

# Answers to RSPL/3

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1. The cow is administered FSH-like hormone, to induce follicular maturation and super ovulation, i.e. to produce 6-8 eggs per cycle instead of the normal one.
2. It is signed to control the emission of ozone-depleting substances, like CFCs.
3. Disturbance in genetic equilibrium, i.e. change of frequency of alleles in a population, would be considered as an evolutionary change.
4. Diplontic life cycle and haplo-diplontic life cycle.
5. – The male honey bee develops parthenogenetically, from an unfertilised ovum; hence, it is haploid with 16 chromosomes.  
– The female honey bee develops from a fertilised ovum (zygote); hence, it is diploid with 32 chromosomes.
6. – Annuals are those plants, which complete their life cycle in one season, e.g. mustard, wheat, rice.  
– Biennials are those plants, which complete their life cycle in two seasons, i.e., they are vegetative in the first season and reproduce in the second season, e.g. carrot, raddish.
7. Mendel's work remained unrecognised for the following reasons:
  - (i) His work could not be widely publicised as communication was not easy.
  - (ii) His concept of 'factors' as stable and discrete units that controlled the expression of traits and that the pair of alleles which did not blend with each other, were not accepted by his contemporaries as the explanation of variation.
  - (iii) Mendel's approach of using mathematical logic to explain the biological phenomena was new and unacceptable to many biologists.
  - (iv) Though Mendel's work suggested that factors were discrete units, he could not provide any physical proof for the existence of factors or prove what they are made of.
8. (a) The infection can be determined either by the antigens that have entered the body or by the antibodies formed in the body.  
(b) GEAC is set up
  - (i) to have some ethical standard to evaluate the morality of human activities that help or harm living organisms.
  - (ii) to have a regulation because genetic modifications may have unpredictable results, when such GMOs are introduced into the ecosystem.

9. – Ecologists believe that ecosystems with more species diversity tend to be more stable than those with less species diversity.
- A stable community does not show too much variation in productivity from year to year and it is resistant to invasion by alien species and is resistant to occasional natural or man-made disturbances.
  - Tilman found that his experimental outdoor plots showed less year-to-year variation in total biomass and increased biodiversity contributed to higher productivity.
10. (i) Increased concentration of carbon dioxide, leading to global warming.  
(ii) Loss of biodiversity due to habitat destruction.  
(iii) Soil erosion.  
(iv) Disturbance to hydrological cycle.  
(v) Desertification in extreme cases.

**Or**

- (a) Earthworm is considered a farmer's friend because
- (i) it breaks down detritus into smaller particles in the process of fragmentation and adds to soil fertility.
  - (ii) it loosens the soil, to give better aeration to the roots.
- (b) A considerable amount of gross primary productivity is used by the plants in respiration; so not all primary productivity is available for consumers.
11. (a) In wind pollinated flowers,
- (i) The stamens are well-exposed, so that pollen grains are easily dispersed in wind currents.
  - (ii) The stigma is large and often feathery, to easily trap the air-borne pollen grains.
  - (iii) The pollen grains are light and non-sticky, to be transported in wind currents.
  - (iv) Pollen grains are produced in enormous quantity.
  - (v) Numerous small flowers are packed into an inflorescence.
  - (vi) There is a single ovule in the ovary of these flowers.
- (b) Cleistogamous flowers are the bisexual flowers which do not open all even at maturity; the anthers and stigma lie close to each other and self pollination is effected easily.
12. The two methodologies are:
- (i) Expressed Sequence Tags, focuses on identifying all the genes that are expressed as RNAs.
  - (ii) Sequence Annotation, is to simply sequence the whole set of genome, which includes all the coding and non-coding sequences and then assigning functions to different regions in the sequence.

13. (a) *Trichophyton, Epidermophyton Microsporium* (any two)

Symptoms

- (i) Dry, scaly lesions on the body parts like skin, scalp and nails.
  - (ii) The lesions are accompanied by intense itching.
- (b) An amnestic response is elicited, during second or subsequent encounters of the body with the same pathogen; it is due to the memory of the immune system of the first encounter with the same pathogen.

**Or**

*Plasmodium* enters the human body as sporozoite.

- When an infected female *Anopheles* mosquito bites a person, the sporozoites are injected into the body.
- They reach the liver cells through blood.
- The parasite reproduces asexually in the liver cells and by the bursting of liver cells, new cells are released into the blood.
- They enter the red blood cells (RBCs) and reproduce asexually; by bursting the red blood cells, the cells of the parasite release haemozoin, which causes the cycles of fever, chill and shivering.
- The released parasite cells infect new red blood cells; some continue the asexual reproduction and cause the cycles of fever.
- Others enter the sexual stage and form gametocytes in the RBCs, which are picked by the *Anopheles* mosquito, along with the blood meal.

**14. Insect-resistant crops:**

- The bacterium *Bacillus thuringiensis* produces proteins, called Bt toxins, which kill the larvae of some insects.
- The Bt toxin gene has been isolated and cloned in bacteria.
- Such genes are introduced into crop plants, which could be expressed in plants to provide resistance to the insects, i.e. they function as biopesticides; so there is no need for insecticides.
- Bt toxins are insect group-specific and coded by *cry* genes; the proteins encoded by genes *cryIAc* and *cryIIAb* control cotton bollworms while *cryIAb* controls corn borer.
- When the insect larvae ingest any plant part, the toxin becomes active in the alkaline pH of the gut and kills the insect pest.
- So such plants are resistant to pests.

15. Gause's competitive exclusion principle states that two closely-related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated.

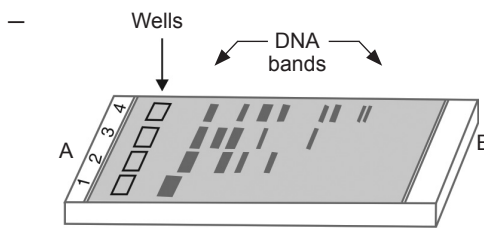
16. (a) The function of reservoir is to make up for the deficit which occurs due to imbalance in the rate of influx and efflux.
- (b) (i) Pyramid of number in a tree ecosystem.  
(ii) Pyramid of biomass is an aquatic ecosystem.
- (c) Climax community is the final community established in the ecological succession, which is in near equilibrium with the environment.
17. (a) Dr. M.S. Swaminathan
- (b) The steps in developing a new genetic variety of crop are:
- (i) Collection of genetic variability or germplasm.  
(ii) Evaluation and selection of parents  
(iii) Cross-hybridisation among the selected parents.  
(iv) Selection and testing of superior recombinants or hybrids.  
(v) Testing, release and commercialisation of new cultivars.
18. (i) The Nile perch introduced into Lake Victoria in East Africa caused extinction of more than 200 species of cichlid fish in that lake.
- (ii) *Parthenium*, *Lantana* and *Eichhornia* caused environmental damage and posed threat to many species in our country.
- (iii) Illegal introduction of African catfish, *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.
19. (a) Outbreeding refers to the breeding of unrelated animals, either of the same breed or of different breeds or even of different species.
- It is accomplished by
- (i) Outcrossing  
(ii) Cross breeding  
(iii) interspecific hybridisation
- (b) Catla, Rohu, Common carp (any two)
20. – Transcription unit in a bacterium consists of a promoter, structural genes, terminator and the enzyme DNA-dependent RNA-Polymerase.
- In bacteria, there is a single RNA polymerase, which catalyses transcription of all the three types of RNAs (mRNA, tRNA and rRNA)
- It binds transiently with the initiation factor (or sigma), binds to the promoter and initiates transcription.
- It also facilitates opening of the double helical DNA and only the DNA strand with 3' → 5' polarity is transcribed, as the enzyme can polymerise the nucleotides only in 5' → 3' direction; it catalyses elongation using the ribonucleotides.



- Microinjection is the method used for animal cells, where the foreign DNA is directly injected into the nucleus of the animal cell.
- (b) – *Agrobacterium* is the vector for plant cells.
- Retroviral Vectors are used for animal cells.

**Or**

- (a) – Gel electrophoresis
  - The DNA fragments are separated by electrophoresis using agarose gel as the matrix.
  - Since, DNA fragments are negatively charged, they move towards the anode under the electric fields through the medium and separate/resolve according to their size due to the sieving effect of agarose gel.
  - The separated fragments can be viewed by staining the DNA with ethidium bromide followed by exposure to UV radiation.
  - Elution is the process in which the separated bands of DNA are cut out from the gel and extracted.



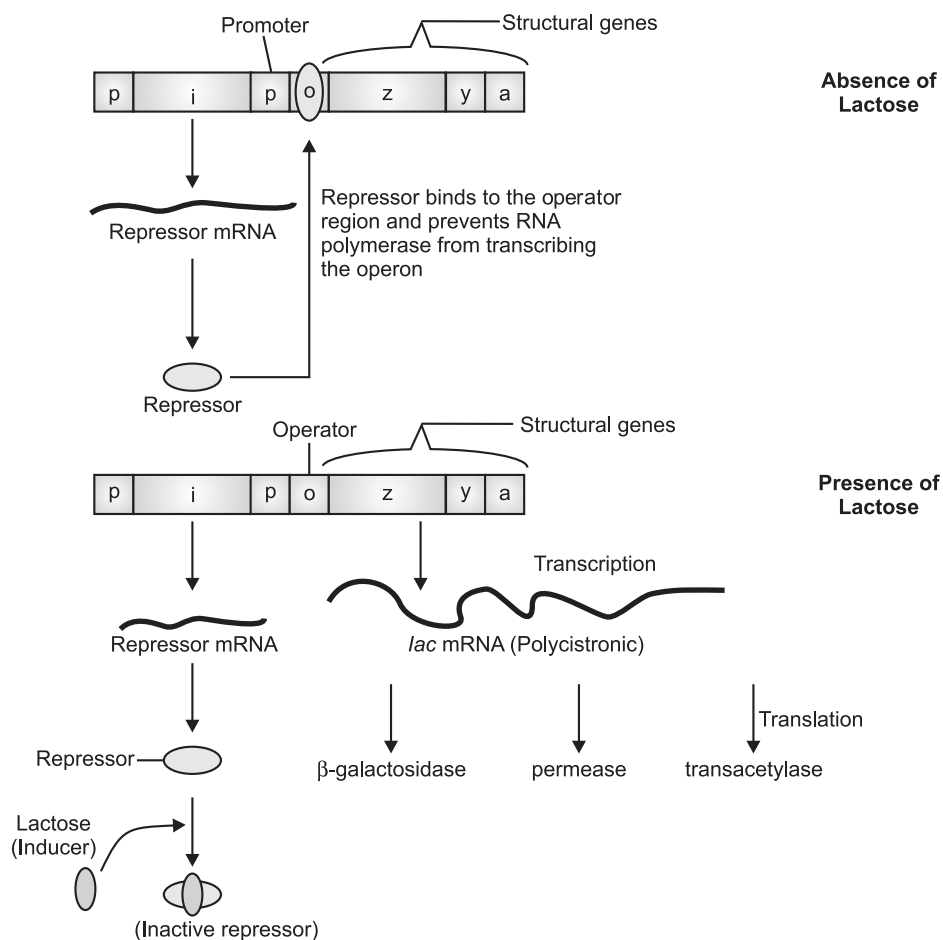
- (b) – In continuous culture system, the used culture medium is drained out from one side and fresh medium is added from the other side.
  - This system produces a larger biomass and leads to a higher yield of the product.
- (c) The DNA polymerase from *Thermus aquaticus* is thermostable and withstands the heat used in the denaturation step; hence, it can be used in a number of cycles of PCR.

25. (a)	<b>Polygenic inheritance</b>	<b>Multiple alleles</b>
	<ul style="list-style-type: none"> <li>– The character is controlled by more than one gene.</li> <li>– Each gene exists in two allelic forms.</li> <li>– The phenotype is produced by the cumulative or additive effect of all the genes.</li> <li>– The hybrid is intermediate between the two parents.</li> </ul>	<ul style="list-style-type: none"> <li>– The character is controlled by a single gene.</li> <li>– The gene exists in more than two allelic forms.</li> <li>– The alleles may be dominant, recessive and codominant.</li> <li>– The hybrid resembles both the parents.</li> </ul>

- (b) (i) Morgan attributed it to linkage, i.e., the physical association between the genes on a chromosome, which tend to be inherited together.

(ii) The genes which he studied were located on the X-chromosome, i.e., they are sex-linked.

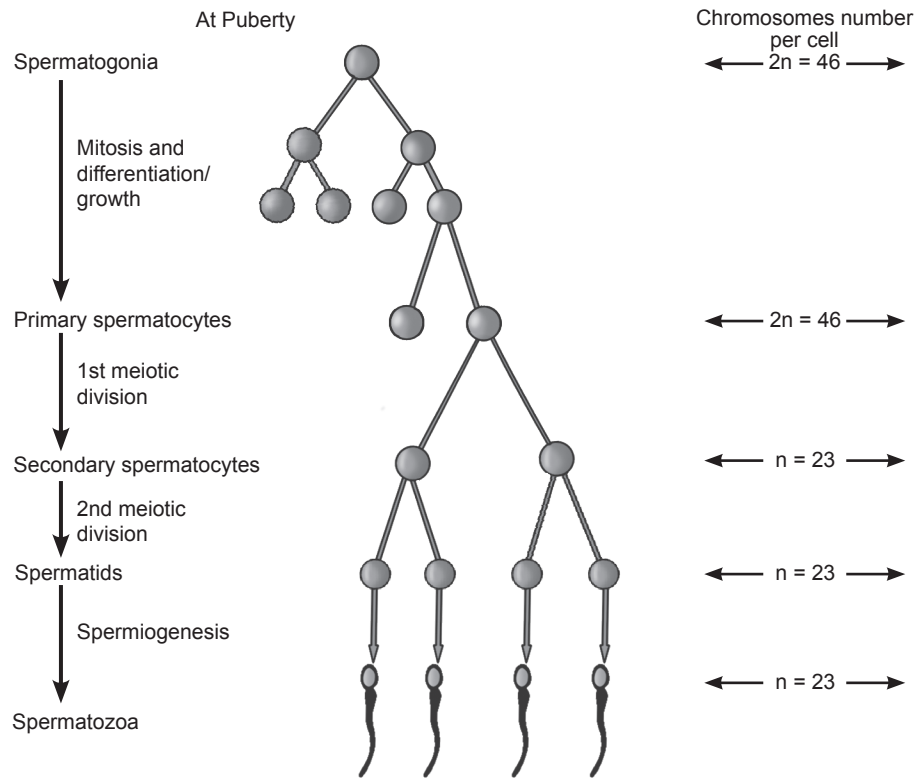
**Or**



**Fig. Lac Operon in *E.coli***

- The regulatory (i) gene codes for repressor protein, which is synthesised constitutively all the time.
- It binds to the operator and prevents the RNA polymerase from transcribing the operon; so the operon is 'switched off'.
- When lactose is present in the cell, it functions as inducer.
- When it binds to the repressor and inactivates it, the repressor does not bind to the operator.
- This allows RNA polymerase access to the promoter and transcription proceeds, i.e. the operon is 'switched on'.

26. (a)



(b)

Spermatogenesis	Oogenesis
<ul style="list-style-type: none"> <li>– The process of formation of sperms in males starts from puberty.</li> <li>– It is not a cyclic process; it occurs continuously.</li> <li>– One primary spermatocyte forms four functional sperms.</li> <li>– The process is completed in the testes.</li> </ul>	<ul style="list-style-type: none"> <li>– The process of formation of ova in females starts from embryonic developmental stages.</li> <li>– It is a cyclical process, completed every 28/29 days.</li> <li>– One primary an oocyte forms only one functional ovum.</li> <li>– The process is completed in the ampullary-isthmic junction of fallopian tube.</li> </ul>

Or

(a) **Double fertilisation**

- In an angiosperm, two male gametes are discharged by a pollen tube into the embryo sac.
- One of the male gametes fuses with the ovum to form a zygote; this process, is called syngamy.



- The other male gamete fuses with the secondary nucleus (formed by fusion of two polar nuclei) to form the primary endosperm nucleus; this process is called triple fusion.
- Since there are two fusions (syngamy and triple fusion), inside an ovule during fertilisation, it is known as double fertilisation.

**Fate of the products**

- The zygote develops into the embryo
- The primary endosperm cell gives rise to the endosperm

(b) The two types of flowers are cleistogamous flowers and chasmogamous flowers.

Differences:

<b>Cleistogamous flowers</b>	<b>Chasmogamous flowers</b>
<ul style="list-style-type: none"> <li>– These are the bisexual flowers which do not open at all, even at maturity.</li> <li>– They are invariably autogamous.</li> </ul>	<ul style="list-style-type: none"> <li>– These are the flowers which open at maturity and expose their stigma(s) and stamen(s).</li> <li>– They show autogamy, geitonogamy or xenogamy.</li> </ul>