

Sources of Water Supply

Q.1 Which of the following is not a surface source of water?

- (a) Springs (b) Pond
(c) Oceans (d) Storage reservoirs

Q.2 Consider the following statements:

1. Larger and older lakes provide comparatively pure water than smaller and newer lakes.
2. The quality of water in lake is generally not good and needs purification.

Which of these statement/s is/are correct?

- (a) Only 1 (b) Only 2
(c) Both 1 and 2 (d) Both are incorrect

Q.3 For the same drawdown in two observations wells at distances r_1 and r_2 , the time after start of pumping are t_1 and t_2 hours respectively. The relation which holds good is

- (a) $t_2 = \frac{r_2}{r_1} \times t_1$ (b) $t_2 = \left(\frac{r_2}{r_1}\right)^2 \times t_1$
(c) $t_2 = \left(\frac{r_2}{r_1}\right)^3 \times t_1$ (d) $t_2 = \left(\frac{r_2}{r_1}\right) \times t_1^2$

Q.4 What type of pumping arrangement is used in the hand pumps generally used in many parts of India?

- (a) Centrifugal type (b) Reciprocating type
(c) Combined type (d) None of the above

Q.5 Consider the following statements:

1. Specific capacity of a well is the rate of flow from a well per unit of drawdown.
2. Infiltration galleries are the horizontal or nearly horizontal tunnels constructed at shallow depths along the banks of river through water bearing strata.

3. Storage coefficient for an artesian aquifer is equal to the volume of the water released from the aquifer of full height for an unit cross-sectional area, when the piezometric surface declines by unity.

Which of these statement/s is/are correct?

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

Q.6 Consider the following statements:

1. A cavity type tubewell draws water from the bottom of the well.
2. A screen type tube well draws water from the sides of the well.
3. The flow in a cavity type tube well is essentially radial.
4. The flow in a screen type tube well is essentially radial.

Which of these statements are correct?

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

Q.7 The life of a tube well can be increased by

1. reducing the drawdown and the pumping rate
2. reducing the flow velocity by increasing the percentage of open area of diameter of the well pipe
3. using thicker pipes
4. using corrosion resistant materials for pipes and corrosion resistant coatings on the pipes

Which of these statements are correct?

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

Q.8 Consider the following statements with reference to the location of an intake:

1. The intake plant should as far as possible, be located in deep waters.
2. The intake plant should be located on the upstream of the point of disposal.
3. On meandering rivers, intake plants should be located on the convex side.

Which of these statement/s is/are correct?

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

Q.9 During a recuperation test, the water level in an open well was depressed by pumping by 3 m and is recuperated by an amount of 1.5 m in 75 minutes. If the diameter of well is 2.5 m, then the yield from well under a depression head of 3 m is

- (a) 8.4 m³/hr (b) 2.4 l/s
(c) 2.27 l/s (d) 8.02 m³/hr

Q.10 A well having a diameter of 20 cm has been drilled in a confined aquifer having a thickness of 10 m. Radius of influence is 275 m from the centre of the well. If coefficient of permeability of soil is 15 m/day, the discharge in the well for a drawdown of 2 m is

- (a) 9.92 m³/hr (b) 250 m³/day
(c) 8.36 m³/hr (d) 223.5 m³/day

Q.11 A 25 cm diameter well was drilled 25 m below the static water table. In two observation wells at distances of 80 m and 40 m from the centre of well, the water level was found to be lowered by 55 cm and 105 cm respectively at a discharge of 6000 litres/min. in 24 hours. The transmissibility of aquifer is

- (a) 1.237 m²/min. (b) 1.893 m²/min.
(c) 1.691 m²/min. (d) 1.368 m²/min.

Q.12 Consider the following statements related to strainer type tube wells:

1. The flow in the well is radial.
2. A strainer consists of a perforated pipe with a fine wire mesh wrapped round the pipe which prevents sand particles of size larger than mesh entering into the well.
3. Generally not suitable for fine sandy strata.

Which of these statements are correct?

- (a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) All of those

Q.13 Which of the following statement is false in relation to factors governing the location of an intake?

- (a) The intake is to be located as near as possible to the treatment plant.
(b) The intake should be located such that its lowest silt level can be kept above the low water level of the source.
(c) The intake site is to be free from sources of contamination.
(d) The location should be such that water may be drawn to treatment plant by gravity.

Q.14 Match List-I (Tests) with List-II (Features) and select the correct answer using the codes given below the lists:

List-I

- A. Pumping test
B. Recuperation test
C. Pressure test
D. Jar test

List-II

1. The gradual rise of water level in well is observed as time progresses.
2. Rate of pumping is adjusted to constant level of water in well.
3. Vigorous mixing of the chemical followed by slow mixing.
4. Pipeline is filled up with water, allowed to stand for sometime and then atleast double the maximum pressure is applied.

Codes:

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

Q.15 Assertion (A): In India, most of water supply systems are provided with the surface water as the source.

Reason (R): Surface water is qualitatively superior than the subsurface water

- (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

Q.16 Stratification of water with depth in reservoir (with free surface) is based on temperature. The dark stagnant cool water layer is known as
 (a) Epilimnion (b) Hypolimnion
 (c) Metalimnion (d) Boundary

Q.17 What does supersaturation of a water body with DO cause?
 (a) Eutrophication
 (b) Endemic goitre
 (c) Methaemoglobinemia
 (d) Gas bubble disease in fish

Q.18 In a city with population of 90,000, water is drawn for domestic purpose from a bell mouth intake in a canal which runs only for 12 hours a day with flow depth of 1.8 m. If the average consumption per person is 170 LPD, then the intake load is

- (a) 0.631 m³/sec (b) 0.296 m³/sec
 (c) 0.354 m³/sec (d) 0.452 m³/sec

Q.19 Best quality of water is to be drawn for public water supply schemes from a lake. Which is the required state of the lake?
 (a) Senescent (b) Eutrophic
 (c) Mesotrophic (d) Oligotrophic

Q.20 Consider the following statements:
 1. Impounding reservoirs are recommended as a water supply source when river flow fluctuates and yet the total supply quantity available is more than the accumulated demand.
 2. Infiltration galleries tap deep ground water for the supply.
 3. Most water supply schemes function with surface sources.
 4. Total potential available with ground water is estimated by mass curve method.
 Which of these statements are correct?
 (a) 1 and 4 (b) 1, 2 and 4
 (c) 3 and 4 (d) 1 and 3

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Answers Sources of Water Supply

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

Explanations Sources of Water Supply

1. (a)
 Surface sources (for example) are ponds and lakes, streams and rivers, storage reservoirs and oceans. Subsurface (underground) sources are springs, wells and tube-wells, infiltration galleries and infiltration wells.
 2. (a)
 The quality of water in a lake is generally good and does not need much purification as sedimentation might have occurred

3. (b)
 Drawdown 'S' is given by

$$S = \frac{Q}{4\pi T} \left[\log_e \left(\frac{4Tt}{r^2 A} \right) - 0.5772 \right]$$

 For well 1
 $r = r_1 \quad t = t_1$

$$S_1 = \frac{Q}{4\pi T} \left[\log_e \left(\frac{4Tt_1}{r_1^2 A} \right) - 0.5772 \right] \quad \dots (i)$$

 For well 2

$$r = r_2 \quad t = t_2$$

$$S_2 = \frac{Q}{4\pi T} \left[\log_e \left(\frac{4Tt_2}{r_2^2 A} \right) - 0.5772 \right] \quad \dots (ii)$$

for same drawdown $S_1 = S_2$

$$\frac{Q}{4\pi T} \left[\log_e \left(\frac{4Tt_1}{r_1^2 A} \right) - 0.5772 \right] = \frac{Q}{4\pi T} \left[\log_e \left(\frac{4Tt_2}{r_2^2 A} \right) - 0.5772 \right]$$

$$\frac{4Tt_1}{r_1^2 A} = \frac{4Tt_2}{r_2^2 A}$$

$$\frac{t_1}{r_1^2} = \frac{t_2}{r_2^2}$$

$$t_2 = \left(\frac{r_2}{r_1} \right)^2 \times t_1$$

6. (c)
 Flow in a cavity tube well is essentially spherical.
 8. (b)
 The intake plant should be nearer to the treatment plant and be located in deep water, be located in the purer zone of the source, up stream side of disposal of waste water. For meandering river it should be located on concave side.
 9. (c)
 We know that,

$$\frac{C'}{A} = \frac{2.3}{T} \log_{10} \frac{S_1}{S_2}$$

Where,

S_1 = Initial drawdown = 3 m

S_2 = Final drawdown = 3 - 1.5 = 1.5 m

$$T = \text{Time} = 75 \text{ min.} = \frac{75}{60} \text{ hr} = 1.25 \text{ hr}$$

$$\text{So, } \frac{C'}{A} = \frac{2.3}{1.25} \log_{10} \left(\frac{3}{1.5} \right) = 0.554 \text{ m}^2/\text{hr/m of depression head}$$

So, yield from the well,

$$Q = \left(\frac{C'}{A} \right) \times A \times S$$

$$\text{Here, } A = \frac{\pi}{4} \times 2.5^2 = 4.91 \text{ m}^2$$

S = Depression head = 3 m

$$\text{So, } Q = 0.554 \times 4.91 \times 3 = 8.16 \text{ m}^3/\text{hr} = 2.27 \text{ l/s}$$

10. (a)
 Using Dupuit's equation,

$$Q = \frac{2\pi kD(H-h)}{2.303 \log_{10} \left(\frac{R}{r} \right)}$$

Here, $k = 15$, $D = 10 \text{ m}$

$(H-h)$ = Drawdown = 2 m

R = Radius of influence = 275 m

r = Radius of well = 10 cm = 0.1 m

$$\text{So, } Q = \frac{2\pi \times 15 \times 10 \times 2}{2.303 \log_{10} \left(\frac{275}{0.1} \right)} = 237.98 \text{ m}^3/\text{day} = 9.92 \text{ m}^3/\text{hr}$$

11. (d)
 We know that discharge is given as,

$$Q = \frac{\pi k (h_2^2 - h_1^2)}{2.303 \log_{10} \left(\frac{r_2}{r_1} \right)}$$

Here, $h_2 = 25 - 0.55 = 24.45 \text{ m}$

$h_1 = 25 - 1.05 = 23.95 \text{ m}$

$r_2 = 80 \text{ m}$

$r_1 = 40 \text{ m}$

$Q = 6000 \text{ l/min.}$

$= 6 \text{ m}^3/\text{min.}$

$$\text{So, } 6 = \frac{\pi k (24.45^2 - 23.95^2)}{2.303 \log_{10} \left(\frac{80}{40} \right)}$$

$$\Rightarrow k = 0.0547 \text{ m/min.}$$

So, transmissibility = kH

$$= 0.0547 \times 25 = 1.368 \text{ m}^2/\text{min.}$$

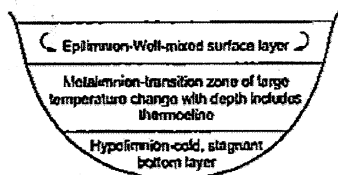
12. (b)

A strainer type tube-well is generally unsuitable for fine sandy strata due to choking problem of strainer.

13. (b)

The intake should be located such that its lowest sill level can be kept below the low water level of the source.

16. (b)



Stratification of water in lakes

18. (c)

Population of city = 90,000

Average consumption = 170 LPD

So, total consumption

$$= 90000 \times 170 \text{ l/day}$$

$$= 15300000 \text{ l/day}$$

$$= 15300 \text{ m}^3/\text{day}$$

But the canal runs for only 12 hours a day.

So intake load

$$= \frac{15300 \times 24}{24 \times 3600 \times 12} \text{ m}^3/\text{sec}$$

$$= 0.354 \text{ m}^3/\text{sec}$$

20. (c)

An impounding reservoir is a basin constructed in a valley of stream or river for the purpose of holding stream flow so that the stored water may be used when supply is insufficient. Infiltration galleries are the horizontal tunnels constructed at shallow depths (3 to 5 meters) along the banks of rivers through the water bearing strata.

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