

- a) EtBr
b) SYBR Green
c) Coomassie Blue
d) Crystal Violet
- (x) Pfizer-BioNTech COVID-19 vaccine is based on:
a) mRNA
b) Inactivated virus
c) Protein subunit
d) DNA plasmid
- (xi) A researcher wants to quantify viral RNA. Which technique should be applied?
a) DNA fingerprinting
b) Northern blot
c) qPCR with reverse transcription
d) ELISA
- (xii) If a lab applies mRNA vaccine technology, what is introduced into the host?
a) mRNA coding for viral antigen
b) DNA plasmid
c) Inactivated virus
d) Viral protein
- (xiii) Which plant was first used to develop edible vaccines?
a) Maize
b) Soybean
c) Potato
d) Wheat
- (xiv) A scientist wants to immunize people against hepatitis B without injections. Which approach should be applied?
a) Edible vaccines in plants
b) Antibiotic injection
c) Inactivated viral spray
d) Vector-based therapy
- (xv) To reduce mercury toxicity in polluted soil, which plant system should be applied?
a) Wild rice plant
b) Transgenic tobacco with merA gene
c) Traditional maize
d) Fungi-based biofilm

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Group-B

(Short Answer Type Questions)

3 x 5=15

2. What are microbial pigments, and why are they important? Name three microorganisms known for producing natural pigments. (3)
3. Compare synthetic dyes and natural microbial pigments in terms of production, safety, and sustainability. (3)
4. Show how Ct values can be applied to monitor patient viral load. (3)
5. Define MALDI-TOF mass spectrometry in short. (3)
6. Differentiate between edible vaccines and conventional injectable vaccines. (3)

OR

- Compare DNA vaccines with protein subunit vaccines. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Explain the principle of in situ bioremediation and how *Pseudomonas putida* KNP9 participates in heavy metal detoxification. (5)
8. Explain how biotechnology is used in developing personalized medicine and targeted drug delivery systems. (5)
9. What are the challenges and future prospects of microbial pigment production? (5)
10. Determine the significance of immunotechnology in disease diagnosis and therapy. (5)
11. Analyse the advantages and disadvantages of using natural vs synthetic scaffolds. (5)
12. Describe in detail recombinant DNA technology, and how has it revolutionized pharmaceutical biotechnology? (5)

OR

- Critically evaluate the use of hybrid scaffolds combining natural and synthetic polymers. (5)
