New Mexico Water and Wastewater Association

Basic Wastewater Math

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Terry Mount
Retired
terry.mount071813@gmail.com

The conversion/formula sheet that is currently posted on the UOCP has been provided to you for use during the class. This will be referred to during the completion of each question and where a formula is not available on that particular document it will be provided.

<u>Conversions and Factor Label:</u>

Discussion of Certification Exam Formula Sheet and reason to use factor labeling

Using the conversions factors from the handout provided, convert the following:

1. 3.2 miles to feet ***(Page 3)***

2. 3.2 acres to sq.ft. ***(Page 1)***

3. 678,754 cu.ft to acre-ft. ***(Page 1)***

4. 3.7 MGD to gpm ***(Page 3)***

5. 1250 gpm to cfs ***(Page 3)***

6. 0.9 cfs to MGD ***(Page 3)***

7. 768 gpm to acre-ft/day ***(Page 3)***

8. 5.6 MGD to cfs ***(Page 3)***

9. 25ºC to ºF ***(Page 10)***

10. 90ºF to ºC ***(Page 10)***

<u>Surface Areas:</u>

11. Determine the surface area (exposed water area) of a rectangular clarifier, in sq. ft., if the clarifier is 74 feet in length and 32 feet in width. ***(Page 4)***

12. A circular clarifier has a diameter of 72 feet and a depth of 31 feet. Determine the surface area (exposed water area) of the clarifier, in sq. ft. ***(Page 4)***

13. A trickling filter is 58 feet in diameter and has a media depth of 6 feet. Determine the surface area of the media of the trickling filter, in sq. ft. ***(Page 4)***

14. A pond has a width of 380 feet and a length of 540 feet. Determine the surface area of the pond, in acres. ***(Page 9)***

15. Determine the cross-sectional area, in sq. ft., of the flow in a grit channel that is 2.5 feet in width and flowing to a depth of 1 foot, 3 inches. ***(Page 4)***

16. Determine the cross-sectional area, in square inches, of a pipe that is 18 inches in diameter. ***(Page 4)***

Volumes:

17. A rectangular clarifier is 58 feet in length, 24 feet in width, and 18 feet in depth. Determine the volume, in cubic feet. ***(Page 4)***

18. A rectangular clarifier is 62 feet in length, 31 feet in width, and 24 feet in depth. Determine the volume, in gallons. ***(Page 4)***

19. A circular clarifier is 71 feet in diameter and has a depth of 22 feet. Determine the volume of the clarifier in cubic feet. ***(Page 4)***

20. A circular clarifier is 64 feet in diameter and a depth of 22 feet. Determine the volume of the clarifier, in million gallons. ***(Page 4)***

21. A pond has a width of 272 feet, a length of 388 feet, and a depth of 6 feet. Determine the volume of the pond, in cubic feet. ***(Page 4)***

22. A pond has a width of 450 feet, a length of 675 feet, and a depth of 5 feet. Determine the volume of the pond, in acre-feet. ***(Page 4 and Page 1)***

Velocity and Flows:

23. A grit channel is 24 feet in length and a stick that has been dropped into the channel travels the length of the channel in 32 seconds. Determine the velocity of flow in the channel, in ft/sec. ***(Page 5)***

Flows:
Q = AV (General Formula)

24. Determine the flow rate, in cfs, in a channel that is 3 feet in width, flowing at a depth of 2 feet, and the velocity of the flow is 2.0 feet per second. ***(Page 5)***

25. Determine the flow rate, in million gallons per day, in a channel that is 2 feet in width, 2 feet in depth, flowing half-full at a velocity of 0.9 feet per second. ***(Page 5)***

26. An 18-inch pipe is flowing full at a velocity of 2.1 feet per second. Determine the flow rate, in cubic feet per second. ***(Page 5)***

27. A 24-inch pipe is flowing full at a velocity of 1.1 feet per second. Determine the flow rate, in gallons per minute. ***(Page 5)***

Detention Times:

28. Determine the detention time, in hours, for a rectangular clarifier that is 68 feet in length, 27 feet in width, and 18 feet in depth, if the flow into the clarifier is 2.6 MGD. ***(Page 11)***

29. A rectangular clarifier is 65 feet in length, 23 feet in width, and has an operating depth of 17 feet. Determine the detention time, in hours, if the flow into the clarifier is 1.1 MGD. ***(Page 11)***

30. Determine the detention time in a clarifier, in hours, that has a diameter of 62 feet and a depth of 21 feet, if the flow into the clarifier is 1.6 MGD. ***(Page 11)***

31. Determine the detention time in a clarifier, in hours, that has a diameter of 64 feet and a depth of 18 feet, if the flow into the clarifier is 1.5 MGD. ***(Page 11)***

32. Determine the detention time in a pond that has a surface area of 12.6 acres, a depth of 5 feet, and an average daily flow of 0.9 MGD. ***(Page 11 and Page 1)***

33. Determine the detention time in a pond that has a surface area of 18 acres, a depth of 6 feet, and an average daily flow of 0.8 MGD. ***(Page 11 and Page 1)***

Surface Overflow Rates/Hydraulic Loadings:

34. Determine the surface overflow rate on a clarifier if the diameter of the clarifier is 62 feet, the depth is 18 feet, and the average daily flow is 2.1 MGD. ***(Page 10 and Page 4)***

35. Determine the surface overflow rate on a clarifier if the diameter of the clarifier is 62 feet, the depth is 22 feet, and the average daily flow 1.3 MGD. ***(Page 10 and Page 4)***

36. Determine the hydraulic loading on a trickling filter if the trickling filter is 65 feet in diameter and is receiving a flow of 1.4 MGD. ***(Page 10 and Page 4)***

37. A trickling filter that is receiving 1.8 MGD is 74 feet in diameter and the media depth is 5 feet. What is the hydraulic loading? ***(Page 10 and Page 4)***

38. A pond receives an average daily flow of 0.9 MGD. The surface area of the pond is 64 acres. Determine the hydraulic loading on the pond, in inches/day. ***(Page 9)***

39. A pond is receiving 0.8 MGD. The pond has a surface area of 16 acres and a depth of 6 feet. What is the hydraulic loading in inches/day? ***(Page 9)***

Weir Overflow Rates:

40. Determine the weir overflow rate for a clarifier that has a diameter of 62 feet and is receiving a flow of 1.9 MGD. ***(Page 5)***

41. The WWTP receives 2.1 MGD. The primary clarifier has a diameter of 78 feet and an operating depth of 18 feet. What is the weir overflow rate? ***(Page 5)***

Population Loadings:

42. Determine the population loading for a pond that receives 0.8 MGD, has a surface area of 22 acres, and serves a population of 4600 persons. ***(Page 9)***

Chlorination:

43. Determine the demand if the dosage applied to the flow is 2.8 mg/L and the residual is 1.1 mg/L. ***(Page 6)***

44. The desired chlorine residual is 0.9 mg/L and the demand is 2.3 mg/L. What is the dosage that should be applied to the wastewater to achieve the desired residual? ***(Page 6)***

45. Determine the feed rate, in pounds per day of chlorine gas, if the flow through the plant is 1.3 MGD and the dosage to maintain the desired residual is 4.2 mg/L. ***(Page 6)***

46. The dosage required to maintain the desired residual is 4.1 mg/L. How many pounds per day, of gaseous chlorine, must be fed if the flow is 0.8 MGD? ***(Page 6)***

47. Determine the feed rate, in pounds per day, if the flow through the plant is 0.84 MGD, the required dosage is 3.4 mg/L, and you are applying HTH with an availability of 65%. ***(Page 6)***

48. A WWTP is using 5% sodium hypochlorite to disinfect the effluent. If the required dosage is 4.1 mg/L and the flow 0.5 MGD, how many pounds per day will need to be fed to the flow? ***(Page 6)***