Seat No.	

M.Phil. / Ph.D. Entrance Examination, August - 2018
CHEMICAL ENGINEERING

Day and Date : Saturday, 11 - 08 - 2018   **Total Marks : 100**

Time : 01.00 p.m. to 03.00 p.m.

Instructions :
1) All questions are compulsory.
2) Each question carries 2 marks.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.
5) Follow the instructions given on OMR Sheet.
6) Rough work shall be done on the sheet provided at the end of question paper.
7) Only non programmable calculators are allowed.

PART - I (CHEMICAL ENGINEERING)

1. Which one of the following is sodium thiosulfate:

    A) $Na_2 SO_4$

    B) $Na_2 SO_3$

    C) $Na_2 S_2O_3$

    D) $Na_2 S_4 O_6$

2. Triphenylphosphine is often given the abbreviated formula PPh_3. The correct name for $Rh(PPh_3)_3 Cl$ is:

    A) chlorotriphenyl phosphinerhodium

    B) chlorotriphenyl phosphinerhodium(I)

    C) tris(triphenyl phosphine)chlororhodium(I)

    D) chlorotris(triphenyl phosphine)rhodium(I)

P.T.O.

3. 100 mol/hr of Butane (CH_4) and 133 mol/hr of air are fed into a combustor. The percent excess air used is:

A) 40%   B) 30%

C) 20%   D) 10%
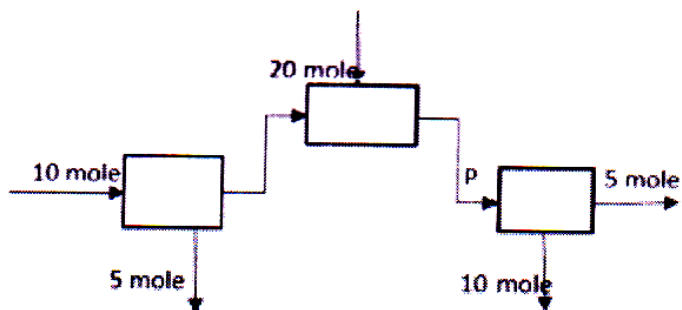
4. The objective of bypass stream is to:

A) Control the composition of final exit stream

B) Utilize valuable reactants

C) Get high extent of reaction

D) All of the above

5. If a system consists of two immiscible liquids (such as CCL_4 and CH_3OH), how many phases are there:

A) 1   B) 2

C) 3   D) 4

6. The frictional resistance of a pipe varies approximately with _____ of the liquid:

A) pressure   B) velocity

C) square of velocity   D) cube of velocity

7. A shell - and - tube heat exchanger is used to heat sugar solution by using steam. No data about the exchanger is given. Which film resistance is likely to control the overall heat transfer process:

A) Steam film resistance

B) Sugar solution film resistance

C) Both steam and sugar film resistances

D) Nothing can be said about the controlling resistance

8. For a counter-current heat exchanger the clean overall heat transfer coefficient is 500 W/m².K and the overall fouling factor is 0.00035 m² K/W. What will be the value of the design overall heat transfer coefficient:

   A) 485.6W/m².K
   B) 425.5W/m².K
   C) 392.8W/m².K
   D) None of the above

9. As the temperature for an exothermic reactions increases, the equilibrium constant

   A) increases
   B) decreases
   C) unchanged
   D) increases and then decrease

10. OSHA stands for _____.

   A) occupational safety and health administration
   B) organization standard and health administration
   C) organization support and hygiene allowance
   D) OSHA

11. What is the specific gravity of a substance with density 100 kg/m³ with respect to reference substance of density 100 lb/m³?

   A) 1.1
   B) 2.2
   C) 3.3
   D) 4.4

12. What is the value of P in the following process?
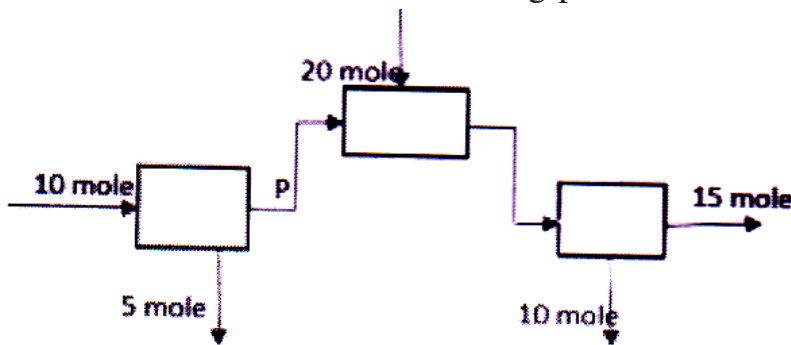

   A) 5 mole
   B) 15 mole
   C) 25 mole
   D) 35 mole

13. A 40% gas in a system has partial pressure 4 atm, what is Henry's constant?

    A) 1.6 atm

    B) 4 atm

    C) 10 atm

    D) l6 atm

14. In the Tyler standard screen scale series, when the mesh number increases from 3 mesh to 10 mesh, then

    A) the clear opening decreases

    B) the clear opening increases

    C) the clear opening is unchanged

    D) the wire diameter increases

15. The effectiveness of a heat exchanger in the ε – NTU method is defined as

    A) $\dfrac{\text{increase in temperature of the cold fluid}}{\text{decrease in temperature of hot fluid}}$

    B) $\dfrac{\text{actual exit temperature attained by the cold fluid}}{\text{maximum exit temperature attained by the cold fluid}}$

    C) $\dfrac{\text{actual exit temperature attained by the hot fluid}}{\text{minimum exit temperature attainable by the hot fluid}}$

    D) $\dfrac{\text{acutual heat transfer rate}}{\text{maximum possible heat transfer rate from hot fluid to cold fluid}}$

16. In a pool boiling experiment, the following phenomena were observed

    P. Natural convection

    Q. Film boiling

    R. Transition boiling

    S. Nucleate boiling

    What was the CORRECT sequence of their occurrence?

    A) P,Q,R,S

    B) S,R,Q,P

    C) Q,R,P,S

    D) P,S,R,Q

17. In a process occurring in a closed system F, the heat transferred from F to the surroundings E is 600 J. If the temperature of E is 300 K and that of F is in the range 380 - 400 K, the entropy changes of the surroundings (SS_E) and system (SS_F), in J/K, are given by

A) $SS_E = 2$, $SS_F = -2$ B) $SS_E = -2$, $SS_F = 2$
C) $SS_E = 2$, $SS_F < -2$ D) $SS_E = 2$, $SS_F > -2$

18. In a double pipe counter-current heat exchanger, the temperature profiles shown in the figure were observed During operation, due to fouling inside the pipe, the heat transfer rate reduces to half of the original value Assuming that the flow rates and the physical properties of the fluids do not change, the LMTD (in °C) in the new situation is

A) 0   B) 20
C) 40   D) indeterminate

19. What is the value of P in the following process?

A) 5 mole   B) 10 mole
C) 15 mole   D) 20 mole

20. Match the reactant-product combination in Group 1 with the unit process in Group 2.

Group 1	Group 2
(P) propylene - butanol	(1) Pyrolysis
(Q) cumene - phenol	(2) Dehydrogenation
(R) butane - butadiene	(3) Hydroformylation
(S) ethylene dichloride-vinyl chloride	(4) Peroxidation

A) P-3, Q-2, R-4, S-1   B) P-2, Q-4, R-3, S-1
C) P-1, Q-3, R-2, S-4   D) P-3, Q-4, R-2, S-1

21. If the additional Safety Valves on boiler are used the highest pressure setting shall not exceed the maximum allowable working pressure by more than _____ percent.

A) 3%   B) 30%

C) 20%   D) 25%

22. Identify which of the following statements are FALSE.

(P) Oils with an oleic radical (1 double bond) are more suitable than oils with a linolenic radical (3 double bonds) as film forming vehicles for paints

(Q) Production of synthesis gas from coal and steam is an endothermic process

(R) Use of chlorine for bleaching of wood pulp results in the release of dioxins

(S) In the manufacture of urea from ammonia, the main intermediate product formed is ammonium bicarbonate

A) P and Q only   B) R and S only

C) Q and R only   D) P and S only

23. All professors are researchers, some scientists are professors Which of the given conclusions is logically valid and is inferred from the above arguments?

A) All scientists are researchers

B) All professors are scientists

C) Some researchers are scientists

D) No conclusion

24. If is necessary to mention the temperature at which specific gravity is calculated, because

A) Mass of the substance changes with temperature

B) Rigidity of the substance changes with temperature

C) Density of the substance changes with temperature

D) None of the mentioned

25. A wet solid is dried over a long period of time by unsaturated air of nonzero constant relative humidity The moisture content eventually attained by the solid is termed as the

    A) unbound moisture content

    B) bound moisture content

    C) free moisture content

    D) equilibrium moisture content

PART - II (RESEARCH METHODOLOGY)

26. The first step in formulating a problem is

    A) Statement of the problem   B) Gathering of Data

    C) Measurement   D) Survey

27. To ensure adequate informed consent, a researcher should include all of the following components in an introduction except _____

    A) Promise of anonymity and confidentiality

    B) Sponsoring organization

    C) Purpose of the research

    D) Estimate of when the research study will be published

28. _____will help in finding out a problem for research.

    A) Professor   B) Tutor

    C) HOD   D) Guide

29. What does a descriptive study seek to accomplish?

    A) Attempts to capture a population's characteristics by making inferences from a sample's characteristics and testing resulting hypotheses

    B) Emphasizes a full contextual analysis of a few events or conditions and their interrelations

    C) Discovers answers to the questions who, what, when, where, or how much

    D) Attempts to reveal why or how one variable produces changes in another

30. An interval scale contains _____.

    A) Mutually exclusive and collectively exhaustive categories as well as the property of order, but not distance or unique origin

    B) The properties of order, classification, and equal distance between points but no unique origin

    C) Mutually exclusive and collectively exhaustive categories, but without the properties of order, distance, and origin

    D) The properties of classification, order, equal distance, and unique origin

31. Second step in problem formulation is

    A) Statement of the problem

    B) Understanding the nature of the problem

    C) Survey

    D) Discussions

32. Last step in problem formulation is

    A) Survey

    B) Discussion

    C) Literature survey

    D) Re Phrasing the Research problem

33. Which of the following is true of resistant statistics?

    A) Inappropriate for statistical analysis

    B) Corrupted with measurement bias

    C) Based on nominal scales

    D) Able to resist influence of extreme values

34. Which quartile value(s) are likely to be most different between bell-shaped and highly skewed distributions?

    A) The first or third quartile, depending on the skewing

    B) The second quartile or mean

    C) All quartiles

    D) The fourth quartile

35. Which ONE of these is the best description of secondary data?

    A) Ordinary data   B) Existing data

    C) Omnibus data   D) Ordinal data

36. A _____ is an abstraction formed by generalization from particulars

    A) Hypothesis   B) Variable

    C) Concept   D) facts

37. A tentative proposition subject to test is

    A) Variable   B) Hypothesis

    C) Data   D) Concept

38. What level of measurement would be used if participants were asked to choose their favorite picture from a set of six?

    A) Ordinal   B) Nominal

    C) Ratio   D) Interval

39. Conclusions from qualitative research are

    A) less certain than from quantitative research

    B) Of little practical use

    C) Of descriptive value only

    D) Seldom defensible.

40. What is the appropriate test statistic to use to determine the significance of the coefficient of determination in a bivariate regression?

A) F statistic   B) Z score

C) X2   D) ANOVA

41. Concepts which cannot be given operational definitions are _____ concepts

A) Verbal   B) Oral

C) Hypothetical   D) Operational

42. A Hypothesis which develops while planning the research is

A) Null Hypothesis   B) Working Hypothesis

C) Relational Hypothesis   D) Descriptive Hypothesis

43. _____ which deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out

A) Statistical design   B) Observational design

C) Operational design   D) Sampling design

44. The _____ is not used as a measure of association for nominal, nonparametric variables.

A) Chi-square   B) Phi

C) Cramer's v   D) Z score

45. When a hypothesis is stated negatively it is called

A) Relational Hypothesis   B) Situational Hypothesis

C) Null Hypothesis   D) Casual Hypothesis

46. Hypothesis which explain relationship between two variables is
    A) Causal
    B) Relational
    C) Descriptive
    D) Tentative

47. A Hypothesis from which no generalization can be made is
    A) Null Hypothesis
    B) Barren Hypothesis
    C) Descriptive Hypothesis
    D) Analytical Hypothesis

48. _____ which deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out
    A) Statistical design
    B) Observational design
    C) Operational design
    D) Sampling design

49. Which of the following is a non-probability sample?
    A) Quota sample
    B) Simple random sample
    C) Purposive sample
    D) (A) and (C) both

50. A Hypothesis contributes to the development of _____.
    A) Theory   B) Generalization
    C) Evolution   D) Concept

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Rough Work