

1. 下水道管線在頂冠及靠近常水位的位置常會發生腐蝕，進而影響下水道管線的壽命，說明造成下水道管線腐蝕的原因及可能的控制方法。(15 分)
2. 2021 年 1 月寒流來襲期間，台北市及新北市部分區域出現自來水黃濁現象，調查後推測為低溫導致水庫內的蓄水發生翻攪而造成。
 - (a) 以圖示說明並解釋水庫分層及溫差造成蓄水翻攪的現象。(10 分)
 - (b) 經水質檢測後發現水庫原水中溶解態錳濃度偏高。除了可能的健康影響外，說明溶解態錳對自來水供水可能造成的影響，並提出淨水廠內可行的處理方法 (15 分)
3. 世界各國以封城方式防堵新冠肺炎(Covid-19)的擴散，很多大企業、學校也以遠距工作或遠距教學的方式運行。試說明這樣的措施對辦公大樓或學校建物內自來水水質可能的影響。(10 分)
4. (a) Explain the purpose and mechanisms of coagulation. (5 分)
(b) Sketch a particle showing the charge in electrical double layer. (5 分)
5. (a) Describe the sedimentation theory (Type I, II, III, and IV settling) and where they are applied in water/wastewater treatment. (10 分)
(b) In a dilute suspension, prove the terminal settling velocity (v_s) of spherical particles following the equation: (10 分)
$$v_s = \frac{g(\rho_p - \rho_w)d_p^2}{18\mu}$$

where
 g = acceleration due to gravity; d_p = particle diameter; ρ_p = density of particle; ρ_w = density of water; μ = dynamic viscosity
6. Explain the difference between the suspended growth and attached growth biological processes. Which one you prefer to use in a secondary wastewater treatment? Why? (10 分)
7. To improve the nitrogen removal efficiency, an anoxic and aerobic (AO) process is proposed in a secondary municipal wastewater treatment plant. Please draw a schematic diagram and describe all the process, role of microorganisms, and mechanisms for nitrogen removal. (10 分)