POSTAL Book Package 2023

CIVIL ENGINEERING

Environmental Engineering

Objective Practice Sets

Contents

MADE EASY Publications

1 CHAPTER
Water Demand

Q.1 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I

A. Freeman's formula
B. Kuichling's formula
C. Boston's formula
D. National Board of Fire Underwriters formula

List-II

1. $4637\sqrt{P}\left[1-0.01\sqrt{P}\right]$
2. $1136\left[\frac{P}{5}+10\right]$
3. $5663\sqrt{P}$
4. $3182\sqrt{P}$

Codes:

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

Q.2 Select the correct relationship between porosity (n), specific yield (S_y) and specific retention (S_r)

(a) $n = S_y + S_r$ (b) $S_y = n + S_r$
(c) $S_r = n + S_y$ (d) $S_r > (n + S_y)$

Q.3 The design period for demand reservoir as recommended by the GOI manual on water supply is

(a) 30 years (b) 50 years
(c) 15 years (d) 40 years

Q.4 Which of the following are correctly matched pairs?

1. Arithmetic increase method : Old cities only
2. Geometric increase method : New cities only
3. Incremental increase method: Old cities only

Select the correct option

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

Q.5 Main supply pipes (water mains) are designed for

(a) maximum hourly demand
(b) average hourly demand
(c) average annual demand
(d) maximum daily demand

Q.6 The total water requirement of a city is generally assessed on the basis of

(a) maximum hourly demand
(b) maximum daily demand + fire demand
(c) average daily demand + fire demand
(d) greater of (a) and (b)

Q.7 The per capita water demand includes

(a) domestic water demand only
(b) domestic and commercial demand
(c) domestic, commercial and industrial demand
(d) domestic, commercial, public, fire and industrial demand

Q.8 Per capita demand for water is affected by which of the following:

1. Size of the city
2. System of supply
3. Cost of water
4. Climatic conditions

Select the correct answer:

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

Q.9 If the average weekly consumption of a city is 650000 m^3, the maximum weekly consumption will be

(a) 832000 m^3 (b) 962000 m^3
(c) 1170000 m^3 (d) 1755000 m^3

Multiple Select Questions (MSQ)

Q.21 In estimating population for assessing water supply demand, using geometric progression method, which of the following statement(s) is/are correct?

(a) This method gives conservative higher values of forecasted population.

(b) In this method percentage growth rate is assumed to be constant.

(c) This method gives correct estimates for a developed city.

(d) In this method, compounding is done every decade.

Q.22 For projecting the population of the town in the year AD 2000 by incremental increase method the following data was available:

Year	Population
1940	25000
1950	27500
1960	34100
1970	41500
1980	54500

Assume the rate of water supply is 200 lpcd in the year 2000. Which of the following option(s) is/are correct?

(a) Expected population at the end of year 2000 is 69250.

(b) Water requirement in year 2000 is 13.85 MLD.

(c) Expected population at the end of year 2000 is 79750.

(d) Water requirement in year 2000 is 15.95 MLD.

■■■■

Answers Water Demand

1. (a)	2. (a)	3. (b)	4. (c)	5. (d)	6. (d)	7. (d)	8. (d)	9. (b)	10. (c)
11. (a)	12. (a)	13. 0.806		14. (b)	15. (d)	16. (c)	17. (b)	18. (c)	19. (a)
20. (b)	21. (a, b, d)		22. (c, d)						

Explanations Water Demand

2. (a)

Correct relationship between porosity, specific yield and specific retention is

$$n = S_y + S_r$$

3. (b)

Design period of demand reservoir in recommended to be of 50 year. Design life of pipe caring raw water as well as treated water in recommended to be 30 years.

4. (c)

Geometric increase method gives high results which is suitable for cities growing with fast rate such as new cities whereas arithmetic increase method gives low results which is suitable for cities growing with slow rate such as old cities, however, incremental increase method gives moderate results which can be used for new and old cities both.

6. (d)

For general community purposes, the total draft is not taken as the sum of maximum hourly demand and fire demand, but is taken as the sum of maximum daily demand and fire demand, or the maximum hourly demand, whichever is more. The maximum daily demand (i.e. 1.8 times the average daily demand) when added to fire draft for working out total draft, is known as coincident draft.

8. (d)

Factors affecting per capita demand for water are:

- Size of city
- Climatic conditions
- Type of gentry and habits of people
- Industrial and commercial activities
- Quality of water supply
- Pressure in the distribution systems
- Development of sewage facilities

- System of supply
- Cost of water
- Policy of metering and method of charging

9. (b)

According to Godrich, the ratio of maximum weekly demand to average weekly demand is 1.48.

So, maximum weekly consumption

$= 1.48 \times 650000 = 962000\ m^3$

13. 0.806 (0.750 to 0.850)

According to National Board of Fire Underwriter's formula,

Fire demand,

$$Q = 4637\sqrt{P}\left(1-0.01\sqrt{P}\right)$$

[Where P in thousand]

$$= 4637\sqrt{140}\left(1-0.01\sqrt{140}\right) l/\min$$

$= 48374$ litres/min

$= 0.806$ cumecs

14. (b)

Average daily requirement of water

$= 70{,}000 \times 150 = 10500\ m^3/d$

This water shall be withdrawn in 10 hours. So

$$\text{Intake load} = \frac{10500}{60\times10\times60} = \frac{10.5}{36}$$

$$= \frac{3.5}{12} = 0.29\ m^3/s$$

15. (d)

Using logistic curve method;

Saturation population is given as,

$$P_s = \frac{2P_0P_1P_2 - P_1^2(P_0+P_2)}{P_0P_2 - P_1^2}$$

where, $P_0 = 42000$

$P_1 = 50000$

$P_2 = 55000$

So we get,

$P_s = 60526$

16. (c)

Assumed growth rate,

$$r = \left(\frac{P_2}{P_1}\right)^{1/t} - 1$$

where,

P_2 is final known population = 8150

P_1 is initial known population = 5500

t is no. of years (period) between P_1 and P_2, $t = 3$

So, $$r = \left(\frac{8150}{5500}\right)^{1/3} - 1 = 0.14$$

or, $r = 14\%$

Population of town in fifth consecutive year,

$$P_5 = P_4\left(1+\frac{r}{100}\right)^1$$

$= 8150 \times 1.14 = 9291$

17. (b)

According to P.F. verhulst, the logistic curve is represented by equation

$$\log_e\left(\frac{P_s-P}{P}\right) - \log_e\left(\frac{P_s-P_0}{P_0}\right) = -K P_s t$$

$$\therefore \quad \log_e\left[\left(\frac{P_s-P}{P_0}\right)\times\left(\frac{P_0}{P_s-P_0}\right)\right] = -K P_s t$$

$$\text{or,} \quad \frac{P_s-P}{P}\times\frac{P_0}{P_S-P_0} = \log_e{}^{-1}(-K P_s t)$$

$$\text{or,} \quad P = \frac{P_s}{1+\left(\frac{P_s-P_0}{P_0}\right)\log_e{}^{-1}(-K P_s t)}$$

Assume $m = \dfrac{P_s-P_0}{P_0}$ where and $n = -K P_s$ are constant.

If three pairs of characteristic value P_0, P_1 and P_2 at time $t = t_0$, $t = t_1$ and $t_2 = 2t$ are selected, the value of m and n can be found as follows;

$$n = \frac{1}{t_1}\log_e\left[\frac{P_0(P_s-P_1)}{P_1(P_s-P_0)}\right]$$

Option (b) is correct.

18. (c)

Population increases to 44000 in 20 years

$\therefore$ Rate of population growth

$$= \frac{44000-28000}{20}$$

$= 800$ per year

Population of community that will have design capacity of 6000 m^3/d