Nepal Engineering Council Registration Examination
Model Question for Chemical Engineering

Section A (60*1 = 60)

1. What is the unit of the reaction activation energy in Arrhenius law?
   a) J/mol
   b) J
   c) J/s
   d) J/m^2

2. If the pressure and temperature remain constant but volume of a gas increases, what will happen to the viscosity?
   a) remain constant
   b) it increases slightly
   c) it increases exponentially
   d) it decreases

3. In steady-state, open processes, input must be equal to the output in both conditions of chemical reaction and without chemical reaction in:
   a) total mole balance
   b) component balance of the mass of a pure compound
   c) component balance of the moles of a pure compound
   d) component balance of the moles of an atomic species

4. Under which condition will the general energy balance reduce to $Q = -W$ for a closed system?
   a) $\Delta KE = 0$
   b) $\Delta PE = 0$
   c) $\Delta U = 0$
   d) $\Delta KE = 0, \Delta PE = 0, \Delta U = 0$

5. What are the raw materials used for the manufacture of polyester?
   a) urea and formaldehyde
   b) vinyl chloride
   c) glycol and terephthalic acid
   d) phenol and formaldehyde

6. If a chemical engineer wants to simulate the process start-up and shutdown of a plant, what type of model will be the most suitable?
   a) stochastic
   b) dynamic
   c) discrete-event
   d) steady-state

7. In which one of the following conditions must a reaction be spontaneous? All symbols given are standard symbols of the Gibbs-Helmholtz equation.
   a) ΔH is positive and ΔS is negative
   b) ΔH is negative and ΔS is positive
   c) ΔH is positive and ΔS is positive
   d) ΔH is negative and ΔS is negative

8. It is true that energy can be transferred to or from a control volume by heat transfer, doing various forms of work, and by ……..
   a) entropy
   b) compression
   c) mass flow
   d) expansion

9. An ideal gas is undergoing a polytropic process where $pV^n = constant$. When $n = 1$, the process is …….
   a) isenthalpic
   b) isothermal
   c) isobaric
   d) isochoric

10. For gas/porous catalyst systems slow reactions are influenced by ……..
   a) pore diffusion
   b) particle ΔT
   c) film ΔT
   d) surface reaction

11. The thermodynamic equilibrium constant is affected by:
   a) pressure
   b) temperature
   c) inerts
   d) kinetics

12. Which one of the following directly implies that it is impossible to construct a refrigeration cycle that operates without a power input?
    a) Entropy statement
    b) Kelvin-Planck statement
    c) Clausius statement
    d) First law of thermodynamics

13. Which fluid can resist a small shear stress indefinitely?
    a) Viscoelastic
    b) Dilatant
    c) Pseudoplastics
    d) Bingham plastics

14. Which type of container has the least metal in the walls to store high-pressure fluids?
    a) cylindrical
    b) capsule-shaped
    c) spherical
    d) rectangular

15. Which equipment uses a fixed pressure difference, and a variable geometry?
    a) rotameter
    b) venturi-meter
    c) orifice-meter
    d) pitot tube

16. The mean distance apart of two parallel lines which are tangential to the particle in an arbitrarily fixed direction is called …….
    a) Equivalent diameter
    b) Feret's diameter
    c) Nominal aperture
    d) Sieve diameter

17. Which process is really a reverse sedimentation process?
    a) screening
    b) sieving
    c) elutriation
    d) laser diffraction

18. To avoid channeling in compressible filter cakes, what can be done?
    a) diffusional washing with an immiscible liquid

b) displacement washing with high pressure difference

c) washing with low pressure difference

d) washing with air for partial drying

19. The amount of desired product obtained divided by amount of the key reactant consumed is:
a) yield

b) limiting reactant

c) selectivity

d) conversion

20. For irreversible reactions in series, what is the key to the formation of intermediates?
a) mixing of fluid of different composition

b) Reynolds number

c) Peclet number

d) plug flow of fluid

21. Consider a two-step first-order irreversible reactions in series. Because laminar flow represents a deviation from plug flow, the amount of intermediate formed will be _____ for plug flow.
a) equal

b) less than

c) greater than

d) initially greater than and then less than

22. Which is the simplest way to represent enzyme catalyzed reactions?
a) competitive inhibition

b) non-competitive inhibition

c) total inhibition

d) Michaelis-Menten equation

23. Which one of the following is the simplest way to find RTD experimentally?
a) pulse

b) periodic

c) reactive

d) random

24. What acts as a shuttle for phosphate groups bound with high energies in metabolism?
a) NAD

b) NADP

c) ADP

d) ATP

25. What can a chemical engineering use to convert organic waste into biogas?
a) gasification

b) anaerobic digestion

c) electrochemical reaction

d) landfilling

26. Thermal conductivities of insulating materials such as rock wool approach that of air since the insulating materials contain _____
a) reflective materials

b) spacers

c) air trapped in void spaces

d) superconductors in layers

27. What does the convective heat transfer coefficient depend upon besides fluid properties, flow velocity and temperature difference?
a) pressure

b) ambient humidity

c) system geometry

d) condensation and boiling

28. What is the ratio of the emissive power of a surface to that of a black body?
a) transmissivity

b) absorptivity

c) reflectivity

d) emissivity

29. Viscosity correction factor for kerosene can be neglected while designing a heat exchanger because of its:
a) high viscosity

b) low viscosity

c) high pressure drop

d) low pressure drop

30. Which one of the following evaporators contain submerged combustion units?
    a) agitated
    b) long-tube
    c) direct-heated
    d) short-tube

31. What is the dimensionless ratio of the molecular momentum diffusivity to the molecular mass diffusivity?
    a) Prandtl number
    b) Schmidt number
    c) Sherwood number
    d) Nusselt number

32. For flow past a flat plate or in a pipe, where no form drag is present, which one of the following is valid?
    a) $J_H = J_D = f$
    b) $J_H = J_D = f/2$
    c) $J_H = f^2$
    d) $J_H = J_D = Pr^{2/3}$

33. An example of the distillation method without rectification is:
    a) fractional distillation
    b) binary distillation
    c) flash distillation
    d) reflux distillation

34. In a packed tower, optimum economic gas velocity is about one-half or more of the _____
    a) loading point
    b) flooding velocity
    c) terminal velocity
    d) volumetric flowrate

35. The solubility of a small crystal is greater than that of a larger-size crystal because ___
    a) small particle has a large amount of surface energy per unit mass than large particle.
    b) large particle has a large amount of surface energy per unit mass than small particle.
    c) nucleation is more dominant in small crystals than in large crystals.
    d) small particle has more numbers than large particles.

36. Which type of packing is more beneficial for cooling towers?
a) stacked rings
b) Intalox
c) saddles
d) grids

37. Which is the most widely used catalyst in Contact process?
a) platinum
b) vanadium pentoxide
c) molybdenum
d) wolfram

38. In cement production, the function of gypsum is to:
a) start the setting of cement
b) stop the hydration of cement
c) retard the setting action of cement
d) provide strength to cement

39. In the production of urea from ammonium carbamate, an undesirable side reaction can produce:
a) ammonium sulfate
b) water
c) biuret
d) carbon monoxide

40. What is the role of metal oxides in soap production?
a) fat splitting
b) saponification
c) removal of excess steam
d) removal of oil

41. Which process produces a thermoplastic?
a) chlorination
b) nitration
c) condensation
d) chain polymerization

42. Textile wastewater treatment uses graphene-based _____for turbidity removal.
a) filtration

b) nanomaterials

c) adsorption towers

d) scrubber

43. If the measured temperature is added to the set point, it leads to an undesirable situation and frequently leads to instability. This phenomenon is called:
a) disturbance rejection

b) offset

c) positive feedback

d) negative feedback

44. In a jacketed kettle system, which includes two controllers and two measuring elements, the output of the primary controller is used to adjust the set point of a secondary controller, which is used to control the jacket temperature. This kind of control is classified as:
a) cascade control

b) feedforward control

c) ratio control

d) internal model control

45. How does a second-order system generally form in chemical engineering?
a) making non-interacting system

b) making interacting system

c) using thermometer

d) adding controller

46. For which one of the following does the control system forces the system to track the requested set point changes?
a) regulator problem

b) servo problem

c) negative feedback problem

d) positive feedback problem

47. In Ziegler-Nichols controller settings, if K_u is ultimate gain, proportional gain for PID controller is:
a) 0.2 K_u

b) 0.5 K_u

c) 0.45 K_u

d) 0.6 K_u

48. A measuring device that changes the type of signal between its input and output is called:
a) controller

b) transducer

c) control valve

d) transfer function

49. An explosion in which the reaction front moves at a speed less than the speed of sound in the unreacted medium is called:
a) mechanical explosion

b) deflagration

c) detonation

d) confined explosion

50. What refers to airborne concentrations that correspond to conditions under which no adverse effects are normally expected during a worker's lifetime?
a) TWA

b) TLV

c) LEL

d) IDLH

51. Which pollution control device may have a cut diameter of 0.4 μ?
a) cyclone

b) hydroclone

c) ESP

d) gravity settler

52. Which method compares a no-project scenario with the various alternative scenarios in which the activities at different stages of the project have potential negative effects on human health and natural resources?
a) ethical analysis

b) cost-benefit analysis

c) risk assessment

d) environmental impact assessment

53. As per ISO 14001, what does PDCA stand for?
a) Plan, Do, Check, Act

b) Plan, Do, Confirm, Amend

c) Prepare, Do, Check, Act

d) Prepare, Do, Confirm, Action

54. For a process which is six sigma complaint, what is the number of defects allowed per million opportunities?
a) 0
b) 3.4
c) 9.7
d) 233

55. Standard dimensions (mm x mm) of A3 drawing sheet is
a) 11.69 × 16.54
b) 29.7 × 42
c) 297 × 420
d) 420 × 280

56. Which of the following methods of charging depreciation of an asset has increased amount of depreciation as the age of asset increases
a) sum-of-year digit
b) sinking fund
c) diminishing balance
d) straight line

57. The process of optimizing the project's limited resources without extending the project duration is known as
a) project crashing
b) resource levelling
c) resource smoothing
d) networking

58. The process of composing/raising the required fund from different sources such as equity, preferred stock, bond and debenture is known as
a) capital structure planning
b) project financing
c) capital budgeting decision
d) deducing earning per share

59. In which of the following society, people used to seek their existence on growing plants for their cattle and domestic animals
a) pastoral society
b) tribal society
c) horticultural society
d) agricultural society

60. According to Nepal Engineering Council Act, 2055 (Revised, 2079), all engineering academic institutions shall be …….. in the Council.

a) affiliated

b) united

c) recognized

d) associated

Section-B (20*2 = 40)

61. Pure A in gas phase enters a reactor. Fifty percent of this A is converted to B through the reaction A → 3B. What is the mole fraction of A in the exit stream?

a) 0.15

b) 0.25

c) 0.3

d) 0.5

62. An ideal gas at 40°C and 1.1 atm is heated to 430°C at constant pressure, and then isothermally compressed to 9 atm. It is then isobarically cooled to 40°C, and finally is isothermally expanded to back to its initial state. For the overall process, What happens to ΔH and ΔU?

a) $\Delta H=0, \Delta U=0$

b) $\Delta H\neq 0, \Delta U=0$

c) $\Delta H=0, \Delta U\neq 0$

d) $\Delta H\neq 0, \Delta U\neq 0$

63. An ideal gas has a gas constant R = 0.3 kJ/kg·K and a constant-volume specific heat c_v = 0.7 kJ/kg·K. If the gas has a temperature change of 100ºC, what will be the change in enthalpy in kJ/kg?

a) 0

b) 30

c) 70

d) 100

64. What is the quality of 15 lb of wet steam at 120 psia when the enthalpy of the wet steam has been calculated to be 12000 Btu? The specific enthalpies of the liquid and vapor are $\Delta\hat{H}_L$ = 312.46 Btu/lb and $\Delta\hat{H}_V$ = 1190.6 Btu/lb.

a) 0.4

b) 0.56

c) 0.75

d) 0.95

65. The pressure drop for a given flow is determined to be 100 Pa. For the same flow rate, if we reduce the diameter of the pipe by half, what will the pressure drop be in Pa?
a) 25

b) 50

c) 200

d) 1600

66. What is the fabric area, in square meters, required in a baghouse treating 230,000 m^3/min of stack gas at an efficiency of 98%? The air-to-cloth ratio of the unit is 2.3 m/min.
a) 98000

b) 9.9×10^{-6}

c) 100000

d) 1089000

67. A liquid contains *A* and *B* (C_{A0} = 0.10 mol/liter, C_{B0}= 0.01 mol/liter) flow into a mixed reactor of volume *V* = 1 liter. The outlet stream from the reactor contains *A*, *B*, and *C* (C_{Af}= 0.02 mol/liter, C_{Bf}= 0.03 mol/liter, C_{cf} = 0.04 mol/liter). The incoming liquid is flowing at 1 liter/min. What is the rate of reaction of *A* in mol/liter·min?
a) 0.08

b) -0.02

c) -0.04

d) 0.02

68. Where do we set the rate of formation of the active intermediates equal to zero?
a) Monod equation

b) Michaelis-Menten equation

c) PSSH

d) Stern-Volmer equation

69. The forced convective heat-transfer coefficient of flowing hot water (390 K) over a cold steel surface (280 K) is 990 W/m^2·K. What is the heat transfer rate per unit surface area (W/m^2) from the water to the steel surface?
a) 108900

b) 9

c) 0.11

d) 386100

70. To reduce cost, multiple-effect evaporators are used that recover the _____ and reuse it.
a) pressure drop across the system

b) latent heat of the vapor leaving

c) momentum of the vapor leaving

d) heat of mixing of the system

71. Let N_A be the number of moles of A diffusing per unit area per unit time in a binary system. The molar flux of A in the z-direction is given as: $N_{az} = -cD_{AB}\, dx_A/dz + x_A(N_{Az}+N_{Bz})$. What does the second term on the right side of the equation signify?
a) combined flux

b) molecular flux

c) convective flux

d) dispersive flux

72. What is the main assumption of McCabe–Thiele method?
a) Equimolar overflow in tower between feed inlet and top tray, and feed inlet and bottom tray.

b) Liquid and vapor streams enter a tray, and leave before being equilibrated

c) If V_n is mol/h of vapor from tray n,the latent heats in streams V_{n+1} and V_n can be neglected.

d) Since molar latent heats for chemically similar compounds are almost the same, molal overflow in the tower can be neglected.

73. What can be the main environmental impacts of the stages of cement manufacturing?
a) local air pollution, dust, gases, noise and vibration

b) heavy metals, global warming

c) local air pollution, global warming, dust, gases, noise and vibration

d) climate change, dust, gases, noise and vibration

74. The pretreatment of feedstock for catalytic cracking is beneficial for petroleum refinery because:
a) it decreases rate constant for gas oil cracking

b) it protects catalyst and saves time needed for purification

c) it decreases the temperature range of cracking

d) it decrease catalyst to oil ratio

75. A pneumatic proportional controller is used to control the cold stream outlet temperature within the range of 50 to 100ºC. The controller gain is adjusted so that the output pressure goes from 4 atm to 13 atm as the measured temperature goes from 66 to 72ºC with the set point held constant. What is the controller gain in atm/ºC?
a) 0.18

b) 0.67

c) 1.5

d) 54

76. "A control system is unstable if the open-loop frequency response exhibits an AR exceeding unity at the frequency for which the phase lag is 180°." What does this statement refer to?
a) Nyquist criterion
b) Bode stability criterion
c) Ziegler-Nichols rule
d) Cohen and Coon rule

77. A process in a plant has FAR (fatal accident rate) of 1.3. If an employee works an 8-hr shift 320 days per year, what will be the deaths per person per year?
a) 3.25×10^{-10}
b) 3.33×10^{-5}
c) 52
d) 1969

78. A plant contains a flammable substance and there is some concern that a leak of its flammable vapors will form a flammable cloud. The LFL was 45.5 g/m^3 and TLV was 0.355 g/m^3. What should be done about the toxic effects of the cloud?
a) It can be safely ignored.
b) The plant should be closed temporarily.
c) The cloud should be dispersed in the nearby residential area.
d) It urgently needs a control mechanism to stop the leak.

79. Effective monthly interest rate will be ……., if nominal interest rate of 10% accounted for continuous compounding
a) 1%
b) 0.84%
c) 1.2%
d) 2%

80. By considering following activities of a project, the project duration will be

Activity	A	B	C	D	E
Immediate predecessors	-	-	-	C	A, B, D
Duration (days)	4	5	3	7	5

a) 9 days
b) 10 days
c) 15 days
d) 24 days