CBSE

Class XII Biology

Time: 3 Hours **Total Marks: 70**

General Instructions:

1. All questions are compulsory.
2. This question paper consists of five sections A, B, C, D and E. Section **A** contains **5** questions of **one** mark each, Section **B** is of **5** questions of **two** marks each, Section **C** is of **12** questions of **three** marks each, Section **D** is of **1** question of **four** marks and Section **E** is of **3** questions of **five** marks each.
3. There is no overall choice. However, an internal choice has been provided in **one** question of **2** marks, **one** question of **3** marks and all the **three** questions of **5** marks weightage. A student has to attempt only one of the alternatives in such questions.
4. Wherever necessary, the diagrams drawn should be neat and properly labelled.

Section A

1. How does colostrum provide protection against diseases to newborn babies? [1]

2. Name the Indian variety of rice patented by an American company. [1]

3. State the function of pyrogens. [1]

4. Name two cloning vectors. [1]

5. What is a palindromic nucleotide sequence? [1]

Section B

6. What is terror of Bengal? [2]

7. What will be the genotypes of the parents if the offspring had phenotypes in the following proportion? [2]
(a) 9:3:3:1
(b) 1:1:1:1 (use the symbols Aa and Bb)

8. If the base sequence of one strand of DNA is CAT, TAG, TAC, GAC, what will be the base sequence [2]
(a) Of complementary DNA strand
(b) Of its complementary RNA strand

9. Name the infective stage of Plasmodium. Give any two symptoms of the disease caused by this pathogen. [2]

OR

RNA is the first genetic material. Highlight some facts and points about RNA.

10. *Bacillus thuringiensis* produces insecticidal protein. Why does this toxin not kill *Bacillus*? [2]

Section C

11. Draw a longitudinal section of a post-pollinated pistil showing the entry of the pollen tube into the mature embryo sac. Label the filiform apparatus, chalazal end, hilum antipodals, male gametes and secondary nucleus. [3]

OR

Draw a labelled sectional view of the seminiferous tubule of a human male.

12. Differentiate between spermatocytes and oocytes. [3]

13. During his studies on genes in Drosophila which were sex-linked, T. H. Morgan found that F_2-population phenotypic ratios deviated from the expected 9:3:3:1. Explain the conclusion he arrived at. [3]

14. [3]

(a) Construct a complete transcription unit with promoter and terminator on the basis of the hypothetical template strand given below:

(b) Write the RNA strand transcribed from the above transcription unit along with its polarity.

15. [3]

(a) Sickle cell anaemia in humans is a result of point mutation. Explain.

(b) Write the genotypes of both parents who have produced a sickle cell anaemic offspring.

16. List some symptoms of drug addicts. [3]

17. What is the significance of SCP? [3]

18. What are sticky ends? Why are they named so? [3]

19. How does the RNA interface help in developing resistance in tobacco plant against nematode infection? [3]

20. Explain the differences between the seral stage and the climax community during succession. [3]

21. Describe various techniques used in the control of gaseous pollutants. [3]

22. Explain mutualism with the help of any two examples. How is it different from commensalism? [3]

Section D

23. Ram is managing a dairy firm. He has been advised to use artificial insemination to overcome several problems in developing better breeds of cow. Govind has advised him MOET for herd improvement. Ram is ignorant and is not able to decide. How will you help Ram regarding [4]

(i) Which technique he should adopt?

(ii) What is the procedure of the new technique?

(iii) What is the advantage of this technique?

(iv) What values are reflected in it?

Section E

24. Describe briefly the structure of a monocotyledonous albuminous (maize) seed. [5]

OR

Describe briefly the structure of the human ovum.

25. What will happen [5]

(i) When complete sets of chromosomes are added to the diploid genome?

(ii) When individual chromosomes are added to or deleted from the diploid genome?

(iii) When a part of the chromosome is lost?

(iv) When a part of chromosome breaks and attaches to another non-homologous chromosome?

(v) When a part of the chromosome breaks and attaches to its homologue?

OR

Describe in brief the structure of transfer RNA.

26.

(a) Explain primary productivity and the factors which influence it.

(b) Describe how do oxygen and chemical composition of detritus control decomposition. [5]

OR

(a) Give the ecological adaptations of succulents.

(b) Define the following terms:

(i) Mimicry

(ii) Acclimatisation

(iii) Ectotherms

CBSE

Class XII Biology

Solution

Time: 3hrs **Total Marks: 70**

Section A

1. **Ans**
   Colostrum provides protection against diseases to newborns because it is rich in IgA antibodies.

2. **Ans**
   Basmati rice

3. **Ans**
   Pyrogens are released by WBCs in order to set the body's thermostat at a higher temperature.

4. **Ans**
   Plasmids and bacteriophages

5. **Ans**
   It is the sequence of base pairs which form the same words when read in both directions—forward and backward.

Section B

6. Ans

It is an aquatic plant called water hyacinth which propagates vegetatively at a phenomenal rate and quickly spreads all over the water body in a short span of time.

It causes depletion of oxygen in the water, ultimately resulting in the death of fish and other aquatic animals.

7. Ans

(a) Because the ratio of the offspring is 9:3:3:1, it reveals the law of independent assortment of genes. The genotype of the parents will be Aa Bb and Aa Bb.

(b) Because the ratio of the offspring is 1:1:1:1, it exhibits the ratio of a test cross where one of the parents will be recessive. So, the genotype of the parents will be AaBb $\times$ aabb.

8. Ans

(a) The complementary bases of the DNA strand will be GTA, ATC, ATG, CTG.

(b) The complementary bases of the RNA strand will be GUA, AUC, AUG, CUG.

9. Ans

Infective stage: Sporozoite

Symptoms:

(i) Headache and nausea

(ii) Chill and shivering, followed by an outbreak of fever. Fever subsides with profuse sweating.

OR

RNA is the first genetic material. All the essential life processes such as metabolism, translation and splicing revolve around RNA. RNA is used as genetic material and a catalyst. Being a catalyst, it is reactive but unstable.

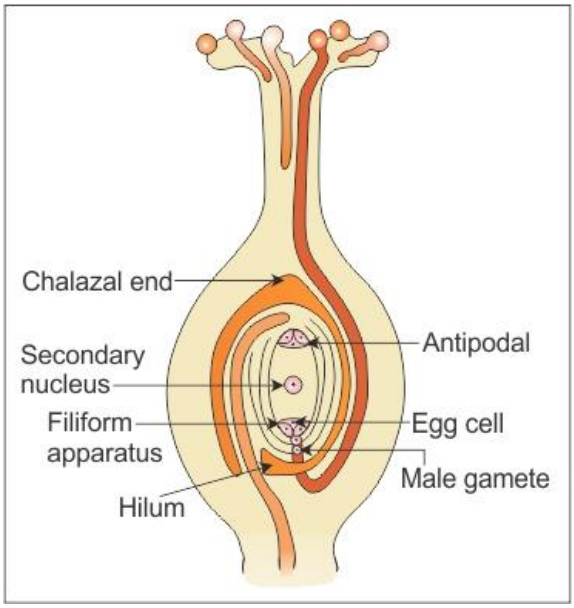
10. Ans

The insecticidal protein (Bt toxin) exists as an inactive protoxin. When an insect ingests the inactive toxin, it is converted to an active form of toxin because of the alkaline pH of the gut which solubilises the crystals of the protein. Thus, this toxin does not kill *Bacillus*.

Section C

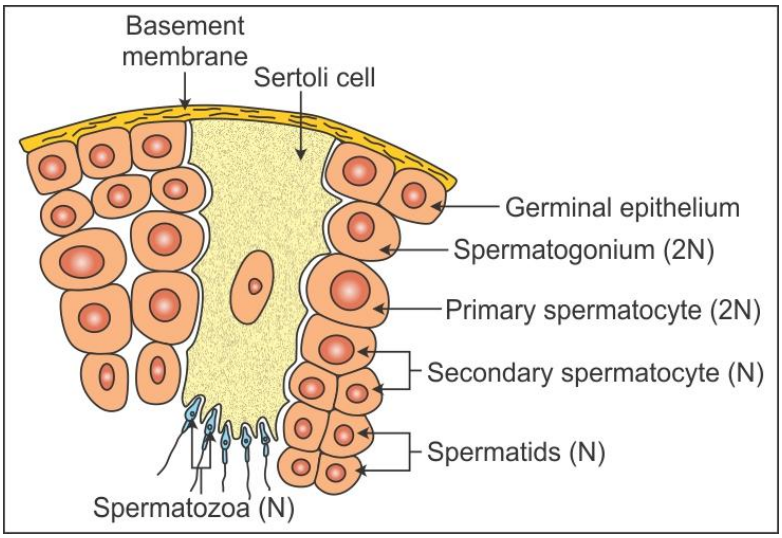
11. Ans

Longitudinal section of a post-pollinated pistil:



OR

Sectional view of the seminiferous tubule of a human male:



12. Ans

Differences between spermatocytes and oocytes:

Spermatocytes	Oocytes
(i) These are formed when the spermatogonia in the seminiferous tubules of the testes divide mitotically. Each spermatogonium undergoes mitosis and forms two primary spermatocytes.	(i) These are formed in the Graafian follicles of the ovary. Each maturing Graafian follicle contains a diploid primary oocyte at its centre.
(ii) Each primary spermatocyte undergoes meiosis I and forms two haploid secondary spermatocytes.	(ii) Each primary oocyte undergoes meiosis I and forms two haploid cells- secondary oocyte and small polar body.
(iii)The secondary spermatocytes undergo meiosis II and form haploid spermatids.	(iii) The secondary oocyte undergoes meiosis II and forms one ovum and polar body.

13. Ans

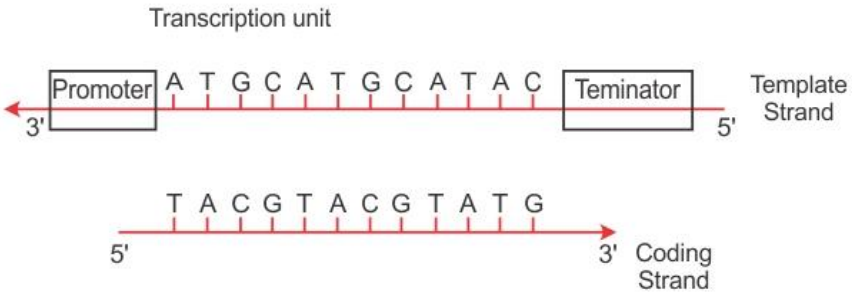
(a) Genes on the same chromosomes are closely associated and are called linked genes. He discovered the process of linkage. The genes could be far apart.

(b) When genes are linked, the percentage of the parental combination is higher than recombinants.

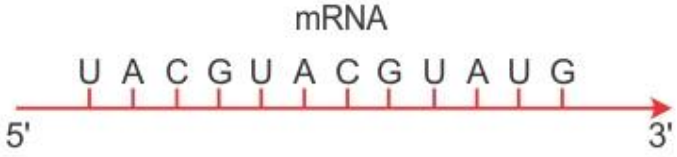
(c) When genes are not linked or loosely linked or far apart, the percentage of the parental combination is less than the recombinants.

14. Ans

(a)



(b) *RNA strand transcribed from the above transcription unit:*



15. Ans

(a) Sickle cell anaemia in humans is a result of a point mutation in which there is a single base change at the sixth position of the β-chain of haemoglobin where glutamic amino acid is substituted by valine.

(b) The genotypes of both parents would be Hb^A Hb^S and Hb^A Hb^S. Marriage between two carriers produces affected carriers and normal children. So, the ratio produced will be 1:2:1, i.e. one child will be normal, two will be disease-free, but carriers, and one will be affected.

16. Ans

Symptoms of drug addictions:

(i) Drowsiness, disturbances in sleep, pale looking eyes, irritation and undue excitement.

(ii) Lack of interest in studies and work, increasing demand for money and socially inactive.

(iii) Loss of weight and appetite, poor memory, weakness and always looking tired.

17. Ans

Significance of SCP:

(i) SCP is rich in high-quality protein and is rather poor in fats; hence, it is a valuable supplement in human diet. Its use bridges the gap between the requirement and supply of proteins in human diet.

(ii) It reduces the pressure on agricultural production systems for the supply of required proteins.

(iii) SCP production based on industrial effluents helps in reducing environmental pollution.

18. Ans

Restriction enzymes cut the DNA duplex at specific points. There single-stranded free ends are called sticky ends.

These are named so because they can be joined end to end by DNA ligases.

19. Ans

A nematode (*Meloidogyne incognita*) infects the roots of tobacco plants and affects its yield. So, to prevent this infestation, the RNA interference (RNAi) process is adopted. Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA produces sense and antisense RNA in the host cells. These two RNAs, being complementary to each other, form a double-stranded RNA which binds to and prevents the translation of mRNA

(silencing) of the nematode. The parasite will not survive in a transgenic host expressing specific interfering RNA. The transgenic plant therefore gets itself protected from the parasite.

20. Ans

Seral	Climax
(i) The species composition at the seral stage is determined by habitat conditions. (ii) Size of individuals remains small. (iii) Ecological niches are few and generalised.	(i) The species composition at the climax stage is determined by the regional climate, local conditions, soil, topography and water availability. (ii) Size of individuals remains large. (iii) Ecological niches are many and specialised.

21. Ans

The various techniques used in the control of gaseous pollutants are

(i) Combustion: In this process, oxidisable gaseous pollutants are completely burnt at a high temperature. Petrochemical, fertiliser, paints and varnish industries use combustion control of gaseous pollutants.

(ii) Absorption: In this technique, gaseous pollutants are absorbed in suitable absorbent material.

(iii) Adsorption: This technique is applied to control toxic gases, vapours and inflammable compounds which are not efficiently removed or transferred by the aforesaid techniques. Such air pollutants are adsorbed on large solid surfaces.

22. Ans

Mutualism is the relationship between two organisms where both are benefited for food, shelter and substratum for attachment. Two examples are

(i) Mycorrhizae are the mutualistic relationship between fungi and the roots of higher plants. The fungi help in mineral nutrition of the plant with which they are associated and obtain in turn carbohydrates from the plant.

(ii) The association of *Trichonympha* and termites is symbiotic. *Trichonympha* lives in the gut of termites and digests the cellulose of wood for them and in turn termites provide food, shelter and constant internal environment to *Trichonympha*.

Commensalism is an interaction between two organisms where one is benefited and the other is neither harmed nor benefited. Example: The sucker fish bears a sucker on the dorsal side of its head which helps it to attach itself

to the body of the shark. It benefits the sucker fish with free transport and free food left behind by the shark.

Section D

23. Ans

(i) MOET (Multiple Ovulation Embryo Transfer) as success rate of this technique is more.

(ii) In this method, hormones with FSH-like activity are given to the cow for inducing follicular maturation and superovulation—instead of one egg, a cow produces 6–8 eggs. The animal is mated. The fertilised eggs are recovered and transferred to a surrogate mother.

(iii) Advantages of MOET:
   (a) Herd size is increased in a short time.
   (b) The genetic mother is available for another round of superovulation.

(iv) Values:
   (a) Critical thinking
   (b) Problem solving

Section E

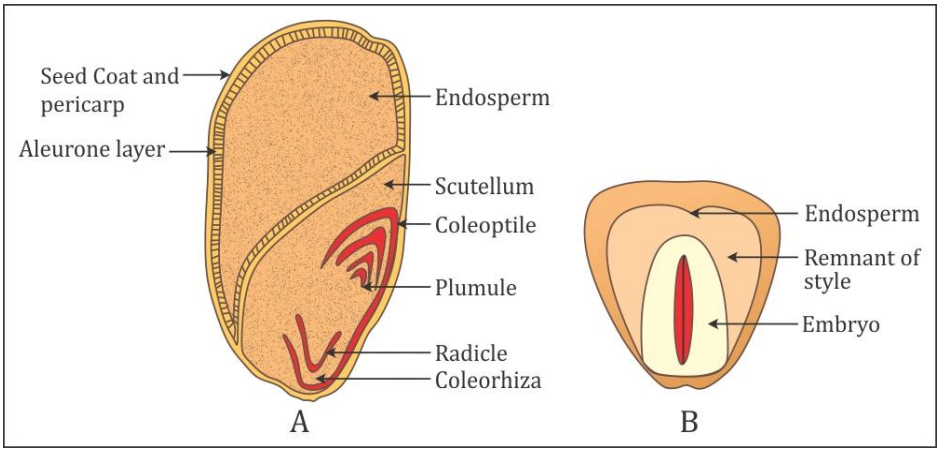
24. Ans.

Structure of monocotyledonous albuminous seed:

(i) Seed coat: It is a thin layer which surrounds the whole grain. It is a single-seeded fruit where the seed coat is fused with the fruit wall.

(ii) Endosperm: It occupies the larger part towards the rounded end. It is filled with stored food, mainly starch. It is surrounded by a sheath of special tissue called the aleurone layer. It contains abundant protein.

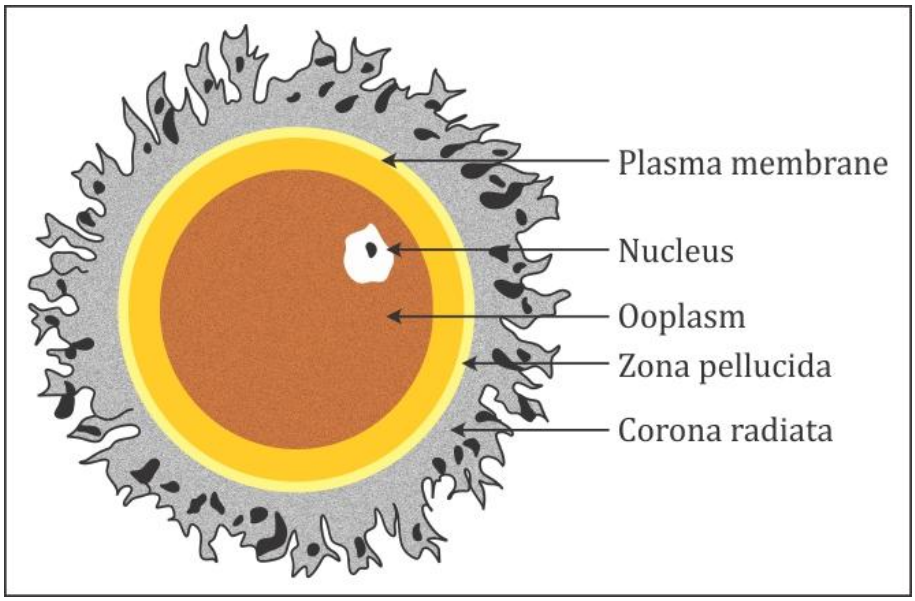
(iii) Embryo: The embryo consists of a single cotyledon called the scutellum. It is thin, small and without food. It has secretory epidermal tissues which are in direct contact with the endosperm for the absorption of nutrition. The region of the embryonic axis below the cotyledon is the radicle covered with a protective sheath called the coleorhiza. Above the point of attachment of the cotyledon, the embryonic axis becomes the plumule which is enclosed by a leaf-like covering called the coleoptile.



OR

The human ovum is a rounded haploid structure which lacks the yolk (alecithal). It is non-motile, containing an eccentric located nucleus with bulk of the cytoplasm. The nucleus of an ovum is called the germinal vesicle and it contains a prominent nucleolus. The cytoplasm is called ooplasm and is surrounded by a vitelline membrane and again by a transparent, thick and non-cellular layer called the zona pellucida. The vitelline membrane is very thin and transparent, and there lies a narrow previtelline space between the vitelline membrane and the zona pellucida. Outside the zona pellucida, there is a thick coat of radially elongated follicle cells called cellular corona radiata. These follicle cells are attached together by hyaluronic acid (a mucopolysaccharide) which acts as a barrier for the entry of sperms. The

ovum has polarity—the side of the ovum which extrudes the polar bodies and has a nucleus is called the animal pole, while the opposite side is called the vegetal pole.



25. Ans

(i) Euploidy will occur. Wheat is an example of polyploidy (hexaploid) with 42 chromosomes (6 times of a normal haploid, N = 7).

(ii) Aneuploidy will occur. It may be trisomic when the diploid organism bears one chromosome extra (2N + 1) or monosomic when the diploid has a loss of one chromosome (2N − 1). Down's syndrome is the best known example of aneuploidy.

(iii) Deletion. Cri-du chat syndrome.

(iv) Translocation will occur. In certain leukaemias, such as chronic myeloid leukaemia (CML), the malignant cells have the chromosome 22 shortened because of the translocation of a piece of its long arm.

(v) Inversion will occur. It produces unbalanced meiotic products, thus leading to sterility.

OR

Structure of transfer RNA

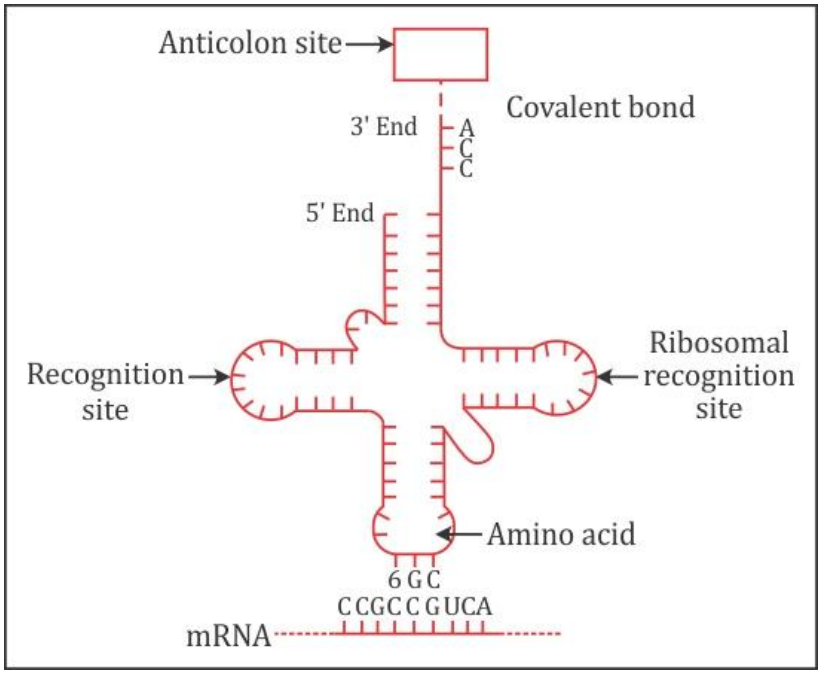
It is soluble RNA and constitutes 10–12% of the total RNA in the cell cytoplasm. It has four main sites:

(i) Amino acid binding site (tail): The 3′ end of the molecule carries a specific amino acid with the CCA base sequence having –OH at the tip. This site is responsible for the attachment of the activated amino acid with its free –OH group and COOH of the amino acid.

(ii) Recognition site or dihydrouridine loop (DHU): It contains a specific base sequence and charging enzymes which catalyse the attachment of the correct amino acid to the t-RNA molecule.

(iii) Anti-codon site: It contains three unpaired ribonucleotides complementary with the codon on mRNA. It determines the correct pairing of t-RNA with the specific codon on mRNA.

(iv) Ribosome recognition site (T ψ C): It is meant for binding the t-RNA with the ribosome. It is made of seven nucleotides and is overlapped on the DHU loop, thus t-RNA appears L-shaped in a 3-D structure.



26. Ans

(a) Primary productivity is the rate of biomass or organic matter produced per unit area by plants during photosynthesis. It is expressed in terms of g m^{-2} yr^{-1} or kcal m^{-2} yr^{-1}.

Factors influencing primary productivity are

(i) Solar radiation: Sunlight is the ultimate source of energy. Maximum light is available in the tropics, whereas the poles receive minimum light. Thus, photosynthesis and net primary productivity are maximum in the tropics and average in the temperate forests. Productivity in an aquatic ecosystem is less than that in a terrestrial ecosystem. It is limited by light which decreases with increasing water depth.

(ii) Temperature: Temperate forests have lesser productivity than tropical rainforests because of the cold climate which severely limits primary productivity.

(iii) Nutrients: Nutrients are essential for the growth of producers. Nitrogen is deficient in oceans which limits the productivity in marine ecosystems. Desert soils are deficient in nutrients and therefore are less productive. Estuaries and coral reefs are highly productive as the nutrient supply is rich. Decomposition is largely an oxygen-requiring process. The rate of decomposition is controlled by the chemical composition of detritus and climatic factors. The decomposition rate is slower if the detritus is rich in lignin, cellulose and chitin, and quicker if the detritus is rich in nitrogen and water-soluble substances like sugars. Availability of oxygen determines the aerobic and anaerobic types of decomposers. Anaerobic decomposers carry out partial or incomplete decomposition, whereas aerobic decomposers decompose the detritus completely.

OR

(a) Succulents are also called drought-resistant plants. They have the following adaptations:
   (i) They have fleshy organs to store large amounts of water.
   (ii) They have fleshy stems which are green and photosynthetic with leaf scales or leaf spines.
   (iii) They have a thick cuticle and sunken stomata which open during the night only.

(b)
   (i) Mimicry: It is the superficial but the close resemblance of one organism to another or to the natural objects among which it lives that secures its concealment, protection or some other advantage.
   (ii) Acclimatisation: Acclimatisation is the gradual physiological adjustments to slow-changing environmental conditions.
   (iii) Ectotherms: Cold-blooded animals whose body temperature tends to match with the environmental temperature in which they live are called ectotherms.