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Paper: Tools and Techniques in Plant Science (Practical)

Module Number: 01

Module's Name: Introduction to Laboratory Tools and Instruments

Self Assessments

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Self-Assessment Terminal Questions

Module 1.1: Study of Basic Laboratory Instruments (Microscope, Colorimeter, Autoclave, Oven, Incubator, Laminar Air Chamber, Tilak Air Sampler)

Multiple-Choice Questions (MCQ)

1. **Which part of the microscope is responsible for magnifying the specimen?**
   - A) Condenser
   - B) Objective lens
   - C) Eyepiece
   - D) Mirror
2. **What is the principle behind the working of an autoclave?**
   - A) Dry heat sterilization
   - B) Steam under pressure
   - C) Ultraviolet radiation
   - D) Chemical disinfection
3. **Which stain is used to visualize cellular components in microbiological studies?**
   - A) Methylene blue
   - B) Safranin
   - C) Carbol fuchsin
   - D) Crystal violet
4. **Which instrument measures the absorbance of light in a sample?**
   - A) Autoclave
   - B) Colorimeter
   - C) Incubator
   - D) Tilak Air Sampler
5. **What is the purpose of a HEPA filter in a Laminar Air Flow Chamber?**
   - A) Sterilize air inside the chamber
   - B) Remove dust and microorganisms

- C) Cool down the chamber
- D) Monitor air quality

6. **What is the principle behind the working of a hot air oven?**
   - A) Moist heat sterilization
   - B) Convection and conduction of dry heat
   - C) UV radiation sterilization
   - D) Chemical disinfection
7. **Which of the following items can be sterilized in a hot air oven?**
   - A) Heat-sensitive plastic materials
   - B) Surgical dressings
   - C) Glassware and metal instruments
   - D) Culture media
8. **What is the ideal temperature and time for sterilizing materials in a hot air oven?**
   - A) 121°C for 15 minutes
   - B) 160°C for 60 minutes
   - C) 100°C for 30 minutes
   - D) 150°C for 2 hours
9. **Which component of a hot air oven ensures the circulation of hot air?**
   - A) Thermostat
   - B) Blower/Fan
   - C) Timer
   - D) Fuse
10. **What type of microorganisms are effectively killed by a hot air oven?**

- A) Only bacteria
- B) Bacteria and viruses
- C) Bacteria, spores, and viruses
- D) Only spores

Short Answer Questions

1. Explain the principle of dry heat sterilization in a hot air oven.

2. What is the role of the thermostat in a hot air oven?
3. Why is preheating necessary before loading items in a hot air oven?
4. What type of items should not be sterilized in a hot air oven?
5. Explain the working of the condenser in a microscope.

Long Answer Questions

1. Describe the components and working procedure of a hot air oven in detail.
2. Discuss the applications of hot air ovens in various industries.
3. Describe the different types of microscopes and their applications in microbiology.
4. Explain the instrumentation and operating procedure of an autoclave in detail.
5. Discuss the importance of laminar air flow chambers in microbiological experiments and their working principle.

Viva-based Questions

1. What factors influence the time and temperature settings in a hot air oven?
2. How does a hot air oven differ from an autoclave in terms of sterilization?
3. Why are motorized fans important in a hot air oven?
4. What precautions should be taken when using a hot air oven?
5. What is the numerical aperture, and why is it important in microscopy?
6. How do you sterilize heat-sensitive materials that cannot be autoclaved?
7. What is the purpose of using a colorimeter in a laboratory?
8. What factors can affect the functioning of an incubator in microbiological cultures?
9. What is the role of HEPA filters in laminar air chambers?
10. Why is it important to preheat a hot air oven before loading items?

Module 1.2: Study of Stains and Staining Techniques

Multiple-Choice Questions (MCQ)

1. **What is the primary purpose of staining in microscopy?**
   - A) To enhance visualization of the specimen
   - B) To clean the microscope lens
   - C) To degrade biological specimens
   - D) To sterilize slides
2. **Which of the following stains is commonly used for Gram-positive bacteria?**
   - A) Safranin
   - B) Methylene Blue
   - C) Crystal Violet
   - D) Iodine
3. **Which type of staining technique is used to differentiate between Gram-positive and Gram-negative bacteria?**
   - A) Simple Staining
   - B) Differential Staining
   - C) Negative Staining
   - D) Acid-Fast Staining
4. **What is the function of a mordant in the staining process?**
   - A) To act as a secondary stain
   - B) To enhance the binding of the stain to the specimen
   - C) To decolorize the specimen
   - D) To rinse the excess stain
5. **Which stain is used to identify acid-fast bacteria, such as Mycobacterium tuberculosis?**
   - A) Crystal Violet
   - B) Methylene Blue

- C) Carbol Fuchsin
- D) Safranin

6. **Which of the following is an example of a simple stain?**
   - A) Gram Stain
   - B) Methylene Blue
   - C) Acid-Fast Stain
   - D) Ziehl-Neelsen Stain
7. **What type of staining technique highlights only the background, leaving the cells unstained?**
   - A) Positive Staining
   - B) Negative Staining
   - C) Gram Staining
   - D) Simple Staining
8. **In Gram staining, what color does Gram-positive bacteria appear?**
   - A) Red
   - B) Pink
   - C) Violet/Blue
   - D) Colorless
9. **Which staining technique is most commonly used to diagnose tuberculosis?**
   - A) Gram Staining
   - B) Acid-Fast Staining
   - C) Simple Staining
   - D) Negative Staining
10. **What is the role of iodine in Gram staining?**

- A) Decolorizing agent
- B) Counterstain
- C) Mordant
- D) Primary stain

Short Answer Questions

1. What is the purpose of using a counterstain in Gram staining?
2. What is the role of fixation in staining techniques?
3. Differentiate between direct (positive) staining and indirect (negative) staining.
4. Explain the use of Acid-Fast staining in diagnosing tuberculosis.
5. What are mordants, and why are they used in staining?

Long Answer Questions

1. Describe the steps of Gram staining and explain the significance of the differential staining process.
2. Discuss the procedure and importance of Acid-Fast staining in microbiological diagnosis.
3. Describe the different types of stains commonly used in botanical experiments and their applications.
4. Explain the working principles of negative staining and its applications in microbiology.
5. Discuss the role of Coomassie Brilliant Blue staining in protein analysis.

Viva-based Questions

1. Why is a mordant used in Gram staining?
2. What is the principle of negative staining, and when is it used?
3. What is the significance of the Acid-Fast stain in clinical microbiology?
4. What precautions should be taken while handling stains like Carbol Fuchsin and Iodine?
5. What is the purpose of using a counterstain in differential staining?
6. How is methylene blue used as a simple stain?
7. Why is Gram staining important in microbiology?
8. What is the difference between simple and differential staining?
9. What are the advantages of using Safranin as a counterstain in Gram staining?
10. Explain the importance of using immersion oil during microscopy at 100x magnification.

Answer Key for MCQs

Module 1.1: Study of Basic Laboratory Instruments

1. B) Objective lens
2. B) Steam under pressure
3. A) Methylene blue
4. B) Colorimeter
5. B) Remove dust and microorganisms
6. B) Convection and conduction of dry heat
7. C) Glassware and metal instruments
8. B) 160°C for 60 minutes
9. B) Blower/Fan
10. C) Bacteria, spores, and viruses

Module 1.2: Study of Stains and Staining Techniques

1. A) To enhance visualization of the specimen
2. C) Crystal Violet
3. B) Differential Staining
4. B) To enhance the binding of the stain to the specimen
5. C) Carbol Fuchsin
6. B) Methylene Blue
7. B) Negative Staining
8. C) Violet/Blue
9. B) Acid-Fast Staining
10. C) Mordant