

BLUE PRINT
BIOLOGY
XII

S.No.	Type of questions → Unit ↓	VSA	SA II	SA I	LA	Total
1.	Reproduction	2(2)	4(2)	3(1)	5(1)	14(6)
2.	Genetics and Evolution	2(2)	2(1)	9(3)	5(1)	18(7)
3.	Biology in Human Welfare	1(1)	10(5)	3(1)	-	14(7)
4.	Biotechnology	1(1)	-	9(3)	-	10(4)
5.	Ecology and Environment	2(2)	4(2)	3(1)	5(1)	14(6)
	Total	8(8)	20(10)	27(9)	15(3)	70(30)

KENDRIYA VIDYALAYA SANGATHAN, JABALPUR REGION
SAMPLE PAPER
BIOLOGY
XII

Time: 3 Hrs

MM: 70

General Instructions:

- (i) All questions are compulsory.
- (ii) This question paper consists of four Sections A, B, C and D. Section A contains 8 questions of one mark each, Section B is of 10 questions of two marks each, Section C is of 9 questions of three marks each and Section D is of 3 questions of five marks each.
- (iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.
- (iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

SECTION – A

- Q1. Name the cells in the embryo which have the potency to give rise to all the tissues and organs.
- Q2. Identify Figure 1.
- Q3. How is sex determined in grasshoppers?
- Q4. (a) Name the adapter molecule in translation.
(b) State an example of point mutation.
- Q5. Which two types of cells in the body are attacked by HIV?
- Q6. Describe the significance of Rosie.
- Q7. Name the pioneer species in primary succession on –
a) rock and in water.
b) In water
- Q8. Define BOD.

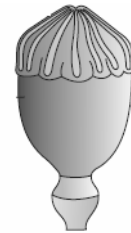


Figure 1

SECTION – B

- Q9. (i) State Allen's Rule.
(ii) State two adaptations that help a kangaroo rat in North American deserts to survive in such harsh conditions.
- Q10. Explain the terms 'standing crop' and 'standing state'.
- Q11. What are UTRs? What is their significance?

OR

State an example of homology in plants. What does homology signify?

Q12. Draw and label a blastocyst.

Q13. Define Biofortification. What is special about Atlas 66?

Q14. In the following table, identify 'a', 'b', 'c' and 'd'.

S No.	Causative Organism	Disease
1.	a	Typhoid
2.	Rhinovirus	b
3.	c	Pneumonia
4.	d	Filariasis

Q15. Some species of *Asteraceae* and grasses, have evolved a special mechanism, to produce seeds without fertilisation,

- Name the mechanism.**
- Explain any one mechanism.**

Q16. What is present in the injection which is given to patients of snakebite? State the type of immunity it generates.

Q17. With reference to cancer, answer the following-

- Contact inhibition.**
- Metastasis.**
- Immunotherapy.**

Q18. Describe any two types of out – breeding devices.

SECTION – C

Q19. Answer the following with reference to genetic code:

- How many codons code for amino acids?**
- Why is the code unambiguous as well as degenerate?**
- What is the code for phenylalanine?**

Q20. A vector is engineered with three features which facilitate its cloning with the host cell. List these three features and briefly explain their role.

Q21. With the help of the Example of β -galactosidase, Explain Insertional Inactivation and its significance.

Q22. It has been seen that high levels of mercury or DDT in a water body gives rise to a particular problem. What is this problem? Explain with an example.

Q23. Describe hormonal control of spermatogenesis.

Q24. What are lymphoid organs? Describe their types.

Q25. Explain the processing of *hn*RNA to convert it to *m*RNA.

Q26. Describe the process of Gel Electrophoresis OR PCR.

Q27. The inheritance of flower colour in the dog flower (snapdragon or *Antirrhinum sp.*) is a good example to understand incomplete dominance. Describe incomplete dominance.

SECTION – D

Q28. Particulate and gaseous pollutants along with harmless gases are released from the thermal power plants.

- i. Name any two harmless gases released.**
- ii. Name the most widely used device for removing particulate pollutants from the air.**

Explain how the device is used.

- iii. State two serious problems of the use of nuclear energy.**

OR

What is ‘The Evil Quartet’? Explain all in detail.

Q29. With the help of well labeled diagrams only, depict embryo development in dicot plants. Name the significant stages in embryogenesis.

OR

Describe development of zygote upto implantation.

- Q30. (i) What do you understand by Hardy- Weinberg equilibrium? What does a change in Hardy- Weinberg equilibrium signify?**
- (ii) Write the above equilibrium in the form of algebraic expression.**
 - (iii) Briefly explain how gene flow affects Hardy- Weinberg Equilibrium.**

OR

Describe *Lac* Operon.

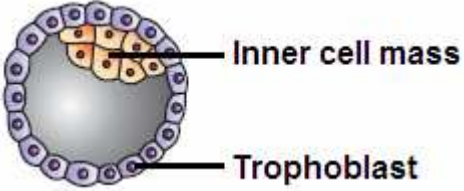
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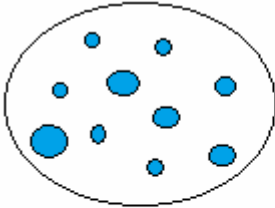
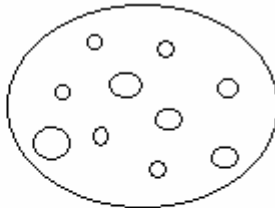
MARKING SCHEME

KENDRIYA VIDYALAYA SANGATHAN, JABALPUR REGION
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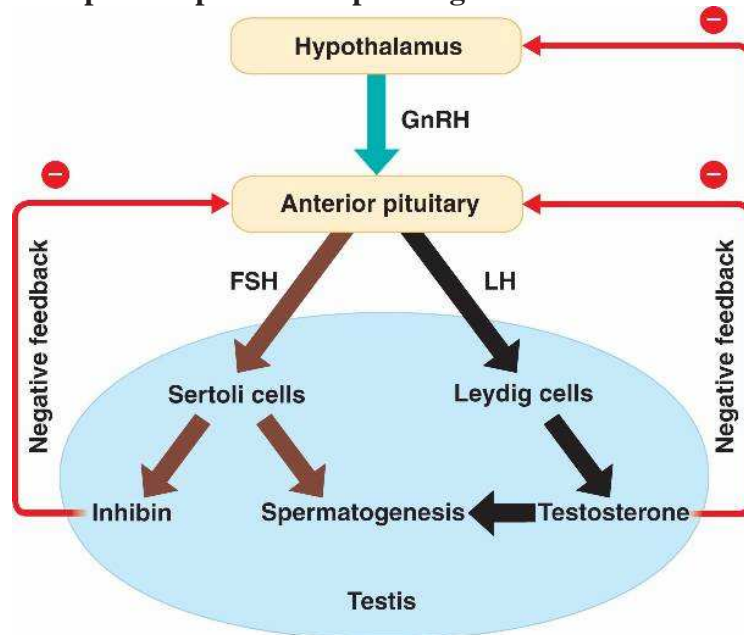
Q.No	Answers	Marks allotted
1.	Stem cells.	1
2.	Multicarpellary, syncarpous pistil of <i>Papaver</i> .	$\frac{1}{2} + \frac{1}{2}$
3.	XO type, i.e., all eggs bear an additional X-chromosome besides the other chromosomes (autosomes).	1
4.	a) tRNA b) Sickle – cell anaemia	$\frac{1}{2} + \frac{1}{2}$
5.	Macrophages and helper T – lymphocytes.	$\frac{1}{2} + \frac{1}{2}$
6.	Rosie - first transgenic cow. Developed in 1997. <ul style="list-style-type: none">Produced human protein-enriched milk (2.4 grams per litre).Contained the human alpha-lactalbumin and was nutritionally a more balanced product for human babies than natural cow-milk.	1
7.	The pioneer species in primary succession on a rock – lichens in water - phytoplankton.	$\frac{1}{2} + \frac{1}{2}$
8.	The amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria.	1
9.	(i) Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. (ii) capable of meeting all its water requirements through <ul style="list-style-type: none">its internal fat oxidation (in which water is a byproduct).It also has the ability to concentrate its urine so that minimal volume of water is used to remove excretory products.	1 + $\frac{1}{2}$ + $\frac{1}{2}$
10.	<ul style="list-style-type: none">Standing crop - A certain mass of living material at a particular time at each trophic level. It is measured as the mass of living organisms (biomass) or the number in a unit area.Standing state - The amount of nutrients, such as carbon, nitrogen, phosphorus, calcium, etc., present in the soil at any given time.	1 + 1
11.	<ul style="list-style-type: none">Untranslated regions (UTR).Present at both 5' -end (before start codon) and at 3' -end (after stop codon).Required for efficient translation process. <hr/> <p style="text-align: center;">OR</p> <ul style="list-style-type: none">The thorn and tendrils of <i>Bougainvillea</i> and <i>Cucurbita</i>.It is based on divergent evolution and indicates common ancestry.	$1\frac{1}{2} + \frac{1}{2}$ <hr/> 1 + 1

12.	 <p style="text-align: center;">BLASTOCYST</p>	
13.	<p>BIOFORTIFICATION – breeding crops with higher levels of vitamins and minerals, or higher protein and healthier fats – is the most practical means to improve public health.</p> <p>Wheat variety, Atlas 66, having a high protein content, has been used as a donor for improving cultivated wheat.</p>	1 + 1
14.	<p>a. <i>Salmonella typhi</i> b. Common cold c. <i>Streptococcus pneumoniae</i> or <i>Haemophilus influenza</i> d. <i>Wuchereria bancrofti</i></p>	½ x 4
15.	<p>a) Apomixis. b) In many <i>Citrus</i> and <i>Mango</i> varieties some of the nucellar cells surrounding the embryo sac start dividing, protrude into the embryo sac and develop into the embryos. In such species each ovule contains many embryos (polyembryony).</p> <p>OR</p> <ul style="list-style-type: none"> In some species, the diploid egg cell is formed without reduction division and develops into the embryo without fertilisation. 	1 + 1
16.	<ul style="list-style-type: none"> Preformed antibodies against the snake venom. Passive immunity. 	1 + 1
17.	<p>a) Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appear to have lost this property.</p> <p>b) Metastasis - Cells sloughed from malignant tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there.</p> <p>c) Immunotherapy - Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called biological response modifiers such as α-interferon which activate their immune system and help in destroying the tumor.</p>	½ + ½ + 1
18.	<p>Any two of the following -</p> <p>i) Out-crossing: This is the practice of mating of animals within the same breed, but having no common ancestors on either side of their pedigree up to 4-6 generations.</p> <ul style="list-style-type: none"> e.g., best breeding method for animals that are below average in productivity in milk production, growth rate in beef cattle, etc. <p>ii) Cross-breeding: Superior males of one breed are mated with superior females of another breed allowing the desirable qualities of two different breeds to be combined.</p> <ul style="list-style-type: none"> e.g., <i>Hisardale</i> is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Marino rams. <p>iii) Interspecific hybridisation: Male and female animals of two different species are mated.</p> <ul style="list-style-type: none"> e.g., the mule (mare x male donkey). 	1 + 1
19.	<p>i. 61 (3 are non - sense codons). ii. One codon codes for only one amino acid, hence, it is unambiguous</p>	1 + 1 + 1

	<p>and some amino acids are coded by more than one codon, hence the code is degenerate.</p> <p>iii. UUU</p>	
20.	<ol style="list-style-type: none"> Origin of replication (ori): A sequence from where replication starts and any piece of DNA when linked to this sequence can be made to replicate within the host cells. Also responsible for controlling the copy number of the linked DNA. Selectable marker: helps in identifying and eliminating nontransformants and selectively permitting the growth of the transformants. Normally, the genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline or kanamycin, etc., are considered useful selectable markers for <i>E. coli</i>. The normal <i>E. coli</i> cells do not carry resistance against any of these antibiotics. Cloning sites: To link foreign DNA a vector should have recognition sites for the commonly used restriction enzymes 	1 + 1 + 1
21.	<p><u>INSERTIONAL INACTIVATION –</u></p> <ul style="list-style-type: none"> It is the Inactivation of a gene due to the insertion of a foreign DNA. It helps us to select transformants from non-transformants. A recombinant DNA is inserted within the coding sequence of an enzyme, for example, <u>β-galactosidase</u>. This results into inactivation of the enzyme, which is referred to as <u>insertional inactivation</u>. The presence of a chromogenic substrate gives <u>blue coloured</u> colonies if the plasmid in the bacteria does not have an insert. Presence of insert results into insertional inactivation of the β-galactosidase and the colonies do not produce any colour, these are identified as recombinant colonies. <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Blue coloured colonies</p> </div> <div style="text-align: center;">  <p>No colour in the colonies due to inactivation.</p> </div> </div>	1 + 2
22.	<ul style="list-style-type: none"> Biological Magnification or <u>BIOMAGNIFICATION</u> in the aquatic food chain. <u>Increase in concentration of the toxicant</u> at successive trophic levels because a toxic substance accumulated by an organism cannot be metabolised or excreted, and is thus passed on to the next higher trophic level. Eg., <u>decline in bird populations</u> due to the increase in concentration of DDT at successive trophic levels – from 0.003 ppb (ppb = parts per billion) in water to 25 ppm (ppm = parts per million) in fish-eating birds, through biomagnification. High concentrations of DDT disturb calcium metabolism in birds, which causes thinning of eggshell and their premature breaking. 	1 + 1 + 1

23. **HORMONAL CONTROL OF SPERMATOGENESIS.**

- Spermatogenesis starts at the age of puberty due to significant increase in the secretion of hypothalamic gonadotropin releasing hormone (GnRH).
- GnRH acts at the anterior pituitary gland and stimulates secretion of two gonadotropins – luteinising hormone (LH) and follicle stimulating hormone (FSH).
- LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis.
- FSH acts on the Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis.



1 + 1 + 1
for each
hormone

24. • Organs where origin and/or maturation and proliferation of lymphocytes occur.

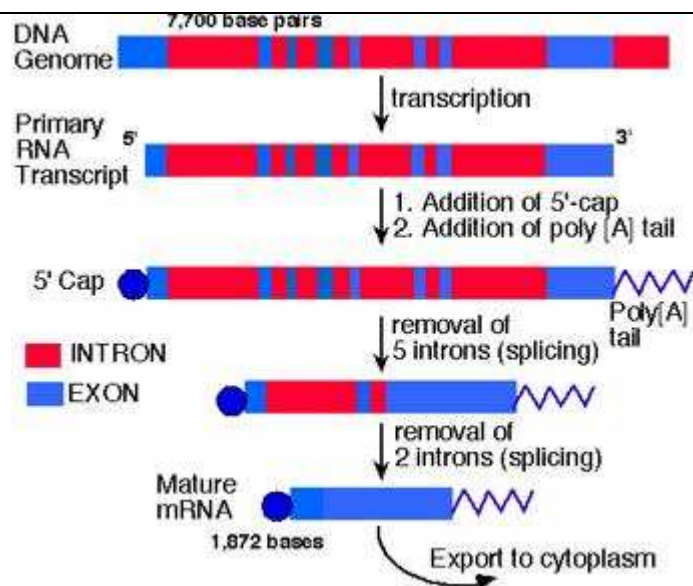
- Primary lymphoid organs: bone marrow and thymus where immature lymphocytes differentiate into antigen-sensitive lymphocytes.
- Secondary lymphoid organs: spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix which provide the sites for interaction of lymphocytes with the antigen, which then proliferate to become effector cells.

1 + 1 + 1

25. **The processing of hnRNA to convert it to mRNA –**

- Splicing - heterogeneous nuclear RNA (hnRNA) contains both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order.
- Capping – an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA.
- Tailing - adenylate residues (200-300) are added at 3'-end in a template independent manner.

1 + 1 + 1

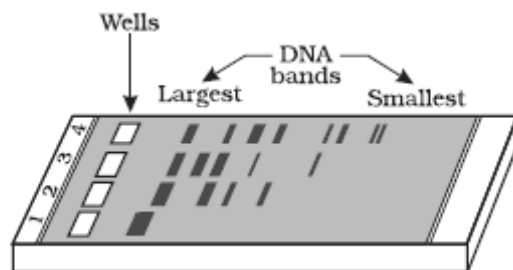


26. **GEL ELECTROPHORESIS:**

- Technique used to separate the fragments of DNA produced by the action of restriction endonucleases. DNA fragments are negatively charged molecules so they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix made of agarose (a natural polymer extracted from sea weeds).
- The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves.
- The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. Bright orange coloured bands of DNA are seen in a ethidium bromide stained gel exposed to UV light.
- The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution.

$\frac{1}{2} * 4 = 2$

1(Figure)



1+1+1
(Figure)

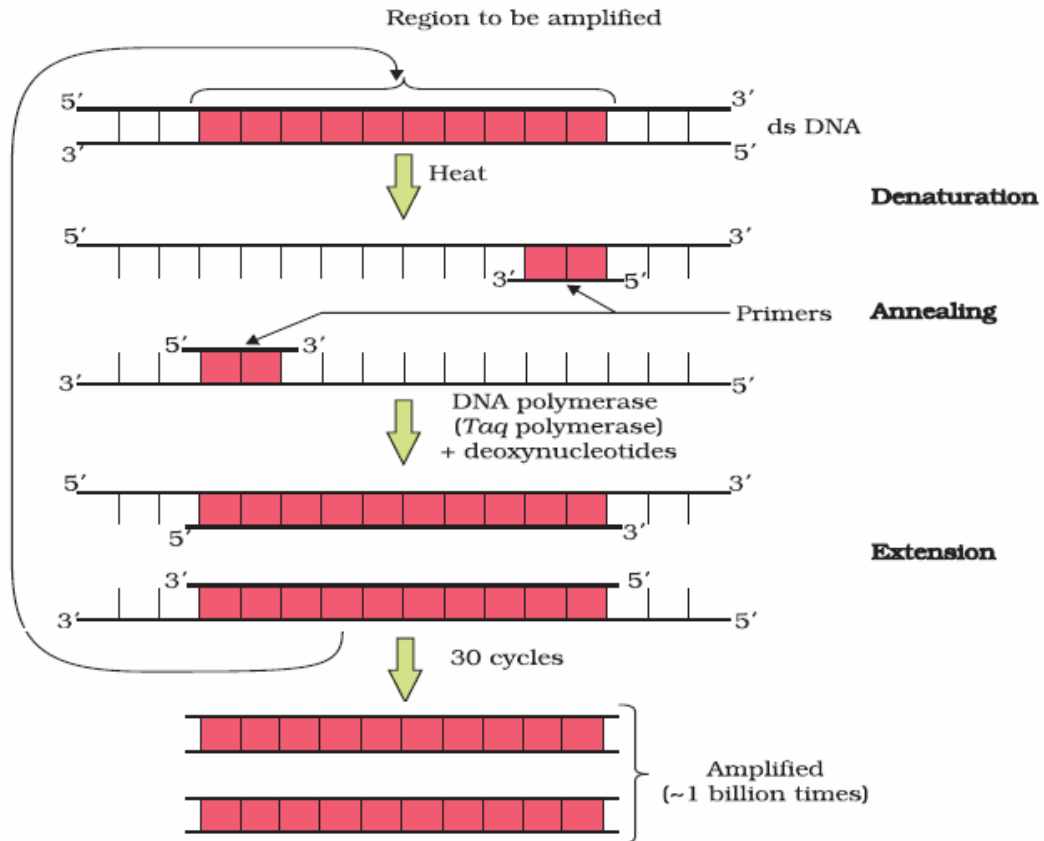
OR

PCR – POLYMERASE CHAIN REACTION –

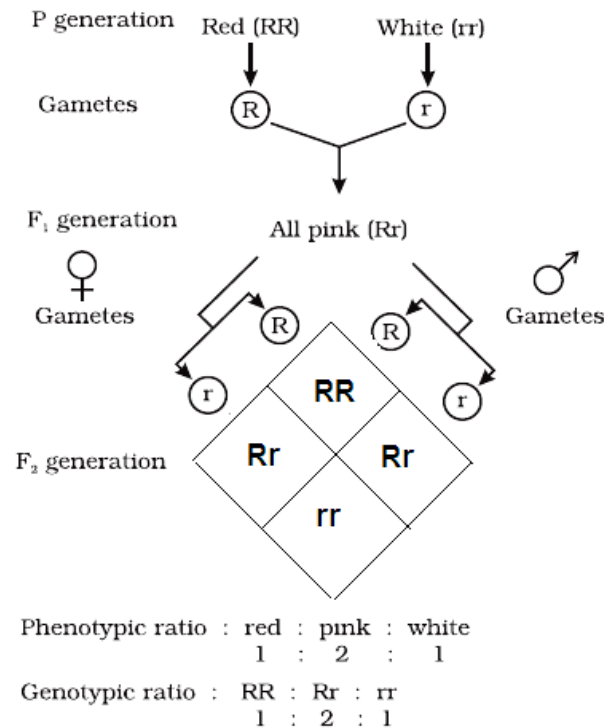
- Technique for Amplification of Gene of Interest.
- 3 steps – denaturation, annealing and extension.
- Multiple copies of the gene (or DNA) of interest is synthesised *in vitro* using two sets of primers (small chemically synthesised oligonucleotides that are complementary to the regions of DNA) and the enzyme DNA polymerase.
- Use of a thermostable DNA polymerase (*taq* polymerase - isolated from a bacterium, *Thermus aquaticus*), which remain active during

the high temperature induced denaturation of double stranded DNA.

- The enzyme extends the primers using the nucleotides provided in the reaction and the genomic DNA as template.



27. **INCOMPLETE DOMINANCE** - Flower colour in the dog flower (snapdragon or *Antirrhinum sp.* is inherited as follows:



R is not completely dominant over r and this made it possible to distinguish Rr as pink from RR (red) and rr (white) .

Parental Generation correct Phenotype and Genotype

1 mark

+

Punnet's Square

1 mark

+

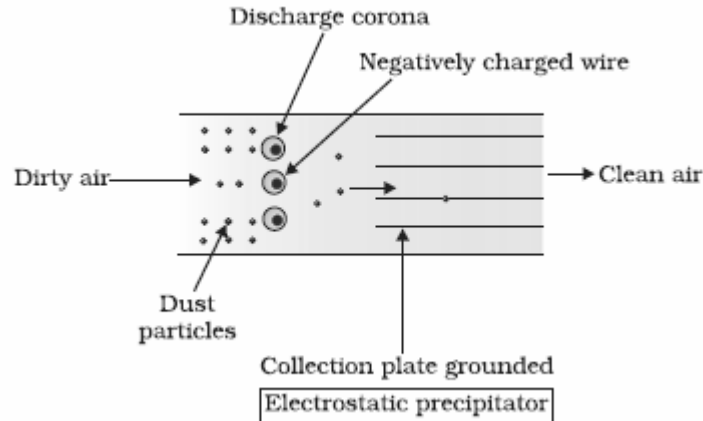
Correct phenotypic and Genotypic ratio

1 mark

28.

i. Nitrogen, Oxygen.

ii. **Electrostatic precipitator:** It has electrode wires that are maintained at several thousand volts, which produce a corona that releases electrons. These electrons attach to dust particles giving them a net negative charge. The collecting plates are grounded and attract the charged dust particles. The velocity of air between the plates must be low enough to allow the dust to fall. It can remove over 99 per cent particulate matter present in the exhaust from a thermal power plant.



- iii. The use of nuclear energy has two very serious inherent problems.
- Accidental leakage**, (as occurred in the Three Mile Island and Chernobyl incidents) and
 - Safe disposal** of radioactive wastes as they may cause mutations.

OR

'THE EVIL QUARTET' are the four major causes for loss of biodiversity.

- Habitat loss and fragmentation:** e.g., The Amazon rain forest (it is so huge that it is called the 'lungs of the planet') harbouring probably millions of species is being cut and cleared for cultivating *soya beans* or for conversion to grasslands for raising beef cattle.
- Over-exploitation:** Many species extinctions in the last 500 years e.g., Steller's sea cow, passenger pigeon, were due to overexploitation by humans.
- Alien species invasions:** e.g., 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. Other examples include carrot grass (*Parthenium*), *Lantana* and water hyacinth (*Eicchornia*) and African catfish *Clarias garipepinus*.
- Co-extinctions:** e.g., coevolved plant-pollinator mutualism where extinction of one invariably leads to the extinction of the other.

$$\frac{1}{2} + \frac{1}{2} + 2 + 2$$

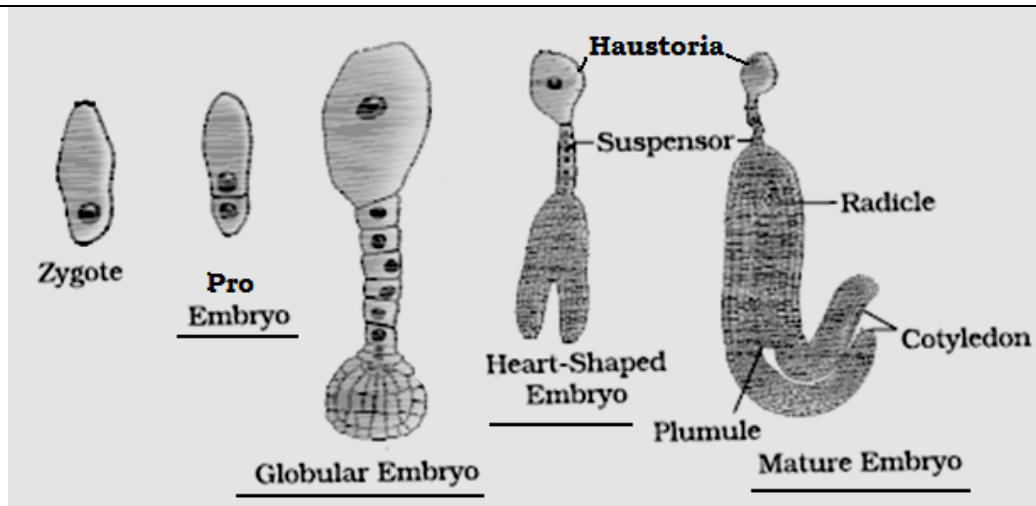
$$1 \times 5$$

29.

EMBRYO DEVELOPMENT IN DICOT PLANTS:

$$1 \times 5 = 5$$

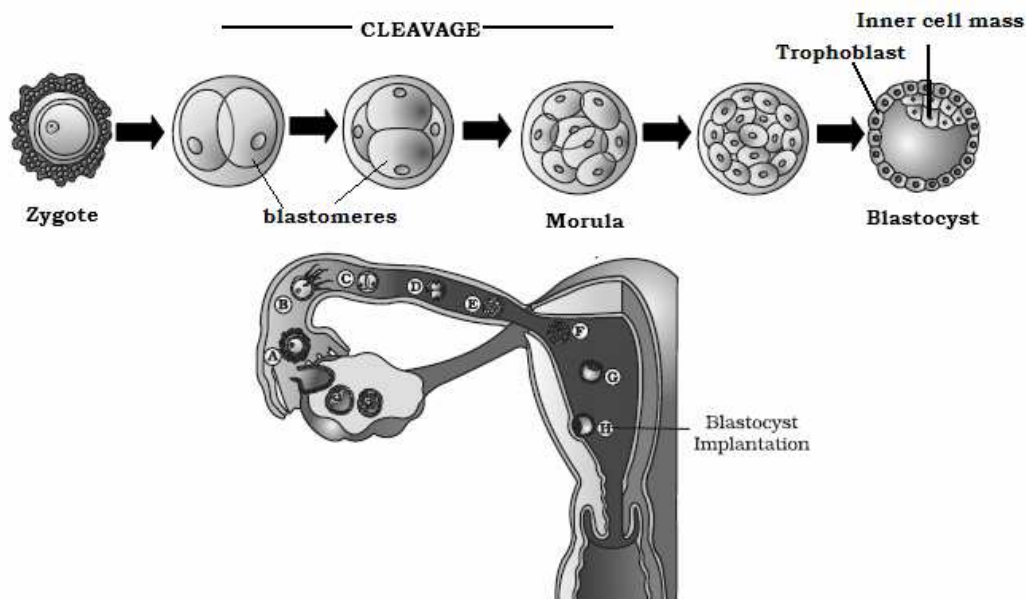
$$1 \times 5 = 5$$



OR

DEVELOPMENT OF ZYGOTE UPTO IMPLANTATION –

- The mitotic division called cleavage starts as the zygote moves through the isthmus of the oviduct towards the uterus and forms 2, 4, 8, 16 daughter cells called blastomeres.
- The embryo with 8 to 16 blastomeres is called a morula. The morula continues to divide and transforms into blastocyst as it moves further into the uterus.
- The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass.
- The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo.
- After attachment, the uterine cells divide rapidly and cover the blastocyst. As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.



30.

(i) HARDY- WEINBERG PRINCIPLE –

- Allele frequencies in a population are stable and constant from generation to generation.
The gene pool (total genes and their alleles in a population) remains a constant. This is called genetic equilibrium.
Sum total of all the allelic frequencies is 1.
- Disturbance in genetic equilibrium, or Hardy- Weinberg equilibrium, i.e., change of frequency of alleles in a population would then be interpreted as resulting in evolution.

(ii) ALGEBRAIC EXPRESSION –

- $p^2+2pq+q^2=1.$

(iii) FACTORS AFFECTING HARDY- WEINBERG EQUILIBRIUM –

- Gene flow occurs when a section of a population migrates to another place and mingles with the population there.
- Gene frequencies change in the original as well as in the new population
- New genes/Alleles are added to the new population and some genes are lost from old population.
- There would be a gene flow if this gene migration happens multiple times.

OR

LAC OPERON:

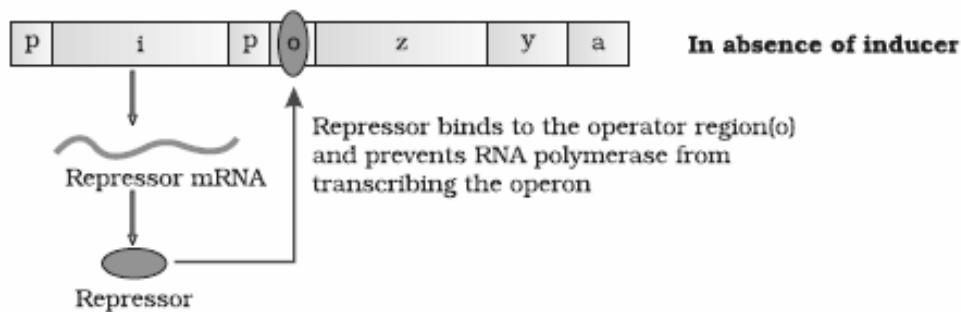
Components: The *lac* operon consists of:

- one regulatory gene - the *i* gene - codes for the repressor of the *lac* operon. and
- three structural genes (*z*, *y*, and *a*).
 - The *z* gene codes for beta-galactosidase (β -gal), which hydrolyses disaccharide lactose into its monomeric units, galactose and glucose.
 - The *y* gene codes for permease, which increases permeability of the cell to β -galactosides.
 - The *a* gene encodes a transacetylase.

Lactose is the substrate for the enzyme beta-galactosidase and it regulates switching on and off of the operon. Hence, it is termed as inducer.

Working of Lac Operon:

In the absence of an inducer, the repressor protein binds to the operator region of the operon and prevents RNA polymerase from transcribing the operon.



In the presence of an inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer. This allows RNA polymerase access to the promoter and transcription proceeds.

1 mark

1 mark

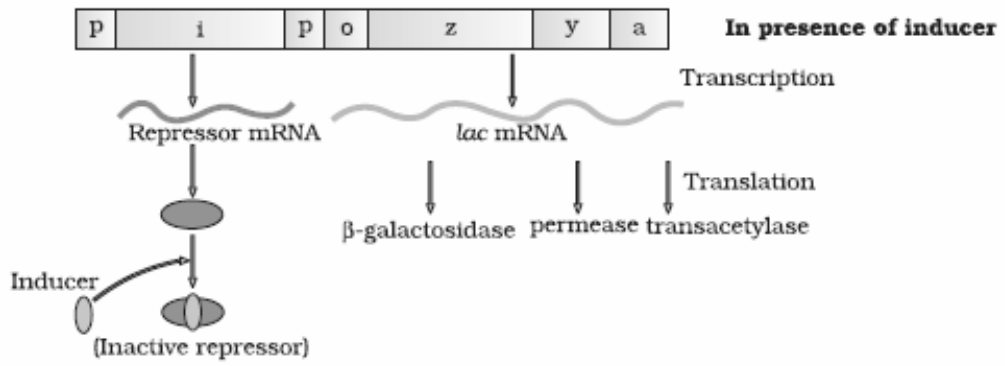
1 mark

2 marks

1/2 marks

1/2 * 3

1 1/2



1½

Essentially, regulation of *lac* operon can also be visualised as regulation of enzyme synthesis by its substrate.