Previous IPE

SOLVED PAPERS

MARCH -2019 (TS)

PREVIOUS PAPERS

IPE: MARCH-2019(TS)

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

SECTION-A

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

1. Name two amino acids in which sulphur is present
2. With reference to transportation of food within a plant, what are source and sink?
3. What is a plasmid ? What is its significance?
4. What is point mutation? Give an example.
5. Who proved that DNA is genetic material? What is the organism they worked on ?
6. Define stop codon. Write the codons.
7. Name any two artificially restructed plasmids.
8. Can a disease be detected before its symptoms appear? Explain the principle involved.
9. Name any two scientists who were, credited for showing the role of penicillin as an antibiotic.
10. Name an immunosuppressive agent. From where is it obtained?

SECTION-B

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

11. Write any four physiological effects of cytokinins in plants.
12. Explain different types of cofactors.
13. Describe the brief photorespiration.
14. Transpiration and photosynthesis a compromise, explain.
15. What is ICTV? How are viruses named?
16. Mention the advantages of selecting pea plant for experiment by Mendel.
17. What are the contributions of George Garnow, H.G. Khorana, Marshall Nirenberg in deciphering the genetic code?
18. Give a brief account of pest resistant plants.

SECTION-C

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

19. Explain the reactions of Kreb's cycle
20. Give a brief account of the tools of recombinant DNA technology?
21. Describe the tissue culture technique and what are the advantages of tissue culture.

BABY BULLET-Q

IPE TS MARCH-2019
SOLUTIONS

SECTION-A

1. **Name two amino acids in which sulphur is present.** **[TS MAR-19]**

A: Cysteine, Methionine

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2. **With reference to transportation of food within a plant, what are source and sink?** **[TS 19]**

A: **1) Source:** It is a place in the plant body where food material is prepared **Ex:** leaf.

2) Sink: It is a place in the plant body where food material is stored. **Ex:** fruits, buds.

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3. **What is a plasmid? What is its significance?** **[TS 17,19]**

A: 1) **Plasmid:** The self duplicating, naked, circular, double stranded DNA fragments is called plasmid.

2) **Significance:** They are used as vectors in genetic engineering technology.

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4. **What is point mutation? Give an example.** **[TS 19, 23]**

A: 1) **Point mutation:** It is the mutation that occurs in a single base pair of DNA fragment.

2) **Ex:** Sickle cell anemia.

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5. **Who proved that DNA is genetic material? What is the organism they worked on?** **[TS 19][AP 17]**

A: 1) Alfred Hershey and Martha chase proved that DNA is the genetic material.

2) They worked on bacteria called bacterio phages.

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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. Name any two artificially restructured plasmids. **[AP 22][TS 19]**

A. 1) pBR 322 (after Boliver and Rodriguez).

2) pUC 19, 101 (after University of California)

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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. Name the scientists who were credited for showing the role of penicillin as an antibiotic.

A: 1) Alexander Fleming discovered Pencillin. **[TS 19,23]**

2) Ernest chain and Howard Florey established the role of penicillin as an antibiotic.]

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10. Name an immuno suppressive agent. From where it is obtained? **[AP 16][TS 19]**

A. 1) Cyclosporin A is used as immuno suppressive agent.

2) It is produced from the fungus Trichoderma polysporum.

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SECTION-B

11. Write any four physiological effects of cytokinins in plants. [TS 19][AP 16,17]

A: 1) Cytokinins are a class of plant growth hormones that promote cell divisions in roots & shoot tips.

2) They help to produce new leaves, chloroplasts in leaves.

3) They help in lateral shoot growth and adventitious shoot formation.

4) They promote nutrient metabolism which helps the delay of leaf senescence.

5) They help to overcome apical dominance.Thus they promote the growth of lateral branches and help in the bushy growth of the tree.

6) Naturally Cytokinins are synthesised in places where rapid cell division occurs.

Ex: Root tips, shoot buds,young fruits.

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12. Explain different types of cofactors. [TS 19,22,23][AP 16,22]

A: The **non-protein** part of the holo enzyme is called **co-factor.**

The co-factors are three types: 1) Prosthetic groups 2) Co-enzymes 3) Metal ions.

1) Prosthetic groups: These are organic compounds which are tightly bound to the apoenzyme

Ex: Peroxidase is the enzyme which breaks hydrogen peroxide into water and oxygen. Prosthetic group of peroxidase is Haem part.

$$2H_2O_2 \xrightarrow{\text{Peroxidase}} 2H_2O + O_2$$

2) Co-enzymes: These are organic compounds, which are loosely attached to the apoenzyme. These co-enzymes are derived from water soluble vitamins.

Ex: Both co-enzymes NAD and NADP contain the vitamin niacin.

3) Metal ions: A number of enzymes require metal ions for their activity.

They form coordination bonds with side chains at the active site.

Ex: Zinc is the co-factor for the proteolytic enzyme carboxy peptidase.

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13. Describe in brief photorespiration. [TS 19,20]

A: $RuBP + CO_2 \xrightarrow{RuBisCO} 2 \times 3PGA$

1) RuBisCO is the most abundant enzyme in the world.

2) Its active site can bind to both CO_2 and O_2 hence the name.

3) RuBisCO has a much greater affinity for CO_2 than for O_2.

4) If O_2 concentration is more, RuBisCO functions as oxygenase, and binds with O_2.

5) Instead of forming two molecules of PGA, it forms one molecule of phosphoglycerate and one molecule of phosphoglycolate.

6) This pathway is called photorespiration.

7) In photorespiration pathway there is synthesis of neither sugar nor ATP nor NADPH.

8) Moreover, there is a release of CO_2 with the utilisation of ATP.

9) Therefore photorespiration is a wasteful process.

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14. Transpiration and Photosynthesis- a compromise. Explain. [TS 19]

A: 1) Photosynthesis requires continuous water supply because plants are in insatiable need of water.

2) So, plants open their stomata to exchange gases.

3) But opening of stomata causes 'loss of water by evaporation'.

4) This causes water to be 'pulled up' from the soil, leading to transpiration.

5) Thus transpiration supplies water required for photosynthesis.

6) Hence, transpiration and photosynthesis become a compromising processes to each other.

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15. What is ICTV? How are viruses named? [AP 23] [TS 19,23]

A: 1) **ICTV means – International Committee on Taxonomy of Viruses.**

2) It explains the classification and nomenclature of viruses.

3) ICTV has three hierarchial levels namely family, genus and species.

4) The family names end with the suffix Viridae

5) The genus names end with virus.

6) The species names are common english expressions describing their nature.

7) Sometimes viruses are named after the disease they cause. **Ex:** Polio virus.

8) According to ICTV, the virus that causes AIDS in man is classified as follows:

Family: Retroviridae, **Genes:** Lentivirus, **Species:** Human Immuno deficiency virus(HIV)

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16. Mention the advantages of selecting pea plant for experiment by Mendel.

[TS 19,20,22][AP 17,18,23]

A: Mendel selected garden pea for his experiments due to following advantages:

1) It has many contrasting characters.

2) It can be grown and crossed easily.

3) It has bisexual flowers containing both female and male flowers

4) It can be self pollinated conveniently.

5) It has a short life cycle and produces large number of off springs.

6) It has less number of chromosomes

7) It may be conducted in simple laboratory conditions.

BABY BULLET-Q

17. What are the contributions of George Gamow. H.G.Khorana, Marshall Nirenberg in deciphering the genetic code? [TS MAR-19]

A: 1) George Gamow is a physicist.

2) He stated that there are only 4 bases to code for 20 aminoacids.

3) The code should constitute 2 combination of these 4 bases only.

4) Each code should contain three nucleotides (Tripletcodons)

5) A permutation and combination of 4^3 (4×4×4) would generate by codons.

6) Har Gobind Khorana developed a chemical method in synthesising RNA moles with defined combinations of bases (homopolymers such as UUU and copolymers such as UUC, CCA) Marshall Nirenberg made cell free system for protein synthesis.

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18. Give a brief account of pest resistant plants. [TS 19]

A: 1) Pest resistant plants are developed by using biotechnology processes.

2) A nematode parasite called 'Meloidegyne incognitia' infects the roots of tobacco plant which reduces the production of tobacco.

3) To prevent the infestation, a process called RNA interference (RNAi) was adopted .

4) RNAi is a method of cellular defence, which prevents a specific mRNA to translate (silencing)

5) Using Agrobacterium vectors, nematode specific genes were introduced into the host (Tobacco) plant.

6) Now this host plant is a transgenic plant.

7) With the introduction of DNA, both sense and anti sense RNAs were produced in the host cells.

8) These two RNAs are complementary to each other and formed a double stranded RNA

9) It initiated RNAi and silenced the specific m RNA to translate.

10) Under these circumstances the parasite could not survive in a transgenic plant.

11) Therefore the transgenic plant got protected from the parasite.

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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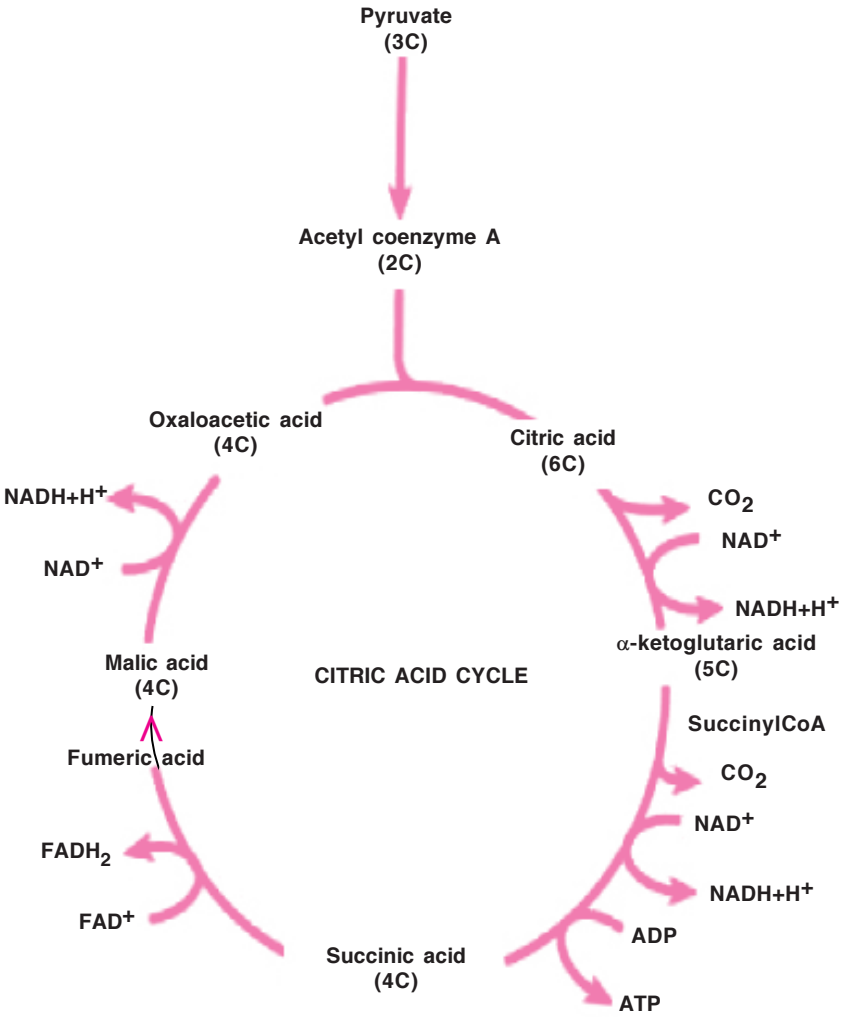

KREB'S CYCLE

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.

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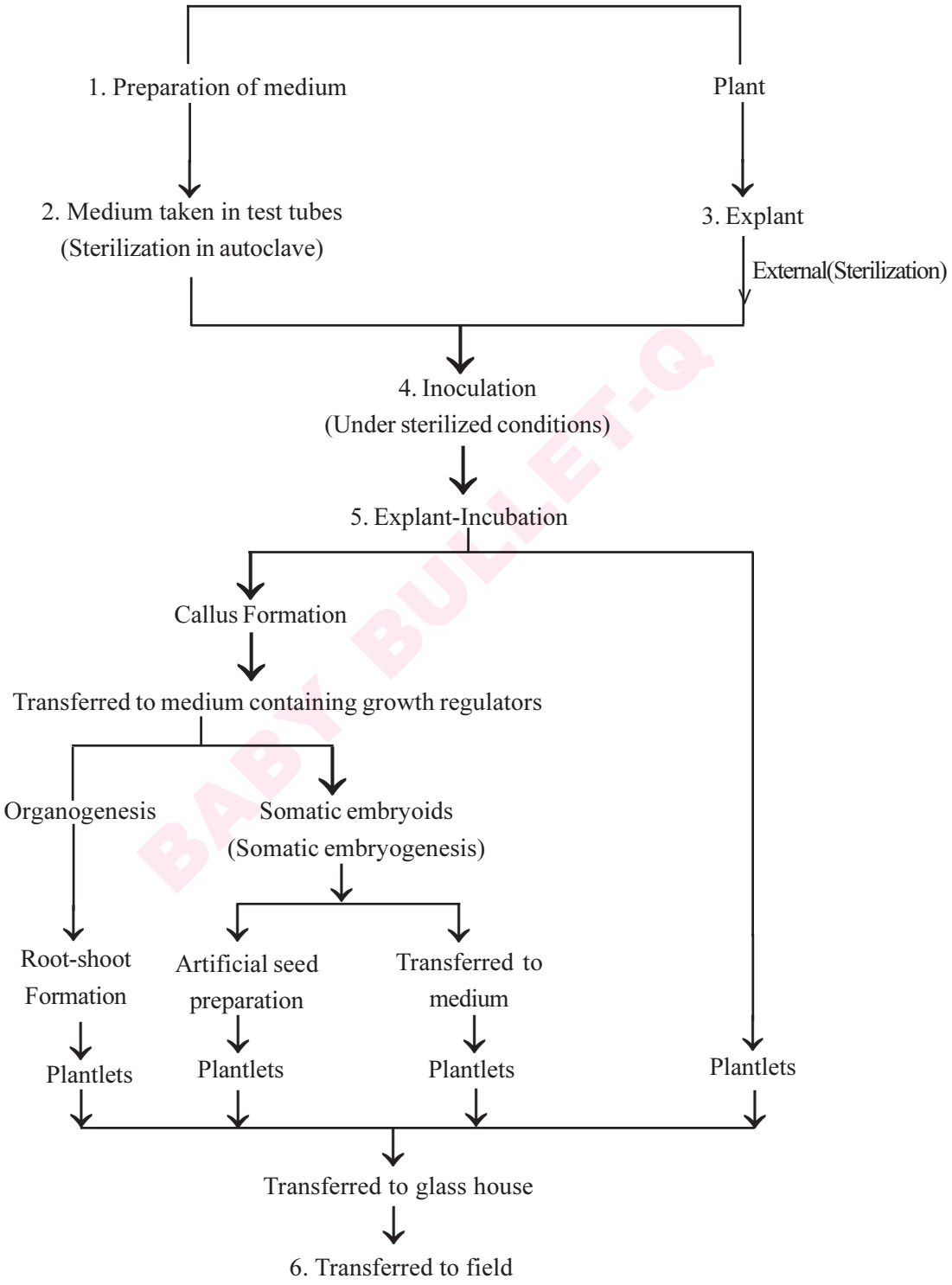
PLANT TISSUE CULTURE TECHNIQUE



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