

1) The formula for calculating the volume of a rectangular wet well is

- A)  $V=L \times W \times C$   
 B)  $V=W \times A \times P$   
 C)  $V=W \times L \times H$   
 D)  $V=W \times H \times D$

Where,

V= volume      C=circumference  
L= length      P=perimeter  
W= width      D=diameter  
A= area      H= height

2) Check valves are used on the discharge side of centrifugal pumps to

- A) Equalize the pressure on both sides of the impeller  
 B) Prevent water in the suction line from flowing back into the reservoir  
 C) Prevent water in discharge line from flowing back  
 D) Regulate the rate of water flow through the discharge pipe

3) How does the area of a(n) 42 inch sewer compare to a(n) 21 inch sewer?

- a) The 42 in. area is 2.00 times larger than the 21 in. area.  
 b) The 42 in. area is 3.14 times larger than the 21 in. area.  
 c) The 42 in. area is 2.55 times larger than the 21 in. area.  
 d) The 42 in. area is 4.00 times larger than the 21 in. area.

4) A lantern ring is a

- A) Metal ring for lowering an explosive-gas detector candle into manholes and wet wells  
 B) Shaft coupling that has been completely worn through in spots or that has "daylighted"  
 C) Spacer ring in a pump packing gland to improve seat water distribution  
 D) Type of coupling for joining pipes that will not be covered or put in the dark for at least 5 days

5) If a(n) 36 in. pipe and a(n) 42 in. pipe are running full and meet at a manhole, what minimum size outlet pipe will be required?

  
  
  

- a) 56 inch
- b) 44 inch
- c) 71 inch
- d) 78 inch

6) Hydrogen sulfide is a toxic gas that smells like \_\_\_\_\_. At high concentrations of hydrogen sulfide, however, the sense of smell is deadened and no odor is detected.

  
  
  

- A) Dead fish
- B) Fuel gas
- C) Rotten cabbage
- D) Rotten eggs

7) What capacity blower is required to ventilate a manhole 48 in. in diameter and 62 feet deep, if 3 air change(s) is required every 6 minutes?

  
  
  

- a) 130 Ft<sup>3</sup>/Min.
- b) 389 Ft<sup>3</sup>/Min.
- c) 2336 Ft<sup>3</sup>/Min.
- d) 934 Ft<sup>3</sup>/Min.

7) A pH of 6.0 is

- A) Acid
- B) Alkaline
- C) Neutral
- D) Basic

8) If a sewer must have a flow rate of 33 MGD with a velocity between 1.09 ft./sec. and 2.25 ft./sec. What must the minimum size be?

- a) 65 in.
- b) 93 in.
- c) 92 in.
- d) 64 in.

9) The purpose of ribs on the outside of a Wayne Sewer Ball is to

- A) Allow the ball's weight to be closer to the ball's center
- B) Avoid patent infringement that would apply if a non-ribbed ball were used
- C) Cause jet action to aid in the hydraulic flushing of the sewer line
- D) Reinforce (strengthen) the ball

10) A circular tank is 39 feet in diameter and 21 feet deep. If the tank is completely full and a 975 GPM pump is supplied, how long will it take to remove 11.5 feet of water from the tank?

  
  
  

- a) 4 Hours, 23 Minutes
- b) 1 Hours, 57 Minutes
- c) 1 Hours, 45 Minutes
- d) 1 Hours, 76 Minutes

11) Your chlorinator room should have an exhaust vent installed

  
  
  

- A) Near the ceiling.
- B) Near the floor.
- C) Halfway up the wall.
- D) At the chlorinator bell jar.

12) Leakage of seal water around the packing on a centrifugal pump is required because it acts as a(n)

  
  
  

- A) Adhesive
- B) Coolant
- C) Lubricant
- D) Vapor Barrier

13) The flushing water pressure in a water-lubricated wastewater pump should be \_\_\_\_\_ the pump discharge pressure.

  
  
  

- A) 10 psi less than
- B) 5 psi less than
- C) 5 psi more than
- D) 10 psi more than

14) A wet well is 10 feet deep by 17 feet in diameter. When the pump is not running, the water rises 31.0 in. in 2 min. 48 sec. If the level rises 5.2 in. in 16.0 min. while the pump is running, what is the pump rate in GPM?

  
  
  

- a) 1,612 Gal./Min.
- b) 1,520 Gal./Min.
- c) 1,797 Gal./Min.
- d) 9,209 Gal./Min.

15) What factors should be considered when providing trench shoring?

  
  
  

- A) Grade of sewer.
- B) Pipe material.
- C) Structures or sources of vibration near trenches.
- D) All of the above.

16) Sewer "A" has 17,000 people at 95 GPCD. Sewer "B" has 13,800 people at 90 GPCD. Sewer "C" has 9,850 people at 85 GPCD. What percent of the flow is due to I&I if the total plant flow is 4.50 MGD?

  
  
  

- a) 21.5%
- b) 82.1%
- c) 65.7%
- d) 17.9%

17 Given the data below, what is the most likely cause of the lift station problem?

**DATA:** Wet well inlet is normal  
 Well drops normally when pump #1 is running  
 Well level rises slowly when pump #2 or pump #3 is running  
 Run amperage is the same for all three pumps  
 One of the pump motors turn backwards when off.  
 Level system is reading correctly.  
 Electrical controls are all in automatic.

- A) Pump #1 & #2 are air-bound  
 B) Pump #1 check valve stuck open.  
 C) Either pump #1 or #2 is wired backwards  
 D) Check valve on pump #3 is clogged.

18) Colored dye is dumped into a manhole. The dye first appears 4 min., 6 sec. later in a manhole 850 feet downstream and disappears 5 min. and 7 sec. after the dye was first dumped into the manhole. What is the velocity of the flow in the sewer?

- a) 2.77 Ft./Sec.  
 b) 3.07 Ft./Sec.  
 c) 3.46 Ft./Sec.  
 d) 0.65 Ft./Sec.

T14) Task least likely to be preformed by collection systems personnel is

- A) Cleaning sewer stoppages  
 B) Making water connections  
 C) Inspecting/testing manholes  
 D) Maintaining collection systems equipment

20) When opening a power rodder properly, do the following

- A) Push the rodding tool into an obstruction and hold it there
- B) Rotate rod in one position
- C) Make sure all the torque is out of a broken rod
- D) Rod past dropped joints or through a crushed pipe

21) An electric motor is supplied by 480 v and 32 amps, given no loss, what horsepower can the motor supply to the water?

- a) 64.2 HP
- b) 2.0 HP
- c) 20.6 HP
- d) 30.9 HP

22) In keeping records,

- A) Every test result should be included in an annual report.
- B) Poor records are better than no records
- C) Records should be destroyed every two years.
- D) Records should be kept up-to-date and maintained as long as they are useful.

23) A 4,160 v motor draws 21 amps. What is the brake horsepower if the pump is 85% efficient and the motor power factor is .91?

- a) 90.6 HP
- b) 117.1 HP
- c) 5.1 HP
- d) 106.6 HP

24) Which one of the following would not be considered a natural event?

- A) Explosion.
- B) Flood.
- C) Lightning.
- D) Tornado.

25) What information must be on a warning tag attached to a switch that has been locked out?

- A) Direction for removing tag
- B) Name of the nearest physician to call in case of an emergency
- C) Signature of person who locked out the switch, who is the only person authorized to remove tag
- D) Time to unlock switch

26) Calculate the water horsepower if the pump it operates provides 875 GPM against 118 feet total dynamic head (TDH)?

- a) 101 HP
- b) 55 HP
- c) 7 HP
- d) 26 HP

27) If the pump in problem 26 is 79% efficient, then what is the brake HP?

- a) 33.0 HP
- b) 70.2 HP
- c) 9.4 HP
- d) 43.8 HP

28) Why are gasoline and volatile solvents objectionable where present in a sewer?

- A) They produce an explosion hazard
- B) They tend to cause the solids to vaporize
- C) They will coagulate floatables and cause stoppages
- D) They represent wasted recourses

29) If you were in charge of a large operation with four foremen, three whose work was exceptionally good and a fourth whose work was substandard, what should you do?

- A) Demote the substandard Forman and bring up a replacement from the ranks
- B) Discuss the problem with the substandard Forman and offer to help before any other action is taken.
- C) Find a replacement, then fire the substandard Forman.
- D) Wait to see if the substandard Forman does better.

30) A pump has an efficiency of 91% and a motor has a power factor of .93. If the water horsepower is 334 HP and electricity has a cost of 11.0 cents per KWH, how much will it cost to run the pump for one month, (31 days) at 12.0 hrs./day?

- a) \$12,047.49 /mo.
- b) \$10,963.22 /mo.
- c) \$3,109.31 /mo.
- d) \$8,032.37 /mo.

31) Which of the following is a type of shore?

- A) Bar
- B) Aluminum hydraulic
- C) Truss
- D) Sand

32) You should never attempt to install, troubleshoot, maintain or replace electrical equipment panels, controls, wiring, or circuits unless

- A) A manhole is overflowing down a street
- B) A pump is unplugged
- C) You are receiving a lot of odor complaints
- D) You know what you are doing, are qualified, and are authorized

33) 37 mg/l. of chlorine is required to treat a flow of 50.0 MGD. The solution available to you, however, is only 74% of chlorine. How many lbs./day of solution are required to treat the flow?

  
  
  

- a) 85,403 lbs./day
- b) 20,850 lbs./day
- c) 15,429 lbs./day
- d) 1,024,012 lbs./day

34) A venturi meter measures quantity of fluid by

  
  
  

- A) difference in pressure between a constricted and a full-size portion
- B) electronic measurement
- C) velocity of the fluid past a given point
- D) weight of the fluid

35) 49 mg/l. of root control must be added to a 42 in. sewer that is 2,125 feet long. If the root control chemical is in a solution that consists of only 38% of the chemical, how many lbs. of the solution must be added to the sewer?

  
  
  

- a) 164.38 lbs.
- b) 23.74 lbs.
- c) 183.28 lbs.
- d) 3,418.02 lbs.

36) On Monday A flow totalizer read 11,156,800 gal. On Thursday the totalizer read 114,081,002 gal.  
What was the daily average flow?


- a) 114.08 MGD
- b) 25.73 MGD
- c) 40.03 MGD
- d) 34.31 MGD

37) Enclosed, open, and semi-closed are terms used for the designation and selection of


- A) Impellers
- B) Lantern rings
- C) Sleeves
- D) Stuffing Boxes

38) If the grade of a sanitary sewer has a slope of 0.50% for 350 feet, what is the rise of the pipe?


- a) 351.8 Feet
- b) 1.75 Feet
- c) 0.02 Feet
- d) 0.18 Feet

39) What must be checked before entering a manhole?

- A) Atmosphere in manhole
- B) Safety equipment
- C) Proper barricades or warning devices around a manhole
- D) All of the above

40) A crew surveys a sewer from STA. 9+ 54.00 to STA 32+ 65.25. If the elevation of the manhole ( farthest to the treatment plant) is 742.6 feet, what is the elevation of the second manhole if the grade is 0.0017 FT/FT,

- a) 3.9 Feet
- b) 738.7 Feet
- c) 746.5 Feet
- d) 7.4 Feet

41) Which of the following is not typical of a "submersible" pump?

- A) Can be installed in a crooked hole.
- B) Minimizes vandalism.
- C) Quieter operation.
- D) Requires water lubrication.

42) A map with a scale of 0.625 in.= 100 feet indicates that manhol"A" is 7.50 in. from manhole "B"  
What is the actual distance between manholes?

- |                          |                |
|--------------------------|----------------|
| <input type="checkbox"/> | a) 4.7 ft.     |
| <input type="checkbox"/> | b) 8.3 ft.     |
| <input type="checkbox"/> | c) 1,200.0 ft. |
| <input type="checkbox"/> | d) 83.3 ft.    |

43) Biological activity in long, sluggish-flow, flat-grade sewer lines will likely

- |                          |  |
|--------------------------|--|
| <input type="checkbox"/> | A) Decrease line sediment  |
| <input type="checkbox"/> | B) Create oxygen deficiency in the air in manholes, sewers, or wet wells |
| <input type="checkbox"/> | C) Stop toxic gas production   |
| <input type="checkbox"/> | D) Increase the "carrying capacity" of the line                          |

44) If a repair job can be done by 14 people in 17 hours, how long will it take for 5 people to do a similar job?

- |                          |                      |
|--------------------------|----------------------|
| <input type="checkbox"/> | a) 12 Hours, 0 min.  |
| <input type="checkbox"/> | b) 47 Hours, 6 min.  |
| <input type="checkbox"/> | c) 6 Hours, 4 min.   |
| <input type="checkbox"/> | d) 47 Hours, 36 min. |

45) Biological hazards in collection system operations include

- |                          |                                     |
|--------------------------|-------------------------------------|
| <input type="checkbox"/> | A) Noxious or toxic gases or vapors |
| <input type="checkbox"/> | B) Oxygen deficiency                |
| <input type="checkbox"/> | C) Physical injuries                |
| <input type="checkbox"/> | D) Hepatitis A                      |

46) A trench is dug at 13 ft. wide x 9 ft. deep x 1,654 ft. long. A 21 in. Sewer is going to be installed in this trench. 16 in. must be left out of the top for concrete. How much backfill will be required to fill the trench?

  
  
  


- a) 5,958 Yd<sup>3</sup>  
 b) 17,875 Yd<sup>3</sup>  
 c) 160,872 Yd<sup>3</sup>  
 d) 7,020 Yd<sup>3</sup>

47) How many tons of backfill would there be in problem 51 if the backfill material weighed 3,724 lbs./cu. yd.?

  
  
  


- a) 11,094 Tons  
 b) 33,283 Tons  
 c) 299,544 Tons  
 d) 13,071 Tons

48) If a loaded dump truck could haul 18 tons each, how many truck loads would be needed in problem 47?

  
  
  


- a) 616 Trucks  
 b) 727 Trucks  
 c) 617 Trucks  
 d) 16,642 Trucks

49) Given the following information, would it be less expensive to finish the job in 2 days, or finish the job in one day by working overtime?

Actual job time = 15.00 hrs  
 Travel time & set-up time = 1.50 hrs  
 Average Work day = 8.00 hrs  
 Hourly pay rate = \$ 18.25  
 Overtime is 1.50 times the normal hourly rate

  
  
  


- a) Cheaper to do the work with O.T.  
 b) Cheaper to do the work in two days  
 c) Costs the same either way  
 d) None of the above

50) The average cost for contractors to clean the city sewers is \$ 5.95 per foot for 1.60 miles of 12 in. pipe, \$ 6.80 per foot for 1.80 miles of 15 in. pipe, and \$ 7.85 per foot for 1.70 miles of 18 in. pipe, The city is considering purchasing a new jet & vac truck for \$ 284,318 and hiring a 3 man crew to operate it. Operator "A" makes \$19.57 per hour, operator "B" makes \$18.59 per hour, operator "C" makes \$17.89 per hour. Health care & benefits cost 37% of wages.

The cost/year of the jet truck will be \$ 31,275.00 for 10 years. The time for the crew to clean 100 feet of sewer is as follows:

- 12" sewer takes 1.50 hours.
- 15" sewer takes 3.25 hours.
- 18" sewer takes 4.00 hours.

.50 hours. of non-productive time (travel, cleanup, etc.) will be used for every hour spent cleaning sewers

Which is the least expensive option (contractor or in-house) and by how much over the 10 year period?


- a) Cheaper to buy a jet-vac, cost savings will be \$625,505.80
- b) Cheaper to contract out, cost savings will be \$502,906.66
- c) Cheaper to buy a jet-vac, cost savings will be \$62,863.33
- d) Cheaper to contract out, cost savings will be \$61,925.07