OCET 2011

Question Booklet Series : A

Important : Please consult your Admit Card / Roll No. Slip before filling your Roll Number on the Test Booklet and Answer Sheet.

Roll No.   *In Figures*   *In Words*

O.M.R. Answer Sheet Serial No.

Signature of the Candidate :

Subject : M.Sc. (Industrial Chemistry)

Time : 90 minutes   **Number of Questions : 75**   **Maximum Marks : 75**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO

INSTRUCTIONS

1. Write your Roll No. on the Question Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Subject and Series Code of Question Booklet on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point / Black Gel pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. To open the Question Booklet remove the paper seal (s) gently when asked to do so.
5. Please check that this Question Booklet contains **75** questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of test.
6. Each question has four alternative answers (A, B, C, D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point / Black Gel pen.**
7. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Sheet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the questions given in the Question Booklet.
9. Negative marking will be adopted for evaluation i.e., 1/4th of the marks of the question will be deducted for each wrong answer. A wrong answer means incorrect answer or wrong filling of bubble.
10. For calculations, use of simple log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the sheets marked "Rough Work" at the end of the Question Booklet be used.
12. The Answer Sheet is designed for **computer evaluation**. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e., not following the instructions completely, shall be of the candidate only.**
13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so, would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistance or found giving or receiving assistance or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
16. **Telecommunication equipment such as pager, cellular phone, wireless, scanner, etc., is not permitted inside the examination hall. Use of calculators is not allowed.**

1. **If two light waves are coherent :**
   (A) their amplitudes are the same
   (B) their frequencies are the same
   (C) their wavelengths are the same
   (D) their phase difference is constant

2. **"LED" stands for :**
   (A) less energy donated
   (B) luminescent energy developer
   (C) light energy degrader
   (D) light emitting diode

3. **The total number of electron states with n = 2 and l = 1 for an atom is :**
   (A) 2
   (B) 4
   (C) 6
   (D) 8

4. **A LASER must be pumped to achieve :**
   (A) a meta-stable state
   (B) fast response
   (C) stimulated emission
   (D) population inversion

5. **The "triple point" is that point for which the temperature and pressure are such that :**
   (A) only solid and liquid are in equilibrium
   (B) only liquid and vapor are in equilibrium
   (C) only solid and vapor are in equilibrium
   (D) solid, liquid, and vapor are all in equilibrium

6. **An adiabatic process for an ideal gas is represented on a P-V diagram by :**
   (A) a horizontal line
   (B) a vertical line
   (C) a circle
   (D) none of these

7. **The mean free path of molecules in a gas is proportional to :**
   (A) the molecular cross-sectional area
   (B) the reciprocal of the molecular cross-sectional area
   (C) the root-mean-square molecular cross-sectional area
   (D) the molecular mass

8. **The change in entropy is zero for :**
   (A) the reversible adiabatic process
   (B) the reversible isothermal
   (C) the reversible isobaric
   (D) all adiabatic process.

9. **Two wires made of dirrerent materials have the same uniform current density. They carry the same current only if :**
   (A) their lengths are the same
   (B) their cross-sectional area are the same
   (C) both their lengths and cross-sectional areas are the same
   (D) the potential differences across them are the same.

10. **The magnetic properties of materials stem chiefly from :**
(A) particles with north poles
(B) particles with south pole
(C) motion of protons within nuclei
(D) electron magnetic dipole moments

11. **The sinusoidal voltage V(t) has an rms value 100 V. Its maximum value is :**
(A) 100 V
(B) 707 V
(C) 70·7 V
(D) 141 V

12. **A heat engine that in each cycle does positive work and rejects heat, with no heat input, would violet :**
(A) the zeroth law of themodynamics
(B) the first law of thermodynamics
(C) the second law of thermodynamics
(D) the third law of thermodynamics

13. **For the structural analysis of crystals, x-rays are used, because :**
(A) x-rays has wavelengths of the order of interatomic spacing.
(B) x-rays are highly penetrating radiations.
(C) wavelength of x-rays is of the order of nuclear size.
(D) x-rays are coherent radiations

14. **An application of Bernoulli's equations for fluid flow is found in the :**
(A) dynamic lift of an airplane
(B) viscosity meter
(C) capillary rise
(D) hydraulic press

15. **In air a solid sphere falls down with some terminal velocity. When falling in vacuum it will have :**
(A) same terminal velocity
(B) less terminal velocity
(C) more terminal velocity
(D) no terminal velocity

16. **Coefficient of rigidity is associated with :**
(A) only solids
(B) only liquids
(C) only gases
(D) solids, liquids and gases

17. **The size of the particle can be determined using the following phenomena of light :**
(A) absorption
(B) refraction
(C) scattering
(D) polarization

18. **The chemical shift, determined through NMR measurements, depends on the :**
(A) mass of the molecule
(B) mass of the nucleus
(C) NMR frequency
(D) electron density around the nucleus

19. **In a voltmeter during electrolysis 107·88 gms, silver is liberated by the flow of 96·487 Coulomb charge. The 63·57 gms. of copper will be liberated by the flow of charge :**
(A) 96·487 Coulomb
(B) 56·85 Coulomb
(C) 188·97 Coulomb
(D) 48·24 Coulomb

20. **Polarization experiments provide evidence that light is :**
    (A) a longitudinal wave   (B) a stream of particles
    (C) a transverse wave   (D) nearly monochromatic

21. **Displacement of the particle of medium due to progressive wave travelling in +ve x-direction is given by**

    $y(x, t) = 0\cdot01 \sin 2\pi (t - 0\cdot1 \ x)$

    where x and y are measured in metres and t in seconds. Wavelength (in metre) of the wave is :
    (A) $0\cdot1$ (B) $1\cdot0$
    (C) 10   (D) 100

22. **f : D → R, following statement is false :**
    (A) If f is differentiable, then it is continuous too
    (B) If f is continuous, then it is differentiable too
    (C) Polynomial function is differentiable and continuous both
    (D) Every differentiable function is continuous

23. **Let $Z_1 = 4 + 3i$ and $Z_2 = 2 - 5i$, then the product $Z_1 Z_2$ is :**
    (A) 23   (B) $- 14 \ i$
    (C) $23 - 14 \ i$ (D) $23 + 14 \ i$

24. **Let A be the matrix of order m × n, then the determinant of A exist iff :**
    (A) $m > n$ (B) $m \neq n$
    (C) $m < n$ (D) $m = n$

25. **In the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ the minor M_{22} is :**

    (A) 1   (B) 2
    (C) 3   (D) 4

26. **We have a biased die such that, each even number is twice likely to occur for odd number. What is the probability of gettig a number greater than 3, in a single roll of die ?**

    (A) $\dfrac{4}{9}$ (B) $\dfrac{5}{9}$

    (C) $\dfrac{1}{3}$ (D) $\dfrac{1}{9}$

27. **The number of arbitrary constants a general solution of first order equation contains :**
    (A) 0   (B) 1
    (C) 2   (D) 3

28. What is the maximum value of K for which $(\cos x + \sin x) + 7(\cos x - \sin x) + K < 0$?

(A) 10

(B) 8

(C) −10

(D) −8

29. What is the shortest distance from the point $(1, 2, -1)$ to the surface of the sphere $x^2 + y^2 + z^2 = 24$?

(A) $3\sqrt{6}$

(B) $2\sqrt{6}$

(C) $\sqrt{6}$

(D) 2

30. Let $\int e^{\sec x} \left[\sec x \tan x\, f(x) + (\sec x \tan x + \sec^2 x) \right] dx = e^{\sec x}\, f(x) + C$ then, what is f(x) equal to ?

(A) $\sec x + \tan x$

(B) $\sec x - \tan x$

(C) $-x \sec x + \tan x$

(D) $\sec x - x \tan x$

31. If $\displaystyle \lim_{x \to 0} \frac{x + 3\sin x - x^3 - K \sinh x}{1 - \cos x + x^2 - 3x^3}$ exists, then what is the value of K ?

(A) −1

(B) 2

(C) 3

(D) 4

32. Which one of the following is the set of all the real numbers x satisfying $||\,3 - x\,| - |\,x + 2\,|| = 5$?

(A) $[\,3, \infty\,)$

(B) $(-\infty, -2\,]$

(C) $(-\infty, -2\,] \cup [\,3, \infty\,)$

(D) $(-\infty, -3\,] \cup [\,2, \infty\,)$

33. What does the curve $x = 3(\cos\theta + \sin\theta)$, $y = 4(\cos\theta - \sin\theta)$ represent ?

(A) ellipse

(B) parabola

(C) hyperbola

(D) circle

34. If α, β and γ are the roots of the equation $x^3 + x + 1 = 0$, then $\dfrac{\alpha}{\beta + \gamma} + \dfrac{\beta}{\alpha + \gamma} + \dfrac{\gamma}{\alpha + \beta}$ is equal to :

(A) 0

(B) 1

(C) −2

(D) −3

35. A unit vector perpendicular to the two vectors $\hat{i} + 2\hat{j} - \hat{k}$ and $2\hat{i} + 3\hat{j} + \hat{k}$ is :

(A) $5\hat{i} - 3\hat{j} - \hat{k}$

(B) $\dfrac{1}{\sqrt{35}}(5\hat{i} - 3\hat{j} - \hat{k})$

(C) $\hat{i} + \hat{j} - 2\hat{k}$

(D) $\dfrac{1}{\sqrt{6}}(\hat{i} + \hat{j} - 2\hat{k})$

36. How many <u>dichlorinated</u> isomers can be formed by the halogenation of $CH_3CH_2CH_2CH_3$ with Cl_2 in the presence of light ?

(A) 2 (B) 3

(C) 5 (D) 6

37. Which of the following compounds is aromatic ?

(A)   (B)

(C)   (D)
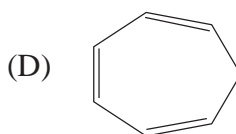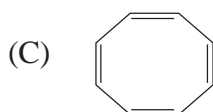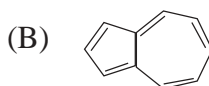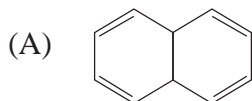
38. The primary difference between the modern periodic table and Mendeleev's periodic table is :

(A) The two tables are same except we know more elements now.

(B) Mendeleev's table did not arrange the elements according to recurring trends in their properties.

(C) The elements in modern periodic table are arranged in order of increasing atomic weight.

(D) The elements in modern periodic table are arranged in order of increasing atomic number.

39. The sugar that is produced by plants during photosynthesis is :

(A) Glucose (B) Fructose

(C) Sucrose (D) Galactose

40. Which of the following molecules does not have a net dipole moment ?

(A) H_2O (B) NH_3

(C) BF_3 (D) BrF_5

41. Determine the de Broglie wavelength of an electron with a kinetic energy of 1·00 eV :

(A) 1·23 nm (B) 28·7 pm

(C) 364 μm (D) 8·79 Å

42. Every 10ºC rise in temperature doubles the rate of chemical reaction. This increase in rate is due to

(A) Decrease in activation energy of reaction

(B) Decrease in the number of collisions between reactants molecules.

(C) Increase in activation energy of reactants

(D) Increase in number of effective collisions.

43. **The photoelectric effect proved to be a problem for a wave model of light because :**

   (A) the number of electrons ejected varied directly with the intensity of the light

   (B) the light intensity had no effect on the energy of the ejected electrons.

   (C) the energy of the ejected electrons varied inversely with the intensity of the light

   (D) the energy of the ejected electrons varied directly with the intensity of the light

44. **Which one of the following species contains the greatest number of lone pairs of electrons ?**

   (A) H_2O 　　　　　　　　　　　　(B) NH_3

   (C) H_3O^+ 　　　　　　　　　　　(D) HF

45. **The term that best describes the isomeric relationship for the following pair of compounds is :**
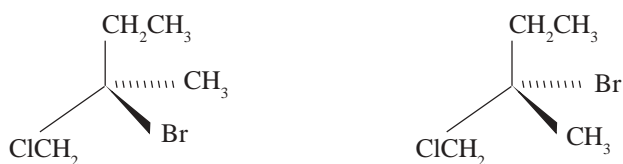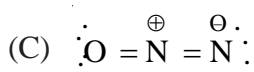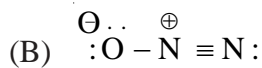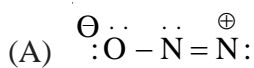

   (A) Diastereoisomers 　　　　　　　(B) Enantiomers

   (C) Same compound 　　　　　　　　(D) None of the above

46. **Which one of the following is *false* ?**

   (A) $K_w = K_a \times K_b$

   (B) $pK_a + pK_b = 14{\cdot}00$

   (C) $K_w = [H_+][OH_-] = 1 \times 10_{-14{\cdot}00}$ only in pure water at 25°C

   (D) $[H_+]$ is non-zero even at very high pH.

47. **Which one of the following represents the conjugate acid and the conjugate base of the $H_2PO_4^-$ ion ?**

   (A) Conjugate acid : H_3PO_4; conjugate base : HPO_4^{2-}

   (B) Conjugate acid : HPO_4^{2-}; conjugate base : H_3PO_4

   (C) Conjugate acid : $H_2PO_4^-$; conjugate base : HPO_4^{2-}

   (D) Conjugate acid : HPO_4^{2-}; conjugate base : PO_4^{3-}

48. **The enthalpy change for the reaction $2NO_2(g)$ $N_2O_4(g)$ is – 54 kJ mol⁻¹. What effect will increasing the temperature at constant pressure have on this equilibrium reaction ?**

   (A) Cannot be predicted 　　　　　　(B) Shift to the left (reactants)

   (C) Shift to the right (products) 　　　(D) No change

49. **What is the IUPAC name for the following compound ?**
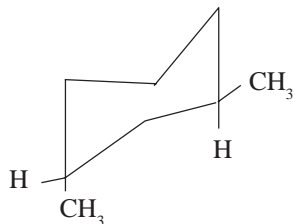
(A) Dimethylcyclohexane
(B) 1, 3-dimethylcyclohexane
(C) *cis*-1, 3-dimethylcyclohexane
(D) *trans*-1, 3-dimethylcyclohexane

50. **Which of the following represents the <u>best resonance</u> structure for N_2O ?**

(A) $\overset{\ominus}{:}\ddot{O} - \ddot{N} = \overset{\oplus}{N}:$

(B) $\overset{\ominus}{:}\ddot{O} - \overset{\oplus}{N} \equiv N:$

(C) $\ddot{O} = \overset{\oplus}{N} = \overset{\ominus}{N}:$

(D) All three are equally good

51. **How many grams of NaOH are needed to make 100 milliliters of a 0·2 molar solution of NaHO ?**

(A) 0·02 grams
(B) 0·8 grams
(C) 20 grams
(D) 800 grams

52. **If both the volume and the pressure of a gas are doubled, how will the absolute temperature change ?**

(A) It will increase by two times its original value
(B) It will decrease to one fourth of its original value
(C) It will stay the same as its original value
(D) It will increase by four times its original value

53. **According to molecular orbital theory, which of the following molecule has the highest bondorder ?**

(A) NO^+
(B) NO^-
(C) NO
(D) NO^{2-}

54. **Consider the reaction of CH_3Cl (methyl chloride) with hydroxide ion :**

$$CH_3Cl + OH^- \rightarrow CH_3OH + Cl^-$$
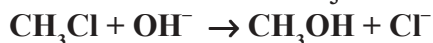
At some temperature, the following data are collected :

Initial conc/M		rate after 1 min/(M/min)
[CH_3Cl]	[OH^-]	
·1	·1	1×10^{-4}
·2	·1	2×10^{-4}
·1	·2	2×10^{-4}

Which statement is TRUE ?

(A) The reaction is first-order with respect to methyl chloride
(B) The reaction is first-order with respect to hydroxide ion
(C) The reaction is second-order overall
(D) All of the above

55. **The half-life of francium-212 is 19 minutes. How many minutes will it take for 1 gram of this isotope to decay to 0·125 grams ?**
   (A) 4·75 minutes
   (B) 9·5 minutes
   (C) 38 minutes
   (D) 57 minute

56. **Steady state heat transfer occurs when the flow of heat is**
   (A) uniform
   (B) uniformly increasing
   (C) uniformly decreasing
   (D) negligible

57. **With increase in temperature, thermal conductivity of solid metals :**
   (A) increases
   (B) decreases
   (C) remains same
   (D) depend on other factors

58. **Multiple pass heat exchanger is used to :**
   (A) increase pressure drop
   (B) increase rate of heat transfer
   (C) decrease pressure drop
   (D) decrease vibrations

59. **Prandtl number for gases is :**
   (A) 0·01 to 0·1
   (B) approximately 1
   (C) 1 to 10
   (D) 10 to 100

60. **Best conductor of heat is :**
   (A) Lead
   (B) Mercury
   (C) Sodium
   (D) Zinc

61. **At the azeotropic composition of a binary mixture, the relative volatility is :**
   (A) zero
   (B) ∞
   (C) 1
   (D) < 1

62. **Bakelite is :**
   (A) same as polytetrafluoroethylene (P.T.F.E.)
   (B) an inorganic polymer
   (C) same as thermoset phenol formaldehyde
   (D) not a polymer

63. **Alum is commercially produced from :**
   (A) gypsum
   (B) feldspar
   (C) galena
   (D) bauxite

64. **Inedible oil is :**
   (A) cottonseed oil
   (B) coconut oil
   (C) olive oil
   (D) corn oil

65. **Oil is :**
   (A) a mixture of glycerides
   (B) a mixture of glycerides of fatty acids
   (C) solid at room temperature
   (D) ester of alcohols other than glycerine

66. **Builders are added in soap to :**
   (A) bost cleaning power
   (B) act as anti-redeposition agents
   (C) act as corrosion inhibitors
   (D) act as fabric brightener

67. **A high grade pulp is :**
   (A) rag pulp
   (B) mechanical pulp
   (C) sulphate pulp
   (D) sulphite pulp

68. **Polyvinyl chloride (P.V.C.) is a :**
   (A) thermosetting material
   (B) thermoplastic material
   (C) fibrous material
   (D) chemically active material

69. **Vulcanisation of rubber :**
   (A) decreases its tensile strength
   (B) increases its ozone and oxygen reactivity
   (C) increases its oil and solvent resistance
   (D) converts its plasticity into elasticity

70. **Basic difference between vegetable oils and fats is in their :**
   (A) density
   (B) chemical properties
   (C) physical state
   (D) composition

71. **CaO is called :**
   (A) quick lime
   (B) slaked lime
   (C) limestone
   (D) calcite

72. **10% oleum comprises of 10% free :**
   (A) SO_2
   (B) H_2SO_3
   (C) SO_3
   (D) H_2SO_4

73. **$CH_3–CH=CH_2$ is a :**
   (A) monomer
   (B) polymer
   (C) isomer
   (D) epimer

74. **C/H ratio (by weight) is maximum for :**
   (A) Coal
   (B) Furnace oil
   (C) Natural gas
   (D) Naptha

75. **The quality of best fuel is :**
   (A) low cost
   (B) negligible cost
   (C) high calorific value
   (D) easy availability

ROUGH WORK