# Senior School Certificate Examination

## March 2016

### 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.

# Question Paper Code 57/2/1

## SECTION – A

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

**1. Name two animals that exhibit Oestrus cycle.**

Ans. cow / sheep / rat / deer / dog / tiger / anyother (correct example) = $\frac{1}{2} \times 2$

[1 Mark]

**2. What is point mutation? Give one example.**

Ans. Arising due to change in a single base pair of DNA , sickle cell anemia = $\frac{1}{2} \times 2$

[1 Mark]

**3. Mention one difference to distinguish an exon from an intron.**

Ans. Exon : coded / expressed sequence of nucleotides in mRNA , = $\frac{1}{2}$

Intron : Intervening sequence of nucleotides not appearing in processed mRNA = $\frac{1}{2}$

[1 Mark]

**4. Suggest a molecular diagnostic procedure that detects HIV in a suspected AIDS patient.**

Ans. PCR / ELISA = 1

[1 Mark]

**5. What does nature's carrying capacity for a species indicate ?**

Ans. (In nature) a given habitat has enough (limited) resources to support a maximum possible number , no further growth in population is possible = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

## SECTION –B

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

**6. Write the location and functions of Myometrium and Endometrium.**

Ans. Myometrium : middle layer of uterus , contractions of the uterus during delivery / child birth / parturition = $\frac{1}{2} + \frac{1}{2}$

Endometrium : Inner layer of uterus , cyclic changes during menstruation / implantation of embryo = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

**7. How does a test cross help to determine the genotype of an individual ?**

Ans. Individual of unknown genotype crossed with recessive parent , = 1

All dominant in progeny - Homozygosity , dominant to recessive ratio 1:1 in progeny - Heterozygosity = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

<div align="center">**OR**</div>

**Mention two applications of DNA polymorphism.**

Ans. Genetic mapping , DNA finger printing $= 1 + 1$

<div align="right">[2 Marks]</div>

**8.** **What kind of areas are suitable for practicing apiculture? Write the scientific name of the variety commonly reared for the purpose.**

Ans. (Bee pastures of) wild shrub , fruit orchards , cultivated crop (any two) $= \frac{1}{2} + \frac{1}{2}$

*Apis indica* $= 1$

<div align="right">[2 Marks]</div>

**9.** **Suggest four advanced ex-situ methods to conserve threatened biodiversity.**

Ans. Cryopreservation , in vitro fertilisation , tissue culture , seed banks $= \frac{1}{2} \times 4$

<div align="right">[2 Marks]</div>

**10.** **Lower BOD of a water body helps reappearance of clean-water organisms. Explain.**

Ans. Lowering of BOD results in decreased biodegradable material $\rightarrow$ reduced microbial decomposition $\rightarrow$ oxygen utilisation reduced $\rightarrow$ more Dissolved Oxygen (DO) available (clean water - organisms reappear) $= \frac{1}{2} \times 4$

<div align="right">[2 Marks]</div>

<div align="center">**SECTION –C**</div>

<div align="center">**Q. Nos. 11-22 are of three marks each**</div>

**11.** **"Post-industrialization, the population of melanised moth increased in England at the expense of white-winged moths." Provide explanations.**

Ans. Pre Industrialisation had more white winged moth against grey lichens on tree trunk, industrialisation led to deposition of soot & smoke on tree bark , making bark of trees dark , against the dark background white moth could easily be preyed upon , melanised moth could camouflage against dark bark , increased in number (through reproduction) / natural selection $= \frac{1}{2} \times 6$

<div align="right">[3 Marks]</div>

**12.** **Why does the 'insertional inactivation' method to detect recombinant DNA is preferred to 'antibiotic resistance' procedure?**

Ans. The presence of a chromogenic substrate gives blue coloured colonies , in absence of an insert / in non-transformants , presence of an insert (in the enzyme site) , results into (insertional inactivation of the β-galactosidase) colonies which do not produce colour $= \frac{1}{2} \times 4$

Antibiotic resistance method requires duplicate plating / cumbersome procedure $= 1$
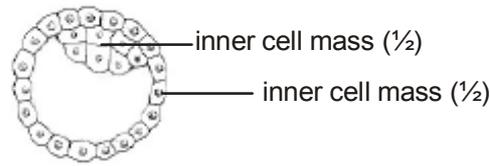
<div align="right">[3 Marks]</div>

**13.** **Explain the role of the enzyme EcoRI in recombinant DNA technology.**

Ans. EcoRI inspects length of DNA and recognises specific palindromic nucleotide sequence , binds with DNA , cuts each of the two strands of double helix at specific points $= 1 \times 3$

<div align="right">[3 Marks]</div>

14. **Draw a labelled diagram of the embryonic stage that gets implanted in the human uterus. State the functions of the two parts labelled.**
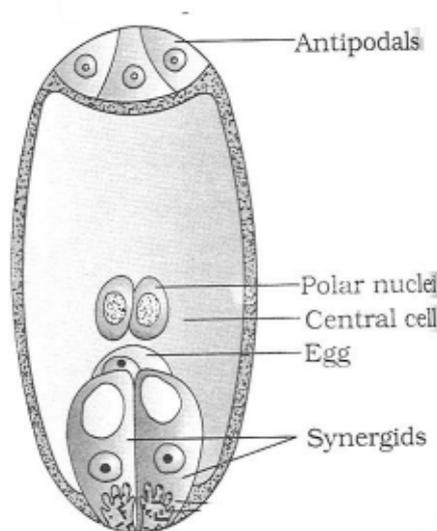
Ans.



-Trophoblast - helps in implantation / attachment to endometrium / attachment to uterus = 1

-Inner cell mass - gets differentiated into an embryo = 1

[3 Marks]

15. **(a)** **Draw a labelled sketch of a mature 7-celled,8-nucleate embryo-sac.**
    **(b)** **Which one of the cell in an embryo-sac produce endosperm after double fertilization?**

Ans. (a)



$$= ½ × 5 = 2½$$

(b) Central cell $= ½$

[3 Marks]

16. **Narrowly utilitarian arguments are put forth in support of biodiversity conservation. Explain the other two arguments that are put forth in support of the same cause.**

Ans. - Broadly utilitarian $= ½$

Ecosystem services - Purify air , cycling of nutrients , habitat for wildlife , pollinating crops , aesthetic pleasure (any two) $= ½ × 2 = 1$

- Ethical = ½

Philosophical / spiritual / moral duty towards future generations = ½ × 2 = 1

(½ + 1 + ½ + 1)                                                                [3 Marks]

**17.    On a visit to a Hill station, one of your friend suddenly become unwell and felt uneasy.**

   **(a)    List two symptoms you would look for to term it to be due to allergy.**

   **(b)    Explain the response of the body to an allergen.**

   **(c)    Name two drugs that can be recommended for immediate relief.**

Ans.  (a)    sneezing , watery eyes, running nose , difficulty in breathing (any two)= ½ + ½

      (b)    body releases antibodies , IgE type = ½ + ½

      (c)    Antihistamine , adrenalin , steroids (any two) = ½ +½

                                                                             [3 Marks]

**18.    (a)    Why did Hershey and Chase use radioactive sulfur and radioactive phosphorus in their experiment ?**

   **(b)    Write the conclusion they arrived at and how.**

Ans.  (a)    In order to label protein coat of virus with radioactive sulfur , label DNA with radioactive phosphorus = ½ + ½

      (b)    Bacteria which were infected with viruses having radioactive DNA were found to contain radioactive DNA later on = ½

             Bacteria which were infected with viruses having radioactive protein coat were not found to contain radioactivity = ½

             Conclusion - DNA is the genetic material = 1

                                                                             [3 Marks]

**19.    (a)  Explain any two defence mechanisms plants evolved against their predators.**

   **(b)  How does predation differ from parasitism?**

Ans.  (a)    (i)     Thorns are (morphological) means of defence = 1

             (ii)    produce / store chemicals which inhibit digestion / disrupts reproduction / kill // Calotropis produces highly poisonous cardiac glycosides // plants may produce chemcials such as nicotine / caffiene / quinine / strychnine / opium are produced as defence  = 1

      (b)    

| Parasitism | Predation |
|---|---|
| - Lives & feed on the host | Only feeds on prey |
| - host specific | prudent / not prey specific |
| - Co-evolve with the host | Control / check prey population |
| | (any one difference) = 1 |

                                                                             [3 Marks]

**20. Human blood group is a good example of multiple allelism and co-dominance. Justify.**

Ans. **Multiple allelism** : Generally in an individual / population **,** only two alleles of a trait govern the character **,** but in case of ABO blood group **,** three alleles $I^A$, $I^B$ and i are found to govern blood group in human population $= \frac{1}{2} \times 4 = 2$

**Co-dominance :** Allele $I^A$ and $I^B$ when present in an individual , both being dominant express their own types of sugars / traits (no marks for the second step if two alleles are not given correctly) $= \frac{1}{2} \times 2 = 1$

[3 Marks]

**21. (a) What is Gene therapy?**

**(b) Describe the procedure of such a therapy that could be a permanent cure for a disease. Name the disease.**

Ans. (a) (Collection of) methods that allows correction of gene defect that has been diagnosed in a child / embryo // Genes are inserted into a person's cells and tissues to treat a disease , this involves delivery of a normal gene into the individual / embryo to take over the function of and compensate for non-functional / a defective gene $= 1$
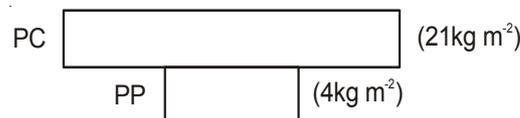
(b) If the desired gene is isolated and introduced into cells at early embryonic stages it can provide a permanant cure $= 1$

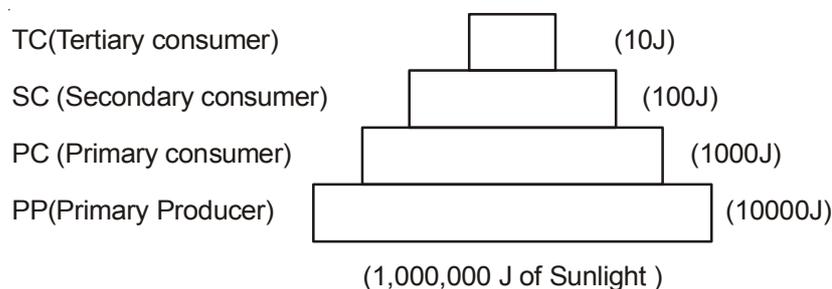ADA / Adenosine deaminase deficiency $= 1$

[3 Marks]

**22. Draw a pyramid of biomass and pyramid of energy in sea. Give your comments on the type of Pyramids drawn.**

Ans.



Pyramid of biomass in sea = 1



Pyramid of energy in sea = 1

The pyramid of biomass in sea is inverted = ½

The pyramid of energy in sea is upright = ½

[3 Marks]

**OR**

**(a)** Rearrange the following greenhouse gases in increasing order of their relative contribution to the total global warming:

$N_2O$; CFC; $CO_2$; $C_2H_4$.

**(b)** What is the effect of global warming on polar ice-caps? Comment on its possible ecological impact.

Ans. (a)   $C_2H_4 \rightarrow N_2O \rightarrow CFC \rightarrow CO_2 \Big/ N_2O \rightarrow CFC \rightarrow CH_4 \rightarrow CO_2$ (Highest) = 1

Note - Ignore $C_2H_4/CH_4$ and give one mark for remaining three greenhouse gases if sequence is correct

(b)   (Global warming) $\rightarrow$ Rise in Atmospheric temperature $\rightarrow$ polar ice melts $\rightarrow$ increase in sea level $\rightarrow$ coastal land mass submerge = $\frac{1}{2} \times 4 = 2$

[3 Marks]

## SECTION –D

### Q No. 23 is of four mark

23. You have a friend whose parents are too indulgent in his/her daily affairs. They think him/her to be still young which makes him/her sad and is upset all the time. As he/she feels that the parents should give him/her opportunity to take independent decision on some issues.

   **(a)** Would you support your friend and why ?

   **(b)** Write the characteristics of this age group.

   **(c)** List two curative measures.

Ans. (a)   Yes , because of peer understanding = $\frac{1}{2} + \frac{1}{2} = 1$

(b)   Curious , adventurous , look for excitement , experimentation = $\frac{1}{2} \times 4 = 2$

(c)   Avoid undue peer pressure / education & counselling / help from parents & peers / identifying the danger signs / professional and medical help or any other appropriate measures **(any two)** = $\frac{1}{2} + \frac{1}{2} = 1$
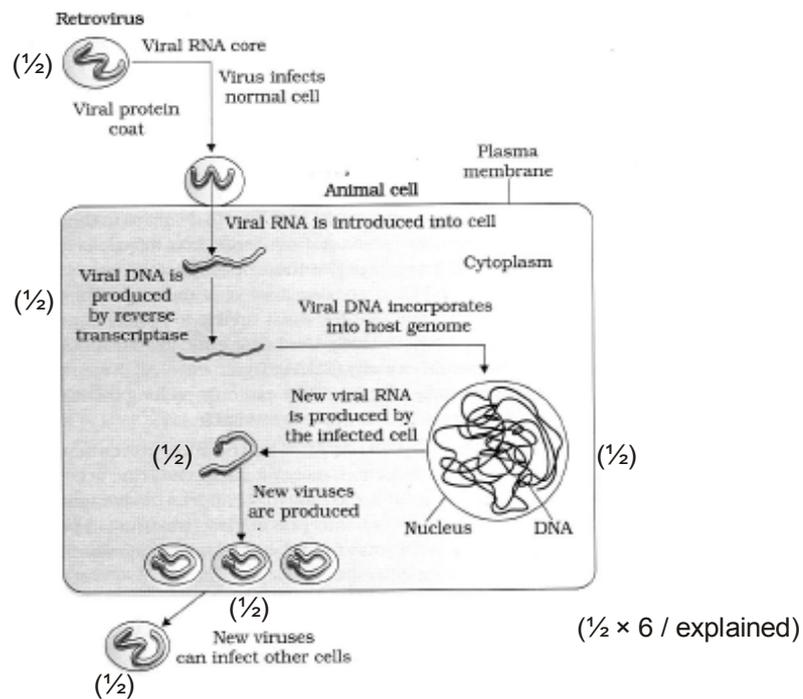
[4 Marks]

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

24. (a) **How does a Human Immunodeficiency Virus( HIV) replicate in a host ?**

(b) **How does an HIV-infected patient lose immunity ?**

(c) **List any two symptoms of this disease.**

Ans. (a)



Retrovirus
Viral RNA core
(½)
Viral protein coat
Virus infects normal cell

Plasma membrane
Animal cell
Viral RNA is introduced into cell

Viral DNA is produced by reverse transcriptase (½)
Cytoplasm
Viral DNA incorporates into host genome

New viral RNA is produced by the infected cell
(½)
New viruses are produced
Nucleus    DNA
(½)

(½)
New viruses can infect other cells
(½)

(½ × 6 / explained)

(b) Loss of T-lymphocytes = 1

(c) Fever / diarrhoea / susceptibility to other diseases , prone to microbial infection **(any two)** = ½ + ½

[5 Marks]

**OR**

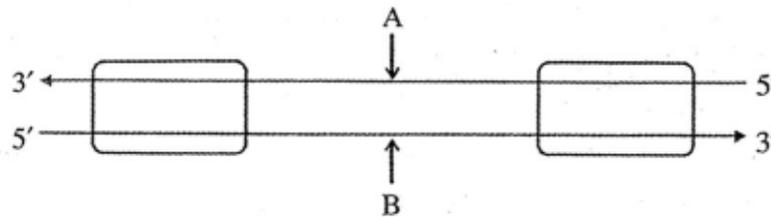**Describe the process of waste- water treatment under the following heads:**
(a) **Primary treatment.**

(b) **Secondary treatment.**

Ans. (a) Primary treatment

1. Physical removal of particles through filtration , sedimentation in stages = ½ + ½

2. Solids settle to form primary sludge , the supernatants form the effluent = ½ + ½

(b) Secondary Treatment

- Effluent passed into aeration tanks = ½

- Vigorous growth of useful aerobic microbes into flocs = ½

- Significant reduction of BOD = ½

- Effluent passed on to settling tanks where bacterial flocs settle to form activated sludge = ½

- Activated sludge is passed on to anaerobic sludge digester , where bacteria and fungi are anaerobically digested = ½ + ½

  = ½ × 10

[5 Marks]

25.



**(a) Identify strands 'A' and 'B' in the diagram of transcription unit given above and write the basis on which you identified them.**

**(b) State the functions of Sigma factor and Rho factor in the transcription process in a bacterium.**

**(c) Write the functions of RNA polymerase-I and RNA polymerase-III in eukaryotes.**

Ans. (a) A - Template strand = 1

B - Coding strand = 1

Template strand has polarity $3' \rightarrow 5' = ½$  /  On the basis of polarity with respect to promoter = ½ + ½

Coding strand has polarity $5' \rightarrow 3' = ½$

(b) In initiation sigma factor associates with RNA polymerase to initiate transcription , Rho factor gets associated to RNA polymerase to terminate transcription = ½ + ½

(c) RNA polymerase I - Transcribes rRNAs = ½

RNA polymerase III - Transcribes tRNA / 5srRNA / SnRNA = ½

[5 Marks]

**OR**

**Describe the packaging of DNA helix in a prokaryotic cell and an eukaryotic nucleus.**
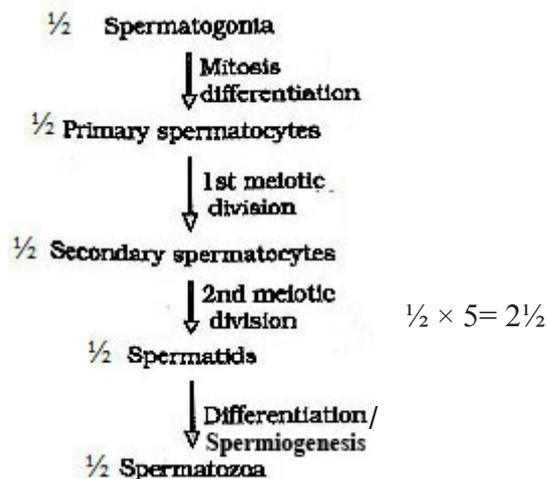
Ans. Prokaryotes : Negatively charged DNA , is held with positively charged proteins , in nucleoid , DNA in nucleoid is organised in large loops held by protein = ½ × 4

Eukaryotes :In nucleus the negatively charged DNA , is wrapped around positively charged histone octamer , to form nucleosome , nucleosomes are repeated , to constitute chromatin , at higher level additional set of non-histone chromosomal protein gets associated with chromatin = ½ × 6

[5 Marks]

**26.** **(a)** **Where does spermatogenesis occur in human testes ? Describe the process of spermatogenesis upto the formation of spermatozoa.**

**(b)** **Trace the path of spermatozoa from the testes upto the ejaculatory duct only.**

Ans. (a) Seminiferous tubules = ½

½ Spermatogonia
↓ Mitosis / differentiation
½ Primary spermatocytes
↓ 1st meiotic division
½ Secondary spermatocytes
↓ 2nd meiotic division        ½ × 5= 2½
½ Spermatids
↓ Differentiation/ Spermiogenesis
½ Spermatozoa

(b) Seminiferous tubules→rete testis→Vasa efferentia→Epididymis→vas deferens→(ejaculatory duct)

½     ½     ½     ½

[5 Marks]

**OR**

**Explain the events upto fertilization that occur in a flower after the pollen grain has landed on its compatible stigma.**

Ans. The pollen grain germinates , on the stigma to produce a pollen tube through one of the germ pores , the content of the pollen grain move into the pollen tube , pollen tube grows through the tissues of the stigma and style and reaches the ovary , the generative cell divides and forms two male gametes during the growth of pollen tube (in the stigma) , the pollen tube enters the ovule through micropyle, and then enters one of the synergids (through filiform apparatus) , the pollen tube releases the two male gametes (in the cytoplasm of synergids) , one of the male gamete fuses with egg cell to form zygote (2n) (syngamy) , the other male gamete fuses with two polar nuclei (in central cell) to form primary endosperm nucleus (PEN-3n)/PEC = ½ × 10

[5 Marks]

# Question Paper Code 57/2/2

## SECTION – A

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

**1.    What does nature's carrying capacity for a species indicate ?**

Ans.  (In nature) a given habitat has enough (limited) resources to support a maximum possible number , no further growth in population is possible = ½ + ½

[1Mark]

**2.    Suggest a molecular diagnostic procedure that detects HIV in a suspected AIDS patient**

Ans.  PCR / ELISA = 1

[1 Mark]

**3.    Name two animals that exhibit oestrus cycle.**

Ans.  cow / sheep / rat / deer / dog / tiger / anyother (correct example) = ½ × 2

[1 Mark]

**4.    Mention one difference to distinguish an exon from an intron.**

Ans.  Exon : coded / expressed sequence of nucleotides in mRNA , = ½

Intron : Intervening sequence of nucleotides not appearing in processed mRNA = ½

[1 Mark]

**5.    What is a Mutagen ? Name a physical factor that can be a Mutagen.**

Ans.  All the physical and chemical factors that induce mutation , UV radiation / X rays = ½ + ½

[1 Mark]

## SECTION – B

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

**6.    How e-wastes are being handled in our country ? Write the correct solution for treating this waste.**

Ans.  E-wastes are being buried in landfills , or incinerated (manually) = ½ + ½

Recycling , in the environment friendly manner = ½ + ½

[2 Marks]

**7.    Suggest four advanced ex-situ methods to conserve threatened biodiversity.**

Ans.  Cryopreservation , in vitro fertilisation , tissue culture , seed banks = ½ × 4

[2 Marks]

**8.    State the role of Oxytocin in parturition. What triggers its release from the pituitary ?**

Ans.  Oxytocin acts on uterine muscle , and cause stronger uterine contraction , leading expulsion of the foetus / baby out of uterus = ½ × 3 = 1½

The signals from fully formed foetus and the placenta which induce mild uterine contraction / foetal ejection reflex triggers release of oxytocin = ½

[2 Marks]

9.  (a)  **"Fortification of crops is the need of the hour." Give two reasons.**

    (b)  **Select one fresh-water and one marine fish from the following :**

         **Prawn; Catla; Mackerel; Lobster**

Ans. (a)  To improve the nutritional quality , in order to improve public health / to prevent malnutrition = ½ +½

    (b)  Fresh water : Catla = ½

         Marine fish : Mackerel = ½

[2 Marks]

10.  **How does a test cross help to determine the genotype of an individual ?**

Ans.  Ans.  Individual of unknown genotype crossed with recessive parent , = 1

      All dominant in progeny - Homozygosity , dominant to recessive ratio  1:1  in progeny - Heterozygosity = ½ + ½

[2 Marks]

**OR**

**Mention two applications of DNA polymorphism.**

Ans.  Ans.  Genetic mapping , DNA finger printing = 1 + 1

[2 Marks]

**SECTION – C**

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

11.  **Explain with the help of an example the relationship between restriction endonuclease and a palindromic nucleotide sequence.**

Ans.  Restriction endonuclease recognises a specific palindromic nucleotide sequence , in the DNA , Restriction endonuclease cuts the strand of DNA a little away from the centre of palindromic nucleotide sequence but between the same two bases on the opposite strands , leaving single stranded portions at the end / sticky ends = ½ × 4

```
       ↓
5'———GAATTC———3'
3'———CTTAAG———3'   =1
              ↑
```
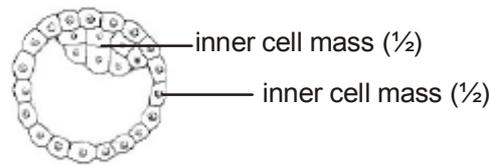
(No mark , if polarity is not shown or if only one strand is shown)

[3 Marks]

12.  **Draw a labelled diagram of the embryonic stage that gets implanted in the human uterus. State the functions of the two parts labelled.**

Ans.



inner cell mass (½)

inner cell mass (½)

-Trophoblast - helps in implantation / attachment to endometrium / attachment to uterus = 1

-Inner cell mass - gets differentiated into an embryo = 1

[3 Marks]

**13.** **(a) State Oparin- Haldane's hypothesis ?**

**(b) How does S.L. Miller's experiment supports it ?**

Ans. (a)   Life could have come from pre-existing non-living organic molecules , and that formation of life was preceded by chemical evolution = ½ + ½

(b)   (S. L. Miller created condition similar to prehistoric earth in the laboratory) He created electric discharge in a closed flask , containing $CH_4$ $H_2$ $NH_3$ and water vapour , at $800^0C$ , observed formation of amino acid (organic molecules) = ½ × 4
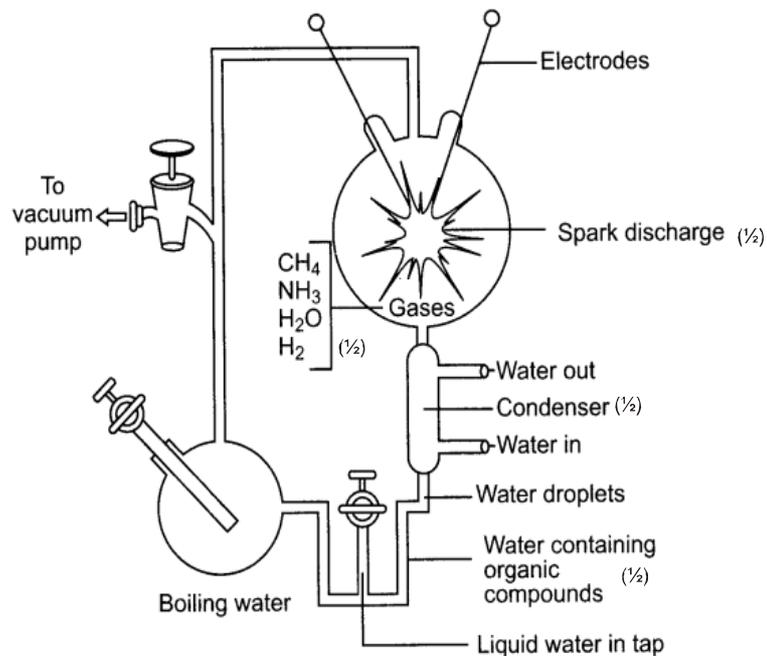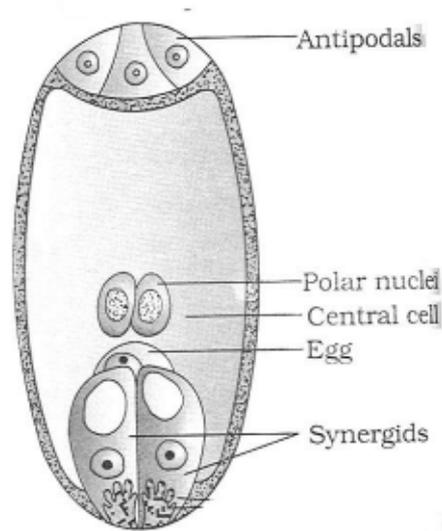
//



Diagram showing Millers's experiment

(All four contents in flask to be mentioned otherwise no marks)

[3 Marks]

**14. (a) Draw the labelled sketch of a mature 7-celled, 8-nucleate embryo-sac.**

**(b) Which one of the cell in an embryo-sac produce endosperm after double fertilization?**

Ans. Ans. (a)



$$= \tfrac{1}{2} \times 5 = 2\tfrac{1}{2}$$

(b)   Central cell $= \tfrac{1}{2}$

[3 Marks]

**15. Narrowly utilitarian arguments are put forth in support of biodiversity conservation.**

**Explain the other two arguments that are put forth in support of the same cause.**

Ans. - Broadly utilitarian $= \tfrac{1}{2}$

Ecosystem services - Purify air , cycling of nutrients , habitat for wildlife , pollinating crops , aesthetic pleasure (any two) $= \tfrac{1}{2} \times 2 = 1$

- Ethical $= \tfrac{1}{2}$

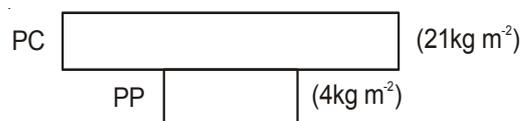Philosophical / spiritual / moral duty towards future generations $= \tfrac{1}{2} \times 2 = 1$

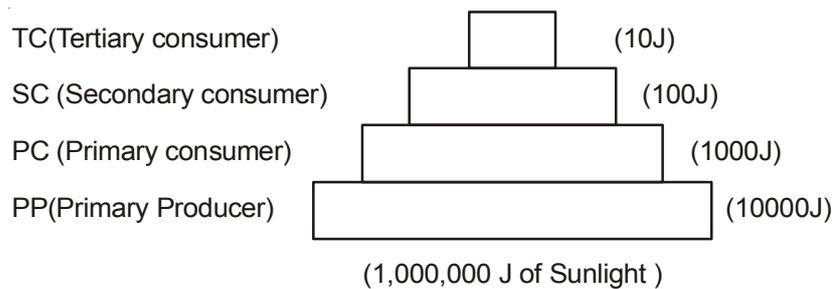$(\tfrac{1}{2} + 1 + \tfrac{1}{2} + 1)$                                                                 [3 Marks]

**16. Draw a pyramid of biomass and pyramid of energy in sea. Give your comment on the type of pyramids drawn.**

Ans.



Pyramid of biomass in sea $= 1$

```
TC(Tertiary consumer)          (10J)
SC (Secondary consumer)        (100J)
PC (Primary consumer)          (1000J)
PP(Primary Producer)           (10000J)
```

(1,000,000 J of Sunlight )

Pyramid of energy in sea = 1

The pyramid of biomass in sea is inverted = ½

The pyramid of energy in sea is upright = ½

[3 Marks]

**OR**

**(a)** **Rearrange the following green house gases in increasing order of their relative contribution to the total global warming:**

$N_2O$; CFC; $CO_2$; $C_2H_4$.

**(b)** **What is the effect of global warming on polar ice-caps? Comment on its possible ecological impact.**

Ans. (a)   $C_2H_4 \rightarrow N_2O \rightarrow CFC \rightarrow CO_2 / N_2O \rightarrow CFC \rightarrow CH_4 \rightarrow CO_2$ (Highest) = 1

Note - Ignore $C_2H_4/CH_4$ and give one mark for remaining three greenhouse gases if sequence is correct

(b)   (Global warming) $\rightarrow$ Rise in Atmospheric temperature $\rightarrow$ polar ice melts $\rightarrow$ increase in sea level $\rightarrow$ coastal land mass submerge = ½ × 4 = 2

[3 Marks]

**17.** **(a)** **What is Gene therapy?**

**(b)** **Describe the procedure of such a therapy that could be a permanent cure for a disease. Name the disease.**

Ans. (a)   (Collection of) methods that allows correction of gene defect that has been diagnosed in a child / embryo // Genes are inserted into a person's cells and tissues to treat a disease , this involves delivery of a normal gene into the individual / embryo to take over the function of and compensate for non-functional / a defective gene  = 1

(b)   If the desired gene is isolated and introduced into cells at early embryonic stages it can provide a permanant cure = 1

ADA / Adenosine deaminase deficiency = 1

[3 Marks]

**18.** **Human blood group is a good example of multiple allelism and co-dominance. Justify.**

Ans. **Multiple allelism** : Generally in an individual / population **,** only two alleles of a trait govern the character **,** but in case of ABO blood group **,** three alleles $I^A$, $I^B$ and i are found to govern blood group in human population $= \frac{1}{2} \times 4 = 2$

**Co-dominance :** Allele $I^A$ and $I^B$ when present in an individual , both being dominant express their own types of sugars / traits (no marks for the second step if two alleles are not given correctly) $= \frac{1}{2} \times 2 = 1$

[3 Marks]

**19.** **On a visit to a Hill station, one of your friend suddenly become unwell and felt uneasy.**

    **(a)** **List two symptoms you would look for to term it to be due to allergy.**

    **(b)** **Explain the response of the body to an allergen.**

    **(c)** **Name two drugs that can be recommended for immediate relief.**

Ans. (a)     sneezing , watery eyes, running nose , difficulty in breathing (any two) $= \frac{1}{2} + \frac{1}{2}$

    (b)     body releases antibodies , IgE type $= \frac{1}{2} + \frac{1}{2}$

    (c)     Antihistamine , adrenalin , steroids (any two) $= \frac{1}{2} + \frac{1}{2}$

[3 Marks]

**20.** **(a)** **A parasite has to adapt to be able to live in the host. Write the various parasitic adaptations.**

    **(b)** **Mention an adaptive feature exhibited in brood parasitism in Koel and Crow.**

Ans. (a)   -     Loss of unnecessary sense organs /

        -     Adhesive organs or suckers to cling on to the host /

        -     Loss of digestive system /

        -     High reproductive capacity /

        -     Loss of chlorophyll and leaves **(any four)** $= \frac{1}{2} \times 4$

    (b)     The eggs of the parasitic bird (Koel) resemble the host's egg (Crow) in size and colour to reduce the chances of the host bird detecting the foreign eggs and ejecting them out from the nest $= 1$

[3 Marks]

**21.** **(a)** **Why did Hershey and Chase use radioactive sulfur and radioactive phosphorus in their experiment?**

    **(b)** **Write the conclusion they arrived at and how.**

Ans. (a)     In order to label protein coat of virus with radioactive sulfur , label DNA with radioactive phosphorus $= \frac{1}{2} + \frac{1}{2}$

    (b)     Bacteria which were infected with viruses having radioactive DNA were found to contain radioactive DNA later on $= \frac{1}{2}$

        Bacteria which were infected with viruses having radioactive protein coat were not found to contain radioactivity $= \frac{1}{2}$

        Conclusion - DNA is the genetic material $= 1$

[3 Marks]

**22.** **Why does the 'insertional inactivation' method to the detect recombinant DNA is preferred to 'antibiotic resistance' procedure?**

Ans. Ans. The presence of a chromogenic substrate gives blue coloured colonies , in absence of an insert / in non-transformants , presence of an insert (in the enzyme site) , results into (insertional inactivation of the β-galactosidase) colonies which do not produce colour $= \frac{1}{2} \times 4$

Antibiotic resistance method requires duplicate plating / cumbersome procedure $= 1$

[3 Marks]

## SECTION – D

### Q. No. 23 is of four mark

**23.** **You have a friend whose parents are too indulgent in his/her daily affairs. They think him/ her to be still young which makes him/her sad and is upset all the time. As he/she feels that the parents should give him/her opportunity to take independent decision on some issues.**

   **(a) Would you support your friend and why ?**

   **(b) Write the characteristics of this age group.**

   **(c) List two curative measures.**

Ans. (a)   Yes , because of peer understanding $= \frac{1}{2} + \frac{1}{2} = 1$

   (b)   Curious , adventurous , look for excitement , experimentation $= \frac{1}{2} \times 4 = 2$

   (c)   Avoid undue peer pressure / education & counselling / help from parents & peers / identifying the danger signs / professional and medical help or any other appropriate measures **(any two)** $= \frac{1}{2} + \frac{1}{2} = 1$
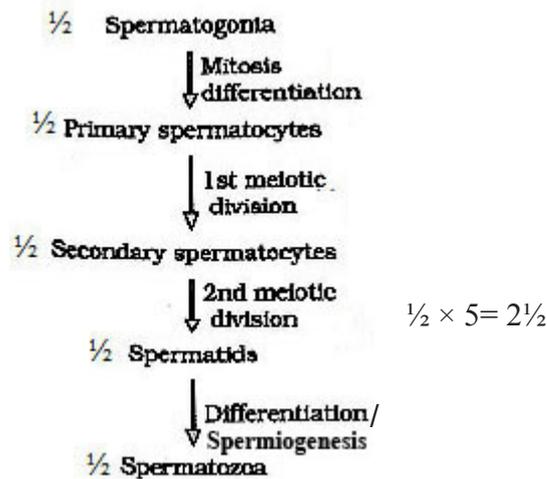
[4 Marks]

## SECTION – E

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

**24. (a)** **Where does spermatogenesis occur in human testes ? Describe the process of spermatogenesis upto the formation of spermatozoa.**

   **(b)** **Trace the path of spermatozoa from the testes upto the ejaculatory duct only.**

Ans. (a) Seminiferous tubules = ½

½ Spermatogonia

| Mitosis
↓ differentiation

½ Primary spermatocytes

| 1st meiotic
↓ division

½ Secondary spermatocytes

| 2nd meiotic
↓ division          ½ × 5= 2½

½ Spermatids

| Differentiation/
↓ Spermiogenesis

½ Spermatozoa

              ½        ½        ½        ½

(b) Seminiferous tubules→rete testis→Vasa efferentia→Epididymis→vas deferens→(ejaculatory duct)
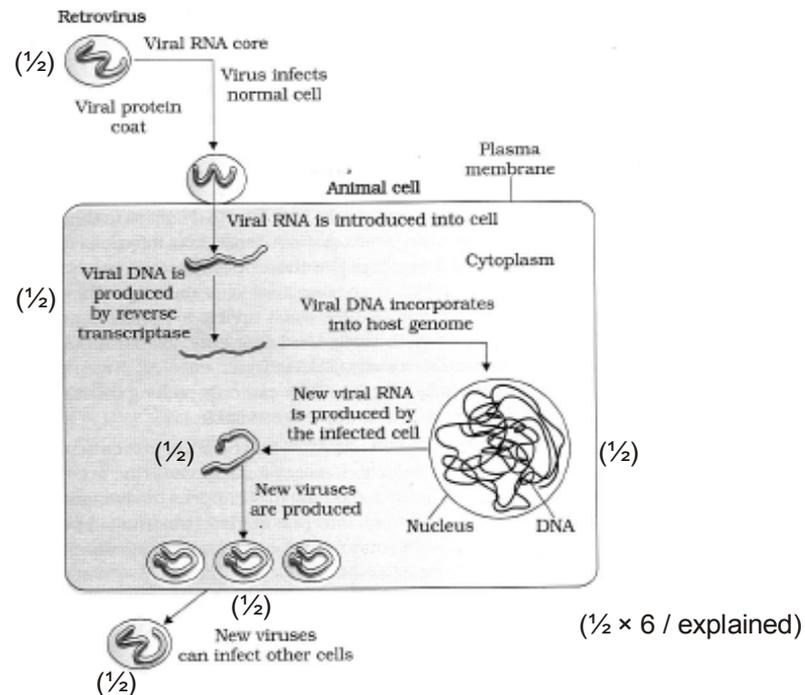
[5 Marks]

**OR**

**Explain the events upto fertilization that occur in a flower after the pollengrain has landed on its compatible stigma.**

Ans. The pollen grain germinates , on the stigma to produce a pollen tube through one of the germ pores , the content of the pollen grain move into the pollen tube , pollen tube grows through the tissues of the stigma and style and reaches the ovary , the generative cell divides and forms two male gametes during the growth of pollen tube (in the stigma) , the pollen tube enters the ovule through micropyle, and then enters one of the synergids (through filiform apparatus) , the pollen tube releases the two male gametes (in the cytoplasm of synergids) , one of the male gamete fuses with egg cell to form zygote (2n) (syngamy) , the other male gamete fuses with two polar nuclei (in central cell) to form primary endosperm nucleus (PEN-3n)/PEC = ½ × 10

[5 Marks]

**25. (a) How does a human Immunodeficiency Virus( HIV) replicate in a host ?**

**(b) How does an HIV-infected patient lose immunity ?**

**(c) List any two symptoms of this disease.**

Ans. (a)



Retrovirus
(½) Viral RNA core
Viral protein coat
Virus infects normal cell
Animal cell
Plasma membrane
Viral RNA is introduced into cell
(½) Viral DNA is produced by reverse transcriptase
Cytoplasm
Viral DNA incorporates into host genome
New viral RNA is produced by the infected cell
(½)
(½)
New viruses are produced
Nucleus DNA
(½)
New viruses can infect other cells
(½)
(½ × 6 / explained)

(b)    Loss of T-lymphocytes = 1

(c)    Fever / diarrhoea / susceptibility to other diseases , prone to microbial infection **(any two)** = ½ + ½

[5 Marks]

**OR**

**Describe the process of waste- water treatment under the following heads:**

**(a)    Primary treatment.**

**(b)    Secondary treatment.**

(a)    Primary treatment

   1.    Physical removal of particles through filtration , sedimentation in stages = ½ +½

   2.    Solids settle to form primary sludge , the supernatants form the effluent = ½ +½

(b)    Secondary Treatment

   -    Effluent passed into aeration tanks = ½

   -    Vigorous growth of useful aerobic microbes into flocs = ½

   -    Significant reduction of BOD = ½

- Effluent passed on to settling tanks where bacterial flocs settle to form activated sludge $= \frac{1}{2}$

- Activated sludge is passed on to anaerobic sludge digester , where bacteria and fungi are anaerobically digested $= \frac{1}{2} + \frac{1}{2}$

$= \frac{1}{2} \times 10$

[5 Marks]

**26. (a)  State the cause and symptoms of colour-blindness in humans.**

**(b)  Statistical data has shown that 8% of the human males are colour-blind whereas only 0.4% of females are colour-blind. Explain giving reasons how is it so.**

Ans. (a)  Cause - sex-linked recessive disorder $= 1$

Symptoms - failure to discriminate between red and green colour $= 1$

(b)  Since males have only one X chromosome gene for colour blindness , if present in any one parent will always be expressed , whereas in female it will be expressed only if it is present on both the X chromosomes , when both parents are carrying gene for colour blindness $= \frac{1}{2} \times 4 = 2$



(affected male) $= \frac{1}{2}$

(affected female) $= \frac{1}{2}$
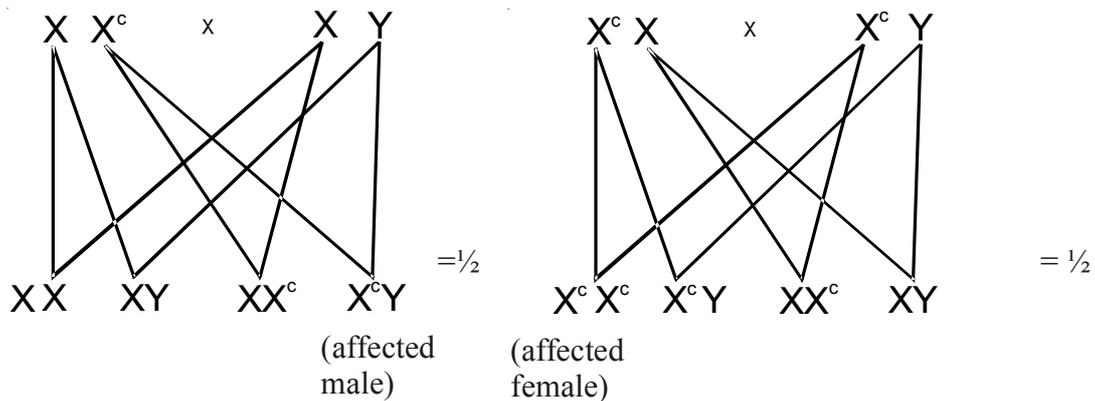
[5 Marks]

**OR**

**(a)  Describe Hardy-Weinberg's principle.**

**(b)  How do variation lead to speciation ?**

**(c)  How is the genetic equilibrium affected by the variations leading to speciation ?**

Ans. (a)  Allele frequencies in a population are stable and constant from generation to generation , sum total of all the allelic frequencies is $1 = \frac{1}{2} + \frac{1}{2}$

(b)  Accumulation of small and directional variation over the generations become heritable , enabling better survival , to reproduce and leave greater number of progeny , forming a new species $= \frac{1}{2} \times 4 = 2$

(c)  As per genetic equilibrium the sum total of all the allelic frequencies in a population is 1 , change of frequency of alleles in a population , due to variation causes , disturbance in the genetic equilibrium resulting in speciation (evolution) $= \frac{1}{2} \times 4$

[5 Marks]

## SECTION – A

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

**1.** **Suggest a molecular diagnostic procedure that detects HIV in a suspected AIDS patient.**

Ans. PCR / ELISA = 1

[1 Mark]

**2.** **Mention one difference to distinguish an exon from an intron.**

Ans. Exon : coded / expressed sequence of nucleotides in mRNA , = ½

Intron : Intervening sequence of nucleotides not appearing in processed mRNA = ½

[1 Mark]

**3.** **What does nature's carrying capacity for a species indicate ?**

Ans. (In nature) a given habitat has enough (limited) resources to support a maximum possible number , no further growth in population is possible = ½ + ½

[1 Mark]

**4.** **Mention two causes of frame- shift Mutation.**

Ans. Insertion , deletion of three bases / one codon or multiple of three bases / multiple codon (hence one or more amino acid) (reading frame remains unaltered from that point onwards) = ½ + ½

[1 Mark]

**5.** **Name two animals that exhibit Oestrus cycle.**

Ans. cow / sheep / rat / deer / dog / tiger / anyother (correct example) = ½ × 2

[1Mark]

## SECTION – B

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

**6.** **Suggest four advanced ex-situ methods to conserve threatened biodiversity .**

Ans. Cryopreservation , in vitro fertilisation , tissue culture , seed banks = ½ × 4

[2 Marks]

**7.** **(a)** **List two advantages of keeping beehives in a crop field during flowering season.**

    **(b)** **Name one annual and one perennial crop species favourable to beeswax collection.**

Ans. (a) Bees help in increasing pollination efficiency , leading to improved yield = ½ + ½

    (b) Annual : Sunflower / Brassica or any other correct example = ½

        Perennial : Apple / pear or any other correct example = ½

[2 Marks]

**8.** **Sewage discharge into a clean-water body leads to increased fish mortality. Explain.**

Ans. Leads to increase in nutrients , promotes algal growth , increases BOD reduces dissolved oxygen

(aquatic animals deprived of oxygen leading to death) , some bloom farming algae are extremely toxic to fish / other pollutants of sewage $= \frac{1}{2} \times 4$

[2 Marks]

**9.** **How does a test cross help to determine the genotype of an individual ?**

Ans. Individual of unknown genotype crossed with recessive parent , $= 1$

All dominant in progeny - Homozygosity , dominant to recessive ratio 1:1 in progeny - Heterozygosity $= \frac{1}{2} + \frac{1}{2}$

[2 Marks]

**OR**

**Mention two applications of DNA polymorphism.**

Ans. Genetic mapping , DNA finger printing $= 1 + 1$

[2 Marks]

**10.** **Explain the events that follow upto fertilization when the sperms come in contact with the ovum in the fallopian tube of a human female.**

Ans. The secretion of the acrosome help the sperm enter into the cytoplasm of ovum through zona pellucida and the plasma membrane , this induces the completion of second meiotic division of the secondary oocyte , forming second polar body and a haploid ovum , soon the haploid nucleus of the sperm and that of the ovum fuse together to form a diploid zygote $= \frac{1}{2} \times 4 = 2$

[2 Marks]

**SECTION – C**

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

**11.** **Narrowly utilitarian arguments are put forth in support of biodiversity conservation. Explain the other two arguments that are put forth in support of the same cause.**

Ans. - Broadly utilitarian $= \frac{1}{2}$

Ecosystem services - Purify air , cycling of nutrients , habitat for wildlife , pollinating crops , aesthetic pleasure (any two) $= \frac{1}{2} \times 2 = 1$
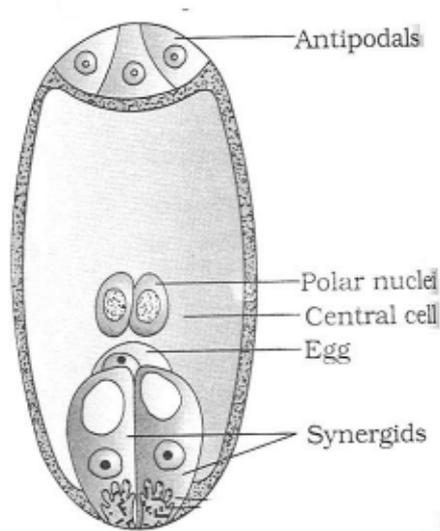
- Ethical $= \frac{1}{2}$

Philosophical / spiritual / moral duty towards future generations $= \frac{1}{2} \times 2 = 1$

$(\frac{1}{2} + 1 + \frac{1}{2} + 1)$                                                                                    [3 Marks]

**12.** **(a)** **Draw a labelled sketch of a mature 7-celled, 8-nucleate embryo-sac.**

**(b)** **Which one of the cell in an embryo-sac produces endosperm after double fertilization?**
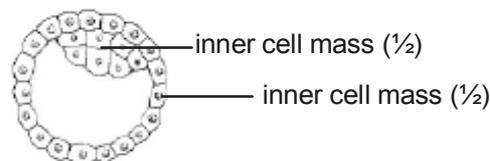
Ans. (a)



$$= \frac{1}{2} \times 5 = 2\frac{1}{2}$$

(b)  Central cell $= \frac{1}{2}$

[3 Marks]

**13.** **Draw a labelled diagram of the embryonic stage that get implanted in the human uterus. State the functions of the two parts labelled.**

Ans.



-Trophoblast - helps in implantation / attachment to endometrium / attachment to uterus $= 1$

-Inner cell mass - gets differentiated into an embryo $= 1$

[3 Marks]

**14.** **Where is an 'operator' located in a prokaryote DNA ? How does an operator regulate gene expression at transcriptional level in a prokaryote ? Explain.**

Ans.  The operator region is located adjacent to promoter elements / prior to structural gene $= \frac{1}{2}$

In regulation of gene expression

switch off - the repressor binds to the operator region , & prevents transcription $= \frac{1}{2} + \frac{1}{2}$

switch on - In the presence of inducer the repressor is inactivated , (by the interaction with the inducer) and operator allows RNA polymerase access to the promoter , & transcription proceeds $= \frac{1}{2} \times 3$

[3 marks]

**15. How does a restriction endonuclease help in DNA recombinant technology ?**

Ans. Restriction endonuclease(EcoRI) inspects length of DNA and recognises specific palindromic nucleotide sequence , binds with DNA , cuts each of the two strands of double helix at specific points $= 1 \times 3$

[3 Marks]

**16 Human blood group is a good example of multiple allelism and co-dominance.  Justify.**

Ans. **Multiple allelism** : Generally in an individual / population **,** only two alleles of a trait govern the character **,** but in case of ABO blood group **,** three alleles $I^A$, $I^B$ and i are found to govern blood group in human population $= \frac{1}{2} \times 4 = 2$

**Co-dominance :** Allele $I^A$ and $I^B$ when present in an individual , both being dominant express their own types of sugars / traits (no marks for the second step if two alleles are not given correctly) $= \frac{1}{2} \times 2 = 1$

[3 Marks]

**17. Why does the 'insertional  inactivation' method to detect recombinant DNA is preferred to 'antibiotic resistance' procedure?**

Ans. The presence of a chromogenic substrate gives blue coloured colonies , in absence  of an insert / in non-transformants , presence of an insert (in the enzyme site) , results into (insertional inactivation of the β-galactosidase) colonies which do not produce colour $= \frac{1}{2} \times 4$

Antibiotic resistance method requires duplicate plating / cumbersome procedure  $= 1$

[3 Marks]

**18. On a visit to a Hill station, one of your friend suddenly became unwell and felt uneasy.**

   **(A)  List two symptoms you would look for to term it to be due to allergy.**

   **(B)  Explain the response of the body to an allergen.**

   **(C)  Name two drugs that can be recommended for immediate relief.**

Ans. (a)    sneezing , watery eyes, running nose , difficulty in breathing (any two)$= \frac{1}{2} + \frac{1}{2}$

   (b)    body releases antibodies , IgE type $= \frac{1}{2} + \frac{1}{2}$

   (c)    Antihistamine , adrenalin , steroids (any two) $= \frac{1}{2} + \frac{1}{2}$

[3 Marks]

**19. (a)  Why did Hershey and Chase use radioactive sulfur and radioactive phosphorus in their experiment?**

   **(b)  Write the conclusion they arrived at and how.**

Ans. (a)    In order to label protein coat of virus with radioactive sulfur , label DNA with radioactive phosphorus $= \frac{1}{2} + \frac{1}{2}$

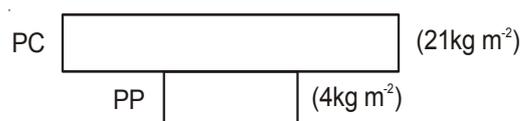(b) Bacteria which were infected with viruses having radioactive DNA were found to contain radioactive DNA later on = ½

Bacteria which were infected with viruses having radioactive protein coat were not found to contain radioactivity = ½

Conclusion - DNA is the genetic material = 1

[3 Marks]
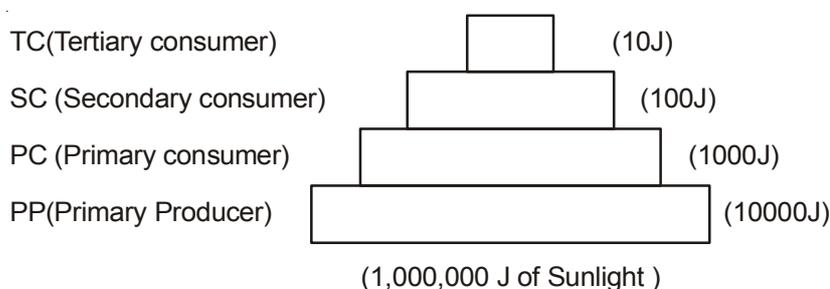
**20 Draw a pyramid of biomass and pyramid of energy in sea. Give your comment on the type of pyramids drawn.**

Ans.



PC (21kg m$^{-2}$)
PP (4kg m$^{-2}$)

Pyramid of biomass in sea = 1



TC(Tertiary consumer) (10J)
SC (Secondary consumer) (100J)
PC (Primary consumer) (1000J)
PP(Primary Producer) (10000J)
(1,000,000 J of Sunlight )

Pyramid of energy in sea = 1

The pyramid of biomass in sea is inverted = ½

The pyramid of energy in sea is upright = ½

[3 Marks]

**OR**

**(a) Rearrange the following green house gases in increasing order of their relative contribution to the total global warming:**

$N_2O$; CFC; $CO_2$ ; $C_2H_4$.

**(b) What is the effect of global warming on polar ice-caps? Comment on its possible ecological impact.**

Ans. (a) $C_2H_4 \rightarrow N_2O \rightarrow CFC \rightarrow CO_2 / N_2O \rightarrow CFC \rightarrow CH_4 \rightarrow CO_2$ (Highest) = 1

Note - Ignore $C_2H_4/CH_4$ and give one mark for remaining three greenhouse gases if sequence is correct

(b) (Global warming) $\rightarrow$ Rise in Atmospheric temperature $\rightarrow$ polar ice melts $\rightarrow$ increase in sea level $\rightarrow$ coastal land mass submerge = ½ × 4 = 2

[3 Marks]

**21.** Co-evolution is a spectacular example of mutualism between an animal and a plant. Describe co-evolution with the help of an example.

Ans. Fig & wasp = 1

The female wasp uses the fruit for oviposition / egg laying , uses seeds within the fruit (developing seeds) for nourishing its larvae , the wasp pollinates the fig inflorescence, the given fig species can be pollinated by its 'partner' wasp species & no other species = ½ × 4 = 2

or any other correct example

[3 marks]

**22.** **(a) What is Gene therapy?**

**(b) Describe the procedure of such a therapy that could be a permanent cure for a disease. Name the disease.**

Ans. (a) (Collection of) methods that allows correction of gene defect that has been diagnosed in a child / embryo // Genes are inserted into a person's cells and tissues to treat a disease , this involves delivery of a normal gene into the individual / embryo to take over the function of and compensate for non-functional / a defective gene = 1

(b) If the desired gene is isolated and introduced into cells at early embryonic stages it can provide a permanant cure = 1

ADA / Adenosine deaminase deficiency = 1

[3 Marks]

**Section – D**

**Q No. 23 is of four mark**

**23.** **You have a friend whose parents are too indulgent in his/her daily affairs. They think him/ her to be still young which makes him/her sad and is upset all the time. As he/she feels that the parents should give him/her opportunity to take independent decision on some issues.**

**(a) Would you support your friend and why ?**

**(b) Write the characteristics of this age group.**

**(c) List two curative measures.**

Ans. (a) Yes , because of peer understanding = ½ + ½ =1

(b) Curious , adventurous , look for excitement , experimentation = ½ × 4 =2

(c) Avoid undue peer pressure / education & counselling / help from parents & peers / identifying the danger signs / professional and medical help or any other appropriate measures **(any two)** = ½ + ½ =1

[4 Marks]

## Section – E

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

**24.** **Thalassemia and haemophilia are both Mendelian disorders related to blood. Write the symptoms of the diseases. Explain with the help of crosses the difference in the inheritance pattern of the two diseases.**

Ans. Thalassemia - Anaemia = ½

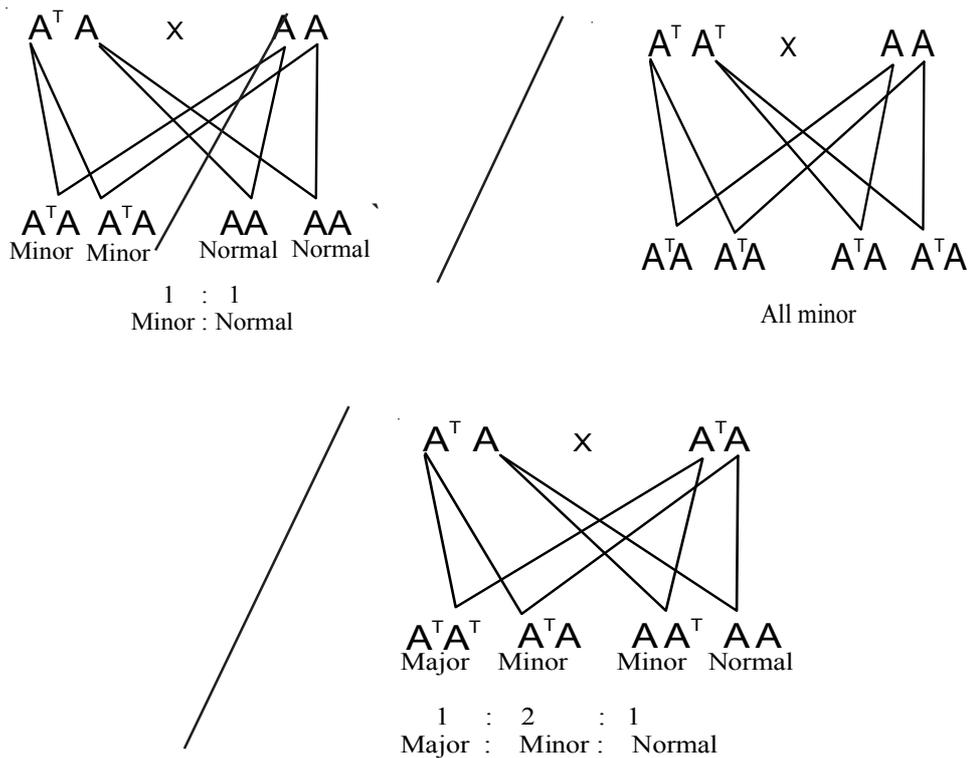Haemophilia - Non stop bleeding = ½

Haemophilia - Sex linked recessive disorder , is generally passed on from (carrier) mother to some of her sons / from affected father to daughter (carrier) = ½ + ½
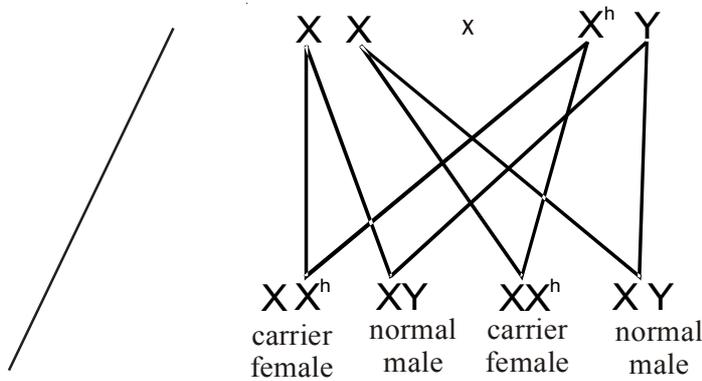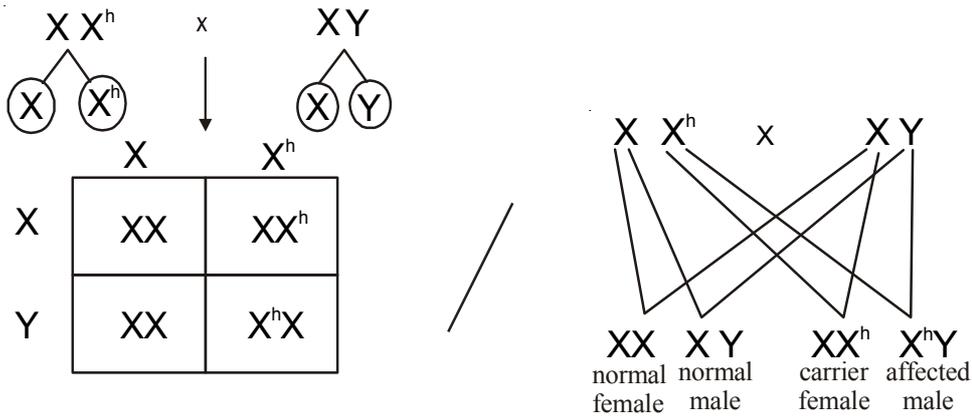


Note : - Any one cross , one mark to be given if the entire diagram (cross) is correct

Thalassemia - Autosome linked recessive blood disease , inheritance is like Mendelian inheritance pattern = ½ + ½

A^T A  ×  A A

A^T A   A^T A   A A   A A
Minor   Minor   Normal   Normal

1  :  1
Minor : Normal

---

A^T A^T  ×  A A

A^T A   A^T A   A^T A   A^T A

All minor

---

A^T A  ×  A^T A

A^T A^T   A^T A   A A^T   A A
Major    Minor   Minor   Normal

1  :  2  :  1
Major :  Minor :  Normal

Note : - Any one cross , one mark to be given if the entire diagram (cross) is correct

[1 + 1 + 1 + 1 + 1 = 5 marks]

**OR**

**(a)** **What are fossils ? How are they an evidence for evolution ?**

**(b)** **"Anthropogenic action can lead to evolution." Explain with the help of an example.**

Ans. (a) Fossil - remains / impression of hard parts of life-forms existed in past , found in rocks = ½ + ½

study of fossils in different sedimentary layers indicates the geological periods in which they existed , and showed that life forms varied over time = 1 + 1
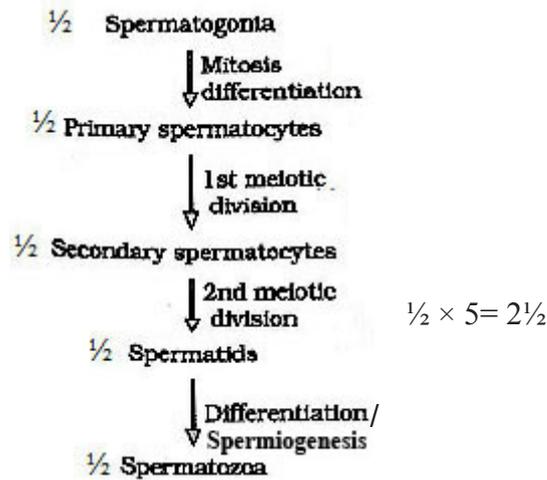
(b) Excess use of herbicides & pesticides , in crop production , has resulted in selection of resistant varieties of pests , in a much lesser time scale // use of antibiotics or drugs , against microbes , leads to resistant organism , in lesser time scale = ½ × 4

[5 Marks]

**25. (a)** **Where does spermatogenesis occur in human testes ? Describe the process of spermatogenesis up to the formation of spermatozoa.**

**(b) Trace the path of spermatozoa from the testes upto the ejaculatory duct only.**

Ans. (a) Seminiferous tubules = ½



½ Spermatogonia
    | Mitosis
    ↓ differentiation
½ Primary spermatocytes
    | 1st meiotic
    ↓ division
½ Secondary spermatocytes
    | 2nd meiotic
    ↓ division     ½ × 5= 2½
½ Spermatids
    | Differentiation/
    ↓ Spermiogenesis
½ Spermatozoa

       ½       ½       ½       ½

(b) Seminiferous tubules→rete testis→Vasa efferentia→Epididymis→vas deferens→(ejaculatory duct)

[5 Marks]

**OR**

**Explain the events upto fertilization that occur in a flower after the pollengrain has landed on its compatible stigma.**
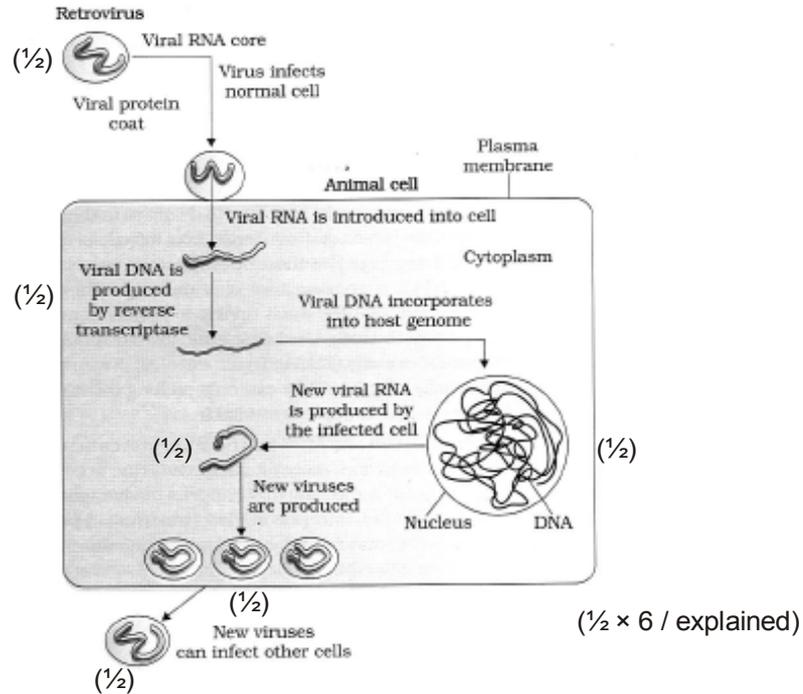
Ans. The pollen grain germinates , on the stigma to produce a pollen tube through one of the germ pores , the content of the pollen grain move into the pollen tube , pollen tube grows through the tissues of the stigma and style and reaches the ovary , the generative cell divides and forms two male gametes during the growth of pollen tube (in the stigma) , the pollen tube enters the ovule through micropyle, and then enters one of the synergids (through filiform apparatus) , the pollen tube releases the two male gametes (in the cytoplasm of synergids) , one of the male gamete fuses with egg cell to form zygote (2n) (syngamy) , the other male gamete fuses with two polar nuclei (in central cell) to form primary endosperm nucleus (PEN-3n)/PEC = ½ × 10

[5 Marks]

**26. (a) How does a Human Immunodeficiency Virus (HIV) replicate in a host?**

**(b) How does an HIV-infected patient lose immunity?**

**(c) List any two symptoms of this disease.**

Ans. (a)



(b) Loss of T-lymphocytes = 1

(c) Fever / diarrhoea / susceptibility to other diseases , prone to microbial infection **(any two)** = ½ + ½

[5 Marks]

**OR**

**Describe the process of waste- water treatment under the following heads:**

**(a) Primary treatment.**

**(b) Secondary treatment.**

Ans. (a) Primary treatment

1. Physical removal of particles through filtration , sedimentation in stages = ½ +½

2. Solids settle to form primary sludge , the supernatants form the effluent = ½ +½

(b) Secondary Treatment

- Effluent passed into aeration tanks = ½

- Vigorous growth of useful aerobic microbes into flocs = ½

- Significant reduction of BOD = ½

-      Effluent passed on to settling tanks where bacterial flocs settle to form activated sludge $= \frac{1}{2}$

-      Activated sludge is passed on to anaerobic sludge digester , where bacteria and fungi are anaerobically digested $= \frac{1}{2} + \frac{1}{2}$

$= \frac{1}{2} \times 10$

[5 Marks]