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**CHEMICAL ENGINEERING REFRESHER COURSE**  
**STOICHIOMETRY AND ENVIRONMENTAL ENGINEERING**

1. How many additional chemicals were added last May 2009 to the original list of POPs prohibited by the Stockholm Convention?
  - a. 9
  - b. 10
  - c. 11
  - d. 12
2. Perfluoro Octane Sulfonate or also known as PFOS is one of the recently banned POPs and was key ingredient in Scotchgard, which is a popular fabric protector made by which global manufacturing giant?
  - a. 3M
  - b. Elmer's
  - c. SC Johnson
  - d. Henkel
3. It is the international stature that is the primary basis of the Philippines in its latest environmental dispute with Canada.
  - a. Kyoto Protocol
  - b. Copenhagen Talks
  - c. Basel Convention
  - d. None of the Above
4. Which of the following true about PCBs?
  - i. PCB stands for Polychlorinated Biphenols.
  - ii. The resistance of a specific PCB to degradation is directly proportional to the number of Chlorine atoms in its molecule.
  - a. Only (i)
  - b. Only (ii)
  - c. Both (i) and (ii)
  - d. Neither (i) nor (ii)
5. All of the following are part of the Global Sustainable Development Goals (SDG) set by the United Nations except:
  - a. Reduced Inequalities
  - b. Quality Education
  - c. Ozone Protection and Clear Air
  - d. Sustainable Cities and Communities
6. Which of the following refers to the Clean Water Act of 2004?
  - a. RA 9256
  - b. RA 9275
  - c. RA 9572
  - d. RA 9527
7. Industrial water supply and fishery water is considered to be under which class of bodies of freshwater according to DENR's Administrative Order 34 on the Classification and Water Quality Criteria?
  - a. A
  - b. B
  - c. C
  - d. D

8. Proper plastic recycling is easily facilitated by using the same type of materials in the actual process. Which of the following numbers is the official designated number for Polyvinyl Chloride?
- a. 3
  - b. 4
  - c. 5
  - d. 6
9. Determine the BOD<sub>2</sub> of a sample wastewater if its BOD<sub>5</sub> is 135 mg/L with a rate constant of 0.23/day.
- a. 197.55 mg/L
  - b. 72.84 mg/L
  - c. 40.6 mg/L
  - d. None of the above
10. The ozone layer or the ozone shield is a region of the earth's stratosphere that absorbs most of the sun's UV rays and protects living things from this harmful element. Who discovered the ozone layer?
- a. Sydney Chapman
  - b. GM Dobson
  - c. Both (a) and (b)
  - d. Neither (a) nor (b)
11. An illegally buried drum of toluene has begun to leak into an unconfined drinking water aquifer. A homeowner's well is located 60 meters down from the leaking drum. If the soil has a retardation coefficient of 17 for toluene and the linear speed of the water in the aquifer is  $4.7 \times 10^{-6}$  m/s, how long will it take for the said contaminant to reach the well?
- a. 10.3 months
  - b. 3.44 years
  - c. 6.88 years
  - d. 13.76 years
12. In solid waste composting, one has to balance the nitrogen and carbon content of the compost in order to optimize the composting time and its odorous character. What is the ideal and recommended carbon-to-nitrogen ratio for composting?
- a. 20:1
  - b. 50:1
  - c. 30:1
  - d. 40:1
13. Among all of the biogeochemical cycles, Phosphorus cycle is considered an exception in terms of its sink and source because the rest of the cycles involve only the \_\_\_\_\_
- a. Lithosphere
  - b. Hydrosphere
  - c. Atmosphere
  - d. None of the above
14. What is the first and topmost preferred option of dealing with solid wastes according to the hierarchy of solid waste management?
- a. Treatment
  - b. Recycling
  - c. Disposal
  - d. Source Reduction
15. 765 cubic meters per day of solid waste are dumped at a landfill 5 days in a week. The same waste is compacted to twice its delivered density. If a sanitary landfill has available space of 16.2 hectares at an average depth of 10 m, what is the expected life of the landfill in years.
- a. 8 years
  - b. 12 years
  - c. 24 years
  - d. None of the above
16. Which of the following acid combination is the dominant composition of acid rain?
- a. Nitric acid and sulfuric acid
  - b. Carbonic acid and sulfuric acid
  - c. Nitric acid and carbonic acid
  - d. None of the above
17. How many meters of a weir will be required by a wastewater flowrate of 0.5 cubic meters per second and assuming a loading rate of 150 m<sup>3</sup>/day-meter?
- a. 144 meters
  - b. 216 meters
  - c. 288 meters
  - d. 432 meters
18. It is an odorless and colorless gas that is lethal to humans with exposure as short as a few minutes to concentrations exceeding 5000 ppm. It reacts with hemoglobin in the blood rendering the latter incapable of carrying oxygen to the body.
- a. Carbon Monoxide
  - b. Nitrogen Dioxide
  - c. Sulfur Dioxide
  - d. Sulfur Trioxide

19. The following test results were obtained for a wastewater sample taken from a treatment plant. All of the tests were performed using a sample size of 50 mL. Determine the concentration of the volatile dissolved solids in the wastewater.

Tare Mass of Evaporating Dish	62.003 g
Mass of Evaporating Dish plus residue after evaporation at 105C	62.039 g
Mass of Evaporating Dish plus residue after ignition at 550C	62.036 g
Tare Mass of whatman filter paper	1.540 g
Residue on whatman filter paper after drying at 105C	1.552 g
Residue on whatman filter paper after ignition at 550C	1.549 g

- a. 60 mg/L  
b. 240 mg/L  
c. 120 mg/L  
d. None of the above
20. Using the same data in the previous number, what is the total suspended solids in the wastewater?  
a. 60 mg/L  
b. 240 mg/L  
c. 120 mg/L  
d. None of the above
21. Which metals form the alloy that serve as the reference basis of the SI unit of kilogram  
a. Palladium and Iridium  
b. Platinum and Iridium  
c. Platinum and Palladium  
d. None of the above
22. Fifty grams of sucrose when burned will require how much theoretical oxygen?  
a. 56.14 grams  
b. 84.21 grams  
c. 112.28 grams  
d. None of the above
23. What is the density of an unknown gas if its specific gravity at STP is 1.83?  
a. 1.83 g/L  
b. 1.83 g/mL  
c. 1.83 g/m<sup>3</sup>  
d. None of the above
24. Lye reacts with chlorobenzene to produce phenol. What is the maximum possible conversion that can be reached by the excess reactant if 1200 kg of the former is combined with 1320 kg of the latter to produce 1000 kg of phenol?  
a. 39.13%  
b. 35.47%  
c. 31.05%  
d. None of the above
25. How do you call the type of materials which do not directly participate in the actual manufacturing process and are also not coming out as part of the final product?  
a. Primary Materials  
b. Premium Materials  
c. Auxiliary Materials  
d. Ancillary Materials
26. Ethyl alcohol is produced from sugar cane at a rate of 100,000 L/day at 99.5% v/v. Fermentation occurs at a rate of 0.511 kg ethanol per kg of fermentable sugar. Assuming that the syrup is 53% fermentable sugar and that the cane juice is 25% syrup with distillation and fermentation being 99% and 90% efficient respectively, calculate the amount of cane juice feed in tons per day.  
a. 1024  
b. 1056  
c. 1303  
d. 1408
27. Referring to the same data and cane juice feed from the previous question, what percent of the ideal ethanol production amount is actually produced?  
a. 89.1%  
b. 96.4%  
c. 98.5%  
d. None of the above

28. For the ultimate analysis given below for a certain coal and assuming that the furnace secures complete combustion, 80% excess air, all sulfur comes out as  $\text{SO}_2$  and that the combustible matter left in the ash from the furnace is negligible,

C	H	N	S	Ash
57.22%	5.64%	1.41%	3.65%	14.67%

Calculate the percentage net hydrogen in the fuel.

- a. 5.77%  
b. 4.51%  
c. 3.43%  
d. 6.12%
29. Calculate the percentage of nitrogen in the dry flue gas on an  $\text{SO}_2$  free basis for the same coal in the previous problem.  
a. 80.6%  
b. 75.7%  
c. 83.4%  
d. None of the above
30. E10 is a regular unleaded petrol blended with ethanol that is compatible with majority of petrol-powered cars on the road today. What is the mass percent of oxygen in this fuel?  
a. 1.05%  
b. 5.91%  
c. 9.36%  
d. 3.63%
31. A wet solid contains 60% moisture and needs to be dried to 10% moisture using 20,000 kg/hr of air. If the humidity of the incoming air is 0.01 kg water / kg dry air and assuming 1000 kg/hr of the feed, determine the percentage increase in the weight of the air as it exits the process.  
a. 1.4%  
b. 2.8%  
c. 3.5%  
d. None of the above
32.  $\text{C}_4\text{H}_{10}$  undergoes combustion with 50% excess air. The percent conversion is 90% and 25% of which reacts to form carbon monoxide. Calculate the %CO in the dry flue gas?  
a. 2%  
b. 3.5%  
c. 5%  
d. None of the Above
33. What is the percentage moisture of the flue gas in the previous problem?  
a. 8.8%  
b. 9.1%  
c. 10%  
d. None of the above
34. Most of the time, air is assumed to be dominantly composed of oxygen and nitrogen. With this assumption, what is the mass percentage of oxygen in air?  
a. 21  
b. 23  
c. 77  
d. 79
35. A distillation column separates 10,000 kg/hr of a 50-50 benzene toluene mixture. The product recovered from the condenser at the top of the column contains 95% benzene and the bottom contains 96% toluene. The vapour stream entering the condenser from the top of the column is 8000 kg/hr. A portion of the product from the condenser is returned to the column as reflux and the rest is withdrawn for other use. What is the recycle ratio (R/D)?  
a. 78%  
b. 60%  
c. 58%  
d. 46%
36. A gasoline was determined to have an octane rating of 95 and was burned in a brand new engine. What is the percentage of the carbon dioxide in the Orsat analysis. Assume complete combustion of the fuel and theoretical oxygen is supplied?  
a. 61.71%  
b. 73.34%  
c. 85.33%  
d. None of the above
37. What is the percentage of water vapor in the wet flue gas for the previous problem?  
a. 12.61%  
b. 14.04%  
c. 14.67%  
d. 38.29%

