MHT CET 2018 Paper II (Physics + Chemistry) May 10 Question Paper

Conducted by the Directorate of Technical Education, Maharashtra

Time Allowed: 90 Minutes **Total Questions: 100** **Maximum Marks: 100**

General Instructions

(i) This **Paper II - Physics and Chemistry** question paper is from **MHT CET 2018**.

(ii) This paper contains **100 objective questions**: **50 Physics** and **50 Chemistry**.

(iii) Each question offers **four choices**; select the single best response.

(iv) The time allowed is **90 minutes**, for a total of **100 marks**.

(v) Each correct response earns **1 mark**. There is **no negative marking**.

1. The path length of oscillation of simple pendulum of length 1 meter is 16 cm. Its maximum velocity is ($g = \pi^2$ m/s^2)

(A) 2π cm/s (B) 4π cm/s
(C) 8π cm/s (D) 16π cm/s

2. A vessel completely filled with water has holes 'A' and 'B' at depths 'h' and '3h' from the top respectively. Hole 'A' is a square of side 'L' and 'B' is circle of radius 'r'. The water flowing out per second from both the holes is same. Then 'L' is equal to

(A) $r^{1/2}(\pi)^{1/2}(3)^{1/2}$ (B) $r \cdot (\pi)^{1/4}(3)^{1/2}$
(C) $r \cdot (\pi)^{1/2}(3)^{1/4}$ (D) $r^{1/2}(\pi)^{1/3}(3)^{1/2}$

3. A transistor is used as a common emitter amplifier with a load resistance 2 KΩ. The input resistance is 150 Ω. Base current is changed by 20 μ A which results in a change in collector current by 1.5 mA. The voltage gain of the amplifier is

(A) 900 (B) 1000
(C) 1100 (D) 1200

4. A disc has mass 'M' and radius 'R'. How much tangential force should be applied to the rim of the disc so as to rotate with angular velocity 'ω' in times 't'?

(A) MRω/4t (B) MRω/2t
(C) MRω/t (D) MRωt

5. A circular coil carrying current 'I' has radius 'R' and magnetic field at the centre is 'B'. At what distance from the centre along the axis of the magnetic field will be B/8?

(A) R$\sqrt{2}$ (B) R$\sqrt{3}$
(C) 2R (D) 3R

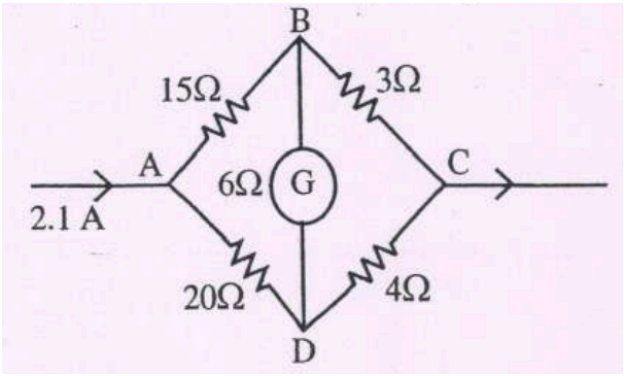
6. Two light waves of intensities 'I1' and 'I2' having same frequency pass through same medium at a time in same direction and interfere. The sum of the minimum and maximum intensities is

(A) (I1+I2) (B) 2(I1+I2)
(C) $(\sqrt{I1} + \sqrt{I2})$ (D) $(\sqrt{I1} - \sqrt{I2})$

7. An alternating voltage e = $200\sqrt{2}$ sin(100t) volt is connected to 1 μF capacitor through a.c. ammeter. The reading of ammeter is

(A) 5mA (B) 10mA
(C) 15mA (D) 20mA

8. In the following network, the current flowing through 15Ω resistance is



(A) 0.8A (B) 1.0A
(C) 1.2A (D) 1.4A

9. The angle made by incident ray of light with normal of the reflecting surface is called

(A) glancing angle (B) angle of incidence
(C) angle of deviation (D) angle of refraction

10. In non uniform circular motion, the ratio of tangential to radius acceleration is (r = radius of circle, v = speed of the particle, α = angular acceleration)

(A) $\alpha^2 r^2/v$ (B) $\alpha^2 r/v^2$
(C) $\alpha r^2/v^2$ (D) $v^2/r^2\alpha$

11. If numerical aperture of a microscope is increased then its

(A) resolving power remains constant (B) resolving power becomes zero
(C) limit of resolution is decreased (D) limit of resolution is increased

12. In amplitude modulation

(A) amplitude remains constant but frequency changes
(B) both amplitude and frequency do not change
(C) both amplitude and frequency change
(D) amplitude of the carrier wave changes according to information signal

13. If M_Z = magnetization of a paramagnetic sample, B = external magnetic field, T = absolute temperature, C = curie constant then according to Curie's law in Magnetism, the correct relation is

(A) $M_Z = T/CB$
(B) $M_Z = CB/T$
(C) $C = M_Z B/T$
(D) $C = T^2/M_Z B$

14. An electron of stationary hydrogen atom jumps from 4th energy level to ground level. The velocity that the photon acquired as a result of electron transition will be (h = Planck's constant, R = Rydberg's constant, m = mass of photon)

(A) 9Rh/16m
(B) 11hR/16m
(C) 13hR/16m
(D) 15hR/16m

15. A metal wire of density 'ρ' floats on water surface horizontally. If it is NOT to sink in water then maximum radius of wire is proportional to (T = surface tension of water, g = gravitational acceleration)

(A) $\sqrt{T/\pi\rho g}$
(B) $\sqrt{\pi\rho g/T}$
(C) $T/\pi\rho g$
(D) $\pi\rho g/T$

16. A sphere of mass 'm' moving with velocity 'v' collides head-on another sphere of same mass which is at rest. The ratio of final velocity of second sphere to the initial velocity of the first sphere is (e is coefficient of restitution and collision is inelastic)

(A) (e-1)/2
(B) e/2
(C) (e+1)/2
(D) e

17. For a particle performing linear S.H.M., its average speed over one oscillation is (a = amplitude of S.H.M., n = frequency of oscillation)

(A) 2an
(B) 4an
(C) 6an
(D) 8an

18. An ideal transformer converts 220 V a.c. to 3.3 kV a.c. to transmit a power of 4.4 kW. If primary coil has 600 turns, then alternating current in secondary coil is

(A) 1/3 A
(B) 4/3 A
(C) 5/3 A
(D) 7/3 A

19. A conducting wire has length 'L1' and diameter 'd1'. After stretching the same wire length becomes 'L2' and diameter 'd2'. The ratio of resistances before and after stretching is

(A) $d_2^4 : d_1^4$
(B) $d_1^4 : d_2^4$
(C) $d_2^2 : d_1^2$
(D) $d_1^2 : d_2^2$

20. The molar specific heat of an ideal gas at constant pressure and constant volume is 'Cp' and 'Cv' respectively. If 'R' is the universal gas constant and the ratio of 'Cp' to 'Cv' is 'γ' then Cv=

(A) $(1-\gamma)/(1+\gamma)$
(B) $(1+\gamma)/(1-\gamma)$
(C) $(\gamma-1)/R$
(D) $R/(\gamma-1)$

21. In a capillary tube having area cross-section 'A' water rises to a height 'h'. If cross-sectional area is reduced to A/9, the rise of water in the capillary tube is

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

22. With forward biased mode, the p-n junction diode

(A) is one in which width of depletion layer increases
(B) is one in which potential barrier increases
(C) acts as closed switch
(D) acts as open switch

23. An alternating electric field of frequency 'v' is applied across the dees (radius R) of a cyclotron to accelerate protons (mass m). The operating magnetic field 'B' used and K.E. of the proton beam produced by it are respectively (e = charge on proton)

(A) $2\pi mv/e$, $2\pi^2 mv^2R^2$
(B) $2\pi^2 mv/e^2$, $4\pi^2 mv^2R^2$
(C) $\pi mv/e$, $\pi^2 mv^2R^2$
(D) $2\pi^2 m^2v^2/e$, $2\pi^2 mv^2R^2$

24. A ray of light is incident normally on a glass slab of thickness 5 cm and refractive index 1.6. The time taken to travel by a from source of slab is same as to travel through glass slab. The distance of source from the surface is

(A) 4cm (B) 8cm
(C) 12cm (D) 16cm

25. A string is vibrating in its fifth overtone between two rigid supports 2.4 m apart. The distance between successive node and antinode is

(A) 0.1m (B) 0.2m
(C) 0.6m (D) 0.8m

26. If $\vec{A} = 3\hat{i} - 2\hat{j} + \hat{k}$, $\vec{B} = \hat{i} - 3\hat{j} + 5\hat{k}$ and $\vec{C} = 2\hat{i} + \hat{j} - 4\hat{k}$ form a right angled triangle then out of the following which one is satisfied?

(A) $\vec{A} = \vec{B} + \vec{C}$ and $A^2 = B^2 + C^2$
(B) $\vec{A} = \vec{B} + \vec{C}$ and $B^2 = A^2 + C^2$
(C) $\vec{B} = \vec{A} + \vec{C}$ and $B^2 = A^2 + C^2$
(D) $\vec{B} = \vec{A} + \vec{C}$ and $A^2 = B^2 + C^2$

27. A square frame ABCD is formed by four identical rods each of mass 'm' and length 'ℓ'. This frame is in X-Y plane such that side AB coincides with X-axis and side AD along Y-axis. The moment of inertia of the frame about X-axis is

(A) $5m\ell^2/3$ (B) $2m\ell^2/3$
(C) $4m\ell^2/3$ (D) $m\ell^2/12$

28. A unit vector is represented as $(0.8\hat{i} + b\hat{j} + 0.4\hat{k})$. Hence the value of 'b' must be

(A) 0.4 (B) $\sqrt{0.6}$
(C) 0.2 (D) $\sqrt{0.2}$

29. Magnetic susceptibility for a paramagnetic and diamagnetic materials is respectively

(A) small, positive and small, positive
(B) large, positive and small, negative
(C) small, positive and small, negative
(D) large, negative and large, positive

30. A mass is suspended from a vertical spring which is executing S.H.M. of frequency 5 Hz. The spring is unstretched at the highest point of oscillation. Maximum speed of the mass is [acceleration due to gravity g = 10 m/s2]

(A) 2π m/s (B) π m/s
(C) $1/2\pi$ m/s (D) $1/\pi$ m/s

31. The moment of inertia of a ring about an axis passing through the centre and perpendicular to its plane is 'I'. It is rotating with angular velocity 'ω'. Another identical ring is gently placed on it so that their centres coincide. If both the rings are rotating about the same axis then loss in kinetic energy is

(A) $I\omega^2/2$ (B) $I\omega^2/4$
(C) $I\omega^2/6$ (D) $I\omega^2/8$

32. A bomb at rest explodes into 3 parts of same mass. The momentum of two parts is $-3P\hat{i}$ and $2P\hat{j}$ respectively. The magnitude of momentum of the third part is

(A) P (B) 5P
(C) 11P (D) $\sqrt{13}$P

33. In a photocell, frequency of incident radiation is increased by keeping other factors constant (v > v0), the stopping potential

(A) decreases (B) increases
(C) becomes zero (D) first decreases and then increase

34. A mass attached to one end of a string crosses top-most point on a vertical circle with critical speed. Its centripetal acceleration when string becomes horizontal will be (g = gravitational acceleration)

(A) g (B) 3g
(C) 4g (D) 6g

35. The expression for electric field intensity at a point outside uniformly charged thin plane sheet is (d is the distance of point from plane sheet)

(A) independent of d
(B) directly proportional to $\sqrt{d}$
(C) directly proportional to d
(D) directly proportional to $1/\sqrt{d}$

36. When source of sound moves towards a stationary observer, the wavelength of sound received by him

(A) decrease while frequency increase
(B) remains the same whereas frequency increases
(C) increases and frequency also increases
(D) decreases while frequency remains the same

37. The deflection in galvanometer falls to (1/4)th when it is shunted by 3Ω. If additional shunt of 2Ω is connected to earlier shunt, the deflection in galvanometer falls to

(A) 1/2 (B) (1/3)th

(C) (1/4)th (D) (1/8.5)th

38. A body is thrown from the surface of the earth with velocity 'u' m/s. The maximum height in m above the surface of the earth upto which it will reach is (R = radius of earth, g = acceleration due to gravity)

(A) $u^2R/(2gR-u^2)$ (B) $2u^2R/(gR-u^2)$

(C) $u^2R^2/(2gR^2-u^2)$ (D) $u^2R/(gR-u^2)$

39. A series combination of N1 capacitors (each of capacity C1) is charged to potential difference '3V'. Another parallel combination of N2 capacitors (each of capacity C2) is charged to potential difference 'V'. The total energy stored in both the combinations is same. The value of C1 in terms of C2 is

(A) $C_2N_1N_2/9$ (B) $C_2N_1^2N_2^2/9$

(C) $C_2N_1/9N_2$ (D) $C_2N_2/9N_1$

40. Heat energy is incident on the surface at the rate of 1000 J/min. If coefficient of absorption is 0.8 and coefficient of reflection is 0.1 then heat energy transmitted by the surface in 5 minutes is

(A) 100J (B) 500J

(C) 700J (D) 900J

41. Two metal wires 'P' and 'Q' of same length and material are stretched by same load. Their masses are in the ratio m1:m2. The ratio of elongation of wire 'P' to that of 'Q' is

(A) $m_1^2 : m_2^2$ (B) $m_2^2 : m_1^2$

(C) $m_2 : m_1$ (D) $m_1 : m_2$

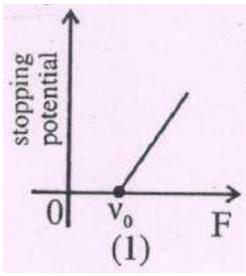
42. Let x = [a ^ 2b ^ 2/c] be the physical quantity. If the percentage error in the measurement of physical quantities a, b and c is 2, 3 and 4 percent respectively then percentage error in the measurement of x is

(A) 7% (B) 14%

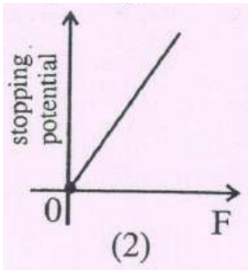
(C) 21% (D) 28%

43. Following graphs show the variation of stopping potential corresponding to the frequency of incident radiation (F) for a given metal. The correct variation is shown in graph (v0 = Threshold frequency)

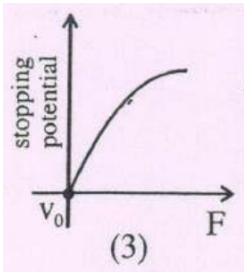
(A) graph (1)



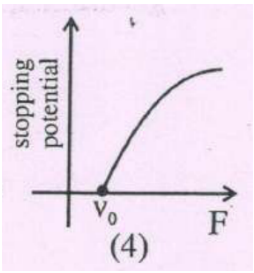
(B) graph (2)



(C) graph (3)



(D) graph (4)



44. In compound microscope, the focal length and aperture of the objective used is respectively

(A) large and large (B) large and small

(C) short and large (D) short and small

45. The energy of an electron having de-Broglie wavelength 'λ' is (h = Planck's constant, m = mass of electron)

(A) $h/2m\lambda$ (B) $h^2/2m\lambda^2$

(C) $h^2/2m^2\lambda^2$ (D) $h^2/2m^2\lambda$

46. 'n' number of waves are produced on a string in 0.5 second. Now the tension in the string is doubled (Assume length and radius constant), the number of waves produced in 0.5 second for the same harmonic will be

(A) n (B) $\sqrt{2}$n

(C) $n/\sqrt{2}$ (D) $n/\sqrt{5}$

47. The increase in energy of a metal bar of length 'L' and cross-sectional area 'A' when compressed with a load 'M' along its length is (Y = Young's modulus of the material of metal bar)

(A) FL/2AY (B) $F^2L/2AY$

(C) FL/AY (D) $F^2L^2/2AY$

48. The ratio of magnetic fields due to a bar magnet at the two axial points P1 and P2 which are separated from each other by 10 cm is 25:2. Point P1 is situated at 10 cm from the centre of the magnet. Magnetic length of the bar magnet is (Points P1 and P2 are on the same side of magnet and distance of P2 from the centre is greater than distance of P1 from the centre of magnet)

(A) 5cm (B) 10cm

(C) 15cm (D) 20cm

49. A satellite is revolving in a circular orbit at a height 'h' above the surface of the earth of radius 'R'. The speed of the satellite in its orbit is one-fourth the escape velocity from the surface of the earth. The relation between 'h' and 'R' is

(A) h=2R (B) h=3R

(C) h=5R (D) h=7R

50. A pipe closed at one end has length 83 cm. The number of possible natural oscillations of air column whose frequencies lie below 1000 Hz are (velocity of sound in air = 332 m/s)

(A) 3 (B) 4

(C) 5 (D) 6

51. A certain reaction occurs in two steps as (i) $2SO_2(g) + 2NO_2(g) \rightarrow 2SO_3(g) + 2NO(g)$ (ii) $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$. In the reaction

(A) $NO_2(g)$ is intermediate
(B) $NO(g)$ is intermediate
(C) $NO(g)$ is catalyst
(D) $O_2(g)$ is intermediate

52. Which among the following equations represents the first law of thermodynamics under isobaric conditions?

(A) $\Delta U = q_p - P_{ex}\Delta V$
(B) $q_v = \Delta U$
(C) $\Delta U = W$
(D) $W = -q$

53. During galvanization of iron, which metal is used for coating iron surface?

(A) Copper
(B) Zinc
(C) Nickel
(D) Tin

54. Formation of PCl_3 is explained on the basis of what hybridisation of phosphorus atom?

(A) sp^2
(B) sp^3
(C) sp^3d
(D) sp^3d^2

55. Identify the element that forms amphoteric oxide.

(A) Copper
(B) Zinc
(C) Calcium
(D) Sulphur

56. Identify the product 'C' in the following reaction. Aniline $\xrightarrow{(CH_3CH_2)O, Pyridine}$ A $\xrightarrow{Br_2, CH_3COOH}$ B $\xrightarrow{H^+ or OH^-}$ C

(A) Acetanilide
(B) p-Bromoacetanilide
(C) p-Bromoaniline
(D) o-Bromoaniline

57. Identify the functional group that has electron donating inductive effect.

(A) -COOH
(B) -CN
(C) $-CH_3$
(D) $-NO_2$

58. Which among the following metals crystallise as a simple cube?

(A) Polonium
(B) Iron
(C) Copper
(D) Gold

59. Which among the following oxoacids of phosphorus shows a tendency of disproportionation?

(A) Phosphinic acid (H_3PO_2)
(B) Orthophosphoric acid (H_3PO_4)
(C) Phosphonic acid (H_3PO_3)
(D) Pyrophosphoric acid ($H_4P_2O_7$)

60. What is the oxidation number of gold in the complex $[AuCl_4]^{1-}$?

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

61. Which symbol replaces the unit of atomic mass, amu?

(A) u
(B) A
(C) M
(D) n

62. Which of the following compounds reacts immediately with Lucas reagent?

(A) CH_3CH_2OH
(B) $CH_3CH_2CH_2OH$
(C) $CH_3 - CH(OH) - CH_3$
(D) $CH_3 - C(OH)(CH_3) - CH_3$

63. What is the catalyst used for oxidation of SO_2 to SO_3 in lead chamber process for manufacture of sulphuric acid?

(A) Nitric oxide
(B) Nitrous oxide
(C) Potassium iodide
(D) Dilute HCl

64. The number of moles of electrons passed when current of 2 A is passed through a solution of electrolyte for 20 minutes is

(A) 4.1×10^{-4} mol e-
(B) 1.24×10^{-2} mol e-
(C) 2.487×10^{-2} mol e-
(D) 2.487×10^{-1} mol e-

65. The molarity of urea (molar mass 60 g mol-1) solution by dissolving 15 g of urea in 500 cm^3 of water is

(A) 2 mol dm-3
(B) 0.5 mol dm-3
(C) 0.125 mol dm-3
(D) 0.0005 mol dm-3

66. Which carbon atom of deoxy Ribose sugar in DNA does NOT contain -C(OH)- bond?

(A) C_5 (B) C_3

(C) C_2 (D) C_1

67. Which of the following carboxylic acids is most reactive towards esterification?

(A) $(CH_3)_3CCOOH$

(B) $(CH_3)_2CHCOOH$

(C) CH_3CH_2COOH

(D) $(C_2H_5)_2CHCOOH$

68. Molarity is

(A) the number of moles of solute present in 1 dm^3 volume of solution

(B) the number of moles of solute dissolved in 1 kg of solvent

(C) the number of moles of solute dissolved in 1 kg of solution

(D) the number of moles of solute dissolved in 100 dm^3 volume of solution

69. Which of the followings is a tricarboxylic acid?

(A) Citric acid (B) Malonic acid

(C) Succinic acid (D) Malic acid

70. What is the number of donor atoms in dimethylglyoximato ligand?

(A) 1 (B) 2

(C) 3 (D) 4

71. In which substance does nitrogen exhibit the lowest oxidation state?

(A) nitrogen gas (B) ammonia

(C) nitrous oxide (D) nitric oxide

72. Which of the following is most reactive towards addition reaction of hydrogen cyanide to form corresponding cyanohydrin?

(A) Acetone (B) Formaldehyde

(C) Acetaldehyde (D) Diethylketone

73. The most basic hydroxide from following is

(A) Pr(OH)3 (Z=59) (B) Sm(OH)3 (Z=62)

(C) Ho(OH)3 (Z=67) (D) La(OH)3 (Z=57)

74. What is the SI unit of density?

(A) g cm-3 (B) g m-3

(C) kg m-3 (D) kg cm-3

75. Which of the following compounds does NOT undergo haloform reaction?

(A) $CH_3 - CH(OH) - CH_3$

(B) $CH_3 - CO - CH_3$

(C) $C_2H_5 - CH(OH) - C_2H_5$

(D) $CH_3 - CO - C_2H_5$

76. Two moles of an ideal gas are allowed to expand from a volume of 10 dm^3 to $2m^3$ at 300 K against a pressure of 101.325 KPa. Calculate the work done.

(A) -201.6kJ (B) 13.22kJ

(C) -810.6J (D) -18.96kJ

77. In which among the following solids, Schottky defect is NOT observed?

(A) ZnS (B) NaCl

(C) KCl (D) CsCl

78. What are the products of auto-photolysis of water?

(A) H_2 and O_2 (B) Steam

(C) H_3O^+ and OH^- (D) Hydrogen peroxide

79. Bauxite, the ore of aluminium, is purified by which process?

(A) Hoope's process (B) Hall's process

(C) Mond's process (D) Liquation process

80. Phenol in presence of sodium hydroxide reacts with chloroform to form salicylaldehyde. The reaction is known as

(A) Kolbe's reaction (B) Reimer-Tiemann reaction

(C) Stephen reaction (D) Etard reaction

81. Which among the following elements of group-2 exhibits anomalous properties?

(A) Be (B) Mg

(C) Ca (D) Ba

82. Excess of ammonia with sodium hypochloride solution in the presence of glue or gelatine gives

(A) $NaNH_2$ (B) NH_2NH_2

(C) N_2 (D) NH_4Cl

83. What is the density of solution of sulphuric acid used as an electrolyte in lead accumulator?

(A) 1.5 g mL-1 (B) 1.2 g mL-1
(C) 1.8 g mL-1 (D) 2.0 g mL-1

84. Which of the following polymers is used to manufacture clothes for firefighters?

(A) Thiokol (B) Kevlar
(C) Nomex (D) Dynel

85. Which elements is obtained in the pure form by van Arkel method?

(A) Aluminium (B) Titanium
(C) Silicon (D) Nickel

86. Which of the following is NOT a tranquilizer?

(A) Meprobamate (B) Equanil
(C) Chlordiazepoxide (D) Bromopheniramine

87. Conversion of hexane into benzene involves the reaction of

(A) hydration (B) hydrolysis
(C) hydrogenation (D) dehydrogenation

88. The element that does NOT exhibit allotropy is

(A) phosphorus (B) arsenic
(C) antimony (D) bismuth

89. Which of the following reactions is used to prepare aryl fluorides from diazonium salts and fluoroboric acid?

(A) Sandmeyer reaction (B) Balz-Schiemann reaction
(C) Gattermann reaction (D) Swarts reaction

90. The correct relation between elevation of boiling point and mass of solute is

(A) $M_2 = K_b W_2 / \Delta T_b W_1$
(B) $M_2 = K_b W_1 / \Delta T_b W_2$
(C) $M_2 = \Delta T_b K_b / W_1 W_2$
(D) $M_2 = \Delta T_b W_1 / K_b W_2$

91. Which among the group-15 elements does NOT exist as tetra atomic molecule?

(A) Nitrogen (B) Phosphorus
(C) Arsenic (D) Antimony

92. Identify the monosaccharide containing only one asymmetric carbon atom in its molecule.

(A) Ribulose (B) Ribose
(C) Erythrose (D) Glyceraldehyde

93. Identify the oxidation states of titanium (Z=22) and copper (Z=29) in their colourless compounds.

(A) Ti^{3+}, Cu^{2+} (B) Ti^{2+}, Cu^{2+}
(C) Ti^{4+}, Cu^{1+} (D) Ti^{4+}, Cu^{2+}

94. Arenes on treatments with chlorine in presence of ferric chloride as a catalyst undergo what type of reaction?

(A) Electrophilic substitution (B) Nucleophilic substitution
(C) Electrophilic addition (D) Nucleophilic addition

95. In case of R, S configuration the group having highest priority is

(A) $-NO_2$ (B) $-NH_2$
(C) $-CN$ (D) $-OH$

96. Lactic acid and glycollic acid are the monomers used for preparation of polymer

(A) Nylon-2 nylon-6 (B) Dextron
(C) PHBV (D) Buna-N

97. What is the geometry of water molecule?

(A) distorted tetrahedral (B) tetrahedral
(C) trigonal planar (D) diagonal

98. With which halogen the reactions, of alkanes are explosive?

(A) Fluorine (B) Chlorine
(C) Bromine (D) Iodine

99. Calculate the work done during combustion of 0.138 kg of ethanol, $C_2H_5OH(l)$ at 300 K. Given: R=8.314 $Jk^{-1}mol^{-1}$, molar mass of ethanol = 46 g mol-1.

(A) -7482J (B) 7482J
(C) -2494J (D) 2494J

100. Slope of the straight line obtained by plotting $log_{10}k$ against 1/T represents what term?

(A) $-E_a$ (B) $-2.303E_a/R$

(C) $-E_a/2.303R$ (D) $-E_a/R$

- End of Question Paper -