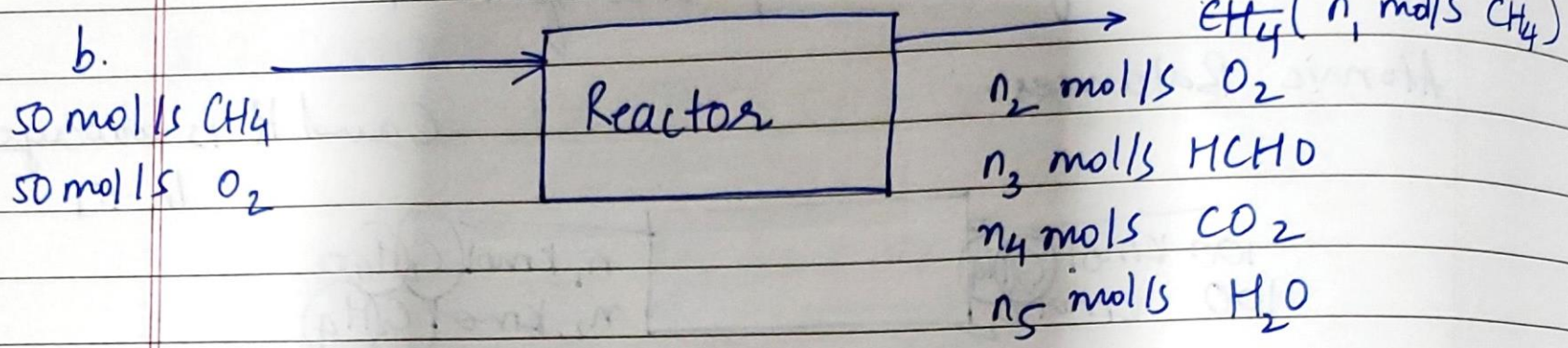
PAGE No.
DATE / /

ICA #10

a. $CH_4 + O_2 \rightarrow HCHO + H_2O$

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

b.



c. Fractional conversion of methane is 0.9

$$0.9 = \frac{50 - n_1}{50}$$

$$45 = 50 - n_1$$

$$\boxed{n_1 = 5 \text{ mol/s } CH_4}$$

d. Fractional yield of formaldehyde = 0.855

$$0.855 = \frac{n_3}{50}$$

$$\boxed{n_3 = 42.75 \text{ mol/s HCHO}}$$

c. Extents of Reactions:

For CH_4:

$$5 - 50 = -1(\xi_1 + \xi_2)$$

$$+45 = \xi_1 + \xi_2$$

For HCHO:

$$n_3 = 1(\xi_1)$$

$$\boxed{\xi_1 = 42.75 \text{ mol/s}}$$

$$\therefore \quad \xi_1 = 45 - \xi_2$$

$$42.75 = 45 - \xi_2$$

$$\xi_2 = 45 - 42.75$$

$$\boxed{\xi_2 = 2.25 \text{ mol/s}}.$$

f) g) For O_2:

$$n_2 - 50 = -\xi_1 - 2\xi_2$$

$$n_2 - 50 = -42.75 - (2 \times 2.25)$$

$$n_2 = -47.25 + 50$$

$$\boxed{n_2 = 2.75 \text{ moles } O_2}$$

For CO_2:

$$n_4 = 1(\xi_2)$$

$$\boxed{n_4 = 2.25 \text{ moles } CO_2}$$

For H_2O:

$$n_5 = \xi_1 + 2\xi_2$$

$$n_5 = 42.75 + 2(2.25)$$

$$\boxed{n_5 = 47.25 \text{ moles } H_2O}$$

h) Selectivity: $\dfrac{\text{no. of moles of HCHO}}{\text{no. of moles of } CO_2}$

$$= \frac{0.4275}{0.0225}$$

$$\boxed{\text{Selectivity} = 19}$$