

Answers to RBI/Set-1

SECTION-A

1. (b) (ii) Seed X is dicot and non-endospermic or non-albuminous.
(iii) Seed Y is monocot and endospermic or albuminous.
2. (c) Sporogenous tissue occupies the centre of a microsporangium. Its cells are called microspore mother cells. Each of them undergoes a meiotic division to form four pollen grains.
3. (c) The spermatids are haploid cells and contain 22 autosomes and 1 sex chromosome.
4. (b) 5' (upstream) end and 3' (downstream) end, respectively of the transcription unit.
5. (c) Short non-coding repetitive sequence forming large portion of eukaryotic genome
6. (a) 0.6 and 0.4
7. (b) I and III
8. (c) 6
9. (b) *Wuchereria* – Female *Culex* mosquito
Plasmodium – Female *Anopheles* mosquito
10. (d) In eukaryotes, coupling of transcription and translation is not possible. RNA polymerase III transcribes tRNA, 5S rRNA and snRNAs.
11. (b) It is the first enzyme isolated from strain S2 of the bacterium.
12. (b) Biogas is a mixture of methane, carbon dioxide and hydrogen sulphide.
13. (d) A is False but R is true.
14. (c) A is true but R is false.
15. (a) Both A and R are true and R is the correct explanation of A.
16. (b) Both A and R are true and R is not the correct explanation of A.

SECTION-B

17. – Seminal vesicles, prostate and bulbourethral glands contribute to seminal plasma.
– Seminal plasma is rich in fructose.

18. (a) The exceptions are found in:
- (i) mitochondrial codons
 - (ii) some protists.
- (b) Some codes are said to be degenerate because some amino acids are coded by more than one codon, *e.g.* UUU and UUC code for the same amino acid, phenylalanine.
19. (a) Giving a booster dose of the vaccine can induce an anamnestic response.
- (b) Because the immune system appears to have memory of the first encounter (in the form of memory B cells and memory T cells) with the same pathogen.
20. – Animals whose DNA has been manipulated to possess and express one or more foreign gene(s), are called ‘transgenic’.
- Mice are used for testing vaccine safety.
 - Polio is the disease.
21. (a) Humus is formed during decomposition of detritus by the action of bacterial and fungal enzymes, in the process called humification.

Characteristics of humus

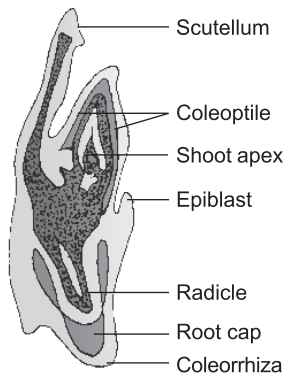
- (i) It is a dark-coloured amorphous substance.
- (ii) It is highly resistant to microbial action and hence, undergoes decomposition at an extremely slow rate.
- (iii) It is colloidal in nature and hence, serves as a reservoir of nutrients.

OR

- (b) – The microbes are also heterotrophs; they are saprotrophs or parasites.
- Those microbes which meet their energy requirement by degrading the dead and decaying organic matter, are called saprotrophs; they are also called decomposers.
 - Those microbes which depend on living organisms for their food as well as shelter, are called parasites.

SECTION-C

22. (a)



(any four)

L.S. of an embryo of grass

(b) If the seeds collected from hybrids are sown, the hybrid characters in the progeny plants will segregate and do not maintain hybrid characters.

23. Follicle stimulating hormone and luteinising hormone influence both spermatogenesis and oogenesis.

Role in Males

- FSH stimulates the Sertoli cells to secrete certain factors necessary for spermatogenesis.
- LH stimulates the Leyding cells in the testes to secrete testosterone that is necessary for spermatogenesis.

Role in Females

- FSH influences the maturation of a primary follicle into a mature Graafian follicle in oogenesis, during the follicular/proliferative phase of menstrual cycle.
- FSH also stimulates the follicle cells to secrete estrogens.
- The high levels of LH (LH surge) during the middle of the menstrual cycle causes the rupture of a mature Graafian follicle and release of secondary oocyte in the process, called ovulation.
- It also influences the formation of corpus luteum from the ruptured Graafian follicle and secretion of progesterone from it.

24. (a) The enzyme RNA polymerase II is responsible for the transcription of eukaryotic hnRNA.

(b) – hnRNA has both exons, the coding sequences and introns, the non-coding sequences and is non-functional.

– It undergoes splicing to remove the introns and join the exons in a defined sequence. Splicing occurs in the nucleus.

(c) σ (sigma) factor acts as an initiation factor during transcription in prokaryotes.

25. (a) The Tasmanian wolf has evolved by adaptive radiation.

(b) Banded ant-eater/Wombat/Marsupial mole/sugar glider/Koala. (any one)

(c) **Similarities:**

– They both have evolved by adaptive radiation.

– They also show convergent evolution in the given geographical area

Difference:

– Wolf is a placental mammal, while the Tasmanian wolf is a marsupia

26. (a) Statins

(b) Blood cholesterol-lowering agent

(c) *Penicillium notatum*

(d) Penicillin

(e) *Trichoderma polysporum*

(f) Immunosuppressive agent

27. (a) (i) A is Vector or plasmid DNA, B is Foreign DNA.

(ii) The restriction enzyme is EcoRI

(iii) DNA ligase.

OR

(b) (i) – This facilitates the maintenance of cells in their physiologically most active exponential phase.

– It results in the production of larger biomass and hence high yield.

– This method is called continuous culture system.

(ii) 1. The stirrer facilitates even mixing and oxygen availability throughout the reactor.

2. The curved base facilitates the mixing of the reactor contents.

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.

SECTION-D

29. (a) – It is morphine
– *Papaver somniferum* is the source plant.
- (b) Heroin is (i) white in colour, (ii) odourless, (iii) bitter in taste and (iv) crystalline.
- (c) (i) It is used as a sedative and painkiller for those who have undergone surgery.

OR

- (c) (ii) – It is diacetylmorphine
– It is a depressant and slows down the body functions.
30. (a) – *Oxalis* and *Viola*
- (b) – B is cleistogamous flower.
– Only autogamy can occur in it
- (c) (i) (1) Flower B
(2) Flower A

OR

- (c) (ii) – A is chasmogamous flower
– Autogamy, geitonogamy and xenogamy can occur in it.

SECTION-E

31. (a) (i) They used $^{15}\text{NH}_4\text{Cl}$ and $^{14}\text{NH}_4\text{Cl}$ to grow *E.coli*, because the density of DNA of *E.coli* grown on these media can be distinguished based on their densities.
- (ii) ^{15}N was incorporated into the nitrogenous bases (adenine, guanine, cytosine and thymine) of DNA and also other nitrogen compounds.
- (iii) The ^{15}N -DNA can be distinguished from the ^{14}N -DNA by centrifugation in cesium chloride density gradient; ^{15}N -DNA is heavier than ^{14}N -DNA.
- (iv) They took samples at definite intervals as the cells multiplied and extracted the DNA that remained as double-stranded helices.
- (v) – At the end of 20 minutes, the DNA of *E.coli* had a hybrid or intermediate density.
– At the end of 40 minutes, the DNA extracted from the cells contained equal quantities of hybrid DNA and light DNA.
- (iv) They concluded that DNA replication is semi-conservative.

OR

(b) (i) **Salient features of Human Genome**

1. The human genome contains 3164.7 million nucleotides (base pairs).
2. The size of the genes varies; an average gene consists of 3000 bases, while the largest gene, dystrophin consists of 2.4 million bases.
3. The total number of genes is estimated to be 30000 and 99.9% of the nucleotides are the same in all humans.
4. The functions of over 50% of the discovered genes are not known.
5. Only less than 2% of the genome codes for proteins.
6. Repetitive segments make up a large portion of the human genome.
7. Repetitive sequences throw light on chromosome structure and dynamics and evolution, though they are thought to have no direct coding functions.
8. Chromosome 1 has 2968 genes and Y-chromosome has the least number (231 genes).
9. 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)

(ii)

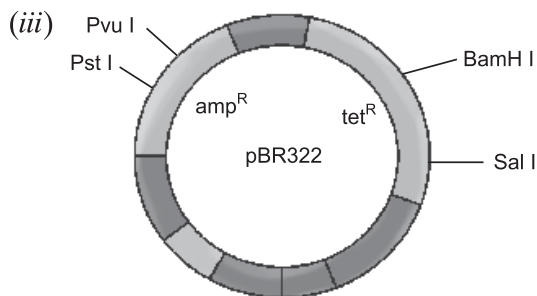
Template strand	Coding strand
<ul style="list-style-type: none">– This is the strand of DNA with 3' → 5' polarity.– It functions as the template for transcription and codes for RNA.	<ul style="list-style-type: none">– This is the strand of DNA with 5' → 3' polarity.– It does not code for any region of RNA during transcription.

32. (a) (i) – DNA being negatively charged, can be separated by forcing them to move towards the anode under an electric field through a matrix, which is agarose.
- The matrix provides the sieving effect and the DNA fragments resolve according to their size; hence, the smaller fragments move farther towards anode.
- (ii) – The number of recognition sites for RE-1 is 3, for RE-2 is 2 and for RE-3 is 3.
- Since the DNA is circular, the number of fragments is equal to the number of recognition sites where the enzyme cuts the DNA.

- (iii) – The gel containing DNA fragments is stained with ethidium bromide and exposed to UV radiation; orange-coloured bands (of DNA) become visible.
- Elution is the process in which the separated bands of DNA are cut out and DNA extracted from the gel.

OR

- (b) (i) – *Salmonella typhimurium*.
 - Antibiotic resistance gene
- (ii) – It became possible with the use of restriction endonucleases.
 - The rDNA was introduced into *Escherichia coli*.



33. (a) (i) Major causes for loss of species include:
1. Habitat loss and fragmentation.
 2. Over-exploitation of species by man.
 3. Invasion of alien species, which compete with the native species and cause their extinction.
 4. Co-extinction of related plants and animals.
- (ii) Loss of biodiversity in a region leads to:
1. decline in plant productivity.
 2. lowered resistance to environmental perturbations like drought.
 3. increased variability in certain ecosystem processes like water use, productivity, pest and disease cycles, etc.
- (ii) – Since they were the first vertebrates to appear, they must have had a long time to diversify and evolve.
- They must have evolved good adaptability to the water bodies, both freshwater and marine.

OR

- (b) (i) 1. Since the natural habitat or ecosystem is conserved, it allows for conservation of other organisms in the habitat.
2. Since the organism is conserved in its natural habitat, its recovery will be fast as its relationship with other organisms is not disturbed.
- (ii) 1. When the climatic conditions become too harsh for the organism.
2. When the predation pressure on the organism becomes very high.
- (iii) 1. Narrowly utilitarian
2. Broadly utilitarian.