

Waste Water Engineering

Question No. 01

For a continuous flow type of sedimentation tanks

- (A) Width of the tank is normally kept about 6 m
- (B) Length of the tank is normally kept 4 to 5 times the width
- (C) Maximum horizontal flow velocity is limited to 0.3 m/minute
- (D) All the above

Answer: Option D

Question No. 02

The asbestos cement sewers are

- (A) Light in weight
- (B) Not structurally strong to bear large compressive stress
- (C) Susceptible to corrosion by sulphuric acid
- (D) All the above

Answer: Option D

Question No. 03

For efficient working of a sewer, it must be ensured that

- (A) Minimum velocity of 0.45 m/sec, is maintained at its minimum flow
- (B) A maximum velocity of 0.90 m/sec, is maintained at its maximum flow
- (C) Both (a) and (b)
- (D) Neither (a) nor (b)

Answer: Option C

Question No. 04

Pick up the correct statement from the following:

- (A) The sewer pipes of sizes less than 0.4 m diameter are designed as running full at maximum discharge
- (B) The sewer pipes of sizes greater than 0.4 m diameter are designed as running 2/3rd or 3/4th full at maximum discharge
- (C) The minimum design velocity of sewer pipes is taken as 0.8 m/sec
- (D) All the above

Answer: Option D

Question No. 05

Pick up the correct statement from the following:

- (A) Maximum daily flow = 2 times the average daily flow
- (B) Maximum daily flow = $\frac{2}{3}$ × average daily flow
- (C) Sewers are designed for minimum permissible velocity at minimum flow
- (D) All the above

Answer: Option D

Question No. 06

Bottom openings 15 cm × 15 cm in the standing baffle wall are provided

- (A) 15 cm c/c
- (B) 22.5 cm c/c
- (C) 30 cm c/c
- (D) 50 cm c/c

Answer: Option B

Question No. 07

The pressure exerted by

- (A) The sewage when running full from inside, is called internal pressure
- (B) The internal pressure if any, causes tensile stress in the pipe material
- (C) Pressure sewers are designed to be safe in tension
- (D) All the above

Answer: Option D

Question No. 08

For drainage pipes in buildings the test applied before putting them to use, is

- (A) Water test
- (B) Smoke test
- (C) Straightness test
- (D) All the above

Answer: Option B

Question No. 09

No treatment of the sewage is given if dilution factor is

- (A) Less than 150
- (B) Between 150 to 200
- (C) Between 200 to 300
- (D) More than 500

Answer: Option D

Question No. 10

Which of the following pumps is used to pump sewage solids with liquid sewage without clogging the pump is?

- (A) Centrifugal pump
- (B) Pneumatic ejector
- (C) Reciprocating pump
- (D) None of these

Answer: Option A

Question No. 11

Acid regression stage of sludge digestion at a temperature 21°C extends over a period of

- (A) 15 days
- (B) 30 days

(C) 60 days

(D) 90 days

Answer: Option D

Question No. 12

Pick up the correct statement from the following:

(A) Small sewers are cleaned by flushing

(B) Medium sewers are cleaned by cane rodding

(C) Medium sewers may be cleaned by pills

(D) All the above

Answer: Option D

Question No. 13

The coagulant which is generally not used for treating the sewage, is

(A) Alum

(B) Ferric chloride

(C) Ferric sulphate

(D) Chlorinated copperas

Answer: Option A

Question No. 14

The layers of vegetable wastes and night soil alternatively piled above the ground to form a mound, is called

(A) A heap

(B) Plateau

(C) Windrow

(D) None of these

Answer: Option D

Question No. 15

If the flame of a miner's safety lamp in the upper layers of the sewer forms an explosive, the sewer certainly contains

(A) Hydrogen sulphide

(B) Carbon dioxide

(C) Methane

(D) Oxygen

Answer: Option C

Question No. 16

The gas which may cause explosion in sewers, is

(A) Carbondioxide

(B) Methane

(C) Ammonia

(D) Carbon monoxide

Answer: Option B

Question No. 17

Pick up the correct statement from the following:

- (A) The water supply pipes carry pure water free from solid particles
- (B) The water supply pipes get clogged if flow velocity is less than self cleansing velocity
- (C) The sewers may be carried up and down the hills and valleys
- (D) The sewer pipes are generally laid along level hills

Answer: Option A

Question No. 18

Pick up the incorrect statement from the following:

- (A) The process of decomposing the organic matter under controlled anaerobic conditions, is called sludge digestion
- (B) Sludge digestion is carried out in sludge tank
- (C) The gases produced in sludge digestion process, contain 75% carbon dioxide
- (D) The gases produced in sludge digestion process, contain 75% methane

Answer: Option C

Question No. 19

The sewer pipes

- (A) Carry sewage as gravity conduits
- (B) Are designed for generating self-cleansing velocities at different discharge
- (C) Should resist the wear and tear caused due to abrasion
- (D) All the above

Answer: Option D

Question No. 20

The settling velocity of the particles larger than 0.06 mm in a settling tank of depth 2.4 is 0.33 m per sec. The detention period recommended for the tank, is

- (A) 30 minutes
- (B) 1 hour
- (C) 1 hour and 30 minutes
- (D) 2 hours

Answer: Option D

Question No. 21

The Chezy's constant C in the formula $V = C \sqrt{rs}$ depends upon

- (A) Size of the sewer
- (B) Shape of the sewer
- (C) Roughness of sewer surface
- (D) All the above

Answer: Option D

Question No. 22

The discharge per unit plan area of a sedimentation tank, is generally called

- (A) Over flow rate

- (B) Surface loading
- (C) Over flow velocity
- (D) All the above

Answer: Option D

Question No. 23

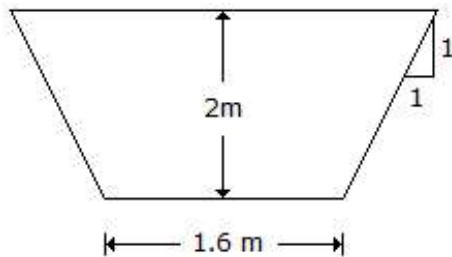
Pick up the incorrect statement from the following for allowing workers to enter sewers

- (A) The particular manhole and one manhole on upstream and one manhole on downstream should remain open for 30 minutes
- (B) Proper tests for the presence of poisonous gases must be carried out
- (C) The men entering the manhole should be advised to smoke in the sewer
- (D) Warning signals should be erected

Answer: Option C

Question No. 24

For the open drain ($N = 0.025$) shown in the below figure, the discharge is



- (A) 26.88 cumecs
- (B) 27.88 cumecs
- (C) 28.88 cumecs
- (D) 29.88 cumecs

Answer: Option C

Question No. 25

To prevent settling down of sewage both at the bottom and on the sides of a large sewer, self-cleaning velocity recommended for Indian conditions, is

- (A) 0.50 m/sec
- (B) 0.60 m/sec
- (C) 0.70 m/sec
- (D) 0.75 m/sec

Answer: Option D

Question No. 26

Assertion (A): The determination of pH value of sewerage is important.

Reason (R): The efficiency of certain treatment methods depends upon the availability of pH value.

- (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

Answer: Option A

Question No. 27

The normal values of over flow rates for sedimentation tanks using coagulant, ranges between

- (A) 25,000 to 35,000 litres/sqm/day
- (B) 40,000 to 50,000 litres/sqm/day
- (C) 50,000 to 60,000 litres/sqm/day
- (D) 80,000 to 100,000 litres/sqm/day

Answer: Option C

Question No. 28

The drainage area of a town is 12 hectares. Its 40% area is hard pavement ($K = 0.85$), the 40% area is unpaved streets ($K = 0.20$) and the remaining is wooded areas ($K = 0.15$). Assuming the time of concentration for the areas as 30 minutes and using the formula $P_s = 900/(t + 60)$ the maximum run off is

- (A) 0.10 cumec
- (B) 0.12 cumec
- (C) 0.15 cumec
- (D) 0.20 cumec

Answer: Option C

Question No. 29

Sewer pipes are designed for maximum discharge with 25% to 33% vacant cross-sectional area for

- (A) Unexpected large scale infiltration of stream water
- (B) Unexpected increase in the population
- (C) Under estimates of maximum and average flows
- (D) All of the above

Answer: Option D

Question No. 30

The rational formula for peak drainage discharge, was evolved by

- (A) Fruhling
- (B) Lloyd David
- (C) Kuichling
- (D) All of these

Answer: Option D

Question No. 31

The sewer that unloads the sewage at the point of treatment is called

- (A) Main sewer
- (B) Outfall sewer
- (C) Branch sewer
- (D) House sewer

Answer: Option B

Question No. 32

During preliminary treatment of a sewage

- (A) Oil and grease are removed from skimming tanks
- (B) Floating materials are removed by screening
- (C) Grit and sand are removed by grit chambers
- (D) All the above

Answer: Option D

Question No. 33

For a grit chamber, if the recommended velocity of flow is 0.2 m/sec and detention period is 2 minutes, the length of the tank, is

- (A) 16 m
- (B) 20 m
- (C) 24 m
- (D) 30 m

Answer: Option C

Question No. 34

Dry weather flow is:

- (A) Average daily rate of flow
- (B) Average monthly rate of flow
- (C) Average annual rate of flow
- (D) Water supply allowance per capita

Answer: Option D

Question No. 35

Pick up the incorrect statement from the following:

- (A) The mixture of water and waste products, is called sewage
- (B) The treated sewage effluents, are generally used for irrigating the crops
- (C) The process of collecting, treating and disposing off the sewage, is called sewerage
- (D) The old convergence system was definitely better than water carried sewerage system

Answer: Option D

Question No. 36

Pick up the correct statement from the following:

- (A) The maximum rate of storm runoff is called peak drainage discharge
- (B) Rational method of estimating peak run off, may be used precisely for areas less than 50 hectares
- (C) The period after which the entire area starts contributing to the runoff, is called the time of concentration
- (D) All the above

Answer: Option D

Question No. 37

If q is the average sewage flow from a city of population P , the maximum sewage flow

- (A) $Q = [(4 + \sqrt{P})/(18 + \sqrt{P})] q$
- (B) $Q = [(18 + P)/(4 + \sqrt{P})] q$
- (C) $Q = [(18 + \sqrt{P})/(4 + \sqrt{P})] q$
- (D) $Q = [(5 + \sqrt{P})/((15 + \sqrt{P}))] q$

Answer: Option C

Question No. 38

3/4th or 1/4th extra space is left in sewer pipes at maximum discharge for

- (A) Low estimates of the average and maximum flows
- (B) Large scale infiltration of storm water
- (C) Unexpected increase in population
- (D) All the above

Answer: Option D

Question No. 39

If the flame of a miner's safety lamp in a manhole extinguishes within 5 minutes, the sewer certainly contains

- (A) Hydrogen sulphide
- (B) Carbon dioxide
- (C) Methane
- (D) Oxygen

Answer: Option B

Question No. 40

Hydraulic mean radius is

- (A) Mean radius of sewer
- (B) Difference in heads between two points in circular pipes
- (C) Mean of radii in a pipe line of varying cross-sections
- (D) Cross-sectional area/wetted perimeter

Answer: Option D

Question No. 41

If the depth of flow in a circular sewer is 1/4th of its diameter D , the wetted perimeter is

- (A) $\pi D/2$
- (B) $\pi D/4$
- (C) $\pi D/3$
- (D) πD

Answer: Option C

Question No. 42

Pick up the correct statement from the following:

- (A) Anaerobic bacteria flourish in the absence of oxygen
- (B) Aerobic bacteria flourish in the presence of oxygen
- (C) Facultative bacteria flourish with or without oxygen
- (D) All the above

Answer: Option D

Question No. 43

The Brake Horse power of the motor (efficiency 60%) required for a pump of capacity 0.075 cumec for a total lift of 12 m, is

- (A) 10
- (B) 15
- (C) 20
- (D) 25

Answer: Option C

Question No. 44

Aerobic bacterias

- (A) Flourish in the presence of free oxygen
- (B) Consume organic matter as their food
- (C) Oxidise organic matter in sewage
- (D) All the above

Answer: Option D

Question No. 45

At the junction of sewers

- (A) Top of smaller sewer is kept lower
- (B) Top of larger sewer is kept lower
- (C) Tops of both the sewers are at the same level
- (D) None of these

Answer: Option D

Question No. 46

Traps

- (A) Are water seals which prevent the entry of foul gases
- (B) Are used to trap the rats entering sewers
- (C) Dissolve the foul gases
- (D) Create syphonic action to increase the quick disposal of sewerage

Answer: Option A

Question No. 47

The sewage treatment units in which anaerobic decomposition of organic matter is used, are called

- (A) Imhoff tanks
- (B) Trickling filters
- (C) Sludge sedimentation tanks
- (D) None of these

Answer: Option B

Question No. 48

Pick up the correct statement from the following:

- (A) In treated sewage, 4 ppm of D.O. is essential
- (B) Only very fresh sewage contains some dissolved oxygen
- (C) The solubility of oxygen in sewage is 95% that is in distilled water
- (D) All the above

Answer: Option D

Question No. 49

If the diameter of a sewer is 150 mm, the gradient required for generating self cleansing velocity, is

- (A) 1 in 60
- (B) 1 in 100
- (C) 1 in 120
- (D) None of these

Answer: Option B

Question No. 50

The sewer which received discharge from two or more main sewers, is known as

- (A) A trunk sewer
- (B) An outfall sewer
- (C) A main sewer
- (D) An intercepting sewer

Answer: Option A

Question No. 51

The grit and silt of the grit chambers, may not be used for

- (A) Raising low lying areas by dumping
- (B) Concreting
- (C) Both (a) and (b)
- (D) Neither (a) nor (b)

Answer: Option B

Question No. 52

For treating the sewage of a large city, you will recommend

- (A) A sedimentation tank and an activated sludge treatment plant
- (B) A plant consisting of Imhoff tanks with low rate trickling filters
- (C) Sedimentation tanks with high rate trickling filters
- (D) None of these

Answer: Option A

Question No. 53

Imhoff cone is used to measure

- (A) Total organic solids
- (B) Total solids

(C) Total in organic solids

(D) Settleable solids

Answer: Option D

Question No. 54

Pick up the correct statement from the following:

(A) The ratio of the quantity of the diluting water to that of the sewage, is known as dilution factor

(B) The automatic purification of polluted water, is known self purification phenomenon

(C) The photosynthesis is carried out in the presence of sun light

(D) All the above

Answer: Option D

Question No. 55

1000 kg of sewage contains

(A) 0.112 kg in suspension

(B) 0.112 kg in solution

(C) 0.225 kg in solution

(D) Both (a) and (c) of above

Answer: Option D

Question No. 56

Dilution method of disposing of sewage, is not preferred to

(A) When sewage is fresh

(B) When diluting water has high dissolved oxygen content

(C) When diluting water is used for water supply near the point of sewage disposed

(D) When the diluting water is having flow currents

Answer: Option C

Question No. 57

If the peak discharge of a storm water drain (S.W. Drain) is expected to exceed 150 cumecs, the free board to be provided, is

(A) 100 cm

(B) 90 cm

(C) 80 cm

(D) 50 cm

Answer: Option A

Question No. 58

The reduced levels of the string at the consecutive sight rails A and B are 203.575 m, 203.475 m respectively. If the difference of their R.D.s is 10 m, the gradient of the sewer line is

(A) 1 in 100 upward

(B) 1 in 500 upward

(C) 1 in 100 downward

(D) 1 in 503 upward

Answer: Option C

Question No. 59

R.M.O. expenses include

- (A) Running expenses
- (B) Maintenance expenses
- (C) Operation expenses
- (D) All the above

Answer: Option D

Question No. 60

For the COD test of sewage, organic matter is oxidised by $K_2Cr_2O_7$ in the presence of

- (A) H_2SO_4
- (B) HNO_3
- (C) HCl
- (D) None of these

Answer: Option A

Question No. 61

The sludge does not contain waste water from

- (A) Bath rooms
- (B) Wash basins
- (C) Kitchen sinks
- (D) Toilets

Answer: Option D

Question No. 62

In sewers the velocity of flow should not be

- (A) More than the self-cleansing velocity
- (B) Less than the self-cleansing velocity
- (C) Less than 10 m/sec
- (D) More than 20 m/sec

Answer: Option B

Question No. 63

Pick up the correct statement from the following:

- (A) Hydrogen sulphide gas in excess, may cause corrosion of concrete sewers
- (B) 4 ppm of Dissolved Oxygen (D.O.) is ensured before discharging the treated sewage in river
- (C) Solubility of oxygen in sewage is 95% of that of distilled water
- (D) All the above

Answer: Option D

Question No. 64

In sewers the effect of scouring is more on

- (A) Top side

- (B) Bottom side
- (C) Horizontal side
- (D) All sides

Answer: Option B

Question No. 65

The rainfall at any place may be determined by

- (A) Its intensity
- (B) Its direction
- (C) Its frequency
- (D) All the above

Answer: Option D

Question No. 66

Pick up the correct statement from the following:

- (A) The circular section of sewers provides maximum hydraulic mean depth
- (B) The circular sewers are provided for separate sewerage system
- (C) The circular sewers work efficiently if the sections run at least half full
- (D) All the above

Answer: Option D

Question No. 67

Pick up the correct statement from the following:

- (A) Rate of digestion of sludge is more at higher temperature
- (B) Thermophilic organisms digest the sludge if the temperature ranges from 40° to 60°C
- (C) Mesophilic organisms digest the sludge if the temperature is between 25° and 40°C
- (D) All the above

Answer: Option D

Question No. 68

Sewer ventilating columns are generally placed at

- (A) Distances 150 m to 300 m
- (B) Upper ends of branch sewers
- (C) Every change in the size of sewers
- (D) All the above

Answer: Option D

Question No. 69

The sewer which resists sulphide corrosion, is

- (A) Brick sewer
- (B) Cast iron sewer
- (C) R.C.C. sewer
- (D) Lead sewer

Answer: Option D

Question No. 70

In a sedimentation tank (length L , width B , depth D) the settling velocity of a particle for a discharge Q , is

- (A) $Q/(B \times D)$
- (B) $Q/(L \times D)$
- (C) Q/L
- (D) $Q/(B \times L)$

Answer: Option D

Question No. 71

The formula which accepts the value of rugosity coefficient $n = 0.012$ to be used in Manning's formula, is given by

- (A) Bazin
- (B) Crimp and Bruges
- (C) William-Hazen
- (D) Kutter

Answer: Option B

Question No. 72

The amount of oxygen consumed by the aerobic bacterias which cause the aerobic biological decomposition of sewage, is known

- (A) Bio-Chemical Oxygen Demand (B.O.D.)
- (B) Dissolved Oxygen (D.O.)
- (C) Chemical Oxygen Demand (C.O.D.)
- (D) None of these

Answer: Option B

Question No. 73

Water content of sewage is about

- (A) 90 %
- (B) 95 %
- (C) 99 %
- (D) 9.9 %

Answer: Option D

Question No. 74

Skimming tanks are

- (A) Used to remove the grease and oil
- (B) Those from which sludge is skimmed out
- (C) Tanks provided with self-cleansing screens
- (D) Improved version of grit chambers

Answer: Option A

Question No. 75

The most efficient cross-section of sewers in a combined sewerage system is

- (A) Parabolic
- (B) Circular
- (C) Rectangular
- (D) New egged

Answer: Option B

Question No. 76

The detention period for plain sedimentation water tanks, is usually

- (A) 4 to 8 hours
- (B) 8 to 16 hours
- (C) 16 to 24 hours
- (D) 24 to 36 hours

Answer: Option A

Question No. 77

The factor responsible for purification of sewage in river is

- (A) Hydrology
- (B) Dissolved oxygen in water
- (C) Temperature
- (D) All the above

Answer: Option D

Question No. 78

Hume steel pipes are

- (A) Steel pipes
- (B) Steel shell coated from inside with cement mortar
- (C) Steel shell coated from outside with cement mortar
- (D) Both (B) and (C)

Answer: Option D

Question No. 79

To maintain aerobic biological activity, the moisture content of the compost mass should be about

- (A) 45 %
- (B) 50 %
- (C) 55 %
- (D) 60 %

Answer: Option C

Question No. 80

Pick up the correct statement from the following:

- (A) The larger the sewer in size, more will be velocity
- (B) The smaller the sewer in size, less will be velocity
- (C) The larger the sewer in size, no deposition will take place
- (D) The larger the sewer in size, deposition will take place

Answer: Option D

Question No. 81

The pH value of sewage is determined with the help of

- (A) Imhoff Cone
- (B) Turbid meter
- (C) Potentiometer
- (D) None of these

Answer: Option C

Question No. 82

If the length of overland flow from the critical point to the mouth of drain is 13.58 km and difference in level between the critical point and drain mouth is 10 m, the inlet time is

- (A) 2 hours
- (B) 4 hours
- (C) 6 hours
- (D) 8 hours

Answer: Option D

Question No. 83

The normal value of over flow rates for plain primary sedimentation tanks, ranges between

- (A) 25,000 to 35,000 litres/sqm/day
- (B) 40,000 to 50,000 litres/sqm/day
- (C) 50,000 to 60,000 litres/sqm/day
- (D) 80,000 to 100,000 litres/sqm/day

Answer: Option B

Question No. 84

Pick up the incorrect statement from the following:

- (A) Septic tanks are horizontal continuous flow type of sedimentation tanks
- (B) Septic tanks are generally provided a detention period of 12 to 36 hours
- (C) Septic tanks are completely covered and high vent shafts are provided for the escape of foul gases
- (D) None of these

Answer: Option D

Question No. 85

Which one of the following statements regarding septic tanks is wrong?

- (A) A gap of 7.5 cm between the bottom of the covering slab and the top level of scum is provided
- (B) The outlet invert level is kept 5 to 7.5 cm below the inlet invert level
- (C) The minimum width of septic level is 90 cm
- (D) The depth of tank is kept equal to its width

Answer: Option D

Question No. 86

In a trickling filter

- (A) Filtration process is used
- (B) Biological action is used
- (C) Neither (a) nor (b)
- (D) Both (a) and (b)

Answer: Option B

Question No. 87

In areas where rainy season is limited to a few months, the type of sewerage system recommended is

- (A) Combined system
- (B) Partially separate system
- (C) Separate system
- (D) None of these

Answer: Option C

Question No. 88

The rate of accumulation of sludge in septic tanks is recommended as

- (A) 30 litres/person/year
- (B) 25 litres/person/year
- (C) 30 litres/person/month
- (D) 25 litres/person/month

Answer: Option A

Question No. 89

Dried sewage after treatment is used as

- (A) Fertilizer
- (B) Building material
- (C) Chemical for lowering B.O.D.
- (D) Base material for paints

Answer: Option A

Question No. 90

For drains up to 15 cumecs, the depth ' d ' and width ' B ' are related by

- (A) $d = 0.2 B$
- (B) $d = 0.5 B$
- (C) $B = 0.2 d$
- (D) $B = 0.5 d$

Answer: Option B

Question No. 91

In areas where light rains are uniformly distributed throughout the year, the type of sewerage system to be adopted is

- (A) Separate system
- (B) Combined system
- (C) Partially combined system

(D) None of these

Answer: Option B

Question No. 92

Self-cleansing velocity is

- (A) Velocity at dry weather flow
- (B) Velocity of water at flushing
- (C) Velocity at which no accumulation remains in the drains
- (D) Velocity of water in a pressure filter

Answer: Option C

Question No. 93

5 days-biochemical oxygen demand (BOD₅) is taken at a temperature of

- (A) 0°C
- (B) 15°C
- (C) 20°C
- (D) 25°C

Answer: Option C

Question No. 94

Pick up the correct statement from the following:

- (A) Inlets are provided on the road surface at the lowest point for draining rain water
- (B) Inlets are generally provided at an interval of 30 m to 60 m along straight roads
- (C) Inlets having horizontal openings, are called horizontal inlets
- (D) All the above

Answer: Option D

Question No. 95

If a 2% solution of sewage sample is incubated for 5 days at 20°C and the dissolved oxygen depletion was found to be 8 mg/l. The BOD of the sewage is

- (A) 100 mg/l
- (B) 200 mg/l
- (C) 300 mg/l
- (D) 400 mg/l

Answer: Option D

Question No. 96

Pick up the in-correct statement from the following:

- (A) Manholes are provided in sewer pipes at suitable intervals
- (B) Catch basins are generally provided in sewers for carrying drainage discharge
- (C) Inlets are generally provided in all sewers
- (D) None of these

Answer: Option C

Question No. 97

A well oxidized sewage contains nitrogen mainly as

- (A) Nitrates
- (B) Nitrites
- (C) Free ammonia
- (D) None of these

Answer: Option A

Question No. 98

The moisture content of sludge is reduced from 90% to 80% in a sludge digestion tank. The percentage decrease in the volume of sludge, is

- (A) 25 %
- (B) 50 %
- (C) 10 %
- (D) 5 %

Answer: Option B

Question No. 99

In a sludge tank, the gas mainly produced, is

- (A) Oxygen
- (B) Nitrogen
- (C) Hydrogen
- (D) Carbon dioxide

Answer: Option D

Question No. 100

Bio-chemical oxygen demand (BOD) for the first 20 days is generally referred to

- (A) Initial demand
- (B) First stage demand
- (C) Carbonaceous demand
- (D) All of these

Answer: Option D

Question No. 101

Stoneware sewers are available in size

- (A) 10 cm
- (B) 15 cm
- (C) 20 cm
- (D) All the above

Answer: Option D

Question No. 102

If 'D' is the diameter of upper circular portion, the overall depth of New Egg shaped sewer section, is

- (A) $1.250 D$

(B) 1.350 D

(C) 1.425 D

(D) 1.625 D

Answer: Option D

Question No. 103

In normal conditions, the period for sludge digestion, is

(A) 10 days

(B) 20 days

(C) 30 days

(D) 60 days

Answer: Option C

Question No. 104

For evaporation and measurement of settable solids, the apparatus used, is

(A) A jar

(B) A breaker

(C) A test tube

(D) An Imhoff cone

Answer: Option D

Question No. 105

In trickling filter, B.O.D. is reduced to

(A) 30 to 40%

(B) 40 to 60%

(C) 60 to 80%

(D) 80 to 90%

Answer: Option C

Question No. 106

For design of sewers, percentage of sewage discharge is assumed

(A) 65 to 70%

(B) 70 to 75%

(C) 75 to 80%

(D) 85%

Answer: Option C

Question No. 107

The grit chambers of sewage treatment plants, are generally cleaned after

(A) 2 days

(B) 7 days

(C) 12 days

(D) 14 days

Answer: Option D

Question No. 108

Maximum permissible velocity 1.5 m/sec, is adopted in drains

- (A) With beds of rocks and gravels
- (B) Lined with stones
- (C) Both (a) and (b)
- (D) Neither (a) nor (b)

Answer: Option C

Question No. 109

The average temperature of sewage in India, is

- (A) 10°C
- (B) 15°C
- (C) 20°C
- (D) 25°C

Answer: Option C

Question No. 110

'Cowl' is provided at

- (A) Lower end of ventilating column
- (B) Upper end of ventilating column
- (C) Upper end of the manhole
- (D) First step in manhole

Answer: Option B

Question No. 111

If the discharge of a sewer running half is 628 l.p.s., $i = 0.001$, and $n = 0.010$, the diameter of the sewer, is

- (A) 1.39 m
- (B) 1.49 m
- (C) 1.59 m
- (D) 1.69 m

Answer: Option D

Question No. 112

A drop manhole is provided if

- (A) A sewer drops from a height
- (B) A branch sewer joins the main sewer at higher level
- (C) A lamp is inserted to check obstruction
- (D) None of these

Answer: Option B

Question No. 113

For a circular sewer of diameter ' D ' running partially full with central angle ' α ',

- (A) $d/D = \frac{1}{2} (1 - \cos\alpha/2)$
- (B) $a/A = [(\pi/360^\circ) - (\sin\alpha/2\pi)]$

(C) $r/R = [1 - 360^\circ \sin\alpha/2\pi\alpha]$

(D) All the above

Answer: Option D

Question No. 114

The use of coarse screens for the disposal of sewage, may be dispensed with by

(A) Comminutor

(B) Shredder

(C) Both (a) and (b)

(D) Neither (a) nor (b)

Answer: Option C

Question No. 115

In the activated sludge process

(A) Aeration is continued till stability

(B) Aeration is done with an admixture of previously aerated sludge

(C) Sludge is activated by constant stirring

(D) Water is removed by centrifugal action

Answer: Option B

Question No. 116

For detecting the nitrates in sewage, the colour may be developed by adding

(A) Potassium permanganate

(B) Sulphuric acid and naphthamine

(C) Phenol-di-sulphuric acid and potassium hydroxide

(D) None of these

Answer: Option C

Question No. 117

The settling velocity of a spherical particle of diameter less than 0.1 mm as per Stock's law, is

(A) $V_s = 418 (G_s - G_w)d [(3T + 70)/100]$

(B) $V_s = 418 (G_s - G_w)d^2 [(3T + 70)/100]$

(C) $V_s = 218 (G_s - G_w)d^2 [(3T + 70)/100]$

(D) $V_s = 218 (G_s - G_w)d [(3T + 70)/100]$

Answer: Option B

Question No. 118

In septic tanks,

(A) Free board of 0.3 m may be provided

(B) The baffles or tees are extended up to top level of scum

(C) The clear space between the baffle top and covering slab is about 7.5 cm

(D) All the above

Answer: Option D

Question No. 119

Inter-distance between ventilation columns in a sewer line is kept

- (A) 25 to 50 m
- (B) 50 m to 100 m
- (C) 100 m to 150 m
- (D) 150 m to 300 m

Answer: Option D

Question No. 120

Stone ware pipes are

- (A) Highly resistant to sulphide corrosion
- (B) Highly impervious
- (C) Hydraulically efficient because of their smooth interior surface
- (D) Especially suited to pressure pipes

Answer: Option D

Question No. 121

The intensity of rain is expressed in

- (A) cm/minute
- (B) cm/hour
- (C) cm/day
- (D) None of these

Answer: Option B

Question No. 122

The ratio of the diameter of a circular section and the side of a square section hydraulically equivalent, is

- (A) 1.095
- (B) 1.085
- (C) 1.075
- (D) 1.065

Answer: Option A

Question No. 123

Which one of the following part of human body withstands minimum radiation?

- (A) Thyroid
- (B) Kidneys
- (C) Eyes
- (D) Ovaries/testis

Answer: Option D

Question No. 124

Drop manholes are the manholes

- (A) Without entry ladders
- (B) Without manhole covers

- (C) With depths more than 3.5 m
- (D) Having drains at different levels

Answer: Option D

Question No. 125

The bottom of the sewage inlet chamber of septic tanks, is provided an outward slope

- (A) 1 in 5
- (B) 1 in 10
- (C) 1 in 15
- (D) 1 in 20

Answer: Option B

Question No. 126

If 2% solution of a sewage sample is incubated for 5 days at 20°C and depletion of oxygen was found to be 5 ppm, B.O.D. of the sewage is

- (A) 200 ppm
- (B) 225 ppm
- (C) 250 ppm
- (D) None of these

Answer: Option C

Question No. 127

Primary treatment of sewage consists of removal of

- (A) Large suspended organic solids
- (B) Oil and grease
- (C) Sand and grit
- (D) Floating materials

Answer: Option A

Question No. 128

The sewers

- (A) Must be of adequate size to avoid over flow
- (B) Must flow under gravity $\frac{1}{2}$ to $\frac{3}{4}$ full
- (C) Must be laid at least 2 to 3 m deep to collect /water from the basements
- (D) All the above

Answer: Option D

Question No. 129

Cement concrete sewers are only suitable if non-scouring velocity is between

- (A) 2.5 to 3.0 m/sec
- (B) 3.0 to 4.0 m/sec
- (C) 3.5 to 4.5 m/sec
- (D) 4.5 to 5.5 m/sec

Answer: Option A

Question No. 130

In a fully mechanised composting plant, involves

- (A) Mechanized receipt
- (B) Mechanized segregation
- (C) Mechanized pulverising of refuse
- (D) All of these

Answer: Option D

Question No. 131

The most widely used pump for lifting sewage is

- (A) Centrifugal pump
- (B) Reciprocating pump
- (C) Pneumatic ejector
- (D) Air pressure pump

Answer: Option A

Question No. 132

If ' γ_w ' is the unit weight of water, ' r ' the hydraulic mean depth of the sewer and ' S ' the bed slope of the sewer, then the tractive force exerted by flowing water, is

- (A) $\gamma_w r S$
- (B) $\gamma_w r^{1/2} S$
- (C) $\gamma_w r \sqrt{S}$
- (D) $\gamma_w r^{2/3} \sqrt{S}$

Answer: Option A

Question No. 133

Setting out the alignments of sewers may start from

- (A) City
- (B) Out-fall
- (C) Tail end
- (D) Any point

Answer: Option C

Question No. 134

The detention time of a circular tank of diameter d and water depth H , for receiving the sewage Q per hour, is

- (A) $d^2 (0.011d + 0.785H)/Q$
- (B) $d (0.022d + 0.085H)/Q$
- (C) $d (0.785d + 0.011H)/Q$
- (D) $d (0.285d + 0.011H)/Q$

Answer: Option A

Question No. 135

Lead acetate test in sewer manhole is done to test the presence of

- (A) Methane gas

- (B) Hydrogen sulphide
- (C) Carbondioxide gas
- (D) Diesel vapours

Answer: Option B

Question No. 136

Antisiphonage pipe is fitted

- (A) At the end of septic tanks
- (B) On manholes
- (C) With a W.C. trap
- (D) At the beginning of sewer line

Answer: Option C

Question No. 137

In a grit chamber of a sewage treatment plant,

- (A) Flow velocity 0.15 m to 0.3 m/sec is kept
- (B) Depth of 0.9 m to 1.20 m is kept
- (C) One minute of detention period is kept
- (D) All the above

Answer: Option D

Question No. 138

The ratio of maximum sewage flow to average sewage flow for mains up to 1 m in diameter, is

- (A) 1.5
- (B) 2.0
- (C) 3.0
- (D) 4.0

Answer: Option B

Question No. 139

pH value of sludge during alkaline regression stage, is

- (A) More than 7
- (B) Less than 7
- (C) Less than 6
- (D) More than 6

Answer: Option A

Question No. 140

The arrangement made for passing the sewer line below an obstruction below the hydraulic gradient lines called

- (A) Inverted syphon
- (B) Depressed sewer
- (C) Sag pipe
- (D) all of these

Answer: Option D

Question No. 141

Pick up the incorrect size of stone ware sewers

- (A) 52.5 cm
- (B) 67.5 cm
- (C) 82.5 cm
- (D) None of these

Answer: Option D

Question No. 142

Chlorination of water is done for the removal of

- (A) Bacterias
- (B) Suspended solids
- (C) Sediments
- (D) Hardness

Answer: Option A

Question No. 143

Sludge banks are formed if sewage is disposed of in

- (A) Rivers
- (B) Seas
- (C) Lakes
- (D) None of these

Answer: Option B

Question No. 144

Assertion (A): A free board of 0.3 m is provided above the top sewage line in septic tanks.

Reason (R): It helps to accommodate the scum in the septic tank.

- (A) Both A and R is true and R is the correct explanation of A
- (B) Both A and R is 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

Answer: Option A

Question No. 145

The temperature affects the

- (A) Biological activity of bacteria in sewage
- (B) Solubility of gases in sewage
- (C) Viscosity of sewage
- (D) All the above

Answer: Option D

Question No. 146

The clarigesters are

- (A) Circular septic tanks
- (B) Rectangular septic tanks

- (C) Circular Imhoff double tanks with bottom hoppers
- (D) Circular Imhoff double storey tanks without bottom hoppers

Answer: Option D

Question No. 147

The density of population over 40 hectares is 250/hectare. If water supply demand per day is 200 litres and sewage discharge is 80% of water supply, the sewage flow in sewers of separate system, is

- (A) 0.05552 cumec
- (B) 0.05554 cumec
- (C) 0.05556 cumec
- (D) 0.0556 cumec

Answer: Option C

Question No. 148

In a residential colony, sewers of diameters 100 mm, 150 mm and 225 mm were laid with a gradient 1 in 120. Which portion of the sewage system does not choke in due course of time?

- (A) 100 mm dia.
- (B) 150 mm dia.
- (C) 225 mm dia.
- (D) All of these

Answer: Option C

Question No. 149

The spacing of bars for perforations in coarse screens used for the treatment of sewage, is

- (A) 20 mm
- (B) 30 mm
- (C) 40 mm
- (D) 50 mm

Answer: Option D

Question No. 150

In case of Imhoff tanks,

- (A) The shape is rectangular
- (B) Detention period is 2 hours
- (C) The velocity of flow is restricted to 0.30 m/minute
- (D) All the above

Answer: Option D

Question No. 151

The pH value of fresh sewage is usually

- (A) Equal to 7
- (B) More than 7
- (C) Less than 7
- (D) Equal to zero

Answer: Option B

Question No. 152

The maximum depth of sedimentation tanks, is kept

- (A) 3 m
- (B) 3.5 m
- (C) 4 m
- (D) 4.5 m

Answer: Option A

Question No. 153

If the depletion of oxygen is found to be 5 ppm after incubating a 2.5% solution of sewage sample for 5 days at 21°C, B.O.D. of the sewage is

- (A) 50 ppm
- (B) 100 ppm
- (C) 150 ppm
- (D) 200 ppm

Answer: Option D

Question No. 154

Pick up the correct statement from the following:

- (A) Indore method of composting involves decomposition under aerobic conditions
- (B) Bangalore method of composting involves decomposing under anaerobic conditions
- (C) Fully stabilised refuse by the Bangalore method of composting is a powdery mass called humus
- (D) all of these

Answer: Option D

Question No. 155

Lead caulked joints are used for laying

- (A) Stone ware pipes
- (B) Earthenware pipes
- (C) C.I. pipes
- (D) G.I. pipes

Answer: Option B

Question No. 156

If D is the diameter of a circular sewer and D' is the top horizontal diameter of an equivalent egg shaped section, the relationship which holds good, is

- (A) $D' = 0.64 D$
- (B) $D' = 0.74 D$
- (C) $D' = 0.84 D$
- (D) $D' = 0.94 D$

Answer: Option C

Question No. 157

The spacing of man holes along a straight portion of a sewer is 300 m, the diameter of the sewer may be

- (A) 0.9 cm
- (B) 1.2 m
- (C) 1.5 m
- (D) > 1.5 m

Answer: Option D

Question No. 158

A sewer running partially full and hurried with back filled, fails in compression due to

- (A) Weight of the pipe
- (B) Weight of the back fill
- (C) Superimposed traffic loads
- (D) All the above

Answer: Option D

Question No. 159

A five day B.O.D. at 15°C of the sewage of a town is 100 kg/day. If the 5 day B.O.D. per head at 15°C for standard sewage is 0.1 kg/day, the population equivalent is

- (A) 100
- (B) 1000
- (C) 5000
- (D) 10000

Answer: Option D

Question No. 160

Kjeldahl nitrogen is a mixture of

- (A) Ammonia and nitrogen
- (B) Nitrogen and organic nitrogen
- (C) Organic nitrogen and ammonia
- (D) All the above

Answer: Option D

Question No. 161

The quantity of liquid waste which flows in sewers during the period of rainfall, is known

- (A) Sanitary sewage
- (B) Industrial waste
- (C) Storm sewage
- (D) None of these

Answer: Option C

Question No. 162

Nitrogen cycle of sewage, is

- (A) Liberation of ammonia-formation of nitrites-formation of nitrates-liberation of nitrogen

- (B) Liberation of nitrogen-liberation of ammonia-formation of nitrites- formation of nitrates
 - (C) Liberation of nitrogen-formation of nitrates-formation of nitrites-liberation of ammonia
 - (D) Formation of nitrates-formation of nitrites-liberation of nitrates-liberation of nitrates
- Answer: Option A

Question No. 163

Depletion of ozone layer in the outer atmosphere may cause

- (A) Lung cancer
- (B) Skin cancer
- (C) Bronchitis
- (D) Heart disorder

Answer: Option B

Question No. 164

The minimum diameter of a sewer is kept

- (A) 10 cm
- (B) 15 cm
- (C) 20 cm
- (D) 25 cm

Answer: Option B

Question No. 165

A cylindrical ejector having its height 2 m fills after every 10 minutes with a peak sewage discharge of 0.0157 cumec. The diameter of the ejector chamber, is

- (A) 2.30 m
- (B) 2.40 m
- (C) 2.45 m
- (D) 2.50 m

Answer: Option C

Question No. 166

Pick up the correct statement from the following:

- (A) The materials separated by screens, is called screenings
- (B) The screenings are disposed off either by burning or by burial or by dumping
- (C) The process of burning the screenings, is known as composting
- (D) All the above

Answer: Option D

Question No. 167

Which one of the following gases is most significant as air pollutant?

- (A) Carbondioxide
- (B) Oxygen
- (C) Nitrogen
- (D) Sulphur-dioxide

Answer: Option D

Question No. 168

Hazen's formula $V_s = 418 (G_s - G_w)d [(3T + 70)/100]$ is used for the settlement velocity of the particles of diameter

- (A) Less than 0.01 mm
- (B) Less than 0.05 mm
- (C) Less than 0.1 mm
- (D) Greater than 0.1 mm

Answer: Option D

Question No. 169

For sewers, inverted siphon is provided for

- (A) One pipe
- (B) Two pipes
- (C) Three pipes
- (D) Four pipes

Answer: Option C

Question No. 170

Pick up the correct statement from the following:

- (A) pH value indicates acidity and alkalinity of sewage
- (B) In acidic sewage, the pH value is less than 7
- (C) In alkaline sewage, the pH value is more than 7
- (D) All the above

Answer: Option D

Question No. 171

For large sewers, maximum distance between manholes may be

- (A) 50 m
- (B) 100 m
- (C) 200 m
- (D) 300 m

Answer: Option D

Question No. 172

In sewers designed with self cleansing velocity,

- (A) The bottom is silted
- (B) The bottom is scoured
- (C) Both silting and scouring occur at the bottom
- (D) Neither silting nor scouring occurs at the bottom

Answer: Option D

Question No. 173

The value of Chezy's constant $C = 157.6/(1.81 + K/vr)$ is used in

- (A) Chezy's formula
- (B) Bazin's formula

- (C) Kutter's formula
- (D) Manning's formula

Answer: Option B

Question No. 174

An inverted siphon is designed generally for

- (A) One pipe
- (B) Two pipes
- (C) Three pipes
- (D) Four pipes

Answer: Option C

Question No. 175

The spacing of bars of perforations of fine screens used for the treatment of sewage, is

- (A) 2 to 3 mm
- (B) 3 to 5 mm
- (C) 5 to 8 mm
- (D) 8 to 10 mm

Answer: Option A

Question No. 176

Pathogens (or pathogenic bacterias) in water may cause

- (A) Typhoid
- (B) Cholera
- (C) Dysentery
- (D) All the above

Answer: Option D

Question No. 177

The rate of accumulation of sludge per person per year, is

- (A) 10 litres
- (B) 15 litres
- (C) 20 litres
- (D) 25 litres

Answer: Option C

Question No. 178

The screens are fixed

- (A) Perpendicular to the direction of flow
- (B) Parallel to the direction of flow
- (C) At an angle 30° to 60° to the direction of flow
- (D) None of these

Answer: Option C

Question No. 179

In circular sewers if depth of flow is 0.2 times the full depth, the nominal gradient,

- (A) Is only provided
- (B) Is doubled
- (C) Is trebled
- (D) Is not enough

Answer: Option B

Question No. 180

In detritus tanks,

- (A) Flow velocity is kept 0.09 m/sec
- (B) Detention period is kept 3 to 4 minutes
- (C) Organic and inorganic materials are separated
- (D) All the above

Answer: Option D

Question No. 181

The flow velocity in detritus tanks is

- (A) 0.05 m/sec
- (B) 0.09 m/sec
- (C) 1.25 m/sec
- (D) None of these

Answer: Option B

Question No. 182

If the side of a square sewer is 1000 mm, the diameter of a hydraulically equivalent circular section, is

- (A) 1045 mm
- (B) 1065 mm
- (C) 1075 mm
- (D) 1095 mm

Answer: Option D

Question No. 183

The water carried sewerage system removes

- (A) Domestic sewage
- (B) Industrial sewage
- (C) Storm sewage
- (D) All the above

Answer: Option D

Question No. 184

A nuisance is experienced in diluting water if dilution factor is less than

- (A) 100
- (B) 60

(C) 40

(D) 20

Answer: Option D

Question No. 185

A manhole is generally provided at each

(A) Bend

(B) Junction

(C) Change of gradient

(D) All the above

Answer: Option D

Question No. 186

The asbestos cement pipes are generally laid

(A) Horizontally

(B) Vertically

(C) At an angle of 30°

(D) At an angle of 60°

Answer: Option B

Question No. 187

The design period in years for pumping plants, is

(A) 1

(B) 2 to 3

(C) 3 to 5

(D) 5 to 10

Answer: Option D

Question No. 188

A safety lamp when inserted in the upper portion of a manhole causes flames. It indicates the presence of

(A) Carbondioxide gas

(B) Hydrogen sulphide gas

(C) Methane gas

(D) Petrol vapours

Answer: Option C

Question No. 189

The disintegrating pump in which solid matter is broken up before passing out, is

(A) Centrifugal pump

(B) Reciprocating pump

(C) Pneumatic ejector

(D) None of these

Answer: Option A

Question No. 190

If the depletion of oxygen is found to be 2.5 mg/litre after incubating 2.5 ml of sewage diluted to 250 ml for 5 days at 20°C, B.O.D. of the sewage is

- (A) 50 mg/l
- (B) 100 mg/l
- (C) 150 mg/l
- (D) 250 mg/l

Answer: Option D

Question No. 191

Design period of 40 to 50 years is adopted for

- (A) Branch sewers
- (B) Main sewers
- (C) Trunk sewers
- (D) All the above

Answer: Option D

Question No. 192

A circular sewer section is preferred to because

- (A) It is cheaper in construction
- (B) It provides maximum area for a given perimeter
- (C) It provides maximum hydraulic mean depth
- (D) All the above

Answer: Option D

Question No. 193

In very first stage of decomposition of the organic matter in sewage

- (A) Nitrites are formed
- (B) Nitrates are formed
- (C) Carbondioxide is formed
- (D) Ammonia is formed

Answer: Option D

Question No. 194

In a city the ratio of the drainage to sewage is 20, the percentage discharge passing through non-monsoon periods, is

- (A) 5
- (B) 10
- (C) 15
- (D) 20

Answer: Option D

Question No. 195

The self-cleansing velocity of water flowing through pipe lines, is

- (A) 2 metres/sec

- (B) 1 metre/sec
 - (C) 0.5 metre/sec
 - (D) 0.25 metre/sec
- Answer: Option A

Question No. 196

In case of sewer lines

- (A) Water test is carried out to check water tightness of the joints
 - (B) Test for straightness is carried out with the help of a lamp and mirror
 - (C) Obstruction test is carried out with the help of smooth ball of diameter 13 mm
 - (D) All the above
- Answer: Option D

Question No. 197

The normal values of over flow rates for secondary sedimentation tanks, ranges between

- (A) 25,000 to 35,000 litres/sqm/day
 - (B) 40,000 to 50,000 litres/sqm/day
 - (C) 50,000 to 60,000 litres/sqm/day
 - (D) 80,000 to 10,000 litres/sqm/day
- Answer: Option A

Question No. 198

A manhole is classified as shallow if its depth is between

- (A) 0.4 to 0.5 m
 - (B) 0.5 to 0.7 m
 - (C) 0.7 to 0.9 m
 - (D) 0.9 to 1.20 m
- Answer: Option C

Question No. 199

The first stage of neutral process of sludge digestion, is

- (A) Acid fermentation
 - (B) Acid regression
 - (C) Alkaline fermentation
 - (D) None of these
- Answer: Option A

Question No. 200

The stone ware sewers

- (A) Are used for carrying sewage and drainage from houses
 - (B) Are manufactured from clays and shale
 - (C) After casting are dried and burnt at temperature 150°C, 700°C and 1200°C
 - (D) All the above
- Answer: Option D

Question No. 201

The formula $V = (1/n) r^{2/3} \sqrt{s}$ vs used for determining flow velocities in sewers, is known as

- (A) Chezy's formula
- (B) Bazin's formula
- (C) Kutter's formula
- (D) Manning's formula

Answer: Option D

Question No. 202

In sewers the highest non-scouring velocity is achieved in

- (A) Glazed bricks sewers
- (B) Cast iron sewers
- (C) Cement concrete sewers
- (D) Stone ware sewers

Answer: Option A

Question No. 203

The maximum diameter of sewers adopted in the designs is

- (A) 1.0 m
- (B) 2.0 m
- (C) 3.0 m
- (D) 4.0 m

Answer: Option C

Question No. 204

If D.O. concentration falls down to zero in any natural drainage, it indicates the zone of

- (A) Degradation
- (B) Active decomposition
- (C) Recovery
- (D) Cleaner water

Answer: Option B

Question No. 205

Facultative bacteria survive in

- (A) The presence of oxygen
- (B) The absence of oxygen
- (C) Both cases (a) and (b)
- (D) Neither (a) nor (b)

Answer: Option C

Question No. 206

For trunk and out-fall, the type of sewers generally used, is

- (A) Standard egg shaped
- (B) Circular shaped
- (C) Horse shoe shaped

(D) Parabolic shaped

Answer: Option C

Question No. 207

The maximum spacing of manholes specified by Indian standard in sewers upto 0.3 m diameter is

(A) 20 m

(B) 30 m

(C) 45 m

(D) 75 m

Answer: Option C

Question No. 208

The suitable cross-section of sewers to carry combined flow, is

(A) Circular

(B) Egg shaped

(C) Rectangular

(D) Horse shoe shaped

Answer: Option B

Question No. 209

The underground sewers are more subjected to

(A) Tensile force

(B) Compressive force

(C) Bending force

(D) Shearing force

Answer: Option B

Question No. 210

The minimum recommended diameter of sewers, is

(A) 5 cm

(B) 10 cm

(C) 15 cm

(D) 20 cm

Answer: Option C

Question No. 211

Ventilating shafts are provided to a sewer line at every

(A) 100 m

(B) 150 m

(C) 200 m

(D) 300 m

Answer: Option D

Question No. 212

The most efficient cross section of sewers in a separate sewerage system is

- (A) Parabolic
- (B) Circular
- (C) Rectangular
- (D) New egged

Answer: Option B

Question No. 213

Boussinesq's equation for ascertaining unit pressure at a depth 'H' on sewers due to traffic loads, is

- (A) $p_t = 3H^3\rho/2\pi Z^5$
- (B) $p_t = 2H^3\rho/3\pi Z^5$
- (C) $p_t = 3H^3\rho/2Z^5$
- (D) $p_t = 2\pi H^3\rho/3Z^5$

Answer: Option A

Question No. 214

If the over land flow from the critical point to the drain is 8 km and the difference in level is 12.4 m, the inlet time is

- (A) 2 hours
- (B) 3 hours
- (C) 4 hours
- (D) 5 hours

Answer: Option C

Question No. 215

For trunk sewers more than 1.25 m in diameter, the ratio of the maximum daily sewage flow to the average daily sewage flow is assumed

- (A) 1.5
- (B) 2.0
- (C) 2.5
- (D) 3.0

Answer: Option A

Question No. 216

The settlement of a particle in sedimentation tank, is affected by

- (A) Velocity of flow
- (B) Viscosity of water
- (C) Size and shape of solid
- (D) All the above

Answer: Option D

Question No. 217

If the pH value of sewage is 7

- (A) It is acidic
- (B) It is alkaline

- (C) It is neutral
- (D) None of these

Answer: Option C

Question No. 218

A sewer pipe contains 1 mm sand particles of specific gravity 2.65 and 5 mm organic particles of specific gravity 1.2, the minimum velocity required for removing the sewerage, is

- (A) 0.30 m/sec
- (B) 0.35 m/sec
- (C) 0.40 m/sec
- (D) 0.45 m/sec

Answer: Option D

Question No. 219

The width of a settling tank with 2 hour detention period for treating sewage 378 cu m per hour, is

- (A) 5 m
- (B) 5.5 m
- (C) 6.5 m
- (D) 7 m

Answer: Option D

Question No. 220

The sewer which collects the discharge from a collecting system and delivers it to a treatment plant, is known

- (A) House sewer
- (B) Lateral sewer
- (C) Branch sewer
- (D) Sewer outfall

Answer: Option D

Question No. 221

For non-scouring velocity 5 m/sec, the type of sewers generally preferred to, is

- (A) Cast iron sewers
- (B) Cement concrete sewers
- (C) Glazed bricks sewers
- (D) Stone ware sewers

Answer: Option C

Question No. 222

Pick up the correct statement from the following:

- (A) The boning rod is used for checking the levels of the sewer inverts
- (B) Manhole covers are made circular for the convenience of the cleaning staff
- (C) A manhole is classified as shallow manhole if its depth is less than 0.9 m
- (D) All the above

Answer: Option D

Question No. 223

The ratio of maximum sewage flow to average sewage flow for trunk mains having diameters more than 1.25 m, is

- (A) 1.5
- (B) 2.0
- (C) 3.0
- (D) 4.0

Answer: Option A

Question No. 224

The most dangerous pollutant in vehicular emissions is

- (A) CO
- (B) SO₂
- (C) CO₂
- (D) O₃

Answer: Option A

Question No. 225

Large diameter sewers subjected to external pressure alone, are reinforced

- (A) Near the inner surface of the pipe
- (B) Near the outer surface of the pipe
- (C) Both (a) and (b)
- (D) With elliptical cage

Answer: Option D

Question No. 226

For laying a sewer line in a trench of 2 m width, an offset line is marked on the ground parallel to the given centre line at a distance of

- (A) 100 cm
- (B) 120 cm
- (C) 140 cm
- (D) 160 cm

Answer: Option D

Question No. 227

The liquid wastes from kitchens, bath rooms and wash basins, is not called

- (A) Liquid waste
- (B) Sullage
- (C) Sewage
- (D) None of these

Answer: Option C

Question No. 228

The detention time (t) of a settling tank, may be defined as the time required for

- (A) A particle to travel along its length

- (B) A particle to travel from top surface to bottom sludge zone
- (C) The flow of sewage to fill the tank
- (D) None of these

Answer: Option C

Question No. 229

The following is the physical characteristic of sewage

- (A) Turbidity
- (B) Colour
- (C) Odour
- (D) All the above

Answer: Option D

Question No. 230

The effluent of a septic tank is

- (A) Fit for discharge into any open drain
- (B) Foul and contains dissolved and suspended solids
- (C) As good as that from a complete treatment
- (D) None of these

Answer: Option A

Question No. 231

The design period of sewage treatment works is normally

- (A) 5 - 10 years
- (B) 15 - 20 years
- (C) 30 - 40 years
- (D) 40 - 50 years

Answer: Option B

Question No. 232

In Chezy's formula $V = C \sqrt{rs}$ for calculating the velocity of flow in circular sewer of diameter 'D' running full, the value of hydraulic mean radius is

- (A) D
- (B) $D/2$
- (C) $D/3$
- (D) $D/4$

Answer: Option D

Question No. 233

It is customary to design a sewer for D.W.F. on the basis of

- (A) Average demand
- (B) Twice the average demand
- (C) Thrice the average demand
- (D) Four times the average demand

Answer: Option C

Question No. 234

For sewer mains of 0.5 to 1 m diameter, the ratio of maximum daily sewage flow to the average daily sewage flow is assumed

- (A) 1.5
- (B) 2.0
- (C) 2.5
- (D) 3.0

Answer: Option B

Question No. 235

Fresh sewage is generally

- (A) Alkaline
- (B) Acidic
- (C) Highly decomposed
- (D) A source of objectionable odour

Answer: Option A

Question No. 236

The recommended detention period for grit chambers is

- (A) 1 minute
- (B) 2 minutes
- (C) 3 minutes
- (D) 5 minutes

Answer: Option A

Question No. 237

For detecting the nitrites in the sewage, the matching colour may be developed by adding

- (A) Potassium permanganate
- (B) Sulphuric acid and naphthamine
- (C) Phenol-di-sulphuric acid potassium hydroxide
- (D) None of these

Answer: Option B

Question No. 238

If ' D ' is the diameter of upper circular portion, the overall depth of a standard egg shaped section, is

- (A) D
- (B) $1.25 D$
- (C) $1.5 D$
- (D) $1.75 D$

Answer: Option C

Question No. 239

The laying of sewers is done with

- (A) Magnetic compass

- (B) Theodolite
- (C) Level
- (D) Clinometer

Answer: Option C

Question No. 240

A rainfall may be classified as acidic if its pH value is less or equal to

- (A) 6
- (B) 7
- (C) 5
- (D) 6.5

Answer: Option C

Question No. 241

The settlement velocity of a solid (diameter 0.5 mm, specific gravity 1.75) in water having temperature 10°C, is

- (A) 213.5 cm/sec
- (B) 313.5 cm/sec
- (C) 413.5 cm/sec
- (D) 500 cm/sec

Answer: Option B

Question No. 242

For house drainage minimum gradient is

- (A) 1 in 60
- (B) 1 in 80
- (C) 1 in 10
- (D) 1 in 400

Answer: Option A

Question No. 243

For estimating the peak run off the rational formula $Q = 0.0278 KpA$ was evolved by

- (A) Kinchling
- (B) Lloyd Davis
- (C) Frubling
- (D) All the above

Answer: Option D

Question No. 244

A rain sanitary sewer is constructed to carry

- (A) Sanitary sewage
- (B) Storm sewage
- (C) Surface water
- (D) Ground water

Answer: Option A

Question No. 245

The most effective arrangement for diverting excess storm water into a natural drainage, is

- (A) Leaping weir
- (B) Overflow weir
- (C) Siphon spill way
- (D) None of these

Answer: Option C

Question No. 246

The drop man holes are generally provided in sewers for

- (A) Industrial areas
- (B) Large town ships
- (C) Hilly town ships
- (D) Cities in plains

Answer: Option C

Question No. 247

For a peak discharge of 0.0157 cumec, with a velocity of 0.9 m/sec, the diameter of the sewer main, is

- (A) 10 cm
- (B) 12 cm
- (C) 15 cm
- (D) 18 cm

Answer: Option C

Question No. 248

For design purposes, the normal rate of infiltration of ground water into the sewer, is

- (A) 500 litres/km/cm
- (B) 1000 litres/km/cm
- (C) 1500 litres/km/cm
- (D) 2000 litres/km/cm

Answer: Option D

Question No. 249

You are asked to design sewer pipes of diameters 0.4 m to 0.9 m at maximum flow, you will assume the sewer flow running at

- (A) Full depth
- (B) Half full
- (C) Two third full
- (D) Three fourth full

Answer: Option B

Question No. 250

The algae dies out in the zone of

- (A) Degradation

- (B) Active decomposition
 - (C) Recovery
 - (D) Cleaner water
- Answer: Option A

Question No. 251

In a sludge digestion tank if the moisture content of sludge V_1 litres is reduced from p_1 % to p_2 % the volume V_2 is

- (A) $[(100 + P_1)/(100 - P_2)] V_1$
- (B) $[(100 - P_1)/(100 + P_2)] V_1$
- (C) $[(100 - P_1)/(100 - P_2)] V_1$
- (D) $[(100 + P_2)/(100 - P_1)] V_1$

Answer: Option C

Question No. 252

Assertion (A) : Discharging the effluents from the oxidation ponds just up stream of lakes or reservoirs is undesirable.

Reason (R) : The discharged algae get settled in the reservoirs and cause anaerobic decomposition and other water qualities.

- (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

Answer: Option A

Question No. 253

The sewage treatment in septic tanks is due to

- (A) Anaerobic decomposition
- (B) Aerobic decomposition
- (C) Parasitic decomposition
- (D) None of these

Answer: Option A

Question No. 254

The dimensions of a rectangular settling tank are: length 24 m, width 6 m and depth 3 m. If 2 hour detention period for tanks is recommended, the rate of flow of sewage per hour, is

- (A) 204 cu.m
- (B) 208 cu.m
- (C) 212 cu.m
- (D) 216 cu.m

Answer: Option D

Question No. 255

If ' n ' is the rugosity coefficient, ' r ' is the hydraulic depth, ' s ' is the bed slope of sewer, the velocity of flow in m/sec may be obtained by the formula $V = (1/n) r^{2/3} s^{1/2}$ evolved by

- (A) Chezy
- (B) Manning
- (C) Bazin
- (D) Kutter

Answer: Option B

Question No. 256

Disposal to sewage in large cities, is done in

- (A) Irrigation
- (B) Dilution
- (C) Oxidation
- (D) Purification

Answer: Option B

Question No. 257

3.0 ml of raw sewage is diluted to 300 ml. The D.O. concentration of the diluted sample at the beginning of the test was 8 mg/l. After 5 day-incubation at 20°C, the D.O. concentration was 5 mg/l. The BOD of raw sewerage is

- (A) 100 mg/l
- (B) 200 mg/l
- (C) 300 mg/l
- (D) 400 mg/l

Answer: Option C

Question No. 258

The digested sludge from septic tanks, is removed after a maximum period of

- (A) 3 years
- (B) 3.5 years
- (C) 4 years
- (D) 5 years

Answer: Option A

Question No. 259

Assertion (A): The minimum self cleansing velocity in the sewer, at least once a day, must be generated.

Reason (R): If certain deposition takes place and is not removed, it obstructs free flow and causes further deposition leading to complete blocking of the sewer.

- (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

Answer: Option A

Question No. 260

The presence of free ammonia in sewage, is detected by

- (A) Boiling
- (B) Adding potassium permanganate
- (C) Adding sulphuric acid
- (D) Phenol-di-sulphuric acid

Answer: Option A

Question No. 261

Dry water flow in a combined sewer, is

- (A) Industrial sewage
- (B) Domestic sewage
- (C) Storm water
- (D) Inclusive of domestic and industrial sewage but excludes storm water

Answer: Option C

Question No. 262

The porosity of sediments in sewer pipes, is usually taken as

- (A) 0.010
- (B) 0.011
- (C) 0.012
- (D) 0.013

Answer: Option D

Question No. 263

In sewage having fully oxidised organic matter, the nitrogen exists in the form of

- (A) Nitrites
- (B) Nitrates
- (C) Free ammonia
- (D) Aluminoid nitrogen

Answer: Option B

Question No. 264

The minimum diameter of sewer to be adopted is

- (A) 10 cm
- (B) 12.5 cm
- (C) 15 cm
- (D) 25 cm

Answer: Option C

Question No. 265

If the diameter of sewer is 225 mm, the gradient required for generating self cleansing velocity, is

- (A) 1 in 60
- (B) 1 in 100
- (C) 1 in 120
- (D) None of these

Answer: Option C

Question No. 266

The sewerage system consists of

- (A) House sewer
- (B) Lateral sewer
- (C) Branch sewer
- (D) All of these

Answer: Option D

Question No. 267

Clogging of sewers, is caused due to

- (A) Silting
- (B) Low discharge
- (C) Greasy and oily matters
- (D) All the above

Answer: Option D

Question No. 268

Oxidation process results in the formation of

- (A) Carbon dioxide
- (B) Nitrates
- (C) Sulphates
- (D) All the above

Answer: Option D

Question No. 269

The sewage is pumped up

- (A) From low lying areas
- (B) From flat areas
- (C) From basements
- (D) All the above

Answer: Option D

Question No. 270

The angle subtended by the surface of sewer water with partial flow, at sewer centre is 120° , the depth of sewerage is

- (A) 20 cm
- (B) 25 cm
- (C) 40 cm
- (D) 50 cm

Answer: Option D

Question No. 271

Pick up the correct statement from the following:

- (A) Turbidity is more in strong sewage
- (B) The black colour indicates septic sewage

(C) The sewage omits offensive odours after four hours

(D) All the above

Answer: Option D

Question No. 272

If the grit in grit chambers is 4.5 million litres per day, its cleaning is done

(A) Manually

(B) Mechanically

(C) Hydraulically

(D) Electrically

Answer: Option A

Question No. 273

Which one of the following tests is used for testing sewer pipes?

(A) Water test

(B) Ball test

(C) Mirror test

(D) All of these

Answer: Option D

Question No. 274

The ratio of depths at partial flow with central angle α and at full flow of a sewer, is

(A) $1 - \sin \alpha/\beta$

(B) $1 - \cos \alpha/2$

(C) $\frac{1}{2} (1 - \cos \alpha/2)$

(D) $\frac{1}{2} (1 - \sin \alpha/2)$

Answer: Option C

Question No. 275

The non-clog pump which permits solid matter to pass out with the liquid sewage, is

(A) Centrifugal pump

(B) Reciprocating pump

(C) Pneumatic ejector

(D) None of these

Answer: Option A

Question No. 276

With self cleansing velocity in sewers

(A) Silting occurs at bottom

(B) Scouring occurs at bottom

(C) Both silting and scouring occur at bottom

(D) Neither silting nor scouring occurs at bottom

Answer: Option D

Question No. 277

When drainage to sewage ratio is 20, the peak dry weather flow is

- (A) 20% of the design discharge
- (B) Slightly less than 5% of the design discharge
- (C) Slightly more than 5% of the design discharge
- (D) None of these

Answer: Option B

Question No. 278

As compared to fresh river water, sea water contains oxygen

- (A) 10% less
- (B) 20% less
- (C) 10% more
- (D) 20% more

Answer: Option B

Question No. 279

Flocculated particles do not change their

- (A) Size
- (B) Shape
- (C) Weight
- (D) None of these

Answer: Option D

Question No. 280

Imhoff cone is used to determine

- (A) Settleable solids
- (B) Suspended solids
- (C) Dissolved solids
- (D) None of these

Answer: Option A

Question No. 281

For providing an Indian type W.C., the R.C.C. slabs in the toilet portion

- (A) Should be sunk by 20 cm
- (B) Should be kept 20 cm above the adjacent portion
- (C) Should be sunk by 50 cm
- (D) Need not be sunk

Answer: Option C

Question No. 282

Discrete or granular particles change their

- (A) Size
- (B) Shape
- (C) Weight

(D) None of these

Answer: Option D

Question No. 283

The sewer pipe which carries sewage from a building for immediate disposal is

(A) House sewer

(B) Lateral sewer

(C) Intercepting sewer

(D) Main sewer

Answer: Option A

Question No. 284

The ratio of design discharge to the surface area of a sedimentation tank is called

(A) Surface loading

(B) Overflow rate

(C) Overflow velocity

(D) All of these

Answer: Option D

Question No. 285

In SI units the power of sound is represented in

(A) Kgs

(B) Joules

(C) Newtons

(D) Watts

Answer: Option D

Question No. 286

Which one of the following resists hydrogen sulphide corrosion?

(A) R.C.C.

(B) Glazed stone wares

(C) Asbestos cement

(D) Glazed ware

Answer: Option D

Question No. 287

The width of a rectangular sewer is twice its depth while discharging 1.5 m/sec. The width of the sewer is

(A) 0.68 m

(B) 0.88 m

(C) 1.36 m

(D) 1.76 m

Answer: Option C

Question No. 288

In olden days the type of section adopted in trunk and out fall sewers was

- (A) Parabolic shaped
- (B) Horse shoe shaped
- (C) Egg shaped
- (D) Circular shaped

Answer: Option B

Question No. 289

For the survival of fish in a river stream, the minimum dissolved oxygen is prescribed

- (A) 3 ppm
- (B) 4 ppm
- (C) 5 ppm
- (D) 10 ppm

Answer: Option B

Question No. 290

In primary sedimentation, the 0.2 mm inorganic solids get separated if specific gravity is

- (A) 2.25
- (B) 2.50
- (C) 2.55
- (D) 2.65

Answer: Option D

Question No. 291

The coagulant widely used for sewage treatment, is

- (A) Alum
- (B) Ferric chloride
- (C) Ferric sulphate
- (D) Chlorinated copperas

Answer: Option B

Question No. 292

House connections to the laterals is generally made by

- (A) R.C.C.
- (B) P.C.C.
- (C) Cast iron
- (D) Glazed stonewares

Answer: Option D

Question No. 293

The ratio of minimum hourly flow to the average flow of sewage is

- (A) 1/4
- (B) 1/3
- (C) 1/2

(D) 3/4

Answer: Option B

Question No. 294

In R.C. sewer pipes, the percentage longitudinal reinforcement to the cross-sectional area of concrete is kept

(A) 10.0

(B) 5.0

(C) 2.0

(D) 0.25

Answer: Option D

Question No. 295

Removal of oil and grease from sewage, is known

(A) Screening

(B) Skimming

(C) Filtration

(D) None of these

Answer: Option B

Question No. 296

Rate of flow of sewage is generally assumed

(A) More than the rate of water supply

(B) Equal to the rate of water supply

(C) Less than the rate of water supply

(D) At 150 litres per capita

Answer: Option D

Question No. 297

The gradient of sewers depends upon

(A) Velocity of flow

(B) Diameter of the sewer

(C) Discharge

(D) All the above

Answer: Option D

Question No. 298

If the depth of partial flow in a sewer of diameter 2 m, is 50 cm, its wetted perimeter is

(A) π

(B) $\pi/2$

(C) $\pi/3$

(D) $2\pi/3$

Answer: Option D

Question No. 299

The standard B.O.D. of water is taken for

- (A) 1 day
- (B) 2 days
- (C) 3 days
- (D) 5 days

Answer: Option D

Question No. 300

In sewers the gas generally found, is

- (A) Hydrogen sulphide (H₂S)
- (B) Carbon dioxide (CO₂)
- (C) Methane (CH₄)
- (D) All the above

Answer: Option D

Question No. 301

Fresh sewage may become stale in

- (A) One hour
- (B) Two to three hours
- (C) Three to four hours
- (D) Six hours

Answer: Option C

Question No. 302

The small sewers are cleaned by

- (A) Flushing
- (B) Cane rodding
- (C) Wooden pills
- (D) None of these

Answer: Option A

Question No. 303

The sewage discharge in a detritus tank of a treatment plant is 576 litres/sec with flow velocity of 0.2 m/sec. If the ratio of width to depth is 2, the depth is

- (A) 100 cm
- (B) 110 cm
- (C) 120 cm
- (D) 150 cm

Answer: Option C

Question No. 304

If ' D ' is the diameter of upper circular portion, the area of cross-section of a standard egg shaped sewer, is

- (A) $[(18 + 5\pi)32] D^2$

- (B) $[(12 + 5\pi)32] D^2$
 - (C) $[(18 + 5\pi)16] D^2$
 - (D) $[(82 + 5\pi)32] D^2$
- Answer: Option A

Question No. 305

Drop manholes at the junctions of sewer lines, are provided if

- (A) Invert level of a branch sewer is more than 60 cm that of the main sewer
- (B) Sewer line runs along a main road
- (C) Ordinary manhole cannot be built
- (D) Two sewer lines intersect

Answer: Option A

Question No. 306

In sewage, the solids in mg per litre is

- (A) 100 to 500
- (B) 500 to 1000
- (C) 1000 to 1500
- (D) 1500 to 2000

Answer: Option B

Question No. 307

During purification process of sewage the gas given off, is

- (A) Carbon dioxide
- (B) Hydrogen
- (C) Ammonia
- (D) All the above

Answer: Option D

Question No. 308

The gas evolved in sewers is

- (A) Carbondioxide
- (B) Hydrogen sulphide
- (C) Methane
- (D) All of these

Answer: Option D

Question No. 309

The sewerage system originates from

- (A) House sewers
- (B) Lateral sewers
- (C) Branch sewers
- (D) Main sewers

Answer: Option A

Question No. 310

If a paper moistened with lead acetate for five minutes when placed in manhole turns black. The sewer certainly contains

- (A) Hydrogen sulphide
- (B) Carbon dioxide
- (C) Methane
- (D) Oxygen

Answer: Option A

Question No. 311

In septic tanks, decomposition of organic bacteria, is done by

- (A) Anaerobic bacteria
- (B) Aerobic bacteria
- (C) Both types of bacterias
- (D) None of these

Answer: Option A

Question No. 312

The sewer which transports the sewage to the point of treatment, is called

- (A) House sewer
- (B) Out-fall sewer
- (C) Branch sewer
- (D) Main sewer

Answer: Option B

Question No. 313

Sewer pipes need be checked for

- (A) Minimum flow
- (B) Maximum flow
- (C) Both (a) and (b)
- (D) None of these

Answer: Option C

Question No. 314

To test chemical oxygen demand (C.O.D.) of sewage, organic matter is oxidised by potassium dichromate in the presence of

- (A) Hydrochloric acid
- (B) Sulphuric acid
- (C) Nitric acid
- (D) Citric acid

Answer: Option B

Question No. 315

'D' is the diameter of a circular sewer and ' α ' is the side of a square section sewer. If both are hydraulically equivalent, the relationship which holds good, is

(A) $\pi D^{8/3} = 4 b^{8/3}$

(B) $\pi D^{3/8} = 4 b^{3/8}$

(C) $\pi D^{2/3} = 4 b^{2/3}$

(D) $\pi D^{3/2} = 4 b^{3/2}$

Answer: Option A

Question No. 316

If the diameter of a sewer is 100 mm, the gradient required for generating self cleansing velocity is

(A) 1 in 60

(B) 1 in 100

(C) 1 in 120

(D) None of these

Answer: Option A

Question No. 317

Aerobic activity is maximum

(A) In freshly produced sewage

(B) At sewer pipes

(C) In sewer treatment plants

(D) None of these

Answer: Option A

Question No. 318

In 1000 kg of sewage, the total solids approximate

(A) 0.5 to 1.0 kg

(B) 1 kg to 2.0 kg

(C) 5 kg to 7.5 kg

(D) 7.5 kg to 10 kg

Answer: Option A

Question No. 319

Sewer manholes are generally provided at

(A) The change of gradient

(B) The change of direction

(C) The junctions of sewers

(D) All of these

Answer: Option D

Question No. 320

Before discharging the foul sewage into rivers, it is generally treated by

(A) Screening

(B) Sedimentation

(C) Oxidation

(D) All the above

Answer: Option D