CBSE-XII-2013 EXAMINATION

BIOLOGY

Paper & Solution

Code: 57/1

Time: 3 Hrs.

Max. Marks: 70

General Instructions:

(i) All questions are compulsory.

(ii) This question paper consists of four Sections **A, B, C** and **D**. Section **A** contains **8** questions of **one** mark each, Section **B** is of **10** questions of **two** marks each, Section **C** is of **9** questions of **three** marks each and Section **D** is of **3** questions of **five** marks each

(iii) There is no overall choice. However, an internal choice has been provided in one question of **2** marks, one question of **3** marks and two questions of **5** marks weightage. A student has to attempt only one of the alternatives in such questions.

(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

SECTION A

1. Name an organism where cell division in itself is a mode of reproduction.

Solution:

Amoeba.

2. When does a human body elicit an anamnestic response?

Solution:

Subsequent encounter with same pathogen elicit anamnestic or secondary response when body have memory of first encounter.

3. Name any two diseases the 'Himgiri' variety of wheat is resistant to.

Solution:

Leaf rust, Stripe rust, Hill bunt.

4. State the role of transposons in silencing of mRNA in eukaryotic cells.

Solution:

This is method of cellular defence.

5. Why are green algae not likely to be found in the deepest strata of the ocean?

Solution:

Green algae lack the photosynthetic pigments like phycoerythrin, which can able to absorb shorter wavelength of light.

6. State what does 'standing crop' of a trophic level represent.

Solution:

Standing crop – is total amount of living matter or organic matter present in an ecosystem in unit area and unit time.

7. Why is the use of unleaded petrol recommended for motor vehicles equipped with catalytic converters ?

Solution:

Lead corrode the catalytic rods of polladium, Rhodium, Platinum which acts as the catalyst in catalytic converter and decrease the efficiency of catalytic converter.

8. Name the type of biodiversity represented by the following :
(i) 1000 varieties of mangoes in India.
(ii) Variations in terms of potency and concentration of reserpine in Rauwolfia vomitoria growing in different regions of Himalayas.

Solution:
(i) Genetic Diversity
(ii) Genetic Diversity

SECTION B

9. In angiosperms, zygote is diploid while primary endosperm cell is triploid. Explain.

Solution:
Zygote is product of syngamy which participate the fusion of haploid male gamete and haploid female gamete i.e. egg cell.

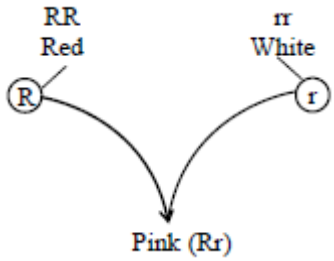
Male gamete + Egg $\rightarrow$ Zygote
(n) (n) $(2n)$

Primary endosperm cell is product of fusion of secondary nucleus (diploid) and haploid male gamete so triploid

Secondary nucleus + Male gamete $\rightarrow$ Primary endosperm cell
$(2n)$ (n) $(3n)$

10. A cross between a red flower bearing plant and a white flower bearing plant of Antirrhinum produced all plants having pink flowers. Work out a cross to explain how this is possible.

Solution:



	R	r
R	RR Red	Rr Pink
r	Rr Pink	rr White

Phenotypic ratio 1 : 2 : 1
Genotypic ratio 1 : 2 : 1
R(Red) factor is not completely dominant over r(white) factor is incomplete dominance.

11. List the two main propositions of Oparin and Haldane.

Solution:
Oparin-Haldane theory of origin of life
(1) At the time of origin of life free O_2 was absent, so first life was anaerobic.

(2) In the primitive atmosphere free oxygen was present but complete oxygen consumed in composition so primitive atmosphere of earth was reducing.

12. Write the events that take place when a vaccine for any disease is introduced into the human body.

OR

Why is a person with cuts and bruises following an accident administered tetanus antitoxin ? Give reasons.

Solution:

Vaccine is Antigen it stimulate the production of Antibody and memory cell is called primary response it does not cause harm when this pathogen enter second time this memory cell show rapid and massive response so body become immune to this pathogen.

OR

Tetanus antitoxin contain Antibody against pathogen it attach and inactivate pathogen (passive immunity).

13.Name the bacterium responsible for the large holes seen in ‘‘Swiss Cheese’’. What are these holes due to ?

Solution:

The large holes in Swiss cheese' are due to production of a large amount of CO_2 by a bacterium named propionibacterium sharmanii.

14. Name the source of the DNA polymerase used in PCR technique. Mention why it is used.

Solution:

Thermus aquaticus because it is heat stable DNA polymerase.

15. Write any four ways used to introduce a desired DNA segment into a bacterial cell in recombinant technology experiments.

Solution:

(1) Chemical method – Poration by divalent cation such as calcium
(2) Micro injection
(3) Biolistic or gene gun
(4) Disarmed pathogen vectors

16. Why is proinsulin so called ? How is insulin different from it ?

Solution:

Proinsulin is like a pro enzyme or pro hormone it contain an extra stretch of C-peptide so it need to be processed to become fully mature and functional hormone like insulin, insulin is mature hormone which contain only A and B peptide.

17. Where would you expect more species biodiversity – in tropics or in polar regions ? Give reasons in support of your answer.

Solution:

High species or biodiversity lies in tropical areas because tropics are

(i) Undisturbed habitats since millions of year in comparison to temperate and polar region which face frequent glaciation. It favours speciation, as speciation is product of time.

(ii) Less seasonal variation than polar areas.

(iii) High availability of solar radiations than polar area, which harbours more plant species.

18. ‘‘It is possible that a species may occupy more than one trophic level in the same ecosystem at the same time.’’ Explain with the help of one example.

Solution:

Yes, as the trophic level of a species represents the functional role of organism in energy flow which is determined by the food if take. The food of an organism is depends on availability of food and what the organism wants to eat so have more than one tropic level at a time

Ex. Sparrow – Primary consumer

When eating seeds

– Secondary consumer

When eating insects

SECTION C

19. Explain the steps in the formation of an ovum from an oogonium in humans.

OR

Suggest and explain any three Assisted Reproductive Technologies (ART) to an infertile couple.

Solution:

In humans (and most vertebrates), the first polar body does not undergo meiosis II, whereas the secondary oocyte proceeds as far as the **metaphase** stage of meiosis II. However, it then stops advancing any further, it awaits the arrival of the spermatozoa for completion of second meiotic division. Entry of the sperm restarts the cell cycle breaking down **MPF** (M-phase promoting factor and turning on the **APC** (Anaphase promoting complex). Completion of meiosis II converts the secondary oocyte into a fertilized egg or zygote (and also a second polar body). oogenesis process also can be divided into three stages :

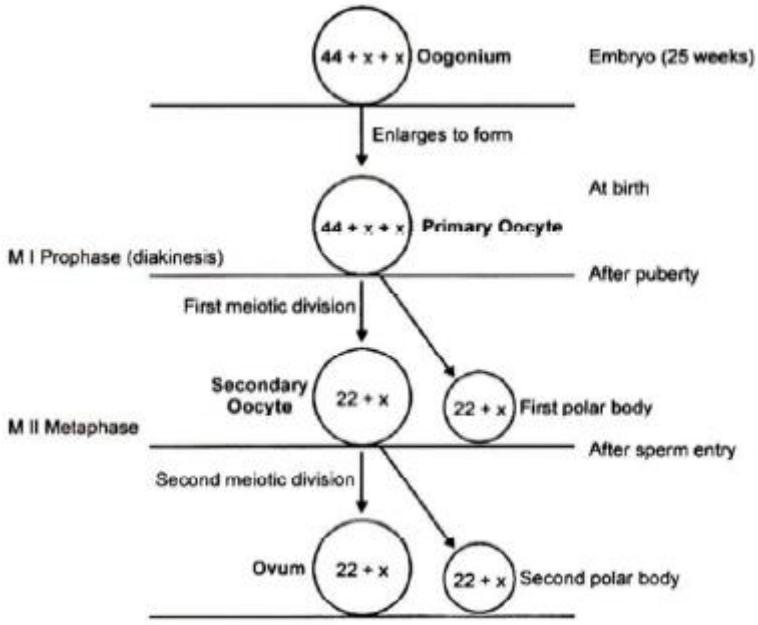
(A) Multiplication (B) Growth phase (C) Maturation phase

(A) Multiplication phase : In this stage primordial germ cells or ovum mother cells repeatedly divide by mitosis to form large number of diploid oogonia.

This process completes in embryo stage of female in most higher animals.

(B) Growth phase : Like spermatogenesis, in this process oogonia grow in size and form primary oocytes. The growth phase is the longest phase oogenesis (except humans). During growth phase size of egg increases many times.

Maturation phase : Oogenesis takes place in the ovaries. In contrast to males the initial steps in egg production occur prior to birth. By the time the foetus is 25 weeks old, all the oogonia that she will ever produce, are already formed by mitosis. Hundreds of these diploid cells develop into primary oocytes, begin the first steps of the first meiotic division, proceed up to diakinesis, and them stop any further development. The oocytes grows much larger and completes the meiosis I, forming a large secondary oocyte and a small polar body that receives very little amount of cytoplasm but one full set of chromosomes.



OR

Assisted reproductive technologies (ART)

In *vitro* fertilisation (IVF–fertilisation outside the body in almost similar conditions as that in the body) followed by **embryo transfer** (ET) is one of such methods. In this method, popularly known as test tube baby programme, ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory. The zygote or early embryos (with upto 8 blastomeres) could then be transferred into the fallopian tube (ZIFT–**zygote intra fallopian transfer**) and embryos with more than 8 blastomeres, into the uterus (IUT – **intra uterine transfer**), to complete its further development.

Embryos formed by in-vivo fertilisation (fusion of gametes within the female) also could be used for such transfer to assist those females who cannot conceive. Transfer of an ovum collected from a donor into the fallopian tube (GIFT – **gamete intra fallopian transfer**) of another female who cannot produce one, but can provide suitable environment for fertilisation and further development is another method attempted.

Intra cytoplasmic sperm injection (ICSI) is another specialised procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum.

Infertility cases either due to inability of the male partner to inseminate the female or due to very low sperm counts in the ejaculates, could be corrected by **artificial insemination** (AI) technique. In this technique, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI – **intra-uterine insemination**) of the female.

20. Why are human females rarely haemophilic ? Explain. How do haemophilic patients suffer ?

Solution:

Mother of such a female has to be at least carries and father should be hamophilic (unviable in entire stage of life) so rare in females.

In an affected individual simple cut will result in non stop bleeding due to increased bleeding time.

21. In a maternity clinic, for some reasons the authorities are not able to hand over the two new-borns to their respective real parents. Name and describe the technique that you would suggest to sort out the matter.
Solution:
DNA Fingerprinting or DNA test (i) isolation of DNA, (ii) digestion of DNA by restriction endonucleases, (iii) separation of DNA fragments by electrophoresis, (iv) transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon, (v) hybridisation using labelled VNTR probe, and (vi) detection of hybridised DNA fragments by autoradiography. Half of the band of child will resemble to father and half to mother.

22. Explain the increase in the numbers of melanic (dark winged) moths in the urban areas of post-industrialisation period in England.
Solution:
Before industrial revolution, the dull grey forms of prepared moth-**Biston betularia** – were dominant; the **Carbonaria** form (Black) was rare because it was susceptible to predation by birds.
The industrial revolution, resulted in large scale smoke which got deposited on tree trunks tuning them Black. Now grey varieties became susceptible – the black forms flourished.
Replacement of coal by oil and Electricity reduced production of black moth so the frequency of grey moths increased again.

23. Describe how biogas is generated from activated sludge. List the components of biogas.
Solution:
Biogas produced by anaerobic fermentation of waste biomass. Anaerobic fermentation of waste biomass can be visualized in three stages : -
1. The **facultative anaerobic microbes** degrade the complex **polymers** to simple monomers by enzymatic action. The Polymer like cellulose, hemicellulose, proteins and lipids get degraded into monomers but **lignins** and inorganic salts are left as residue because they do not degrade.
2. In second stage, monomers are converted in **to organic acids** by microbial action under partially aerobic conditions which are finally converted to **acetic acid**.
3. In third stage acetic acid is oxidized in to **methane** by the activity of anaerobic methanogenic bacteria. These bacteria are commonly found in the anaerobic sludge during sewage treatment. These bacteria are also present in the rumen (a part of stomach) of cattle. A lot of cellulosic material present in the foods of cattle is also present in the rumen. In rumen, these bacteria help in the breakdown of cellulose and play an important role in the nutrition of cattle. In this whole process digestion of cellulose takes place at very slow rate so that it is the **''rate limiting factor in biogas production**.

24. Name the pest that destroys the cotton bolls. Explain the role of Bacillus thuringiensis in protecting the cotton crop against the pest to increase the yield.
Solution:
A soil bacterium **Bacillus thuringiensis**, produce **crystal** [Cry] **Protein**. This Cry protein is toxic to Larvae of certain insects. Each Cry protein is toxic to a different group of insects. The gene encoding cry protein is called "cry gene". This Cry protein isolated and transferred into several crops. A crop expressing a cry gene is usually resistant to the group of insects for which the concerned Cry protein is toxic. There are a number of them, for example, the proteins encoded by the genes cryIAc and cryIIAb control the cotton bollworms, that of cryIAb controls corn borer.

Bt Cotton : some strains of Bacillus thuringiensis produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes). B. thuringiensis forms protein crystals during a particular phase of their growth. These crystals contain a toxic **insecticidal protein**. The Bt toxin protein exist as inactive protoxins but once an insect ingest the inactive toxin, it is converted into an active from of toxin due to the alkaline pH of the gut which solubilise the crystals. The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

25. (a) Write the importance of measuring the size of a population in a habitat or an ecosystem
(b) Explain with the help of an example how the percentage cover is a more meaningful measure of population size than mere numbers.

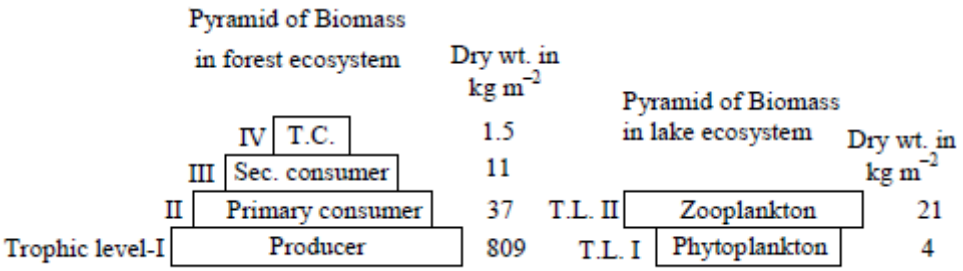
Solution:

(a) Measurement of population in a habitat determines the relative abundance of that particular species and the effect of the species on the available resources of habitat.
(b) Percentage cover is more meaning measure of population size than mere numbers because the relative abundance of a species is not only determined by number of individual but by both i.e. the relative abundance in number and relative abundance in biomass.
Ex. In unit area the number of a grass species individuals or relative abundance in number is high but not in relative abundance of biomass, if the same area have one or two ficus benghalensis (Bargad) tree as it is very low in relative abundance in number while high in relative abundance of biomass.

26. Differentiate between two different types of pyramids of biomass with the help of one example of each.

Solution:

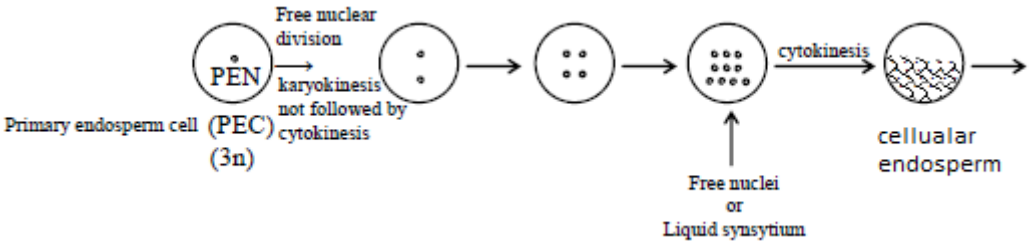
Pyramid of biomass are of both types upright and inverted. Upright pyramid of biomass in forest and grassland ecosystems while inverted pyramid of biomass in lake and ocean ecosystem as the biomass on next trophic level is higher than previous trophic level



27. (a) Describe the endosperm development in coconut.
(b) Why is tender coconut considered a healthy source of nutrition ?
(c) How are pea seeds different from castor seeds with respect to endosperm ?

Solution:

(a) Coconut endosperm is formation is nuclear type



(b) Soft coconut is endosperm rich in nutrients like fat, proteins, carbohydrates, minerals, vitamins, as endosperm provide nutrition to developing embryo.

(c) Pea seed is **non endospermic** as endosperm is absent because endosperm is consumed completely during embryo development while Castor seed is **endospermic** as endosperm is present because endosperm is not utilized completely during embryo development.

SECTION D

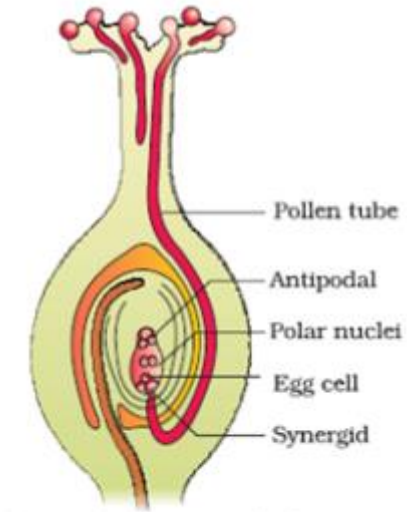
28. (a) Draw a L.S. of a pistil showing pollen tube entering the embryo-sac in an angiosperm and label any six parts other than stigma, style and ovary.
(b) Write the changes a fertilized ovule undergoes within the ovary in an angiosperm plant.

OR

(a) Draw a diagrammatic sectional view of a human seminiferous tubule, and label Sertoli cells, primary spermatocyte, spermatogonium and spermatozoa in it.
(b) Explain the hormonal regulation of the process of spermatogenesis in humans.

Solution:

(a)



Longitudinal section of a flower showing growth of pollen tube

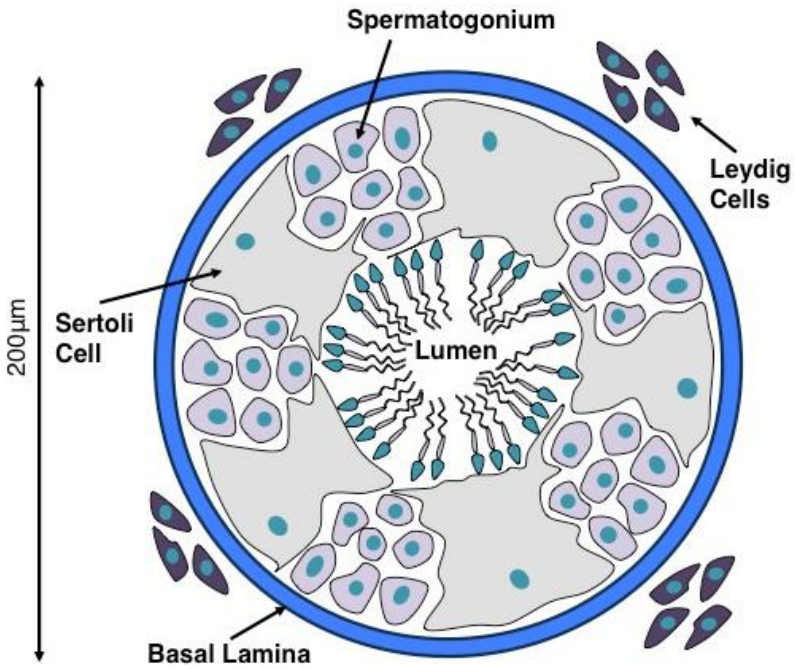
(b) Unfertilized ovule ⇒ Fertilized ovule = Seed
→ Funiculus → Present
→ Hilum → Present
→ Integument → Seed Coat
Outer integument → Testa

Inner integument → Tegman
→ Chalaza → Present
→ Micropyle → Present
→ Nucellus → Absent or utilized But if present called perisperm
→ Embryo sac

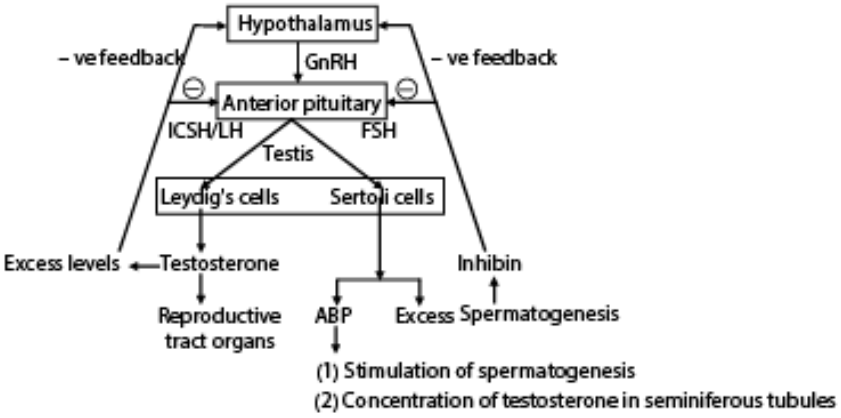
- Antipodal cells → Degenerate
- Synergid cells → Degenerate
- Central cell → Endosperm
- Egg → Embryo

OR

(a)



(b) **FSH** : Binds with FSH receptors attached to the Sertoli cells in seminiferous tubules. This causes these cells to grow and secrete various spermatogenic substances and androgen binding proteins (ABP)
ABP : Concentrates the testosterone inside seminiferous tubules.
LH/ICSH : - It stimulates the leydig cells to secrete testosterone. Leydig's cells mature at 10 years of age .
Inhibin : : It is secreted by Sertoli cells in response to excess spermatogenesis. The inhibin gives a negative feedback to the hypothalamus and anterior pituitary, this results in suppression of synthesis and release of FSH (∴ Spermatogenesis decreases).



29. (a) Write the conclusion drawn by Griffith at the end of his experiment with Streptococcus pneumoniae.
(b) How did O. Avery, C. MacLeod and M. McCarty prove that DNA was the genetic material? Explain.

OR

(a) Explain the mechanism of sex-determination in humans.
(b) Differentiate between male heterogamety and female heterogamety with the help of an example of each.

Solution:

(a) When Streptococcus pneumoniae (pneumococcus) bacteria are grown on a culture plate, some produce smooth shiny colonies (S) while others produce rough colonies (R). This is because the S strain bacteria have a mucous (polysaccharide) coat, while R strain does not. Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia.

S strain $\rightarrow$Inject into mice $\rightarrow$ Mice die

R strain $\rightarrow$ Inject into mice $\rightarrow$ Mice live

Griffith was able to kill bacteria by heating them. He observed that heat-killed S strain bacteria injected into mice did not kill them. When he

S strain $\rightarrow$ Inject into mice $\rightarrow$ Mice live

(heat-killed)

S strain

(heat-killed)

+ $\rightarrow$ Inject into mice $\rightarrow$ Mice live

R strain

(live)

injected a mixture of heat-killed S and live R bacteria, the mice died. Moreover, he recovered living S acteria from the dead mice. He concluded that the R strain bacteria had somehow been transformed by the heat-killed S strain bacteria. Some ‘transforming principle’, transferred from the heat-killed S strain, had enabled the R strain to synthesise a smooth polysaccharide coat and become virulent. This must be due to the transfer of the genetic material.

(b) They purified biochemicals (proteins, DNA, RNA, etc.) from the heat-killed S cells to see which ones could transform live R cells into S cells. They discovered that DNA alone from S bacteria caused R bacteria to become transformed. They also discovered that protein-digesting enzymes (proteases) and RNA-digesting enzymes (RNases) did not affect transformation, so the transforming substance was not a protein or RNA. Digestion with DNase did inhibit transformation, suggesting that the DNA caused the transformation. They concluded that DNA is the hereditary material.

OR

(a) The sex determining mechanism in case of humans is XY type. Out of 23 pairs of chromosomes present, 22 pairs are exactly same in both males and females; these are the autosomes. A pair of X-chromosomes are present in the female, whereas the presence of an X and Y chromosome are determinant of the male characteristic. During spermatogenesis among males, two types of gametes are produced. 50 per cent of the total sperm produced carry the X-chromosome and the rest 50 per cent has Y-chromosome besides the autosomes. Females, however, produce only one type of ovum with an X-chromosome. There is an equal probability of fertilisation of the ovum with the sperm carrying either X or Y chromosome. In case the ovum fertilises with a sperm carrying X-chromosome the zygote develops into a female (XX) and the fertilisation of ovum with Y-chromosome carrying sperm results into a male offspring. Thus, it is evident that it is the genetic makeup of the sperm that determines the sex of the child. It is also evident that in each pregnancy there is always 50 per cent probability of either a male or a female child.

(b) There has two types of sex determining mechanisms, i.e., XO type and XY type. But in both cases males produce two different types of gametes, (a) either with or without X-chromosome or (b) some gametes with X-chromosome and some with Y-chromosome. Such types of sex determination mechanism is designated to be the example of **male heterogamety**. In some other organisms, e.g., birds a different mechanism of sex determination is observed. In this case the total number of chromosome is same in both males and females. But two different types of gametes in terms of the sex chromosomes, are produced by females, i.e., **female heterogamety**. The two different sex chromosomes of a female bird has been designated to be the Z and W chromosomes. In these organisms the females have one Z and one W chromosome, whereas males have a pair of Z-chromosomes besides the autosomes.

30. A person in your colony has recently been diagnosed with AIDS People/residents in the colony want him to leave the colony for the fear of spread of AIDS.
(a) Write your view on the situation, giving reasons.
(b) List the possible preventive measures that you would suggest to the residents of your locality in a meeting organised by you so that they understand the situation.
(c) Write the symptoms and the causative agent of AIDS

Solution:

(a) AIDS is infectious but not contagious it does not spread by shaking hand and use of common utensil so there is no need of fear to live with AIDS patient.

(b) Making blood (from blood banks) safe from HIV, ensuring the use of only disposable needles and syringes in public and private hospitals and clinics, free distribution of condoms, controlling drug abuse, advocating safe sex and promoting regular check-ups for HIV in susceptible populations, are some such steps taken up.

(c) AIDS is caused by the Human Immuno deficiency Virus (HIV), a member of a group of viruses called retrovirus. Which have an envelope enclosing the RNA genome T lymphocytes, the person

starts suffering from infections that could have been otherwise overcome such as those due to bacteria especially Mycobacterium, viruses, fungi and even parasites like Toxoplasma. The patient becomes so immuno-deficient that he/she is unable to protect himself/herself against these infections.