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Continuing Education Course #053  
Introduction to Reverse Osmosis Desalination

1. What is the capacity of the largest operational seawater desalination plant in the US?
  - a. 20 MGD
  - b. 50 MGD
  - c. 25 MGD
  - d. 10 MGD
  
2. What is the TDS concentration range of brackish seawater?
  - a. 500 mg/L to 15,000 mg/L
  - b. 200 mg/L to 10,000 mg/L
  - c. 1,000 mg/L to 25,000 mg/L
  - d. Higher than 15,000 mg/L
  
3. Reverse Osmosis Membranes Can Remove Viruses – True or False?
  - a. True
  - b. False
  
4. What Size Compounds Can Be Removed By RO Membranes?
  - a. 50 Daltons or less
  - b. 600 Daltons or more
  - c. 200 Daltons or more
  - d. 100 Daltons or less
  
5. Reverse Osmosis Membranes Cannot Remove Protozoa – True or False?
  - a. True
  - b. False
  
6. Water Sample Contains 601.2 mg/L of Calcium. What is the Concentration of Calcium in meq/L?
  - a. 45 meq Ca/L
  - b. 60 meq Ca/L
  - c. 22 meq Ca/L
  - d. 30 meq Ca/L
  
7. Which Compound Contributes Highest Percentage of the TDS Concentration of Ocean Water?
  - a. Sodium Sulfate
  - b. Calcium Chloride
  - c. Sodium Chloride
  - d. Magnesium Bicarbonate
  
8. Which Geographic Location Has Highest Ocean Water Salinity?

- a. Red Sea
  - b. Pacific Ocean
  - c. Mediterranean
  - d. Arabian Gulf
9. What is the Typical Ratio between TDS concentration in mg/L and EC in  $\mu\text{S}/\text{m}$  in Saline Source Waters?
- a. 0.67 to 0.70
  - b. 0.55 to 0.95
  - c. 0.70 to 0.85
  - d. 0.35 to 0.60
10. Osmotic Pressure is A Function of the Type of RO Membrane Used for Desalination – True or False?
- a. True
  - b. False
11. What is Osmotic Pressure of Source Water That Has TDS Concentration of 550 mg/L?
- a. 6.8 psi
  - b. 68 psi
  - c. 5.5 psi
  - d. 340 psi
12. What is the Typical Recovery of Brackish Water RO System?
- a. 75% to 85%
  - b. 40% to 55%
  - c. 85% to 99 %
  - d. 30% to 45%
13. Below What Concentration Can RO Membranes Remove Iron in Oxidized Form without Fouling?
- a. less than 2 mg/L
  - b. less than 0.1 mg/L
  - c. more than 2.5 mg/L
  - d. less than 0.05 mg/L
14. Semi-permeable RO Membranes Let Dissolved Solids Pass Through at Higher Rate than They Do Water – True or False?
- a. True
  - b. False
15. Permeate Recovery Rate is A Ratio between Which Two Parameters?
- a. Permeate and Concentrate Flows
  - b. Concentrate and Permeate Salinities
  - c. Permeate and Feed Flows
  - d. Permeate and Feed Salinities
16. If RO System Has Feed Water TDS Concentration of 40,000 mg/L, Permeate TDS Concentration of 400 mg/L and Recovery Rate of 44 %, What is The Salinity of the Concentrate Generated by This RO System?
- a. 69,800 mg/L
  - b. 77,453 mg/L
  - c. 71,114 mg/L
  - d. 56,300 mg/L

17. What is the Salt Passage of RO Membrane Which Has TDS Concentration of the Feed Water of 990 mg/L and Produces Permeate of TDS Concentration of 80 mg/L?

- a. 8.1%
- b. 0.57%
- c. 2.4%
- d. 5.2%

18. What is The Salt Rejection of RO Membrane Which Has Feed TDS Concentration of 33,500 mg/L and produces Permeate of Salinity of 210 mg/L?

- a. 99.4%
- b. 89.4%
- c. 99.8%
- d. 76.2%

19. What is the TDS Concentration of Standard Sodium Chloride Solution Used for Determining Salt Rejection of Commercial SWRO Membranes?

- a. 35,000 mg/L
- b. 40,000 mg/L
- c. 20,000 mg/L
- d. 32,000 mg/L

20. What is the Typical Specific Permeability of Brackish Water RO Membranes?

- a. 0.2 to 0.35 gfd/psi
- b. 0.3 to 0.5 gfd/psi
- c. 0.04 to 0.06 gfd/psi
- d. 0.1 to 0.15 gfd/psi

21. Seawater Membranes Have Higher Permeability than Brackish Water Membranes – True or False?

- a. True
- b. False

22. What Are the Two Key Factors That Determine Membrane Concentration Polarization?

- a. Permeate Flux and Feed Pressure
- b. Permeate Flux and Feed Flow
- c. Feed Flow and Permeate Salinity
- d. Feed Water Salinity and Permeate Salinity

23. Water Transport Rate of RO Membrane is Proportional to Net Driving Pressure – True or False?

- a. True
- b. False

24. What Will Be the Impact of the Increase in Feed Water Salinity on the Permeate Flux?

- a. Increase in Feed Water Salinity Will Increase Membrane Permeate Flux
- b. Increase in Feed Water Salinity Will Have No Impact on Permeate Flux
- c. Increase in Feed Water Salinity Will Decrease Membrane Permeate Flux

25. Membrane Salt Rejection Increases with RO System Recovery – True or False?

- a. True
- b. False

26. What Is the Effect of Temperature of the Feed Saline Water on the RO Membrane Rejection?

- a. No Effect
- b. RO Membrane Rejection Decreases with Increase in Feed Water Temperature
- c. RO Rejection Increases with Increase in Feed Water Temperature

27. What is the Thickness of the Membrane Film Which Actually Separates Salts from the Water?

- a. 0.2  $\mu\text{m}$
- b. 40  $\mu\text{m}$
- c. 0.1  $\mu\text{m}$
- d. 100  $\mu\text{m}$

28. What is the Diameter of the Most Widely Used Spiral Wound, PA RO Membranes?

- a. 16 inches
- b. 4 inches
- c. 18 inches
- d. 8 inches

29. CA Membranes Have Higher Tolerance to Oxidants than PA Membranes – True or False?

- a. True
- b. False

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