

LIBERTY PAPER SET

STD. 12 : Biology

Full Solution

Time : 3 Hours

ASSIGNMENT PAPER 6

Part A

1. (D) 2. (B) 3. (B) 4. (C) 5. (D) 6. (C) 7. (C) 8. (B) 9. (D) 10. (C) 11. (A) 12. (D) 13. (B) 14. (B)
15. (C) 16. (A) 17. (D) 18. (A) 19. (B) 20. (C) 21. (D) 22. (B) 23. (B) 24. (D) 25. (C) 26. (B) 27. (C)
28. (B) 29. (B) 30. (B) 31. (D) 32. (A) 33. (A) 34. (B) 35. (A) 36. (B) 37. (A) 38. (D) 39. (D) 40. (D)
41. (C) 42. (B) 43. (B) 44. (A) 45. (B) 46. (C) 47. (C) 48. (A) 49. (A) 50. (B)



Part B

Section A

➤ Write the answer of the following questions : (Each carries 2 Mark)

1.

➤ (i) **Non-endospermic/Ex-albuminous seeds :**

- In this type of seeds, endosperm, completely consumed by the developing embryo before seed germination. e.g. Pea, groundnut, beans.

(ii) **Endospermic/Albuminous Seeds :**

- Endosperm persists in the mature seeds and is used up during seed germination. e.g. Castor and coconut
- The endosperm is persistent in cereals such as wheat, rice and maize

2.

➤ Pollen grains are rich in nutrients.

It has become a fashion in recent years to use pollen tablets as food supplements.

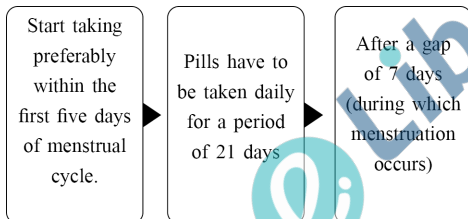
In western countries, a large number of pollen products in the form of tablets and syrups are available in the market.

Pollen consumption has been claimed to increase the performance of athletes and race horses.

3.

➤ Pills :

- Oral administration of small doses of either progestogens or progestogen-estrogen combinations is another contraceptive method used by females.
- They are used in form of tablets and hence are popularly called pills.



- They have to be repeated in the same pattern till the female desires to prevent conception.
- They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/ retard entry of sperms.
- Pills are very effective with lesser side effects and are well accepted by the females.

➤ Saheli :

- Saheli - the new oral contraceptive for the females contains a non-steroidal preparation.
- It is a 'once a week' pill with very few side effects and high contraceptive value.
- Developed by Central Drug Research Institute (CDRI) - Lucknow.

4.

➤ **A - Chromosomes**

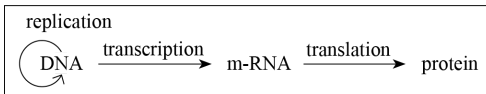
- Occur in pairs : Segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete
- Independent pairs segregate independently of each other

➤ **B - Genes**

- Occur in pairs : Segregate at gamete formation and only one of each pair is transmitted to a gamete
- One pair segregates independently of another pair
- During Anaphase of meiosis I, the two chromosome pairs can align at the metaphase plate independently of each other.
- To understand this, compare the chromosomes of four different colours in the left and right columns.
- In the left column (Possibility I) orange and green is segregating together. But in the right hand column (Possibility II) the orange chromosome is segregating with the red chromosomes.

5.

- The proposition of a double helix structure for DNA and its simplicity in explaining the genetic implication became revolutionary.
- Very soon, Francis Crick proposed the Central dogma in molecular biology, which states that the genetic information flows from DNA → RNA → Protein



- In some viruses, the flow of information is in reverse direction, that is, from RNA to DNA. It is called reverse transcription.

6.

- Our health is affected by the following:

- (1) Genetic Disorder : A child is born with a defect and the effects of defects which the child inherits from parents from birth.
- (2) Infections
- (3) Our way of life : Including the food we eat, the water we are drink, the rest and exercise we give the body, the habits we possess or lack.

7.

- Primary treatment steps basically involve physical removal of particles- large and small -from the sewage through filtration and sedimentation. These are removed in stages; initially, floating debris is removed by sequential filtration.
- Then the grit soil and small pebbles are removed by sedimentation.
- All solids that settle form the primary sludge and the supernatant form the effluent. The effluent from the primary settling tank is taken for secondary treatment.

8.

- After completion of the biosynthetic stage, the product has to be subjected through a series of processes before it is ready for marketing as a finished product.
- The processes include separation and purification, which are collectively referred to as downstream processing.
- The product has to be formulated with suitable preservatives.
- Such formulation has to undergo through clinical trials as in case of drugs.
- Strict quality control testing for each product is also required.
- The downstream processing and quality control testing vary from product to product.

9.

- Orchids show a bewildering diversity of floral patterns many of which have evolved to attract the right pollinator insect (bees and bumblebees) and ensure guaranteed pollination by it (Figure 11.5).
- Not all orchids offer rewards. The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee.
- One petal of its flower bears an uncanny resemblance to the female of the bee in size, colour and markings.
- The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower.
- When this same bee 'pseudocopulates' with another flower, it transfers pollen to it and thus, pollinates the flower.
- Here you can see how co-evolution operates.
- If the female bee's colour patterns change even slightly for any reason during evolution, pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee.

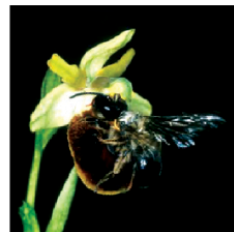


Figure 11.5 : Showing bee - a pollination on orchid flower

10.

➔ The trophic structure and function at successive trophic levels, i.e. (producers, herbivores, carnivores), may be graphically represented by means of ecological pyramids where the first or producer level constitutes the base of the pyramid and the successive levels, the tiers, making the apex.

➔ Ecological pyramids are of three general types.

(A) Pyramid of Number

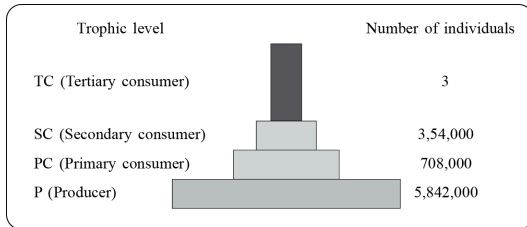
(B) Pyramid of Biomass

(C) Pyramid of Energy

➔ Trophic level represents structure of an ecosystem is one kind of producer consumer arrangement.

➔ (A) Pyramid of number :

➔ It shows the number of individual organisms at each trophic level. Producers occur in the largest number and top level carnivores are in the smallest number. Normally, the pyramids of numbers is upright.



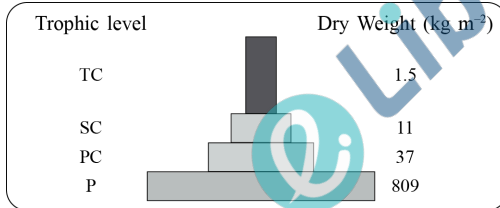
➔ There are exceptions to this generalisation.

➔ If you were to count the number of insects feeding on a big tree, the number pyramid is inverted.

➔ For example, 50 parrot live on a banyan tree and 50 insects on each parrot.

➔ (B) Pyramid of biomass :

➔ It shows the total dry weight or the average biomass of organisms at a particular trophic level.



➔ The pyramid of biomass in sea is generally inverted.

➔ Example, the biomass of fishes far exceeds that of phytoplankton.

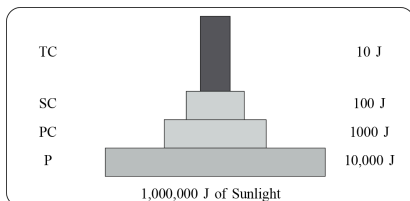
➔ (C) Pyramid of energy :

➔ It shows the rate of energy flow and/or productivity at successive trophic levels. Pyramids of energy are always upright.

➔ Pyramid of energy is always upright, can never be inverted, because when energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.

➔ Each bar in the energy pyramid indicates the amount of energy present at each trophic level in a given time or annually per unit area.

➔ According to law of thermodynamics amount of available energy decreases during utilization.



- There are certain limitations of ecological pyramids.
- Such as it does not take into account the same species belonging to two or more trophic levels.
- It assumes a simple food chain, something that almost never exists in nature; it does not accommodate a food web.
- Sparrow, when eats seed, pea and fruits then it is a primary consumer but when it eats insects and worms, its called secondary consumers.
- Saprophytes are not given any place in ecological pyramids even though they play a vital role in the ecosystem.

11.

➤ Differences :

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.

12.

➤ Exponential growth equation:

$$N_t = N_0 e^{rt}$$

Where,

N_t = Population density after time t

N_0 = Population density at time zero

r = Intrinsic rate of natural increase

e = Base of natural logarithms (2.71828)

➤ From the above equation, we can calculate the intrinsic rate of increase (r) of a population.

Now, as per the question,

Present population density = x

Then,

Population density after two years = 2x

t = 3 years

Substituting these values in the formula, we get:

$$\Rightarrow 2x = x e^{3r}$$

$$\Rightarrow 2 = e^{3r}$$

Applying log on both sides:

$$\Rightarrow \log 2 = 3r \log e$$

$$\Rightarrow \frac{\log 2}{3 \log e} = r$$

$$\Rightarrow \frac{\log 2}{3 \times 0.434} = r$$

$$\Rightarrow \frac{0.301}{3 \times 0.434} = r$$

$$\Rightarrow \frac{0.301}{1.302} = r$$

$$\Rightarrow 0.2311 = r$$

➤ Hence, the intrinsic rate of increase for the above illustrated population is 0.2311.

Section B

➤ Write the answer of the following questions : (Each carries 3 Mark)

13.

- Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.
- This triggers release of oxytocin from the maternal pituitary. Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin.
- The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions. This leads to expulsion of the baby out of the uterus through the birth canal – parturition.
- Soon after the infant is delivered, the placenta is also expelled out of the uterus.
- Certain hormones are required to induce delivery. These hormones control the reflex action to deliver the baby.
- Oxytocin is a hormone that is responsible for inducing uterine contractions, labour, and delivery of the baby.
- When oxytocin is insufficient in the body, it becomes difficult for the baby to be delivered.
- Doctors inject this hormone artificially to carry out the delivery smoothly.
- The mammary glands of the female undergo differentiation during pregnancy and start producing milk towards the end of pregnancy by the process called lactation. This helps the mother in feeding the newborn.
- The milk produced during the initial few days of lactation is called colostrum which contains several antibodies absolutely essential to develop resistance for the new-born babies.
- Breast-feeding during the initial period of infant growth is recommended by doctors for bringing up a healthy baby.

14.

- The salient features of genetic code are as follows :
 - (i) The codon is a triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids, hence they function as stop codons.
 - (ii) Some amino acids are coded by more than one codon, hence the code is degenerate.
 - (iii) The codon is read in mRNA in a contiguous fashion. There are no punctuations.
 - (iv) The code is nearly universal; for example, from bacteria to human UUU would code for Phenylalanine (phe). Some exceptions to this rule have been found in mitochondrial codons, and in some protozoans.
 - (v) AUG has dual functions. It codes for Methionine (met) , and it also act as initiator codon.
 - (vi) UAA, UAG, UGA are stop terminator codons.

15.

- Human evolution can be referred to as adaptive radiation because adaptive radiation is an evolutionary process which gives rise to new species from a single common ancestor .
- But in the case of human evolution, although we share a common ancestor, we humans have undergone an eventual but progressive alteration in the eating preferences, structure of body etc.
- The evolution of humans does not include diversification and radiating into different species, which in fact, is a distinguishing feature of adaptive radiation.

16.

- These are the organs where origin/maturation & proliferation of lymphocytes occur. These are of two types : Primary & Secondary.
- (a) Primary lymphoid organs
 - The organs where lymphocytes are matured & differentiated to antigen-sensitive lymphocytes. It is of two types :
 - 1) Bone marrow :
 - The site of formation of all blood cells including B & T-lymphocytes.

➔ 2) Thymus :

- A bilobed organ seen near the heart and beneath the breastbone. It is large during birth but gradually reduces in size and becomes very small-sized in puberty. Immature T-lymphocytes from bone marrow is migrated to thymus and matured.

➔ (b) Secondary lymphoid organs

- The organs, to which matured lymphocytes migrate from primary lymphoid organs, interact with antigens and then proliferate to become effector cells.

- E.g. Spleen, lymph nodes, tonsils, Peyer's patches, Mucosa-associated lymphoid tissue (MALT) & appendix.

➔ Spleen :

- Bean-shaped organ. Contains lymphocytes and phagocytes. It removes worn-out RBCs & microorganisms from blood. It is a reservoir of erythrocytes in foetus.

➔ Lymph nodes :

- Found in lymphatic system. They trap microorganisms or other antigens. Trapped antigens activate lymphocytes and cause immune response.

➔ MALT :

- Located within the lining of respiratory, digestive & urinogenital tracts. It constitutes 50% of lymphoid tissue.

17.

➔ In agriculture, there is a method of controlling pests that relies on natural predation rather than introduced chemicals.

➔ A key belief of the organic farmers is that biodiversity furthers health.

➔ The use of biocontrol measures will greatly reduce our dependence on toxic chemicals and pesticides.

➔ An important part of the biological farming approach is to become familiar with the various life forms that inhabit the field, predators as well as pests, and also their life cycles, patterns of feeding and the habitats that they prefer. This will help develop appropriate means of biocontrol.

➔ Different biocontrol agents are as follows:

Ladybird and Dragonflies :

- These beetles are useful to get rid of aphids and mosquitoes.

Bacillus thuringiensis:

- An example of microbial biocontrol agents that can be introduced in order to control butterfly caterpillars is the bacteria *Bacillus thuringiensis* (often written as Bt).

- These are available in sachets as dried spores which are mixed with water and sprayed onto vulnerable plants such as brassicas and fruit trees, where eaten by the insect larvae.

- In the gut of the larvae, the toxin is released and the larvae get killed.

- The bacteria disease will kill the caterpillars, but leave other insects unharmed.

- The scientists have introduced Bt toxin genes into plants. Such plants are resistant to attack by insect pests.

Trichoderma :

- *Trichoderma* species are free living fungi that are very common in root ecosystems.

- This fungi is used as biocontrol agent for the treatment of plant disease.

- They are effective biocontrol agents of several plant pathogens.

Baculoviruses :

- The majority of baculoviruses used as biocontrol agents are in the genus *Nucleopolyhedrovirus*.

- *Baculoviruses* are pathogens that attack insects and other arthropods.

➔ Various biocontrol agents have shown no negative impacts on plants, mammals, birds, fish or even on non target insects.

➔ In spite of this, they are desirable when beneficial insects are being conserved to aid in an overall integrated pest management (IPM) programme, or when an ecologically sensitive area is being treated.

18.

- ➔ In addition to these uses, GM has been used to create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals.

19.

- ➔ This is the most important cause driving animals and plants to extinction.
- ➔ The most dramatic examples of habitat loss come from tropical rain forests.
- ➔ Once covering more than 14 per cent of the earth's land surface, these rain forests now cover no more than 6 per cent. They are being destroyed fast.
- ➔ The Amazon rain forest it is so huge that it is called the 'lungs of the planet'.
- ➔ The Amazon rain forest is the place of harbouring probably millions of species and is being cut and cleared for cultivating soya beans or for conversion to grasslands for raising beef cattle.
- ➔ Besides total loss, the degradation of many habitats by pollution also threatens the survival of many species.
- ➔ When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.
- ➔ When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species.
- ➔ The Nile perch introduced into Lake Victoria in east Africa eventually led to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake.
- ➔ The environmental damage caused and threat posed to our native species by invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eicchornia).
- ➔ The recent illegal introduction of the African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

20.

- ➔ In a broad ecological context, all carnivores, herbivores etc. are predators. About 25 % insects are phytophagous.
- ➔ If a predator overexploits its prey, then the prey might become extinct. It results in the extinction of predator. Therefore, predators in nature are 'prudent'.

Importance of predators :

- ➔ Predators control prey populations.
 - When certain exotic species are introduced into a geographical area, they spread fast due to the absence of its natural predators. E.g. Prickly pear cactus introduced into Australia (1920's) caused havoc by spreading. Later, it was controlled by introducing a cactus-feeding predator moth.
 - Predators are used in **Biological control** methods.
 - Predators **maintain species diversity** in a community by reducing competition among prey species.
E.g. the predator starfish *Pisaster* in the rocky intertidal communities of American Pacific Coast. In an experiment, all these starfishes were removed from an enclosed intertidal area. It caused extinction of over 10 invertebrate species within a year, due to interspecific competition.

Defenses of prey species to lessen impact of predation :

- **Camouflage** (cryptic colouration) of some insects & frogs.
- Some are **poisonous** and so avoided by the predators.
- Monarch butterfly is highly distasteful to its predator bird. It is due to a special chemical in its body.
- It is acquired during its caterpillar stage by feeding on a poisonous weed.
- **Thorns** (Acacia, Cactus etc.) are the most common morphological means of defense of plants.
- Many plants produce chemicals that make the herbivore sick, inhibit feeding or digestion, disrupt its reproduction or kill it. E.g. *Calotropis* produce highly poisonous **cardiac glycosides**.
- Therefore cattle or goats do not eat it.
- **Nicotine, caffeine, quinine, strychnine, opium**, etc. are defenses against grazers and browsers.

21.

- Mostly plasmid and bacteriophage is used as a cloning vector.
- Plasmid and bacteriophage have the potential to replicate independently in the host cell without having control of chromosomal DNA.
- In each cell there are plenty of copies of bacteriophage which contains many copies of their genome.
- In certain bacteria, there are one or two copies of plasmid.
- Whereas others may have 15-100 copies per cell. Their numbers can go even higher.
- If we are able to link an alien piece of DNA with bacteriophage or plasmid DNA, we can multiply its numbers equal to the copy number of the plasmid or bacteriophage.
- Vectors used at present, are engineered in such a way that they help easy linking of foreign DNA and selection of recombinants from non-recombinants.

Section C

➤ Write the answer of the following questions : (Each carries 4 Mark)

22.

- (i) Menarche - The first menstruation begins at puberty and is called menarche.
- (ii) Menopause - In human beings, menstrual cycles ceases around 50 years of age; that is termed as menopause.
- (iii) Menstrual cycle - In human females, menstruation is repeated at an average interval of about 28/29 days, and the cycle of events starting from one menstruation till the next one is called the menstrual cycle.
- Menstrual cycle: It is the reproductive cycle of female primates (such as monkeys, apes, and humans).
- The menstrual cycle is the sequence of events that begins with one menstruation and ends with the next.
- Menstruation occurs every 28/29 days in human females.
- Menstruation, the follicular phase, ovulation, and the luteal phase are the four phases of the menstrual cycle.
- Hormones that regulate the menstrual cycle are: Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), Estrogen and Progesterone.

23.

- Co-dominance is a phenomenon in which two alleles express themselves independently when present together in an organism.
- Example : ABO Blood Group
- It is the inheritance in which both alleles of a gene are expressed in a hybrid. E.g. ABO blood grouping in human.
- ABO blood groups are controlled by the gene I.
- This gene controls the production of sugar polymers (antigens) that protrude from plasma membrane of RBC.
- The gene I has three alleles I^A , I^B & i .
- I^A and I^B produce a slightly different form of the sugar while allele i doesn't produce any sugar.

Allele from Parent 1	Allele from Parent 2	Genotype of offspring	Blood types of offspring
I^A	I^A	$I^A I^A$	A
I^A	I^B	$I^A I^B$	AB
I^A	i	$I^A i$	A
I^B	I^A	$I^A I^B$	AB
I^B	I^B	$I^B I^B$	B
I^B	i	$I^B i$	B
i	i	$i i$	O

- When I^A and I^B are present together, they both express their own types of sugars. This is due to co-dominance.

24.

➔ Type of RNA

➔ In bacteria, there are three major types of RNAs:

- (i) mRNA (messenger RNA),
- (ii) tRNA (transfer RNA), and
- (iii) rRNA (ribosomal RNA).

➔ All three RNAs are needed to synthesise a protein in a cell.

➔ The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation.

➔ There is a single DNA-dependent RNA polymerase that catalyses transcription of all types of RNA in bacteria.

Process of Transcription

➔ RNA polymerase binds to promoter and initiates transcription (Initiation).

➔ It uses nucleoside triphosphates as substrate and polymerises in a template depended fashion following the rule of complementarity.

➔ It somehow also facilitates opening of the helix and continues elongation.

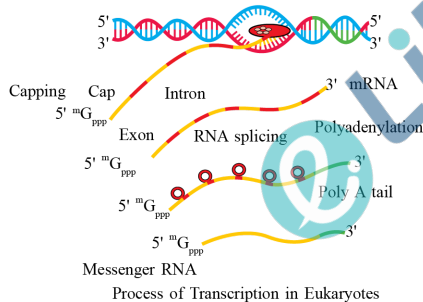
➔ Only a short stretch of RNA remains bound to the enzyme.

➔ Once the polymerases reaches the terminator region, the nascent RNA falls off, so also the RNA polymerase. This results in termination of transcription.

➔ An intriguing question is that how is the RNA polymerases able to catalyse all the three steps, which are initiation, elongation and termination.

➔ The RNA polymerase is only capable of catalysing the process of elongation. It associates transiently with initiation-factor (σ) and termination-factor (ρ) to initiate and terminate the transcription, respectively.

➔ Association with these factors alter the specificity of the RNA polymerase to either initiate or terminate.



➔ In bacteria, since the mRNA does not require any processing to become active, and also since transcription and translation take place in the same compartment (there is no separation of cytosol and nucleus in bacteria), many times the translation can begin much before the mRNA is fully transcribed.

➔ Consequently, the transcription and translation can be coupled in bacteria.

25.

➔ Nucleic acid is the genetic material of all organisms without exception.

➔ In majority of organisms this is deoxyribonucleic acid or DNA.

➔ In order to cut the DNA with restriction enzymes, it needs to be in pure form, free from other macro-molecules.

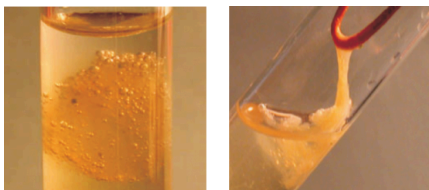
➔ Since the DNA is enclosed within the membranes, we have to break the cell open to release DNA along with other macromolecules such as RNA, proteins, polysaccharides and also lipids.

➔ This can be achieved by treating the bacterial cells/plant or animal tissue with enzymes such as lysozyme (bacteria), cellulase (plant cells), chitinase (fungus).

➔ Genes are located on long molecules of DNA intertwined with proteins such as histones.

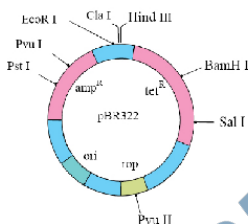
➔ The RNA can be removed by treatment with ribonuclease whereas proteins can be removed by treatment with protease.

- ➔ Purified DNA ultimately precipitates out after the addition of chilled ethanol.
- ➔ This can be seen as collection of fine threads in the suspension.
- ➔ DNA that separates out can be removed by spooling.



26.

- ➔ (i) pBR322
- ➔ In order to link the alien DNA, the vector needs to have very few, preferably single, recognition sites for the commonly used restriction enzymes.
- ➔ Presence of more than one recognition sites with in the vector will generate several fragments, which will complicate the gene cloning.



- ➔ The ligation of alien DNA is carried out at a restriction site present in one of the two antibiotic resistance genes.
- ➔ For example, you can ligate a foreign DNA at the BamHI site of tetracycline resistance gene in the vector pBR322.
- ➔ The recombinant plasmids will lose tetracycline resistance due to insertion of foreign DNA but can still be selected out from non-recombinant ones by plating the transformants on tetracycline containing medium.

➔ (ii) Insertional Inactivation

- ➔ This results into inactivation of the gene for synthesis of this enzyme, which is referred to as insertional inactivation.
- ➔ The presence of a chromogenic substrate gives blue coloured colonies if the plasmid in the bacteria does not have an insert.
- ➔ Presence of insert results into insertional inactivation of the β -galactosidase gene and the colonies do not produce any colour, these are identified as recombinant colonies.

27.

➔ **Benign tumours :**

- Confined to the place of its origin. They do not spread to other parts. Cause little damage.

➔ **Malignant tumours :**

- Mass of proliferating cells (**neoplastic or tumour cells**) that grow rapidly, invade and damage the surrounding normal tissues. Due to active division and growth, they starve normal cells by competing for nutrients.
- Cells sloughed from tumours reach other sites via blood where they form a new tumour. This is called **metastasis**.