

20+26-46

POST GRADUATE COMMON ENTRANCE TEST-2019

DATE and TIME	COURSE	SUBJECT
20-07-2019 2.30 p.m. to 4.30 p.m.	ME/M.Tech/M.Arch/ courses offered by VTU/UVCE/UBDTCE	CHEMICAL ENGINEERING
MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
100	150 Minutes	120 Minutes
MENTION YOUR PGCET NO.		QUESTION BOOKLET DETAILS
		VERSION CODE
		SERIAL NUMBER
		B
		110002

DOs :


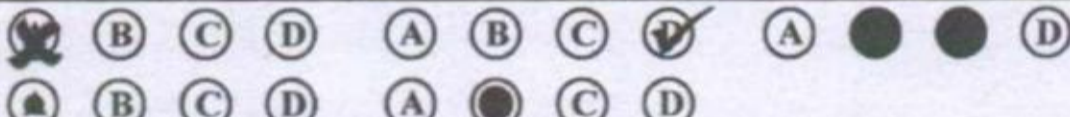

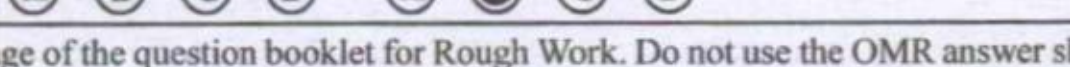
1. Candidate must verify that the PGCET number & Name printed on the OMR Answer Sheet is tallying with the PGCET number and Name printed on the Admission Ticket. Discrepancy if any, report to invigilator.
2. This question booklet is issued to you by the invigilator after the 2nd bell i.e., after 2.25 p.m.
3. The Version Code of this Question Booklet should be entered on the OMR Answer Sheet and the respective circle should also be shaded completely.
4. The Version Code and Serial Number of this question booklet should be entered on the Nominal Roll without any mistakes.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts :

1. The timing and marks printed on the OMR answer sheet should not be damaged / mutilated / spoiled.
2. The 3rd Bell rings at 2.30 p.m., till then;
 - Do not remove the paper seal / polythene bag present on the right hand side of this question booklet.
 - Do not look inside this question booklet.
 - Do not start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 75 (items) questions and each question will have one statement and four answers. (Four different options / responses.)
2. After the 3rd Bell is rung at 2.30 p.m., remove the paper seal / polythene bag on the right hand side of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
3. During the subsequent 120 minutes :
 - Read each question (item) carefully.
 - Choose one correct answer from out of the four available responses (options / choices) given under each question / item. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **only one response** for each item.
 - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALL POINT PEN against the question number on the OMR answer sheet.**

ಸರಿಯಾದ ಕ್ರಮ CORRECT METHOD	ತಪ್ಪು ಕ್ರಮಗಳು WRONG METHODS
	
	

4. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
5. After the last Bell is rung at 4.30 p.m., stop marking on the OMR answer sheet and affix your left hand thumb impression on the OMR answer sheet as per the instructions.
6. Handover the OMR ANSWER SHEET to the room invigilator as it is.
7. After separating the top sheet (KEA copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
8. Preserve the replica of the OMR answer sheet for a minimum period of ONE year.
9. Only Non-programmable calculators are allowed.

Marks Distribution

PART-1 : 50 QUESTIONS CARRY ONE MARK EACH (1 TO 50)
PART-2 : 25 QUESTIONS CARRY TWO MARKS EACH (51 TO 75)

CH - B



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CHEMICAL ENGINEERING

PART - 1

Each question carries one mark.

(50 × 1 = 50)

1. Molten ammonium nitrate is mixed with ground lime stone in fertilizer plant in a
 - (A) Pug mill
 - (B) Mixer – extruder
 - (C) Ban bury mixer
 - (D) Muller mixer
2. The filter medium resistance is controlled by
 - (A) the pressure drop alone
 - (B) the flow rate alone
 - (C) both pressure drop and flow rate
 - (D) the cake thickness
3. A screen is said to be blinded when
 - (A) oversizes are present in under size fraction
 - (B) undersizes are retained in over size fraction
 - (C) the screen is plugged with solid particles
 - (D) its capacity is abruptly increased
4. Which is most suitable for transportation of sticky material ?
 - (A) apron conveyor
 - (B) belt conveyor
 - (C) screw conveyor
 - (D) pneumatic conveyor
5. Which of the following is an extensive property of a system ?
 - (A) heat capacity
 - (B) concentration
 - (C) pressure
 - (D) molal heat capacity
6. Which of the following is a thermodynamic property of a system ?
 - (A) concentration
 - (B) mass
 - (C) temperature
 - (D) entropy

Space For Rough Work



7. What is the degree of freedom for a system comprising of liquid water equilibrium with its vapour ?
- (A) 0
(B) 1
(C) 2
(D) 3
8. As the time is passing, entropy of the universe
- (A) is increasing
(B) is decreasing
(C) remains constant
(D) data insufficient, can't be predicted
9. Boyle's law for gases states that
- (A) $P \propto \frac{1}{V}$ when temperature is constant
(B) $P \propto \frac{1}{V}$ when temperature and mass of the gas remains constant
(C) $P \propto V$ at constant temperature and mass of the gas
(D) $\frac{P}{V} = \text{constant}$, for any gas.
10. Number of components (C), phase (P) and degree of freedom (F) are related by Gibb's phase rule as
- (A) $C = P - F + 2$
(B) $F = C - P - 2$
(C) $P + F = C + 2$
(D) $P = F - C - 2$
11. $C_p - C_v = R$ is valid for
- (A) ideal gases
(B) all gases
(C) gases at very high pressure
(D) gases at very low temperature
12. Second law of thermodynamics is concerned with
- (A) amount of energy transferred
(B) direction of energy transfer
(C) irreversible process only
(D) non-cyclic process only

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13. Joule - Thomson co-efficient is defined as

(A) $\mu = \left(\frac{\partial P}{\partial T}\right)_H$

(B) $\mu = \left(\frac{\partial T}{\partial P}\right)_H$

(C) $\mu = \left(\frac{\partial U}{\partial T}\right)_H$

(D) $\mu = \left(\frac{\partial U}{\partial P}\right)_H$

14. Mollier diagram is a plot of

(A) temperature v/s enthalpy

(B) temperature v/s entropy

(C) entropy v/s enthalpy

(D) temperature v/s internal energy

15. In the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3 + 22.4 \text{ kcal}$, the formation of NH_3 will be favoured by

(A) high temperature

(B) low pressure

(C) low temperature only

(D) low temperature and high pressure

16. Unsteady state heat conduction occurs when

(A) temperature distribution is independent of time

(B) temperature distribution is dependent on time

(C) heat flows in one direction only

(D) three dimensional heat flow is concerned

17. The heat transfer co-efficient in film type condensation is

(A) greater than that for dropwise condensation

(B) lower than that for dropwise condensation

(C) is same as that for dropwise condensation

(D) half that for dropwise condensation

18. Prandtl number is the ratio of

(A) momentum diffusivity to mass diffusivity

(B) momentum diffusivity to thermal diffusivity

(C) thermal diffusivity to mass diffusivity

(D) thermal diffusivity to momentum diffusivity

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19. Which has the lowest Prandtl number ?

(A) liquid metal

(B) aqueous solution

(C) water

(D) lube oil

20. Dropwise condensation occurs on

(A) clean and dirt free surface

(B) smooth clean surfaces

(C) contaminated cooling surfaces

(D) polished surfaces

21. The percentage humidity is less than the relative humidity only at

(A) zero percentage humidity

(B) hundred percent humidity

(C) both zero or hundred percent humidity

(D) fifty percent humidity

22. Raoult's law applies to

(A) all liquid solution

(B) only non-ideal solution

(C) non-volatile solute

(D) the solvents

23. Flash distillation is

(A) same as differential distillation

(B) used for multicomponent system like crude refining

(C) same as simple distillation

(D) most useful for handling binary system

24. What is the Laplace Transform of $\sin t$?

(A) $\frac{S}{S^2 + 1}$

(B) $\frac{1}{S^2 + 1}$

(C) $\frac{1}{S^2 - 1}$

(D) $\frac{S}{S^2 - 1}$

Space For Rough Work



25. Time constant is
- (A) the time taken by the controlled variable to reach 63.2 percent of its full change
 - (B) same as transportation lag
 - (C) same as dead time
 - (D) the time required by the measured variable to reach 62.3 percent of its ultimate change.
26. When the damping co-efficient (ϵ) is unity, the system is
- (A) overdamped
 - (B) critically damped
 - (C) under damped
 - (D) highly fluctuating
27. Number of poles in a system with transfer function $\frac{Y(s)}{X(s)} = \frac{1}{S^3 + 2S^2 + 1}$ is
- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4
28. Final control element is a
- (A) Switch
 - (B) Signal
 - (C) Set Point
 - (D) Valve
29. Stability of a control system containing a transportation lag can be best analyzed by
- (A) Routh test
 - (B) Frequency response method
 - (C) Root locus method
 - (D) Nyquist method
30. Which of the following is a biodegradable organic chemical / substances ?
- (A) Plastics
 - (B) Oils
 - (C) Pesticides
 - (D) Garbage

Space For Rough Work



31. Disease caused by eating fish inhabiting mercury contaminated water is
- (A) Bright's disease
 - (B) Hiroshima episode
 - (C) Mina-mata disease
 - (D) Osteosclerosis
32. Widely used method for conditioning of boiler feed water
- (A) cold lime process
 - (B) coagulation
 - (C) hot-lime soda process
 - (D) sequestration
33. Permanent hardness of water is due to the presence of calcium and magnesium
- (A) bi-carbonate
 - (B) sulphate and chloride
 - (C) carbonate
 - (D) oxide
34. Fat splitting catalyst is
- (A) CaCO_3
 - (B) ZnO
 - (C) Alumina
 - (D) Iron
35. Space time equals the mean residence time
- (A) when the density of the reaction mixture is constant
 - (B) for large diameter tubular reactor
 - (C) for narrow diameter tubular reactor
 - (D) for CSTR
36. The use of space time is preferred over the mean residence time in the design of
- (A) batch reactor
 - (B) ideal tubular flow reactor
 - (C) slurry reactor
 - (D) CSTR

Space For Rough Work



37. Oxygen percentage by volume in atmospheric air is
- (A) 23
(B) 22
(C) 21
(D) 29
38. The molecular weight of the compound MgSO_4 is
- (A) 110
(B) 120
(C) 130
(D) 100
39. What is the equivalent weight of HCl ?
- (A) 36.5
(B) 35.5
(C) 34.5
(D) 33.5
40. The total volume occupied by a gaseous mixture is equal to the sum of the pure component volume is the statement of
- (A) Dalton's law
(B) Amagat's law
(C) Ideal gas law
(D) Raoult's law
41. With increase in temperature the viscosity of a liquid
- (A) increases
(B) decreases
(C) remains constant
(D) may increase or decrease depends on the liquid
42. For water, when the pressure increases the viscosity
- (A) increases
(B) decreases
(C) remains constant
(D) first decreases then increases

Space For Rough Work



43. The centre of pressure is
- (A) always below the centroid of the area
 - (B) always above the centroid of the area
 - (C) a point on the line of action of the resultant force
 - (D) at the centroid of the submerged area
44. The value of critical Reynolds number for pipe flow is
- (A) 1300
 - (B) 10,000
 - (C) 20,000
 - (D) 50,000
45. Reynolds number is the ratio of
- (A) viscous force to gravity force
 - (B) inertial force to viscous force
 - (C) viscous force to inertial force
 - (D) inertial force to gravity force
46. Terminal velocity is
- (A) a constant velocity with no acceleration
 - (B) a fluctuating velocity
 - (C) attained after moving one half of actual distance
 - (D) attained after moving one third of actual distance
47. Boiler feed pump is usually a
- (A) reciprocating pump
 - (B) gear pump
 - (C) multistage centrifugal pump
 - (D) diaphragm pump
48. Molten soap mass is transported by a
- (A) diaphragm pump
 - (B) reciprocating pump
 - (C) gear pump
 - (D) centrifugal pump
49. Pump used for transportation of molten sodium in fast breeder reactor is
- (A) reciprocating pump
 - (B) electro-magnetic pump
 - (C) plunger pump
 - (D) gear pump
50. Ribbon blender are exclusively meant for
- (A) blending miscible liquids
 - (B) non flowing powder and thin paste
 - (C) batch mixing
 - (D) continuous mixing

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PART - 2

(Each question carries two marks.)

(25 × 2 = 50)

51. An aqueous solution of sodium chloride is prepared by dissolving 20 kg of NaCl in 100 kg of water. What is the weight % composition of solution ?
- (A) NaCl = 17.50%, water = 82.5%
(B) NaCl = 17.66%, water = 82.34%
(C) NaCl = 16.66%, water = 83.34%
(D) NaCl = 15.66%, water = 84.34%
52. The control system described by the following characteristic equation $S^4 + 3S^3 + 5S^2 + 4S + 2 = 0$. Find the number of roots having +ve real parts.
- (A) 0
(B) 1
(C) 2
(D) 3
53. It is required to make 100 kg of 30% NaOH solution by mixing the following liquids. 20% NaOH and 36% NaOH solution. Calculate the quantities of the two solution mixed.
- (A) 37.5 kg, 62.5 kg
(B) 35.0 kg, 65.0 kg
(C) 40.2 kg, 59.8 kg
(D) 42.0 kg, 58.0 kg
54. Which of the following conditions are satisfied at the critical condition by the PVT relation of a real fluid ?
- (A) $\left(\frac{\partial^2 P}{\partial V^2}\right)_T < 0, \left(\frac{\partial P}{\partial V}\right)_T = 0$
(B) $\left(\frac{\partial^2 P}{\partial V^2}\right)_T = \left(\frac{\partial P}{\partial V}\right)_T = 0$
(C) $\left(\frac{\partial^2 P}{\partial V^2}\right)_T > 0, \left(\frac{\partial P}{\partial V}\right)_T = 0$
(D) $\left(\frac{\partial^2 P}{\partial V^2}\right)_T > 0, \left(\frac{\partial P}{\partial V}\right)_T > 0$

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55. For an ideal plug flow reactor the value of the pelect number is
- (A) 10
(B) 5
(C) 0
(D) 1
56. Find the Laplace Transform of the function $e^{-at} \sinh (wt)$.
- (A) $\frac{w}{(s+a)^2 - w^2}$
(B) $\frac{s}{(s+a)^2 - w^2}$
(C) $\frac{w}{(s+a)^2 + w^2}$
(D) $\frac{w+s}{(s+a)^2 + w^2}$
57. $\text{Na}_2\text{SO}_4 \cdot 10 \text{H}_2\text{O}$ crystals are formed by cooling 100 kg of 30% by weight aqueous solution of Na_2SO_4 . The final concentration of the solute in the solution is 10%. The weight of the crystal is
- (A) 20 kg
(B) 32.2 kg
(C) 45.3 kg
(D) 58.65 kg
58. Air at a temperature of 20 °C and 750 mmHg pressure has a relative humidity of 80%. What is its percentage humidity ? Vapour pressure of water at 20 °C is 17.5 mmHg.
- (A) 80.38
(B) 80.0
(C) 79.52
(D) 78.51
59. 6 g of carbon is burnt with an amount of air containing 18 g oxygen. The product contains 16.5 g CO_2 and 2.8 g CO beside other constituents. What is the degree of conversion on the basis of disappearance of the limiting reactant ?
- (A) 100%
(B) 95%
(C) 75%
(D) 20%

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60. The Laplace transform of $f(t) = \frac{1}{\sqrt{t}}$ is

(A) $\sqrt{\frac{\pi}{s}}$

(B) $\frac{1}{\sqrt{s}}$

(C) $\frac{1}{s^{3/2}}$

(D) $\frac{1}{s^2}$

61. For a pure substance, the Maxwell relation obtained from the fundamental property relation $du = Tds - Pdv$ is

(A) $\left(\frac{\partial T}{\partial V}\right)_S = \left(\frac{\partial P}{\partial S}\right)_V$

(B) $\left(\frac{\partial P}{\partial T}\right)_V = \left(\frac{\partial S}{\partial V}\right)_T$

(C) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$

(D) $\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial S}{\partial P}\right)_T$

62. The molar composition of a gas is 10% H_2 , 10% O_2 , 30% CO_2 and balance H_2O . If 50% H_2O condenses the final mole percent of H_2 in the gas on a dry basis will be

(A) 10%

(B) 5%

(C) 18.18%

(D) 20%

63. The reaction rate constant at two different temperatures T_1 and T_2 are related by

(A) $\ln\left(\frac{K_2}{K_1}\right) = \frac{E}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

(B) $\ln\left(\frac{K_2}{K_1}\right) = \frac{E}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

(C) $\exp\left(\frac{K_2}{K_1}\right) = \frac{E}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

(D) $\frac{K_2}{K_1} = \frac{E}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

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64. The Maxwell relation derived from the differential expression for the Helmholtz free energy (dA) is
- (A) $\left(\frac{\partial T}{\partial V}\right)_S = \left(\frac{\partial P}{\partial S}\right)_V$
- (B) $\left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial T}\right)_P$
- (C) $\left(\frac{\partial V}{\partial S}\right)_P = \left(\frac{\partial T}{\partial P}\right)_S$
- (D) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$
65. An PID controller has the transfer function $(1 + 1/0.5 + 0.2 s)$. The frequency at which the magnitude ratio of the controller is 1, is
- (A) $0.5 / 0.2$
- (B) $0.2 / 0.5$
- (C) 0.2×0.5
- (D) $1 / \sqrt{0.2 \times 0.5}$
66. Heat capacity of air can be approximately expressed as $C_p = 26.693 + 7.365 \times 10^{-3} T$ Where C_p is in $J/(\text{mol}\cdot\text{K})$ and T is in K . The heat given off by 1 mole of air when cooled at 1 atmospheric pressure from 500°C to -100°C is
- (A) 10.73 kJ
- (B) 16.15 kJ
- (C) -18.11 kJ
- (D) 18.33 kJ
67. The inverse Laplace transform of the function $f(s) = 1/(s)(s + 1)$ is
- (A) $1 + e^t$
- (B) $1 - e^t$
- (C) $1 + e^{-t}$
- (D) $1 - e^{-t}$
68. In distillation where q is defined as the moles of liquid flow in the stripping section per mole of feed introduced, for saturated liquid feed
- (A) $q > 1$
- (B) $q < 1$
- (C) $q = 1$
- (D) $q = 0$
69. Which is a high grade pulp ?
- (A) rag pulp
- (B) mechanical pulp
- (C) sulphate pulp
- (D) sulphite pulp

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70. A certain reaction has a rate given by $-r_A = 0.005 C_A^2$, mol / (cm³.min)
If the concentration is expressed in mol/l and time in hours, what would be the value and units of rate constant ?
(A) 3×10^{-4} l/(mol.hr)
(B) 2.5×10^{-4} l/(mol.hr)
(C) 2.0×10^{-4} l/(mol.hr)
(D) 1.5×10^{-4} l/(mol.hr)
71. On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order
(A) 1.4
(B) 1.6
(C) 1.8
(D) 2.0
72. The activation energy of a bimolecular reaction is about 9150 cal/mol. How much faster is this reaction takes place at 500 K than at 400 K ?
(A) 7
(B) 8
(C) 9
(D) 10
73. At 500 K the rate of a bimolecular reaction is 10 times the rate at 400 K. What will be the activation energy for this reaction using Arrhenius law ?
(A) 9250 cal/mol
(B) 9150 cal/mol
(C) 9350 cal/mol
(D) 9450 cal/mol
74. The rate constant of a zero order reaction is 0.2 mol/(l.hr). What will be initial concentration of the reactant if, after half an hour its concentration is 0.05 mol/l ?
(A) 0.45 mol/l
(B) 0.35 mol/l
(C) 0.25 mol/l
(D) 0.15 mol/l
75. A single effect evaporator is fed with 4000 kg/hr. of weak liquor containing 15% caustic by weight and is concentrated to get thick liquor containing 40% weight of caustic. Calculate the amount of water evaporated ?
(A) 2300 kg/hr
(B) 2500 kg/hr
(C) 2200 kg/hr
(D) 2600 kg/hr

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