

科目	質能均衡	適用 系別	化工系三年級	時間	80分鐘
----	------	----------	--------	----	------

※ 請務必在答案卷作答區內作答 ※ 共 1 頁第 1 頁

1. (25%) Sea water is to be desalinated by reverse osmosis using the scheme indicated in Figure 1. Use the data given in the figure to determine: (a) the rate of waste brine removal (B); (b) the rate of desalinated water (called potable water) production (P); (c) the fraction of the brine leaving the reverse osmosis cell (which acts in essence as a separator) that is recycled.

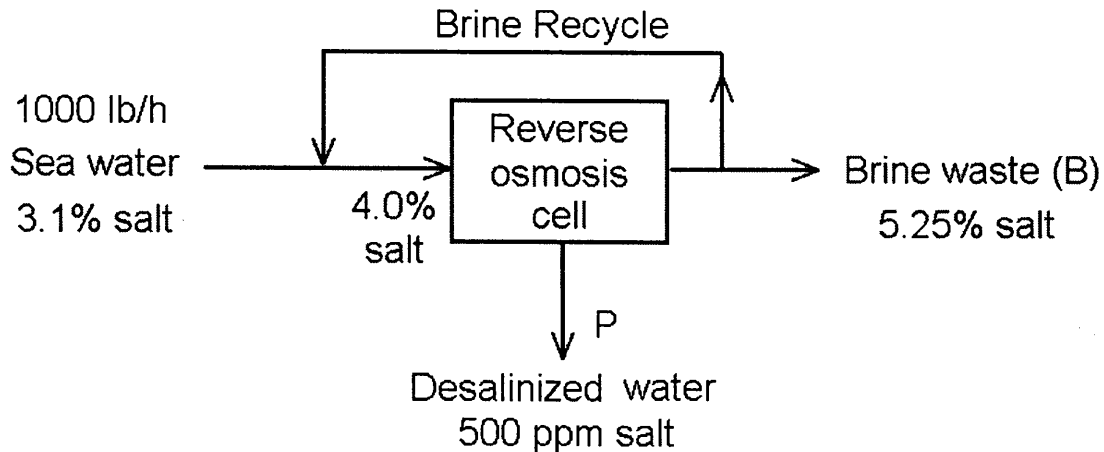


Figure 1

2. (25%) Answer the following questions.
- Explain the purpose of using recycle in a process.
 - Explain the difference in meaning for the term “ppm” used on gases and on liquids/solids.
 - What is the equation to convert gauge pressure to absolute pressure?
 - (Answer yes or no) Will adding a decimal point to a reported number that does not have a decimal point, such as replacing 12,600 with 12,600., improve the precision of the number?
 - What are the reference points of (a) the Celsius and (b) the Fahrenheit scales?
3. (50%) Methane is used as the fuel for a furnace. For a daily operation, air is used as the oxygen source with 25% of excess air and with 50% of moisture saturation. If methane and air is fed to the reactor at 25°C. Based on complete combustion of the fuel, please determine
- The composition of the flue gas (20%)
 - The dew point of the flue gas (7%)
 - The heat of the reaction (7%)
 - If the flue gas is considered as the ideal gas and the constant pressure heat capacity (C_p) is $5/2R$, what is the temperature of the effluent flue gas? (8%)
 - If the flue gas is cooled from effluent temperature (answer of D) to the dew point of the flue gas (answer of B), how much heat should be removed per mole of methane fed to the furnace? (8%)

Reference:

Gas constant: $R = 8.314 \text{ joule/gmol/K}$

Heat of formation: $\Delta H_{\text{CH}_4(\text{g})}^f = -74.84 \text{ kJ/gmol}$, $\Delta H_{\text{CO}_2(\text{g})}^f = -393.51 \text{ kJ/gmol}$,

$\Delta H_{\text{H}_2\text{O}(\text{g})}^f = -241.826 \text{ kJ/gmol}$,

The saturated pressure for water: $\ln(P^*) = 18.3036 - \frac{3816.44}{T(\text{K}) - 43.16}$, P^* in mmHg