

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Water Quality Management (25%)

1. After receiving the discharge from a wastewater treatment plant, a river has a dissolved-oxygen concentration of 8 mg O₂/L and an ultimate CBOD of 20 mg O₂/L. The saturation dissolved oxygen concentration is 10 mg O₂/L, deoxygenation rate coefficient k_1 is 0.2/day, and the reaeration rate coefficient k_2 is 0.6/day. The river travels at a velocity of 10 km/day. Calculate the location of the critical point (time and distance) and the oxygen deficit and concentration at the critical point (25 %).

Hint: using the first-order kinetics $\frac{dO_2}{dt} = k_2 \times D - k_1 \times L$ to build the DO sag curve's model

Air Quality Control (25%)

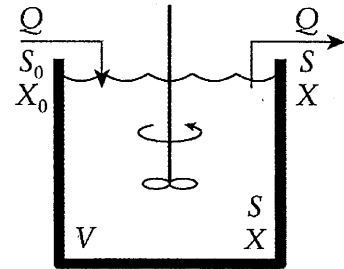
2. Cutting the coal-burning allowance of the coal-fired Taichung power plant in is one way to improve the air quality of central Taiwan. What are the other sources of air pollution which have the potential to be better controlled for better air quality in central Taiwan (12%)?
3. Please use the emission factor model to estimate carbon monoxide emission from oil combustion for an industrial boiler that burns 180,000 L of distillate oil per day. According to AP-42, the CO emission factor for industrial boilers that burn oil distillate is 0.6 kg CO per m³ of oil that is burned (13 %).

Waste and Resource Management (25%)

4. In the operation of sanitary landfills, what are the purposes of installing geosynthetic liner and gas vents (8%)?
5. The mass composition of a kind of dry waste is 48 % carbon, 12% hydrogen, 32% oxygen, and 8% other. Estimate the liters of air required to burn a kg of this dry waste. Assume carbon dioxide and water are the only products of combustion of carbon, hydrogen, and oxygen. Assume a temperature of 20°C and pressure of 1 atm (17%).

Wastewater Treatment (25%)

6. A well-mixed biological reactor such as the picture below (with no cells in the inflow) must be operated so that an influent BOD of 600 mg/L is reduced to 60 mg/L. The kinetics constants have found to be that the half-saturation constant $K_s = 500$ mg/L and the maximum growth rate constant $\mu_m = 4$ d⁻¹. If the flow is 4 m³/day, how large should the reactor be (15%)?



A suspended growth reactor with no recycle.

7. Please describe the method to measure the Sludge Volume Index (SVI) with the equation to calculate SVI. What is the water treatment implication of a water sample with high SVI (10%)?