

**Note that there is only one correct answer**

1. Natural systems for wastewater treatment in general have a smaller footprint than conventional (technical) systems
  - a. true
  - b. false
2. Natural systems tolerate large fluctuations in wastewater inflow volumes.
  - a. true
  - b. false
3. How large reduction of indicator bacteria can you expect in an infiltration system receiving primary treated wastewater?
  - a. 1-2 logs
  - b. 10-12 logs
  - c. 4-6 logs
4. Where does the main treatment happen in a soil infiltration system?
  - a. In the groundwater or saturated zone
  - b. In the gravel bed circumferencing the infiltration pipe
  - c. In the unsaturated zone above groundwater
5. The phosphorus (P) removal in an infiltration system depends on the P-sorption capacity of the soil or porous media. In a natural soil the soil color can indicate good P-removal capacity. What color indicates good P-removal capacity?
  - a. Brown or red color
  - b. Black color
  - c. Light yellow or white
6. In colder climates the health regulations often require longer safety distances between a groundwater well used for potable water extraction and a pit latrine or wastewater infiltration system. As an example in some African countries it can be as little as 10m and in Scandinavia it is 100m. What do you think is the main reason for this difference?
  - a. Because people in colder climates, as Scandinavians, are more risk oriented
  - b. Because the pathogens survive longer in colder environments
  - c. Because there are less pathogens in warm climate
7. What is the amount of nutrients (nitrogen (N) phosphorus(P)) in wastewater we find in our excreta (feces and urine).
  - a. 90% of N and 90% of P
  - b. 90% of N and 60% of P
  - c. 80% of N and 60% of P
8. What is blackwater?
  - a. Wastewater from showers and bath tub
  - b. Wastewater from the kitchen sink
  - c. Wastewater/excreta from toilets only
9. International research show that dry sanitation may give an equal or higher reduction of pathogens and a high reduction in risk of exposure.
  - a. true
  - b. false

10. The nutrient (nitrogen, phosphorus and potassium) content varies in the different wastewater fractions. Which fraction contains the majority of the nutrients:
- Faeces
  - Urine
  - Greywater.
  - Greywater from the kitchen.
11. What two main elements are reclaimed when struvite is precipitated from wastewater:
- Nitrogen and Potassium
  - Phosphorus and Sulphur
  - Phosphorus and Nitrogen
  - Phosphorus and Potassium
12. The pathogen reduction in the compost is due to:
- UV light
  - Free chlorine
  - Generation of hydrogen sulphide (H<sub>2</sub>S) that is a toxic gas
  - Elevated temperature (above ambient) and microbial processes
13. The C/N content in our excreta is around 7. In order to facilitate composting it should be around 30 so we should add a carbon rich bulking material. Select what you think would be a best bulking material if you want to improve both the C/N ratio and also provide readily available carbon for the processes.
- Ash
  - Sawdust or bark
  - Fine sand
  - Organic household waste (preferably grinded or cut)
14. Correct construction of the ventilation system is crucial in order to avoid smell in a composting toilet. The air should be drawn down through the toilet seat and be expelled above the roof. How can this be facilitated?
- raise the ventilation chimney of a composting toilet above the highest point of the roof?
  - Use a wind fan
  - paint the chimney black or insulate it above the roof
  - all of the above
15. How much water is normally used per flush in a vacuum toilet?
- 10 to 20 litres
  - 4 to 5 litres
  - 0.5 to 1.5 litres
  - 0.1 to 0.5 litres
16. What is considered sufficient storage time for urine prior to land application?
- Two years
  - 20 years
  - Two months
  - Six months

17. Soil infiltration systems are characterized by:
- Robustness, high treatment efficiency, enables groundwater recharge and have high potential for phosphorus recovery.
  - Robustness, high treatment efficiency, enables groundwater recharge, but have low potential for phosphorus recovery.
  - Robustness, variable treatment efficiency, enables groundwater recharge, but have low potential for phosphorus recovery.
  - Robustness, relatively low treatment efficiency, enables groundwater recharge, but have low potential for phosphorus recovery.
18. What is the correct statement ?
- Package treatment plants have low investment costs, low operational costs, but have high treatment performance on phosphorus and nitrogen
  - Package treatment plants have low investment costs, low footprint, high operational costs, but have high treatment performance on phosphorus and nitrogen.
  - Package treatment plants have low investment costs, low footprint, high operational costs, but have high treatment performance on phosphorus and nitrogen.
  - Package treatment plants have low investment costs, low footprint, relatively high operational costs and have shown variable treatment performance.
19. What is the explanation for malfunctioning package treatment plants
- Sludge should be pumped more often
  - Run out of coagulants
  - General lack of operation and maintenance (knowledge missing)
  - All above
20. Viruses are mainly removed by inactivation when transported with the groundwater in cold climate
- Yes
  - No
21. Viruses are mainly removed by filtration mechanisms when transported with the groundwater in cold climate.
- Yes
  - No
22. Climate Change in Scandinavia may:
- increase pollution concentrations in influent to WWTPs
  - increase the wastewater volumes to the WWTPs
  - reduce to snow melting during winters
  - negatively impact on water availability
23. When the winter air temperatures are increasing due to Climate Change
- amount and frequency of snow fall will reduce
  - amount of rain frequency will increase while the amplitude will decrease
  - wastewater concentration will increase
  - wastewater temperature will reduce
24. Lower wastewater temperatures may
- increase biological degradation
  - generate larger flocs during coagulation
  - require increased sedimentation volumes

- d. reduce optimal coagulant dosage
25. A rapidly urbanising medium size city in an Arctic region requires to increase the capacity of the existing biological WWTP. What can be a viable solution?
- a. Add a coagulation stage after the existing biological stage
  - b. Add a coagulation stage after the existing mechanical stage
  - c. Add a coagulation stage before the existing mechanical stage
  - d. Add a membrane unit after mechanical stage
26. What is a specific advantage of an MBBR process in a cold climate?
- a. Microorganisms will be more active compared with activated sludge process
  - b. Require less oxygen
  - c. Require less reactor volume
  - d. Will require less energy per reactor volume unit
27. Which statement is true during an upgrading of a WWTP in a cold climate?
- a. Coagulation is not advisable as floc formation process will slow down and increasing flocculation and sedimentation tank volumes will be inevitable
  - b. Fine sieves are not advisable as they may get clogged faster due increased viscosity of ww
  - c. Active control of coagulant and flocculent dosing is advisable
  - d. Conversion to fully automated membrane processes instead of biological process is advisable
28. What is the main process advantage of having WWTPs inside rocks as in Norway?
- a. Increased safety
  - b. Less melted snow in influent
  - c. Higher wastewater temperature
  - d. Reduces nitrification rates
29. What could be an impact of the cold climate?
- a. Reduced nitrification activities
  - b. Increased settling speeds
  - c. Increased solids separation efficiencies with modern fine screens
  - d. More concentrated influents
30. What could be a significant disadvantage of cold climate?
- a. Required treatment efficiencies are impossible to achieve
  - b. MBBR processes are slowed down favouring Activated Sludge processes
  - c. Increased chemical costs during coagulation
  - d. Increased pollution concentrations leading to increased operational costs