

Answers to RBI/Set-2

1. (b) A . Lactic acid, B. Vitamin B₁₂
2. (d) Net increase in population = [(Natality + Immigration) – (Mortality + Emigration)]
 = [(130 + 20) – (120 + 30)]
 = [150 – 150] = 0

3. (b) *Wuchereria* – Female *Culex* mosquito

Plasmodium – Female *Anopheles* mosquito

4. (c) About 200 base pairs are present in each nucleosome and the distance between two base pairs is 0.34 nm.

5. (b) **Parents** : Father × Mother
 (Blood group A) (Blood group B)
 I^Ai I^Bi
- Gametes** : (I^A), (i) (I^B), (i)
- Progeny** : I^A i

I ^B	I ^A I ^B (Blood group AB)	I ^B i (Blood group B)
i	I ^A i (Blood group A)	ii (Blood group O)

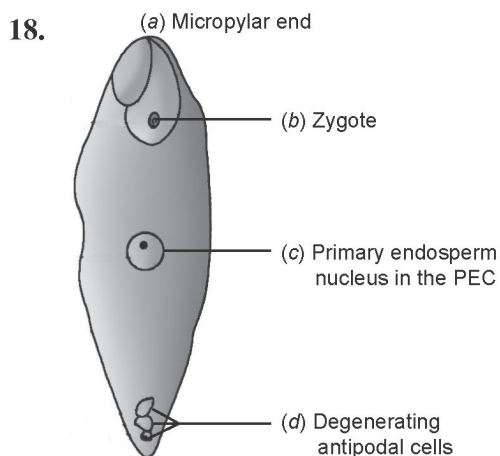
6. (d) Skin prevents entry of many microbes/pathogens into our body.
7. (c) The generative cell does not have food reserve. It has a dense cytoplasm and a small round nucleus and floats in the cytoplasm of the vegetative cell.
8. (b) silencing of a specific mRNA due to complementary dsRNA
9. (c) More than 70% of all the species recorded are animals and plants account for about 22%. 70% of the animals are insects.
10. (a) Contraceptive pills have to be taken daily for a period of 21 days, starting within the first five days of menstrual cycle after a gap of 7 days (during menstruation), it has to be repeated till next menstruation.

Lactational amenorrhoea method of birth control has been reported to be effective only upto a maximum period of six months following parturition.

11. (a) A-2, B-3, C-4, D-1
12. (a) gross primary productivity
13. (b) Both A and R are true and R is not the correct explanation of A.
14. (d) A is False but R is true.
15. (a) Both A and R are true and R is the correct explanation of A.
16. (c) A is true but R is false.
17. A. Biodiversity must be conserved as it plays an important role in many ecosystem services.
 - (i) Spiritually or philosophically, we have to realise that every species has an intrinsic value, though it may not be of any economic value to us currently.
 - (ii) Morally, we have a duty to care for the well-being of the species and pass on our biological legacy in good order to future generations.

OR

- B. – The slope of regression lines are amazingly similar regardless of the taxonomic group or the region; it lies in the range of 0.1 to 0.2.
- The line is much steeper (with Z values being in the range of 0.6 to 1.2), if one analyses the species–area relationships for very large areas like the entire continent; it indicates more species richness.



19. The two core techniques are:
- (i) Genetic engineering

- This includes the techniques to alter the chemistry of genetic material (DNA/RNA), to introduce these into host organisms and thereby change the phenotype of the host organism.

(ii) Bioprocess engineering

- This refers to the maintenance of sterile ambience in the chemical engineering processes to enable growth of only the desired microbe or eukaryotic cell in large quantities for the manufacture of products like enzymes, antibiotics, vaccines, etc.

20. A. - Pedigree analysis is an analysis of the distribution and movement of traits in a series of generations of a family.
- It is an important method to study human genetics.
 - Genetic disorders occurring in a family can be identified and the movement of the trait in the future generations can be predicted.

OR

B. **Parents:** rrTt Rrtt

Gametes: (rT), (rt) × (Rt), (rt)

Progeny: rT rt

Rt	RrTt Round, tall	Rrtt Round, dwarf
rt	rrTt Wrinkled, tall	rrtt Wrinkled, dwarf

- The phenotypic ratio is 1 : 1 : 1 : 1
- The genotypic ratio is 1 : 1 : 1 : 1

21. A. P – Heroin, Q – Cardiovascular system, R – Cocaine, S – Central nervous system

OR

B. (a) National AIDS (Acquired Immuno Deficiency Syndrome) Control Organisation

(b) The various routes of transmission of human immunodeficiency virus include:

- (i) sexual contact with the infected person.
- (ii) by transfusion of contaminated blood and blood products.
- (iii) from infected mother to the child through the placenta.
- (iv) through contaminated needles and syringes. (any three)

22. (a) – In mutation A, the change in the codon GAG to GAA does not change the amino acid coded, i.e. both GAG and GAA code for amino acid, glutamic acid; hence, there is no change in the haemoglobin structure.
- In mutation B, the codon GAG is changed to GUG, where GUG codes for valine, while the original codon GAG codes for glutamic acid; hence, there is a change in the haemoglobin structure and it leads to sickle-cell anaemia.
- (b) When the defective haemoglobin undergoes polymerisation under low oxygen tension, the RBCs become sickle-shaped.

23. Aneuploidy	Polyploidy
<ul style="list-style-type: none"> – It is the phenomenon of loss or gain of one or more chromosomes from any pair(s) of chromosomes in a diploid cell/ organism, called aneuploid. – It arises due to failure of segregation of members of one/more pair(s) of homologous chromosomes during anaphase I of meiosis. <p>e.g. Down's syndrome, Turner's syndrome, etc.</p>	<ul style="list-style-type: none"> – It is the presence of three or more sets of chromosomes in an organism, called polyploid. – It arises due to failure of cell division following the duplication of DNA/ chromosomes. – It is found in many plants.

24. (a) A is Vector or plasmid DNA, B is Foreign DNA.
- (b) The restriction enzyme is EcoRI
- (c) DNA ligase.
25. – The surgical method of birth control in males is called vasectomy.
- In this method, a portion of vas deferens is removed or ligated, through a small incision in the scrotum.
- The surgical method of birth control in females is called tubectomy.
- In this method, a portion of fallopian tube is removed or ligated through a small incision in the abdomen or through the vagina.

Advantage

- These are fool-proof methods that are highly effective.

Disadvantage

- Their reversibility is very poor.

26. (a) Primary oocytes.
(b) Y–Fimbriae; they help in the collection of ovum into the fallopian tube, after ovulation.
(c) Z–Ampullary-isthmic junction; this is the site of fertilisation in humans.
27. (a) (i) Cyanobacteria can fix atmospheric nitrogen in the soil.
(ii) They also add organic matter to the soil to increase soil fertility.
(b) The two institutes are:
(i) Indian Agricultural Research Institute (IARI)
(ii) Khadi and Village Industries Commission (KVIC)
28. (a) The food resources are unlimited in curve 'p' and limited in curve 'q'.
(b) Curve 'p'.
(c) The dotted line represents the carrying capacity.
Carrying capacity refers to the maximum number of individuals (or size of a population) that a given environment can support, beyond which further growth is not possible.
29. (a) During anaphase I of meiosis; the phenomenon is called disjunction.
(b) 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. (any two)
- (c) T.H. Morgan; he worked on *Drosophila melanogaster*.

OR

- (d) Walter Sutton and Theodor Boveri proposed the chromosomal theory of inheritance.

30. (a) The municipal waste water, is called sewage.
- (b) – Primary treatment and secondary treatment.
– Primary sewage treatment is a physical process and secondary treatment is a biological process.
- (c) Aerobic and anaerobic heterotrophic microbes, i.e., bacteria and fungi.

OR

- (d) Activated sludge is the sediment of 'flocs', i.e. aerobic bacteria and fungi.

31. A. (a) **Salient features of Human Genome**

- (i) The human genome contains 3164.7 million nucleotides (base pairs).
- (ii) The size of the genes varies; an average gene consists of 3000 bases, while the largest gene, dystrophin consists of 2.4 million bases.
- (iii) The total number of genes is estimated to be 30000 and 99.9% of the nucleotides are the same in all humans.
- (iv) The functions of over 50% of the discovered genes are not known.
- (v) Only less than 2% of the genome codes for proteins.
- (vi) Repetitive segments make up a large portion of the human genome.
- (vii) Repetitive sequences throw light on chromosome structure and dynamics and evolution, though they are thought to have no direct coding functions.
- (viii) Chromosome 1 has 2968 genes and Y-chromosome has the least number (231 genes).
- (ix) Scientists have identified about 1.4 million locations, where DNA differs in single base in human beings; these are called single nucleotide polymorphisms (SNPs). (any six)

(b)

Template strand	Coding strand
– This is the strand of DNA with 3' → 5' polarity.	– This is the strand of DNA with 5' → 3' polarity.
– It functions as the template for transcription and codes for RNA.	– It does not code for any region of RNA during transcription.

OR

B. (a) *Dryopithecus and Ramapithecus*

Characteristics:

- (i) They were hairy.
 - (ii) They walked like gorillas and chimpanzees.
 - (iii) *Ramapithecus* was more man-like while *Dryopithecus* was more ape-like.
- (b) Ethiopia and Tanzania
- (c) During the ice age between 75000-10000 years before.
- (d) – *Homo habilis* probably did not eat meat.
– *Homo erectus* probably ate meat.
32. A. (a) (i) – The bacterial cells are treated with lysozyme, to remove the cell wall.
- The proteins associated with the DNA are removed by treatment with proteases and the associated RNAs are removed by treatment with RNases.
 - Similarly other molecules (if any) are removed by appropriate treatments.
 - The purified DNA is precipitated by the addition of chilled ethanol and removed by spooling.
- (ii) – The recipient bacterial cell is made ‘competent’ to take up the recombinant DNA by treatment with a specific concentration of calcium ions.
- The recombinant DNA is then forced into such cells by heat shock treatment, i.e. by incubating the cells with recombinant DNA on ice, followed by placing them briefly at 42°C (heat shock) and then putting them back on ice; this enables bacteria to take up the recombinant DNA.
- (b) (i) A-BamHI, B-PstI, C-amp^R
- (ii) A and B are the recognition sites for the restriction enzymes.
 - (iii) The rop gene codes for the proteins involved in the replication of the plasmid.

OR

- B. (a) – The purified DNA molecule containing the desired gene is incubated with the specific restriction endonuclease, at optimal conditions of pH, temperature, etc. of that enzyme.
- Similarly, the vector DNA is also incubated with the same restriction endonuclease under optimal conditions.
 - This results into cutting of the DNA into fragments.
- (b) – Gel electrophoresis is used to separate the DNA fragments produced by restriction digestion.
- The DNA fragments resolve according to their sizes, through the sieving effect provided by the agarose gel.
- (c) – The resultant fragments are joined to the vector by use of DNA-ligases, which form hydrogen bonds between their complementary cut counterparts.
33. A. (a) – A is chasmogamous flower
- Autogamy, geitonogamy and xenogamy can occur in it.
- (b) – B is cleistogamous flower.
- Only autogamy can occur in it
- (c) – *Oxalis* and *Viola*
- (d) (i) Flower B
(ii) Flower A

OR

B. Events in pollen-pistil interaction:

- A compatible pollen grain starts its germination on the stigma.
- The intine grows out through one of the germ pores to form a pollen tube; the contents of the pollen grain move into the pollen tube.
- In those species, where the pollen grains are shed at the two-celled stage, the generative cell divides to form two male gametes.
- The pollen tube grows through the tissues of style and stigma and reaches the ovary.
- It enters the ovule through the micropyle and then enters the embryo sac through the filiform apparatus of one of the synergids.
- All these events, from the deposition of pollen grains on the stigma till the entry of pollen tube into the ovule, are collectively called pollen-pistil interaction.

The two events that follow this are:

- (i) Syngamy, i.e., fusion of male and female gametes to form a zygote.
- (ii) Triple fusion, i.e., fusion of two polar nuclei (secondary nucleus) and a male gamete, to form the primary endosperm nucleus (PEN).