

※ 考生請注意：本試題不可使用計算機

1. An engineer is planning the electricity supply for an isolated city. He wants to make the system as energy efficient and environmentally friendly as possible, but his options are limited. The two options he is considering are as follows.

Option 1: coal-burning power station on a coal field approximately 300 km from the city, with high-voltage transmission lines between them.

Option 2: diesel power station in the city, generating power at the desired voltage (250 V AC)

In Option 1, the efficiency of the various stages in the process is as follows.

- efficiency of the generating plant (coal to electricity) – 60%
- efficiency of the long-distance, high-voltage transmission lines – 90%
- efficiency of the transformers to convert high voltage to 250 V in the city – 90%

In Option 2, the diesel power station is approximately 60% efficient (oil fuel to electricity, ready to use).

(a) What percentage of the coal's energy reaches the city?(5pt.)

(b) Assume one kilogram of diesel-oil fuel used contains 8000 kJ of energy. How much of the energy contained in the diesel-oil fuel is not converted to electricity when burnt in the power station?(5pt.)

(c) What kind of pollution is possibly generated by Option 1? Please state your control strategy to prevent (or solve) this problem. (10pt.)

2. (a) Please design a secondary municipal wastewater treatment plant (MWWTP). Draw a diagram to illustrate every treatment unit and the direction of the wastewater flow clearly. Describe the function of each treatment unit.(15pt.)

(b) Mercury is a naturally occurring metal that is present in several forms. The source of mercury in municipal wastewater may come from household bleach, dental amalgam, batteries, electric lighting, pesticides, household detergents and cleaners, laboratory chemicals, inks and paper coatings, lubrication oils, wiring devices, etc. Is the MWWTP you designed sufficient to remove mercury from wastewater? State your reason clearly.(15pt.)

(背面仍有題目,請繼續作答)

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3.The governments and local authorities are planning to incorporate microbial approach in the solid waste treatment of the city. What factors need to be considered before they launch the plan? (15pt.)

4.The Hydraulic Conductivity, K (m/s) is critical in determining the formation of leachate in landfills.

$$K = Cd \frac{\gamma}{\mu} = k \frac{\gamma}{\mu}$$

where C = dimensionless constant or shape factor,
 d = average size of pores
 γ = specific weight of water
 μ = dynamic viscosity of water
 k = intrinsic permeability.

There are two typical intrinsic permeability values, 10^{-12} m^2 and 10^{-10} m^2 for compacted solid waste in a landfill. Please assign which value is for vertical intrinsic permeability and which value is for horizontal intrinsic permeability. State your reason.(15pt.)

5.Please state the definition of the following glossaries:

- (a)Renewable energy(5pt.)
- (b)PPCPs(5pt.)
- (c)Eutrophication(5pt.)
- (d)DNAPL(5pt.)