351. The ash content is the same as the
   a. difference in raw sludge and the sludge after air drying.
   b. inorganic solids.
   c. organic solids.
   d. volatile solids.

352. The most abundant pollutant entering natural water bodies (rivers, lakes) is
   a. domestic waste.
   b. food processing waste.
   c. hospitals.
   d. non-point.

353. The weight of a chemical compound is 1/8 of the total weight of a chemical solution. The percent, by weight, of the chemical in solution is
   a. 6.4
   b. 8.3
   c. 10.5
   d. 12.5

354. All of the following are types of starters for electrical motors except
   a. actuator.
   b. autotransformer.
   c. reduced voltage.
   d. resistors.

355. Instrumentation friction discs or clutch surfaces should be
   a. frequently brushed briskly with a solution of water and soda.
   b. kept free of oil.
   c. oiled frequently.
   d. roughened with emery cloth as necessary.

356. If a generator will not start, check for
   a. loose terminal connections.
   b. shaft binding or sticking.
   c. tripped circuit breakers.
   d. all of the above.
357. Given the data below, what is the most likely cause of the problem?

DATA: Wet well inlet increased flow because of rain.
Wet well unchanged at excessively high level.
Lead pump running.
Follow pump running.
Lead pump check valve lifting arm up.
Follow pump check valve lifting arm down.
Force main pressure remains at normal range for one pump.
Low-level pressure switch normal.
High-level pressure switch normal.
Electrical controls automatic.

a. lead pump clogged.
b. force main pressure too high.
c. follow pump clogged.
d. both pumps clogged.

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

DATA: Wet well inlet has normal dry weather flow.
Wet well empty with flow going directly to pump suction.
Lead pump is running.
Follow pump is running.
Lead and follow pump check valve lifting arms are slightly above closed position.
Forced main pressure low and erratic.
Lead air compressor running.
Low-level pressure switch is closed.
Electrical controls automatic mode.

a. malfunctioning level control is causing pressure switches to open too soon.
b. malfunctioning level control is causing pumps to run out of phase.
c. malfunctioning level control is causing pumps to run constantly.
d. malfunctioning level control is causing high wet well level.

359. A chlorine demand test will show the
a. safe amount of chlorine that may be fed without killing fish.
b. number of pounds of chlorine required to kill 100 percent of the coliforms.
c. amount of chlorine required to give a desired residual after a given time.
d. amount of chlorine required to satisfy the biochemical oxygen demand.

360. One-ton chlorine tanks
a. have fusible plugs located at valves.
b. must be stored in an upright position.
c. remove liquid chlorine from the top valve.
d. use the bottom valve only with chlorine evaporators.
361. "Uniformity coefficient" refers to
   a. uniform floc formation.
   b. running the test the same way each time.
   c. quality of wastewater.
   d. measure of uniformity of filter media.

362. What conditions determine the backwash rate for a pressure filter?
   a. largest media size.
   b. quality of the backwash water.
   c. settleability of solids in the secondary clarifier.
   d. suspended solids concentrations in the water applied to the filter.

363. If your effluent turbidity changes from 200 T. U. to 500 T. U. and you did not want to increase your effluent pH any further, what chemical would you use?
   a. alum.
   b. ferric chloride.
   c. polymer.
   d. sodium aluminate.

364. The hydraulic loading for a phosphate stripper depends on the
   a. ability of the stripper to remain anaerobic.
   b. ability of the aerobic phosphate stripper to remain aerobic.
   c. BOD loading of the unit.
   d. pH of the wastewater being treated.

365. What will not affect the vacuum produced in a vacuum filter system?
   a. clogged silencer drain.
   b. drum speed.
   c. poor filtrate pump performance.
   d. seal water flow to the vacuum pump.

366. Calculate the food/microorganism (F/M) loading ratio.

   DATA: Flow = 1 MGD.
   Average BOD to aeration tank = 140 mg/L.
   Aeration tank capacity = 250,000 gal.
   MLSS conc. = 2,000 mg/L.

   a. 25 lbs BOD per day/100 lbs. MLSS.
   b. 28 lbs BOD per day/100 lbs. MLSS.
   c. 30 lbs BOD per day/100 lbs. MLSS.
   d. 32 lbs BOD per day/100 lbs. MLSS.

367. How many gallons of return activated sludge should be wasted each day to maintain the MLSS at 2000 mg/L? Disregard reduction or gain of solids due to oxidation and/or effluent carry-over.

   DATA: Influent Raw = 200 mg/L suspended solids.
   Return Activated Sludge = 4000 mg/L suspended solids.
   Flow = 1 MGD.
368. Calculate the clarifier sludge flow demand necessary to reduce the return sludge concentration from 15.0 to 13.0.

DATA: Suspended solids concentrations are obtained by the centrifuge method.
Final effluent flow = 6 MGD.
Final clarifier sludge flow = 3 MGD.
Aeration tank conc. = 5.0%.
Return sludge conc. = 15.0%.
Settled sludge conc. = 13.0%.

a. 1.15 MGD.
b. 3.46 MGD.
c. 3.75 MGD.
d. 5.63 MGD.

369. At what rate in gallons per minute must wash water be delivered to a mixed media filter to attain a backwash rate of 24 inch vertical rise if the filter is 20 feet wide and 30 feet long?
   a. 600
   b. 2,400
   c. 3,000
   d. 9,000

370. What problems are created when the sludge build-up on the bottom of the sedimentation basin become too great?
   a. degradation of process efficiency will result.
   b. localized high flow velocities will be produced.
   c. sludge scouring will occur.
   d. all of the above.

371. What is the solids recovery rate of this vacuum filter?

DATA: Filter area = 500 sq. ft.
Hours of operation = 10
Sludge filtered = 80,000 gallons
Sludge solids = 5 percent
Sludge volatile solids = 70 percent
Cake solids = 22 percent
Cake produced = 68 wet tons

a. 20 percent
b. 63 percent
c. 82 percent
d. 90 percent
372. Jar tests may be used to determine the optimum dosage of
   a. alum
   b. BD
   c. oil and grease
   d. volatile acids

373. Given the following data, what is the most likely cause of the primary sedimentation tank problem?

   DATA: Flow through inlet gates normal.
   Tank level at correct height.
   Sludge collectors (flights) operating normally.
   Scum skimming mechanisms operating normally.
   Sludge collector drive motor controllers in automatic.
   Gas bubbles evident at sides of the tank.

   a. effluent channel restriction.
   b. flow pattern through tank.
   c. sludge accumulation.
   d. sludge collector drive motor load.

374. Given the data below, what is the most likely cause of the aeration tank problem?

   DATA: Inlet flow and loading to aeration tank constant.
   Aeration tank level at set-point.
   Aeration blower (auto-manual selector) in automatic mode.
   Aeration blower running below maximum output.
   Aeration blower discharge (pressure controller) in automatic mode.
   Dissolved oxygen (probe selector) set on control probe.
   Dissolved oxygen (control probe) below set-point.
   Dissolved oxygen controller calling for increase blower output.
   Air flow controller calling for increased blower output.

   a. dissolved oxygen probe malfunctioning causing false indication.
   b. dissolved oxygen probe selector set on wrong probe.
   c. malfunctioning air flow controller overriding blower automatic selector.
   d. malfunctioning discharge pressure controller causing blower to limit output.

375. Given the following data, what is the most likely cause of the chlorinator problem?

   DATA: All five of the one ton cylinders received from supplier in acceptable condition.
   All five cylinders hooked up to manifold in acceptable manner.
   Manifold header pressure is normal.
   Chlorinator vacuum is normal.
   Chlorine residual after post-treatment chlorination is normal.
   Five cylinders normally last for 10 days, but chlorine flow is dropping after 8 days.
   Chlorine controllers are in the automatic mode.
   Alarm system functioning normally -- no leaks.
376. Given the following data, what is the most likely cause of the tertiary filter problem?

DATA: All filters operating.
Rate of filter flow is 20%.
Effluent valve is 60% open.
Influent valve open.
Filter level is normal.

Given the following data, what is the most likely cause of the tertiary filter problem?

a. effluent valve open too much.
b. needs backwashing.
c. rate of flow too low.
d. too many filters on-line.

377. What could be the cause of excessive carbon fines in the effluent from activated carbon column reactors?

a. carbon is being produced in the reactor due to poor combustion.
b. carbon is flowing out in the effluent due to a hole in one of the screens.
c. microscreens are breaking up the carbon floc upstream from the reactor.
d. pin floc containing carbon is escaping from the secondary clarifier.

378. A chemical analysis indicates the following substances were present: $\text{HCO}_3^-$, $\text{SO}_4^-$, $\text{CO}_3^-$. If you are interested in determining the alkalinity, you would ignore the concentration of which substance?

a. $\text{CO}_3^-$
b. $\text{HCO}_3^-$
c. $\text{SO}_4^-$
d. none of the above.

379. The mixed media filtration process may be terminated for backwashing on the basis of

a. effluent turbidity.
b. elapsed run time.
c. total head loss.
d. all of the above.

380. A composite sample is needed on the plant effluent. Given the data below, calculate the sample size if the flow is 1.2 mgd.

DATA: Average flow is 1.5 mgd.
The required total amount of sample is 1000 ml.
Sample 12 times/day.

a. 67 ml.
b. 100 ml.
c. 104 ml.
d. 150 ml.
381. The managerial function which involves devising an appropriate system of pay is
   a. controlling.
   b. organizing.
   c. planning.
   d. staffing.

382. For utility records and/or rate analyses purposes, customers with similar patterns of
     water use are usually grouped together into classes. Which one of the following is
     not generally used?
     a. commercial.
     b. domestic.
     c. industrial.
     d. retail.

383. The span of supervision is the
     a. average length of time required to be in the organization before making
        supervisor.
     b. number of levels between the lowest employee and the boss.
     c. number of subordinates for each manager.
     d. number of supervisors in an organization.

384. If an organization's departments are organized by jobs to be done, this is known as
     departmentation by
     a. customer.
     b. function.
     c. product.
     d. territory.

385. Decentralized authority describes the process of
     a. changing an organization from centralized to decentralized again.
     b. delegating authority to one's superiors instead of one's subordinates.
     c. delegating power for decisions to lower levels.
     d. retracting authority which has been previously delegated, and probably
        changing functions and duties.

386. What term means that the employee reports to one specific supervisor, and that
     the delegation of authority comes from one particular supervisor to the employee?
     a. unity of command.
     b. span of supervision.
     c. organizational chart.
     d. formal organization.

387. It is generally accepted by psychologists that human behavior is goal-oriented and
     a. selfish.
     b. random.
     c. other-centered.
     d. motivated.
388. Steel tanks may be protected from rusting by
   a. alternately wetting and drying walls.
   b. maintaining humidity in tank.
   c. protective coatings.
   d. washing tank walls.

389. What should be the most important concern of an operator after a bypass?
   a. aquatic life.
   b. clean-up procedures.
   c. health-related effects.
   d. odors.

390. A supervisor could be responsible for an accident, in part or completely, by
   a. disregarding an unsafe work environment.
   b. haste in requiring work performed.
   c. overlooking a potential hazard.
   d. all of the above.

391. Control is
   a. backward looking.
   b. concentrating on the present.
   c. forward looking.
   d. not connected to the other managerial functions.

392. Increased funds for the year are limited. However, 2 or 3 outstanding newly employed individuals are grossly underpaid for their services. How should this situation be handled?
   a. call a staff meeting, explain the situation and then raise their salaries.
   b. don't give anyone a raise.
   c. pass the word that there will be no raises but change their titles, not their duties, and raise their pay.
   d. Say nothing and do nothing because it is none of the employee's business.

393. When purchased materials are received by the utility, they should not be
   a. counted and checked against P.O.'s.
   b. inspected.
   c. placed on shelves where they will be used first.
   d. recorded.

394. If chlorine costs 15 cents per pound, what is the daily cost to chlorinate 5 MGD of wastewater to an initial concentration of 2.6 mg/L?
   a. $1.95
   b. $3.25
   c. $10.84
   d. $16.25

395. Disaster plans should be developed in case of
   a. broken sewers
   b. floods
   c. power outages
   d. pump stoppages
396. Preparing for a public open house, what following in-plant arrangements must be made?
   a. a printed handout is available and up-to-date.
   b. adequate coffee cups and ash trays are available.
   c. all pump casings are repainted.
   d. visitor safety is ensured.

397. Public relations are important because we
   a. want to finish our work in a hurry.
   b. need lots of training.
   c. must deal with the public.
   d. like our jobs.

398. Trees and brush should be removed from areas to be flooded by waste stabilization ponds to reduce
   a. aeration.
   b. leakage
   c. silt
   d. turbidity

399. Your system’s billing is based on the water usage rate. If your system bills quarterly at a rate of 50 cents/1,000 gallons for the first 10,000 gallons, $0.40/1,000 for the next 15,000 gallons and $0.25/1,000 for all over 25,000 gallons. If a customer uses 35,000 gallons per quarter, what is the bill?
   a. $11.00
   b. $13.50
   c. $21.75
   d. $27.15

400. An organization chart for a utility can be helpful for several reasons. Which of the following is the least valid objective of an organization chart?
   a. to establish proper chain of command authority.
   b. to help develop a budget.
   c. to help in making up project schedules.
   d. to help in scheduling emergencies.
Answers
Wastewater Study Guide
Class IV