

GU-RET 2016

GAUHATI UNIVERSITY RESEARCH ELIGIBILITY TEST

CHEMICAL ENGINEERING

Booklet Series : **A**

Invigilator's Name and Signature

BOOKLET NO.

OMR SHEET NO.

ROLL NO.

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TIME : 2 HOURS 20 MINUTES

TOTAL MARKS : 80

Number of Pages in this Booklet : 18

Instructions for Candidates

1. Write your Roll No. and OMR Sheet No. in the boxes provided above.
2. This paper consists of two sections : **Section B** with 50 (fifty) multiple choice questions (MCQ) and **Section C** with 7 (seven) descriptive questions. Each MCQ has 4 (four) answers, out of which **ONLY** one is correct. You have to darken the circle (on the OMR Sheet) for the correct answer corresponding to the question given in this booklet.

Example : (A) (B) (C) (D)

where (C) is the correct answer. No marks will be given for markings made in this booklet. The descriptive questions in **Section C**, **MUST** be answered in the space provided in this booklet. **No extra pages will be provided in any case.**

3. Use a **BLACK** ball point pen in your OMR Sheet.
4. Read the instructions given inside this booklet before attempting to answer any questions.
5. **DO NOT** write your name, roll no, phone no, or anything, or put any marks anywhere in this booklet, otherwise your candidature will be disqualified.
6. If you are found to resort to any kind of unfair means such as carrying extra material other than pen, pencil, watch, eraser, and scale, or copying from somebody or from external material, your candidature will be disqualified.
7. Mobile phones, programmable calculators, log tables or any other tables, wearable smart devices such as smart Android watches or objects of similar nature **CAN NOT** be used inside the examination hall. **Simple and scientific calculators can be used.**
8. At the end of the examination, you have to return this booklet and the OMR Sheet back to the invigilator. There is no negative marks for incorrect answer.

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Section B (50 Marks)

1. If n is the order of a chemical reaction, then unit of the rate constant is
 - (A) $(\text{time})^{n-1}(\text{concentration})$
 - (B) $(\text{time})^{-1}(\text{concentration})^{n-1}$
 - (C) $(\text{time})^{-1}$
 - (D) $(\text{time})^{-1}(\text{concentration})^{1-n}$
2. Arrhenius equation shows the variation of temperature with
 - (A) reaction rate
 - (B) rate constant
 - (C) energy of activation
 - (D) frequency factor
3. Very high temperature (about 2000°C) will be measured most precisely by
 - (A) thermocouple
 - (B) radiation pyrometer
 - (C) bi-metallic thermometer
 - (D) optical pyrometer
4. Reactions in which the rate equation corresponds to a stoichiometric equation are called
 - (A) homogeneous reaction
 - (B) heterogeneous reaction
 - (C) elementary reaction
 - (D) Both (A) and (C)
5. Can a cooling tower cool water below the wet bulb temperature of inlet air?
 - (A) Yes
 - (B) No
 - (C) Yes, but height of cooling tower will be high
 - (D) Yes, but the air flow rate should be excessively high
6. Catalyst used in hydrogenation of oil is
 - (A) iron
 - (B) nickel
 - (C) alumina
 - (D) platinum
7. The binary diffusivity in gases and liquids vary respectively as
 - (A) $T^{3/2}$ and T
 - (B) T and $T^{3/2}$
 - (C) $T^{1/2}$ and $T^{3/2}$
 - (D) $T^{3/2}$ and $T^{1/2}$
8. As reflux ratio decreases
 - (A) separation becomes more efficient
 - (B) number of plate decreases
 - (C) column diameter increases
 - (D) None of these
9. Saponification number of an oil
 - (A) gives idea about its molecular weight
 - (B) is inversely proportional to its molecular weight
 - (C) detects its adulteration
 - (D) All (A), (B), and (C)
10. Baffle spacing is generally
 - (A) more than the ID of the shell
 - (B) not greater than the ID of the shell
 - (C) not less than one fifth of the ID of the shell
 - (D) Both (B) and (C)
11. The LMTD correction factor (F_T) is applied in
 - (A) 1 – 1 cocurrent heat exchanger
 - (B) double pipe heat exchanger
 - (C) all multipass heat exchanger
 - (D) all the heat exchanger involving liquid-liquid heat transfer
12. Which of the following does not discharge the dust collected as a dry solid?
 - (A) Bag filter
 - (B) Electrostatic precipitator
 - (C) Wet scrubber
 - (D) Gravity settler

13. The main purpose of galvanizing iron sheets is to
- harden the surface
 - prevent it from corroding
 - increase its glossiness and luster
 - None of these
14. An insulator should have
- high thermal conductivity
 - low thermal conductivity
 - a porous structure
 - less resistance to heat flow
15. Heat flow rate through an area $A = 0.5 \text{ m}^2$ and thickness $L = 0.02 \text{ m}$ ($k = 70 \text{ W/m}^\circ\text{C}$) for a temperature difference of 40°C is
- 70 kW
 - 140 kW
 - 35 kW
 - 100 kW
16. Equation which relates pressure, temperature and volume of gas is called
- ideal gas equation
 - equation of state
 - Gibbs-Duhem equation
 - both (A) and (B)
17. A negative gain margin expressed in decibels means
- a stable system
 - unstable system
 - critically damped system
 - None of these
18. Which of the following valve is commonly used for close control of flow of fluid?
- Gate valve
 - Globe valve
 - Butterfly valve
 - Check valve
19. Prilling of urea should be accomplished just above the melting point of urea with minimum of retention time, otherwise it will result in
- low bulk density product
 - biuret formation
 - non spherical prills
 - non flowing and sticky product
20. Size measurement of ultrafine particles can be best expressed in terms of
- centimetre
 - micron metre
 - surface area per unit mass
 - screen size
21. Priming is needed in a
- centrifugal pump
 - reciprocating pump
 - gear pump
 - diaphragm pump
22. Nylon 6-6 is manufactured from
- Hexamethylene diamine and adipic acid
 - Hexamethylene diamine and maleic acid
 - Caprolactum
 - Dimethyl terephthalate and ethylene glycol
23. Pick out the first order system from the following systems
- Damped vibrator
 - Mercury in glass thermometer kept in boiling water
 - Interacting system of two tanks in series
 - Non-interacting system of two tanks in series
24. In a cyclone separator, the separation is based on
- particle size only
 - particle size and density
 - particle density only
 - coefficient of friction between particle and the walls of the cyclone

25. Double pipe heat exchangers are preferred to shell and tube heat exchangers when the
- liquid is more viscous
 - heat transfer area required is low
 - overall heat transfer coefficient is very low
 - liquid is corrosive
26. At normal temperature and pressure, 16 kg of Oxygen occupies
- 22.4 m³
 - 11.2 m³
 - 33.6 m³
 - None of the above
27. 1000 kg of wet solid is dried from 55% to 10% moisture. The mass of water removed in kg is
- 500
 - 450
 - 400
 - 300
28. In a gyratory crusher, the size reduction is affected mainly by
- compression
 - impact
 - cutting action
 - attrition
29. Mannheim furnace is used in the manufacture of
- hydrochloric acid
 - sulphuric acid
 - nitric acid
 - calcium carbide
30. Which of the following has no significance in forced convection?
- Reynolds number
 - Grashof number
 - Prandtl number
 - Nusselt number
31. Potassic fertilizer is graded based on its
- KCl content
 - K₂O content
 - KNO₃ content
 - HNO₃ content
32. The unit of heat transfer co-efficient is
- Kcal/hr m °C
 - Kcal/hr m²°C
 - Kcal/hr °C
 - Kcal/hr m
33. The operation of a rotameter is based on
- variable flow area
 - pressure at a stagnation point
 - pressure drop across a nozzle
 - rotation of a turbine
34. Smoke point of a test sample of kerosene is found to be 15 mm. On removal of from it, the smoke point rises to 25 mm.
- aromatics
 - olefins
 - n*-paraffins
 - None of these
35. In petroleum refining, the process used for conversion of hydrocarbons to aromatics is
- catalytic cracking
 - catalytic reforming
 - hydrotreating
 - alkylation
36. In the reaction $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$, what volume of hydrogen at STP would be liberated when 80 gm of calcium reacts with excess water
- 2240 c.c.
 - 4480 c.c.
 - 1120 c.c.
 - 0.4 c.c.

37. Nickel (56%) and molybdenum (17%) alloy is called
- Monel
 - Bronzes
 - Hastealloy
 - Stainless steel
38. Response of a system to a sinusoidal input is called response.
- unit step
 - frequency
 - impluse
 - None of these
39. Polytetrafluoro Ethylene (PTFE) is known as
- Teflon
 - Bakelite
 - Celluloid
 - Dacron
40. Maximum permissible turbidity in potable water is ppm.
- 1000
 - 1
 - 250
 - 10
41. Ideal solution obeys
- Boyle's law
 - Amagat's law
 - Raoult's law
 - All the above laws
42. Enthalpy change in a chemical reaction is independent of the steps through which the reaction proceeded. This is a consequence of
- Boyle's law
 - Van't Hoff's law
 - Hess's law
 - LeChatlier's principle
43. The rate of a homogeneous reaction is a function of
- temperature and pressure only
 - temperature and composition only
 - pressure and composition only
 - all temperature, pressure and composition
44. For an autocatalytic reaction, the suitable reactor set up is
- PFRs in series
 - CSTRs in series
 - CSTR followed by PFR
 - PFR followed by CSTR
45. A chemical reaction will occur spontaneously at constant pressure and temperature, if the free energy is
- zero
 - positive
 - negative
 - none of these
46. *P-I* controller as compared *P*-controller has a
- higher maximum deviation
 - longer response time
 - longer period of oscillation
 - all (A), (B), (C)
47. Shift conversion is the conversion of
- $\text{CO} \rightarrow \text{CO}_2$
 - $\text{N}_2 \rightarrow \text{NO}_2$
 - $\text{S} \rightarrow \text{SO}_2$
 - None of these
48. An UF membrane has a pore size range of
- 1 – 100 Å
 - 1 – 100 μm
 - 1 – 100 nm
 - 1 – 10 μm
49. The decomposition of dimethylether at 504 °C is first order with a half-life of 1570 seconds. What fraction of an initial amount of dimethylether remains after 4710 seconds?
- 1/3
 - 1/6
 - 1/8
 - 1/16
50. The average molecular weight of a flue gas having the composition by volume as $\text{CO}_2 = 25\%$, $\text{O}_2 = 25\%$, $\text{N}_2 = 50\%$ will be
- 27.6
 - 23
 - 47.3
 - 42.9

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Section C (30 Marks)

Answer any 5 (five) from the following

1. For a chemical reaction, the rate of reaction at 390°C is 10 times that at 340°C . Calculate the activation energy. (Marks : 6)

2. An aqueous solution contains 40% Na_2CO_3 by weight. Express the composition in mole percent. (Marks : 6)

3. Name two important water quality parameters and explain their significances with respect to water pollution. (Marks : 6)

4. State Fourier's law of heat conduction. Determine the steady state heat flux through a 0.2 m thick brick wall ($k = 0.69 \text{ W/m}^{\circ}\text{C}$) with one surface at 30°C and the other at -20°C . (Marks : 2 + 4 = 6)

5. Why size reduction of solid is necessary in chemical industries? What are the different ways of size reduction? State and explain Rittinzer law of size reduction. (Marks : 6)

6. State Fick's law of diffusion. Show that for a binary gas mixture of A and B , the diffusivity coefficient D_{AB} for A diffusing into B is same as D_{BA} for B diffusing into A . (Marks : 2 + 4 = 6)

7. How composition of crude oil effect the product pattern of a refinery? (Marks : 6)

Space for Answers (Section C) : for Questions 1 to 7 (10 pages)

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Space for Answers (Section C) : for Questions 1 to 7 (10 pages)

GU-RRET 2019

Space for Answers (Section C) : for Questions 1 to 7 (10 pages)

GU-RREF 2018

Space for Answers (Section C) : for Questions 1 to 7 (10 pages)

GU-RFET 2019

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