Disposal of Sewage Effluents

Q.1 Which of the following is not a condition favoring disposal by dilution?
  (a) When sewage is around 3-4 days old.
  (b) When the diluting water has high dissolved oxygen content.
  (c) Where diluting waters are not used for the purpose of navigation.
  (d) When the outfall sewer of the city or the treatment plant is situated near some natural waters having large volumes.

Q.2 Treatments such as sedimentation, screening and essential chemical precipitation are required when dilution factor is
  (a) above 500
  (b) between 300 to 500
  (c) between 150 to 300
  (d) less than 150

Q.3 Match List-I (characteristics of the effluent) with List-II (tolerance limit for industrial effluents discharged into inland surface waters) and select the correct answer using the codes given below the lists:
  List-I
  A. BOD_5
  B. Total suspended solids
  C. Sulphides
  D. Fluorides
  List-II
  1. 100 mg/l
  2. 80 mg/l
  3. 1 mg/l
  4. 2 mg/l
  Codes:

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

Q.4 Which of the following is a chemical force which help in affecting self-purification process?
  (a) Dispersion   (b) Sunlight
  (c) Reduction   (d) Sedimentation

Q.5 At a place, waste water with DO 3 mg/l and discharge rate 1.5 m³/s mixes with the river water instantaneously and completely. DO of river is 9 mg/l and its flow rate is 9.3 m³/s. Initial amount of DO in the mixture of waste water and river shall be
  (a) 5.32 mg/l   (b) 6.51 mg/l
  (c) 7.09 mg/l   (d) 8.17 mg/l

Q.6 Assertion (A): Increase in temperature may lead to anaerobic condition.
  Reason (R): This is due to expulsion of dissolved oxygen into atmosphere.
  (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 the correct explanation of A
  (c) A is true but R is false
  (d) A is false but R is true

Q.7 Assertion (A): Too much turbulence is not desirable.
  Reason (R): Too much turbulence will decrease the dissolved oxygen content.
  (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.8 The zone near the shore where rooted plants grow is called
  (a) Euphotic zone
  (b) Littoral zone
  (c) Benthic zone
  (d) None of these

Q.9 The fresh water reaches its maximum density at a temperature of
  (a) 0°C   (b) 2°C
  (c) 4°C   (d) 6°C

Q.10 A very old lake which has almost become marshy is known as
  (a) Oligotrophic lake
  (b) Mesotrophic lake
  (c) Eutrophic lake
  (d) Senescent lake

Q.11 Self purification of running streams may be due to
  (a) sedimentation, oxidation and coagulation
  (b) dilution, sedimentation and oxidation
  (c) dilution, sedimentation and coagulation
  (d) dilution, oxidation and coagulation

Q.12 When a sewage is disposed off in a river, the rate of depletion of DO of the river mainly depends on
  (a) BOD of sewage
  (b) COD of sewage
  (c) TOC of sewage
  (d) DO present in sewage

Q.13 Sewage may be disposed off without treatment into a water body if the available dilution is
  (a) Less than 150   (b) More than 150
  (c) More than 300   (d) More than 500

Q.14 A community normally levies a sewer charge Rs 20/m³. For discharge in which the BOD > 250 mg/l and suspended solids (SS) > 300 mg/l, an additional Rs 0.50/kg BOD and Rs 1.00/kg SS are levied.
  A chicken processing plant uses 2000 m³ water/day and discharges wastewater with BOD = 480 mg/l and SS = 1530 mg/l. The plant's daily wastewater disposal pill is
  (a) Rs 24,960   (b) Rs 21,600
  (c) Rs 20,690   (d) Rs 42,690

Q.15 In continuous flow settling tank 3.5 m deep and 65 m long, if the flow velocity of water is 1.22 cm/sec. The size of particle of specific gravity 2.65 which can be effectively removed is (Assume temperature 25°C and free beard 0.5 m and v_w = 0.01 cm²/sec)
  (a) 0.025 mm   (b) 0.033 mm
  (c) 0.041 mm   (d) 0.016 mm

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1. (a)   2. (c)   3. (d)   4. (c)   5. (d)   6. (b)   7. (c)   8. (b)   9. (c)   10. (d)

11. (b)   12. (a)   13. (d)   14. (d)   15. (a)

Explanations **Disposing of Sewage Effluents**

1. (a)
Favourable condition is when sewage is comparatively fresh (4 to 5 hour old)

5. (d)

$$DO_{mix} = \frac{Q_W \cdot DO_W + Q_R DO_R}{Q_W + Q_R}$$

$$= \frac{(1.5 \times 3) + (9.3 \times 9)}{1.5 + 9.3}$$

$$= 8.17 \text{ mg}/l$$

6. (b)
Increase in temperature leads to decrease in DO and increase in rate of reaction. This is likely to lead to anaerobic condition.

7. (c)
Too much of turbulence is not desirable because it scours the bottom sediment, increase the turbidity and retards the algae growth, which is useful in re-aeration process.
Turbulence never decrease the DO content.

14. (d)
Excess BOD and SS are respectively,
$(480 - 200)$ mg/l × 2000 × 1000 × 10^{-6} kg/mg/l
= 460 kg excess BOD

$(1530 - 300)$ × 2000 × 1000 × 10^{-6} = 2400 kg excesses SS.
Daily bill is thus;
$\Rightarrow$ 2000 × 20 + 460 kg$_{BOD}$ × 0.50 + 2460 × 1
$= $ Rs 42,690

15. (a)
We know, for particle to be removed, it must satisfy

$$\frac{V}{V_s} = \frac{L}{H_s}$$

$$\Rightarrow \quad V_s = \frac{v_s L}{H_s}$$

or, $\quad V_s = \frac{vH}{L_s} = 1.22 \times \frac{3}{65} = 0.0563$ cm/sec

But settling velocity V_s as per stoke's equation

$$v_s = \frac{g}{18}(S_s - 1)\frac{d^2}{v}$$

$$v_s = \frac{981}{18}(2.65 - 1)\frac{d^2}{0.01} = 0.0563$$

or, $\quad d = 0.025$ mm (< 0.1 mm) $\Rightarrow$ OK

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