Preparation Questions

Safety & Preparation

1. List the different protective clothing that you must wear in a lab.

2. On top of a lab coat and the proper clothing and shoes, what other safety measures may be needed in a lab?

3. With which symbol are emergency exits marked? a)  b)  c) 

4. Name three pieces of the safety equipment available in the lab.

5. Where shall you work in the lab when toxic/hazardous fumes can occur?

6. Which documents must always be read beforehand *and* at hand when working in the lab?

7. Before you start with the experiment, you need to be familiar with the material safety data sheets of…

The Chemical Reactor System

8. A __(a)__ is the place (vessel, tank, or pipe) in which the reaction takes place, while the __(b)__ includes the machines, apparatuses, piping and fittings.

9. What is the purpose of a chemical reactor system?

10. Name 3 types of basic chemical reactors.

11. Give an example of a continuously operated chemical reactor.

12. Give an example of a discontinuously operated chemical reactor.

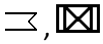
13. Give 2 examples of properties or conditions that can be controlled in a chemical reactor.

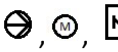
Process Flow Diagram & Equipment Operation

14. The _____ shows the general flow of processes and major equipment of a system.

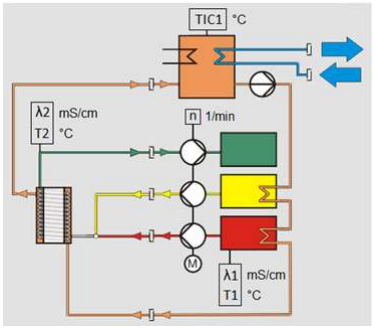
15. What does a Process Flow Diagram usually includes?

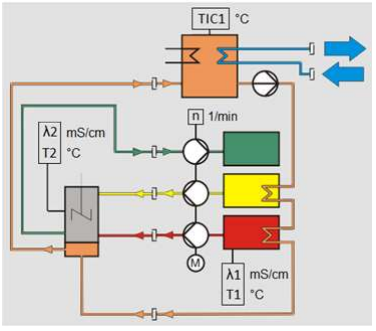
16. What does the Process Flow Diagram not show?

17. In a Process Flow Diagram, what do the symbols  represent?

18. In a Process Flow Diagram, what do the symbols  represent?

19. Assign the following process flow diagrams to the corresponding reactor system.

a) 

b) 

20. Where does the mixing of the reactants occur?
a) In the Reactants' tank b) In the Reactor c) In the Products' tank

21. What is the difference between a CST and a CSTR?

22. Name two types of pumps.

23. What piece of equipment do you need to use/power a pump?

24. What peculiarity of the "new" chemical reactor systems in our lab leads into serious setbacks in the operation of the system?

25. Which component of the cooling system let you know if there is enough cooling water available?

26. With the help of heat exchangers in the temperature control fluid's tank, the reactant tanks and the reactor itself can be:

Solutions, Reactants & Conductivity

27. What information is required to prepare a solution with a salt?

28. The preparation of 60mL NaCl solution (0.1M) can be done in a simple dilution step by mixing ____ of NaCl soln. (0.2M) with ____ of water.

29. What property is traced during the Residence Time Distribution practical training?

30. What is the conductivity value of air?

31. What is the conductivity value of deionized water?

32. What is the conductivity value of tap water?

33. Order of the following substances [Deionized water, NaCl 0.1M, NaCl 0.2M, tap water] from low to high conductivity.

34. What substance shall be used for rinsing the sensors?

35. What is the food colorant in our practical training used for?

36. Does the addition of food colorant lead to a significant change in the conductivity of tap water?

Hint: Compare the conductivity measurements for tap water with the conductivity measurement for the aqueous solution of the colorant. Keep in mind that small changes in measurement can be caused by the measurement inaccuracy of the sensors.

37. What happens if water is added to a tank that contains NaCl solution?

38. Name the reactants which are used for the Saponification reaction?

39. Why do you have to be extra careful when working with the reactants needed for the Saponification practical training?

40. The electrical conductivity of sodium hydroxide (NaOH) is _____ compared to the conductivity of Ethyl acetate (EtOAc).

Residence Time Distribution

41. What does the residence time (also called age) indicate?

42. The concept of residence time originated in models of chemical reactors, but it can also be applied to other fields? Give two examples!

43. What do you need to measure the residence time distribution E(t) of a chemical reactor?

44. A _____ is a substance with specific properties that allow observing or identifying the behavior of a given physical or chemical process.

45. What properties shall the ideal tracer have?

46. In which categories can a tracer be classified in terms of time?

47. In which categories can a tracer be classified in terms of influence on the flow?

48. Name 2 examples of a tracer and describe the change it triggers!

49. What tracer do we use in the Residence Time Distribution practical training?

50. List the properties and devices that are controlled during the conduction of the Residence Time Distribution experiment.

51. Which are the two most commonly used input signals for measuring the Residence Time Distribution?

52. What is needed to conduct the Dirac Pulse Procedure?

53. Why is the Dirac pulse theoretically the ideal input signal for determining the Residence Time Distribution?

54. What kind of response curve is obtained from a (normalized) Step input signal?

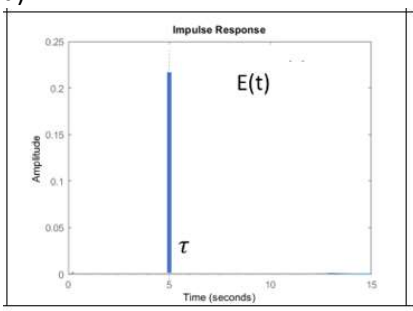
55. What is the independent variable (x-axis) in the Residence Time Distribution plot?

56. What is the dependent variable (y-axis) in the Residence Time Distribution plot?

57. Which effect does the perfect back-mixing of CSTRs (i.e. continuous washing out the traces) trigger?

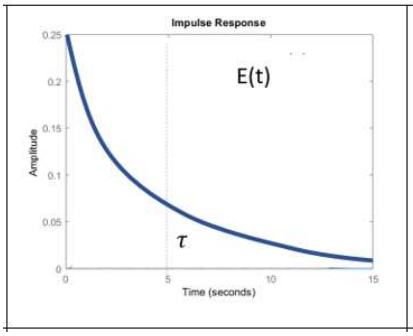
58. Assign the shown pulse responses to the proper ideal reactor.

a)



$$E(t) = \delta(t - \tau)$$

b)



$$E(t) = \frac{1}{\tau}\exp\left(-\frac{t}{\tau}\right)$$

59. Name 2 effects that lead to non-ideal behavior in real reactors?

60. In process engineering, why is it so important to analyze the RTD?