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PG-EE-2013

SUBJECT : Chemistry

D

Sr. No. 11388

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

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SEAL

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1. The Boyle temperature is that at which the second virial coefficient of real gas is :

(1) zero (2) one (3) four (4) one and half

2. The fugacity function is defined as :

(1) $\underset{P\to 0}{Limit}\frac{p}{f}=1$ (2) $\underset{P\to 0}{Limit}\frac{f}{p}=1$ (3) $\underset{f\to 0}{Limit}\frac{p}{f}=1$ (4) $\underset{P\to 0}{Limit}\frac{p}{f}=0$

3. Choose the correct relation :

(1) $(\partial A/\partial T)_p=\left(\frac{\partial G}{\partial T}\right)_V$ (2) $\left(\frac{\partial A}{\partial T}\right)_V=\left(\frac{\partial G}{\partial T}\right)_P$

(3) $\left(\frac{\partial T}{\partial S}\right)_P=\left(\frac{\partial V}{\partial S}\right)_P$ (4) $\left(\frac{\partial S}{\partial P}\right)_T=-\left(\frac{\partial T}{\partial V}\right)_P$

4. For the combustion of one mole of $CH_3COOH(l)$ at 298 K, Δn is :

(1) 1 (2) -1 (3) zero (4) $-1/2$

5. In the limit $T \to 0$, for a crystal :

(1) $S_T = 3C_p$ (2) $S_T = 2C_p$ (3) $S_T = C_p/2$ (4) $S_T = C_p/3$

where C_P is the heat capacity at constant pressure.

6. The compressibility factors of Vander Waal gas at critical point is :

(1) 0.375 (2) 0.400 (3) zero (4) 0.512

7. The Joule-Thomson expansion of an ideal gas is :

(1) Adiabatic process (2) an isentropic process

(3) an isenthalpic process (4) an isothermal process

8. The spacing between 123 planes in an orthorhombic unit cells having a = 50 pm, b = 100 pm and c = 150 pm is :

(1) 2.9 pm (2) 29 pm (3) 9.2 pm (4) 92 pm

9. The cell potential is a :

(1) Colligative property (2) Thermodynamic property

(3) Intensive property (4) Extensive property

10. The solubility of silver chloride in water at 298.15 K is 0.00179 g litre^{-1}. The solubility product will be :

(1) $156\times10^{-10}\,mol^2dm^{-6}$ (2) $1.56\times10^{-9}\,mol^2dm^{-6}$

(3) $15.6\times10^{-12}\,mol^2dm^{-6}$ (4) $1.56\times10^{-10}\,mol^2dm^{-6}$

11. Which of the Halogens is strongest oxidizing agent in water ?

(1) F_2 (2) Cl_2 (3) Br_2 (4) I_2

12. Which of the oxides is most acidic in nature ?

(1) CO (2) CO_2 (3) N_2O_5 (4) SO_3

13. Which of the following is most stable ?

(1) Ce^{2+} (2) Eu^{2+} (3) Sm^{2+} (4) Pr^{2+}

14. Pitchblende is an Ore of :

(1) Lanthanum (2) Cerium (3) Uranium (4) Thorium

15. How many Isomers are possible for the complex $K_2[Pt(NH_3)_4Cl_2]$?

(1) One (2) Two (3) Four (4) Six

16. What is the spin only magnetic moment of $[Fe(CN)_6]^{3-}$ ion ?

(1) 5.92 (2) 4.90 (3) 2.83 (4) 1.73

17. Which of high spin octahedral complex will show tetragonal distortion ?

(1) d^3 (2) d^4 (3) d^5 (4) d^8

18. How many unpaired electrons are present in $[CoF_6]^{3-}$ ion ?

(1) Zero (2) One (3) Two (4) Four

19. Predict the type of isomerism in $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$:

(1) Linkage Isomerism (2) Coordination Isomerism

(3) Stereoisomerism (4) Coordination position Isomerism

20. Which of the following complex ions will not be square planar in structure ?

(1) $[Co(CN)_4]^{2-}$ (2) $[Ni(CN)_4]^{2-}$ (3) $[Cu(NH_3)_4]^{2+}$ (4) $Ni(CO)_4$

21. What is the decreasing order of chemical shifts for protons among these ?

(1) Alkynes > Alkanes > Alkenes (2) Alkanes > Alkenes > Alkynes

(3) Alkynes > Alkenes > Alkanes (4) Alkenes > Alkynes > Alkanes

22. The singlet at about 4.0 ppm in the proton NMR spectrum of methylacetate is due to which protons ?

(1) Methyl (2) Methoxy

(3) Methyl and Methoxy (4) None of these

23. Which is ***not*** an anti-cancer drug ?

(1) Vincristine (2) Cyclophosphamide

(3) Doxorubicin (4) Gabapentin

24. Hexene-1 after reaction with metachloro-perbenzoic acid followed by treatment with lithium aluminium hydride and then with water in acidic medium gives :

(1) Hexane (2) Hexan-1-ol (3) Hexan-2-ol (4) None

25. Write the symbol of atomic orbital if $n = 3$, $l = 2$ and $m = -2, -1, 0, +1, +2$:

(1) $2s$ (2) $3s$ (3) $3p$ (4) $3d$

26. An element with atomic number 72 belongs to :

(1) s-block (2) p-block (3) d-block (4) f-block

27. Which of the following metals has lowest ionization potential ?

(1) Lithium (2) Sodium (3) Berylium (4) Magnesium

28. Which cation has highest polarizing power ?

(1) Na^+ (2) Mg^{2+} (3) K^+ (4) Al^{3+}

29. How many lone pairs of electrons are present in ICl_2^- ion ?

(1) Zero (2) One (3) Two (4) Three

30. Which of the following molecules/ions has smallest O – O bond ?

(1) O_2 (2) O_2^+ (3) O_2^- (4) O_2^{2-}

31. Which reacts fastest with N-bromosuccinimide (NBS) ?

(1) Toluene (2) Methane (3) Pyridine (4) Benzene

32. When vinyl cyanide reacts with ethylalcohol in presence of a base, what is formed ?

(1) $CH_2 = CH - OH$ (2) $C_2H_5O - CH_2 - CH_2CN$

(3) CH_3CH_2OH (4) $C_2H_5 - O - C_2H_5$

33. Which is the best leaving group ?

(1) Chloride (2) Fluoride (3) Tosylate (4) None

34. With cis-alkenes, the triplet carbenes give :

(1) cis-product (2) trans-product

(3) no product (4) both cis and trans products

35. DNFB is used to identify N-terminal amino acid of peptides. The reagent is called :

(1) Van-Slyke reagent (2) Sorenson reagent

(3) Sanger's reagent (4) Stephens reagent

36. Continuous wave NMR spectroscopy involves :

(1) sequential detection of resonances of nuclei

(2) simultaneous detection of all resonances of nuclei

(3) sometimes sequential and sometimes simultaneous detection of nuclei

(4) None

37. The addition of Br_2 to methyl acetylene to give trans-1, 2-dibromopropene is a :

(1) Stereoselective reaction

(2) Stereospecific reaction

(3) Stereoselective and Stereospecific reaction

(4) None

38. The reagent used in Edman degradation for N-terminal group analysis of peptides is :

(1) Phenyl isothiocyanate (2) Benzylchloroformate

(3) DNFB (4) Di-t-butyl carbonate

39. Aspartic acid shows :

(1) pKa_1 (2) pKa_2

(3) pKa_1 and pKa_2 (4) pKa_1, pKa_2 and pKa_3

40. Which is incorrect about grading of sugars ?

(1) Sucrose-1 (2) Fructose-1.75 (3) Lactose-6 (4) Saccharin-3500

41. The force constant of a diatomic S.H.O. can be calculated by employing relation :

(1) $k = 4\pi^2 c^2 (\overline{v}^2)\mu$ (2) $k = 4\pi^2 c(\overline{v}^2)\mu$

(3) $k = 4\pi^2 c(\overline{v})\mu^2$ (4) $k = 4\pi^2 \mu c$

where all the symbols have their usual meaning.

42. Zero point energy for diatomic molecule possessing harmonic motion is :

(1) zero (2) $h\nu$ (3) $\frac{1}{2}h\nu$ (4) $\frac{1}{3}h\nu$

43. The power output of a laser in which 2.0 J pulse can be delivered in one nanosecond is :

(1) 2.0 GW (2) 20.0 GW (3) 0.20 GW (4) None of these

44. For Arhenius equation, $A = e^{-E_a/RT}$, if $T \to \infty$, then value of E_a will be :

(1) positive (2) negative (3) zero (4) equal to A

45. The molarity of pure water is :

(1) 50 (2) 18 (3) 100 (4) 55.6

46. The degeneracy of the rotational energy level with J = 4 for a heterodiatomic molecule is :

(1) 4 (2) 7 (3) 9 (4) 8

47. Mean free path of a gas molecule is :

(1) inversely proportional to pressure

(2) directly proportional to pressure

(3) independent of pressure

(4) independent of temperature

48. In B.E.T. equation one of the following statement is ***not*** true. Select the one :

(1) It considers the multi layer adsorption

(2) It doesn't use the concept of saturation of vapour pressure

(3) It is not valid for porous adsorbent

(4) It uses the concept of latent heat of condensation

49. No diffraction would result, if :

(1) $\lambda << 2d$ (2) $\lambda \approx 2d$ (3) $\lambda << d$ (4) $\lambda >> 2d$

50. $11.2 \times 10^3 m^3$ of a gas at STP requires 104.6 J to raise its temperature by 10 degree. The C_v for the gas is :

(1) $20.92\ J\,deg^{-1}\,mole^{-1}$ (2) $10.46\ J\,deg^{-1}\,mole^{-1}$

(3) $9.4\ J\,deg^{-1}\,mole^{-1}$ (4) zero

51. How many peaks are observed in UV-visible absorption spectra of $[Ni(H_2O)_6]^{2+}$?

(1) One (2) Two (3) Three (4) Four

52. Write the Ground Term of Cr^{3+} :

(1) 6_S (2) 4_F (3) 2_D (4) 3_P

53. Predict the Point Group in $Fe(CO)_5$:

(1) O_h (2) C_{3V} (3) C_{2V} (4) D_{3h}

54. Nitrogenase enzyme consists of :

(1) *Co* (2) *Se* (3) *Mo, Fe* (4) *Mg*

55. Vitamin B_{12} consists of :

(1) *Fe* (2) *Co* (3) *Mn* (4) *V*

56. Complete the reaction :

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + ...$$

(1) $2\ ^{1}_{0}n$ (2) $^{1}_{1}H$ (3) $^{2}_{1}H$ (4) $^{4}_{2}He$

57. Bhopal Tragedy which killed thousands of people, was due to air pollution of :

(1) CO (2) SO_2

(3) Nitrogen oxides (4) Methyl Isocyanate

58. The cartesian components of angular momentum in a direction parallel to x-axis is given by :

(1) $\hat{L}_x = i\hbar\left[x.\frac{\partial}{\partial x} - z.\frac{\partial}{\partial z}\right]$ (2) $-i\hbar\left[y.\frac{\partial}{\partial z} - z.\frac{\partial}{\partial y}\right]$

(3) $\hat{L}_x = i\hbar\left[y.\frac{\partial}{\partial z} - z.\frac{\partial}{\partial y}\right]$ (4) $-i\hbar\left[x.\frac{\partial}{\partial z} - z.\frac{\partial}{\partial x}\right]$

59. Operators $\hat{A}$ and $\hat{B}$ are said to be commutative, if :

(1) $\hat{A} - \hat{B} = 0$ (2) $\hat{A} + \hat{B} = 0$

(3) $\hat{A}\hat{B} - \hat{B}\hat{A} = 0$ (4) $\hat{A}\hat{B} + \hat{B}\hat{A} = 0$

60. The wave function for a particle in one dimensional box is expressed as :

(1) $\frac{\sqrt{2}}{a}\sin\frac{n\pi x}{a}$ (2) $\sqrt{\frac{2}{a}}\frac{n\pi x}{a}$ (3) $\sqrt{\frac{2}{a}}\sin\frac{\pi x}{a}$ (4) $\sqrt{\frac{2}{a}}\sin\frac{n\pi x}{a}$

61. In the lead acid battery during charging, the cathode reaction is :

(1) reduction of Pb^{+2} to Pb (2) formation of $PbSO_4$

(3) formation of PbO_2 (4) None of these

62. When a radioactive element loses one 'α' and two 'β' particles, it yields :

(1) Isobar (2) Isomer (3) Isotope (4) Allotrope

63. 50 ml of 0.1 *NaOH* are added to 49 ml of 0.1 *HCl*. The *pH* of the resulting solution is :

(1) 12 (2) 11 (3) 10 (4) 9

64. The heat of reaction is independent of :

(1) Pressure (2) Temperature

(3) Physical state (4) The path by which product is formed

65. Which of the following will show ESR spectra ?

(1) C_6H_6 (2) CH_3 (3) CH_4 (4) H_2

66. What is the frequency of radiation possessing wave length 400 nm ?

(1) $7.5\times10^{-14}S^{-1}$ (2) $7.5\times10^{14}S^{-1}$ (3) $7.5\times10^{9}S^{-1}$ (4) $7.5\times10^{-13}S^{-1}$

67. In aerosol, the dispersion medium is :

(1) Gas (2) Solid (3) Liquid (4) Mixture of all

68. The polymers consist of coil like polymer chain are :

(1) Thermoplasts (2) Elastomers (3) Thermosets (4) None of these

69. Which of the following is a state function ?

(1) E – PV (2) E + PV (3) Q/W (4) Q – W

70. The ilkovic equation for diffusion current is expressed as :

(1) $\vec{I}_d = 607n\,DC\,m^{2/3}\,t^{1/6}$ (2) $\vec{I}_d = 607n\,D^{1/2}C\,m^{2/3}\,t^{1/6}$

(3) $\vec{I}_d = 607nC\,D^{1/2}\,m^{2/3}\,t^{1/6}$ (4) $\vec{I}_d = 607n\,D^{1/2}C^{1/2}\,m^{1/3}\,t^{1/6}$

71. In Rutile structure, the coordination number of Titanium atoms is :

(1) Six (2) Four (3) Two (4) Eight

72. Which of the following metal ion pairs have similar ionic radii ?

(1) Ti^{4+} and Zr^{4+} (2) V^{5+} and Nb^{5+}

(3) Cr^{3+} and Mn^{3+} (4) Zr^{4+} and Hf^{4+}

73. Which of the following solid will behave as p-type semiconductor ?

(1) $NaCl$ (2) ZnS (3) FeS (4) $AgCl$

74. Which metal has highest cohesion energy ?

(1) Cobalt (2) Nickel (3) Copper (4) Zinc

75. The aqueous solution of which metal ion will be colourless ?

(1) Ti^{3+} (2) Cr^{3+} (3) Cu^{+} (4) Cu^{2+}

76. Which of the following is a Lanthanide element ?

(1) Francium (2) Europium (3) Tungsten (4) Polonium

77. In the reaction $HClO_4 + HF \rightleftharpoons H_2F^+ + ClO_4^-$ the base is :

(1) $HClO_4$ (2) HF (3) H_2F^+ (4) ClO_4^-

78. Which of the following will behave as a Lewis acid ?

(1) NH_3 (2) NH_4^+ (3) BF_3 (4) CH_4

79. If you titrate an aqueous solution of borax with HCl, indicator used will be :

(1) Phenolphthalein (2) Methyl orange

(3) Methyl red (4) Eriochrome black T

80. As per HSAB concept, the hardest acid will be :

(1) Fe^{3+} (2) Zn^{2+} (3) Ag^{+} (4) Hg^{2+}

81. Which is a local anaesthetic ?

(1) Cocaine (2) Quinine (3) Morphine (4) None

82. Which enhances the absorption of Vitamin A ?

(1) Vit. K (2) Vit. C (3) DMG (4) None

83. By which of the following reaction, acetophenone can be converted to phenol ?

(1) m-CPBA followed by base catalyzed hyrolysis

(2) Conc. HNO_3

(3) Iodine and $NaOH$

(4) Singlet oxygen followed by hydrolysis

84. Diazomethane with acetylene gives :

(1) Pyrazole (2) Pyrazoline (3) Piperidine (4) Pyrimidine

85. Cinnamoyl alcohol with lead tetraacetate gives :

(1) Cinnamic acid (2) Cinnamoyl acetate

(3) Cinnamaldehyde (4) Acetophenone

86. Betaine is an intermediate in :

(1) Wittig reaction (2) Stobbe reaction

(3) Stephenson reduction (4) MPV reduction

87. If the migrating group in Beckman rearrangement is chiral, then :

(1) Its configuration will change

(2) Its configuration will be retained

(3) Both

(4) None

88. Which reduces only the carbonyl group in the presence of nitro, carboxyl, double bond and ester functional groups ?

(1) *LAH* (2) Na/NH_3 (3) $NaBH_4$ (4) H_2 /Ni

89. Which is the correct decreasing order of reactivity towards electrophilic aromatic substitution ?

(1) Indole > Pyrrole > Pyridine

(2) Pyrrole > Pyridine > Indole

(3) Pyrrole > Indole > Pyridine

(4) Indole > Pyridine > Pyrrole

90. OH signal of alcohol appears at what ppm range ?

(1) 0.5 – 5.0 (2) 0.1 – 8.0 (3) 0.3 – 4.0 (4) 0.3 – 10.0

91. C = C frequency in Oct-4-ene appears at :

(1) 1680-1600 cm^{-1} (very weak)

(2) 1680-1600 cm^{-1} (strong)

(3) 1680-1600 cm^{-1} (m)

(4) No peak in this region of 1680-1600 cm^{-1}

92. I for C-13 is :

(1) 1 (2) 1/2 (3) 3/2 (4) 2

93. I for P-31 is :

(1) 1 (2) 1/2 (3) 3/2 (4) 3

94. What is the right order of coupling constants ?

(1) $J^1 > J^2 > J^3$ (2) $J^3 > J^2 > J^1$ (3) $J^1 = J^2 = J^3$ (4) None of these

95. Which aromatic band shows fine structure ?

(1) Primary (2) Secondary (3) Tertiary (4) None

96. Which is a better Diels Alder Diene for reaction with maleic anhydride ?

(1) Furan (2) Pyrrole (3) Thiophene (4) Pyridine

97. Which is a strong base ?

(1) Aniline (2) Cyclohexylamine

(3) Pyrrole (4) Quinoline

98. Which is the right decreasing order of nucleophilicity ?

(1) $CH_3 - \overset{\ominus}{C}H_2 > \overset{\ominus}{N}H_2 > CH \equiv \overset{\ominus}{C} > \overset{\ominus}{O}H$

(2) $CH \equiv \overset{\ominus}{C} > \overset{\ominus}{N}H_2 > CH \equiv \overset{\ominus}{C} > \overset{\ominus}{O}H$

(3) $\overset{\ominus}{O}H > \overset{\ominus}{N}H_2 > CH \equiv \overset{\ominus}{C} > CH_3 - \overset{\ominus}{C}H_2$

(4) $\overset{\ominus}{N}H_2 > CH \equiv \overset{\ominus}{C} > \overset{\ominus}{O}H > CH_3 - \overset{\ominus}{C}H_2$

99. Which gives single mononitroderivative ?

(1) Naphthalene (2) O-xylene (3) Ethylbenzene (4) p-xylene

100. Which one is most effective in an SN^2 displacement on methyl bromide ?

(1) $C_2H_5\overset{\ominus}{O}$ (2) $H\overset{\ominus}{O}$ (3) $C_6H_5\overset{\ominus}{O}$ (4) $CH_3CO\overset{\ominus}{O}$