The MCQ Samples for the Competitive Exam

Master Degree

Environmental Engineering Department

Water Supply Engineering

Q1: Water resources such as (Ponds and lakes, Streams and rivers, Storage reservoirs, and Oceans) are called ……..

A) surface sources B)industrial sources C) underground sources D) Sub-surface sources.

Q2: ……. water is one that contains microorganisms, chemicals, industrial or other wastes, or sewage so that it is unfit for its intended use.

A) potable B) drinking C) polluted D) safe

Q3: The Iraqi Standards value for color in water is …… Cobalt Unit.

A) 13 B) 12 C) 11 D) 10

Q4: A 4-story wooden building, each floor is 509 m^2. Determine the fire flow in m^3/hr.

A) 908 B) 905 C) 912 D) 902

Q5: A residential area of a city has a population density of 15000 capita per km^2 and an area of 120000 m^2. If the average water flow is 300 L/capita.day. Estimate the maximum rate expected in m^3/sec.

A) 0.0764 B) 0.0647 C) 0.0467 D) 0.467

Q6: ……. Is a unit operation that removes floating and large suspended matter from water.

A) screening B) sedimentation C) floating D) bubbling

Q7: The sedimentation with the chemical unit is unit……..

A) process B) operation C) process/operation D) operation/process

Q8: The consumption of water for residential use is …….

A. 40-60% B) 25-30% C) 10-15% D) 5-10%

Q9: According to its size , screens can be classified into ……..

A. rack B) mesh C) Fine D) All of the above

Q10: Chlorine existing in water as molecular chlorine is defined as…….

A. Free available chlorine B) Combined available chlorine C) Total chlorine D) Residual chlorine

Q11: Surface overflow rate (SOR) represents the settling velocity of the ……particle to be 100% removed from the flow or to be settled.

A. Smallest B) Largest C) Largest and smallest D) None of the above

Q12: The gravel layer in rapid sand filter is ……..

A. 40-60 cm B) 60-90 cm C) 60-120 cm D) 80 – 120

Q13: The structure that made of several parts, mainly constructed to collect raw water from the source to water treatment plant is …….. .

A. Sedimentation tank B) pump C) screen D) intake

Q14: ……. usually uses to determine the daily amount of coagulant.

A) Settling test B) Dosage test C) Head test D) Jar test

Q15: ……. of water may be caused by the presence of uncombined carbon dioxide, mineral acids and salts of strong acids and weak bases.

A) calcination B) acidity C) alkalinity D) hardness

Q16: viruses can be removed by ……. .

A) Disinfection B) Softening C) Aeration D) Screen

Q17: A rectangular flocculator is designed with 3 rotating paddles, to treat 393 m^3/hr flow during 60 min. The tank is of dimensions L = 3H and W = 2H, where H is the depth of the tank. Find the dimensions of the tank, L, W and H (m)?

A) L=8, H=4, W=12 B) L=12, H=8, W=4 C) L=8, H=4, W=6 D) L=12, H=4, W=8

Q18: A WTP is designed to treat 48 x10^3 m^3/d. For filtration 12 RSFs are used, each filter is designed with 2 troughs of a square cross sectional area. The filtration rate is 160 m/d and the backwash rate is 864 m/d. Find the dimension of each filter, L and W (m).

A) L=12.5, W=2 B)L=12, W=2 C) L=6.5, W=4 D) L=6, W=4

Q19: A WTP is designed to treat 48 x10^3 m^3/d. For filtration 12 RSFs are used, each filter is designed with 2 troughs of a square cross sectional area. The filtration rate is 160 m/d and the backwash rate is 864 m/d. Find the volume of water (m^3) to wash 2 filters at the same time for 5 minutes.

A) L=150 B) 145 C) 155 D) 152

Q20: Type of filters by process is……. filters

A) Pressure B) Mono C) Sand D) Anthracite

Q21: Type of filters by media is……. filters

A) Dual B) Mono C) Sand D) All of above

Q22: Ozone used in …….. .

A) sedimentation B) softening C) disinfection D) coagulation

Q23: …….. used for removing the taste and odors

A) adsorbents B) Stabilization C) sedimentation D) Softening

Q24: In sedimentation tank,…… shall be designed to distribute the water equally and at uniform velocities.

A) Trough B) Freeboard C) Outlet D) Inlets

Q25: The screen is placed in a canal 0.6 m in width and 0.4 m in height. Use rectangular bars 10 X 30 mm in cross section, assume size of the openings = 25mm, the number of bars equal…… .

A) 16 B) 15 C) 17 D) 16.4

Q26: The screen is placed in a canal 0.6 m in width and 0.4 m in height. Use rectangular bars 10 X 30 mm in cross section, assume size of the openings = 25mm, the number of spacing equal…… .

A) 16 B) 16.4 C) 17 D) 15

Q27: a coarse screen (rack) design for a flow of 0.8 m3/sec. The screen is placed in a channel 1.5 m in depth and 2 m width. Use square bars 13 X 13 mm in cross section, assume size of the openings c/c = 80 mm? the head loss through the openings is equal…….m.

A) 9.8 B) 0.98 C) 0.098 D) 0.0098

Q28: ……. intakes are especially likely to need screens to exclude large floating matter which might injure pumps.

A) River B) Tower C) Lake D) None of above

Q29: chlorine is obtained in pressurized cylinders ranging in weight from …… to ……. kg.

A) 0 to 1000 B) 45 to 1000 C) 0 to 2000 D) 45 to 2000

Q30: ……. used for electrical Firefighting.

A) Hydrants B) Sprinkler C) Hose reel D) None of above

Sludge Treatment

Q1. Which of the following is **not** a common type of sludge produced in wastewater treatment plants?
A. Primary sludge
B. Activated sludge
C. Tertiary sludge
D. Digested sludge

Q2. The primary purpose of sludge thickening is to:
A. Kill pathogens in the sludge
B. Reduce the volume of sludge by removing some water
C. Remove heavy metals from the sludge
D. Increase the organic content of the sludge

Q3. Which method is commonly used for **aerobic stabilization** of sludge?
A. Anaerobic digestion
B. Incineration
C. Extended aeration
D. Composting

Q4. Which equipment is typically used for mechanical dewatering of sludge?
A. Trickling filter
B. Grit chamber
C. Belt filter press
D. Sedimentation tank

Q5. Which of the following is a **beneficial use** of treated sludge (biosolids)?
A. Landfilling
B. Ocean dumping
C. Land application as fertilizer
D. Open burning

Q6. Anaerobic digestion of sludge primarily results in the production of:
A. Ammonia and carbon dioxide
B. Biogas (methane and CO_2)
C. Ozone and hydrogen
D. Sulfuric acid

Q7. Sludge Volume Index (SVI) is used to assess:
A. Pathogen concentration in sludge
B. Biochemical oxygen demand
C. Settleability of activated sludge
D. Heavy metal content in sludge

Q8. Adding lime to sludge helps to:
A. Increase sludge volume
B. Enhance dewatering efficiency
C. Raise pH and reduce pathogens
D. Lower temperature

Q9. The disposal of sludge to land must comply with:
A. Water Framework Directive only
B. No regulations if sludge is stabilized
C. Environmental protection and public health regulations
D. Local municipal recycling guidelines only

Q10. What is the primary advantage of thermal hydrolysis as a sludge pre-treatment method before anaerobic digestion?
A. Reduces the need for dewatering
B. Converts nitrogen to phosphorus
C. Increases biodegradability and biogas yield
D. Eliminates the need for further treatment

Q11. In the context of energy recovery, which sludge treatment method is most commonly used to produce renewable energy?
A. Thickening
B. Anaerobic digestion
C. Composting
D. Air drying

Q12. The use of polymers in sludge dewatering primarily serves to:
A. Kill pathogens in sludge
B. Reduce the organic load
C. Improve solid-liquid separation
D. Convert sludge to compost

Q13. Which sludge treatment technology uses high temperatures (typically >150°C) and pressures to break down cell walls and improve sludge digestibility?
A. Anaerobic digestion
B. Thermal hydrolysis
C. Composting
D. Air drying

Q14. Which equipment is **most commonly used** to mechanically dewater sludge and reduce its volume before disposal?
A. Trickling filter
B. Belt filter press
C. Anaerobic digester
D. Sedimentation tank

Q15. Which of the following **emerging technologies** involves the use of sound waves to rupture microbial cells in sludge?
A. Microwave irradiation
B. Thermal drying
C. Ultrasonic disintegration
D. Freeze-thaw treatment

Q16. Which sludge treatment method **generates biogas** that can be used for energy recovery?
A. Composting
B. Incineration
C. Anaerobic digestion
D. Lime stabilization

Q16. A sludge sample has a total solids (TS) concentration of 6%. If the sludge volume is 1000 liters, what is the mass of total solids in kilograms?
A) 60 kg
B) 600 kg
C) 6 kg
D) 0.6 kg

Q17. If the volatile solids (VS) content is 70% of the total solids, and the total solids mass is 80 kg, what is the mass of volatile solids?
A) 56 kg
B) 70 kg
C) 24 kg
D) 80 kg

Q18. A digester treats 5000 liters of sludge daily with a solids concentration of 5%. How many kilograms of solids are treated per day?
A) 250 kg
B) 500 kg
C) 50 kg
D) 25 kg

Q19. A sludge dewatering process reduces the volume of sludge from 1000 liters to 250 liters. What is the volume reduction percentage?
A) 75%
B) 25%
C) 50%
D) 80%

Q20. The BOD concentration in raw sludge is 400 mg/L. After treatment, it reduces to 80 mg/L. What is the percentage removal of BOD?
A) 20%
B) 80%
C) 100%
D) 50%

Q21. A sludge thickener receives 10,000 liters per day of sludge with 1% total solids (TS). The thickener outputs sludge with 5% TS. What is the volume of sludge after thickening?
A) 2,000 liters
B) 50,000 liters
C) 5,000 liters
D) 500 liters

Q22. The specific gas production from anaerobic digestion is 0.25 m^3 CH_4 per kg of volatile solids destroyed. If 80 kg VS are destroyed daily, how much methane is produced?
A) 20 m^3/day
B) 0.32 m^3/day
C) 200 m^3/day
D) 32 m^3/day

Q23. A centrifuge dewaters sludge from 3% solids concentration to 20% solids concentration. If the input volume is 5000 liters, what is the volume of sludge after dewatering?
A) 750 liters
B) 333 liters
C) 300 liters
D) 3333 liters

Q24. The sludge retention time (SRT) of an aerobic digester is 15 days, treating 10,000 liters of sludge daily. What is the volume of the digester in liters?
A) 150,000 liters
B) 10,000 liters
C) 1500 liters
D) 15,000 liters

Q25. The sludge feed to a centrifuge has a solids concentration of 1.5% and flow rate of 2000 L/hr. The centrifuge produces cake with 25% solids. What is the flow rate of the cake discharge?

A) 120 L/hr
B) 150 L/hr
C) 300 L/hr
D) 350 L/hr

Q26. A waste activated sludge (WAS) has a concentration of 3% total solids and is thickened to 6%. The WAS flow rate is 1500 L/day. Calculate the volume of thickened sludge produced daily.

A) 750 L/day
B) 3000 L/day
C) 4500 L/day
D) 2250 L/day

Q27. A sludge with 4.5% solids is dewatered to 18% solids, resulting in a volume reduction. If the initial sludge volume is 5000 L, what is the volume of dewatered sludge?

A) 1250 L
B) 1000 L
C) 1500 L
D) 1100 L

Q28. An anaerobic digester produces biogas containing 65% methane by volume. If 1000 m^3 of biogas is produced per day, calculate the volume of methane produced daily.

A) 350 m^3
B) 500 m^3
C) 650 m^3
D) 700 m^3

Q29. A centrifuge processes sludge at 1,200 L/hr with 3% solids. If the cake produced contains 20% solids, what is the volume of the cake?

A) 180 L/hr
B) 200 L/hr
C) 240 L/hr
D) 300 L/hr

Q30. The sludge retention time (SRT) in a biological treatment plant is 20 days. The mixed liquor suspended solids (MLSS) concentration is 3000 mg/L, and the daily sludge wasting flow is 1000 m^3/day. Calculate the sludge production rate (kg/day).

A) 60,000 kg/day

B) 3,000 kg/day

C) 300 kg/day

D) 30,000 kg/day

Wastewater Treatment Systems

1. In the activated sludge process, the term F/M ratio refers to ……. .

A. Flow/Membrane
B. Food/Microorganism
C. Flow/Mixing
D. Filtration/Mass

2. The main purpose of secondary clarifiers in a treatment plant is ……. .

A. Remove inorganic solids
B. Settle biological floc
C. Aerate the wastewater
D. Disinfect the water

3. Trickling filters are categorized under:

A. Primary treatment
B. Secondary treatment
C. Tertiary treatment
D. Disinfection

4. The typical range for hydraulic retention time (HRT) in a conventional primary clarifier is ……. .

A. 5–10 minutes
B. 30 minutes–1 hour
C. 1–4 hours
D. 3–4 hours

5. Sludge from the primary clarifier is usually ……. .

A. Returned to aeration tank
B. Sent to digestion or dewatering
C. Used for filtration
D. Discharged with effluent

6. A primary sedimentation tank receives 10,000 m^3/day of wastewater with an influent TSS concentration of 300 mg/L. If the tank removes 55% of TSS, the removed TSS in kg/day is ……. .

A. 1,650 kg/day
B. 2,250 kg/day
C. 1,800 kg/day
D. 2,500 kg/day

7. Which of the following is not a typical feature of secondary treatment?

A. Biological oxygen demand (BOD) reduction
B. Settling of biomass
C. Screening of large solids
D. Use of aerobic microorganisms

8. The sludge volume index (SVI) is used to assess …… .

A. Grit particle size
B. Clarifier overflow rate
C. Settleability of activated sludge
D. TSS concentration in influent

9. A secondary clarifier handles a flow of 5,000 m^3/day and has a surface area of 500 m^2, the surface overflow rate (SOR) is …… .

A. 2 m/day
B. 5 m/day
C. 10 m/day
D. 15 m/day

10. In an aeration tank, if the influent BOD is 250 mg/L and the effluent BOD is 25 mg/L, the percent removal efficiency is …… .

A. 80%
B. 85%
C. 90%
D. 95%

11. Which of the following units is not included in a typical secondary treatment system?

A. Trickling filter
B. Activated sludge tank
C. Grit chamber
D. Secondary clarifier

12. The mean cell residence time (MCRT) is also known as …… .

A. Hydraulic retention time
B. Sludge age
C. Solids retention time
D. Both B and C

13. A plant operates an aeration tank with 3,000 mg/L of MLSS and a flow rate of 10,000 m^3/day. If the volume of the aeration tank is 5,000 m^3, the F/M ratio given influent BOD of 200 mg/L is …… .

A. 0.13
B. 0.20
C. 0.30
D. 0.50

14. The hydraulic retention time (HRT) for a secondary aeration tank is calculated using formula ….. .

A. HRT = Q/V
B. HRT = V/Q
C. HRT = MLSS × Q
D. HRT = Q/MLSS

15. A primary clarifier has a volume of 600 m^3 and treats a flow of 7,200 m^3/day. the HRT in hours is …… .

A. 1.5 hours
B. 2.0 hours
C. 3.0 hours
D. 4.5 hours

16. The main function of the return activated sludge (RAS) is to …… .

A. Reduce sludge age
B. Provide additional aeration
C. Maintain biomass in aeration tank
D. Remove excess nutrients

17. A wastewater treatment plant has an influent flow of 20,000 m^3/day with influent BOD of 220 mg/L, the total BOD load (kg/day) is …… .

A. 4,400 kg/day
B. 5,500 kg/day
C. 3,800 kg/day
D. 6,200 kg/day

18. Which operational issue is often associated with high F/M ratios in the activated sludge process?

A. Poor settling of sludge
B. Excess nitrification
C. Low microbial growth
D. Anaerobic conditions

19. The MLVSS concentration ……., if the MLSS is 3,500 mg/L and 75% is volatile.

A. 1,750 mg/L
B. 2,000 mg/L
C. 2,625 mg/L
D. 3,000 mg/L

20. An aeration tank has 4,000 mg/L MLSS and a volume of 6,000 m^3. The MLSS in kilograms …… .

A. 12,000 kg
B. 16,000 kg
C. 20,000 kg
D. 24,000 kg

21. A trickling filter treats 3,000 m^3/day with an influent BOD of 180 mg/L and removes 70% of BOD. The BOD in the effluent ……. .

A. 36 mg/L
B. 45 mg/L
C. 54 mg/L
D. 72 mg/L

22. In wastewater terminology, RAS stands for ……. .

A. Raw Activated Solids
B. Recirculated Aerated Solids
C. Return Activated Sludge
D. Reused Aeration Solids

23. A plant processes 12,000 m³/day of wastewater with 250 mg/L BOD. The system removes 92% BOD. The BOD mass removed per day is …….. .

A. 2,400 kg/day
B. 2,760 kg/day
C. 3,100 kg/day
D. 3,450 kg/day

24. A reactor has an aeration tank of 3,000 m³, flow of 9,000 m³/day. The HRT is ……. .

A. 4 hours
B. 6 hours
C. 8 hours
D. 12 hours

25. A circular sedimentation tank has a diameter of 30 m and a depth of 3 m. What is its volume in cubic meters?

A. 2,120 m³
B. 1,250 m³
C. 2,118 m³
D. 3,000 m³

26. Which of the following is the primary goal of wastewater treatment?

A. Increase organic matter.
B. Remove impurities and contaminants
C. Add nutrients to water
D. Convert water to gas.

27. ……. used to remove oil from wastewater.

A. Equalization tank
B. Oil and Grease Trap
C. PST
D. Secondary Clarifier

28. A wastewater flows through a pipe with a diameter of 0.5 m at a velocity of 2 m/s. What is the flow rate in cubic meters per second?

A. 0.3926
B. 0.6932
C. 0.7592
D. 0.45

29. ……is the process that microorganisms maintained as attached on media.

A. attached growth
B. fixed film
C. suspended growth
D. trickling filter

30. …… is the process that operat in present of molecular oxygen.

A. aerobic process
B. anoxic process
C. facultative process
D. anaerobic process

Soil Pollution

1. A cylinder was used to take a soil sample with a diameter of (2.5 in) and a height of (4.25 in). The weight of the soil was (3.25 Ib) after drying it at a temperature of (105 C^o). Its apparent density $_b$ = ...
2. Types of actinomycetes: 1. ....., 2.....
3. Treatment ..... of contaminated soils uses microorganisms to decompose toxic substances.
4. Soil particles with the exact dimensions are called grains.....
5. The letter ..... is used to indicate the characteristics of soil horizons, where it represents a heavily mottled horizon.
6. The group ..... consists of two layers of silica and one layer of alumina.
7. Rich, immature soils consist of two horizons: 1. ..... and 2. .....
8. The minimum pore space in the soil is .....
9. A sample of soil had a void ratio (e = 0.72), moisture content (ω =12%), and specific gravity (Gs = 2.72). What is the dry density?
10. The weight of water used in the moisture content equation is the weight lost when the soil is heated from …….. to …… C^o.
11. The amount of nitrogen and organic matter in the soil horizon to a depth of (…….. to ……..) cm decreases with time.
12. Clay may have permeability less than ……. cm/s.
13. Middle Porosity: it has a diameter greater than (……. mm) is responsible for aeration and rapid drainage and prevails in hard soils.
14. Montmorillonite group has diameters ranging from ..... to ..... microns.
15. Humic substances are classified according to their solubility in bases and acids into three types: ....., ..., and .....
16. There are more than ..... species of fungi in the soil, and they belong to approximately ..... genus.
17. The method of fixing and hardening pollutants in soil is divided into three types: ....., ..., and .....
18. The percentage of organic matter in the soil during the upper 30 cm of soil height ranges from .....% to .....%.
19. The diameters of silt particles in soil range between ..... and .....
20. The process of hardening with bituminous materials is one of the methods of treating pollutants in the soil and is called the process of .....
21. The process of converting ammonia into nitrite and then nitrate by microorganisms in the soil is called the process of .....
22. During the process of washing contaminated soil, we need an amount of water amounting to ..... m^3 for every ..... meter of soil depth.
23. Biological treatment of contaminated soils uses ..... to decompose toxic substances.
24. There are two types of soil deposits resulting from glacial deposits: 1. ..... and 2. .....
25. When potassium ions are present in the soil, they bind the surfaces of adjacent units together, forming what is called.....
26. The process of converting ammonia into nitrite and then nitrate by microorganisms in the soil is called the process of .....
27. Most nutrients are available in soil at a pH value ranging from ..... to .....
28. The process of composting organic fertilizers before using them in the soil to reduce the ratio of carbon to nitrogen by a percentage of .....
29. ..... is one of the Atterberg limits, which is the water content when the soil behaves like a plastic material without cracks.
30. The speed of water flow in the soil depends on 1. ....., 2. ....., 3. .....

Statistics

1- The correlation coefficient between two variables is r = -0.85. What does this imply?

A) Strong positive linear relationship
B) Strong negative linear relationship
C) Weak negative linear relationship
D) No linear relationship

2-Given two points: (2, 3) and (4, 7), find the slope of the regression line.

A) 1
B) 2
C) 1.5
D) 0.5

3- Given the regression line $\hat{y} = 3x + 2$, what is the predicted value of y when x = 5?

A) 15
B) 17
C) 13
D) 12

4- Which of the following is true if the correlation coefficient is zero?

A) x and y have a strong linear relationship
B) x and y have a strong non-linear relationship
C) x and y have no linear relationship
D) x and y are causally related

5- Given:

- Mean of x = 10
- Mean of y = 20
- Slope (b) = 2

Find the coefficient (a) in the regression equation $\hat{y} = a + bx$.

A) 0
B) 10
C) -10
D) -5

6- If an increase in hours studied is associated with higher exam scores, the correlation between them is:

A) Negative
B) Zero
C) Positive
D) Undefined

7- given the following paired data:
X: 1, 2, 3
Y: 2, 4, 6

What is the Pearson correlation coefficient (r)?

A) 0
B) 1
C) -1
D) 0.5

8- A machine fills soda bottles with a mean of 500 ml. The standard deviation is known to be 5 ml. A sample of 36 bottles has a mean of 498.5 ml.
Test at $\alpha = 0.05$ whether the machine is underfilling. What is the z-statistic?

A) -3.00
B) -1.80
C) 1.50
D) -2.50

9- From the Previous question (No. 8), what is the correct decision?

A) Reject H_0
B) Fail to reject H_0
C) Increase sample size
D) Use a t-test

10- A sample of n = 9 observations has a mean of 50 and a standard deviation of 4. Test $H_0: \mu = 52$ vs $H_1: \mu \neq 52$ at $\alpha = 0.05$.

What is the t-statistic?

A) -1.5
B) -2.0
C) -2.25
D) -1.0

11- A 95% confidence interval for the population mean is (45.2, 54.8). What decision do you draw for $H_0: \mu = 55$?

A) Reject H_0 at $\alpha = 0.05$
B) Accept H_0 at $\alpha = 0.05$
C) Increase confidence level
D) Use more tests to decide

12- The Pearson linear correlation coefficient between age and number of sleeping hours for the following data is:

Age	0.1	0.2	0.5	0.7	0.8	0.9
Number of sleeping hours	14.9	14.5	13.4	14.1	13.4	13.7

A) -0.79
B) -0.13
C) 0.79
D) 0.05

13- The type of correlation for the data in the previous question (No. 12) is:

A) Strong positive
B) Weak positive
C) Strong negative
D) Weak negative

14- The value of the correlation coefficient ranges between:

A) -1 and 1
B) -1 and 0
C) 0 and 1

15- A fair die is rolled once. What is the probability of getting a number greater than 4?

A) 1/2
B) 1/3
C) 1/6
D) 2/3

16- If the probability that it rains today is 0.2, what is the probability that it does not rain?

A) 0.2
B) 0.5
C) 0.8
D) 1.0

17- A fair coin is flipped twice. What is the probability of getting two heads?

A) 1/4
B) 1/2
C) 1/3
D) 3/4

18- A card is drawn at random from a standard deck of 52 cards. What is the probability of drawing a red king?

A) 1/13
B) 1/26
C) 1/52
D) 2/13

19- If $P(A) = 0.4$, $P(B) = 0.3$, and A and B are mutually exclusive, what is $P(A \cup B)$?

A) 0.7
B) 0.1
C) 0.12
D) 0.4

20- If $P(A \cap B) = 0.2$ and $P(B) = 0.5$, what is $P(A \mid B)$?

A) 0.2
B) 0.5
C) 0.4
D) 0.25

21- A box contains 3 red balls and 2 green balls. One ball is drawn at random, then replaced, and another ball is drawn. What is the probability both are green?

A) 1/25
B) 2/5
C) 4/25
D) 9/25

22- In the same box above (3 red, 2 green), if you draw two balls without replacement, what is the probability both are red?

A) 3/10
B) 1/2
C) 6/20
D) 3/5

23- Which of the following can represent a valid probability distribution?

A) P(x) = {0.3, 0.3, 0.4}
B) P(x) = {0.1, 0.9, 0.2}
C) P(x) = {-0.1, 0.5, 0.6}
D) P(x) = {0.5, 0.3, 0.3}

24- A random variable X takes values {1, 2, 3} with probabilities {0.2, 0.5, 0.3}. What is E(X)?

A) 2.1 B) 2.0 C) 1.8 D) 1.5

25- The data set is: 4, 8, 6, 10, 12, What is the mean?

A) 8 B) 9 C) 10 D) 6

26- What is the median of the following numbers 7, 5, 9, 11, 3

A) 7 B) 5 C) 9 D) 11

27- Find the mode of the data: 2, 3, 3, 4, 5, 3, 6

A) 3 B) 2 C) 5 D) No mode

28- What is the range of the following data: 15, 10, 22, 18, 25

A) 10 B) 15 C) 5 D) 20

29- Find the sample standard deviation of: 2, 4, 4, 4, 6, 8

A) 2 B) √4 C) √2 D) 1.79

30- The weights of a type of fruit are normally distributed with a mean of 150 grams and a standard deviation of 20 grams.
What is the probability that a randomly selected fruit weighs more than 170 grams?

A) 0.1587
B) 0.8413
C) 0.3085
D) 0.6915

Solid Waste Management

1. Which method is commonly used for determining solid waste composition in the field?

A) Statistical analysis B) Visual observation

C) Waste sampling and sorting D) Survey questionnaires

2. Why is accurate waste component analysis important?

A) To reduce taxes B) To plan effective waste management systems

C) To improve public relations D) To comply with OSHA regulations

3. Which of the following directly affects public health due to improper waste management?

A) Air pollution only B) Vector breeding and disease spread

C) Decreased recycling rates D) Road congestion

4. Aesthetic considerations in waste management mainly involve:

A) Worker salaries B) Landfill gas emissions

C) Visual impacts and odors D) Political debates

5. Which of the following is NOT an on-site handling activity?

A) Sorting recyclables B) Bagging waste

C) Loading waste into collection vehicles D) Composting at a centralized facility

6. On-site storage containers must be:

A) Heavy and difficult to move B) Resistant to weather, pests, and vandalism

C) Made only of metal D) Installed underground

7. The generation rate of solid waste is typically measured in:

A) Tons per acre B) Pounds per person per day

C) Gallons per household D) Liters per square mile

8. A major factor influencing waste generation rates is:

A) Type of vehicles used B) Household income levels

C) Number of waste workers D) Local fuel prices

9. What type of collection service typically requires users to bring waste to a central location?

A) Curbside collection B) Communal collection

C) Door-to-door collection D) Automated collection

10. The primary goal of collection system design is to:

A) Maximize landfill life B) Minimize operating cost

C) Increase recycling contamination D) Maximize driver overtime

11. Which vehicle is most commonly used for residential waste collection?

A) Roll-off truck B) Rear-loading compactor truck

C) Front-end loader D) Transfer trailer

12. A front-end loader is primarily used for:

A) Collecting residential curbside trash B) Lifting large commercial containers

C) Compost processing D) Hazardous waste management

13. Which factor does NOT influence equipment selection for waste collection?

A) Road width B) Type of waste generated

C) Building architecture D) Local climate conditions

14. In collection system labor planning, a one-person crew is most common with:

A) Open trucks B) Automated side-loader trucks

C) Rear-loader manual trucks D) Roll-off containers

15. A transfer station becomes economically justified when:

A) The hauling distance to the disposal site is very short

B) Waste generation rates are extremely low

C) The disposal site is located far from the collection area

D) There are frequent equipment breakdowns

16. Which of the following is NOT a function of a transfer station?

A) Waste volume reduction B) Consolidating waste loads

C) Treating hazardous waste D) Reducing transport costs

17. What is the major advantage of using transfer trailers?

A) Increased recycling rates B) Higher waste collection speed

C) Lower long-haul transportation costs D) Decreased odor emissions

18. Mechanical processing of solid waste may include:

A) Landfilling B) Shredding and size reduction

C) Composting D) Anaerobic digestion

19. In waste processing, densification refers to:

A) Increasing the waste's volume B) Increasing the waste's weight

C) Decreasing the waste's volume by compaction D) Sorting waste by material type

20. In material recovery facilities (MRFs), waste is often processed to:

A) Increase landfill disposal B) Destroy recyclable materials

C) Separate recyclables from mixed waste D) Mix all waste types together

21. One condition that must be applied is that from the available truck sizes, the sizes that closely match the calculated values must be chosen in order to...

A) number of collection trips. B) labor requirements

C) cost-effective combination. D)determine the required truck volume.

22. If the homeowner is responsible for placing the container to be emptied on the curb on the day of waste collection and returning it to its storage location until the day of collection, we use the following term to express this:

A) Where curb. B) Dwelling units. C)Where curb. D) urban areas.

23. The following term means that it is the responsibility of the waste collection crew to enter the homeowner's property and remove the waste from its storage location.

A) Setout service. B) In setout-setback service,

C) In backyard carry service, D) Were alleys.

24. Most often the value of the off-course factor (w), which is an important factor to take into account in calculating the total travel time, expressed as a fraction, is between.

A) from 0.10 to 0.25 B) from 0.15 to 0.35

C) from 0.25 to 0.45 D) from 0.30 to 0.50

25. In the fixed container system in the process of collecting solid waste from its origins and transporting it to landfills, the term (Dw) refers to one of the most important factors that must be found. This term refers to:

A) Average daily quantity of waste collected, yd3/week.

B) time required per week, days/week.

C) number of collection trips required per day, trips/day.

D) Integer number of trips per week, trips/week,

26. The quantities of certain types of solid waste are also affected by other factors, as the quantities of food waste are affected by the growing season of vegetables and fruits, an important factor which is:

A) Catch basin. B) Season of the year. C) Tree and landscaping. D) Street and alley cleaning.

27. In general, more wastes are collected. This observation should not be used to infer that more waste is generated, So the question is about the impact of.

A) services are provided B) wastes are collected.

C) Frequency of Collection. D) wastes may be actually the same,

28. It affects (reduces) the quantity of food waste collected, but it is not clear whether they affect the quantity of solid waste generation.

A) Use of Home Grinder. B) garage of storage area.

C) the quantity of generated wastes. D) waste generation rate.

29. It has been observed that one of the most important factors significantly influences solid waste production. For example, in villages and areas with low economic levels, waste production is observed to be lower.

A) Characteristics of Population. B) solids in farming.

C) use the resources ultimately. D) quantity of food waste collected,

30. Excessive use of a specific process has a definite impact on the amount of waste collected. The impact of these processes on the amount produced is another matter. Until further information is available, this process is:

A) Typical Generation Rate. B) Extent of Salvage and Recycling.

C) certain locations. D) Factors that Affect.

Fluid Mechanics

1. **What is the primary property that distinguishes a fluid from a solid?**
   A) Compressibility
   B) Ability to flow
   C) Density
   D) Viscosity

2. **Which equation is known as the equation of continuity in fluid mechanics?**
   A) P1V1=P2V2*P1V1=P2V2*
   B) A1V1=A2V2*A1V1=A2V2*
   C) F=ma*F=ma*
   D) Q=πd4128μL*Q*=128*μLπd*4

3. **In laminar flow, the flow of fluid is:**
   A) Turbulent and irregular
   B) Smooth and orderly
   C) Chaotic and unpredictable
   D) None of the above

4. **What does the Bernoulli's equation relate?**
   A) Pressure, velocity, and height in a moving fluid
   B) Force and acceleration in a fluid
   C) Viscosity and temperature of a fluid
   D) Density and specific gravity

5. **Which of the following is a unit of viscosity?**
   A) Pascal (Pa)
   B) Poise (P)
   C) Newton (N)
   D) Joule (J)

6. **The Reynolds number is used to predict:**
   A) Flow velocity
   B) Turbulent or laminar flow
   C) Pressure distribution
   D) Fluid density

7. **Which type of flow occurs when inertial forces dominate viscous forces?**
   A) Laminar
   B) Turbulent
   C) Steady flow
   D) Compressible flow

8. **What is the primary assumption in the ideal fluid model?**
   A) Viscosity is zero
   B) Compressibility is high
   C) Viscosity is constant but non-zero
   D) Turbulence is present

9. **In the Hagen-Poiseuille equation, what does it describe?**
   A) Velocity distribution in pipe flow
   B) Discharge of a fluid flowing through a pipe
   C) Boundary layer thickness
   D) Shear stress in a fluid

10. **Which of the following increases with an increase in fluid viscosity?**
    A) Reynolds number
    B) Flow velocity
    C) Resistance to shear stress
    D) Specific weight

11. **The velocity at the center of a pipe in laminar flow (Poiseuille flow) is:**
    A) Zero
    B) Maximum
    C) Equal to the average velocity
    D) Unpredictable

12. **What is cavitation?**
    A) Formation of vapor bubbles in a liquid due to local low pressure
    B) Flow separation in a boundary layer
    C) Increase in fluid temperature due to flow
    D) Complete vaporization of a fluid

13. **Surface tension effects are most significant in which flow type?**
    A) Turbulent flow
    B) Laminar flow in large pipes
    C) Microfluidics
    D) High-speed aerodynamics

14. **The energy per unit weight of fluid is known as:**
    A) Head
    B) Pressure
    C) Velocity
    D) Viscosity

15. **Which of the following is a non-dimensional number in fluid mechanics?**
    A) Reynolds number
    B) Pascal number
    C) Archimedes number
    D) All of the above

16. **In a horizontal pipe, if the flow velocity increases, what happens to the pressure?**
    A) Increases
    B) Decreases
    C) Remains constant
    D) First increases then decreases

17. **The main purpose of a venturimeter is to measure:**
    A) Flow velocity
    B) Pressure difference and hence flow rate
    C) Fluid temperature
    D) Viscosity of fluid

18. **The boundary layer is a layer of fluid:**
    A) Near the wall where viscous effects are significant
    B) In the free stream away from walls
    C) Where turbulence is maximum
    D) No specific location

19. **In which of the following situations does flow separation usually occur?**
    A) Smooth and steady flow
    B) Sharp corners and sudden changes in pipe diameter
    C) Very low velocities
    D) Laminar flow conditions

20. **What is the primary purpose of a diffuser in fluid systems?**
    A) Increase velocity
    B) Decrease pressure and increase velocity
    C) Increase pressure and decrease velocity
    D) Filter particles from the flow

21. **An ideal fluid is considered to be:**
    A) Inviscid and incompressible
    B) Viscous and compressible
    C) Viscous and compressible
    D) Inviscid and compressible

22. **Flow rate through a pipe is directly proportional to the:**
    A) Pressure difference and pipe diameter raised to the 4th power
    B) Pipe length
    C) Viscosity of fluid
    D) Density of fluid

23. **What type of forces are responsible for viscous flow?**
    A) Inertial forces
    B) Gravitational forces
    C) Viscous shear forces
    D) Electrostatic forces

24. **Which of these factors does not significantly influence the flow of an ideal fluid?**
    A) Viscosity
    B) Pressure gradient
    C) Density
    D) Velocity

25. **An orifice meter measures the:**
    A) Flow rate by creating a pressure difference
    B) Total head of the fluid
    C) Viscosity of fluid
    D) Turbulence in fluid

26. **The main difference between laminar and turbulent flow is:**
    A) Laminar flow is irregular, turbulent is smooth
    B) Laminar flow has higher Reynolds number than turbulent flow
    C) Turbulent flow is characteristically irregular and mixing occurs
    D) Turbulent flow occurs only in gases

27. **In flow through a pipe, the head loss is caused by:**
    A) Viscous and frictional effects
    B) Gravity only
    C) Pressure recovery
    D) Pump work

28. **The critical Reynolds number for flow in a pipe is approximately:**
    A) 2000
    B) 1000
    C) 2300
    D) 4000

29. **Which principle is used to explain buoyancy?**
    A) Bernoulli’s principle
    B) Archimedes’ principle
    C) Pascal’s law
    D) Newton’s second law

30. **In a steady, incompressible flow, the total mechanical energy remains:**
    A) Constant along a streamline, unless work is added or removed
    B) Always increasing
    C) Always decreasing
    D) Unrelated to flow conditions

Air Pollution

1. What is the primary function of a scrubber in an air pollution control system?
A) To reduce the temperature of exhaust gases
B) To remove particulate matter from exhaust gases
C) To absorb harmful gases using liquid
D) To increase airflow efficiency

2. Which factor is most critical in determining the efficiency of a scrubber?
A) The material of the scrubber
B) The liquid flow rate and contact time
C) The fan speed
D) The exhaust temperature

3. What role does a centrifugal fan play in air pollution control systems?
A) It removes gases through a chemical reaction
B) It circulates clean air into the environment
C) It increases the velocity of exhaust gases
D) It filters particulate matter from the air

4. When designing a scrubber system, what is the main consideration regarding the choice of liquid used for scrubbing?
A) The liquid should be non-volatile
B) The liquid should not react with pollutants
C) The liquid should have a high density
D) The liquid should be highly viscous

5. What is a key advantage of using an electrostatic precipitator in an industrial setting?
A) It requires no external power source
B) It effectively removes particulate matter from flue gases
C) It can also remove gaseous pollutants
D) It is highly efficient in removing both particulate and gaseous pollutants

6. In the design of a venturi scrubber, what factor is crucial for achieving high efficiency in particulate matter removal?
A) Increasing the diameter of the venturi throat
B) Increasing the pressure drop across the throat
C) Reducing the velocity of the gas flow
D) Using a high-density liquid in the scrubber

7. Which of the following factors is least important when designing a centrifugal fan for an air pollution control system?
A) Fan speed B) Blade angle
C) Exhaust gas temperature D) Blade material hardness

8. The efficiency of an electrostatic precipitator largely depends on which of the following factors?
A) The ionization of the particles in the flue gas
B) The temperature of the exhaust gases
C) The number of filter stages used
D) The pressure of the incoming air

9. In which scenario would a baghouse filter be more suitable than an electrostatic precipitator?
A) When dealing with gases with high particulate content
B) When the dust particles are very fine and difficult to capture
C) When the gases contain both particulate matter and corrosive gases
D) When high electrical conductivity is present in the flue gases

10. Which of the following is a disadvantage of using a scrubber in air pollution control?
A) It requires high maintenance
B) It is not effective in removing gaseous pollutants
C) It consumes a lot of energy
D) It generates large quantities of sludge that need disposal

11. What is the overall efficiency of a scrubber if it removes 85% of sulfur dioxide (SO2) from flue gases?
A) 75%
B) 80%
C) 85%
D) 90%

12. If a centrifugal fan operates at 1500 RPM and the fan blades have a diameter of 1.5 meters, what is the tip speed of the blades?
A) 50 m/s
B) 80 m/s
C) 100 m/s
D) 120 m/s

13. What is the removal efficiency of an electrostatic precipitator if it captures 95% of particulate matter from flue gases with a total inlet flow rate of 5000 cubic meters per hour?
A) 85%
B) 90%
C) 95%
D) 98%

14. A baghouse filter system processes 100,000 cubic meters of air per hour. If the filtration velocity is 2 m/s, what is the required filtration area?
A) 30 m^2
B) 50 m^2
C) 100 m^2
D) 150 m^2

15. If the pressure drop across a scrubber is 150 Pa, and the gas flow rate is 2000 cubic meters per hour, what is the power required by the fan to maintain the flow?
A) 10 W
B) 50 W
C) 100 W
D) 200 W

16. What is the volumetric flow rate of a centrifugal fan if the blade diameter is 1 meter, and the speed is 1200 RPM?
A) 50,000 m^3/h
B) 60,000 m^3/h
C) 70,000 m^3/h
D) 80,000 m^3/h

17. If a venturi scrubber is designed to achieve a pressure drop of 120 Pa, and the gas flow rate is 1500 m^3/h, what is the energy required by the system?
A) 10 W
B) 15 W
C) 20 W
D) 25 W

18. The efficiency of a baghouse filter increases with the number of filter bags. If the efficiency improves from 80% to 95% with an increase of 100 filter bags, how many filter bags are used in the system if the efficiency is 95%?
A) 100
B) 200
C) 300
D) 400

19. If a scrubber removes 90% of carbon monoxide (CO) from exhaust gases, and the flow rate is 3000 cubic meters per hour, how much CO remains in the exhaust gases?
A) 10%
B) 5%
C) 15%
D) 20%

20. What is the pressure drop across a scrubber if the airflow velocity is 10 m/s and the flow rate is 100,000 cubic meters per hour?
A) 200 Pa
B) 150 Pa
C) 100 Pa
D) 50 Pa

21. What is the main reason that pollutants from industrial stacks are emitted at high elevation?
A) To prevent heat loss
B) To avoid oxidation
C) To reduce ground-level pollutant concentration
D) To increase visibility

22. Which of the following best describes an aerosol?
A) A type of gaseous pollutant
B) A mist formed by sulfur combustion
C) A suspension of solid or liquid particles in air
D) A chemical used in air purification

23. In the Gaussian plume model, what does the term ΔH represent?
A) Atmospheric lapse rate
B) Wind speed
C) Plume rise
D) Ground-level height

24. What happens to ozone when it absorbs UV radiation?
A) It releases carbon dioxide
B) It becomes inert
C) It decomposes into oxygen and an oxygen radical
D) It converts into water vapor

25. Which of the following is not a direct consequence of global warming?
A) Ocean acidification
B) Sea-level rise
C) Ozone layer formation
D) Extreme weather events

26. Which of the following statements about ocean acidification is correct?
A) It is caused by excess sulfur dioxide
B) It leads to increased alkalinity
C) It is a result of excess CO_2 being absorbed by seawater
D) It enhances coral reef growth

27. What is the first step in the chemical destruction of ozone by CFCs?
A) Ozone reacts with nitrogen
B) UV radiation breaks CFCs and releases chlorine atoms
C) Ozone forms sulfuric acid
D) Chlorine reacts with CO_2

28. What is the typical behavior of a plume under unstable atmospheric conditions?
A) Fanning
B) Looping
C) Coning
D) Trapping

29. The wet adiabatic lapse rate is less than the dry adiabatic lapse rate due to:
A) Higher humidity causing rapid heating
B) Heat release from condensation during ascent
C) Wind turbulence
D) Cloud formation blocking UV

30. In the U.S. AQI system, which pollutant is typically used as the responsible pollutant?
A) The pollutant with the lowest concentration
B) The pollutant with highest concentration regardless of AQI
C) The pollutant with the highest individual AQI
D) A weighted average of all pollutants

31. What is the function of green roofs in improving urban air quality?
A) Increase traffic flow
B) Store solid waste
C) Reduce stormwater runoff and absorb heat
D) Block industrial noise

32. Which of the following tools is primarily used for visualizing air pollution hotspots?
A) Infrared thermography
B) Geographic Information Systems (GIS)
C) Digital barometer
D) Cyclonic separator

33. When multiple pollutant AQI values are calculated for a location, which one determines the reported AQI?
A) The average of all AQIs
B) The lowest AQI
C) The AQI of the most harmful pollutant
D) The highest individual AQI among all pollutants

34. Which of the following is not needed to calculate AQI for a pollutant?
A) Concentration of the pollutant
B) Time of the year
C) AQI breakpoint table
D) AQI formula

35. Which of the following air monitoring technologies measures pollution levels without physical contact?
A) Reference monitor
B) Remote sensor
C) Research device
D) Air sensor

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