Previous IPE

SOLVED PAPERS

MARCH-2019 (AP)

PREVIOUS PAPERS

IPE: MARCH-2019(AP)

Time: 3 Hours **SR BOTANY** **Max. Marks: 60**

SECTION-A

I. Answer ALL the following VSAQ: **10 × 2 = 20**

1. What are apoplast and symplast ?
2. Define the law of limiting factors proposed by Blackman.
3. What is a genophore ?
4. Who proposed the Chromosome Theory of Inheritance ?
5. What are the components of a transcription unit ?
6. Define stop codon. Write the codons.
7. What is down - stream processing ?
8. Can a disease be detected before its symptoms appear ? Explain the Principal involved.
9. Give two examples of fungi used in SCP production.
10. Name any two industrially important enzymes.

SECTION-B

II. Answer any SIX of the following SAQs: **6 × 4 = 24**

11. Define and explain water potential.
12. Explain the steps involved in the formation of root nodule.
13. Write briefly about enzyme inhibitors
14. Write the physiological responses of gibberellins in plants.
15. Explain the lytic cycle with reference to certain viruses.
16. Explain the law of Dominance using a monohybrid cross.
17. Write briefly on nucleosomes.
18. List out the beneficial aspects of transgenic plants.

SECTION-C

III. Answer any TWO of the following LAQs: **2 × 8 = 16**

19. Explain the reactions of Krebs cycle.
20. Give a brief account of the tools of recombinant DNA technology.
21. Describe the tissue culture technique. What are the advantages of tissue culture over conventional method of plant breeding in crop improvement programmes?

BABY BULLET-Q

IPE AP MARCH-2019
SOLUTIONS

SECTION-A

1. What are apoplast and symplast? **[TS 15,17] [AP 19,22]**

A:

Apoplast	Symplast
1) **Apoplast** is the path of transport of water in a plant without crossing any membrane.	1) **Symplast** is the path of transport of water in a plant by crossing **some membranes**.
2) It is a fast process.	2) It is a slow process

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2. Define the law of limiting factors proposed by Blackman. **[AP 16,17, 19]**

A: **Law of limiting factors:** In a process participated by a number of separate factors, the rate of the process is limited by the factor which is present in a relative minimal value.

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3. What is a genophore? **[TS 23][AP 19,22]**

A: **Genophore:** The main genetic material of bacteria is called genophore (Bacterial chromosome).

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4. Who proposed the Chromosome theory of Inheritance? **[TS 20,22] [AP 17, 19,22]**

A: Sutton and Boveri.

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5. What are the components of a transcription unit? **[TS 17, 17][AP 16,19,23]**

A: The components of transcription unit are

a) A promoter

b) The structural gene and

c) A Terminator.

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6. Define stop codon. Write the codons. **[TS 19] [AP 15, 19]**

A: 1) The codons which terminates the protein synthesis are called stop codons.
2) They are UAA, UAG, UGA.
3) They donot code for any amino acid.

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7. What is down-stream processing? **[AP 16,17,19,19][TS 16,17,23]**

A. Separation and purification of products before they are ready for marketing is called down streaming processing.

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8. Can a disease be detected before its symptoms appear? Explain the principle involved.

A: 1)Earlier detection of diseases can be done using (i) PCR (ii) ELISA techniques.

2)The principle of PCR is gene amplification. **[TS 19, 19][AP 17, 19]**

3)The principle of ELISA is antigen-antibody interaction.

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9. Give two examples of fungi used in SCP production. **[AP 15,17,23][TS 17]**

A: 1) Candida utilis (Torula Yeast)

2)Saccharomyces cerevisiae (Baker's yeast)

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10. Name any two industrially important enzymes. **[TS 17,22] [AP 17, 19,22]**

A: Amylase, Lipases, Streptokinases.

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SECTION-B

11. Define and explain water potential . [TS 19][AP 18,19]

A: Water potential (ψ_w): Water potential is the measure of movement of water from one part to the another part within the plant. It involves diffusion, osmosis.

It is expressed in Pascals(Pa).

Water potential of Pure water is taken as zero at standard temperature and pressure.

Water potential has two main components (i) Solute potential and (ii) Pressure potential.

i) Solute potential (ψ_s) : When a solute is dissolved in pure water , the concentration of pure water decreases. Hence its water potential also decreases. This decrease in water potential is called solute potential. **It is always negative.**

ii) Pressure potential (ψ_p) : When some water enters into a plant cell, the pressure against cell wall increases due to diffusion. This makes the cell turgid(swollen). This increase in water potential is called pressure potential. It is always positive. It is observed in the ascent of water through stem. Total water potential =Sum of solute & pressure potential.

Total Water potential $\psi_w = \psi_s + \psi_p$

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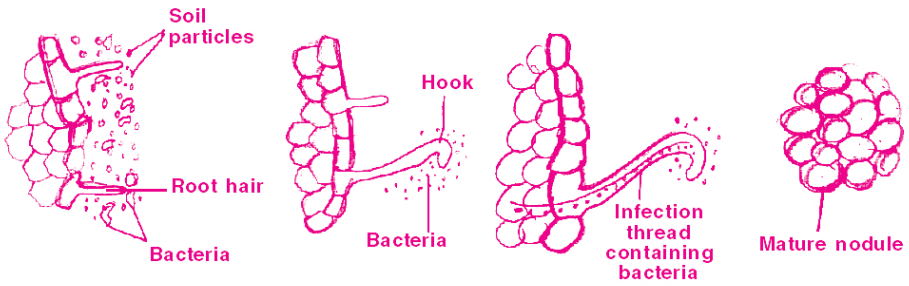
12. Explain the steps involved in the formation of root nodule.

A: Steps involved in the formation of root nodule: **[AP 17, 19,23][TS 16,17,20,23]**

1) The roots of host Legume release sugars and amino acids.
2) These sugars attract Rhizobia.
3) They multiply, colonise and get attached to the epidermis of root hair cells.
4) The root hairs curl and bacteria spread into the cortex of the root.
5) Then an infection thread is produced.
6) It carries the bacteria into the cortex.
7) The bacteria initiate nodule formation in the cortex of the root.
8) Then the bacteria present in the cortical cells, stimulate the host cells to divide.
9) This leads to the differentiation of specialised nitrogen fixing cells, which form root nodule.
10) The nodule thus formed establishes a direct vascular connection with the host, for exchange of nutrients



BABY BULLET-Q

13. Write briefly about enzyme inhibitors.

A: Enzyme Inhibitors: These are the chemicals which2 stop the activity of the enzymes. Those chemicals are called "inhibitors" and the process is called inhibition. The inhibitors are three types. They are 1) Competitive inhibitors 2) Non-competitive inhibitors 3) Feed back inhibitors.

1) **Competitive inhibitors:** The inhibitors that resemble the substrate molecules and prevents the activity of the enzyme are called competitive inhibitors.

   Ex: Malonic acid resembles the substrate succinate and it inhibits the succinic dehydrogenase.

2) **Non-competitive inhibitors:** The inhibitors having no structural similarity with the substrate and binding to an enzyme of locations other than the active sites so that the globular structure of the enzyme is changed are called non-competitive enzyme inhibitors.

   Ex: Metal ions of Copper, Mercury.

3) **Feed back inhibitors:** Feed back inhibition is a cellular control mechanism in which an enzyme's activity is inhibited by the enzyme's end product.

   It is a part of homeostatic control metabolism.

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14. Write the physiological responses of gibberellins in plants. [AP 19][TS 15]

A: 1) Gibberellins are growth hormones that stimulate fruit repining , stem elongation, termination, flowering, sex expression, enzyme induction, Leaf & fruit senescence.

2) Gibberellins are denoted by GA_1, GA_2, GA_3 and so on.

3) GA hastens the maturity period of conifers thus leading to early seed production.

4) GA_3 is used to speed up the malting process in brewing industry.

5) Gibberellins increase the length of the axis, thus used to increase the length of grape's stalks.

6) Gibberellins cause fruits like apple to elongate and improve their shape.

7) They delay senescence.

8) Spraying GA on sugarcane stems, increases the length of stem thus increasing the yield by 20 tonnes per acre.

BABY BULLET-O

15. Explain the lytic cycle with reference to certain viruses. **[TS 19] [AP 16,19]**

A: **Lytic Cycle:** Lytic Cycle is one of the two cycles of viral reproduction. It results in the destruction of the infected cell and its membrane. Viruses causing lysis of host cells are called virulent phages. The lytic cycle consists of following five steps.

1) Attachment: The tail fibres of the virus attach to the complementary receptor sites on bacterial cell walls.

2) Penetration:

(i) The injection of phage nucleic acid into bacterium cell is called penetration.

(ii) The tail core is driven in through the bacterial cell wall.

(iii) The DNA of bacterio phage passes through the plasma membrane and enters into the bacterial cell.

(iv) The phage particle functions like a hypodermic syringe and injects its DNA into the bacterial cell.

(v) The capsid out side the bacterial cell is called as the Ghost.

3) Biosynthesis:

(i) Once the phage DNA reaches the cytoplasm of the host cell, many copies of phage DNA, enzymes and capsid proteins are synthesized using the cellular machinery of the host cell.

(ii) Complete phages can not be found in the host cell.

4) Maturation:

(i) In this process, the phage DNA and capsids are assembled into complete virons.

(ii) This period of time between the infection by a virus and the appearance of mature virus with in the cell is called **eclipse period.**

5) Release:

(i) The final stage of viral multiplication is the lysis phage of the host cell.

(ii) The plasma membrane of the host cell gets dissolved by the host enzyme called lysozyme.

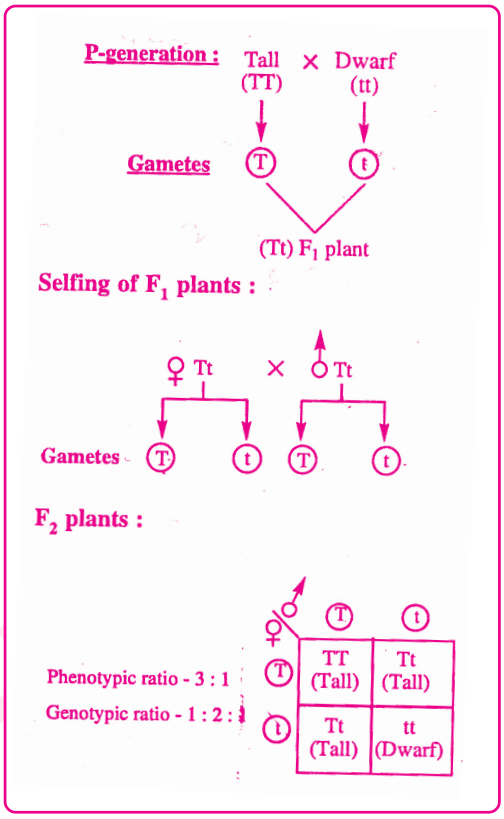
(iii) The host cell wall breaks, releasing newly produced phage particles (or) Virus.

BABY BULLET-Q

16. Explain the law of Dominance using a monohybrid cross. **[AP 15, 17,19]**

A: Monohybrid cross: The cross made between two individuals differing in one character is called Monohybrid cross.

In the hybridization experiment Mendel crossed tall and dwarf pea plants to study the inheritance of one gene. Based on his observation on monohybrid crosses, Mendel proposed Law of Dominance.



Law of Dominance:

1) Characters are controlled by discrete units called factors.
2) Factors occur in pairs.
3) In a dissimilar pair of factors, one member dominates the other memer of the pair.
4) The law of dominance is used to explain the expression of only one of the parental characters in a 'monohybrid cross' in the F_1 generation and the expression of both in the F_2 generation.
5) It also explains the proportion of 3:1 ratio obtained at the F_2 generation.

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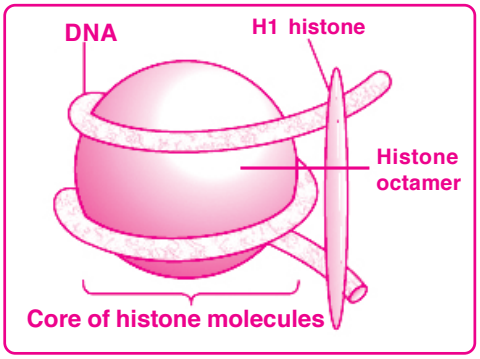
17. Write briefly on nucleosomes. **[AP 17, 19][TS 22]**

A: 1) Nucleosome is a bead like structure of chromosomes.



2) It consists of eight histone molecules (histone octamer) and a DNA segment of about 150 base pairs.
3) The negatively charged DNA is wrapped around the positively charged histone octamer to form the structure of nucleosome.
4) Nucleosome helps to fold DNA into a compact form.
5) DNA and basic histone proteins constitute chromatin.
6) Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin.
7) The nucleosomes in chromatin are seen as 'beads-on-string' when viewed under electron microscope.

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18. List out the beneficial aspects of transgenic plants. [TS 17,22] [AP 17,19,23]

A: Beneficial aspects of transgenic plants:

1) Transgenic crop plants having resistance to pathogens and pests:

(i) Transgenic papaya is resistant to papaya ring spot virus.

(ii) Bt cotton is resistant to insects.

(iii)Transgenic tomato plants are resistant to the bacterial pathogen pseudomonas.

(iv)Transgenic potato plants are resistant to the fungus phytophthora.

2) Transgenic plants suitable for food processing technology:

- Transgenic tomato "Flavr Savr" is bruise resistant i.e., suitable for storage and transport due to delayed ripening.

3) Transgenic plants with improved nutritional value:

- Transgenic golden rice obtained from "Taipei" is rich in vitamin A and prevents blindness.

4) Transgenic plants used for hybrid seed production:

- Male sterile plants of Brassica napus are produced. This will eliminate the problem of manual emasculation and reduce the cost of hybrid seed production.

5) Transgenic plants tolerant to abiotic stresses caused by chemicals, cold, drought, salt, heat etc:

- Basmati variety of rice was made resistant against biotic and abiotic stresses.
- Round up ready soyabean is herbicide tolerant.

BABY BULLET-Q

SECTION-C

19. Explain the reactions of Krebs cycle. [AP 16,17,19,19,22,23][TS 17,19,19,22]

A: 1) Krebs Cycle: Krebs cycle is a cyclic process which occurs in all aerobic organisms to generate energy. It takes place in mitochondria.

2) In Krebs cycle, Acetyl coenzyme (CoA) is oxidised to form CO_2 and H_2O.

Also, ADP is converted into 'energy-rich' ATP.

3) Krebs Cycle- Reaction Steps:

Step 1 (Condensation):

$$\text{Acetyl CoA + Oxalo acetic acid + Water} \xrightarrow{\text{Citric Synthetase}} \text{Citric acid + Coenzyme A}$$

Step 2 (Dehydration):

$$\text{Citric acid} \xrightarrow{\text{Aconitase}} \text{Cis-aconitic acid} + H_2O$$

Step 3 (Hydration):

$$\text{Cis-aconitic acid} \xrightarrow{\text{Aconitase}} \text{Isocitric acid}$$

Step 4(Oxidation I):

$$\text{Isocitric acid} + NAD^+ \xrightarrow{\text{dehydrogenase}} \underline{\text{Oxalosuccinic acid + NADH + H}^+}$$

Step 5 (Decarboxylation):

$$\text{Oxalosuccinic acid} \xrightarrow{\text{decarboxylase}} \alpha\text{-Ketoglutaric acid} + CO_2$$

Step 6(Oxidation II):

$$\alpha\text{-Ketoglutaricacid} + NAD^+ + CoA \xrightarrow{\text{dehydrogenase}} \underline{\text{Succinyl CoA + NADH + H}^+ + CO_2}$$

Step 7(Cleavage):

$$\text{Succinyl CoA + ADP + Pi} \xrightarrow{\text{Thio kinase}} \text{Succinic acid + ATP + CoA}$$

Step 8(Oxidation III):

$$\text{Succinic acid + FAD} \xrightarrow{\text{dehydrogenase}} \text{Fumaric acid} + FADH_2$$

Step 9(Hydration):

$$\text{Fumaric acid} + H_2O \xrightarrow{\text{Fumerase}} \text{Malic acid}$$

Step 10(Oxidation IV):

$$\text{Malic acid} + NAD^+ \xrightarrow{\text{dehydrogenase}} \underline{\text{Oxaloacetic acid + NADH + H}^+}$$

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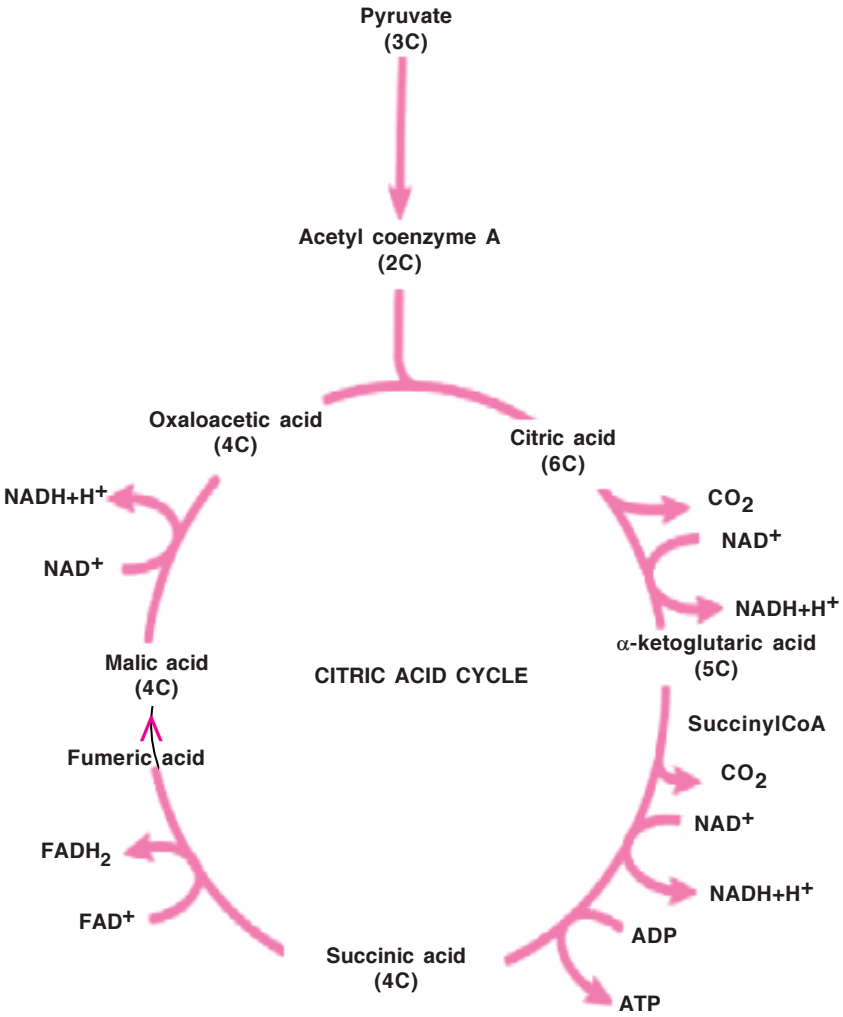


KREB'S CYCLE

Kreb's Cycle

- ☺ It's the Second Step of Respiration
- ☺ It's Second IMP. LAQ
- ☺ It's a cyclic 'Q'.

20. Give a brief account of the tools of recombinant DNA technology.

[TS 17,19,20, 23][AP 15,17,19,20,23]

A: Tools of recombinant DNA technology:

1) Restriction enzymes 2) Polymerase enzymes 3) Ligases 4) Vectors 5) Host organism

1) Restriction enzymes: Restriction enzymes belong to a larger class of enzymes called nucleases. These are two kinds

(i) Exonucleases: Exonucleases remove nucleotides from the ends of the DNA

(ii)Endonucleases: Endonucleases make cuts at specific positions within the DNA.

Each restriction endonuclease recognises a specific palindromic sequence in the DNA.

The palindrome in DNA is a sequence of base pairs, that reads the same on the two strands

Ex: EcoRI recognises 5^1 GAATTC 3^1 sites on the DNA and cuts in between G and A

5^1 G A A T T C 3'

3^1 C T T A A G 5'

2) Polymerase enzymes:

(i) In polymerase chain reaction multiple copies of gene of interest are synthesized by using primers and DNA polymerase.

(ii) In this process the replication of DNA is repeated many times and 1 billion copies can be produced.

(iii)Such amplification is achieved by Taq polymerase which remain active at high temperatures.

(iv) The amplified fragment, if desired, can now be used to ligate with a vector for further cloning.

3) Ligases: The enzyme DNA ligase, joins the ends of plasmid DNA with that of desired gene by covalent bonding. It regenerates a circular hybrid called rDNA.

4) Vectors: The DNA used as a carrier, for transferring a fragment of foreign DNA, into a suitable host called vector.

(i) Vectors used for multiplying the foreign DNA sequences are called cloning vectors.

(ii) Commonly used cloning vectors are plasmids, bacteriophages, cosmids, BAC, YAC.

Properties of cloning vectors:

(i) They must have low molecular weight

(ii) They must have unique cleavage site for the activity of restriction sites.

(iii)They must be able to replicate inside the host cell after its introduction.

(iv)They require a 'selectable marker' which helps in identifying and eliminating non transformants.

5) Host organisms: Competent host for transformation with r-DNA is made by treating host with Ca^{+2} ions

BABY BULLET-Q

21. Describe the tissue culture technique and what are the advantages of tissue culture over conventional method of plant breeding in crop improvement programmes?

[AP 15,16,17,19,19,20,22,23][TS 15,17,19,20]

A: I) Tissue Culture: The technique of growing, culturing and maintaining cells, tissues and organs in vitro is known as tissue culture. It is based on the cellular totipotency.

Plant tissue culture techniques:

1) Preparation of nutrient culture medium. 2) Sterilization of the culture medium.
3) Preparation of explant. 4) Inoculation of explant.
5) Incubation for growth 6) Acclimatization of plantlets and transfer to pots.

1) Preparation of nutrient culture medium: The nutrient medium must provide a carbon source such as sucrose and also inorganic salts, vitamins, aminoacids and growth regulators like auxins, cytokinins etc.

2) Sterilization of the culture medium.: The culture medium is rich in nutrients and therefore attracts micro organisms. So the medium should be sterilised. Sterilisation is carried out in an autoclave for 15 min, at 121ºC and 15 lb pressure.

3) Preparation of explant: Any living part of the plant such as root, stem etc which is used as inoculum is called explant.

4) Inoculation of explants: The transfer of explants onto the sterile medium is called inoculation. It is carried out in the laminar air-flow chamber.

5) Incubation for growth:

(i) The cultures are incubated for 3 to 4 weeks. During thie period the cells of the explant absorb nutrients, grow and undergo repeated mitotic divisions. They produce an undifferentiated mass of cells known as callus.

(ii) Auxins and Cytokinins are added to the culture media, so that the callus is induced to produce organs like roots and shoots. This phenomenon is called organogenesis.

(iii)The explant develops an embryonic callus through embryogenesis, from which embryoids are produced.

(iv)Since, these embryoids develop from somatic tissues they are referred to as somatic embryos.

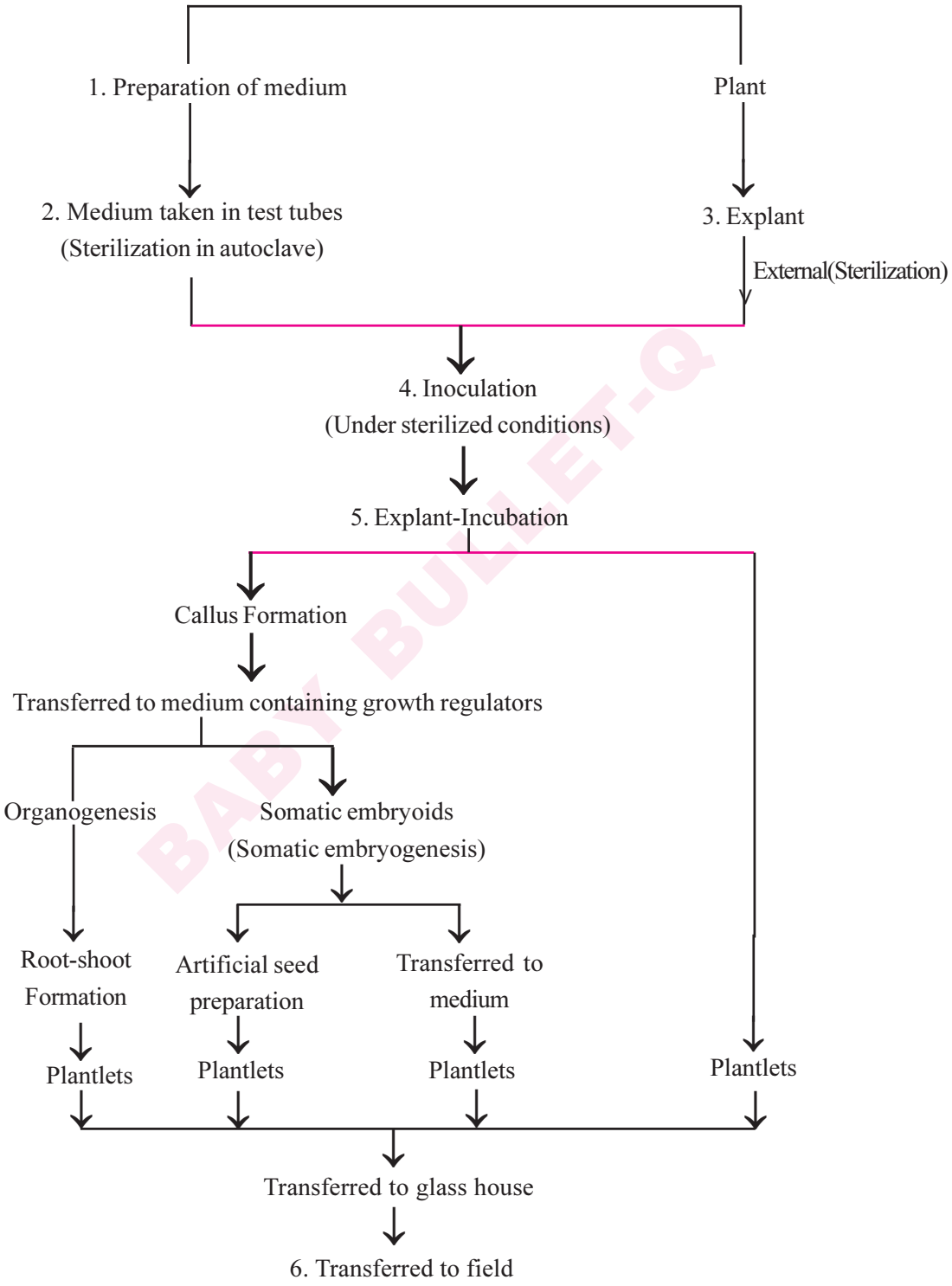
6) Acclimatization of plantlets and transfer to pots: The plants generated through organogenesis need to be acclimatized before they are transferred to pots.

II) Advantages of Tissue Culture:

(i) More number of plants can be produced in a short time.
(ii) Virus diseases can be prevented by producing virus free plants from shoot-tip cultures.
(iii) Seedless plants can be multiplied
(iv) Female plants are selectively produced through tissue culture.
(v) Somatic hybrids can be raised by tissue culture, where sexual hybridisation is not possible.
(vi) Tissue culture of medicinal plants produce high value products of industrial and medicinal importance.

BABY BULLET-Q

PLANT TISSUE CULTURE TECHNIQUE



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