Topic '**Transitioning DNA Analytic Devices and Technologies to the Field'**

20 multiple-choice questions (MCQs) covering the key concepts. The questions range from basic recall to application and understanding.

Quiz: DNA Analytic Technologies for Field Applications

1. What is the main advantage of portable qPCR systems for field applications?

A. They require a full laboratory setup.
B. They eliminate the need for DNA extraction.
C. They enable on-site DNA testing with rapid results.
D. They can only detect bacterial DNA.

2. Why are portable glove boxes used during field DNA testing?

A. To increase PCR speed.
B. To prevent aerosol DNA contamination.
C. To store DNA samples.
D. To cool PCR reagents.

3. Which characteristic of field DNA extraction is considered most important?

A. Highest DNA purity possible
B. Long DNA fragments
C. Speed, simplicity, and sufficient DNA quality
D. Use of hazardous chemicals

4. Approximately how long can the complete field workflow (DNA extraction → PCR → result) be completed?

A. 15 minutes
B. 1 hour
C. 3 hours
D. Overnight

5. Which of the following is NOT a commonly used rapid DNA extraction method?

A. Chelex® extraction
B. Magnetic bead extraction
C. Phenol-chloroform extraction
D. Heat lysis

6. Why is high-purity DNA generally unnecessary for portable PCR systems?

A. Portable PCR does not amplify DNA.
B. Portable PCR amplifies short DNA fragments that tolerate partially degraded DNA.
C. Portable PCR only detects RNA.
D. DNA purity has no effect on PCR.

7. What is the primary purpose of fuzzy logic algorithms in field-deployed qPCR?

A. Increase DNA extraction efficiency.
B. Design PCR primers.
C. Automatically interpret amplification results and reduce false positives.
D. Increase PCR temperature.

8. Which technology amplifies DNA without repeated thermal cycling?

A. Conventional PCR
B. Sanger sequencing
C. Isothermal amplification
D. Gel electrophoresis

9. Recombinase Polymerase Amplification (RPA) typically operates at approximately:

A. 25°C
B. 39°C
C. 63°C
D. 95°C

10. Which statement best describes an advantage of RPA?

A. Requires expensive laboratory equipment.
B. Produces results in 10–20 minutes.
C. Requires multiple thermal cycles.
D. Requires ultra-pure DNA.

11. In the RPA-NALFIA system, which labels are attached to the primers?

A. FITC and DAPI
B. FAM and Biotin
C. SYBR Green and Ethidium Bromide
D. Gold nanoparticles and Cy5

12. A positive RPA lateral flow test is indicated by:

A. A fluorescent glow only.
B. Formation of bubbles.
C. Appearance of a visible dark line on the test strip.
D. Complete disappearance of the sample.

13. Loop-Mediated Isothermal Amplification (LAMP) generally operates at:

A. 37°C
B. 39°C
C. 50°C
D. 63°C

14. Why is LAMP considered highly specific?

A. It amplifies RNA only.
B. It uses six different polymerases.
C. It employs 4–6 primers targeting multiple regions.
D. It requires DNA sequencing.

15. Which enzyme is responsible for DNA synthesis in LAMP?

A. Taq DNA polymerase
B. Reverse transcriptase
C. Bst DNA polymerase
D. Cas12

16. How can LAMP results be detected visually?

A. DNA bands on agarose gel only
B. Blue-to-red fluorescence
C. Color change of Hydroxynaphthol Blue (HNB)
D. Silver staining

17. In CRISPR-based detection, what determines the specificity of target recognition?

A. DNA polymerase
B. Magnesium ions
C. Guide RNA (gRNA)
D. Ethanol

18. What happens after Cas12 recognizes the target porcine DNA?

A. DNA replication stops.
B. Cas12 performs collateral cleavage of nearby single-stranded DNA reporters.
C. The DNA immediately degrades.
D. PCR begins automatically.

19. Which combination is commonly used to improve CRISPR detection sensitivity?

A. PCR followed by sequencing
B. RPA or LAMP before CRISPR detection
C. Gel electrophoresis before DNA extraction
D. Western blot before PCR

20. According to the presentation, what is the recommended dual-tiered testing strategy for halal food authentication?

A. Use PCR only for every sample.
B. Use microscopy followed by culture.
C. Use RPA/LAMP/CRISPR for rapid screening and qPCR for confirmation.
D. Use DNA sequencing for every sample.

Bonus Higher-Order Thinking Question

21. A food inspector performing on-site halal verification requires a DNA detection method that is **fast, battery-powered, requires minimal equipment, and provides results visible to the naked eye**. Which technology would be the **most suitable**?

A. Conventional laboratory qPCR

B. RPA coupled with NALFIA lateral flow detection

C. Sanger DNA sequencing

D. Whole genome sequencing