01. Which one the following remedial measures are taken to avoid negative head and air binding in a rapid sand filter?

1. Avoiding the occurrence of excessive negative head
2. Pumping in air
3. Avoiding increase in water temperature
4. Control of algae growth

Select the correct answer using the codes given below

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

02. Match List-I (Equation/Law) with List-II (Related Applications) and select the correct answer using the codes given below the lists:

List – I	List – II
A. Chick's Law	1. Discrete particle settling
B. Darcy-Weisbach equation	2. Head loss in a pipe
C. Stoke's equation	3. Head loss in filters
D. Carmen-Kozeny equation	4. Rate of bacterial kill

Codes :
A. A – 4, B – 2, C – 1, D – 3
B. A – 3, B – 1, C – 2, D – 4
C. A – 4, B – 1, C – 2, D – 3
D. A – 3, B – 2, C – 1, D – 4

03. A flash mixer of 2.0 m^3, with a velocity gradient of mixing mechanism equal to 600/s, and fluid absolute viscosity of 1.0 10^{-3} Ns/m" is continuously operated. What is the power input per unit volume?

(a) 360 W
(b) 720 W
(c) 1440 W
(d) 300 W

04. Match List-I (Treatment Process) with List-II (Removed Matter) and select the correct answer using the code given below the lists:

List – I	List – II
A. Plain Sedimentation	1. Dissolved gases
B. Chemical Precipitation	2. Dissolved solids
C. Slow Sand Filtration	3. Suspended solids with specific gravity more than 1.0
D. Aeration	4. Floating solids
	5. Bacterial cells

Codes :
A. A – 5, B – 1, C – 4, D – 2
B. A – 3, B – 2, C – 5, D – 1
C. A – 5, B – 2, C – 4, D – 1
D. A – 3, B – 1, C – 5, D – 2

05. According to the theory of filtration in water treatment, which of the following mechanisms come into play when water is filtered through a filter bed?

1. Mechanical straining
2. Capillary action
3. Centrifugal force
4. Electro kinetic phenomenon
5. Osmotic force
6. Bacteriological action

Select the correct answer using the code given below
(a) 1, 2, 4 and 6
(b) 2, 3 and 5
(c) 3, 4, 5 and 6
(d) 1, 3, 4 and 6

06. Which of the following are associated with alum coagulation?

1. A decrease of alkalinity in treated water
2. Formation of hydroxide flocs of aluminium
3. A slight decrease of pH in treated water
4. An increase of permanent hardness

Select the correct answer using the code given below:
(a) 1, 2 and 3
(b) 1, 3 and 4
(c) 1, 2, 3 and 4
(d) 2 and 4

07. Chlorides from water are removed by

(a) Lime soda process
(b) Reverse osmosis
(c) Cation exchange process
(d) Chemical coagulation

08. Which one of the following chemicals is employed for dechlorination of water?

(a) Sodium sulphite
(b) Sodium bicarbonate
(c) Calcium carbonate
(d) Hydrogen peroxide

09. Which one of the following is the correct sequence of slow sand filter (SSF), rapid sand filter (RSF), dual media filer (DMF) and mixed media filter (MMF) in the decreasing order of their filtration rates?

(a) MMF~ DMF > RSF > SSF
(b) DMF > RSF > SSF > MMF
(c) RSF > SSF > MMF ~ DMF
(d) SSF > MMF ~ DMF > RSF

10. If total hardness and alkalinity of a water sample are 200 mg/l as $CaC0_3$ and 260 mg/l as $CaC0_3$ respectively, what are the values of carbonate hardness and non- carbonate hardness?

(a) 200 mg/l & zero
(b) Zero & 60 mg/l
(c) Zero & 200 mg/l
(d) 60 mg/l & zero

11. In which treatment unit is "Schmutzdecke" formed?

(a) Sedimentation tank
(b) Rapid sand filter
(c) Coagulation tank
(d) Slow sand filter

12. Match List-I (Disinfectant) with List-II (Property) and select the correct answer using the code given below the lists:

List – I	List – II
A. Chlorine	1. No carcinogenic result
B. Ozone	2. Ineffective in the presence of suspended solids
C. Iodine	3. Not affected by the Ammonium ion
D. Ultra-violet rays	4. Feasible residual content

Codes :
A. A – 4, B – 3, C – 1, D – 2
B. A – 1, B – 2, C – 4, D – 3
C. A – 4, B – 2, C – 1, D – 3
D. A – 1, B – 3, C – 4, D – 2

13. What is the predominating coagulation mechanism for raw water having high turbidity and high alkalinity?

(a) Ionic layer compression
(b) Adsorption and charge neutralization
(c) Sweep coagulation
(d) Inter particle bridging

14. Match List-I (Type of impurity) with List-II (Harm caused) and select the correct answer using the codes given below the lists:

List – I	List – II
A. Excess of nitrates	1. Brackish water
B. Excess of fluorides	2. Goitre
C. Lack of iodides	3. Fragile bones
D. Excess of chlorides	4. Blue babies

Codes :
A. A – 4, B – 2, C – 3, D – 1
B. A – 1, B – 2, C – 3, D – 4
C. A – 4, B – 3, C – 2, D – 1
D. A – 1, B – 3, C – 2, D – 4

15. Which combination of surface water quality parameters will indicate sweep coagulation as the preferred mechanism of coaqulation?

(a) High turbidity - low alkalinity
(b) High turbidity - high alkalinity
(c) Low turbidity - high alkalinity
(d) Low turbidity - low alkalinity

16. Which one of the following processes of water softening requires recarbonation?

(a) Lime-soda ash process
(b) Hydrogen - cation exchanger process
(c) Sodium - cation exchanger process
(d) Demineralization

17. **Consider the following treatment process units in a water treatment plant :**

1. Coagulation
2. Disinfection
3. Sedimentation
4. Filtration

Which is the correct sequence of the process units in the water treatment plant?

(a) 2 - 4 - 3 - 1
(b) 1 - 4 - 3 - 2
(c) 2 - 3 - 4 - 1
(d) 1 - 3 - 4 - 2

18. **The correct sequence of treatment of typical turbid surface water is**

(a) Flocculation, Coagulation, Sedimentation, Filtration
(b) Flocculation, Coagulation, Filtration, Sedimentation
(c) Coagulation, Flocculation, Filtration, Sedi mentation
(d) Coagulation, Flocculation, Sedimentation, Filtration

19. **Consider the following statements: The appropriate method(s) for removal of fluorides from water comprise:**

1. Addition of alum and lime followed by clarification.
2. Passing through beds of activated alumina.

Which of the above statements is/are correct?

(a) Neither 1 nor 2
(b) Both 1 and 2
(c) 1 only
(d) 2 only

20. **If the specific gravity of a suspended particle is increased from 2 to 3, the settling velocity will**

(a) not change
(b) get doubled
(c) get increased by 1.5 times
(d) get increased by 2.25 times