

Quiz 2: Process intensification

Part 1: True-false

Circle T (true) or F (False)

- 1) **T F** For single reactant first order reactions of type $A \rightarrow B$, there is no influence of the degree of segregation on the conversion of reactant A.
- 2) **T F** For a same concentration set using the Villermoux-Dushman protocol, a decrease in the segregation index implies an increase in the mixing time.
- 3) **T F** For a homogeneous reaction, the characteristic reaction time is linearly dependent on the characteristic dimension of the reactor.
- 4) **T F** The Nusselt number is significantly higher in a COBR than in an unbaffled tube (under identical Re_n and Re_o conditions).
- 5) **T F** In the laminar regime, the Bodenstein number in a COBR is higher than in a smooth (unbaffled) tube (using identical Re_n and Re_o)

Short justification of your answer:

- 6) **T F** In a RPB, the HETP is significantly higher than in a conventional packed column.
- 7) **T F** In a RPB, the liquid is delivered at the eye of the rotor.
- 8) **T F** A RPB can be used for stripping, gas absorption and distillation.
- 9) **T F** In a TF-SDR, the film thickness decreases with flowrate.
- 10) **T F** In a TF-SDR, the film thickness increases with disk rotational speed.
- 11) **T F** In a TF-SDR, the mixing time is short enough to carry out precipitations and obtain very low particle sizes with particularly narrow particle size distributions.
- 12) **T F** In a TF-SDR, the film thickness decreases with radial position.
- 13) **T F** In a PFR, there is no effect of segregation on the conversion of single reactant reactions of the type $A \rightarrow P$.

- 14) T F For a single reactant reaction of the type $A \rightarrow P$ with a reaction order $n > 1$, a negative effect of segregation on the reaction rate is expected.

Part 2: Multiple choice

Choose the correct answer. Check only one box per question, as there is only one correct answer.

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- 15) The ratio of characteristic times between a homogeneous and a heterogeneous reaction (R = characteristic length of the reactor)
- ☐ is independent of R ☐ increases with R ☐ decreases with R
-
- 16) For the following competing scheme: $A_1 + 2A_2 \rightarrow A_3$ (instantaneous) and $A_4 + 3A_2 \rightarrow A_5$, with $c_{10} = 1$ and $c_{40} = 2$, Y_{CS} is equal to
- ☐ 3/5 ☐ 3/4 ☐ 2/3
-
- 17) At equal values of t_{mx} and τ , the segregation intensity in a CSTR is
- ☐ larger than in a PFR ☐ smaller than in a PFR ☐ the same as in a PFR
-
- 18) For the following reaction: $A_1 + A_2 \rightarrow P$, first order in A_1 and A_2 with $DaI_{mx} = 1$ (separate A_1 and A_2 feeds), the conversion in a given type of reactor at a given value of DaI , compared to the micromixed system, is expected to be
- ☐ higher ☐ lower ☐ the same
-
- 19) For a single reactant reaction of the type $A \rightarrow P$ carried out in a PFR, segregation has the following effect on conversion (compared to a micromixed PFR):
- ☐ Increases the conversion ☐ Decreases the conversion ☐ No effect on conversion ☐ Depends on the reaction order
-
- 20) In a PFR, the intensity of segregation
- ☐ increases with Z ☐ decreases with Z ☐ is constant in the reactor
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- 21) The segregation index was measured in two reactors using the Villermoux-Dushman protocol. $X_s(\text{reactor } 1) > X_s(\text{reactor } 2)$. Which reactor has the lowest mixing time?
- ☐ Reactor 1 ☐ Reactor 2 ☐ There is not enough information available to decide

Short justification of your answer:

22) Which variables should preferably be kept constant for the scale-up of a COBR?

☐ $\frac{L}{D}, \alpha, \psi, Str$ ☐ $\frac{L}{D}, Re_o, Str, \psi$ ☐ $\frac{L}{D}, \alpha, f, x_o$

23) The RTD in a RS-SDR can be described by the following model:

☐ Plug-flow☐ Combination of plug-flow and cascade of CSTRs☐ Cascade of CSTRs

24) For a reaction with $\Delta V^\ddagger > 0$, an increase in the pressure

☐ increases the reaction rate☐ decreases the reaction rate

25) How do the following properties change when a liquid changes from standard (below critical p and T) to supercritical conditions?

 D_m ☐ Increases☐ Decreases ρ ☐ Increases☐ Decreases μ ☐ Increases☐ Decreases