Soil Science Reviewer Based On TOS (Module B: Physical Properties of Soils)

BY AGRICULTURE REVIEW

1. Which of the following best differentiates soil texture from soil structure?

a) Texture refers to the arrangement of particles, while structure refers to the proportion of separates.

b) Texture is a dynamic property, while structure is inherent and unchanging.

c) Texture refers to the relative proportions of sand, silt, and clay, while structure is the arrangement of these particles into aggregates.

d) Texture is determined by organic matter, while structure is determined by mineral content.

2. Why is soil texture considered a fundamental and permanent property of the soil?

a) It is easily modified by adding organic matter.

b) It dictates the natural color of the soil horizon.

c) It changes rapidly with continuous tillage practices.

d) It cannot be easily or economically changed under field conditions.

3. Which physical property is most readily altered by agricultural management practices such as plowing and harrowing?

a) Particle density

b) Soil structure

c) Soil texture

d) Soil depth

4. Based on the USDA classification, what is the size range of sand separates?

a) 0.05 to 2.0 mm

b) 0.002 to 0.05 mm

c) Less than 0.002 mm

d) Greater than 2.0 mm

5. Which soil separate provides the greatest specific surface area, thereby influencing plasticity and nutrient retention?

a) Sand

b) Silt

c) Gravel

d) Clay

6. What is the highly recommended soil texture for cultivating upland crops like corn and leafy vegetables?

a) Heavy clay

b) Silty clay

c) Loam

d) Coarse sand

7. Why is a loam texture more suitable for leafy vegetables compared to a heavy clay texture?

a) Loam provides an optimal balance of water retention, drainage, and aeration for root respiration.

b) Loam strictly minimizes downward water percolation to zero.

c) Loam has a higher cation exchange capacity than heavy clay.

d) Loam forms a dense plow pan that supports shallow vegetable roots.

8. Which soil texture is traditionally recommended for irrigated wetland rice cultivation?

a) Sandy loam

b) Clay or Clay Loam

c) Silt loam

d) Loamy sand

9. What is the primary agronomic advantage of clayey textures in irrigated rice ecosystems?

a) High rates of gaseous exchange.

b) Low percolation rates that minimize the loss of ponded water.

c) Rapid warming during the early spring season.

d) Prevention of salt accumulation in the root zone.

10. What soil structure is considered most ideal for upland crops to facilitate seed germination and root proliferation?

a) Platy
b) Massive
c) Granular or Crumb
d) Columnar

11. The physical manipulation of soil in flooded conditions, intended to destroy soil structure for rice production, is known as what?

a) Subsoiling
b) Puddling
c) Terracing
d) Fallowing

12. How does the ideal structural requirement for irrigated rice drastically differ from that of upland corn?

a) Rice requires maximum macroporosity, while corn requires microporosity.
b) Rice thrives in a well-aggregated soil, while corn requires a structureless soil.
c) Rice is favored by destroyed aggregates and a muddy state, whereas corn requires stable macro-aggregates.
d) There is no difference; both require highly granular structures.

13. What structural issue frequently arises when planting upland crops in a field previously used for irrigated lowland rice?

a) Excessive granulation leading to root exposure.
b) The presence of a compacted plow pan that restricts deep root penetration.
c) High macroporosity causing severe nutrient leaching.
d) The formation of single-grained structure prone to wind erosion.

14. When a puddled rice soil is drained and left to dry without further tillage, it typically develops which unfavorable structure?

a) Granular
b) Crumb
c) Massive or Cloddy
d) Prismatic

15. Leafy vegetables require high soil aeration. Which pore size dominates in a well-structured upland soil compared to a puddled rice soil?

a) Micropores
b) Macropores
c) Cryptopores
d) Capillary pores

16. By definition, what does soil bulk density measure?

a) The mass of dry soil per unit volume of soil solids only.

b) The mass of wet soil per unit volume of pore space.

c) The mass of dry soil per unit total volume, including both solids and pores.

d) The mass of organic matter divided by mineral weight.

17. Particle density is distinct from bulk density because it explicitly excludes which soil component in its volume calculation?

a) Sand separates

b) Organic matter

c) Soil moisture

d) Pore spaces

18. For most arable mineral soils, the standard average value assumed for particle density is approximately what?

a) 1.33 g/cm3

b) 2.65 g/cm3

c) 3.50 g/cm3

d) 1.00 g/cm3

19. How are soil bulk density and total porosity related?

a) They are directly proportional; as bulk density increases, porosity increases.

b) They are inversely related; as bulk density increases, porosity decreases.

c) They are unrelated variables dependent on atmospheric pressure.

d) They maintain a constant 1:1 ratio in agricultural soils.

20. A soil sample has a bulk density of 1.32 g/cm3 and a particle density of 2.64 g/cm3. What is its percent total porosity?

a) 30 percent

b) 40 percent

c) 50 percent

d) 60 percent

21. Which of the following soil textural classes generally exhibits the highest bulk density under natural field conditions?

a) Clay

b) Clay loam

c) Silt loam

d) Sand

22. Why do sandy soils typically possess a higher bulk density than well-aggregated clayey soils?

a) Sand particles are inherently heavier than clay particles.

b) Sandy soils lack significant organic matter and have lower total pore space.

c) Sand contains massive amounts of micropores that increase weight.

d) Clayey soils consist mostly of quartz minerals.

23. What is the typical impact of intensive farm machinery traffic on the bulk density of an upland field?

a) It decreases bulk density by loosening the topsoil.

b) It increases bulk density by compacting soil and destroying macropores.

c) It has no measurable effect on bulk density.

d) It alters the particle density, thus affecting the bulk density indirectly.

24. Continuous incorporation of crop residues and organic compost into an agricultural soil will likely result in which physical change over time?

a) An increase in bulk density.

b) A decrease in bulk density.

c) An increase in particle density.

d) A reduction in total porosity.

25. At approximately what bulk density value does root penetration become severely restricted in medium-textured loam soils?

a) 1.0 g/cm3
b) 1.3 g/cm3
c) 1.6 g/cm3
d) 2.6 g/cm3

26. Which field method is commonly utilized to extract an undisturbed soil volume for bulk density determination?

a) Hydrometer method
b) Pipette method
c) Core method
d) Tension infiltrometer

27. Which of the following factors does NOT significantly alter the particle density of a soil?

a) The mineralogical composition of the parent material.
b) The amount of organic matter present.
c) The dominant soil structural type and pore space arrangement.
d) The presence of heavy minerals like magnetite.

28. Compared to mineral soils, organic soils like peat and muck typically have bulk densities that are:

a) Significantly higher (greater than 2.0 g/cm3).
b) Roughly equal (around 1.3 g/cm3).
c) Slightly higher due to water retention.
d) Significantly lower (often less than 0.5 g/cm3).

29. What is the primary textural characteristic of soils located adjacent to beaches?

a) High clay content
b) High silt content
c) High sand content
d) High organic matter content

30. Under the concept of soil structure, beach sands are predominantly classified as having what structural state?

a) Blocky
b) Single-grained
c) Granular
d) Platy

31. Which of the following best describes the water holding capacity of soils situated near beaches?

a) Extremely high due to capillary action.
b) Moderate, making them suitable for most crops.
c) Very low, as water rapidly drains through large macropores.
d) High, because salt retains water in the soil profile.

32. What is the primary physical reason why irrigated rice cannot be successfully grown in areas immediately near beaches?

a) The soil is too compact for rice root expansion.
b) The excessively high percolation rate prevents ponding of water.
c) The soil structure is too massive and lacks aeration.
d) The particle density of beach sand is toxic to rice roots.

33. In addition to physical limitations, what major chemical condition typically restricts the cultivation of non-adapted crops near beaches?

a) Extreme acidity and aluminum toxicity.
b) High salinity and excessive sodium levels.
c) Deficiency of silicon and iron.
d) Toxic levels of heavy metals like lead.

34. Beach soils are highly susceptible to which form of degradation if protective vegetation is removed?

a) Waterlogging and subsequent denitrification.
b) Wind erosion and shifting sand dunes.
c) Severe soil compaction forming a fragipan.
d) Rapid accumulation of persistent organic pollutants.

35. How does the specific heat capacity of sandy beach soils influence their temperature dynamics compared to moist clayey soils?

a) They warm up much faster and cool down quicker.
b) They warm up significantly slower.
c) They maintain a constant temperature year-round.
d) They require massive energy to increase temperature by one degree.

36. The cation exchange capacity (CEC) of typical beach sands is generally described as:

a) Very high, ensuring excellent nutrient availability.
b) Moderate, heavily buffered by clay minerals.
c) Very low, leading to rapid leaching of applied fertilizers.
d) Variable, dependent exclusively on the phase of the moon.

37. To determine the true volume of soil solids for particle density calculations in the laboratory, what specialized glassware is used?

a) Burette
b) Pycnometer
c) Erlenmeyer flask
d) Spectrophotometer cuvette

38. Which of the following practices is specifically implemented in wetland rice to reduce the high infiltration rate of coarse-textured subsoils?

a) Deep ripping
b) Subsoiling
c) Creation of an artificial hardpan
d) Applying massive amounts of sand

39. Which soil physical property dictates the resistance of a soil to deformation or rupture under applied stress?

a) Soil consistence
b) Particle density
c) Soil color
d) Soil temperature

40. In preparing a seedbed for corn, what is the main objective regarding soil physical properties?

a) To completely destroy secondary aggregates.
b) To produce a fine, granular tilth for optimal seed-soil contact and aeration.
c) To increase bulk density to its maximum potential.
d) To encourage the formation of single-grained structure.

41. When assessing a previously flooded rice paddy that has been dried for planting legumes, what physical impediment is most commonly encountered by the legume roots?

a) Loose, shifting sand layers.
b) A highly compacted plow sole (hardpan) located just below the tillage depth.
c) Excessive crumb structure causing root desiccation.
d) High capillary rise flooding the root zone.

42. Why is structural stability against water drops crucial for soils planted with upland leafy vegetables?

a) To prevent surface sealing and crusting which inhibits seedling emergence.
b) To ensure maximum water runoff away from the root zone.
c) To encourage anaerobic conditions required for vegetative growth.
d) To increase the bulk density of the soil surface.

43. Which natural binding agent is highly critical in maintaining the crumb structure necessary for upland crops?

a) Sodium chloride
b) Silicon dioxide
c) Humus and microbial exudates
d) Inert quartz particles

44. What is the standard unit of measurement used internationally for both bulk density and particle density?

a) Megagrams per hectare (Mg/ha)
b) Grams per cubic centimeter (g/cm3)
c) Kilograms per square meter (kg/m2)
d) Centimoles of charge per kilogram (cmolc/kg)

45. A farmer attempts to grow irrigated rice in a sandy coastal area. Despite continuous pumping, the paddy dries up within hours. Which soil physics principle explains this?

a) Hydraulic conductivity is inversely proportional to macroporosity.
b) Sandy soils have extremely high hydraulic conductivity and infiltration rates.
c) The particle density of sand repels water molecules.
d) Coastal soils undergo immediate reverse osmosis.

46. How does the destruction of soil structure during rice puddling affect the bulk density of the puddled layer once it completely dries?

a) It significantly decreases the bulk density.
b) It increases the bulk density due to the loss of macropores.
c) It converts bulk density into particle density.
d) It has absolutely no effect.

47. In terms of particle size analysis, what laboratory technique relies on Stokes' Law to determine soil texture?

a) Core sampling
b) Hydrometer method
c) Clod method
d) Neutron scattering

48. To accurately calculate the mass of 'dry soil' for bulk density, the soil sample must be oven-dried to a constant weight at what specific temperature?

a) 60 degrees Celsius
b) 105 degrees Celsius
c) 150 degrees Celsius
d) 250 degrees Celsius

49. Which characteristic best explains why native vegetation near beaches (halophytes) survives while traditional agronomic crops fail?

a) Ability to tolerate high osmotic potential from soil salinity.
b) Requirement for anaerobic root environments.
c) Dependence on high soil clay content.
d) Inability to tolerate direct solar radiation.

50. In summary, the transition from upland corn cultivation to lowland rice cultivation in the same field fundamentally requires a shift from:

a) Anaerobic to aerobic soil conditions.
b) Micro-aggregated to macro-aggregated structures.
c) A highly structured, porous state to an unstructured, puddled state.
d) High particle density to low particle density.

Detailed Answer Key

Q1: c	**Q2:** d	**Q3:** b	**Q4:** a	**Q5:** d
Q6: c	**Q7:** a	**Q8:** b	**Q9:** b	**Q10:** c
Q11: b	**Q12:** c	**Q13:** b	**Q14:** c	**Q15:** b
Q16: c	**Q17:** d	**Q18:** b	**Q19:** b	**Q20:** c
Q21: d	**Q22:** b	**Q23:** b	**Q24:** b	**Q25:** c
Q26: c	**Q27:** c	**Q28:** d	**Q29:** c	**Q30:** b
Q31: c	**Q32:** b	**Q33:** b	**Q34:** b	**Q35:** a
Q36: c	**Q37:** b	**Q38:** c	**Q39:** a	**Q40:** b
Q41: b	**Q42:** a	**Q43:** c	**Q44:** b	**Q45:** b
Q46: b	**Q47:** b	**Q48:** b	**Q49:** a	**Q50:** c

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