

Answers to RBI-DS1/Set-1

1. (a) synergids and antipodals
2. (a) A – B 3' → 5', E – F 5' → 3'
3. (c) Sertoli cells, primary spermatocytes and spermatogonia
4. (d) 2, 4 and 5
5. (c) Fitness is the end result of the ability to adapt and get selected by nature.
6. (c) Formation of DNA through reverse transcription → Incorporation of viral DNA into host genome → Formation of viral RNA → Infected host cell produces new viruses.
7. (d) A, B and AB
8. (c) A is ribose, that is reactive.
9. (d) convergent evolution.
10. (b) A - 2, B - 3, C - 1
11. (a) Primary consumers occupy the first trophic level in any food chain.
12. (d) *cry* gene *cryIAb*—Cotton bollworm.
13. (b) Both A and R are true, but R is not the correct explanation of A.
14. (a) Both A and R are true, and R is the correct explanation of A.
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.

GIFT	ZIFT
– It is a method of ART in which ovum collected from a woman is transferred to the fallopian tube of another woman.	– In this method, the zygote or early embryo with upto 8-blastomeres is transferred into the fallopian tube of a woman for further development.
– It is advised for a woman who cannot produce functional gametes, but can provide suitable conditions for fertilisation and embryo development.	– It is advised for a woman who cannot conceive but can provide suitable condition for implantation and further development of the embryo.
– It is a method of gamete transfer.	– It is a method of embryo transfer.

18. (a) – Boxes A and D
 – The genotype is Tt
- (b) (i) 25%; (ii) 25%;

19. Warning signs of drugs/alcohol abuse

- Drop in academic performance.
- Unexplained absence from school/college.
- Lack of interest in personal hygiene.
- Aggressive and rebellious behaviour.
- Deteriorating relationship with family and friends.
- Fluctuations in weight and appetite.
- Change in sleeping and eating habits. *(any four)*

20. – It is the prohormone which needs to be processed before it becomes a fully mature and functional hormone/insulin.

- Proinsulin has three polypeptide chains (A, B and C), whereas insulin has only two (A and B) polypeptide chains.

21. – The growth rate of both Species A and Species B has increased.

- It indicates that both the species are mutually benefitted by the presence of the other species.
- This phenomenon is called mutualism, an interspecific interaction, where both the partner species are equally benefitted in the association.

OR

(a) The standing crop is expressed in terms of biomass (mass of living material) or number in a unit area.

(b) **Limitations of ecological pyramids:**

(i) They do not take into account the same species belonging to two or more trophic levels.

(ii) It assumes a simple food chain, whereas in nature it does not exist.

(iii) Saprophytes/decomposers are not given any place in ecological pyramids.

(any two)

22. – The tissues involved are the chorionic villi from the trophoblast of the blastocyst and the uterine tissue (endometrium) and blood of the mother.

- The interdigitation of these tissues results in the formation of placenta, whose functions are:

(i) facilitating the supply of oxygen and nutrients to the foetus.

(ii) removal of the excretory products from the foetus.

(iii) acting as an endocrine gland to secrete certain hormones (human chorionic gonadotropin, human placental lactogen, estrogens and progesterogens) necessary for the growth and development of foetus.

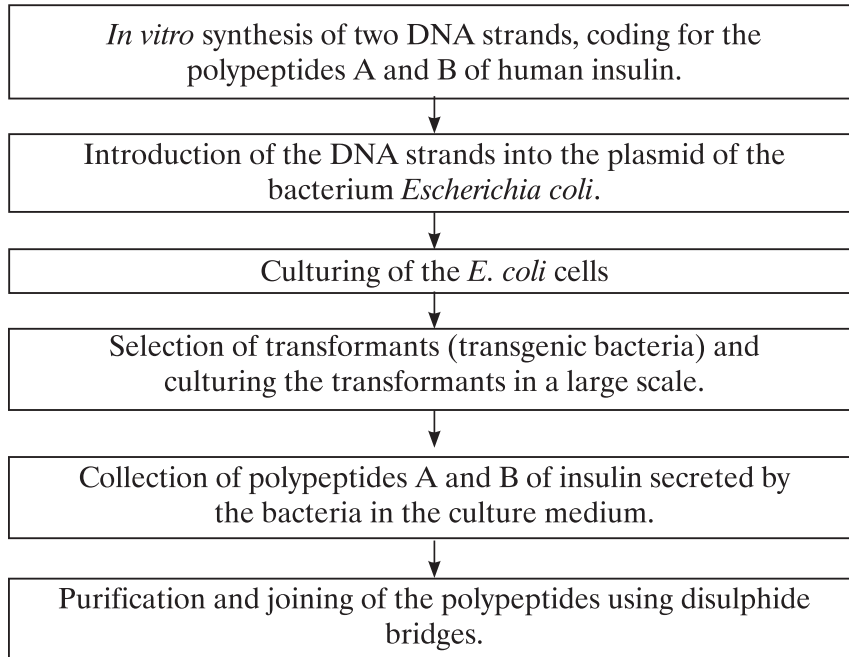
23. – The process of delivery of the full grown foetus (now called infant), is called parturition.
- It is induced by a complex neuroendocrine mechanism.
 - The signals for parturition originate from the fully developed foetus and the placenta; the signals induce mild contractions of the uterine muscles, called foetal ejection reflex.
 - This causes the release of oxytocin from the maternal pituitary.
 - Oxytocin causes stronger contractions of the uterine muscles, which in turn stimulates secretion of more oxytocin.
 - The stimulatory reflex between the uterine contractions and secretion of oxytocin, continues resulting in stronger contractions of uterine muscles.
 - This results in the expulsion of the infant out of the uterus through the birth canal, i.e. parturition is achieved.
 - It is soon followed by the expulsion of placenta from the uterus.

24. Industrial Melanism:

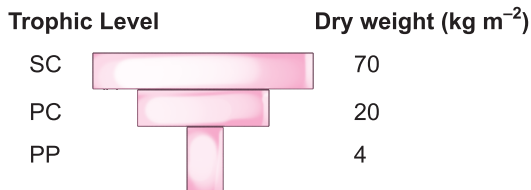
- In England, in a collection of moths made in 1850, i.e. before industrial revolution, there were more white-winged moths on the tree trunks, than the dark-winged or melanic moths.
- In the collection of moths, carried out in the same area after industrial revolution, i.e. in 1920, there were more dark-winged moths, i.e. the proportion was reversed.
- The explanation given for this observation was that predators will spot a moth against a contrasting background.
- During the post-industrialisation period, the tree 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; no variant was completely wiped out.

25. (a) The two methodologies are:
- (i) Expressed Sequence Tags (ESTs)—It focuses on identifying all the genes that are expressed as RNAs.
 - (ii) Sequence Annotation—It aims at sequencing the whole set of genome that includes all the coding sequences and non-coding sequences and then assigning functions to different regions in the sequence.
- (b) Yeast artificial chromosome.
- It is used as the vector.
26. (a) Organic farmers prefer biological control to chemical because:
- (i) The chemical methods kill both useful and harmful organism.
 - (ii) The chemical are extremely harmful to humans and other animals.
 - (iii) They also pollute the soil and ground water.
 - (iv) He also believes that eradication and pests is impossible and also it is undesirable because the useful organisms may be dependent on the pests for their food or as host.
- (b) **Bacterium:** *Bacillus thuringiensis*
Fungus: *Trichoderma*
Insect: Ladybird beetles feeding on aphids. (or)
 Dragonflies controlling mosquitoes.
27. – Cry proteins are the crystal proteins coded by the *cry* genes of the bacterium, *Bacillus thuringiensis* (Bt) during a particular phase of their growth.
- They are toxic to certain group of insects; hence, called Bt toxin too.
 - While the *cry* genes *cryIAc* and *cryIIAb* control cotton bollworms, the *cry* gene, *cryIAb* controls corn borer.
 - The *cry* genes are cloned from the bacterium and introduced into the cotton/corn plants and made to express in the plants.
 - When the parts of such Bt crop plants are ingested by the larvae of the insect, they are killed.
 - Thus plants are provided with resistance to specific insect pests without the use of insecticides; in effect, biological pesticide is created.

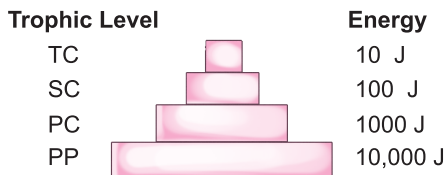
OR



28.



Pyramid of Biomass in Sea



Pyramid of Energy in Sea

- The pyramid of biomass is inverted; it is because the biomass of zooplanktons is greater than the phytoplanktons and that of fishes far exceeds that of the plantations.
- The pyramid of energy is always upright, because the amount of energy in the producers (base tier) is more than that in consumers; only 10% of energy is transferred from one trophic level to the next higher trophic level and there is always loss of energy in the form of heat during transfers.

29. (a) – One of them (exonucleases) added methyl groups to DNA.
 – The other (endonucleases) cut the DNA at specific points within the DNA.
- (b) – EcoRI is a restriction enzyme.
 – EcoRI recognises and cuts the DNA strands as given below:
- $$\begin{array}{c} 5' - G \downarrow A A T T C - 3' \\ 3' - C T T A A \uparrow G - 5' \end{array}$$
- This leaves single-stranded portions, called sticky ends, overhanging at the end of each strand.
 – Since, the stickiness facilitates the action of DNA ligase, they easily form hydrogen bonds with their complementary counterparts.

OR

- (b) (i) Four
 (ii) DNA fragments are negatively charged molecules; hence, they can be separated by forcing them to move towards the anode under an electric field through a matrix/medium.
 The DNA fragments separate (resolve) according to their size through the sieving effect provided by the agarose gel.

30. (a) – Alexander von Humboldt
 – He explored the South American jungles.
- (b) – Z stands for slope of the line or regression coefficient.
 – It becomes steeper when
 (i) species-area relationship is analysed for very large areas like the entire continent.
 (ii) the species richness is very high.
- (c) – He observed in the South American jungles that within a region, species richness increased with the increasing explored area, but only upto a certain limit.
 – The relation between species richness and area for a wide variety of taxa turns out to be a rectangular hyperbola.
 – On a logarithmic scale, the relationship is a straight-line.

OR

- (c) (i) The slopes of regression line are very similar, regardless of the taxonomic group or region when small areas are explored.
 (ii) When species-area relationship in very large area like the entire continent is analysed, the slope of the line becomes steeper with 'Z' value between 0.6 and 1.2.
 'Z' stands for slope of regression.

31. (a) Test tube baby programme

- It involves two steps:
 - (i) *In vitro* fertilisation (IVF) and
 - (ii) Embryo transfer (ET).
 - In this method, the ovum of the woman or a healthy donor and the sperm of her husband or a donor, are made to fuse to form a zygote in the laboratory under conditions very similar to that in the body; it is called *in vitro* fertilisation (IVF).
 - The zygote or early embryo with upto eight blastomeres is implanted in the fallopian tube (ZIFT) or embryo with more than eight blastomeres is implanted in the uterus (IUT) for further development.
 - This method is used when the female is not able to conceive but can provide suitable conditions for embryo development.
- (b) – Artificial insemination refers to the transfer of semen collected from the husband or a male donor into the vagina or into the uterus of the female
- It becomes necessary when:
 - (i) the male partner is unable to inseminate the female or
 - (ii) the sperm count is low in the ejaculate.

OR

(a) Modes of pollination in a chasmogamous flower

(i) Autogamy:

It refers to the transfer of pollen grains from the anthers to the stigma of the same flower.

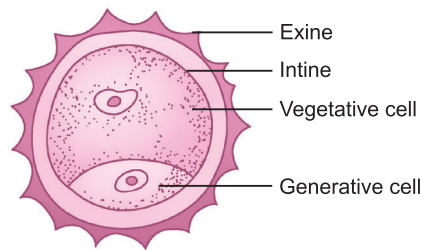
(ii) Geitonogamy:

It refers to the transfer of pollen grains from the anthers of flower to the stigma of another flower of the same plant.

(iii) Xenogamy:

It refers to the transfer of pollen grains from the anthers of a flower to the stigma of another flower on a different plant of the same species.

(b)



A two-celled pollen grain

32. (a) Since the child has blood group B, the man must be heterozygous for blood group A, i.e., genotype $I^A i$.

Parents : Mother × Father
 AB group A group
 $I^A I^B$ $I^A i$

Gametes : $(I^A), (I^B)$ $(I^A), (i)$

Progeny : I^A i

I^A	$I^A I^A$ Blood group A	$I^A i$ Blood group A
I^B	$I^A I^B$ Blood group AB	$I^B i$ Blood group B

- The children can have any one of the following blood groups: A, AB and B.
- (b) - The gene controlling human blood group character exists in three allelic forms, I^A , I^B and i , i.e., it shows multiple allelism.
 - I^A and I^B are dominant over i and they also show codominance and produce both glycoprotein A and glycoprotein B when they are together and hence, blood group AB.
 - There are six possible genotypes, which produce four phenotypes, i.e. blood groups A, B, AB and O.

OR

In Prokaryotes

- The negatively charged DNA is held by some positively charged proteins, in a region of the cell, called nucleoid.
- The DNA in the nucleoid is arranged in large loops held by the proteins.

In Eukaryotes

- In eukaryotes, DNA is packaged in the form of nucleosomes, with the positively-charged basic proteins, called histones.
- Eight molecules of histones are organised as a unit, called histone octamer.
- The negatively charged DNA (of about 200 base pairs) is wrapped around the histone octamer, to form a nucleosome.

- The nucleosomes form the repeating units of chromatin.
 - The packaging of chromatin at higher levels involves a set of proteins, called non-histone chromosomal (NHC) proteins.
 - In a eukaryotic nucleus, some regions of chromatin are loosely packed (euchromatin) and some regions are tightly packed (heterochromatin).
33. (a) The exaggerated response of the immune system to certain antigens present in the environment, is called allergy.
- (b) Mast cells release chemicals like histamine and serotonin.
- (c) The symptoms include:
- (i) sneezing
 - (ii) watery eyes
 - (iii) running nose
 - (iv) difficulty in breathing
- (d) Antihistamine, adrenalin, some steroids. (any two)

OR

Cancer–Diagnosis:

Cancer can be diagnosed/detected by:

- (i) Biopsy and histopathological studies of the tissue.
- (ii) Blood and bone marrow tests for increased cell counts as in leukaemia.
- (iii) Use of techniques like radiography, Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) for cancer of internal organs.
- (iv) Use of antibodies against cancer-specific antigens.
- (v) Applying principles of molecular biology to detect genes in individuals with inherited susceptibility to certain types of cancer.