[P118-124(T2)]

SOLUTION

COURSE NAME: Advanced Water treatment

COURSE CODE: CVPA11184A

Q1.

1. Answer:Option b
2. Answer:Option b
3. Answer:Option a.
4. Answer:Option a.
5. Answer:Option c.
6. Answer:Option c.
7. Answer:Option a.
8. Answer:Option b
9. Answer:Option c.
10. Answer:Option b.

Q2.

1. Answer: c

Explanation: Hardness of water is due to the presence of salts of calcium and magnesium. Hard drinking water may have moderate health benefits, but can pose serious problems in industrial settings, where water hardness is monitored to avoid costly breakdowns in boilers, cooling towers, and other equipment that handles water.

2. Answer: a

Explanation: The permanent hardness can be removed by adding $Ca(OH)_2$ as lime and sodium carbonate as soda in water and the process is called lime soda process.

3. Answer: d

Explanation: Due to the presence of dissolved hardness-producing salts, the boiling point of

water is elevated. Elevation in boiling point is one of the most important colligative property. All the other options are correct.

4. Answer: b
Explanation: Unlike temporary hardness, permanent hardness is not destroyed on boiling. Varoius methods are adopted for the removal of permanent hardness like zeolites, lime-soda process etc. All the other options are correct.

5. Answer: c
Explanation: The detention period of a lime soda treatment plant is 2-4 hours to obtain greater clarification.

6. Answer: a
Explanation: Alkaline hardness is due to the presence of bicarbonate, carbonate and hydroxides of the hardness-producing metal ions. This is also called carbonate hardness. It is temporary and can be removed easily by boiling.

7. Answer: c
Explanation: Hardness of water is conventionally expressed in terms of equivalent amount of $CaCO_3$. The total water hardness is the sum of the molar concentrations of Ca^{2+} and Mg^{2+}, in mol/L or mmol/L units.

8. Answer: a
Explanation: The molar mass of $MgSO_4$ is 120 and its n-factor is 2. So, chemical equivalent = Molar mass/ n-factor = 60.

9. Answer: b
Explanation: In the zeolite process, calcium and magnesium are removed from hard water by ion exchange phenomenon.

10. Answer: d
Explanation: The thickness of the layers of filter sand of zeolite softener lies in the range of 75 to 150cm and their functioning is similar to rapid sand filter.