

SET - I

1. Hardness of water is caused by the presence of the following in water:
- (a) Chlorides and sulphate
 - (b) Calcium and magnesium
 - (c) Nitrites and nitrates
 - (d) Sodium and potassium

[SSC: JE: 2011]

2. Match List-I (Industry and unit of production) With List-II (Water need in kL/unit/day).

Select the correct answer using the codes given below the lists:

List I

- A. Automobile (per vehicle)
- B. Leather (per 100 kg)
- C. Paper (per tonne)
- D. Crude petroleum refinery (per tonne)

List-II

- 1. 1 to 2
- 2. 4
- 3. 40
- 4. 50-100
- 5. 200-400

Codes:

	A	B	C	D
(a)	3	2	5	1
(b)	1	3	5	4
(c)	3	2	4	5
(d)	5	4	2	1

3. **Assertion (A):** The future population is predicted on the basis of knowledge of the city and its environment.

Reason (R): The future population depends on the trade and expansion of the city, discovery of mineral deposits, power generation etc.

4. **Assertion (A):** The leakage losses are less when the water supply is intermittent.

Reason (R): Pressure is less in intermittent water supply.

5. The population figures in a growing town are as follows:

Year	Population
1970	40,000
1980	46,000
1990	53,000
2000	58,000

The predicted population in 2010 by Arithmetic Regression method is

- (a) 62,000 (b) 63,000
 (c) 64,000 (d) 65,000
6. On which of the following factors, does the population growth in a town normally depend?
1. Birth and death rates
 2. Migrations
 3. Probabilistic growth
 4. Logistic growth
- Select the correct answer using the codes given below:
- (a) 1 and 4 (b) 1 and 2
 (c) 1, 2 and 3 (d) 2 and 3
7. For water supply to a medium town, what is the daily variation factor?
- (a) 1.5 (b) 2.5
 (c) 3 (d) 3.5
8. Which one of the following factors has the maximum effect on figure of per capita demand of water supply of a given town?
- (a) Method of charging of the consumption
 (b) Quality of water
 (c) System of supply-intermittent or continuous
 (d) Industrial demand
9. Consider the following statements:
Assertion (A): In estimating population for assessing water supply demand, the

- geometric progression (GP) method gives correct estimates for a developed city.
Reason (R): In the GP method, a constant rate of increase in population is assumed.
- Of these statements
- (a) both A and R are true and R is the correct explanation of A.
 (b) both A and R are true but R is not a correct explanation of A
 (c) A is true but R is false
 (d) A is false but R is true
10. Which one of the following methods gives the best estimate of population growth of a community with limited land area for future expansion?
- (a) Arithmetical increase method
 (b) Geometrical increase method
 (c) Incremental increase method
 (d) Logistic method
11. The present population of a community is 28000 with an average water consumption of 4200 m³/d. The existing water treatment plant has a design capacity of 6000 m³/d. It is expected that the population will increase to 44000 during the next 20 years. The number of years from now when the plant will reach its design capacity, assuming an arithmetic rate of population growth, will be
- (a) 5.5 years (b) 8.6 years
 (c) 15.0 years (d) 16.5 years

SET - II

1. In transition of sewers from smaller diameter sewers to larger diameter sewers, the continuity of sewers is maintained at the
- (a) bottom of the concrete bed of sewers
 (b) inverts of the sewers
 (c) crowns of the sewers
 (d) hydraulic gradients of the sewers
2. **Assertion (A):** While laying a sewer line, the socket end of a sewer is kept facing the downward slope in the trench.

- Reason (R):** The socket end being heavy will slide down the slope if it faces the downward slope.
3. The following steps are involved in laying a sewer in a trench:
1. Transferring the centre line of the sewer to the bottom of a trench.
 2. Setting sight rails over the trench.
 3. Driving pegs to the level of the invert line of the sewer.
 4. Placing the sewer in the trench.

The correct sequence of these steps is

- (a) 1, 2, 3, 4 (b) 2, 3, 4, 1
 (c) 4, 2, 3, 1 (d) 2, 3, 1, 4

4. Consider the following statements:

- Ventilation of sewer lines is necessary to
1. avoid building up of sewer gases
 2. ensure atmospheric pressure in the waste water surface
 3. ensure the safety of sewer maintenance people
 4. provide oxidation facility to sewage

Which of these statements are correct?

- (a) 1, 2 and 4 (b) 1, 3 and 4
 (c) 2, 3 and 4 (d) 1, 2 and 3

5. Match List-I (Unit) with List-II (Purpose) and select the correct answer using the codes given below the lists:

List-I

- A. Leaping weir
- B. Gutter inlet
- C. Inverted syphon
- D. Catch basin

List-II

1. To prevent grit, sand, debris, etc. from entering the storm sewer.
2. To carry the sewer below a stream or railway line
3. To drain rain water from roads to the storm sewer
4. To separate storm water and the sanitary sewage

Codes:

	A	B	C	D
(a)	4	3	1	2
(b)	4	3	2	1
(c)	3	4	2	1
(d)	3	4	1	2

6. Which of the following are storm water regulators?

1. Side weir
2. Leaping weir
3. Syphonic spillway
4. Float actuated gates or valves
5. Inverted syphon

Select the correct answer using the codes given below:

- (a) 1, 2, 3 and 4 (b) 1, 3 and 5
 (c) 2, 3, 4 and 5 (d) 1, 2, 4 and 5

7. Consider the following statements

Assertion (A): Most important activity in sewer line construction is to start constructing it from the tail end and to check levels with a boning rod.

Reason (R): Construction of sewer line from tail end is recommended because required number of pumping stations may be incorporated in sewer network design.

Of the statements

- (a) both A and R are true and R is the correct explanation of A
- (b) both A and R are true but R is not a correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

8. Consider the following statement regarding building manholes:

1. They must be provided at every change of alignment, gradient or diameter.
2. They must be provided at the head of all sewers.
3. They must be provided at every junction of two or more sewers.
4. They must be provided at every 100 m along straight runs of sewers.

Which of these statements are correct?

- (a) 1, 2, 3 and 4 (b) 1, 3 and 4
 (c) 1, 2 and 3 (d) 2 and 4

9. Consider the following statements:

The basic difference between water pipes and sewer pipes is

1. in the material used for the pipes
2. in the pressure of the liquid flow
3. in the suspended solids they carry

Which of these statements is/are correct?

- (a) 1 and 3 (b) 1 only
 (c) 2 and 3 (d) 1, 2 and 3

10. Match List-I (Appurtenance) with List-II (Function in water supply) and select the correct answer using the codes given below the lists:

List-I

- A. Drop Manhole
- B. Inverted Siphon
- C. Manhole
- D. Air Ejector

List-II

- 1. Carrying sewage flow below depressions
- 2. Connecting higher level branch sewer to lower level main sewer
- 3. Transporting sewage from basements to higher level sewer
- 4. Connecting branch sewer to lower level main sewer

Codes:

	A	B	C	D
(a)	3	4	1	2
(b)	2	1	4	3
(c)	3	1	4	2
(d)	2	4	1	3

11. Which is the best sewer material to resist hydrogen sulphide corrosion?

- (a) Glazed stoneware
- (b) Glazed earthenware
- (c) RCC
- (d) Brick masonry

12. When are drop manholes provided in a sewerage system?

- (a) There is change from gravity system to pressure system.
- (b) There is change in the elevation of the ground level.
- (c) There is change in the diameter of the sewer.
- (d) There is change in the direction of the sewerline.

13. Match List-I (Test) with List-II (Purpose) and select the correct answer using the codes given below the lists:

List-I

- A. Inverted siphon
- B. Drop Manhole
- C. Clean out
- D. Leaping weir

List-II

- 1. Maintenance of sewer
- 2. Sewer crossing a river/road way
- 3. Storm water regulation
- 4. Connecting between sewers at different invert levels

Codes:

	A	B	C	D
(a)	2	4	1	3
(b)	1	3	2	4
(c)	2	3	1	4
(d)	1	4	2	3

14. Consider the following pairs of treatment units and impurities removed:

- 1. Grit chamber — Sand and silt
- 2. Detritus tank — Organic matter
- 3. Primary sedimentation—Suspended tank impurities
- 4. Aeration tank of — Oil and grease activated sludge process plant

Which of these pairs are correctly matched?

- (a) 1 and 2
- (b) 1, 2, 3 and 4
- (c) 2, 3 and 4
- (d) 1 and 3

15. The ultimate BOD value of a waste

- (a) increases with temperature
- (b) decreases with temperature
- (c) remains the same at all temperatures
- (d) doubles with every 10°C rise in temperature

16. The correct statement of comparison of ultimate BOD, COD, Theoretical Oxygen Demand (ThOD) and 5-day BOD (BOD₅) is

- (a) BOD_u > COD > ThOD > BOD₅
- (b) COD > ThOD > BOD_u > BOD₅
- (c) ThOD > COD > BOD_u > BOD₅
- (d) COD > BOD_u > BOD₅ > ThOD

SET-III

1. If the total hardness and alkalinity of a sample of water are 300 mg/L and 100 mg/L (CaCO_3 scale) respectively, then its carbonate and non-carbonate hardness (in units of mg/L) will be respectively

- (a) 100 and 200 (b) 400 and 300
(c) 100 and 400 (d) 400 and zero

2. Electrical conductivity (EC) of water and total dissolved solids (TDS) are interrelated. The value of EC will

- (a) decrease with increase in TDS
(b) increase with increase in TDS
(c) decrease initially and then increase with increase in TDS
(d) increase initially and then decrease with increase in TDS

3. **Assertion (A):** Presence of E. Coli bacteria in water indicates that the water is polluted with fecal discharge.

Reason (R): E. Coli is a pathogenic bacteria.

4. Which one of the following would contain water with the maximum amount of turbidity?

- (a) Lakes (b) Oceans
(c) Rivers (d) Wells

Match **List-I** (Parameters) with **List-II** (Permissible concentration in drinking water) and select the correct answer using the codes given below the lists:

List-I	List-II
A. Hardness	1. 0.1 mg/L
B. Nitrate concentration	2. 0.5 mg/L
C. Iron concentration	3. 200 mg/L
D. Fluoride concentration	4. 45 mg/L

Codes:

A	B	C	D
(a) 3	4	2	1
(b) 3	4	1	2
(c) 4	3	2	1
(d) 4	3	1	2

6. Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I	List-II
A. Absence of fluorides	1. Methaemoglobinemia
B. Excess of lead	2. Goitre
C. Presence of excess iodide	3. Dental caries nitrates
D. Absence of iodide	4. Anaemia

Codes:

A	B	C	D
(a) 3	4	2	1
(b) 2	3	4	1
(c) 3	4	1	2
(d) 1	2	4	3

7. Which of the following is/are the characteristic(s) of coliform organism?

1. Bacillus
2. Gram-negative
3. Ferments lactose
4. Spore-forming

Select the correct answer using the codes given below:

- (a) 1 alone (b) 1, 2 and 4
(c) 1, 2 and 3 (d) 2, 3 and 4

8. If the methyl orange alkalinity of water equals or exceeds total hardness, all of the hardness is

- (a) non-carbonate hardness
(b) carbonate hardness
(c) pseudo hardness
(d) negative non-carbonate hardness

9. Consider the following statements associated with water pollution parameters:

1. One of the primary indicators of the degree of water pollution is the concentration of organic matter.

2. Total organic carbon (TOC), chemical oxygen demand (COD) and biochemical oxygen demand (BOD) are important parameters of water pollution.
3. Generally $TOC > COD > BOD$

Which of these statements are correct?

- (a) 1, 2 and 3 (b) 1 and 2
(c) 1 and 3 (d) 2 and 3

10. Match List-I (Impurities) with List-II (Effects) and select the correct answer using the codes given below the lists:

List-I

- A. Dissolved sulphates and chlorides of Ca and Mg
B. Dissolved bicarbonates of Ca and Mg
C. Dissolved fluorides of Na
D. Dissolved organic matter

List-II

1. Hardness and corrosion
2. Bacterial infection
3. Alkalinity and softness
4. Impairment of dental health

Codes:

	A	B	C	D
(a)	2	3	4	1
(b)	1	4	3	2
(c)	2	4	3	1
(d)	1	3	4	2

11. Match List-I (Water quality) with List-II (Method of determination) and select the correct answer using the codes given below the lists:

List-I

- A. Hardness
B. Chlorine
C. DO
D. Chloride

List-II

1. Winkler's method
2. EDTA method
3. Orthotolidine test
4. Mohr method

Codes:

	A	B	C	D
(a)	2	3	1	4
(b)	2	4	1	3
(c)	1	3	2	4
(d)	1	4	2	3

12. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I

- A. Protozoa
B. Bacteria
C. Presence of nitrate
D. Virus

List-II

1. Methaemoglobinemia
2. Poliomyelitis
3. Dysentery > 45 mg/L
4. Typhoid fever

Codes:

	A	B	C	D
(a)	3	2	1	4
(b)	1	4	3	2
(c)	3	4	1	2
(d)	1	2	3	4

13. Which one of the following organisms is responsible for enteric fever?

- (a) ECHO
(b) Salmonella typhi
(c) Entamoeba histolytica
(d) Echinococcus

14. Match List-I (Water/Waste water parameter) with List-II (Test) and select the correct answer using the codes given below the lists:

List-I

- A. Potability of water
B. Chloride
C. Residual chlorine
D. Hardness of water

List-II

1. Mohr's method
2. Orthotolidine test
3. EDTA method
4. MF technique

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	2	1	4	3
(c)	2	3	4	1
(d)	4	1	2	3

15. Match List-I (Type of impurity) with List-II (Effect) and select the correct answer using the codes given below the lists:

List-I

- A. Carbonates and bicarbonates of calcium and magnesium
- B. Carbonates and bicarbonates of sodium
- C. Sulphates and chlorides of calcium and magnesium
- D. Oxides of iron and manganese

List-II

- 1. Permanent hardness
- 2. Temporary hardness
- 3. Alkalinity and softness
- 4. Colour and taste

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	2	4	1	3
(c)	1	4	2	3
(d)	2	3	1	4

16. A sample of ground water at a pH of 7.0 contains 122 mg/L of bicarbonates. What is the alkalinity of this water (in terms of CaCO_3)?

- (a) 120 mg/L
- (b) 60 mg/L
- (c) 100 mg/L
- (d) 200 mg/L

17. What is 5 days 20°C BOD equal to?

- (a) 3 days 27°C BOD
- (b) 4 days 30°C BOD
- (c) 6 days 32°C BOD
- (d) 7 days 35°C BOD

18. What is the equivalent calcium carbonate concentration of 110 mg/L of CaCl_2 ?

- (a) 50 mg/L
- (b) 58.5 mg/L
- (c) 100 mg/L
- (d) 117 mg/L

19. Which of the following cations impart(s) pseudo-hardness to water?

- (a) Calcium only
- (b) Magnesium only
- (c) Calcium and magnesium
- (d) Sodium

20. Match List-I (Equipment) with List-II (Parameter) and select the correct answer using the codes given below the lists:

List-I

- A. Tintometer
- B. Nephelometer
- C. Imhoff cone
- D. Muffle furnace

List-II

- 1. Temperature
- 2. Colour
- 3. Turbidity
- 4. Settleable solids
- 5. Volatile solids

Codes:

	A	B	C	D
(a)	4	3	1	5
(b)	2	5	4	3
(c)	4	5	1	3
(d)	2	3	4	5

21. A standard multiple-tube fermentation test was conducted on a sample of water. The results of the analysis for the confirmed test are given below:

Sample size (mL)	No. of positive results out of 5 tubes	No. of negative results out of 5 tubes
10	4	1
1	2	3
0.1	1	4
0.01	0	5

MPN Index for combinations of positive results when 5 tubes used per dilutions (10 mL, 1.0 mL, 0.1 mL)

Combination of positives	per 100 mL
5-4-3	280

4-3-1	33
4-2-1	26
2-1-0	7

Using the above MPN Index table, what is the most probable number (MPN) of the sample?

- (a) 280 (b) 33
(c) 26 (d) 70

22. What is the most common cause of acidity in water?

- (a) Carbon monoxide
(b) Nitrogen
(c) Hydrogen
(d) Carbon dioxide

23. If total hardness and alkalinity of a water sample are 200 mg/L as CaCO₃ and 260 mg/L as CaCO₃ respectively, what are the values of carbonate hardness and non-carbonate hardness?

- (a) 200 mg/L and zero
(b) Zero and 60 mg/L
(c) Zero and 200 mg/L
(d) 60 mg/L and zero

24. Hardness to water is caused by the presence of calcium (Ca²⁺) and magnesium (Mg²⁺) ions. Which are the least soluble forms of calcium and magnesium at normal water temperature?

- (a) CaCl₂ and MgCO₃
(b) Ca(HCO₃)₂ and MgCl₂
(c) Ca(OH)₂ and Mg(HCO₃)₂
(d) CaCO₃ and Mg(OH)₂

25. Match List-I (Parameter) with List-II (Impact) and select the correct answer using the codes given below the lists:

- | | |
|----------------------------|-----------------------------|
| List-I | List-II |
| A. Excess sulphates | 1. Greater soap consumption |
| B. Lack of iodide | 2. Laxative effect |
| C. Excess hardness | 3. Goitre |
| D. Excess dissolved oxygen | 4. Corrosion of pipes |

Codes:

- | | | | | |
|-----|----------|----------|----------|----------|
| | A | B | C | D |
| (a) | 2 | 1 | 3 | 4 |
| (b) | 4 | 3 | 1 | 2 |
| (c) | 2 | 3 | 1 | 4 |
| (d) | 4 | 1 | 3 | 2 |

26. The concentration of hardness producing cations may be estimated using which one of the following?

- (a) Conductivity meter
(b) pH meter
(c) Spectrophotometer
(d) Flame photometer

27. Which one of the following treatments is economically effective in the control of guinea worm disease?

- (a) Chlorination
(b) Filtration
(c) Ozonation
(d) Sedimentation

28. Match List-I (Pathogen) with List-II (Epidemic) and select the correct answer using the codes given below the lists:

- | | |
|---------------|--------------------|
| List-I | List-II |
| A. Bacteria | 1. Gastroenteritis |
| B. Virus | 2. Cholera |
| C. Protozoa | 3. Worms |
| D. Helminth | 4. Polio |

Codes:

- | | | | | |
|-----|----------|----------|----------|----------|
| | A | B | C | D |
| (a) | 2 | 4 | 1 | 3 |
| (b) | 3 | 1 | 4 | 2 |
| (c) | 2 | 1 | 4 | 3 |
| (d) | 3 | 4 | 1 | 2 |

29. What does the presence of excess nitrates in river water indicate?

- (a) Recent pollution of water with sewage
(b) Past pollution of water with sewage
(c) Intermittent pollution of water with sewage
(d) No pollution of water with sewage

30. Pneumoconiosis is caused due to inhalation of which one of the following?

- (a) Silica
- (b) NO_2
- (c) Lead
- (d) Cadmium

31. Match **List-I** (Type of impurity) with **List-II** (Harm caused) and select the correct answer using the codes given below the lists:

List-I

- A. Excess of nitrates
- B. Excess of fluorides
- C. Lack of iodides
- D. Excess of chlorides

List-II

- 1. Brackish water
- 2. Goiter
- 3. Fragile bones
- 4. Blue babies

Codes:

	A	B	C	D
(a)	4	2	3	1
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	3	2	4

32. The concentration of OH^- ion in a water sample is measured as 17 mg/L at 25°C . What is the pH of the water sample?

- (a) 10
- (b) 11
- (c) 12
- (d) 13

33. If pH value of solution A is 4 and that of solution B is 5, then the hydrogen-ion concentration of solution

- (a) A is ten times higher than that of B
- (b) B is double than that of A
- (c) A is ten times lesser than that of B
- (d) A is double than that of B

34. Match **List-I** (Bacteria) with **List-II** (Diseases) and select the correct answer using the codes given below the lists:

List-I

- A. Escherichia coli
- B. Salmonella typhi
- C. Salmonella (-1700 spp)
- D. Legionella pneumophira

List-II

- 1. Food poisoning
- 2. Acute respiratory illness
- 3. Typhoid fever
- 4. Gastroenteritis Diarrhoea
- 5. Cholera

Codes:

	A	B	C	D
(a)	3	4	2	1
(b)	3	4	5	2
(c)	4	3	5	2
(d)	4	3	2	1

35. Match **List-I** (Element of impurity) with **List-II** (Disease) and select the correct answer using the codes given below the lists:

List-I

- A. Nitrates
- B. Fluorides
- C. Virus
- D. Bacteria

List-II

- 1. Cholera
- 2. Blue Baby disease
- 3. Embrittlement of bones
- 4. Infectious Hepatitis

Codes:

	A	B	C	D
(a)	1	4	3	2
(b)	2	3	4	1
(c)	1	3	4	2
(d)	2	4	3	1

36. Match **List-I** (Bacteria) with **List-II** (Shape) and select the correct answer using the codes given below the lists:

Codes:

	A	B	C	D
(a)	4	3	1	2
(b)	2	1	3	4
(c)	4	1	3	2
(d)	2	3	1	4

45. What is the maximum permissible limit of fluoride in drinking water?

- (a) 1.2 mg/L (b) 1.5 mg/L
(c) 3.0 mg/L (d) 0.5 mg/L

46. What is the maximum permissible limit of chromium in drinking water?

- (a) 0.01 mg/L (b) 0.001 mg/L
(c) 0.005 mg/L (d) 0.05 mg/L

47. Consider the following statements:

- Calcium and magnesium as bicarbonates are responsible for carbonate hardness.
- The carbonate hardness is measured by the difference between the total hardness and bicarbonate hardness.
- The non-carbonate hardness is measured by the difference between the total hardness and the carbonate hardness.
- The carbonates and bicarbonates of sodium are described as negative carbonate hardness.

Which of these statements is/are correct

- (a) 1, 2 and 4 (b) 1, 3 and 4
(c) 2 and 4 only (d) 3 only

48. Consider the following statements:

Assertion (A): Rainwater harvesting or artificial recharging of groundwater minimizes the TDS level in subsurface water.

Reason (R): TDS level falls in subsurface water due to dilution.

Of these statements

- (a) both A and R are true and R is the correct explanation of A
(b) both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

49. When sewage enters a flowing river, the rapid depletion of dissolved oxygen is due to

- (a) change in temperature in river water
(b) the suspended particles in river and waste
(c) respiratory activity of aquatic plants in the river
(d) microbial activity

50. Sewage sickness signifies

- (a) diseases caused by sewage
(b) soil pores getting clogged and preventing free circulation of air when sewage is continuously applied on land
(c) raw sewage is applied and used for irrigating vegetables which are eaten raw
(d) disposal of septic sewage on land

51. Results of a water sample analysis are as follows:

Cation	Concentration (mg/L)	Equivalent Weight
Na ⁺	40	23
Mg ⁺²	10	12.2
Ca ⁺²	55	20
K ⁺	2	39

(milliequivalent weight of CaCO₃ = 50 mg/meq).

Hardness of the water sample in mg/L as CaCO₃ is

- (a) 44.8 (b) 89.5
(c) 179 (d) 358

52. Match List-I (Type of water impurity) with List-II (Method of treatment) and select the correct answer using the codes given below the lists:

List-I

- A. Hardness
B. Brackish water from sea
C. Residual MPN from filters
D. Turbidity

List-II

1. Reverse Osmosis
2. Chlorination
3. Zeolite Treatment
4. Coagulation and Flocculation
5. Coagulation, Flocculation and Filtration

Codes:

	A	B	C	D
(a)	1	2	4	5
(b)	3	2	2	4
(c)	2	1	3	5
(d)	3	1	2	5

53. Most of the turbidity meters work on the scattering principle. The turbidity value so obtained is expressed in
- (a) CFU (b) FTU
(c) JTU (d) NTU
54. Hardness of water is directly measured by titration with ethylenedi-amine-tetracetic acid (EDTA) using
- (a) eriochrome black T indicator
(b) ferroin indicator
(c) methyl orange indicator
(d) phenolphthalein indicator
55. The organism, which exhibits very nearly the characteristics of an ideal pathogenic indicator is
- (a) *Entamoeba histolytica*
(b) *Escherichia coli*
(c) *Salmonella typhi*
(d) *Vibrio comma*
56. A standard multiple-tube fermentation test was conducted on a sample of water from a surface stream. The results of the analysis for the confirmed test are given below.

Sample size (mL)	No. of positive results out of 5 tubes	No. of negative results out of 5 tubes
1.0	4	1
0.1	3	2
0.01	1	4

MPN index and 95% confidence limits for combination of positive results when five tubes used per dilutions (10 mL, 1.0 mL, 0.1 mL)

Com- bination of positive	MPN index per 100 mL	95% confidence limit	
		Lower	Upper
4-2-1	26	12	65
4-3-1	33	15	77

Using the above MPN index table, the Most Probable Number (MPN) of the sample is

- (a) 26 (b) 33
(c) 260 (d) 330

57. 1 TCU is equivalent to the colour produced by
- (a) 1 mg/L of chloroplatinate ion
(b) 1 mg/L of platinum ion
(c) 1 mg/L platinum in form of chloroplatinate ion
(d) 1 mg/L of organo-chloroplatinate ion
58. If tomato juice is having a pH of 4.1, the hydrogen ion concentration will be
- (a) 10.94×10^{-5} mol/L
(b) 9.94×10^{-5} mol/L
(c) 8.94×10^{-5} mol/L
(d) 7.94×10^{-5} mol/L
59. A synthetic sample of water is prepared by adding 100 mg Kaolinite (a clay mineral), 200 mg glucose, 168 mg NaCl, 120 mg $MgSO_4$, and 111 mg $CaCl_2$ to 1 liter of pure water.
- The concentrations of total solids (TS) and fixed dissolved solids (FDS) respectively in the solution in mg/L are equal to
- (a) 699 and 599 (b) 599 and 399
(c) 699 and 199 (d) 699 and 399

Environmental Engineering

Statement for Linked Answer Questions 60 and 61:

A water contains the following dissolved ions:

$[\text{Na}^+] = 56 \text{ mg/L}$; $[\text{Ca}^{2+}] = 40 \text{ mg/L}$;

$[\text{Mg}^{2+}] = 30 \text{ mg/L}$; $[\text{Al}^{3+}] = 3 \text{ mg/L}$;

$[\text{HCO}_3^-] = 190 \text{ mg/L}$; $[\text{Cl}^-] = 165 \text{ mg/L}$

Water pH is 7.

Atomic weights: Ca : 40; Mg : 24; Al : 27; H : 1; C : 12; O : 16; Na : 23; Cl : 35.5

60. The total hardness of the sample in mg/L as CaCO_3 is

- (a) 484 (b) 450
(c) 242 (d) 225

61. The non-carbonate hardness of the sample in mg/L as CaCO_3 is

- (a) 225 (b) 156
(c) 86 (d) 0

62. The presence of hardness in excess of permissible limit causes

- (a) cardio-vascular problems
(b) skin discolouration
(c) calcium deficiency
(d) increased laundry expenses

63. The alkalinity and the hardness of a water sample are 250 mg/L and 350 mg/L as CaCO_3 , respectively. The water has

- (a) 350 mg/L carbonate hardness and zero non-carbonate hardness
(b) 250 mg/L carbonate hardness and zero non-carbonate hardness
(c) 250 mg/L carbonate hardness and 350 mg/L non-carbonate hardness
(d) 250 mg/L carbonate hardness and 100 mg/L non-carbonate hardness