SAMPLE QUESTION PAPER

BLUE PRINT

Time Allowed : 3 hours **Maximum Marks :** 70

S. No.		Chapter	VSA /Case based/ AR (1 mark)	SA-I (2 marks)	SA-II (3 marks)	LA (5 marks)	Total	
1.	Unit-VI	Sexual Reproduction in Flowering Plants	2(2)	–	–	–	**2(2)**	**14**
2.		Human Reproduction	2(2)	1*	1(3)	–	**3(5)**	
3.		Reproductive Health	–	1(2)	–	1+1*(5)	**2(7)**	
4.	Unit-VII	Principles of Inheritance and Variation	3+1*(3)	1(2)	–	–	**4(5)**	**18**
5.		Molecular Basis of Inheritance	1(1)	2(4)	1(3)	1+1*(5)	**5(13)**	
6.	Unit-VIII	Human Health and Diseases	–	1+1*(2)	1(3)	–	**2(5)**	**14**
7.		Microbes in Human Welfare	1(4)	–	–	1+1*(5)	**2(9)**	
8.	Unit-IX	Biotechnology : Principles and Processes	2(2)	3(6)	–	–	**5(8)**	**12**
9.		Biotechnology and Its Applications	1(1)	–	1(3)	–	**2(4)**	
10.	Unit-X	Organisms and Populations	1(1)	1(2)	1+1*(3)	–	**3(6)**	**12**
11.		Biodiversity and Conservation	3(6)	–	–	–	**3(6)**	
		Total	**16(22)**	**9(18)**	**5(15)**	**5(15)**	**33(70)**	

*It is a choice based question.

Subject Code : 044

BIOLOGY

Time allowed : 3 hours ***Maximum marks : 70***

General Instructions :

(i) All questions are compulsory.

(ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.

(iii) Section-A has 14 questions of 1 mark each and 02 case-based questions. Section-B has 9 questions of 2 marks each. Section-C has 5 questions of 3 marks each and Section-D has 3 questions of 5 marks each.

(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION - A

1. Give reasons why micropyle remains as a small pore in the seed coat of a seed.

2. Why pollen tablets are in use by people these days?

3. Name the embryonic stage that gets implanted in the uterine wall of human female.

4. Write the physiological reason, why a woman generally cannot conceive a child after 50 years of age.

5. A geneticist interested in studying variations and patterns of inheritance in living beings prefers to choose organisms for experiments with shorter life cycle. Provide a reason.

6. Mention the type of allele that expresses itself only in homozygous state in an organism.

7. How is repetitive/satellite DNA separated from bulk genomic DNA for various genetic experiments?

8. How is *Agrobacterium tumefaciens* able to transform a normal plant cell into a tumor?

9. Write the importance of the bacterium *Thermus aquaticus* in polymerase chain reaction.

10. "India has greater ecosystem diversity than Norway". Do you agree with the statement? Give reasons in support of your answer.

11. **Assertion :** Monogenes produce continuous variations in the expression of traits.
Reason : Monogenic inheritance controls quantitative trait.
(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.

OR

Assertion : Down's syndrome is a genetic disorder caused due to the presence of an additional copy of X-chromosome.

Reason : Both X chromosomes pass into single egg due to non disjunction during oogenesis.

(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.

12. Assertion : PCR primers must not have self complementary regions.

Reason : Self complementary regions result in hairpin structures adversely affecting the PCR.

(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.

13. Assertion : Offsite collections can be used to restock depleted populations, reintroduce species in the wild and restore degraded habitats.

Reason : *In situ* conservation refers to the conservation of endangered species in their natural habitats.

(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.

14. Assertion : Plant-animal interactions do not generally involve co-evolution of the mutualist organisms.

Reason : Evolution of the plants and animals can never go side by side.

(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.

15. Read the following and answer any four questions from 15(i) to 15(v) given below:

Some microbes and the products derived from them are very useful in our daily life. The production of curd from milk is one of the most common examples of microbes benefits to humans. Microorganisms such as *Lactobacillus* and others commonly called lactic acid bacteria (LAB) are responsible for the formation of curd. Microbes are also used in preparation of many foods such as the rice dough for *dosa* and *idli*, bread, cheese and some traditional drinks like toddy, etc.

(i) Which of the following microbes is generally used in bread making?

(a) Baker's yeast
(b) *Propionibacterium shermanii*
(c) *Lactobacillus*
(d) Lactic acid bacteria

(ii) The preparation of which of the following things does not require microbes?

(a) Pizza
(b) Toddy
(c) Swiss cheese
(d) Rice

(iii) The large holes in Swiss cheese is a resultant of _____.

(a) anerobic respiration in microbes
(b) aerobic respiration in microbes
(c) fermentation
(d) both (a) and (c)

(iv) How lactic acid bacteria increase the quality of milk?

(a) Turning it into cheese (b) Increasing vitamin B_{12}

(c) Turning it into curd (d) None of these

(v) **Assertion :** Lactic acid bacteria are very beneficial to humans.

Reason : Lactic acid bacteria checks the growth of disease causing microbes in stomach.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

16. Read the following and answer any four questions from 16(i) to 16(v) given below:

India is one of the 12 megadiversity countries of the world as it holds only 2.4 per cent area of the world's land area but it shares 8.1 per cent to the global species diversity. Nearly 45,000 species of plants and twice as many of animals have been recorded from India. The distribution of the huge variety of plants and animals is not uniform throughout the world. Species diversity generally decreases on moving towards the poles from the equator. With very few exceptions, tropics (latitudinal range of 23.5° N to 23.5° S) harbour more species than temperate or polar areas. The largely tropical Amazonian rainforest in South America has the greatest biodiversity on earth. The reason behind this latitudinal variation include speciation, relatively constant tropical environment as compared to temperate environment, and the high availability of solar energy in the tropics.

(i) Unlike temperate environment, tropical environments have more species diversity as it has _____.

(a) less seasonal variations (b) high solar energy

(c) less precipitation (d) both (a) and (b)

(ii) Polar areas have _____ species diversity as compared to tropics.

(a) less (b) more (c) almost equal (d) can not say

(iii) Amazon rainforests are also known as _____.

(a) Heart of Earth (b) Brain of Earth (c) Lungs of Earth (d) Liver of Earth

(iv) The reason behind the the latitudinal variation in vegetation might be due to

(a) seasonal differences (b) sunlight variations

(c) precipitation differences (d) all of these.

(v) Read the following statements.

I. Amazon rain forest has maximum diversity due to the seasonal variations.

II. Western ghat have almost stable with less seasonal variations.

III. Thar desert have least biodiversity.

Choose from below the correct alternative.

(a) Only I is true. (b) Only II and III are true

(c) Only I and III is true (d) I, II and III are true.

SECTION - B

17. A childless couple has agreed for a test tube baby programme. List only the basic steps the procedure would involve to conceive the baby.

OR

List the different parts of the human oviduct through which the ovum travels till it meets the sperm for fertilisation.

18.

i	p	o	x	y	a

Given above is a schematic representation of the *lac* operon in *E.coli*. What is the significant role of '*i*' gene in switching on or off the operon?

19. Identify A, B, C and D in the following table:

S.No.	Scientific name of the source plant	Drug	Harmful effects/Human body part affected
1.	*Papaver somniferum*	A	Depressant/slows body function
2.	*Cannabis sativa*	Cannabinoids	B
3.	*Erythroxylum coca*	C	D

OR

List the two types of immunity a human baby is born with. Explain the differences between the two types.

20. Explain the work carried out by Cohen and Boyer that contributed immensely in biotechnology.

21. What are the differences between action of exonucleases and endonucleases?

22. Briefly explain Western blotting.

23. A template strand is given below. Write down the corresponding coding strand and the *m*RNA strand that can be formed, along with their polarity.
3′ ATGCATGCATGCATGCATGCATGC 5′

24. Write the types of sex-determination mechanisms the following crosses show. Give an example of each type.
(i) Female XX with male XO
(ii) Female ZW with male ZZ.

25. Name and explain the interaction, that is seen between clownfish and sea anemones.

SECTION - C

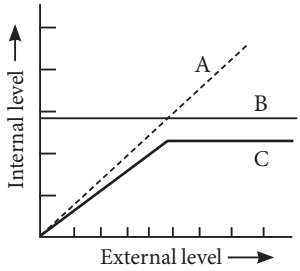
26. Enumerate the events in the ovary of a human female during:
(i) Follicular phase,
(ii) Luteal phase of menstrual cycle.

27. **(a)** How codon is different from anticodon?
(b) Explain Chargaff's rules.

28. What is the functional difference between B-cells and T-cells?

29. Describe any six advantages of genetically modified plants.

30. Refer to the given graph and answer the following questions.



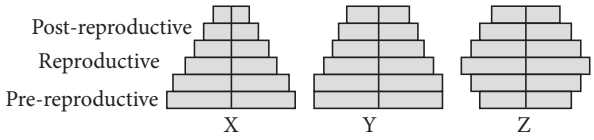
(i) What does the graph represent? Identify A, B and C.

(ii) Differentiate between A and B.

(iii) How organism C regulates their body functions?

OR

Study the given figures and answer the followings:



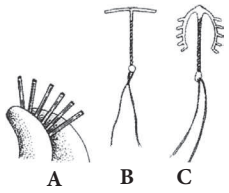
(i) Identify the given figures X, Y and Z. What does X represent?

(ii) Write a short note on Y.

(iii) Briefly describe the growth status of Z.

SECTION - D

31. Observe the given figures and answer the following questions.



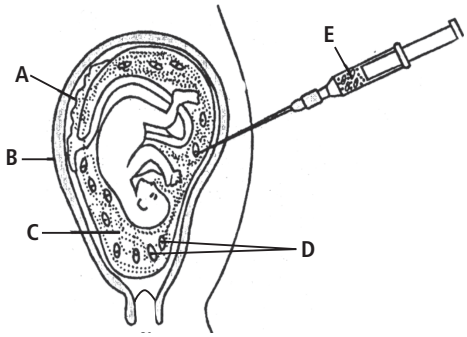
(i) Identify the given figures A, B and C.

(ii) Explain the role of figure B and C.

(iii) Define the figure A.

OR

Consider the given figure and answer the following questions.



(i) Identify A, B, C, D and E in the given figure.

(ii) Briefly describe the procedure given in the figure.

(iii) How this procedure is being misused?

32. **(a)** Differentiate between repetitive and satellite DNA.

(b) How can satellite DNA be isolated? Explain.

(c) List two forensic applications of DNA fingerprinting.

OR

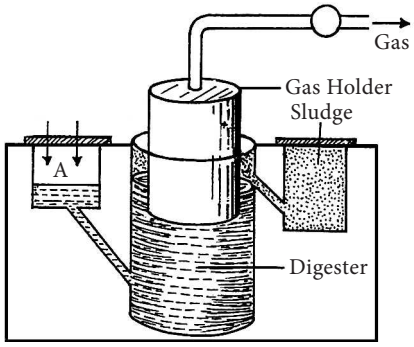
Explain the process of translation.

33. **(a)** Name the category of microbes occurring naturally in sewage and making it less polluted during the treatment.

(b) Explain the different steps involved in the secondary treatment of sewage.

OR

Study the picture of biogas plant given below and answer the questions that follow.



(i) Name the components gaining entry from A into the chamber.

(ii) Mention the group of bacteria and the condition in which they act on the component that entered from A in the digester.

(iii) Name the components that get collected in gas holder.

SOLUTIONS

1. Micropyle remains as a small pore in the seed coat to facilitate entry of O_2 and water into the seed during germination.

2. Pollen tablets are used as food supplement by people to improve health.

3. Blastocyst

4. A woman generally cannot conceive a child after 50 years of age as at this age menopause occurs. It is a phase in a woman's life when ovulation and menstruation stops.

5. Living beings with shorter life cycles are preferred by geneticists for studying variations and patterns of inheritance because such organisms complete their life cycle in short duration and produce large number of progenies in less time span, *e.g.*, pea plant used in Mendel's experiments.

6. Recessive allele, *e.g.*, tt represents dwarf plant.

7. Repetitive/satellite DNA can be separated from bulk genomic DNA by using density gradient centrifugation.

8. When *Agrobacterium tumefaciens* infects a plant cell, its Ti plasmid (Ti-tumour inducing plasmid) transfers a piece of its DNA known as 'T-DNA' into plant cells and transform normal plant cells into a tumour.

9. *Taq* DNA polymerase is isolated from thermophilic bacterium *Thermus aquaticus*. It is used to synthesise the segment of DNA between the primers (extension) in polymerase chain reaction at high temperatures.

10. Yes, India has greater ecosystem diversity than Norway as India comes under the tropical region whereas, Norway lies in temperate region. Tropical regions account for greater biological diversity as they have deserts, rainforests, mangroves, coral reefs, wetlands, estuaries and alpine meadows than temperate regions. In tropical region more solar energy is available that also promotes higher productivity and increased biological diversity.

11. (d) : The genes in which dominant allele expresses the complete trait are called monogenes, *e.g.*, TT or Tt for tallness in pea. This type of inheritance is called monogenic inheritance or qualitative inheritance. Qualitative inheritance produces a sort of discontinuous trait variations in the progeny i.e., either tallness or dwarfness. Intermediate forms or continuous trait variations are not produced.

OR

(d) : Down's syndrome is an autosomal aneuploidy caused by the presence of an extra chromosome number 21. Both the chromosomes of the pair 21 pass into a single egg due to non-disjunction during oogenesis.

12. (a) : Primers are nucleotide sequences that serve as base for formation of new DNA strand. In PCR, primers are added on the ends of DNA strand to be copied and the primers are extended towards each other so that the DNA segment lying between the two primers is copied. If self complementary bases are present in primers then hydrogen bonds are formed between them and hairpin-like structure is formed. It makes the primers unsuitable for extension of strands in PCR.

13. (b)

14. (d): Plant-animal interactions often involve co-evolution of the mutualists, that is, the evolution of the flower and its pollinator species are closely linked with one another. This is because plants need the help of animals for pollinating their flowers and dispersing their seeds. Animals get rewards in the form of pollen and nectar for pollinators and juicy and nutritious fruits for seed dispersal.

15.(i) (a) : In bread making, the fermentation of dough is done by microbe *Saccharomyces cerevisiae* also called as baker's yeast.

(ii) (d) : 'Swiss cheese' is prepared by using bacterium *Propionibacterium shermanii*. Pizza dough is fermented by using baker's yeast and 'Toddy', a traditional drink of some parts of Southern India is made by fermenting sap of palms.

(iii) (d) : *Propionibacterium shermanii* is the species of the bacterium which is used in the production of the Swiss cheese. This bacterium performs the anaerobic mode of reproduction and produces carbon dioxide. The release of carbon dioxide is responsible for the production of large holes in the cheese. Fermentation is a kind of anaerobic (non-oxygen-requiring) pathway for breaking down glucose.

(iv) (b) : When small amount of curd added to the fresh milk as inoculum or starter it contains millions of LAB, which at suitable temperatures multiply, thus converting milk to curd, which improves its nutritional quality by increasing vitamin B_{12}.

(v)(a) : LAB play very beneficial role in human's stomach by checking disease causing microbes.

16.(i) (d) : Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity and there is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.

(ii) (a) : Tropics (latitudinal range of 23.5° N to 23.5° S) harbour more species than temperate or polar areas except some exceptions.

(iii) (c) : Amazon rainforest is the most biodiverse region on earth, providing shelter to three million species on plants and animals. Billions of trees absorb tons of carbon dioxide every year and slow down the climate change along with producing 20% of earth's oxygen, hence named 'Lungs of Earth.

(iv) (d) : The vegetation around equatorial region is abundant, diverse and evergreen due to hot and humid climatic conditions due to ample amount of insolation received in the region. As we move away from the equator towards the tropics, the insolation received the climate does not provide with torrential rains hence, the vegetation becomes thinner characterised by tropical forest or grasslands depending on the rains the regions receive.

(v) (b) : Tropical areas, such as the Amazon Rainforest, don't have seasons like spring, summer, fall, and winter. Western ghats are less seasonal, relatively more constant and predictable. Biodiversity is low in hot desert ecosystems. There are far fewer species supported by the extreme climate compared to other biomes. This is due to the high temperatures, low rainfall and a lack of available water.

17. Two principle procedures adopted for test tube baby programme are ZIFT (Zygote Intra Fallopian Transfer) and IUT (Intra Uterine Transfer). In this procedure fusion of ovum and sperm is done outside the body of a woman, in the laboratory to form a zygote. The zygote is then allowed to divide forming 8 blastomeres and is transferred into the Fallopian tube (ZIFT - Zygote Intra Fallopian Transfer). If the embryo is with more than 8 blastomeres it is transferred into the uterus (IUT - Intra Uterine Transfer) to complete its further development. Thus , this is *in vitro* fertilisation (IVF - fertilisation outside the body in almost similar conditions as that in the body) followed by embryo transfer (ET).

OR

Fimbriae, infundibulum, ampulla and isthmus are the main parts of oviduct, through which ovum travels till it meets the sperm for fertilisation. Finally it reaches the ampullary-isthmic junction of oviduct.

18. '*i*' gene is regulator gene. It produces a repressor, which binds to the operator gene and stops its working. This '*i*' gene exerts a negative control over the working of structural genes.

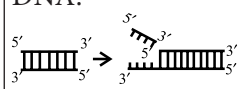
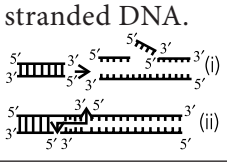
19. A - Heroine
B - Cardiovascular system
C - Cocaine
D- Central nervous system

OR

Two types of immunity with which human baby is born include-
(i) Innate immunity - It is inherited by an organism from the parents and protects it from birth throughout the life. It is not specific to particular pathogen and consists of four types of barriers - physical, physiological, cellular and cytokine.
(ii) Natural passive immunity - It is passively transferred from mother to fetus through placenta, as IgG antibodies can cross placental barrier to reach the fetus.

20. Cohen and Boyer contributed to the field of biotechnology by constructing the first recombinant DNA molecule in 1972. They cut the piece of DNA from a plasmid carrying antibiotic resistance gene, using restriction enzymes. This piece of foreign DNA, was linked with the plasmid DNA, acting as a vector with the help of enzyme DNA ligase. This newly formed DNA molecule is called recombinant DNA.

21. Differences between action of exonucleases and endonucleases are as follows :

S. No.	Exonucleases	Endonucleases
(i)	These nucleases cleave base pairs of DNA at their terminal ends.	They cleave DNA at any point except the terminal ends.
(ii)	They do not cut RNA.	They may cut RNA.
(iii)	They act on single strand of DNA or gaps in double stranded DNA. 	They cleave one strand (i) or both strands (ii) of double stranded DNA. 

22. Western blotting is a process where proteins are electrophoresed in polyacrylamide gel, transferred onto a nitrocellulose or nylon membrane (to which they bind strongly) and the protein bands are detected by their specific interaction with antibodies, lectins or other protein compounds.

23. The corresponding coding strand is :
5′ TACGTACGTACGTACGTACGTACG 3′
The corresponding *m*RNA strand is
5′ UACGUACGUACGUACGUACGUACG 3′

24. (i) The type of sex determination mechanism shown in female XX with male XO is called male heterogamety. In this case male are heterogametic with half the male gametes carrying X-chromosome while the other half being devoid of it, *e.g.,* grasshopper.
(ii) The type of sex determination mechanism shown in female ZW with male ZZ is female heterogamety because female produces two different types of gametes, *e.g.,* birds.

25. Commensalism is the interaction between clownfish and sea anemone. The clownfish lives among the stinging tentacles of sea anemone and gets protection from its predators which stay away from the stinging tentacles. The sea anemone does not appear to derive any benefit by hosting the clownfish.

26. (i) During follicular phase, ovarian follicle secretes estrogens under the influence of FSH secreted by anterior pituitary. Estrogens stimulate the proliferation of the endometrium of the uterine wall.
(ii) During luteal phase, the remaining cells of the ovarian follicles after ovulation are stimulated by LH to develop corpus luteum. The corpus luteum secretes progesterone that stimulates the uterine glands to produce increased amount of mucus and is also essential for the maintenance of the endometrium which is necessary for implantation of the fertilised ovum.

27. (a) Differences between Codon and Anticodon.

S.No.	Codon	Anticodon
(i)	It is found in DNA and mRNA.	It occurs in tRNA.
(ii)	Codon is complementary to a triplet of template strand.	It is complementary to a codon.
(iii)	It determines the position of an amino acid in a polypeptide.	It helps in bringing a particular amino acid at its proper position during translation.

(b) Chargaff (1950) made generalisations on the bases and other content of DNA. These generalisations are :
(i) Purines and pyrimidine base pairs are in equal amounts, *i.e.*, adenine + guanine = thymine + cytosine.

$$[A + G] = [T + C] \text{ } i.e., \frac{[A+G]}{[T+C]} = 1$$

(ii) The ratio of $\frac{[A+T]}{[G+C]}$ is variable, but constant for a species. It can be used to identify the source of DNA.
This ratio is low in primitive organisms, and higher in advanced ones.
(iii) Sugar deoxyribose and phosphate occur in equimolar proportions.
(iv) Molar amount of adenine is always equal to molar amount of thymine. Similarly, molar concentration of guanine equals molar concentration of cytosine.

28. Differences between the role of B-lymphocytes (B-cells) and T-lymphocytes (T-cells) in generating immune responses are :

S.No.	B-lymphocytes (B-cells)	T-lymphocytes (T-cells)
(i)	B-cells form humoral or antibody mediated immune system(AMIS).	T-cells form cell-mediated immune system (CMIS).
(ii)	They defend against viruses and bacteria that enter the blood and lymph.	They defend against pathogens including protists and fungi that enter the cells.
(iii)	Plasma cells formed by division of B-cells produce antibodies and provide immunity against foreign substances.	T-lymphocytes produce different types of T-cells, e.g., killer T-cells react against cancer cells, suppressor cells inhibit immune system.

29. Applications of genetically modified plants are as follows:
(i) These plants are resistant to (a) diseases resulting from viral, bacterial and fungal infections (b) pests, such as nematodes and insects and (c) pesticides.
(ii) They can tolerate adverse abiotic stresses such as cold, drought, salt, heat, etc.
(iii) They show increased efficiency of mineral usage (this prevents early exhaustion of fertility of soil).
(iv) GM plants have high nutritional value, *e.g.,* vitamin A enriched rice.

(v) Plants such as poplar (*Populus*) trees have been genetically engineered to clean up heavy pollution from contaminated soil.
(vi) These plants helped to reduce post harvest losses, *e.g.,* Flavr Savr transgenic tomato.

30. (i) The given graph represents various ways of organismic response *i.e.*, possibilities of living organisms to cope with stressful conditions. A represents the conformers, B represents regulators and C represents partial regulators.
(ii) Differences between A (conformers) and B (regulators) are as follows:

S.No.	Conformers	Regulators
(i)	Homeostasis is little.	They possess a constant internal environment or homeostasis.
(ii)	Their body temperature changes according to that of environment.	They maintain constant body temperature.
(iii)	They have a narrow range of distribution.	They have a wide range of distribution.
(iv)	They consume lesser amount of energy and are less active.	They consume large amount of energy and are more active.

(iii) C *i.e.*, partials regulators have the ability to regulate body functions to a limited extent. Beyond that limit they become conformers.

OR

(i) The given figures represent different age pyramids of human population. X represents expanding population,Y represents stable population and Z represents declining population.
(ii) Age pyramid Y showing stable population is bell-shaped. In this pyramid, the number of pre-reproductive and reproductive individuals is almost equal. Number of post-reproductive individuals is few. The population size remains stable, neither growing nor declining.
(iii) Z is an urn-shaped age pyramid. In this pyramid proportion of reproductive age group is higher than the individuals in pre-reproductive age group. It is declining or diminishing population with negative growth.

31. (i) Here, A is hormone implant capsules, B is CuT and C is Multiload 375.
(ii) CuT and Multiload 375 are types of copper releasing intra-uterine devices (IUDs). These devices increase phagocytosis of sperms within the uterus and the Cu ions released suppress sperm motility and the fertilising capacity of sperms.
(iii) Hormone implant capsules or norplant is a type of subcutaneous implantation of synthetic progesterone. It acts by blocking ovulation and thickening the cervical mucus to prevent sperm transport. Six matchstick-sized capsules containing the steroid are inserted under the skin of the inner arm above the elbow. The capsules slowly release the synthetic progesterone for about five years. It is very safe, convenient, and effective and long-lasting (5 years). The woman has irregular periods or periods may be absent. Minor surgical procedure is needed for insertion and removal.

OR

(i) In the given figure, A is placenta, B is uterine wall, C is amniotic fluid, D are the cells shed by growing fetus and E is syringe with needle that withdraws a small amount of fluid and cells.
(ii) The given figure represents the procedure of amniocentesis in which amniotic fluid containing cells from the skin of the fetus and other sources are withdrawn by using a special surgical syringe with needle. These cells are cultured and are used to determine chromosomal abnormalities such as Down's syndrome, Klinefelter's syndrome and metabolic disorders such as phenylketonuria; sickle cell anaemia of the fetus.
(iii) Unfortunately, amniocentesis is being misused to kill the normal female fetus. Therefore, it is legally banned for the determination of sex to avoid female feticide.

32. (a) Difference between repetitive and satellite DNA are as follows :

Repetitive DNA	Satellite DNA
Repetitive DNA consist of short identical sequences which are repeated several hundred or thousand times. It is of three types, terminal repeats, tandem repeats and interspersed repeats. The disposition of repetitive element consist either in arrays of tandemly repeated sequences or in repeats dispersed throughout the genome.	The proportion of the DNA of a eukaryotic cell that consists of very large numbers of copies of a tandem repeatedly short nucleotide sequence. It occurs mainly around the centromeres and telomeres of the chromosomes. The highly repetitive nature of this DNA fraction gives it a distinctive base composition, and consequently when samples of DNA are centrifuged, it forms so-called 'satellite bands' quite separate from the band representing the bulk of the cell's DNA.

(b) Satellite DNA can be isolated from bulk genomic DNA by density gradient centrifugation.
(c) DNA fingerprinting is very useful in detection of crime and legal pursuit.

OR

The process of decoding of the message from *m*RNA to protein with the help of *t*RNA, ribosome and enzyme is called translation (protein synthesis). Protein synthesis occurs over ribosomes.
The 4 main steps in protein synthesis (translation) are : activation, initiation, elongation and termination of polypeptide chain.
The newly synthesised *m*RNA joins the smaller subunit of ribosome at 5′ end. *m*RNAs carry the codon and *t*RNAs carry the anticodon for the same codon. Activation of amino acid is catalysed by the enzyme aminoacyl tRNA synthetase in the presence of ATP. In presence of ATP an amino acid combines with its specific amino acyl-*t*RNA synthetase to produce aminoacyl adenylate enzyme complex. This reacts with *t*RNA to form aminoacyl-*t*RNA complex. Activated *t*RNA is taken to ribosome *m*RNA complex for initiation of protein synthesis.
Initiation of protein synthesis is accomplished with the help of initiation factor which are 3 (IF3, IF2, IF1) in prokaryotes and 9 in eukaryotes (eIF2, eIF3, eIF1, eIF4A, eIF4B, eIF4C, eIF4D, eIF5, eIF6). The ribosome binds to the *m*RNA at the start codon (AUG) that is recognised only by the initiator *t*RNA. A polypeptide chain forms as *t*RNAs deliver amino acids to the ribosome. Large ribosomal subunit binds the initiation complex forming two (A and P) binding site for *t*RNA molecules. The first site is P site or peptidyl site which is occupied by $tRNA^{met}$. The second site is A or amino acyl site and is positioned over the second codon. The ribosome proceeds to the elongation phase of protein synthesis. During this stage, complexes composed of an amino acid linked to *t*RNA, sequentially bind to the appropriate codon in *m*RNA by forming complementary base pairs with the *t*RNA anticodon. The ribosome moves from codon to codon along the *m*RNA. Amino acids are added one by one, translated into polypeptide sequences dictated by DNA and represented by *m*RNA. The enzyme peptidyl synthetase catalyses the formation of peptide bond between the carboxylic group of amino acid at P site and amino group of amino acid at A site. Enzyme translocase brings about the movement of *m*RNA by one codon.
The termination of protein synthesis occur when a non-sense codon reaches at A site of ribosome. The chain detaches from the ribosome. A release factor binds to the stop codon, terminating translation and releasing the complete polypeptide from the ribosome. Two subunits of ribosomes dissociate with the help of dissociation factor.

33. (a) Aerobic heterotrophs like bacteria and fungi occur in sewage water. They are natural decomposers and digest a lot of organic matter present in the polluted water thereby releasing minerals and reducing organic waste. Hence, they play an important role in cleaning water and making it fit for various domestic uses.
(b) Secondary treatment of the sewage is also called biological treatment because microbes are used to digest the organic matter in the sewage water. The steps involved in the process are :
(i) Primary effluent is passed into aeration tank where liquid is constantly agitated and air is pumped into it.
(ii) Large number of aerobic heterotrophic microbes grow in aeration tank and form flocs.
(iii) Microbes digest organic matter, convert it into microbial biomass and reduce BOD.
(iv) In settling tank, the bacterial flocs are allowed to undergo sedimentation. The effluent is passed into natural waters like rivers and streams. It can also be further treated with chemicals to purify it.
(v) The sediment is called activated sludge. A part of this sludge is passed into anaerobic sludge digester where anaerobic microbes digest the organic mass as well as aerobic microbes.
(vi) During digestion, microbes produce methane, H_2S and CO_2. These gases form biogas that can be used as source of energy.

OR

(i) Dung and water enter the digester chamber from A.
(ii) The group of bacteria found in biogas plant are methanogens. Methanogens are a group of anaerobic bacteria which obtain their energy by reducing carbon dioxide and oxidising hydrogen with the production of methane. These microorganisms are present in anaerobic sludge digester where they digest organic mass as well as aerobic microbes of the sludge.
(iii) Biogas is a methane rich fuel gas produced by anaerobic breakdown of biomass with the help of methanogenic bacteria. It is made up of methane (50-70%), carbon dioxide(30-40%) with traces of nitrogen, hydrogen sulphide and hydrogen.

☺ ☺ ☺