

M.Tech. Entrance Test – 2013 (AKU, Patna)

Subject: Chemical Engineering

Time: - 1½ Hrs.

Full marks: 50

INSTRUCTIONS: -There are four options given for a question. You have choose the correct option/s. Candidates are required to submit this Question paper with answer book.

1. which one of the following statements applicable to a perfect gas will also be true for an irreversible process? (symbols have the usual meanings)
(a) $ds = du + pdv$ (b) $ds = Tds$
(c) $Tds = du + pdv$ (d) None of the above
2. When a system undergoes a process such that $\int \frac{ds}{T} = 0$ and $\Delta s > 0$, the process is
(a) irreversible adiabatic (b) reversible adiabatic
(c) isothermal (d) isobaric
3. clausius-clapeyron equation gives the slope of a curve in
(a) p-v diagram (b) p-h diagram
(c) p-T diagram (d) T-s diagram
4. For the same maximum pressure and heat input the most efficient cycle is
(a) otto cycle (b) Diesel cycle
(c) Brayton cycle (d) Dual cycle

5. Identify the process for which the two integrals $\int p dv$ and $-\int v dp$ evaluated between any two given states give the same value
- (a) Isenthalpic (b) Isothermal
(c) Isentropic (d) Polytropic
6. For a heat engine operating on the Carnot cycle the work output is $\frac{1}{4}$ th of the heat transferred to the sink. The efficiency of the engine is
- (a) 20% (b) 33.3%
(c) 40% (d) 50%
7. Which one of the following thermodynamic process approximates the steaming of food in a pressure cooker?
- (a) Isenthalpic (b) Isobaric
(c) Isochoric (d) Isothermal
8. Which one of the following relationships define the Helmholtz function F ?
- (a) $F = H + TS$ (b) $F = H - TS$
(c) $F = U - TS$ (d) $F = U + TV$
9. The turbulent boundary-layer thickness varies as
- (a) $x^{4/5}$ (b) $x^{1/5}$
(c) $x^{1/2}$ (d) $x^{1/7}$
10. Kinematic similarity between model and prototype is the similarity of
- (a) shape (b) discharge
(c) stream (d) forces

11. Euler number is defined as the ratio of inertia force to
- (a) viscous force
 - (b) elastic force
 - (c) pressure force
 - (d) gravity force
12. The dimensions of surface tension is
- (a) N/m^2
 - (b) J/m
 - (c) J/m^2
 - (d) W/m
13. Separation of fluid flow is caused by
- (a) reduction of pressure in the direction of flow
 - (b) reduction of the boundary layer thickness
 - (c) presence of adverse pressure gradient
 - (d) presence of favourable pressure gradient
14. The pressure drop in a 100 mm diameter horizontal pipe is 50 kPa over a length of 10 m. The shear stress at the pipe wall is
- (a) 0.25 kPa
 - (b) 0.125 kPa
 - (c) 0.50 kPa
 - (d) 0.15 kPa
15. The capillary rise at 20°C in clean glass tube of 1 mm diameter containing water is approximately
- (a) 15 mm
 - (b) 50 mm
 - (c) 20 mm
 - (d) 30 mm
16. The fluid property that remains unchanged across a normal shock wave is
- (a) stagnation enthalpy
 - (b) stagnation pressure
 - (c) static pressure
 - (d) mass density

17. ~~(b)~~ In forced convection molecular diffusion causes
- (a) ~~no~~ momentum flow in turbulent region
 - (b) momentum flow in the laminar region
 - (c) Heat flow in the turbulent region
 - (d) diffusion has no part in energy transfer.
18. The heating effect is caused by the wavelengths when they are in the range of
-
- (a) 0.1μ to 100μ
 - (b) 100μ to 1500μ
 - (c) 150μ to 2000μ
 - (d) none of the above
19. The ratio of thermal to hydrodynamic boundary layer thickness varies as
- (a) root of Reynold number
 - (b) root of Nusselt number
 - (c) root of Prandtl number
 - (d) one third power of Prandtl number
20. The critical radius of insulation for sphere is equal to
- (a) $k \times h$
 - (b) $\sqrt{k \times h}$
 - (c) $\frac{2k}{h}$
 - (d) $\frac{h}{k}$
21. When a liquid flows through a tube with subcooled or saturated boiling, the process is known as
- (a) pool boiling
 - (b) bulk boiling
 - (c) convection boiling
 - (d) forced convection boiling
22. Fins are provided on heat transfer surface so as to increase
- (a) heat transfer area
 - (b) heat transfer coefficient
 - (c) mechanical strength to the equipment
 - (d) level of turbulence

23. Dropwise Condensation usually occurs on
 (a) glazed surface (b) smooth surface
 (c) oily surface (d) coated surface
24. The temperature of a radiating surface changes from 400°K to 1200°K . The ratio of total emissive powers at the higher and lower temperature would be
 (a) 3 (b) 9 (c) 27 (d) 81
25. Thermal diffusivity of a substance is - - - - proportional to - - - -:
 (a) inversely, specific heat (b) inversely, density of substance
 (c) directly, thermal conductivity (d) all of the above
26. "The boiling point of a solution is a linear function of water at the same pressure". This statement is associated with
 (a) Fick's rule (b) Reynold law (c) Dühring's rule (d) none of the above.
27. In a balanced counter flow heat exchanger with $m_1 c_{p1} = m_2 c_{p2}$, the NTU is equal to unity. What is the effectiveness of heat exchanger?
 (a) 1.0 (b) 0.5 (c) 0.33 (d) 0.2
28. What is the value of shape factor for two infinite parallel surfaces separated by a distance x
 (a) 0 (b) ∞ (c) 1 (d) x
29. The rate at which energy propagates is faster than the rate of mass transfer, indicates the high value of
 (a) Lewis number (b) Prandtl number
 (c) Schmidt number (d) Reynold number
30. ~~The~~ For natural convection mass transfer, the Sherwood number is function of
 (a) Reynold ~~no~~ and Prandtl ~~no~~ number (b) Reynold and Schmidt number
 (c) Schmidt and Nusselt number (d) Grashof and Schmidt number

31. For Complete Similarity in momentum, heat and mass transfer, we should have
 (a) $Le = Re = 1$ (b) $Pr = Sc = 1$ (c) $Sh = Sc = 1$ (d) $Pr = Sh = 1$
32. Which is false statement in respect of dehumidification process,
 (a) moisture is removed (b) dry bulb temperature remains unchanged
 (c) sp. humidity and relative humidity decrease
 (d) enthalpy of saturation increases
33. The value of Prandtl number of air is about
 (a) 0.1 (b) 0.4
 (c) 0.7 (d) 1.1
34. Design of heterogeneous catalytic reactor involves consideration of steps.
 A Only chemical
 B Only Physical
 C Both (A) and (B).
 D Neither (A) nor (B)
35. Sulphuric acid used as catalyst in the
 A Hydrogenation of oils
 B Gas phase oxidation of SO_2 in chamber process
 C Alkylation of hydrocarbons
 D None of these.
36. Which of the following will give maximum gas conversion?
 A Fixed bed reactor
 B ~~Fluidised bed reactor~~
 C semi-fluidised bed reactor
 D Plug flow catalytic reactor

37. _____ explains the theory of catalysis
- A. Activation Complex Theory
 (B) Collision theory
 (C) Thermodynamics
 (D) None of above
38. Load cells are used for the measurement of
- (A) Stress (B) weight (C) Strain (D) Velocity
39. Which of the following is the dynamic characteristics of an instrument?
- A. ~~Reproduct~~ Reproducibility (B) Sensitivity
 (C) Dead zone (D) Fidelity
40. The order of the reaction: $H_2 + Cl_2 \xrightarrow[\text{light}]{\text{Sun}} 2HCl$ is over water is
- (A) zero (B) one (C) Two (D) Three
41. When a catalyst increases the rate of chemical reaction, the rate constant
- (A) Decreases (B) Increases (C) Remains constant (D) become infinite
42. When the density of the reaction mixture is constant in a chemical reaction, the ratio of the mean residence time to space time is
- (A) > 1 (B) < 1 (C) \perp (D) \emptyset
43. Neoprene is chemically known as
- (A) Polybutadiene (B) Polystyrene-butadiene rubber
 (C) Polypropylene (D) Polychloroprene
44. Buna-S is known
- (A) Teflon (B) PTFE (C) Polyacrylates (D) Styrene-butadiene polymer

45. Caprolactam, a raw material for the manufacture of Nylon-6 is produced from
 (A) Phenol (B) Toluene (C) Benzene (D) Pyridine
46. The monomer of Polyvinyl chloride (PVC) is
 (A) Chloro-ethene (B) Ethylenedichloride
 (C) Ethyl chloride (D) Chloroethane
47. Vulcanisation of rubber makes it
 (A) Soft (B) Less elastic (C) Plastic (D) Tacky
48. Epoxy resin is
 (A) Not used for surface coating (B) A good Abrasive
 (C) An elastomer (D) A polyester
49. Bulk diffusion in catalyst pore — with increase in pressure
 (A) Increases (B) Decreases
 (C) Remains unchanged (D) Increases exponentially
50. The gas is normally employed in B.E.T method of finding out the surface area of catalyst
 (A) Nitrogen (B) Hydrogen (C) CO₂ (D) Helium