# ISC EXAMINATION-2023
# BIOLOGY
# PAPER-1
# Solved Paper
# Class-12th

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***Maximum Marks: 70***

***Time allowed: Three hours***

*Candidates are **allowed additional 15 minutes** for **only** reading the paper.*
*They must **NOT** start writing during this time.*

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*This paper is divided into four **sections - A, B, C and D.***
*Attempt **all** four questions.*
***Section – A** consists of **one** question **having sub-parts** of **one** mark/**two** marks each.*
***Section — B** consists of **seven** questions of **two** marks each.*
***Section — C** consists of **seven** questions of **three** marks each, and*
***Section - D** consists of **three** questions of **five** marks each.*
***Internal choices have been provided in one question each in Section B, Section C and Section D.***
*The intended marks for questions or parts of questions are given in brackets [].*

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**SECTION A** ***20 MARKS***

**1. Answer the following questions briefly.**

**(i)** Name the source of thermostable DNA polymerase. **[1]**

**(ii)** Mention the scientific name of protozoan parasite that causes Amoebiasis. **[1]**

**(iii)** What is *cryopreservation*? **[1]**

**(iv)** The maternal grandfather of a boy is colour blind, but his maternal grandmother is normal. The father of the boy is also normal. What is the probability of this boy being colour blind? **[1]**

**(v)** Name the type of antibody that can be transferred through the placenta. **[1]**

**(vi)** During which phase of cell cycle, does DNA replication take place? **[1]**

**(vii)** How many sets of primers are required in each cycle of PCR ? **[1]**

**(viii)** Define *perisperm*. **[1]**

**(ix)** Which one of the following enzymes is used to join DNA fragments? **[1]**

**(a)** DNA polymerase **(b)** Ligase

**(c)** Primase **(d)** Endonuclease

**(x)** What type of ecological pyramid would be obtained from the following data? **[1]**

Secondary consumer: 120 gm
Primary consumer: 60 gm
Primary producer: 10 gm

**(a)** Inverted pyramid of biomass **(b)** Pyramid of energy

**(c)** Upright pyramid of numbers **(d)** Upright pyramid of biomass

**(xi)** **Assertion:** A person who has received a cut from a sharp object and is bleeding, needs to be given an anti-tetanus injection.

**Reason:** Anti-tetanus injection stimulates the production of antibodies for tetanus. **[1]**

**(a)** Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.

**(b)** Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

**(c)** Assertion is true, but Reason is false.

**(d)** Both Assertion and Reason are false.

**(xii)** Which one of the following factors is responsible for activation of protoxin into active Bt toxin of *Bacillus thuringiensis* ? **[1]**

**(a)** Body temperature **(b)** Moist surface of midgut

**(c)** Alkaline pH of gut **(d)** Acidic pH of stomach

**(xiii)** Give *one* significant contribution of each of the following scientists: **[2]**

**(a)** T.R. Malthus

**(b)** R. Mishra

**(xiv)** Give a term for the following: **[2]**

**(a)** An ART in which eggs are removed from the ovary of the female, fertilised and then placed in her fallopian tube.

**(b)** Fusion of male gamete and secondary nucleus in angiosperms.

**(xv)** Expand the following abbreviations: **[2]**

**(a)** NACO

**(b)** PID

**(xvi)** Give a reason for each of the following: **[2]**

**(a)** Cattle avoid browsing on *Calotropis* plant.

**(b)** DNA cannot enter directly into the host cell.

## *SECTION B* *14 MARKS*

**2.** Give *one* difference between the following pairs: **[2]**

**(i)** Sites of maturation of B - Lymphocytes and T – Lymphocytes

**(ii)** Sources of Opioids and Cannabinoids

**3.** Briefly discuss *any two* methods by which plants avoid self- pollination. **[2]**

**4.** Mention the location and the function of Leydig cells. **[2]**

**5.** **(i)** What are *vestigial organs*? Give *any one* example of a vestigial organ in human body. **[2]**

**OR**

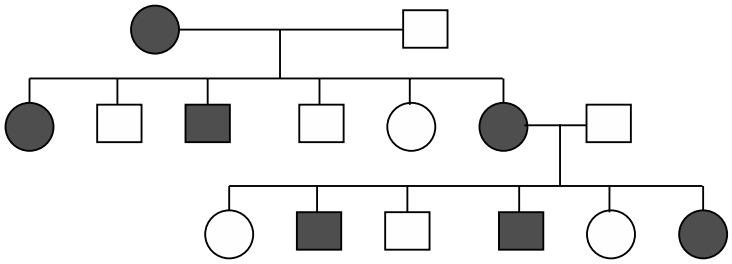
**(ii)** State Hardy Weinberg's principle. Give a mathematical expression for this principle.

**6.** Riya went to the hospital to meet her sister who was undergoing some treatment. The hospital was crowded with patients suffering from various types of allergies, pneumonia and Ascariasis.

Name the disease that Riya is most likely to get infected with. Give *one* reason for your answer. **[2]**

**7.** State the steps involved in the process of gene therapy for the treatment of ADA - deficiency. **[2]**

**8.** The pedigree chart given below represents the pattern of inheritance of sickle cell anaemia in a family. Study it carefully and answer the questions that follow. **[2]**



**(i)** What is the genotype of the father?

**(ii)** What is the phenotype of the mother?

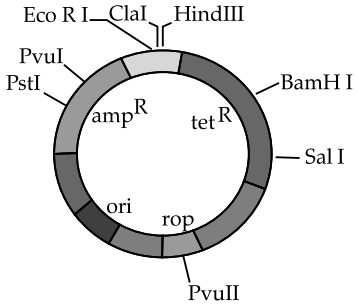
## *SECTION C* *21 MARKS*

**9.** Discuss *any three* major causes of loss of biodiversity. **[3]**

**10.** **(i)** Name and describe the technique that helps in the separation and isolation of DNA fragments.

**OR**

**(ii)** Study the diagram given below and answer .the questions that follow.




**(a)** Name the cloning vector shown above. In which organism is this cloning vector inserted?

**(b)** Mention *any two* restriction sites shown in the diagram.

**(c)** Name *any two* selectable markers shown in the diagram.

**11.** Draw a neat and well labelled diagram of L. S of an anatropous ovule. **[3]**

**12.** **(i)** Explain the process of sex - determination in grasshopper.

**(ii)** What is the genotype of Turner's Syndrome? Mention *any one* symptom of this syndrome. **[3]**

**13.** With the help of neatly labelled diagrams, explain the different types of age pyramids of human population. **[3]**

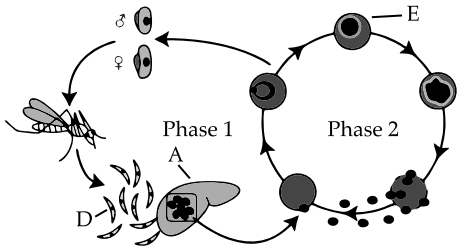
**14.** The scientists from a research institute collected samples of water from sewage pipes of two different cities, A, and B. On analysis, the BOD value of the sample from city A was found to be 500 mg/L. The BOD value of the sample from city B was 200 mg/L.

**(i)** Which one of the two cities needs a sewage treatment plant?

**(ii)** Briefly discuss the steps involved in the treatment of sewage.

**(iii)** What will be the effect of sewage treatment on the value of BOD? **[3]**

**15.** The diagram given below shows the life cycle of a malarial Parasite. Study it carefully and answer the questions that follow:




**(i)** Name the hosts in which the asexual phase and sexual phase of the life cycle take place.

**(ii)** Identify the infective stage labelled 'D'.

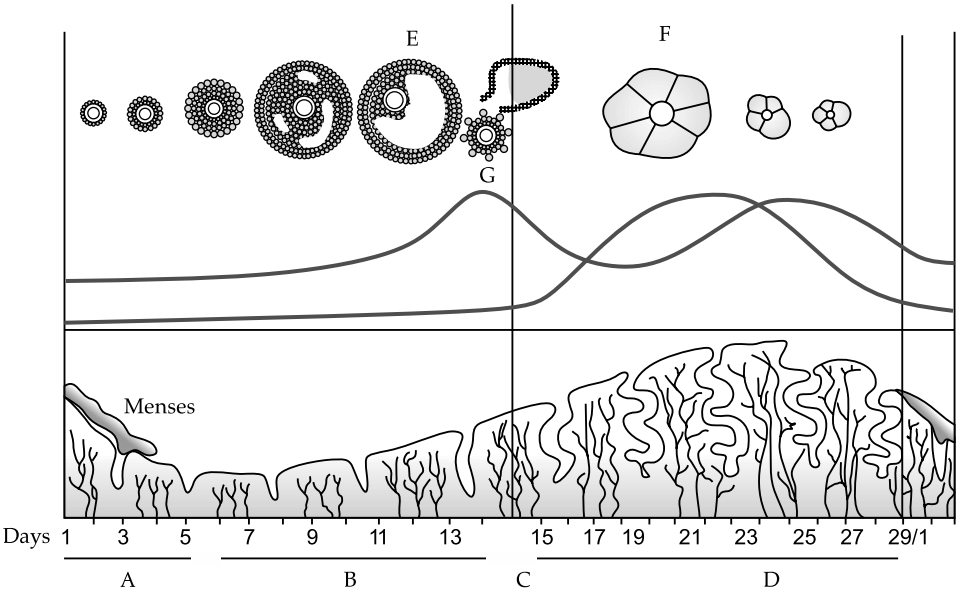
**(iii)** Name the structures labelled 'A' and 'E'

**(iv)** Give *any one* symptom of malaria. **[3]**

## *SECTION D* *15 MARKS*

**16.** Explain the components of the structural genes in the *Lac operon* system in E. coli. How does the operon function in the presence of lactose? **[5]**

**17.** **(i)** Given below is the diagram depicting the menstrual cycle in human beings. Study it carefully and answer the questions that follow.




**(a)** Which phases are indicated by 'C and 'D'?

**(b)** Name the structure labelled 'F'? What is its role?

**(c)** Explain the changes in the level of progesterone during phases 'C' and 'D'.

**(d)** Which hormone present in the urine confirms pregnancy in human beings?

**(e)** Identify the structure labelled 'E'. Name the hormone released by it. **[5]**

**OR**

**(ii)** According to a survey conducted by the Government of India in the year 1950,the population of the country was 350 million. In the next survey conducted in the year 2010, die population had reached above 1000 million.

**(a)** List *any two* reasons for this rise in the population.

**(b)** Suggest *any two* steps which should be taken by the Government to control this rise.

**(c)** How does the population explosion affect the growth of a country?

**(d)** What is the difference between the *natural* and *artificial contraceptive methods*? Give one example of each method. **[5]**

**18.** Describe the mechanism of decomposition by explaining the various processes involved in it. **[5]**

■■

# ANSWERS

## *SECTION A* *20 MARKS*

**1. (i)** *Thermus aquaticus*
***Explanation:*** *Thermus aquaticus* is a source of thermostable DNA polymerase for which PCR is possible at high temperature. **[1]**

**(ii)** *Ascaris lumbricoides* **[1]**

**(iii)** **Cryopreservation :** It is the method of storage of materials at ultra-low temperature either by very rapid cooling or by gradual cooling and simultaneous dehydration at low temperature. **[1]**

**(iv)** **Data given:** Maternal grandfather of a boy is colour blind. Therefore his daughter(Mother of boy) would be carrier for colour blindness. Genotype would be $x^cX$ on the other hand father of a boy is normal with genotype (XY). So, boy has 50% probability of being colour blind. **[1]**

**(v)** IgG is the antibody significantly transferred through the placenta. **[1]**

**(vi)** S- Phase of the interphase period in which DNA get doubled for cell division. **[1]**

**(vii)** Two sets of primers are required in each cycle of PCR (Polymerase Chain Reaction) . Primers are necessary to start functioning of DNA polymerase. **[1]**

**(viii)** The perisperm is the nucellus that remains after fertilisation. They are the nutritive tissues deposited external to the embryo.e.g., Black pepper **[1]**

**(ix)** **Correct option is (b)**
***Explanation:*** Ligase is an enzyme which is used to join DNA fragments and have significant properties in biotechnology. **[1]**

**(x)** **Correct option is (a)**
***Explanation:*** This data shows inverted pyramid of biomass because here the mass of producers are less as compare to the primary consumers. **[1]**

**(xi)** **Correct option is (c)**
***Explanation:*** After received cut its need to be given anti-tetanus treatment because the bacteria *Tetanus bacilli* can get access to enter in the body and produce toxins that cause tetanus.
Anti-tetanus injection provides passive immunity to the body not stimulate the production of antibodies. **[1]**

**(xii)** **Correct option is (c)**
***Explanation:*** Alkaline pH of gut triggers activation of protoxin to active Bt toxin of *Bacillus thurigiensis*, so further protein synthesis does not takes place. **[1]**

**(xiii)** **(a)** **T.R. Malthus:** He developed an exponential formula used to forecast population growth.

**(b)** **R. Mishra:** He contributed in the field of ecology, it refers to the relation and interaction between the organism and their surrounding environment. **[2]**

**(xiv)** **(a)** IVF (*in vitro* fertilization ) and ZIFT (Zygote intra fallopian transfer)

**(b)** Triple fusion **[2]**

**(xv)** **(a)** **NACO**: National Aids Control Organisation

**(b)** **PID**: Pelvic Inflammatory Disease **[2]**

**(xvi)** **(a)** *Calotropis* produces a milk like chemical toxin called cardiac glycosides that affect the heart hence cattle avoid browsing on this plant.

**(b)** As DNA is a hydrophilic in nature and the cell membrane or plasma membrane is hydrophobic in nature so this membrane do not allow DNA to enter in it. **[2]**

## *SECTION B* *14 MARKS*

**2. (a)** B- lymphocytes matures in bone marrow while the T-lymphocytes matures in thymus gland.

**(b)** Sources of- opioids is morphine which is extracted from the latex of poppy plant *Papever somniferum*,. Cannabinoids are obtained from inflorescence of the plant *Cannabis sativa.* **[2]**

**3. Self pollination can be prevented by-**

**(i)** Dicliny or unisexuality- Both the male and female flowers are separate. E.g. Papaya

**(ii)** Dichogamy- Stigma and stamen matures at different times. **[2]**

**4.** Leydig cells are located in the testicles near the seminiferous tubules. They produces male sex hormone androgen that helps in the production of secondary sexual characteristics of males after puberty. **[2]**

**5.** Vestigial organs are the organs that do not have noticeable or apparent functions and counted as residual part of the body . But our ancestors have the importance of that organ. e.g., Appendix, wisdom tooth, external ear, etc. **[2]**

**OR**

**Hardy-Weinberg Principle :** It says that allele frequencies in a population are stable and constant from generation to generation. The gene pool (total genes and their alleles in a population) remains constant. This is called genetic equilibrium (Hardy-Weinberg equilibrium). Sum total of all the allelic frequencies $= 1$

e.g., In a diploid, $p$ and $q$ are the frequencies of alleles A & a respectively.

The frequency of AA $= p^2$ (i.e. the probability of an allele A with frequency $p$ is the product of the probabilities, i.e. $p^2$ )

The frequency of $aa = q^2$

The frequency of A$a = 2pq$

Hence, $\boldsymbol{p^2 + 2pq + q^2} = 1$ [binomial expansion of $(p+q)^2$ ] **[2]**

**6.** Riya is most likely to infected with pneumonia because it is a bacterial disease and spread through coughing and sneezing, their bacteria are suspended in the air so the healthy person can be infected very easily. While in allergies the contact with the infected person is necessary. **[2]**

**7.** Gene therapy is a method of correcting defective gene that has been diagnosed in a child.

**Steps involved in this therapy are:**

**(i)** Lymphocytes of blood of the patient and grown in a culture medium outside the body.

**(ii)** A correct or functional ADA, cDNA is introduced into these lymphocytes and then again introduces into the patient.

**(iii)** These cells are not immortal so the patient required periodic infusion of the same. **[2]**

**8. (i)** Genotype of the father is $Hb^A Hb^s$ (A carrier)

**(ii)** Phenotype of mother is diseased ($Hb^s Hb^s$) **[2]**

## *SECTION C* *21 MARKS*

**9. Causes of loss of biodiversity:**

**(i) Over-exploitation:** Biological processes are overexploited by man for the natural resources.

**(ii) Habitat loss and fragmentation:** Destruction of habitat cause extinction of many species. When large sized habitat broken due to human settlement, buildings and roads, digging canals etc.

**(iii) Alien species invasion:** When alien species introduced unintentionally become invasive or harmful for the indigenous species.

**10.** Gel electrophoresis is used in separation and isolation of the DNA fragments. It is a process of separation of biomolecules by placing them in mild electric field.

**(i)** Fragments of DNA are separated by agarose gel electrophoresis.

**(ii)** DNA fragments being negatively charged move towards positive electrode/anode.

**(iii)** Fragments separate according to size/ charge.

**(iv)** Separated fragments are stained with ethidium bromide and exposed to UV rays and they form orange coloured bands.

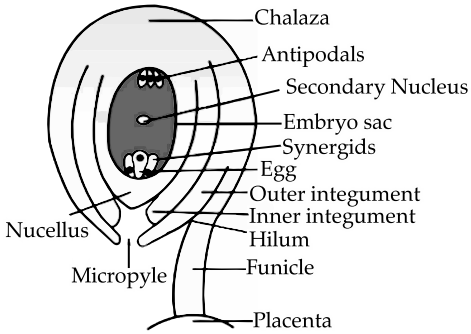
**OR**

**(a)** Vector name is pBR322. The organism in which it is inserted is *E.coli.* bacteria.

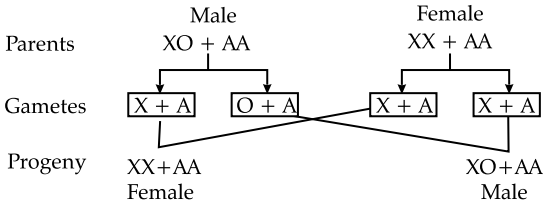
**(b)** Two restriction sites are- Hind III and EcoR I.

**(c)** Two selectable markers are ampicillin and tetracycline.

**11. Diagram of an anatropous ovule is below:**




**12. (i)** In grasshopper male have only one X chromosome besides autosomes and female have a pair of X chromosomes.

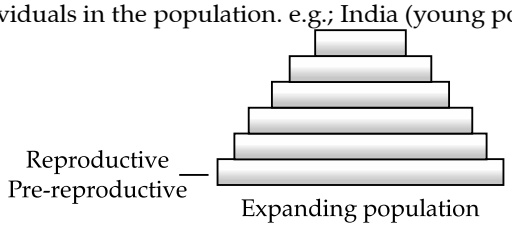



**(ii)** Turner's syndrome- Genotype are 44+XO i.e., have 45 chromosomes.

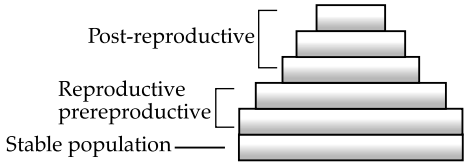
Symptoms- Sterile female with rudimentary ovaries.

**13. Age pyramid** is a plot of the age distribution (per cent individuals of a given age or age group) for a population. Age distribution depends upon the natality and mortality and determines the population growth. With regard to age distribution, there are three kinds of population.

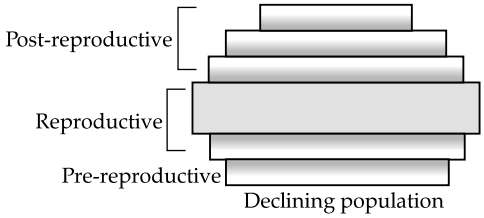
**(i) Rapidly growing or expanding population:** It has high birth rate and low death rate, so there are more number of young individuals in the population. e.g.; India (young population).




**(ii) Stationary or stable population:** It has equal birth and death rates, so the population shows zero population growth.




**(iii) Declining population:** It has higher death rate than birth rate, so the population of young members is lower than that of old members, e.g., Japan (ageing population).



**14.** **(a)** City A needs a sewage treatment plant because its biological oxygen demand is high as comparative to city B.

**(b)** Steps involved in the sewage treatment are as follows-

Municipal wastewater (sewage) contains large amount of organic matter and microbes which are pathogenic and cannot be discharged into natural water bodies like rivers and streams.

Sewage is treated in sewage treatment plant to make it less polluting by using heterotrophic microbes naturally present in sewage. Sewage treatment is done in two stages:

**Primary treatment:** In primary treatment, floating debris is removed by sequential filtration. Grit (soil and small pebbles) are removed by sedimentation.

**Secondary treatment:** Secondary treatment or biological treatment involves passing of primary effluents in large aeration tank to help the growth of aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structures). These microbes increase the consumption of organic wastes and decrease the BOD (biological oxygen demand) of the effluents.

**(c)** After proper sewage treatment the value of BOD will decreases useful microbes consume lot of organic matter.

**15.** **(i)** As it is a *plasmodium* a malarial parasite which completed its life cycle in two hosts- asexual phase in human host and sexual phase in female Anopheles mosquito host.

**(ii)** label D shows- sporozoites.

**(iii)** Label A and E shows- liver cells and trophozoites respectively.

**(iv)** Signs and symptoms of malaria are- fever, chills, abdominal pain, general feeling of discomfort, etc.

## *SECTION D* *15 MARKS*

**16.** There are three structural genes (*z, y, a*) which transcribe a polycistronic mRNA.

**(i)** Gene *z* codes for b-galactosidase (β-gal), which catalyses the hydrolysis of lactose into galactose and glucose.

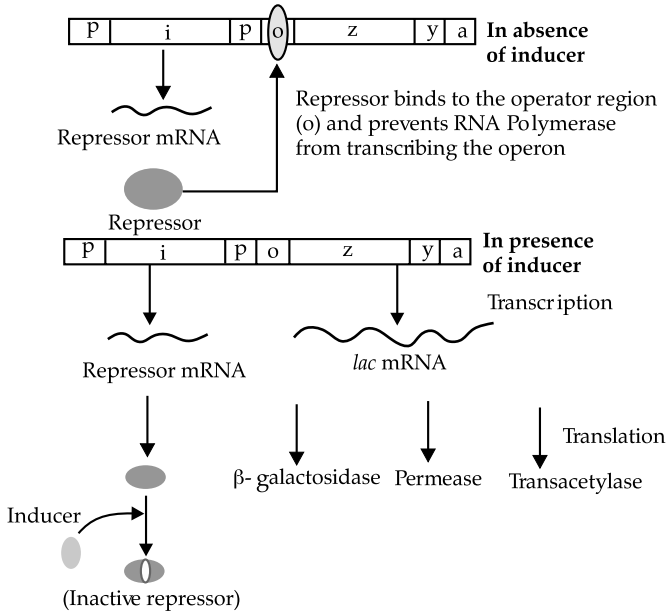
**(ii)** Gene *y* codes for permease, which increases the permeability of the cell to β-galactosidase (lactose).

**(iii)** Gene *a* codes for transacetylase, which catalyses the transacetylation of lactose into its active form.

**(Any one )**

An operon is a part of genetic material (or DNA), which acts as a single regulated unit of one or more structural genes, an operator gene, a promotor gene, a regulator gene, a repressor and an inducer or compressor gene.

In *lac* operon, when lactose is added, it enters the cell with the help of permease, a small amount of which is already present in the cell. Lactose binds itself to active repressor and changes its structure. The repressor now fails to bind to the operator then RNA polymerase starts transcription of operon by binding to the promotor site P. All the three enzymes for lactose metabolism are synthesized. Finally, all the lactose molecules are used up in the whole process of induction.



**17. (i)** In the given diagram 'C' indicates luteal phase and 'D' indicates the next menstrual cycle begins.

**(ii)** 'F'- Corpus luteum

**(iii)** During luteal phase the progesterone level increases which thickens the uterus lining for implantation of fertilized egg. If the egg is not fertilised the progesterone level decreases and the female get there periods.

**(iv)** Human Chorionic Gonadotropin (HCG) hormone present in the urine that confirms the pregnancy in humans.

**(v)** 'E'- Graffian Follicles which releases progesterone hormone.

**OR**

**(ii) (a) Reasons for high population growth:**

- Rapid decline in death rate to better public health care.
- Decline in maternal and infant mortality rates.

**(b)** Steps taken by the government to control the population are:

- Family planning programs were initiated by the Government of India.
- Encouraging sex education the schools to give the right information to the young people.

**(c)** The rapid growing population of our country transforms the economy into mass unemployment where the situation getting uncontrolled due to lack of resources over population.

**(d) Natural Methods:** They work on the principle of avoiding chances of ovum and sperms meeting. It includes:

- **Periodic abstinence:** It is a method in which the couples avoid or abstain from coitus from day 10 to 17 of the menstrual cycle when ovulation could be expected, as chances of fertilization are very high during this period. It is called the **fertile period**.
- **Withdrawal or coitus interruptus:** It is another method in which the male partner withdraws his penis from the vagina just before ejaculation so as to avoid insemination.
- **Lactational amenorrhea:** It is a method which is based on the fact that ovulation and therefore the cycle do not occur during the period of intense lactation following parturition.
- **Artificial Methods:** This involves mechanical or barrier methods. In barrier methods, ovum and sperms are prevented from physically meeting with the help of barriers. These methods are available for both males and females. It includes:
- **Condoms**

**Fig: Condom for Male**

- **Diaphragms, Cervical caps and Vaults**
- **Spermicidal creams, jellies**

**18. Decomposition :** It is the breakdown of complex organic matter by decomposers into inorganic substances like carbon dioxide, water and nutrients.

- The detritus is the raw material for decomposition. Detritus are dead plant remains such as leaves, bark, flowers and dead remains of animals, including faecal matter.
- The earthworm is referred to as the 'farmer's friend'. This is so because they help in the breakdown of complex organic matter as well as in loosening of the soil.
- The steps involved in the decomposition process are :

**(a) Fragmentation:** It is the breakdown of detritus into smaller particles by detritivores like earthworm

**(b) Leaching:** Here, the water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.

**(c) Catabolism:** It is the degradation of detritus into simpler inorganic substances by bacterial and fungal enzymes.

**(d) Humification:** The degradation of detritus leads to accumulation of humus, a dark amorphous substance in soil. Humus is resistant to microbial action and so decomposes very slowly. Being colloidal in nature, it serves as a reservoir of nutrients.

**(e) Mineralization:** The humus gets degraded by some microbes and release inorganic nutrients. This process is called mineralization.

**(f) Nutrient immobilization:** At times, the soil nutrients instead of getting mineralized, get bound with biomass of microbes, and so become temporarily unavailable to other organisms. This incorporation of nutrients in living microbes is called nutrient immobilization.