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Basics of Parallel & Single Reactions Formulas

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List of 16 Basics of Parallel & Single Reactions Formulas

Basics of Parallel & Single Reactions

1) Instantaneous Fractional Yield

Open Calculator

fx $$\varphi = \frac{dP}{dR}$$

ex $$0.6 = \frac{27mol}{45mol}$$

2) Molar Feed Rate of Reactant using Reactant Conversion

Open Calculator

fx $$F_{Ao} = \frac{F_A}{1 - X_A}$$

ex $$5mol/s = \frac{1.5mol/s}{1 - 0.7}$$

3) Molar Flow Rate of Unreacted Reactant using Reactant Conversion

Open Calculator

fx $$F_A = F_{Ao} \cdot (1 - X_A)$$

ex $$1.5mol/s = 5mol/s \cdot (1 - 0.7)$$

4) Number of Moles of Product Formed

Open Calculator

fx $$dP = dR \cdot \varphi$$

ex $$27\text{mol} = 45\text{mol} \cdot 0.6$$

5) Number of Moles of Reactant Reacted

Open Calculator

fx $$dR = \frac{dP}{\varphi}$$

ex $$45\text{mol} = \frac{27\text{mol}}{0.6}$$

6) Overall Fractional Yield

Open Calculator

fx $$\Phi = \frac{P}{R_0 - R_f}$$

ex $$0.6 = \frac{5.835\text{mol}}{15\text{mol} - 5.275\text{mol}}$$

7) Reactor Space Time

Open Calculator

fx $$\tau_{Reactor} = \frac{V_{reactor}}{v_o}$$

ex $$0.254082\text{s} = \frac{2.49\text{m}^3}{9.8\text{m}^3/\text{s}}$$

8) Reactor Space Velocity

Open Calculator

$$s_{Reactor} = \frac{v_o}{V_{reactor}}$$

$$3.935743\text{cycle/s} = \frac{9.8\text{m}^3/\text{s}}{2.49\text{m}^3}$$

9) Space Time using Molar Feed Rate of Reactant

Open Calculator

$$\tau = \frac{C_{A0} \cdot V_{reactor}}{F_{Ao}}$$

$$14.94\text{s} = \frac{30\text{mol/m}^3 \cdot 2.49\text{m}^3}{5\text{mol/s}}$$

10) Space Time using Space Velocity

Open Calculator

$$\tau_{Spacevelocity} = \frac{1}{s}$$

$$16.66667\text{s} = \frac{1}{0.06\text{cycle/s}}$$

11) Space Velocity using Molar Feed Rate of Reactant

Open Calculator

$$s = \frac{F_{Ao}}{C_{A0} \cdot V_{reactor}}$$

$$0.066934\text{cycle/s} = \frac{5\text{mol/s}}{30\text{mol/m}^3 \cdot 2.49\text{m}^3}$$

12) Space Velocity using Space Time

Open Calculator

fx $s = \frac{1}{\tau}$

ex $0.066934\text{cycle/s} = \frac{1}{14.94\text{s}}$

13) Total Product Formed

Open Calculator

fx $P = \Phi \cdot (R_0 - R_f)$

ex $4.8625\text{mol} = 0.5 \cdot (15\text{mol} - 5.275\text{mol})$

14) Total Reactant Fed

Open Calculator

fx $R_0 = \left(\frac{P}{\Phi}\right) + R_f$

ex $16.945\text{mol} = \left(\frac{5.835\text{mol}}{0.5}\right) + 5.275\text{mol}$

15) Total Reactant Reacted

Open Calculator

fx $R = R_0 - R_f$

ex $9.725\text{mol} = 15\text{mol} - 5.275\text{mol}$

16) Total Unreacted Reactant

Open Calculator

fx $$R_f = R_0 - \left(\frac{P}{\varphi}\right)$$

ex $$5.275\text{mol} = 15\text{mol} - \left(\frac{5.835\text{mol}}{0.6}\right)$$

Variables Used

- C_{A0} Concentration of Reactant in Feed *(Mole per Cubic Meter)*
- **dP** Number of Moles of Product Formed *(Mole)*
- **dR** Number of Moles of Reactant Reacted *(Mole)*
- F_A Molar Flow Rate of Unreacted Reactant *(Mole per Second)*
- F_{Ao} Molar Feed Rate of Reactant *(Mole per Second)*
- **P** Total Moles of Product Formed *(Mole)*
- **R** Total Reactant Reacted *(Mole)*
- R_0 Initial Total Moles of Reactant *(Mole)*
- R_f Total Moles of Unreacted Reactant *(Mole)*
- **s** Space Velocity *(Cycle per Second)*
- $s_{Reactor}$ Reactor Space Velocity *(Cycle per Second)*
- v_o Volumetric Flow Rate of Feed to Reactor *(Cubic Meter per Second)*
- $V_{reactor}$ Reactor Volume *(Cubic Meter)*
- X_A Reactant Conversion
- φ Instantaneous Fractional Yield
- Φ Overall Fractional Yield
- τ Space Time *(Second)*
- $\tau_{Reactor}$ Reactor Space Time *(Second)*
- $\tau_{Spacevelocity}$ Space Time using Space Velocity *(Second)*

Constants, Functions, Measurements used

- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Amount of Substance** in Mole (mol)
  Amount of Substance Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Frequency** in Cycle per Second (cycle/s)
  Frequency Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Molar Flow Rate** in Mole per Second (mol/s)
  Molar Flow Rate Unit Conversion
- Measurement: **Molar Concentration** in Mole per Cubic Meter (mol/m^3)
  Molar Concentration Unit Conversion

Check other formula lists

- Basics of Chemical Reaction Engineering Formulas
- Basics of Parallel & Single Reactions Formulas
- Basics of Reactor Design and Temperature Dependency from Arrhenius Law Formulas
- Forms of Reaction Rate Formulas
- Important Formulas in Basics of Chemical Reaction Engineering & Forms of Reaction Rate
- Important Formulas in Constant and Variable Volume Batch Reactor
- Important Formulas in Constant Volume Batch Reactor for First, Second & Third Order Reaction
- Important Formulas in Potpourri of Multiple Reactions
- Reactor Performance Equations for Variable Volume Reactions Formulas

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