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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)
(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)
SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R,S), MAY 2024
Chemical Engineering
(2020 SCHEME)

Course Code	:	**20CHT308**	
Course Name	:	**Comprehensive Course Work**	
Max. Marks	:	**50**	**Duration:75 Minutes**

PART A
(Answer all questions. Each question carries 1 mark)

1. Pascal's law is valid, only when the fluid is
   (A) frictionless and at rest. (B) at rest.
   (C) at rest and when the frictionless fluid is in motion. (D) none of these.

2. Foot valves provided in pumps are _____ valves.
   (A)
   relief
   (B)
   three/four way
   (C)
   pressure reducing
   (D)
   directional control

3. Which of the following equations represent the relationship between pressure, velocity, and elevation in fluid flow according to Bernoulli's principle?
   (A)
   $F = d(mv)/dt$
   (B)
   F = ma
   (C)
   PV = nRT
   (D)
   $P + \rho v^2/2 + \rho gh = \text{constant}$

4. Which of the following statements best describes viscosity?
   (A)
   Viscosity is a measure of a fluid's resistance to flow.
   (B)
   Viscosity is the force per unit area exerted by a fluid.
   (C)
   Viscosity is the tendency of a fluid to adhere to the surface of a solid.
   (D)
   Viscosity is the ratio of the density of a fluid to the density of a reference fluid.

5. Manometers measure the _____ pressure.
   (A) vacuum as well as the atmospheric (B) difference in
   (C) absolute (D) gauge

6. For flow of fluids through packed bed, the superficial velocity is
   (A) less than the average velocity through channels. (B) more than the average velocity through channels.
   (C) dependent on the pressure drop across the bed. (D) same as the average velocity through channels.

7. For an isothermal reversible compression of an ideal gas
   (A) only $\Delta E = 0$ (B) only $\Delta H = 0$
   (C) $\Delta E = \Delta H = 0$ (D) $dQ = dE$

8. Compound having large heat of formation is
   (A) more stable. (B) less stable.

(C) not at all stable (like nascent O_2). (D) either more or less stable; depends on the compound.

9. Boiling of liquid is accompanied with increase in the
   (A) vapor pressure. (B) specific Gibbs free energy.
   (C) specific entropy. (D) all (a), (b) and (c).

10. The temperature at which both liquid and gas phases are identical, is called the _____ point.
    (A) critical (B) triple
    (C) freezing (D) boiling

11. Which phase diagram exhibits a eutectic reaction?
    (A) Binary phase diagram (B) Ternary phase diagram
    (C) Quaternary phase diagram (D) Unary phase diagram

12. A chemical reaction will occur spontaneously at constant pressure and temperature, if the free energy is
    (A) zero (B) positive
    (C) negative (D) none of these

13. Fouling factor
    (A) is a dimensionless quantity. (B) does not provide a safety factor for design.
    (C) accounts for additional resistances to heat flow. (D) none of these.

14. Black liquor generated during paper manufacture is concentrated in a
    (A) single effect evaporator. (B) single effect evaporator followed by a crystalliser.
    (C) multiple effect evaporator. (D) multiple effect evaporators followed by a crystalliser.

15. Which one gives the monochromatic emissive power for black body radiation?
    (A) Planck's law (B) Kirchhoffs law
    (C) Wien's law (D) Stefan-Boltzman law

16. Fluid motion in the natural convection heat transfer between a solid surface and a fluid in contact with it, results from the
    (A) existence of thermal boundary layer. (B) temperature gradient produced due to density difference
    (C) buoyancy of the bubbles produced at active nucleation site. (D) none of these.

17. Radiation heat transfer rates does not depend upon the
    (A) type of absorbing surface. (B) distance between the heat source and the object receiving the heat.
    (C) surface area and temperature of the heat source. (D) none of these.

18. When warm and cold liquids are mixed, the heat transfer is mainly by
    (A) conduction (B) convection
    (C) radiation (D) both (a) & (c)

19. Capacity of a rotary dryer depends on its
    (A) r.p.m (B) inclination with ground surface
    (C) both (a) and (b) (D) neither (a) nor (b)

20. The diffusivity (D) in a binary gas mixture is related to the pressure (P) as

    (A) $D \propto P^{0.5}$

    (B)

    (C)

    (D)

21. The velocity, concentration and temperature boundary for the boundary layer development on a flat plate during convective mass transfer will be same, if

(A) $N_{Sc} = 1$ (B) $N_{Sc} = N_{Pr} = N_{Le}$

(C) $N_{Pr} = N_{Le}$ (D) $N_{Sc} = N_{Le}$

22. Spray tower is a _____ process.
    (A) Co-current   (B) Counter current
    (C) Continuous   (D) Batch

23. At 750°K and 1 atm, the approximate value of Schmidt number for air is
    (A) 0.01   (B) 0.1
    (C) 1   (D) 10

24. Find the moisture to be evaporated per kg of dried product if initial and final moisture content per kg of dry solid is 85% and 15%.
    (A) 0.5   (B) 0.6
    (C) 0.7   (D) 0.8

25. For reactions in parallel viz A P (desired product) and A Q (unwanted product), if the order of the desired reaction is higher than that of the undesired reaction, a
    (A) batch reactor is preferred over a single CSTR for high yield.   (B) tubular reactor is preferred over a single CSTR for high yield.
    (C) both (a) and (b).   (D) single CSTR is the most suitable.

26. Which of the following is an example of autocatalytic reaction?
    (A) Oxidation of copper   (B) Ammonia formation reaction
    (C) Hydrogen peroxide decomposition reaction (D) Reaction of permanganate with oxalic acid

27. The rate constant of a first-order reaction depends on the _____
    (A) Temperature   (B) Concentration
    (C) Time   (D) Pressure

28. The reaction $H_2 + Br_2 \rightarrow 2HBr$ proceeds via which mechanism?
    (A) Free-radical   (B) Ionic substitution
    (C) Elimination   (D) Pericyclic

29. Which of the following is not a characteristic of tracer?
    (A) Inertness   (B) Non–reactive
    (C) Easily detectable   (D) Adsorbance onto the reactor surface

30. Which of the following reactions follows elementary rate law?
    (A) Reversible catalytic decomposition of isopropyl benzene   (B) Formation of hydrogen bromide
    (C) Vapor phase decomposition of ethanol   (D) Cis-trans isomerization

PART B
(Answer all questions. Each question carries 2 marks)

31. In the low Reynolds number region, the drag force on a sphere is proportional to
    (A) V   (B) V^2
    (C) V^4 (D) $V^{0.5}$

32. A particle '**A**' of diameter 10 microns settles in an oil of specific gravity 0.9 and viscosity 10 poise under Stoke's law. A particle '**B**' with diameter 20 microns settling in the same oil will have a settling velocity
    (A) same as that of '**A**'.   (B) one fourth as that of '**A**'.
    (C) twice as that of '**A**'.   (D) four times as that of '**A**'.

33. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then –

(A) compressing the gas through an adiabatic process will require more work to be done.

(B) compressing the gas isothermally or adiabatically will require the same amount of work.

(C) which of the case (whether compression through isothermal or through the adiabatic process) requires more work will depend upon the atomicity of the gas.

(D) compressing the gas isothermally will require more work to be done.

34. Choose the condition that must be specified in order to liquify CO_2 (triple point for CO_2 is -57°C and 5.2 atm).

(A) Pressure must be kept below 5.2 atm.

(B) Temperature must be kept above -57°C.

(C) Pressure must be kept below 5.2 atm and temperature must be kept above 57°C.

(D) Pressure and temperature must be kept below 5.2 atm and -57°C respectively.

35. Economy of a multiple effect evaporator is not influenced much by the

(A) boiling point elevations

(B) temperature of the feed

(C) rate of heat transfer

(D) ratio of the weight of the thin liquor to thick liquor

36. Steam consumption in kg/hr in case of an evaporator is given by (where, C & E are capacity the economy of the evaporator respectively)

(A) C/E

(B) E/C

(C) CE

(D) $1/(CE)$

37. Air initially at 101.3 kPa and 40°C and with a relative humidity of 50%, is cooled at constant pressure to 30°C. The cooled air has a

(A) higher dew point.

(B) higher absolute (specific) humidity.

(C) higher relative humidity

(D) higher wet bulb temperature.

38. Find the false statement for the better choice of the absorbent.

(A) Gas solubility should be high

(B) Vapour pressure should be low

(C) Viscosity should be high

(D) Low freezing point

39. In ideal PFR, which of the following satements is more suitable.

(A) There is no mixing in longitudinal direction. (B) Mixing takes place in radial direction.

(C) There is a uniform velocity across the radius. (D) All of the above.

40. What is the concentration C_4 at the end of 4th reactor, for n unequal sized CSTRs in series, where X_4 is the conversion in 4th reactor?

(A) $C_4 = (1 - X_4)$

(B) $C_4 = C_0 X_4$

(C) $C_0 = C_4 (1 - X_4)$

(D) $C_4 = C_0(1 - X_4)$

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