



ii. Write *very shortly* about how to generate energy from the biodegradable organic matter of wastewater, using the idea of the anaerobic degradation. [1 Mark]

b) Choose the most appropriate answer for each of the following: - [13 Marks]

- 1- In the stationary phase of the microbial growth patterns in batch cultures, there is a balance between the activated sludge amount and (*effluent organic load – dissolved oxygen – influent organic load – growth of bacteria – adaptation of bacteria*).
- 2- Treatment of wastewater using activated sludge system followed by discharging into nearest surface water is the predominant type of wastewater treatment, however (*reuse / recovery – groundwater recharge – discharge onto land area – separation of wastewater*) is a better option.
- 3- The actual treatment stage in the activated sludge system for wastewater treatment is the (*secondary settling tank – primary settling tank – thickener – tertiary treatment – disinfection – secondary aeration tank*).
- 4- As an example of nutrient recovery from wastewater, ammonia can be recovered and reused – after several conversions and up taking by some organisms – as (*heavy metals – carbohydrates – an organic fertilizer – a protein*).
- 5- Trickling filter is an example of (*suspended growth – microbial growth – attached growth – activated sludge*) biological wastewater treatment.
- 6, 7- One of the drawbacks present in urban wastewater management system is the (*option – evolution – pollution – concentration – population – dilution*), which causes wastage of resources such as (*liquid wastes – water, N, P & heavy metals – microorganisms – suspended & dissolved solids – solid wastes*).
- 8- Priority pollutants are among the (*radiological – microbiological – physicochemical*) properties of liquid wastes.
- 9- COD is used to measure the amount of (*biological – chemical – organic – inorganic – oxidant – TOC – colloidal*) content of a liquid waste.
- 10- In the liquid waste management system, substitution of a chemical fertilizer with organic fertilizer and substitution of phosphorus in detergents with a biodegradable matter are considered as (*reuse – self-purification – pollution prevention – abuse*) option.
- 11- Activated sludge treatment system for the liquid wastes is considered as: (*a recycling of the wastewater within the same process – pollution prevention at source – an end of pipe measures*).
- 12- Inorganic fertilizers, which discharged into waterways by the drainage of the agricultural wastewaters, cause organic pollution after a period of time due to the .....
  - i. degradation of pesticides and dump of animals that composed of organic matters
  - ii. degradation of sewage that composed mainly of organic matters
  - iii. degradation of aquatic plants that composed of organic matters
  - iv. degradation of the naturally occurring humic materials
  - v. none of the above
- 13- The higher the organic matter content of water, the .....
  - i. lower the oxygen content.
  - ii. higher the BOD results.
  - iii. both of i and ii.
  - iv. none of the previous.



**Question [4]: (20 Marks)**

- a) Calculate the TOC and COD of 7.6 millimoles of pentanoic acid solution in ppm, knowing that the oxidation of pentanoic acid occurs as follows:



- b) What are the organic loading rate and the sludge loading rate of an activated sludge plant treating sewage water, and working with a hydraulic retention time of 5.09 hours and has an influent biochemical oxygen demand of 399 ppm and a mixed liquor suspended solid of 3699 mg/l? then comment on the treatment rate of this treatment plant. [10 Marks]
- c) A sample of a medium strength industrial liquid waste was analyzed, and the results showed that 19% of its content of solids is coarse suspended solids, 13% is dissolved solids and 68% is colloidal solids. According to your knowledge, what will be the first choice for treating this investigated wastewater? Is it *chemical*, *biological* or *physical* treatment? and why? [3 Marks]

----- *Best Wishes* -----

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