

# Answers to RSPL/1

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1. Lysine and Arginine
2. The RNA intermediate produced by transposons bind to and inhibit the translation of a specific segment of mRNA.
3. (a) Water hyacinth  
(b) *Agave*
4. Smoking increases the carbon monoxide content of the blood, which reduces the concentration of haem-bound oxygen; hence there is oxygen deficiency in their body.
5. (i) A true-breeding line has undergone continuous self-pollination inbreeding.  
(ii) It shows stability in the inheritance of the trait for several generations.
6. (a) Gametogenesis and gamete transfer.  
(b) (i) There is great synchrony between the two sexes, i.e. they release the mature gametes simultaneously.  
(ii) They release a large number of gametes in the surrounding medium (water) to enhance the chances of syngamy.
7. (i) Lemur  
(ii) Bobcat
  - Australian marsupials as well as placental mammals have undergone adaptive radiation.
  - When more than one adaptive radiation appeared to have occurred in an isolated geographical area, there is convergent evolution; hence certain marsupials and placental mammals resembling each other occupy the same habitat.
8. The important components of Poultry Farm Management include:
  - (i) Selection of disease-free and suitable breeds.
  - (ii) Proper and safe farm conditions.
  - (iii) Proper feed and water.
  - (iv) Hygiene and health care.

**Or**

- Primary treatment involves only physical processes, i.e. filtration and sedimentation.
- It is the physical removal of large and small particles present in the sewage, in a step-wise manner.
- At first, the floating debris is removed by sequential filtration.
- It is followed by the sedimentation of grit (soil and small pebbles).
- All solids settle to form the primary sludge, while the supernatant (effluent) is taken for secondary treatment.

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*Biology – 12*

9. (a) Carbon dioxide and nitrogen
- (b) (i) It causes inflammation of cornea (snow-blindness)
- (ii) It also causes cataract.
10. (a) (i) In biological control, only the harmful organisms are killed, whereas chemical methods kill both useful and harmful life forms.
- (ii) There is no pollution of the environment in biological control, whereas air, soil and ground water are polluted in the chemical methods.
- (b) (i) Hill bunt and (ii) leaf and stripe rust.
11. – After entering the body of a person, the virus enters the macrophages.
- The viral genome (RNA) undergoes replication and reverse transcription to become viral DNA with the help of reverse transcriptase.
  - The viral DNA gets incorporated into the DNA of the cells and directs these cells to produce virus particles.
  - The macrophages function as HIV factory and produce a number of HIV particles.
  - These HIV particles move out of macrophages and infect the helper T-lymphocytes and replicate to produce progeny viruses.
  - The progeny viruses released in the blood attack new helper T-cells.
  - This process is repeated and there is a progressive decrease in the number of helper T-cells; hence, the immune system weakens.
12. The outbreeding devices are as follows:
- (i) Self-incompatibility is the genetic mechanisms that prevents self-pollen from fertilising the ovule by inhibiting pollen germination or retarding the growth of pollen tube.
- (ii) Certain plant species produce male and female flowers on different plants, i.e. the plants are dioecious; this prevents both autogamy and geitonogamy.
- (iii) Pollen release and stigma receptivity are not synchronised; either the anthers mature first on the pistil/gynoecium matures first.
- (iv) The anthers and stigma of a flower are placed in such a way that the pollen of the flower cannot fall on the stigma of the same flower. (any three)
13. Pleiotropy is a phenomenon, where a single gene controls more than one phenotypic effect.
- In garden pea, a single gene controls the shape of seed and the size of starch grains in the seed.

- The genotype BB produces round seeds with large starch grains, bb produces wrinkled seeds with small starch grains and Bb produces round seeds with intermediate size starch grains.
- It shows that the alleles show true dominance for seed shape, but incomplete dominance for size of starch grains.

14.

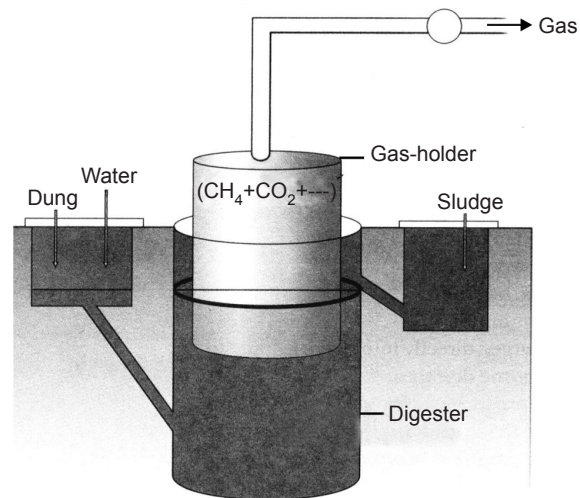


Fig. A Typical Biogas Plant

- It is advantageous to have biogas plants in rural areas where cattle dung is available in large quantities as cattles are used for various purposes.

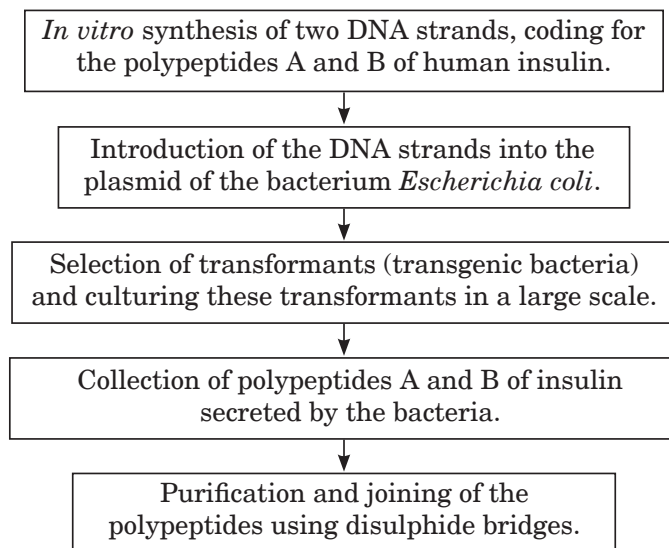
### 15. Advantages of GMO:

- (i) Genetic modification has made the crops more tolerant to abiotic stresses like cold, heat, drought, salinity, etc.
  - (ii) It has reduced the dependence of crops on chemical pesticides as they are made pest-resistant.
  - (iii) Post-harvest losses are much reduced.
  - (iv) These plants have increased efficiency of mineral usage and hence, the early exhaustion of soil fertility is prevented.
  - (v) Food produced from GM crops have enhanced nutritional value. *(any four)*
- (b) Rosie is the first transgenic cow
- Her milk contains human protein, alpha-laetalbumin (2.4 g/litre), which is a more balanced product for human infants than other normal cow milk.

**Or**

The main challenge was getting the two polypeptides assembled into functional insulin.

**Steps in Insulin production**



16. (a) – Lichens are the pioneer species.
- They secrete certain acids, which help in weathering of rocks and soil formation.
  - This gives way to small plants like bryophytes, which can take hold in the small amount of soil.
- (b) Gaseous cycle and sedimentary cycle.
17. (a) (i) *Spirulina* is a food rich in proteins, minerals, vitamins, carbohydrates and healthier fats.
- (ii) Since *Spirulina* can be cultured on cheap and waste materials like animal manure, waste water from potato processing units, molasses etc., there is reduction in pollution from these sources.
- (b) South Indian sugarcane: *Saccharum officinarum*  
North Indian sugarcane: *Saccharum barberi*.
18. (a) George Gamow.
- There are only four bases, which have to code for 20 amino acids.
  - If the codon will have a combination of three nucleotides, a permutation combination of  $4^3$  ( $4 \times 4 \times 4$ ), would generate 64 codons, i.e., many more codons than the required number for the 20 amino acids.
- (b) The untranslated regions are located before the initiation codon at the 5' end and after the termination codon at the 3' end.

**19. Three features of a cloning vectors:**

(i) Origin of Replication (Ori)

- This is the sequence of DNA from where replication starts.
- Any piece of alien/foreign DNA linked to it, is made to replicate within host cell; it also decides the copy number of the linked DNA.

(ii) Selectable marker

- A marker is a gene, which helps in selecting the transformants/recombinants from the non-recombinant ones, e.g. ampicillin and tetracycline resistant genes in *E.coli*.

(iii) Cloning site

- The vector should have a few, preferably one unique recognition site to link the foreign DNA; presence of a particular cloning/recognition site enables the particular restriction enzyme to cut the vector DNA.

**20. (a) It is a sex-linked trait.**

(b) Parents: Mother—  $XX^t$ , Father—  $X^tY$

Third child—  $XX^t$

(c) – The mother is a carrier for the trait

- Since the gene for the trait is present on the X–chromosome and the male/son receives the X–chromosome from the mother, he shows the trait.

**21. (a) An ideal contraceptive should be:**

(i) user friendly

(ii) easily available

(iii) reversible

(iv) effective with no or least side effects.

(v) non-interfering with the sexual drive/desire and the sexual act of the user.

(b) CuT, Cu 7, multiloader 375.

(any two)

**22. (a) The bacterium was used for cloning the recombinant plasmid DNA.**

(b) – Cohen and Boyer were the first to construct a recombinant DNA (rDNA) molecule.

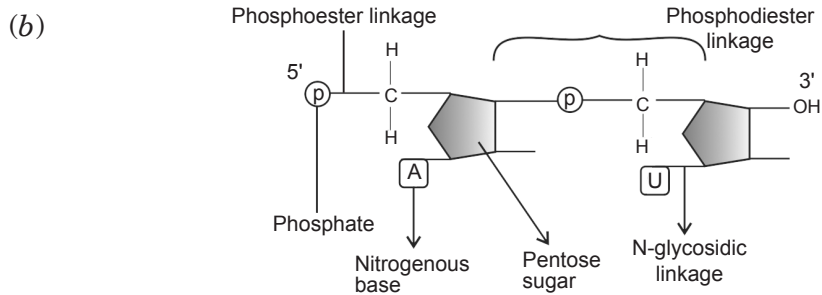
- They isolated the antibiotic-resistance gene by cutting out a piece of DNA with the help of a restriction endonuclease enzyme and linked it with a native plasmid of *Salmonella typhimurium* with the help of DNA-ligase.

- This recombinant DNA (rDNA) was introduced into *Escherichia coli* for multiplication to make many copies.

23. (a) In the sanitary landfill, wastes are dumped in a trench or depression and after compaction, it is covered with dirt/mud everyday.
- (b) (i) The amount of garbage generated, especially in metros is so much that the landfills are getting filled very fast.
- (ii) There is also danger of seepage of chemicals, which can pollute the underground water resources.
- (c) – The best way is to reduce the generation of garbage.
- The wastes have to be segregated into bio-degradable, recyclable and non-biodegradable ones.
  - The biodegradable wastes must be used for making manure for plants.
  - Recyclable ones have to be used for making new articles.
  - The non-biodegradable ones pose problems; hence, we must judiciously reduce or stop using them.

24. (a) Avery, MacLeod and McCarty.

- They purified biochemicals like proteins, DNA and RNA from the heatkilled S-cells.
- When these fractions were added individually to the culture of live R-cells, DNA was able to cause transformation of R-cells into S-cells.
- They also found that protein-digesting enzymes and RNA-digesting enzymes did not affect transformation, indicating that transforming substance is not a protein or RNA.
- Digestion with DNase did inhibit transformation; this suggests that the DNA caused transformation.



**Or**

- (a) – There were many varieties of these small black birds in the Galapagos islands.
- Darwin reasoned that after originating from a common ancestral seed-eating stock, the finches must have radiated to different geographical areas and undergone adaptive changes, especially in their beaks, enabling some of them to become insectivorous.

- Living in isolation for a long time, new kinds of finches much have evolved, which could survive in the new habitats.

**(b) Industrial Melanism:**

- In England, before Industrial revolution, there were more white-winged or dull-grey moths on the tree trunks, than the dark-winged or melanic moths.
- In the collection of moths, carried out in the same area after Industrial revolution, there were more dark-winged moths.
- The explanation given for this observation was that predators will spot a moth against a contrasting background.
- During the post-industrialisation period, the trunks became dark with the industrial smoke and soot.
- Under this condition, white-winged moths did not survive as predators could easily spot these, while dark-winged or melanic moths survived better.
- Before industrialisation, there used to be a thick growth of the almost white-coloured lichens on the tree trunks and in that background, the white-winged moths survived better; the dark-coloured moths were easily spotted and picked up by their predators.
- In this case, the moths which were able to camouflage and hide in the background survived and increased their population size through reproduction.

25. (a) In interference competition, the feeding efficiency of one species might be reduced just by the interfering and inhibitory presence of another species, even if resources are not limiting, e.g. the Abingdon tortoise in Galapagos islands became extinct within a decade due to the introduction of goats, whose browsing efficiency was greater than the tortoise.

- (b) – In summer, we sweat profusely and the evaporation of the sweat causes a cooling, to maintain the body temperature.
- In winters, we shiver; shivering is a form of exercise which produces heat and raises the body temperature.

(c)

<b>Mutualism</b>	<b>Commensalism</b>
– It is an interspecific interaction, in which both the partner species are benefitted. e.g. In the association between <i>Rhizobium</i> bacterium and leguminous plants, the bacterium fixes atmospheric nitrogen and makes it available to the leguminous plants; in return, it gets food and shelter from the root.	– It is an interspecific interaction in which one of the species is benefitted and the other is neither benefitted nor harmed. e.g. In the association between an orchid plant growing on a mango tree, the orchid plant gets shelter on the mango tree, but the mango tree is neither benefitted nor harmed.

Or

(a)	<b><i>In situ</i> Conservation</b>	<b><i>Ex situ</i> Conservation</b>
	<ul style="list-style-type: none"><li>– It is the method of protecting the endangered species of plants or animals in the natural habitat, either by protecting or cleaning up the habitat itself or by defending the species from predators.</li><li>– It helps in recovering populations in the surroundings where they have developed their distinct features.</li></ul>	<ul style="list-style-type: none"><li>– It is the method of protecting the endangered species of plants or animals by removing them from the unsafe or threatened habitat and placing them in special settings, where they can be protected and given special care.</li><li>– It helps in recovering populations or preventing their extinction by keeping under simulated conditions that closely resemble their natural habitats.</li></ul>

(b)	<b>Narrowly utilitarian</b>	<b>Broadly utilitarian</b>
	<ul style="list-style-type: none"><li>– These arguments are obvious ones; humans derive a number of direct economic benefit from nature like food, industrial products, medicinal substances, fibres, firewood, etc.</li></ul>	<ul style="list-style-type: none"><li>– These arguments account for the role of ecosystem services that nature provides e.g. oxygen production during photosynthesis, pollination of crops (without which fruits and seeds cannot be produced), or enjoying the song of a bulbul, etc.</li></ul>

(c) Africa – Quagga

Australia – Thylacine

26. (a) – The primary endosperm nucleus of the primary endosperm cell undergoes repeated mitotic divisions, to give rise to a number of free nuclei; at this stage, the endosperm is called free nuclear endosperm.
- Subsequently, cell wall formation starts from the periphery and the endosperm becomes cellular.
  - The water in the tender coconut represents the nuclear endosperm, while the white kernel represents the cellular endosperm.

(b)	<b>Perisperm</b>	<b>Endosperm</b>
	<ul style="list-style-type: none"><li>– It is the remnant of nucellus, formed in the ovule before fertilisation.</li><li>– The cells are diploid, eg. black pepper, beet.</li></ul>	<ul style="list-style-type: none"><li>– It is the product formed from the primary endosperm cell, in the ovule after fertilisation.</li><li>– The cells are triploid, eg. castor, maize.</li></ul>

(c) Polyembryony is the phenomenon of occurrence of more than one embryo in a seed e.g. *Citrus*.



**Or**

- (a) – Each primary oocyte becomes surrounded by a layer of granulosa cells and becomes a primary follicle.
- It becomes surrounded by more layers of granulosa cells and a theca; it is now called a secondary follicle.
  - The secondary follicle transforms into a tertiary follicle, with the development of a fluid-filled cavity, called antrum, around the primary oocyte.
  - The theca becomes organised into an outer layer, the theca externa and an inner layer, the theca interna.
  - At this stage the primary oocyte grows in size and completes meiosis I and forms a larger cell, the secondary oocyte and a smaller cell, the first polar body.
  - The tertiary follicle grows further and changes into a mature Graafian follicle.
  - The secondary oocyte secretes a new membrane, called zone pollicida, around it.
  - At this stage, the follicle ruptures and releases the secondary oocyte (ovum); this process is called ovulation.

<b>Menarche</b>	<b>Menopause</b>
– Menarche refers to the beginning of menstruation at puberty in primate/human females. – It marks the beginning of reproductive period.	– Menopause refers to the stoppage/cessation of menstruation and menstrual cycle at the age of about 45-50 in human females. – It marks the end of reproductive phase.