Test

Environmental Engineering

Time: 60 Minutes

1. Baylis turbidimeter is generally used to measure turbidities in the range of
(A) 0–10 mg/lit (B) 0–5 mg/lit
(C) 5–15 mg/lit (D) 5–10 mg/lit

2. Water supply projects, under normal circumstances, may be designed for a period of (from the completion of project)
(A) 10 years (B) 30 years
(C) 25 years (D) 25 years

3. The presence of silver (Ag) in drinking water causes
(A) argyria (B) hypertension
(C) anaemia (D) blue baby disease

4. Ferric chloride ($FeCl_3$) is used as a coagulant if the pH range is
(A) > 8.5 (B) < 6.5 and > 8.5
(C) < 7 (D) None of these

5. Design a circular sedimentation (diameter (D) and depth (d) of tank) to capture flocculants particles after coagulant with a surface loading rate of 30 $m^3/day/m^2$. Detention time = 3 hours to treat 15 MLD of water.
(A) $D = 20.3$ m and $d = 5.6$ m
(B) $D = 25.2$ m and $d = 5.6$ m
(C) $D = 20.3$ m and $d = 3.12$ m
(D) $D = 25.2$ m and $d = 3.12$ m

6. Plain sedimentation follows
(A) Type I settling
(B) Type II settling
(C) Type III settling
(D) Both B and C

7. Filtration helps in removing _____ from water.
(A) only color and odour
(B) turbidity
(C) some pathogenic bacteria
(D) All of these

8. In water treatment, slow sand filters when compared to rapid sand filters produce
(A) lesser contaminated effluent.
(B) More contaminated effluent.
(C) Equally contaminated effluent.
(D) Cannot be judged

9. An air bubble is present in water. If concentration of a gas (C_t) in water is more than saturated concentration (C_s), then
(A) absorption first, desorption next.
(B) absorption takes place.
(C) desorption takes place.
(D) desorption first, absorption next.

10. The valve which allows flow only in one direction is
(A) reflux valve. (B) sluice valve.
(C) blow off valve. (D) air valve.

11. Match List I with List I

	List I		List II
P.	Radial system	1.	More valves are used
Q.	Grid iron system	2.	Design calculations are simple
R.	Dead end system	3.	Distribution area divided into rectangular circular blocks
S.	Ring system	4.	Suitable for direct pumping and gravity system

Codes:

	P	Q	R	S
(A)	3	4	1	2
(B)	2	3	4	1
(C)	1	2	3	4
(D)	4	1	2	3

12. Chlorine gas is used for disinfection combined with water to form hypochlorous acid (HOCl). The HOCl ionizes to form hypochlorite (OCl^-) in a reversible reaction: $HOCl \leftrightarrow H^+ + OCl^-$ ($K = 3 \times 10^{-8}$ at 20°C), the equilibrium of which is governed by pH. The sum of HOCl and OCl is known as free chlorine residual and HOCl is the more effective disinfectant. The 95% fraction of HOCl in the free chlorine residual is available at a pH value
(A) 5.38 (B) 6.24
(C) 7.82 (D) 8.38

Direction for questions 13 and 14:

In a rapid sand filter, the time for reaching particle breakthrough (T_B) is defined as the time elapsed from start of filter run to the time at which the turbidity of the effluent from the filter is greater than 2.5 NTU. The time for reaching terminal head loss (T_H) is defined as the time elapsed from the start of the filter run to the time when head loss across the filter is greater than 3 m.

13. The effect of increasing the porosity (while keeping all other conditions same) on T_B and T_H is
(A) T_B increases and T_H decreases.
(B) T_B decreases and T_H increases.
(C) Both T_B and T_H increase.
(D) Both T_B and T_H decrease.

14. The effect of increasing the concentration of impurities (while keeping all other conditions same) on T_B and T_H is:
(A) T_B increases and T_H decreases
(B) T_B decreases and T_H increases
(C) Both T_B and T_H increase
(D) Both T_B and T_H decrease

15. A coagulation treatment plant with a flow of 0.7 m^3/s is dosing alum at 25 mg/lit. No other chemicals are added. The raw water suspended solid concentration is 40 mg/lit. The effluent suspended solids concentration is measured as 15 mg/lit. Specific gravity of sludge solids is 3.01. Find the volume of sludge solids produced in m^3/day?

(A) 0.53 (B) 0.41
(C) 0.62 (D) 0.86

16. In a continuous flow settling tank 3.5 m deep and 60 m long, what flow velocity of water would you recommend for effective removal of 0.026 mm particles at 25°C. The specific gravity of particles is 2.5 and kinematic viscosity for water is 0.01 cm^2/s. (take free board as 0.5 m)

(A) 0.8 cm/s (B) 1.1 cm/s
(C) 2.0 cm/s (D) 1.6 cm/s

17. Match the type of settling List I with where it occurs List II:

	List I		List II
P.	Type I settling	**1.**	Secondary settling tank
Q.	Type II settling	**2.**	Sedimentation with coagulation
R.	Type III settling	**3.**	Waste water treatment with excessive solid concentration
S.	Type IV settling	**4.**	Plain sedimentation

Codes:

	P	Q	R	S
(A)	4	2	1	3
(C)	1	3	2	4

	P	Q	R	S
(B)	2	4	3	1
(D)	3	1	4	2

18. Medium amount of coagulant dosage is used when turbidity (T) and Alkalinity (A) are:

(A) T is high and A is low
(B) T is low and A is high
(C) Both T and A are high
(D) Both T and A are low

19. In order to test filtration process, clear water is made to pass through a bed of uniform sand at a filtering velocity of 4 m/h. Sand bed has the following properties.
Depth of bed: 0.8 m
Sand grain size: 0.6 mm
Sand specific gravity: 2.65
Sand shape factor ϕ: 0.9
Porosity of sand bed n: 0.5
Kinematic viscosity r: 1×10^{-6} m^2/s
Calculate the loss of head in filtration in (cm).

(A) 7.86 (B) 8.43
(C) 10.61 (D) 9.45

20. A water sample has pH of 10.3. The concentration of hydroxyl ions in the water sample is

(A) $10^{-10.3}$ moles/lit (B) 10^{-37} moles/lit
(C) 3.39 mg/lit (D) 0.339 mg/lit

Direction for questions 21 and 22:

Following chemical species were reported for water sample from a well:

Species	Concentration (milliequivalent/lit)
Chloride (Cl^-)	10
Sulphate (SO_4^{2-})	20
Carbonate (CO_3^{2-})	7
Bicarbonate (HCO_3^-)	25
Calcium (Ca^{2+})	15
Magnesium (M_g^{2+})	20
pH	9

21. Total hardness in mg/lit as $CaCO_3$ is

(A) 120.8 (B) 32.16
(C) 1600 (D) 1750

22. Carbonate hardness (mg/lit × as $CaCO_3$) present in the above water sample is

(A) 32.16 (B) 1600
(C) 88.64 (D) 1750

23. Match the Characteristics of water in List I with corresponding test used for measuring in List II:

	List I		List II
P.	Color	**1.**	Nephelometer
Q.	Turbidity	**2.**	EDTA
R.	pH	**3.**	Tintometer
S.	Hardness	**4.**	Potentiometer

Codes:

	P	Q	R	S
(A)	3	1	4	2
(C)	1	4	3	2

	P	Q	R	S
(B)	4	3	1	2
(D)	2	1	3	4

24. Determine the future population of Mumbai town by geometric increase method for the year 2021, from the following data:

Year	1951	1961	1971	1981	...	2021
Population in Thousand	95	121	135	164	...	?

(A) 4,51,622 (B) 3,80,460
(C) 3,28,323 (D) 4,89,671

25. To treat 6 MLD of water 1 mg/lit of bleaching powder is added to water to have free chlorine residual of 0.1 mg/lit. Find out Cl demand of water in mg/lit and amount of bleaching powder/month in kg, if the available Cl in bleaching powder is 40%.

(A) 0.9 mg/lit and 180 kg/month
(B) 0.9 mg/lit and 72 kg/month
(C) 0.3 mg/lit and 72 kg/month
(D) 0.3 mg/lit and 180 kg/month

Answer Keys

1. B	**2.** B	**3.** A	**4.** B	**5.** D	**6.** A	**7.** D	**8.** A	**9.** C	**10.** A
11. D	**12.** B	**13.** B	**14.** D	**15.** C	**16.** B	**17.** A	**18.** B	**19.** D	**20.** C
21. D	**22.** B	**23.** A	**24.** C	**25.** D					