Chapter 5
Plant Tissue Culture

Question 1.
Totipotency refers to
(a) capacity to generate genetically identical plants
(b) capacity to generate a whole plant from any plant cell / explant
(c) capacity to generate hybrid protoplasts
(d) recovery of healthy plants from diseased plants
Answer:
(b) capacity to generate a whole plant from any plant cell / explant

Question 2.
Micro propagation involves
(a) vegetative multiplication of plants by using micro-organisms
(b) vegetative multiplication of plants by using small explants
(c) vegetative multiplication of plants by using microspores
(d) Non-vegetative multiplication of plants by using microspores and megaspores
Answer:
(b) vegetative multiplication of plants by using small explants

Question 3.
Match the following:

Column A	Column B
1) Totipotency	A) Reversion of mature cells into meristem
2) Dedifferentiation	B) Biochemical and structural changes of cells
3) Explant	C) Properties of living cells developing into entire plant
4) Differentiation	D) Selected plant tissue transferred to culture medium

(a) C A D B
(b) A C B D
(c) B A D C
(d) D B C A
Answer:
(a) C A D B

Question 4.
The time duration for sterilization process by using autoclave is _____ minutes and the temperature is _____

(a) 10 to 30 minutes and 125° C
(b) 15 to 30 minutes and 121° C
(c) 15 to 20 minutes and 125° C
(d) 10 to 20 minutes and 121° C
Answer:
(b) 15 to 30 minutes and 121° C

Question 5.
Which of the following statement is correct?
(a) Agar is not extracted from marine algae such as seaweeds
(b) Callus undergoes differentiation and produces somatic embryoids
(c) Surface sterilization of explants is done by using mercuric bromide
(d) PH of the culture medium is 5.0 to 6.0
Answer:
(d) PH of the culture medium is 5.0 to 6.0

Question 6.
Select the incorrect statement from given statements:
(a) A tonic used for cardiac arrest is obtained from Digitalis purpuria
(b) Medicine used to treat Rheumatic pain is extracted from Capsicum annum
(c) An anti-malarial drug is isolated from Cinchona officinalis
(d) Anti-carcinogenic property is not seen in Catharanthus roseus.
(e) All the above are correct
Answer:
(e) All the above are correct

Question 7.
Vims free plants are developed from
(a) Organ culture
(b) Meristem culture
(c) Protoplast culture
(d) Cell suspension culture
Answer:
(b) Meristem culture

Question 8.
The prevention of large scale loss of biological integrity
(a) Biopatent
(b) Bioethics
(c) Biosafety
(d) Biofuel
Answer:
(c) Biosafety

Question 9.
Cryopreservation means it is a process to preserve plant cells, tissues or organs
(a) at very low temperature by using ether
(b) at very high temperature by using liquid nitrogen
(c) at very low temperature of-196 by using liquid nitrogen
(d) at very low temperature by using liquid nitrogen
Answer:
(c) at very low temperature of-196 by using liquid nitrogen

Question 10.
Solidifying agent used in plant tissue culture is
(a) Nicotinic acid
(b) Cobaltous chloride
(c) EDTA
(d) Agar
Answer:
(d) Agar

Question 11.
What is the name of the process given below? Write its 4 types.
Answer:

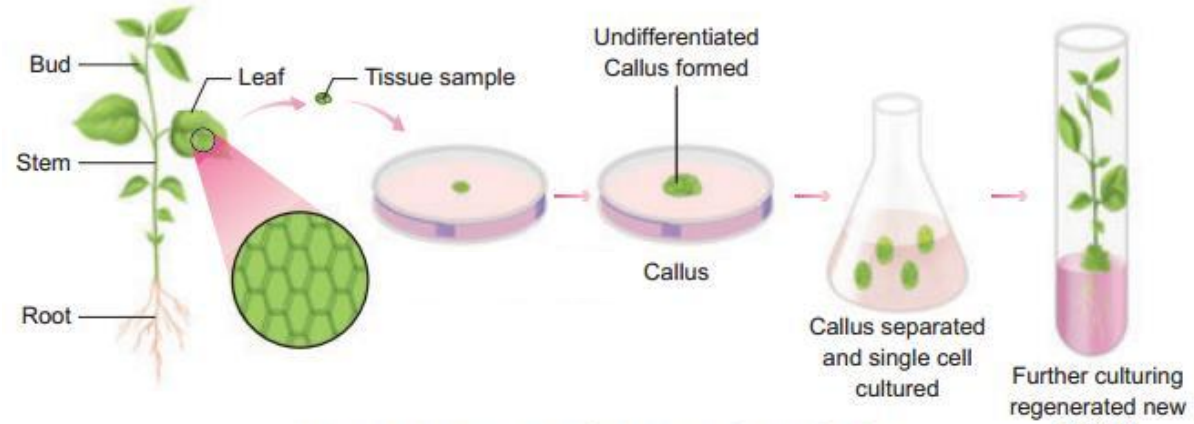


Figure 5.3: Basic steps in Plant tissue culture technology

These are the basic steps in plat Tissue culture technology
The process is plant tissue culture. Based on the explants, plant tissue culture is classified as:

1. Organ culture
2. Meristem culture
3. Protoplast culture
4. Cell culture

Question 12.

How will you avoid the growing of microbes in nutrient medium during culture process? What are the techniques used to remove the microbes?

Answer:

Sterilization: Sterilization is the technique employed to get rid of microbes such as bacteria and fungi in the culture medium-vessels and explants.

(i) Maintenance of Aseptic Environment:

- During in vitro tissue culture maintenance of aseptic environmental conditions should be followed, (ie.)
- Sterilization of glassware, forceps, Scalpels, And all accessories in wet steam sterilization by autoclaving at 15 psi (121°C) for 15 to 30 minutes or dipping in 70% ethanol followed by flaming and cooling.

(ii) Sterilization of culture room:-

- The floor and walls are washed first with detergent and then with 2% sodium hypochlorite or 95% ethanol.
- The cabinet of laminar airflow is sterilized by clearing the work surface with 95% ethanol and then exposed to UV radiation for 15 minutes.

(iii) Sterilization of Nutrient Media

- Culture media are dispensed in glass containers, plugged with non – absorbent cotton, or sealed with plastic closures and then sterilized using autoclave at 15 psi (121°c) for 15 to 30 minutes.
- The plant extracts, vitamins, amino acids, and hormones are sterilized by passing through a Millipore filter with 0.2 mm pore diameter and then added to the sterilized culture medium inside the Laminar Airflow chamber under sterile conditions.

Question 13.

Write the various steps involved in cell suspension culture.

Answer:

Step 1: Growing of cells/callus in medium (Single or aggregates).
Step 2: Transfer of callus to a liquid medium.
Step 3: Agitation of callus using rotary shaker.
Step 4: Filtration and separation of cells.

Question 14.

What do you mean by Embryoids? Write its application.

Answer:

Somatic embryogenesis is the formation of embryos from the callus tissue directly and these embryos are called Embryoids from the Vitro cells directly from pre-embryonic cells which differentiate into embryoids.

uses:
Somatic embryoids can be used for the production of synthetic seeds.

Example:
Allium Sativum, Hordeum Vulgare, Oryza sativa, Zea mays

Question 15.
Give examples of micropropagation performed plants.
Answer:
Pineapple, banana, strawberry and potato.

Question 16.
Explain the basic concepts involved in plant tissue culture.
Answer:
Basic concepts of PTC (Plant Tissue Culture):
1. Totipotency:
Plant cells have the inherent genetic potential to get different larged into a complete individual plant if provided a nutrient medium (they can also get redifferentiated or dedifferentiated)

2. Differentiation:
(Meristematic tissue is differentiated into simple or complex tissue) The biochemical and structural change – by which cells become specialized in form and function.

3. Re differentiation:

- Callus has the ability to develop into a whole plant in a nutrient medium.
- Already differentiated cell into another type of cell.

4. Dedifferentiation:
Reversion of mature tissue into a meristematic state leading to the formation of callus is called dedifferentiation.

Question 17.
Based on the material used, how will you classify the culture technology? Explain it.
Answer:
Based on explants used culture technology are of following types:

1. Organ culture – Embryos, anthers, root and shoot part are used.
2. Meristem culture – Meristematic tissues are used.
3. Protoplast culture – Protoplasts are used.

4. Cell culture – Single cells or aggregate of cells from callus are used.

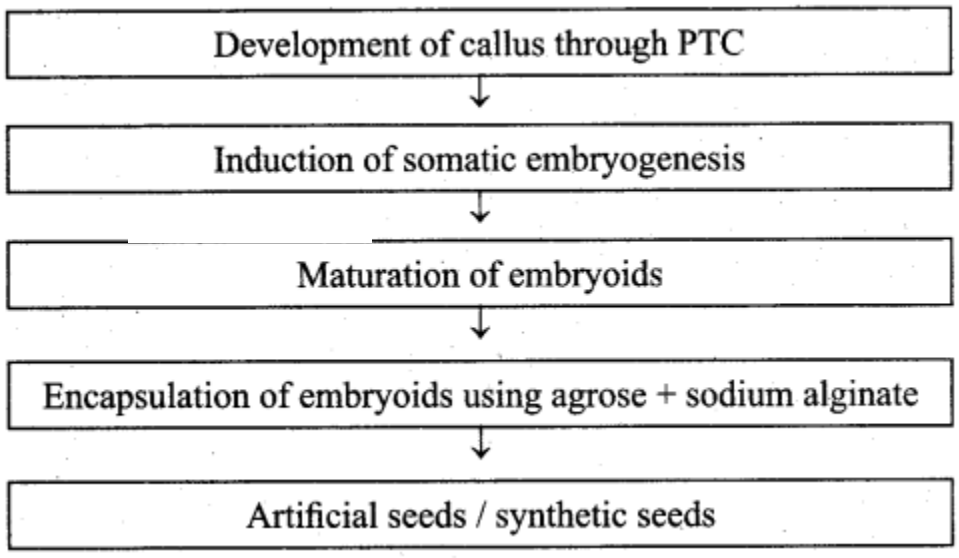
Question 18.
Give an account on Cryopreservation.
Answer:

- protoplasts, cells & tissues.
- organelles & organs.
- Extracellular matrix & other biological material.
- When these are subjected to temperature treatment at -196 0 C using Liquid nitrogen – This low-temperature preservation is known as cryopreservation
- Protectants such as dimethyl sulphoxide, glycerol, or sucrose are added before cryopreservation
- The cryopreservation stops the enzymatic or chemical activity, so whenever needed the substance is subjected to room temperature to restore activation

Question 19.
What do you know about Germplasm conservation? Describe it.
Answer:
Germplasm conservation refers to the conservation of living genetic resources like pollen, seeds, or tissue of plant material maintained for the purpose of selective plant breeding, preservation in live condition, and used for many research works.

Germplasm conservation resources are a part of the collection of seeds and pollen that are stored in seed or pollen banks, so as to maintain their viability and fertility for any later use such as hybridization and crop improvement. Germplasm conservation may also involve a gene bank, DNAbank of elite breeding lines of plant resources for the maintenance of biological diversity and also for food security.

Question 20.
Write the protocol for artificial seed preparation.
Answer:



- Artificial seeds (or) synthetic seeds (Synseeds) are produced by using embryoids (Somatic embryos) obtained through in vitro culture.
- They may even be derived from single cells from any part of the plant that later divide to form cell mass containing dense cytoplasm, large nucleus, starch grains, proteins, and oils, etc.