Q1. As per BIS : 1172 – 1963, water required per head per day for average domestic purposes, is
(a) 85 litres
(b) 100 litres
(c) 115 litres
(d) 135 litres

Q2. Per capita water demand is –
(a) average amount of daily water required by one person
(b) monthly average amount of daily water required by one person
(c) annual average amount of daily water required by one person
(d) weekly average amount of daily water required by one person

Q3. A water supply scheme has to be designed for a city having a population of 100,000 people. If the average consumption is 250 Lpcd the estimated average daily draft is –
(a) 35 MLD
(b) 25 MLD
(c) 45 MLD
(d) 15 MLD

Q4. The rate of demand of water per capita per day for population between 50,000 to 2,00,000 is –
(a) 110 to 150 litres
(b) 180 to 210 litres
(c) 150 to 180 litres
(d) 210 to 240 litres

Q5. As Per IS : 1172, the domestic demand (in litres) of water / day, under normal conditions, for a family of 4 member will be –
(a) 540
(b) 520
(c) 500
(d) 480

Q6. The population forecasting method which that is based on the assumption that the percentage increase in population from one decade to the other decade remains constant is called……
(a) incremental increase
(b) geometrical increase
(c) arithmetical increase
(d) decrease rate of growth

Q7. The Buston's formula for estimating water required for fire demand is _____.
(a) $7500\sqrt{P}$
(b) $3182\ \sqrt{P}$
(c) $4637\sqrt{P}$
(d) $5663\sqrt{P}$

Q8. If Q is the total quantity of water required by a town per year in litres, and P is the population of the town, then the per capita demand of water will be:
(a) $\frac{2Q}{P\times270}$
(b) $\frac{2Q}{P\times365}$
(c) $\frac{Q}{P\times365}$
(d) $\frac{Q}{P\times270}$

Q9. According to Kuichling formula, if P is the population of a thousand, then the fire demand of water in litres per minute is given by:
(a) $6563\sqrt{P}$
(b) $4640\sqrt{P}$
(c) $3182\sqrt{P}$
(d) $5663\sqrt{P}$

Q10. What is the peak factor of population above 2 lakh?
(a) 1.0
(b) 1.9
(c) 3.9
(d) 2.0

Q11. Which range of population having the rate of demand is 110 to 150 litres per capita per day?
(a) 20000 to 50000
(b) 50000 to 100000
(c) 200000 to 500000
(d) 500000 to 100000

Q12. Which of the following represents the value of hourly variation factor?
(a) 1.2
(b) 1.5
(c) 1.7
(d) 2.5

Q13. For which of the following, distribution mains is designed?
(a) Average daily demand
(b) Annual peak demand
(c) Monthly peak demand
(d) Maximum hourly demand on maximum day

Q14. Which of the following method is used to forecast the population of old and very large city?
(a) Arithmetical increase method
(b) Geometric progression method
(c) Graphical method

(d) Logistic curve method

Q15. The population of a town as per census records were 2,00,000; 2,10,000 and 2,30,000 for the year 1981, 1991 and 2001 respectively. Find the population of the town in the year 2011 using arithmetic mean method. The answer is
(a) 240000
(b) 245000
(c) 250000
(d) 255000

Q15. The most common constiuents of alkalinity in natural water are measured by titrating the water sample with 0.02 N H_2SO_4 using _____.
(a) Phenolphthalein and methyl orange indicators
(b) ferroin and phenolphthalein indicators
(c) Methyl orange and erichrome black-T indicators
(d) Erichrome black-T and Ferrion indicators

Q16. _____ is the apparatus in which turbidity is measured as a function of intensity of light scattered as it passes through the water sample.
(a) Barometer
(b) Tintometer
(c) Colorimeter
(d) Nephelometer

Q17. Which of the following causes eutrophication of water bodies?
(a) Discharge of toxic substances
(b) Excessive discharge of nutrients
(c) Excessive discharge of chlorides
(d) Excessive turbidity

Q18. A soft water would have hardness (in mg/l):
(a) > 180
(b) 60 – 150
(c) 150 – 180
(d) < 60

Q19. According to IS: 10500-2012, what is the acceptable limit (in mg/l) of total dissolved solids?
(a) 2000
(b) 500
(c) 250
(d) 1000

Q20. The maximum permissible limit of Chlorides (mg/l) in potable water, in absence of an alternate source is:

(a) 1000
(b) 750
(c) 250
(d) 500

Q21. Consumption of higher concentration of fluorides exceeding 1.5 mg/L may cause:
(a) Arsenicosis
(b) Argyria
(c) Blue baby disease
(d) Fluorosis

Q22. Water borne disease Typhoid fever is caused by
(a) Salmonella typhi
(b) Amoeba
(c) typhi shiga bacillus
(d) Entamoeba hystalytica

Q23. On which scale the turbidity is measured?
(a) Platinum scale
(b) Silica cobalt scale
(c) Silica platinum scale
(d) Standard silica scale

Q24. The measure of absorption or scattering of light by the suspended materials present in the water is known as …….
(a) Alkalinity
(b) Colour
(c) Hardness
(d) Turbidity

Q25. As per Indian standard (IS 10500 : 2012) of drinking water specification, pH value should be in range of:
(a) 6.5 – 8.0
(b) 6.5 – 8.5
(c) 6.0 – 8.5
(d) 7.0

Q26. The hardness caused by sulphates, chlorides and nitrates of calcium or magnesium is termed as _____ hardness.
(a) pseudo
(b) permanent
(c) alkaline
(d) temporary

Q27. Which of the following parameter is determined using Winkler's method?
(a) Alkalinity

(b) Hardness
(c) Fluoride content
(d) Dissolved oxygen

Q28. Which chemical indicator turns water into pink color, if the pH is more than 8.3
(a) Bromothymol blue
(b) Murexide
(c) Phenolphthalein
(d) Methyl orange

Q29. Alkalinity in water is expressed as mg/l; in terms of: -
(a) Calcium carbonate
(b) Magnesium carbonate
(c) Sodium carbonate
(d) Sodium bi-carbonate

Q30. Cavities in teeth are caused if fluoride concentration (mg/l) is less than
(a) 1.5
(b) 1
(c) 0.5
(d) 0.25

Q31. The settling velocity of inorganic particles in a sedimentation tank of the water treatment plant is governed by
(a) Darcy's Law
(b) Dupuit's Law
(c) Stoke's Law
(d) None of the above

Q32. The ratio of discharge and plan area of a continuous flow type settling tank, is known as
(a) Surface loading
(b) Over flow
(c) Over flow rate
(d) All the above

Q33. With the increase in temperature, the rate of settling of particles
(a) decreases
(b) increases
(c) remains unchanged
(d) none of the above

Q34. In a sedimentation tank
Length – L Width – B
Depth – D Discharge – Q
Settling velocity of a particle is
(a) $\frac{Q}{BD}$

(b) $\frac{Q}{LD}$
(c) Q/L
(d) Q/BL

Q35. Particles intended to be removed in a continuous flow water sedimentation tank should have settling velocity
(a) More than the surface loading of the tank
(b) Less than the surface loading of the tank
(c) Equal to the surface loading of the tank
(d) Half of surface loading of the tank

Q36. The rate of settling of a particle depends upon the
(a) viscosity of water
(b) specific gravity of particle
(c) shape and size of particle
(d) viscosity of water, specific gravity and shape and size of particles

Q37. In slow sand filters, the rate filtration is –
(a) 100 to 200 litres/ hours per. sq. m. of filter area
(b) 200 to 300 litres/ hour per. sq. m. of filter area
(c) 100 to 200 litres/ hour per. sq. m. of filter area
(d) 200 to 300 litres/ hour per. sq. m. of filter area

Q38. Slow sand filters are cleaned at an interval of:
(a) 1 – 3 hours
(b) 1 – 3 days
(c) 1 – 3 months
(d) 1 – 3 years

Q39. Which one of the following filters will produce water of higher bacteriological quality?
(a) Slow sand filter
(b) Rapid sand filter
(c) Rapid sand filter
(d) Trickling filter

Q40. Uniform coefficient of filter sand is given by:
(a) $D_{60}/\ D_5$
(b) $D_{60}/\ D_{10}$
(c) $D_{50}/\ D_{10}$
(d) $D_{50}/\ D_5$

Q41. On which of the following parameters are the slow sand filters better than rapid sand filters?
(a) Ease of construction
(b) Land requirement for constructing a unit

(c) Flexibility in meeting the demand
(d) Rate of filtration

Q42. The process of purifying water by passing it through a bed of fine granular material is known as:
(a) Screening
(b) Sedimentation
(c) Filtration
(d) Coagulation

Q43. Which test is not performed on chlorine residuals?
(a) Orthotolidine test
(b) Orthotolidine arsenite test
(c) Starch iodide test
(d) Chloramine test

Q44. Imhoff come is used to measure
(a) Settleable solids
(b) Suspended solids
(c) Dissolved solids
(d) colloidal solids

Q45. Match the following

List – I	List – II
(a) Hardness	(i) Winkler method
(b) Chlorine	(ii) EDTA method
(c) DO	(iii) Orthotolidine test
(d) Chloride	(iv) Mohar method

	(a)	(b)	(c)	(d)
(a)	(ii)	(iii)	(i)	(iv)
(b)	(ii)	(iv)	(i)	(iii)
(c)	(i)	(iii)	(ii)	(iv)
(d)	(i)	(iv)	(ii)	(iii)

Q46. The valve which protects the water meter from the damages of water hammer?
(a) stop cock
(b) pressure relief valve
(c) reflux valve
(d) water hammer valve

Q47. A “Gate Valve” also known as a _____.
(a) Sluice valve
(b) Reflux valve
(c) Ball valve
(d) Float valve

Q48. A type of valve which provided at the corner of roads to control the flow of water at the cross section of the distribution system is called?
(a) Safety valve
(b) Scour valve
(c) Sluice valve
(d) check valve

Q49. Which one of the following pairs is INCORRECTLY matched?
(a) Air Valve – to check the water flow in pipes, in the directions
(b) Check valve – To release the accumulated air in pipelines.
(c) Scour valve – To drain or empty the pipe line section
(d) Surge arrestor – control of water hammer in pipe lines

Q50. The suitable layout of a water supply distribution system for an irregularly grown town is called as _____ system.
(a) dead end
(b) radial
(c) grid iron
(d) ring

S1. Ans.(d)
Sol, as per IS, per capita consumption of water per day for domestic purpose should be 135 litres.

S.no.	Use	Consumption in litres per capita per day
1.	Drinking	5l.
2.	Cooking	5l.
3.	Bathing	55l.
4.	Flushing	30l.
5.	Washing of clothes	20l.
6.	Washing of utensils	10l.
7.	Washing and cleaning of houses and residences	10l.
	Total	135l.

S2. Ans.(c)
Sol. Per capita water demand is annual average amount of daily water required by one person.

S3. Ans.(b)
Sol. Given, Population = 100,000
Average consumption = 250 lpcd
Average daily draft = 100,000×250
= 25×10^6 l.
= 25 MLD

S4. Ans.(c)
Sol.

Sr.no.	Population	Per capita demand in l/day person
1	Less than 20,000	110
2.	20,000 – 50,000	110-150
3.	50,000 – 2 lakh	150 – 240
4.	2 lakh – 5 lakh	240-275
5.	5 lakh – 10 lakh	275-335
6.	More than 10 lakh	335-360

S5. Ans.(a)
Sol. As per IS : 1172 , per capita consumption of water per day for domestic purpose should be 135 l.
Hence, for a family of 4 member the domestic demand of water/day = 135×4
= 540 litres.

S6. Ans.(b)
Sol. Geometric increase method: - in this method the rate of growth of population is assumed to be constant.

$$\boxed{P_n = P_o \left(1 + \frac{r}{100}\right)^n}$$

Where P_n = population after n no. of decades
r = rate of growth
P_o = Initial population
N = no. of decades

S7. Ans.(d)
Sol. Buston formula for estimating water required for fire demand $\boxed{Q = 5663\sqrt{P}}$
Where Q = l/min.
P = population (in thousands)

S8. Ans.(c)

Sol. Given, total quantity of water = Q
Population = P
Time = 1 year

$$\text{Per capita demand of water} = \frac{\text{Q}}{\text{P} \times 365}$$

S9. Ans.(c)

Sol. according to kuchling's formula, fire demand is given by $\boxed{Q = 3182\sqrt{P}}$

Where Q = l/min
P = Population (in thousands)

S10. Ans.(d)

Sol.

Population	Peak factor
Up to 50,000	3
50,000 to 2 lakh	2.5
More than 2 lakh	2.0

S11. Ans.(a)

Sol.

S12. Ans.(b)

Sol. Maximum Hourly demand = 1.5 × Average hourly demand
→ Maximum daily demand = 1.8 × Average daily demand

S13. Ans.(d)

Sol. distributor mains is designed for maximum hourly demand on maximum day.

S14. Ans.(a)

Sol. Arithmetical increase method is used to forecast the population of old and very large city. According to this method, the Population of town or city after 'n' decades is

$$\boxed{P_n = P_o + n\bar{x}}$$

$P_0 =$ Present population
n = no. of decades
$\bar{x} =$ Average of increase in population
$P_n =$ Population after 'n' decades

S15. Ans.(b)

Sol.

Year	Population	Increase in population
1981	2,00,000	

1991	2,10,000	10,000
2001	2,30,000	20,000
		Total = 30,000

Population of town after 'n' decades $P_n = P_o + n\bar{x}$
Where P_o = 2,30,000 (Present Population)
N = 1 (no. of decades)
$\bar{x}$ = (average in increase in population) = $\frac{10000+20000}{2}$
= 15,000
Hence,
$P_n = 2{,}30{,}000 + 1 \times 15{,}000$
$\boxed{P_n = 2{,}45{,}000}$

S16. Ans.(d)
Sol. Nephelometer is the apparatus in which turbidity is measured as a function of intensity of light scattered as it passes through the water sample.

S17. Ans.(b)
Sol. Eutrophication is excessive discharge of nutrients in water bodies.

S18. Ans.(d)
Sol.

Classification	Hardness (mg/l.)
Soft water	0-60
Moderate hard water	61-120
Hard water	121-180
Very hard water	≥ 181

S19. Ans.(b)
Sol. According to IS 10500:2012, the acceptable limit of total dissolved solids in drinking water is 500 mg/l and cause for rejection is 2000 mg/l.

S20. Ans.(a)
Sol. the permissible limit of chlorides content in drinking water is 250 mg/l. and maximum permissible limit is 1000 mg/l.

S21. Ans.(d)
Sol. It concentration of fluorides in drinking water exceeding 1.5 mg/l, then it may cause fluorosis, decolorization and molting of teeth. It the concentration of fluorides is less than 1 mg/l then it may cause dental cavity.

S22. Ans.(a)

Water borne disease	Bacteria
Typhoid	Salmonella typhi
Cholera	Vibrio cholerae
Hepatitis	Hepatitis virus
Polio	Polio virus

S23. Ans.(d)
Sol. the turbidity is measured at standard silica scale. 1mg of silica as SiO_2 is added to 1 litre of pure water to make the standard turbid solution.

S24. Ans.(d)
Sol. turbidity is extent to which light is either scattered or absorbed due to presence of suspended solids in water.

S25. Ans.(b)
Sol. As per Indian standard of drinking water specification, pH value should be in range of 6.5-8.5.

S26. Ans.(b)
Sol. the permanent hardness of water is caused by sulphates, chlorides and nitrates of calcium or magnesium.

S27. Ans.(d)
Sol. Winkler's method is used to determine the dissolved oxygen in fresh water.

S28. Ans.(c)
Sol. if the pH is more than 8.3 then phenolphthalein indicator turns water into pink color. phenolphthalein is a basic indicator.

S29. Ans.(a)
Sol. Alkalinity in water is expressed as mg/l in terms of calcium carbonate.
Major ions → CO_3^{-2}, HCO_3^-, OH^-
Minor ions → $HS^-, H_2PO_4^-, HPO_4^{-2}\ etc.$

S30. Ans.(b)
Sol. cavities in teeth are caused if fluoride content (in mg/l) is less than 1.
S31. Ans.(c)
Sol. The settling velocity of inorganic particles is given by stoke's law.
Settling velocity (V_s) by stoke's law is given by-

$$\boxed{V_S = \frac{(G-1)\gamma_w d^2}{18\mu}}$$

Or

$$\boxed{V_s = \frac{g}{18}\,(G-1)\frac{d^2}{\upsilon}}$$

Where

d = diameter of particle in m.

μ = dynamic viscosity

υ = Kenematic viscosity

G = Specific gravity

S32. Ans.(d)

Sol. the ratio of discharge and plan area of a continuous flow type settling tank, is known as surface loading or overflow rate.

S33. Ans.(b)

Sol. with increase in the temperature of water the viscosity of water decrease hence it increase the rate of settling of particles.

S34. Ans.(d)

Sol.

$$\boxed{Settling\ velocity\ or\ surface\ overflow\ rate = \frac{Q}{B.L}}$$

S35. Ans.(a)

Sol. settling velocity of particles intended to be removed should be more than the surface loading of the tank.

S36. Ans.(d)

Sol. the rate of settling of a particle depends upon the viscosity of water, specific gravity and shape and size of particles.

S37. Ans.(a)

Sol. the rate of filtration for slow sand filters is 2400 to 4800 l/day/m² or 100 to 200 l/hour/m².

S38. Ans.(c)

Sol. slow sand filters are cleaned at an interval of 1-3 months.

S39. Ans.(a)

Sol. Bacteria removal efficiency of slow sand filter is 98 to 99%, hence it produce water of higher bacteriological quality.

S40. Ans.(b)

Sol. $\boxed{Uniformity\ coefficient\ of\ filter\ sand = \frac{D_{60}}{D_{10}}}$

S41. Ans.(a)
Sol. Ease of construction of slow sand filters better than rapid sand filters. slow sand filter produce water of higher bacteriological quality than rapid sand filter.

S42. Ans.(c)
Sol. filtration is the process of purifying water by passing it through a bed of fine granular material. This is carried out for the removal of organic matter, micro-organism, dissolved mineral and suspended particle from the water.

S43. Ans.(d)
Sol. Chloramine test is not performed on chlorine residuals while orthotolidine test, starch iodide test and chlorotex test performed on chlorine residuals.

S44. Ans.(a)
Sol. Imhoff cone is used to measure settleable solids.

S45. Ans.(a)

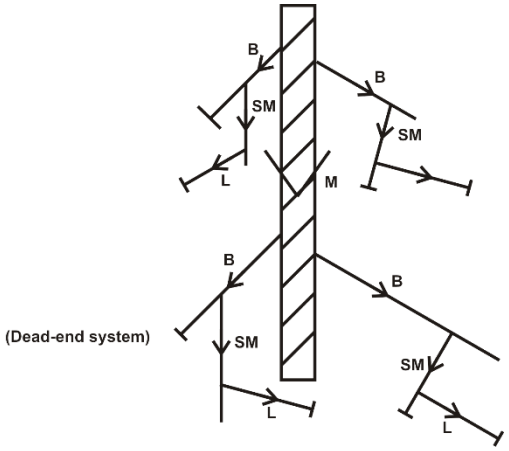
S46. Ans.(b)
Sol. Pressure relief value protects the water meter from the damages of water hammer. These valves provide the safety against bursting of pipe.

S47. Ans.(a)
Sol. A 'Gate value' also known as sluice value. These valves are used to regulate the flow of the water in the pipe network.

S48. Ans.(c)
Sol. Sluice value or gate value are provided at the corner of roads which control and regulate the flow of water at the cross-section of the distribution system.

S49. Ans.(b)
Sol. Check value or reflux valve or non-returning valves are allows the flow only in one direction only back flow is not permitted.

S50. Ans.(a)
Sol. The suitable layout of a water supply distribution system for an irregularly grown town is dead end system
M= Main
B= Branch
SM= Sum-main
L= Lateral



(Dead-end system)