



## **FACULTY OF SCIENCE**

### **DEPARTMENT OF BIOTECHNOLOGY AND FOOD TECHNOLOGY BIOTECHNOLOGY**

**MODULE     BTN7X03  
              APPLIED PLANT BIOTECHNOLOGY 4  
CAMPUS     DFC**

### **Supplementary Examination January 2021 MEMO**

**DATE:   20 January 2021**

**SESSION: 8:00 –11:00**

**EXAMINER:**

**DR S. M. MOYO**

**EXTERNAL MODERATOR:**

**DR J. M BAPELA**

**DURATION: 3 HOURS**

**MARKS   106**

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### **Multiple choice and True or False answers**

- 3. a **(2)**
- 4. b **(2)**
- 5. False **(2)**
- 7. b **(4)**
- 8. d **(2)**
- 9.a **(2)**
- 10.c **(2)**
- 11.c **(2)**
- 14.b **(2)**
- 15.d **(2)**
- 16.d **(2)**
- 18.b **(2)**
- 19. c **(2)**
- 21. c **(2)**
- 24. True **(2)**
- 25. b **(2)**
- 26.b **(2)**
- 27.b **(2)**
- 29.False **(2)**
- 30.False **(2)**
- 32. b **(2)**
- 33. a **(2)**
- 34. True **(2)**
- 35. a **(2)**
- 36. True **(2)**
- 37. a **(2)**
- 38. d **(2)**
- 41. True **(2)**

### Structured questions answers

1. (i) **Hypogeous germination** (3)
- The epicotyl elongates and raises the plumule above the ground.
  - The cotyledons, which are usually still enclosed by the seed coats, and the hypocotyl never emerge and remain below the surface of the soil.
  - Peas have a hypogeous type of germination.
- Epigeous germination** (3)
- the hypocotyl of the embryo elongates and raises the plumule, epicotyl, and cotyledons through the soil surface and above the ground.
  - Garden beans have an epigeous type of germination.
- (ii) **Stratification and scarification**
- Scarification** (3)
- is the process of chemically or mechanically treating seeds to break or soften their hard seed coats.
  - Seed coats are scratched or cracked by blowing and/or rolling seeds against an abrasive surface.
  - Natural methods of scarification may include factors such as physical abrasion, fire, alternate freezing and thawing, attack by microorganisms such as fungi and bacteria, and passing through the digestive tract of an animal.
  - Artificial methods include mechanical, or physical, abrasion, hot water soaking, and acid scarification techniques.
- Stratification** (3)
- is the process of overcoming embryo dormancy by satisfying a seed's chilling requirements.
  - With this technique, seeds require exposure to cold (2 to 4°C), moist conditions for 6 to 12 weeks for the completion of embryo development.
  - In nature, the cold of the winter and the moisture in the soil act as a natural method of stratification.
  - Some underdeveloped embryos may be stratified under warm conditions (above 7°C) for completion of embryo development.
2. A-Young leaf, B-Axillary bud, C-Tunica, D-Corpus, E-Epidermis, F-Procambium, G-Ground meristem (7)
6. Growth factors, vitamins, amino acids, toxins are heat sensitive and cannot be autoclaved.
- Use filters with 0.45 0.22µm pore size. As medium is passed through the filter, bacteria, and other particles with dimensions greater than pore size are screened out and collect on the surface of the membrane (4)
12. Morphological differentiation influences the accumulation of secondary metabolites only in specific plant structures. Lack of tissue differentiation in callus/ liquid culture causes low yield. Start cultures from already differentiated tissues to improve yield (3)
13. **Gametophytic phase** (2)
- The stage when plants produce haploid (n) gametes

The diploid cells undergo meiosis (reduction division) to form gametes (n).  
It is a short-lived phase as fertilization of the egg in ovary by sperm from pollen again results into the diploid sporophytic phase.

**Sporophytic phase (2)**

The stage when plants produce diploid (2n) spores

Chromosome number (2n) is the product of fertilization of male and female gametes, containing the haploid (n) set of chromosomes from each parent.

17. At high density, the cell colonies arising from individual protoplasts tend to grow into each other resulting into chimera tissue if the protoplast population is genetically heterogeneous.  
An excessively high plating density rapidly depletes nutrients, and protoplast-derived cells can fail to undergo sustained division. (4)
20. Cryoprotectants are the compounds that can prevent the damage caused to cells by freezing or thawing.  
The freezing point and super-cooling point of water are reduced by the presence of cryoprotectants as they limit formation of large ice crystals and help dehydrate cells during freezing. (3)
22. The TATA box is able to define the direction of transcription and also indicates the DNA strand to be read.  
Proteins called transcription factors can bind to the TATA box and recruit an enzyme called RNA polymerase, which synthesizes RNA from DNA. (3)
23. Inactive DNA is generally highly methylated compared to DNA that is actively transcribed.  
  
Within the promoter region of genes there is a high frequency of cytosine and guanine dinucleotide DNA pairs (CG).  
  
the cytosine member of the pair can be methylated (a methyl group is added).  
  
This modification changes how the DNA interacts with proteins, including the histone proteins that control access to the region. (3)
28. Protease digests the protein and RNAase digests the RNA (2)
31. Microprojectile bombardment (2)
39. It is generally the presence or absence of specific forms of midgut receptors that determines whether a particular insect species is susceptible to a given Bt protein. (2)
40. A gene from bacteria that can produce Polyhydroxyalkanoates (PHAs) which are biodegradable biopolymers naturally synthesized and accumulated as intracellular energy and carbon reserves by a wide range of bacteria is transferred to plants. PHAs have properties similar to those of conventional petrochemical plastics. Therefore, PHAs can be used in place of plastics to reduce plastic use. (3)