16, Mitosis = ½ + ½

[1 Mark]

3. List two advantages of the use of unleaded petrol in automobiles as fuel.

Ans. (i) Allows the catalytic convertor to remain active = ½

(ii) Reduces air pollution = ½

[1 Mark]

4. Retroviruses have no DNA. However, The DNA of the infected host cell does possess viral DNA how is it possible?

Ans. Reverse transcription of viral RNA into viral DNA, then integrates/ incorporates with the host DNA = ½ + ½

[1 Mark]

5. Suggest any two possible treatments that can be given to a patient exhibiting adenosine deaminase deficiency.

Ans. (i) Enzymes replacement therapy (in which functional ADA is injected)

(ii) Bone marrow transplantation

(iii) Gene therapy / Culturing the lymphocytes followed by introduction of functional ADA cDNA into it & returning it into the patient's body

(Any two) = ½ + ½

[1 Mark]

SECTION – B

Q. Nos. 6 - 10 are of two marks each

6. Select *two* pairs from the following which exhibit divergent evolution. Give reasons for your answer.

(i) **Forelimbs of cheetah and mammals**

(ii) **Flippers of dolphins and penguins**

(iii) **Wings of butterflies and birds**

(iv) **Forelimbs of whales and mammals**

Ans. (i) and (iv) = ½ + ½

Having similar anatomical structure / origin, but performing different functions = ½ + ½

[2 Marks]

7. **A liverwort plant is unable to complete its life-cycle in a dry environment. State two reasons.**

Ans. (i)   They need water as medium of gamete transfer for fertilisation = 1

(ii)   For germination of spores = 1

[2 Marks]

8. **What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture.**

Ans. Interaction between two species in which both are benefitted =1

i.   *Rhizobium* in the roots (nodules) of legumes = ½

ii.   *Mycorrhiza / Glomus* with the roots of higher plants = ½

[2 Marks]

OR

List any four techniques where the principle of ex-situ conservation of biodiversity has been employed.

Ans. Cryopreservation , in vitro fertilisation, micro propagation / tissue culture , sperm bank/ seed bank / gene bank = ½ ×4

[2 Marks]

9. **(a)** **Why are the plants raised through micropropagation termed as somaclones ?**

(b) **Mention two advantages of this technique.**

Ans. (a)   Genetically identical = 1

(b)   Large number of plants in short duration,Virus free plants = ½ + ½

[2 Marks]

10. **Explain the function of "anaerobic sludge digester" in a sewage treatment plant.**

Ans. Anaerobic sludge digester has anerobic bacteria that digests the aerobic bacteria and fungi present in the sludge = 1

during the digestion these bacterias produce mixture of gases such as methane and H_2S and CO_2/ biogas = 1
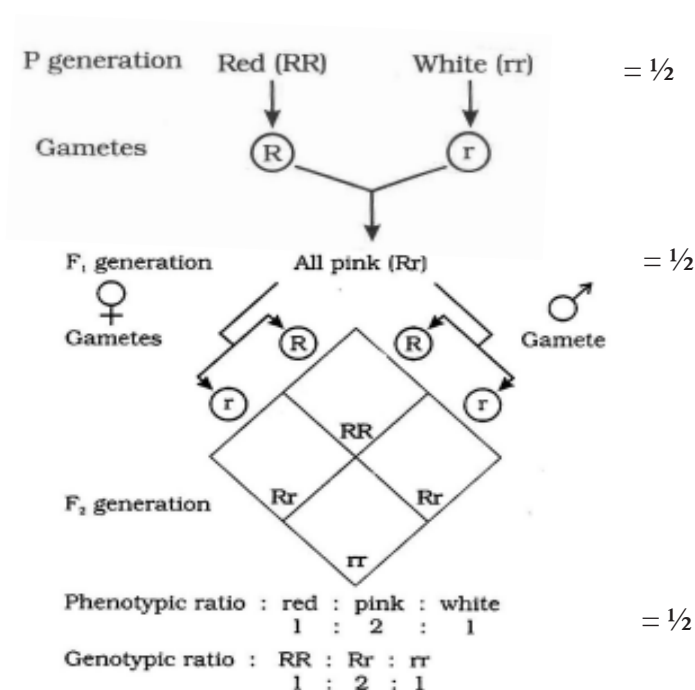
[2 Marks]

SECTION – C

Q. Nos. 11 - 12 are of three marks each

11. **The F_2 progeny of a monohybrid cross showed phenotypic and genotypic ratio as 1:2:1, unlike that of Mendel's monohybrid F_2 ratio. With the help of suitable example, work out a cross and explain how it is possible.**

Ans. *Mirabilis jalapa* / four O' clock plant / *Antirrhinum (majus)/* Snapdragon flower /dog flower
= ½

P generation   Red (RR)   White (rr)   = ½
Gametes   (R)   (r)

F₁ generation   All pink (Rr)   = ½

Phenotypic ratio : red : pink : white   = ½
1 : 2 : 1
Genotypic ratio : RR : Rr : rr
1 : 2 : 1

In heterozygous condition a single dominant gene is not sufficient to produce red colour, therefore it is a case of incomplete dominance = ½ + ½

[3 Marks]

12. Why are some seeds referred to as apomictic seeds? Mention one advantage and one disadvantage to a farmer who uses them.

Ans   Seeds produced without fertilisation are referred to as apomictic = 1

Advantage: Desired characters retained in offspring (progeny) / no segregation of characters in offspring (progeny) / assured seed production in absence of pollinators =1 (Any other relevant advantage)

Disadvantage: Cannot control accumulation of deleterious genetic mutation / usually restricted to narrow ecological niches / lack ability to adapt to changing envionrment = 1(Any other relevant disadvantage)

13. A heavily bleeding and bruised road accident victim was brought to a nursing home. The doctor immediately gave him an injection to protect him against a deadly disease.

   (a)   Write what did the doctor inject into the patient's body.

   (b)   How do you think this injection would protect the patient against the disease ?

   (c) Name the disease against which this injection was given and the kind of immunity it provides.

Ans. (a)   Tetanus antitoxins/Tetanus toxoid =1

   (b)   The preformed antibody injected , act on the pathogen immediately to provide protection = ½×2

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(c) Tetanus, passive immunity $= \frac{1}{2} \times 2$

[3 Marks]

14. "A very small sample of tissue or even a drop of blood can help to determine paternity". Provide a scientific explanation to substantiate the statement.

Ans. (i) DNA from all cells of an individual shows the same degree of polymorphism and therefore becomes a useful identification tool $=1$

(ii) Polymorphs are heritable and the child inherits 50% of the chromosome from each parent $=1$

(iii) With the help of PCR the small amount of DNA from blood can be amplified and be used in DNA finger printing to identify the paternity $=1$

Note: (if only DNA finger printing is described or illustrated allot only 1 mark)

[3 Marks]

15. What does the following equation represent ? Explain.

p2 + 2 pq + q2 = 1

Ans. Hardy Weinberg's Principle / allele frequencies in a population are stable and is constant from generation to generation, 1 represents stable allelic frequency in a population,indicating no evolution occuring, p^2 frequency of homozygous dominant /AA, 2 pq frequency of heterozygous/Aa,q^2 frequency of homozygous recessive /aa $= \frac{1}{2} \times 6$

Note : (if AA,Aa,aa have been indicated using any other alphabet correctly can be accepted)

[3 Marks]

16. Describe any three potential applications of genetically modified plants.

Ans. More tolerant to abiotic stress, less dependence on chemical pesticides, reduces post harvest losses,increase efficiency of mineral usage by plants,enhance nutritional value of food. eg. Vitamin A enriched rice (any three) $= 1+1+1$

[3 Marks]

17. How did an American company ,Eli Lilly use the knowledge of r-DNA technology to produce human insulin ?.

Ans. Two chains of DNA sequence corresponding to A & B chains of human insulin prepared, introduced them into plasmids of *E.coli* to produce separate A & B chains, A & B chains extracted combined by creating disulphide bonds $= 1 \times 3$

[3 Marks]

18. How do snails, seeds, bears, zooplanktons, fungi and bacteria adapt to conditions unfavorable for their survival ?

Ans. Snail-aestivation $= \frac{1}{2}$

Seeds-dormancy/suspended metabolic activities $= \frac{1}{2}$

Bear-Hibernation $= \frac{1}{2}$

Zooplankton- diapause/suspended development $= \frac{1}{2}$

Fungi-Spore/Zygospore $= \frac{1}{2}$

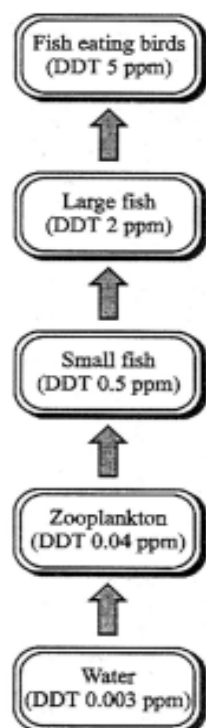Bacteria-Cyst/spore $= \frac{1}{2}$

[3 Marks]

19. Enumerate any six essentials of good ,effective Dairy Farm Management Practices.

Ans. Selection of high yielding and diseases resistant breeds,housedwell,adequate water supply,maintained disease free,feeding in a scientific manner,regular visits by veteranary doctors,regular inspection and record keeping,cleanliness and hygiene while milking and transport

(any six) $= \frac{1}{2} \times 6$

[3 Marks]

20. With help of a flow chart ,show the phenomenon of biomagnifications of DDT in an aquatic food chain.

Ans

5 stages- ½ Mark each ($\frac{1}{2} \times 5$) the flow chart should show arrows in correct direction with increasing levels of DDT $= (\frac{1}{2})$

[3 Marks]

21. State the medicinal value and the bioactive molecule produced by *Streptococcus*, *Monascus* and *Trichoderma*.

Ans. *Streptococcus* ; Streptokinase , clot buster / remove clot from the blood vessels $= \frac{1}{2} + \frac{1}{2}$

Monascus ; Statin , blood cholesterol lowering agent / it inhibits the enzymes responsible for synthesis of cholesterol $= \frac{1}{2} + \frac{1}{2}$

Trichoderma ; cyclosporin A , immunosuppressive agents used in organ transplantation $= \frac{1}{2} + \frac{1}{2}$

[3 Marks]

OR

What are Mathanogens? How do they help to generate biogas?

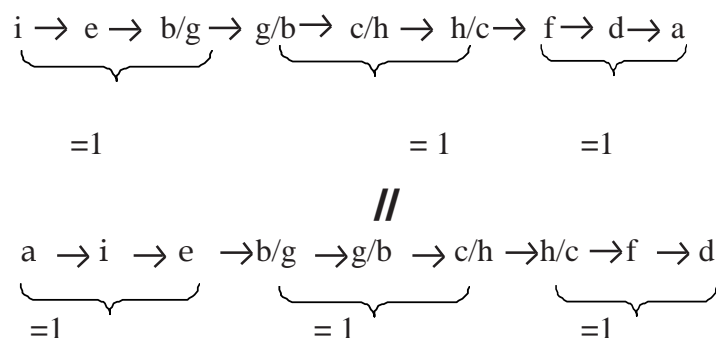Ans. Anaerobic, methane producing bacteria $= \frac{1}{2} \times 2$

methanogens generate biogas, when act on cellulose rich biowaste (anerobically) $= 1 + 1$

[3 Marks]

Out-B-15 - 57/1, 2, 3 DPSVK/25

22. **Rearrange the following in the correct sequence to accomplish an important biotechnological reaction:**

   (a) *In vitro* **synthesis of copies of DNA of interest**

   (b) **Chemically synthesized oligonucleotide**

   (c) **Enzyme DNA-polymerase**

   (d) **Complementary region of DNA**

   (e) **Genomic DNA template**

   (f) **Nucleotides provided**

   (g) **Primers**

   (h) **Thermostable DNA-ploymerase (from** *Thermus aquaticus***)**

   (i) Denaturation of ds-DNA

Ans. Correct sequence is

$$i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d \rightarrow a$$

$$\underbrace{\qquad\qquad}_{=1} \qquad \underbrace{\qquad\qquad}_{=1} \qquad \underbrace{\qquad}_{=1}$$

//

$$a \rightarrow i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d$$

$$\underbrace{\qquad\qquad}_{=1} \qquad \underbrace{\qquad\qquad}_{=1} \qquad \underbrace{\qquad}_{=1}$$

Note: (Stop Marking where the sequence goes wrong)

[3 Marks]

SECTION :- D

Q No. 23 is of four mark

23. **Your school has been selected by the Department of Education to organize and host an interschool seminar on "Reproductive Health –Problems and Practices". However, many parents are reluctant to permit their wards to attend it. Their argument is that the topic is "too embarrassing".**

   Put forth four arguments with appropriate reasons and explanation to justify the topic to be very essential and timely.

Ans. 1. The issue of puberty and adolescence need to be addressed effectively with the respective age group because many changes take place in the body during adolescence of which they are supposed to be aware of = 1

   2. To bring in awareness about their reproductive health and its effect on their physical, emotional and social being = 1

   3. To address the increase in sex abuse and sex crimes in our country = 1

4. Myths and misconceptions related to reproductive issues =1

Note: (any other related or relevant argument with reasons may be accepted)

[4 Marks]

SECTION:-E

Q. Nos. 24 - 26 are of five marks each

24. (a) How are Mendelian inheritance, polygenic inheritance and pleiotropy different from each other ?

(b) Explain polygenic inheritance pattern with help of suitable example.

Ans. (a)

Mendelian Inheritance	Polygenic inheritance	Pleiotropy
One gene controls one trait/character/phenotype	Two or more genes influence the expression of one trait/character/phenotype	One gene controls the expression of more than one trait/character/phenotype

$=1 \times 3$

(b) Human Height/skin colour are examples of polygenic inheritance, height trait is controlled by at least three gene pairs, additive effect of each allele contributes to the phenotypic expression of the trait, more the dominant alleles more pronounced is the phenotypic expression /more the recessive alleles less pronounced is the phenotypic expression $= \frac{1}{2} \times 4$
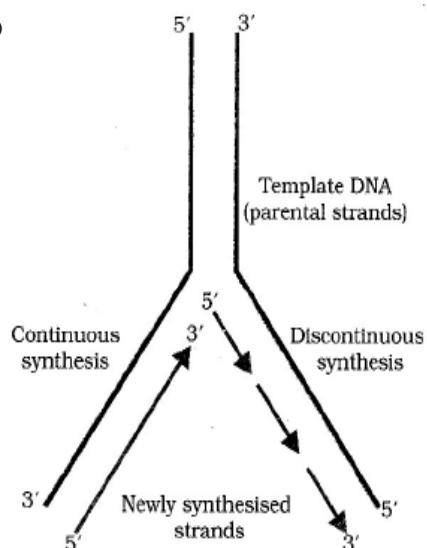
Note: (skin colour may be accepted in place of height as an example)

[5 Marks]

OR

(a) Draw a labelled diagram of a "replicating fork" showing the polarity. Why does DNA replication occur within such 'fork' ?

(b) Name two enzymes involved in the process of DNA replication, along with their prop

Ans. (a)

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(Correct diagram with polarity of parental strands and any other 3 labels) $= ½ × 4$

Since two strands of DNA cannot be seperated in its entire length due to very high energy requirement / high amount of energy is required to break the hydrogen bonds holding the two strands the replication occurs in small opening of DNA strands called the Replication fork $= 1$

(b)   i)   DNA dependent DNA polymerase , adds nucleotides only in 5' to 3' directions/are very fast $=½ ×2$

      ii)   DNA ligase , joins the discontinuously synthesised DNA fragments during replication $=½ ×2$

[5 Marks]

25.   **(a)**   **List the different attributes that a population has and not an individual organism.**

      (b)   **What is population density? Explain any three different ways the populationdensity can be measured, with the help of an example each .**

(a)   <u>Attributes of population</u>

      Birth rate , Death Rate , sex ratio,age pyramids/age distribution (any two) $= ½ × 2$

(b)   <u>Population density -</u>

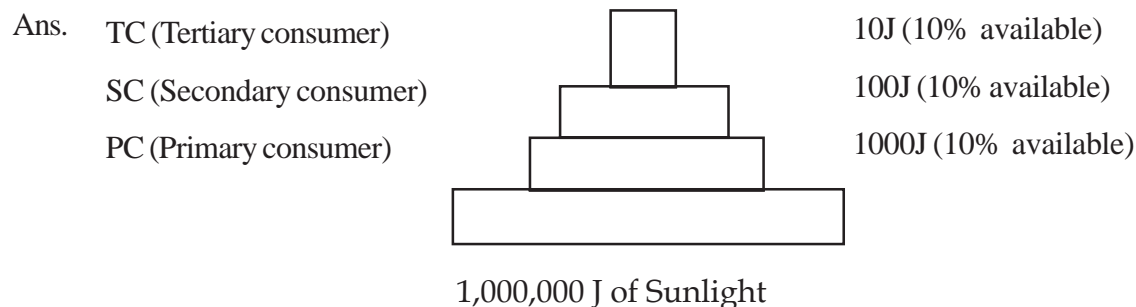   Number of individuals per unit area at a given time / period $= 1$

      1.   <u>Biomass / % Cover</u> **,** e.g Hundred *Parthenium* plants and 1 huge banayan tree $= ½×2$

      2.   <u>Relative Density</u> , e.g Number of fish caught per trap from a lake $=½×2$

      3.   <u>Numbers</u> , e.g Human population $= ½ × 2$

      4.   <u>Indirect estimation</u> , e.g without actually counting/seeing them e.g tiger census based on pugmarks and fecal pellets $= ½ × 2$
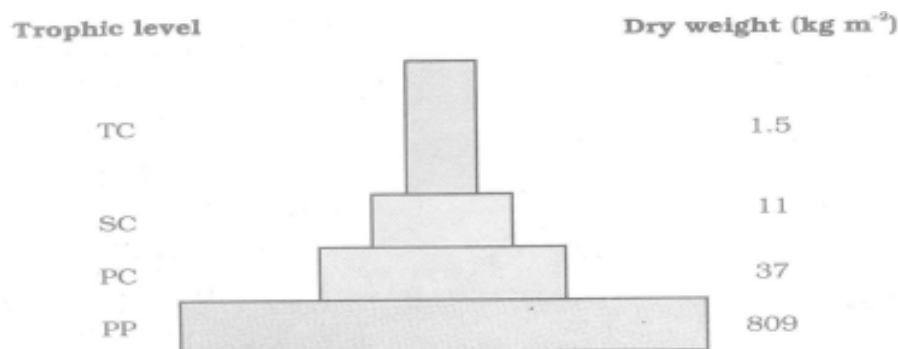
(Any three)

[5 Marks]

OR

"It is often said that the pyramid of energy is always upright. On the other hand the pyramid of biomass can be both upright and inverted." Explain with the help of examples and sketches.
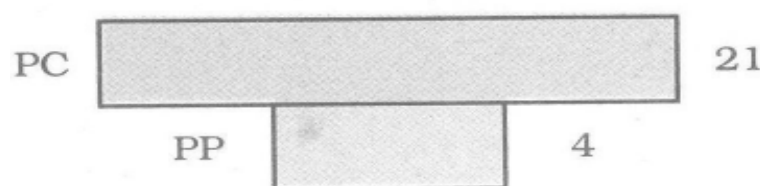
Ans.   TC (Tertiary consumer)   10J (10% available)

      SC (Secondary consumer)   100J (10% available)

      PC (Primary consumer)   1000J (10% available)

1,000,000 J of Sunlight

<u>Upright Pyramid of Energy</u> : e.g of any Grassland food chain depicting energy transfer at each trophic level $= 1+1$

Trophic level	Dry weight (kg m^{-2})
TC	1.5
SC	11
PC	37
PP	809

Upright Pyramid of Biomass : e.g grassland food chain-grass $\longrightarrow$ rabbit $\longrightarrow$ fox $\longrightarrow$ Tiger

(Any other relevant example) = 1 for Diagram + ½ for example

 Note:(If only two trophic levels are drawn with dry weight mentioned correctly can be accepted)

PC	21
PP	4

Inverted Pyramid of Biomass: e.g aquatic ecosystem where small standing crop of phytoplanktons supports large standing crop of zooplanktons =1 for Diagram + ½ for example

[5 Marks]

26. **(a)** **Plan an experiment and prepare a flow chart of the steps that you would follow to ensure that the seeds are formed only from the desired sets of pollen grains. Name the experiment that you carried out .**

(b) **Write the importance of such experiments.**

Ans. (a) Selection of flowers from desired plants $\longrightarrow$ emasculation $\longrightarrow$ bagging $\longrightarrow$ dusting of the pollens on the stigma of the flowers that were bagged $\longrightarrow$ flower rebagged $\longrightarrow$ fruit formed = ½ × 6

Artificial Hybridisation =1

(b) Production of superior/ improved varieties of plants = 1

[5 Marks]

OR

Describe the roles of pituitary and ovarian hormones during the menstrual cycle in a human female.

Ans. Pituitary hormones :

(When levels of FSH is high) FSH, induces follicular growth, secretion of estrogen by follicles, (when LH surge is there in the mid of the cycle) lutinising hormones/LH, along with FSH leads to ovulation , and then formation of corpus luteum = ½ ×6

Ovarian hormone:

Estrogen , repair/proliferation of endometrium,

Progesterone,maintains endometrium for implantation = ½ ×4

(Low level of progesterone leads to menstrual flow)

[5 Marks]