

### Question 8.

(1) According to the law of mass action,  
we can get:

$$- \frac{dc_E}{dt} = - \frac{dc_S}{dt} = \frac{dc_{ES}}{dt} = k_1 c_E c_S$$

$$- \frac{dc_{ES}}{dt} = \frac{dc_E}{dt} = \frac{dc_S}{dt} = k_2 c_{ES}$$

$$- \frac{dc_{ES}}{dt} = \frac{dc_E}{dt} = \frac{dc_P}{dt} = k_3 c_{ES}$$

$$\therefore E: \frac{dc_E}{dt} = k_2 c_{ES} + k_3 c_{ES} - k_1 c_E c_S$$

$$S: \frac{dc_S}{dt} = k_2 c_{ES} - k_1 c_E c_S$$

$$ES: \frac{dc_{ES}}{dt} = k_1 c_E c_S - k_2 c_{ES}$$

$$P: \frac{dc_P}{dt} = k_3 c_{ES}$$