UPSEE 2020

Paper – 1 **Booklet Code: AA**

Time: 3 Hours **Total Marks: 600**

Instructions for the Candidate:

1. Use BLUE or BLACK BALL POINT PEN only for all entries and for filling the bubbles in the OMR Answer Sheet.

2. Before opening the SECURITY SEAL of the question booklet, write your Name, Roll Number {In figures}, and OMR Answer-sheet Number in the 'space provided at the top of the Question Booklet. Non-compliance of these instructions would mean that the Answer Sheet cannot be evaluated leading the disqualification of the candidate.

3. Each question carries FOUR marks. No marks will be awarded for unattempted questions. There is no negative marking on wrong answer.

4. Each multiple choice questions has only one correct answer and marks shall be awarded for correct answer.

5. Use of calculator, log table, mobile phones, any electronic gadget and slide rule etc. is strictly prohibited.

6. Candidate will be allowed to leave the examination hail at the end of examination time period only.

7. If a candidate is found in possession of books or any other printed or written material from which he/she might derive assistance, he/she is liable to be treated as disqualified. Similarly, if a candidate is found giving of obtaining (or attempting to give or obtain} assistance from any 'source, he/she is liable to be disqualified.

8. English version of questions paper is to be considered as authentic and final to resolve any ambiguity.

9. OMR sheet is placed within this paper and can be taken out from this paper but seal of paper must be opened only at the start of paper.

1. Which of the following expression has a dimensional formula different from others?

(A) $\frac{1}{2}\epsilon_0 E^2$ (ϵ_0 permitivity of free space, E: electric field)

(B) hv (h : Planck's constant, v : frequency)

(C) ρgh (ρ: density, g: acceleration due to gravity, h: height)

(D) $\frac{1}{2}\rho v^2$ (ρ: density, v: velocity)

2. The acceleration (a) of an object varies as a function of its velocity (v) as $a = \lambda\sqrt{v}$ where λ is a constant. If at t=0, v=0, then the velocity as a function of time (t) is given as

(A) $\frac{3}{4}\lambda^2 t^3$

(B) $\frac{1}{4}\lambda t$

(C) $\frac{1}{4}\lambda^2 t^2$

(D) $\frac{1}{4}\lambda^2 t$

3. A car starts from rest to cover distance 'd' on a road where the coefficient of friction between the road and the tyres is

μ. The minimum time in which car can cover this distance is proportional to

(A) μ

(B) μ^{-1}

(C) $\mu^{\frac{1}{2}}$

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

4. A 1.5 m tall girl standing at a distance of 15 m from a fence 5 m high throws a stone of mass 0.25 Kg at an angle of 450 to the horizontal. The minimum velocity of the stone to be thrown to fly over the fence is

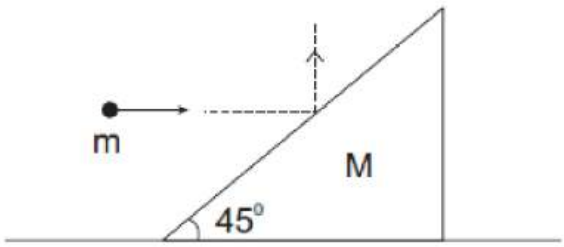
(A) 9.8 m/s

(B) 10.2 m/s

(C) 13.8 m/s

(D) 19.6 m/s

5. A body of mass M in the form of an inclined plane with a 450 angle of inclination lies on a horizontal plane. A ball of mass 'm' moving horizontally with velocity 'v_0' collides with the inclined plane. After the impact the ball bounces vertically upwards and the inclined plane begins to slide without friction along the horizontal plane. The velocity of the ball after the collision in its vertical travel is



(A) $\frac{mv_0}{M}$

(B) $\frac{Mv_0}{m}$

(C) $v_0\sqrt{\frac{M-m}{M}}$

(D) $v_0\sqrt{\frac{M-m}{m}}$

6. A body can rotate in a vertical plane at the end of a string of length L. The horizontal velocity imparted to the body in its highest position, so that the tension in the string at the lowermost position is ten times the weight of the body, will be

(A) $\sqrt{13gL}$

(B) $\sqrt{6gL}$

(C) $\sqrt{5gL}$

(D) $\sqrt{gL}$

7. An empty container is put on the pan of a physical balance and the scale is adjusted to zero. Small identical balls of mass 10 g each are dropped into the container from rest from height 4.9 m at a constant rate of 100 balls per second. If the collision between each ball and container is completely inelastic, the reading of the balance after 5 second will be

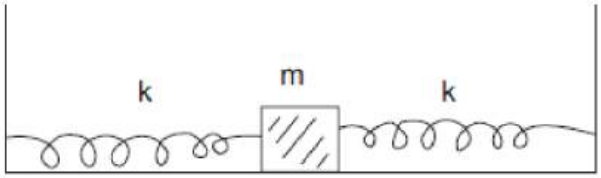
(A) 1 Kg

(B) 2 Kg

(C) 5 Kg

(D) 6 Kg

8. A ball of mass 'm' lying on a frictionless surface is attached to the two elastic springs of force constant 'k' as shown in the figure. The other two ends of the spring are connected to rigid wall. The ball can perform simple harmonic motion horizontally. The ratio of the velocity of the ball at positions equal to one half and one third of amplitude from the equilibrium position will be



(A) $\frac{2}{3}$

(B) $\frac{3}{2}$

(C) $\sqrt{\frac{2}{3}}$

(D) $\frac{3\sqrt{3}}{4\sqrt{2}}$

9. The angular velocity of earth rotation, at which the bodies at the equator become weightless, is (Radius of earth = 6400 Km)

(A) 800 /sec

(B) 1.25 /sec

(C) 1.25×10^{-2} /sec

(D) 1.25×10^{-3} /sec

10. A metal rod of Young's modulus 1.5×10^{10} N/m^2 undergoes an elastic strain of 0.06%. The energy stored per unit volume of the rod is

(A) 900 J/m^3

(B) 1800 J/m^3

(C) 2700 J/m^3

(D) 5400 J/m^3

11. A piece of ice containing a piece of iron inside it is floating on water in a container. When ice melts completely, the level of water in the container will

(A) Increase

(B) Decrease

(C) Remain unchanged

(D) Become zero

12. A uniform circular disc of mass 'M' and radius 'R' is rotating in a horizontal plane about an axis passing through its centre of mass and perpendicular to its plane with an angular velocity ω. Another disc of same radius but mass (M/2) is placed gently on the first disc. The angular velocity of the system now is

(A) 2

(B) 3

(C) 3

(D) ω

13. The period of a simple pendulum hanging from the ceiling of a stationary cart is T_0. When the cart rolls without friction down the inclined plane with angle of inclination θ, the period of oscillation

(A) increases

(B) decreases

(C) remains unchanged

(D) becomes infinity

14. Four identical rings of radius R and mass M are placed at the corner of a square in x-y plane such that each ring touches the two rings tangentially. The moment of inertia of this system about z-axis passing through the centre of the square is

(A) 8 MR^2

(B) 7 MR^2

(C) 6 MR^2

(D) 4 MR^2

15. A police car moving at 5.4 Km/Hr sounds siren emitting frequency of 550 Hz which is reflected back from a stationary object some distance ahead of the car. The number of beats heard per second by an observer sitting in the car is (Assume velocity of sound in air = 330 m/sec)

(A) 4

(B) 5

(C) 6

(D) 0

16. A uniform string of mass M and length L is hanging from the ceiling. If a transverse wave travels along the length of the string, then the time taken by it to travel the whole length is

(A) $\sqrt{\frac{L}{g}}$

(B) $\sqrt{\frac{2L}{g}}$

(C) $\sqrt{\frac{3L}{g}}$

(D) $\sqrt{\frac{4L}{g}}$

17. In an organ pipe open at one and closed at the other end, two successive harmonics have frequencies 560 Hz and 720 Hz. The length of the pipe is (Assume the velocity of sound in air =330 m/sec)

(A) 20.6 cm

(B) 41.25 cm

(C) 103.13 cm

(D) 206.25 cm

18. The equation of the displacement of a wave is y (in cm) $= 10(\sqrt{3}\sin 2\pi t + \cos 2\pi t)$. The amplitude of the wave is

(A) 10 cm

(B) 17.3 cm

(C) 20 cm

(D) 40 cm

19. 200 gram of ice at -10 0C is mixed with 200 gram of water at 6 0C in a calorimeter. If the specific heat of ice and water are 0.5 and 1.0 cal/gm ^{0}C respectively and the latent heat of ice is 80 cal/gm, the temperature of the mixture in thermal equilibrium is

(A) 0 ^{0}C

(B) -2 ^{0}C

(C) -10 ^{0}C

(D) 6 ^{0}C

20. An ideal gas having pressure P, volume V and temperature T is allowed to expand adiabatically until its volume becomes 4V while its temperature falls to T/2. The adiabatic exponent of the gas is

(A) 1.66

(B) 1.50

(C) 1.40

(D) 1.33

21. If the Wien's constant b=0.3 cm-K, then the temperature of the sun having maximum intensity of radiation at 6000 A^0 wavelength is

(A) 2000 K

(B) 5000 K

(C) 6000 K

(D) 7000 K

22. A Carnot engine works between 727^0C and 27^0C. The efficiency of the engine is

(A) 30 %

(B) 70 %

(C) 96 %

(D) 100 %

23. The entropy remains constant in

(A) A cyclic process

(B) An isobaric process

(C) An isothermal process

(D) An adiabatic process

24. Two identically charged spherical balls of mass 'm' are suspended by strings of length l each from the same point. At the point of suspension, there is a third ball of same charge. The charge of the balls for the angle between the strings in equilibrium position being 90^0 is

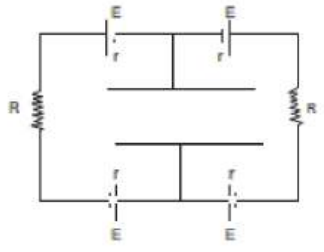
(A) $\sqrt{8\pi\varepsilon_0 l^2 mg}$

(B) $\sqrt{16\pi\varepsilon_0 l^2 mg}$

(C) $\sqrt{4\pi\varepsilon_0 l^2 mg}$

(D) $\sqrt{16\pi\varepsilon_0 mg}$

25. The circuit shown in the figure has four batteries of emf E and internal resistance 'r', two resistances R each and a parallel plate capacitor with plates of length l and the distance between them as 'd'. An electron having charge 'e' enters the capacitor plates at velocity 'v' parallel to the plates. The angle to the plates with which the electron come out of the capacitor is



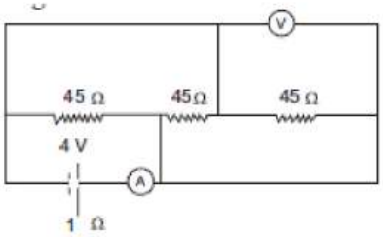
(A) $\tan^{-1}\left(\frac{2eEl}{mdv^2}\right)$

(B) $\tan^{-1}\left(\frac{2eEl}{m(2R+4r)dv^2}\right)$

(C) $\tan^{-1}\left(\frac{4eEl}{mdv^2}\right)$

(D) 0^0

26. A battery of EMF 4V and internal resistance 1 Ohm is connected with three 45 Ohms resistances, a voltmeter and an ammeter in the electrical circuit as shown in the figure. The reading of the voltmeter and ammeter are



(A) 11.25 V, 0.25 A

(B) 3.75 V, 0.25 A

(C) 1.32 V, 0.03 A

(D) 3.06 V, 0.94 A

27. The filament of an electric kettle is made up of three sections of equal resistances. These sections are connected in parallel and the water begins to boil in 9 minutes. If these resistances are connected in series, then the time taken by the same mass of water in the kettle to boil is

(A) 1 minute

(B) 9 minute

(C) 27 minutes

(D) 81 minutes

28. Two conducting spheres A and B of radii 1 cm and 2 cm carrying charge 5×10^{-8} C and 1×10^{-7} C respectively are kept far apart. If the spheres are joined by a conducting wire, then

(A) Charge will flow from A to B

(B) Charge will flow from B to A

(C) No charge will flow between A and B

(D) Charge may flow on either side

29. A piece of platinum and germanium are heated above the room temperature, then the resistance of

(A) Germanium will increase while platinum will decrease with temperature

(B) Platinum will increase while germanium will decrease with temperature

(C) Both platinum and germanium will increase with temperature

(D) Both platinum and germanium will decrease with temperature

30. The ratio of electrostatic force F_e and gravitational force F_g acting between a proton and an electron distant r from each other is approximately

(A) 10^{19}

(B) 10^{29}

(C) 10^{39}

(D) 10^{49}

31. An electron is moving in a circular orbit of radius r with angular velocity ω. The magnetic field at its centre will be

(A) 0

(B) $\frac{\mu_0 \omega e}{4\pi r}$

(C) $\frac{\mu_0 \omega e}{4r}$

(D) $\frac{\mu_0 \omega^2 e}{r}$

32. In an ammeter, 0.2 % of the main current flows from the coil of the galvanometer. If the resistance of the coil of galvanometer is G, then the resistance of the ammeter will be

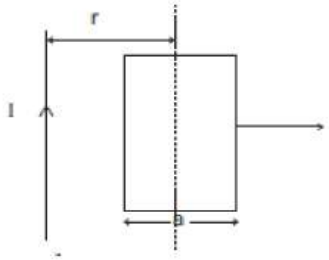
(A) $\frac{G}{499}$

(B) $\frac{G}{500}$

(C) $\frac{500G}{499}$

(D) $\frac{499G}{500}$

33. A long straight conductor carrying current I and a square frame of side a are in the same plane as shown in the figure. This frame moves with a constant velocity v right side. The induced emf in the frame will be proportional to



(A) $\frac{1}{(2r-a)^2}$

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

(C) $\frac{1}{(2r-a)(2r+a)}$

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

34. The angle of dip at a place is 300. If horizontal component of earth's magnetic field is H, the total field intensity is

(A) $\frac{H}{\sqrt{2}}$

(B) $\frac{2H}{\sqrt{3}}$

(C) $H\sqrt{2}$

(D) $H\sqrt{3}$

35. The magnetic susceptibility is positive and small for a

(A) Diamagnetic substance

(B) Paramagnetic substance

(C) Ferromagnetic substance

(D) Nonmagnetic substance

36. The phenomenon of propagation of light in an optical fiber is due to

(A) Interference of light

(B) Diffraction of light

(C) Polarization of light

(D) Total internal reflection of light

37. The resolving power of a microscope can be increased by

(A) Increasing diameter of objective lens

(B) Increasing diameter of eye lens

(C) Increasing wavelength of light used

(D) decreasing wavelength of light used

38. The convex side of a plano-convex lens of radius of curvature 60 cm and refractive index 1.5 is silver plated to obtain a special type of concave mirror. The focal length of the mirror is

(A) 60 cm

(B) 30 cm

(C) 24 cm

(D) 20 cm

39. A monochromatic beam of light of wavelength 600 nm in vacuum enters a medium of refractive index (4/3). Its wavelength and frequency in the medium will be

(A) 450 nm, 5×10^{14} Hz

(B) 600 nm, 5×10^{14} Hz

(C) 800 nm, 3.8×10^{14} Hz

(D) 450 nm, 6.7×10^{14} Hz

40. A thin mica sheet of refractive index 1.4 is used to cover one slit of Young's double slit experiment being performed using monochromatic beam of light of wavelength 6000 A^0. If at the central point is now found the fifth bright fringe, the thickness of the mica sheet is

(A) 4.2 micron

(B) 6.0 micron

(C) 7.5 micron

(D) 8.4 micron

41. An unpolarized light wave is incident from air on a glass surface at the Brewster angle. The angle between the reflected and the refracted wave is

(A) 0^0

(B) 45^0

(C) 90^0

(D) 120^0

42. A prism of angle of prism 60^0 has angle of minimum deviation 40^0. The angle of incidence in this position is

(A) 30^0

(B) 50^0

(C) 60^0

(D) 100^0

43. If the common-base current gain of a transistor is 0.96, then its common-emitter current gain will be

(A) 2

(B) 20

(C) 24

(D) 48

44. The work function of a metal is 2.0 eV. The stopping potential for the light of wavelength 4000 A^0 will be

(A) 5.1 V

(B) 3.1 V

(C) 2.0 V

(D) 1.1 V

45. A 1 milliwatt laser source is emitting light of wavelength 555 nm. The number of photons emitted per second are approximately (Planck's constant = 6.6×10^{-34} m^2 Kg/s)

(A) 10^7

(B) 10^{11}

(C) 10^{15}

(D) 10^{18}

46. If V be the accelerating voltage of the tube, the maximum frequency of continuous x-rays produced depends on V as

(A) V^2

(B) V

(C) $V^{1/2}$

(D) V^{-1}

47. Hydrogen atoms in its ground state are excited by monochromatic radiation of photon energy 12.8 eV. If the ionization potential of hydrogen atom is 13.6 eV, the number of spectral lines emitted according to Bohr theory will be

(A) 6

(B) 4

(C) 3

(D) 1

48. The half life of a radioactive substance is 7.5 seconds. The fraction of substance left after one minute is

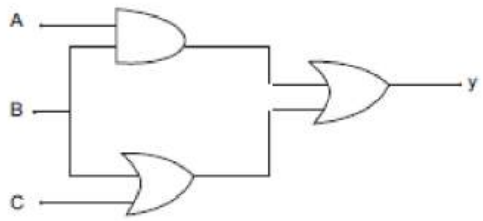
(A) 1/16

(B) 1/64

(C) 1/128

(D) 1/256

49. The output equation of the logical circuit shown in figure is



(A) Y= (A+B)BC

(B) Y = AB+(B+C)

(C) Y= A+B+C

(D) Y=ABC

50. The number of atoms in the lower and upper energy states of a material are N_1 and N_2 respectively. For population inversion between these two levels

(A) $N_2 = N_1$

(B) $N_2 > N_1$

(C) $N_2 < N_1$

(D) $N_2 = 0$

51. Which one of the following will be most reactive for alkaline hydrolysis

(A) $CH_3 - CH_2 - CH_2 - \underset{\underset{Br}{|}}{CH} - COOH$

(B) $CH_3 - CH_2 - \underset{\underset{Br}{|}}{CH} - CH - COOH$

(C) $CH_3 - \underset{\underset{Br}{|}}{CH} - CH_2 - Ch_2 - COOH$

(D) $Br - CH_2 - CH_2 - CH_2 - CH_2 - COOH$

52. The most suitable reagent for the conversion of methylbenzoate to be benzyalcohol is

(A) H_2/Pd-C

(B) LiA/H_4

(C) $NaBH_4$

(D) Li/NH_3 (l)

53. Which one can be synthesized by Wurtz reaction

(A) Toluene

(B) alkyle halide

(C) alkane

(D) alkene

54. Which one of the following made through condensation polymerization.

(A) Teflon

(B) bakelite

(C) Polythene

(D) Acrilan

55. Which one of the following has hexagonal crystal structure

(A) $BaSO_4$

(B) CdS

(C) SnO_2

(D) $Na_2SO_4 \cdot 10H_2O$

56. Which of the following is anti ferromagnetic.

(A) H_2O

(B) CrO_2

(C) MnO

(D) $MgFe_2O_4$

57. Synthesis of amonia is represented by the following reaction.

$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$

$\Delta_r H° = -91.8 KJ\ mol_{-1}$

What will be enthalpy of decomposition of ammonia according to reaction.

$2NH_{3(g)} \rightarrow N_2 + 3H_{2(g)}$; $\Delta_r H° = ?$

(A) – 91.8 kJ mol^{-1}

(B) + 91.8 kJ mol^{-1}

(C) – 45.9 kJ mol^{-1}

(D) + 45.9 kJ mol^{-1}

58. What will be the pH of 0.001M $Ba(OH)_2$ solution

(A) 2.0

(B) 8.4

(C) 11.3

(D) 2.7

59. Which of the following aqueous solution must have the highest boiling point.

(A) 1.0 M NaOH

(B) 1.0 M Na_2SO_4

(C) 1.0 M $NH_4 NO_3$

(D) 1.0 M KNO_3

60. Which of the following is the correct for increasing bond order.

(A) $O_2^+ > O_2 > O_2^- > O_2^{2-}$

(B) $O_2^+ < O_2 < O_2^- < O_2^{2-}$

(C) $O_2^+ = O_2, O_2^- > O_2^{2-}$

(D) $O_2^+ < O_2 > O_2^- < O_2^{2-}$

61. Two particles A and B are in motion. If the wavelength associated with particle A in motion is 5×10^{-8} m. What will be the wavelength associated with particle B if the momentum is half than that of A.

(A) 5×10^{-8} m

(B) 10×10^{-8} m

(C) 2.5×10^{-8} m

(D) 0.2×10^{-8} m

62. The radius of which of the following orbits is same as that of the first Bohr's orbit of H atom?

(A) He^+ (n=2)

(B) Li^{2+} (n=2)

(C) Li^{2+} (n=3)

(D) Be^{3+} (n=2)

63. Which of the following substances is serving as a reducing agent in the following reaction?

$14H^+ + Cr_2O_7^{2-} + 3Ni \rightarrow 2Cr^{3+} + 7H_2O + 3Ni^{2+}$

(A) H_2O

(B) Ni

(C) H^+

(D) $Cr_2O_7^{2-}$

64. Which is the strongest acid?

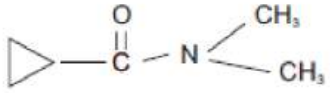
(A) $H(ClO)O_2$

(B) $H(ClO)O_3$

(C) H(ClO)O

(D) H(ClO)

65. IUPAC name of compound



is

(A) N, N - dimethyl cyclopropan carboxamide

(B) N - methyl cyclopropanamide

(C) Cyclopropianomide

(D) None of the above

66. Which of the following reaction is not correct.

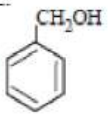
(A) $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$

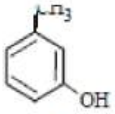
(B) $2MnO_2 + 4KOH + O_2 \rightarrow 4KMnO_4 + 2H_2O$

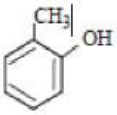
(C) $2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$

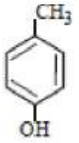
(D) $K_2Cr_2O_7 + 7H_2SO_4 + 6KI \rightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 3I_2 + 7H_2O$

67. Which of the following compound will give tribromo derivative when treated with bromine water.

(A) 

(B) 

(C) 

(D) 

(A)

(B)

(C)

(D)

68. If $E°Cu^{2+}|\ Cu = 0.34V$ and $E°Ag+|Ag = 0.80V$, what is the emf of the cell

$Cu|Cu^{2+}$ (0.01M) || Ag^+(0.01M)|Ag at 298 K?

(A) 0.40V

(B) 0.46 V

(C) 0.50 V

(D) 0.52 V

69. The dark purple colours of $KMnO_4$ is due to

(A) d - d transition

(B) Ligand field transition

(C) Charge transfer transition

(D) $\sigma - \pi^+$ transition

70. The number of σ and π bonds between two carbon atoms in CaC_2 is

(A) Three σ bonds and no π bonds

(B) Two π bonds and one σ bond

(C) Two σ bonds and one π bond

(D) One π bond and one σ bond

71. Which one of the following is the weakest Lewis base?

(A) CH_3^-

(B) NH_2^-

(C) OH^-

(D) F^-

72. Which of the following cations will be have minimum flocculation value for arsenic sulphide sol?

(A) Na^+

(B) Mg^{2+}

(C) Ca^{2+}

(D) Al^{3+}

73. In the plot of $\log \frac{x}{m}$ vs log P for an adsorption, a straight line inclined at an angle of $\theta = 14.04^{o}$ to the x-axis was obtained. The 'n' value for this adsorption process is (tan $14.04^{o} = 0.25$)

(A) 5

(B) 8

(C) 4

(D) 2

74. Extra pure N_2 can be obtained by heating

(A) NH_3 with CuO

(B) $NH_4 NO_3$

(C) $(NH_4)_2 Cr_2O_7$

(D) Ba $(N_3)_2$

75. Which of the following exhibits square pyramidal geometry?

(A) X_eF_6

(B) X_eO_3

(C) BrF_5

(D) X_eF_4

76. Which one amongst the following exhibit geometrical isomerism

(A) $[Co^{III} (NH_3)_5 Br]SO_4$

(B) $[Co^{III} (EDTA)]^{-1}$

(C) $[Co^{III} (SCN)_6]^{3-}$

(D) $[Pt^{III} (NH_3)_2 Cl_2]$

77. The carbocation formed in SN1 reaction of alkyl halide in the slow stop is

(A) SP^3 - hybridised

(B) SP^2 - hybridised

(C) SP - hybridised

(D) SP^3d - hybridised

78. Which of the following compounds is responsible for depletion of Ozone layer?

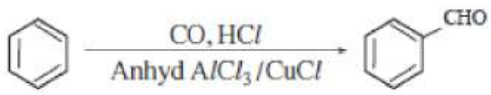
(A) Freon

(B) Chloroform

(C) D.D.T

(D) Iodoform

79. The chemical reation



is known as

(A) Gatterman reaction

(B) Tischenko reaction

(C) Gatterman - Koch reaction

(D) Frankland reaction

80. When acetone is treated with dilute alkali, the product obtained is

(A) Mesitylene

(B) Mesityl oxide

(C) Paraldheyde

(D) Phorone

81. A metal present in insulin is

(A) aluminium

(B) zinc

(C) iron

(D) copper

82. Which of the following amino acid is not optically active

(A) lactic acid

(B) serine

(C) alanine

(D) glycine

83. Time required for 100% completion of a zero order reaction is

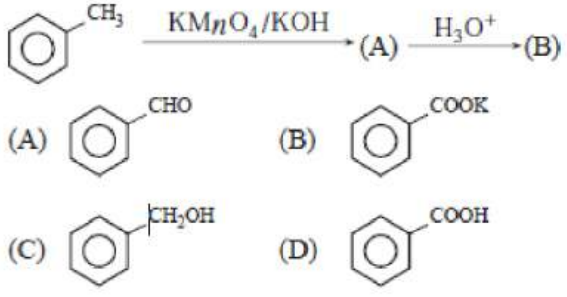
(A) ak

(B) $\frac{a}{2k}$

(C) $\frac{a}{k}$

(D) $\frac{2k}{a}$

84. The final product formed in this reaction is



85. Lassaigne's test for the detection of nitrogen fails in

(A) $H_2N - CO - NHNH_2 \bullet HCl$

(B) $NH_2 - NH_2 \bullet HCl$

(C) $NH_2\ CO\ NH_2$

(D) $C_6H_5 - NH - NH_2\ HCl$

86. The self-indicating silicagel impregnated with cobalt chloride turns pink on absorbing moisture and becomes blue on heating. The pink and blue colours are respectively due to

(A) $[Co\ (H_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$

(B) $[Co\ (H_2O)_6]^{2+}$ and Co_2O_3

(C) $[Co\ (H_2O)_6]^{2+}$ and $[Co(H_2O)_6]^{3+}$

(D) Co^{2+} and Co^{3+}

87. Which of the following complex ions has the highest magnetic moment

(A) $[Cr\ (NH_3)_6]^{3+}$

(B) $[Fe\ (CN)_6]^{3-}$

(C) $[Fe\ (CN)_6]^{4-}$

(D) $[Zn\ (NH_3)_6]^{2+}$

88. Which of the following compounds is most reactive towards nucleophilic

(A) CH_3CHO

(B) $PhCOCH_3$

(C) PhCOPh

(D) CH_3COCH_3

89. In the cannizzaro reaction given below

2 PhCHO → $PhCH_2OH + PhCO_2^-$, the slowest step is

(A) the attack of OH– at the carbonyl group

(B) the transfer of hydride to the carbonyl group

(C) the obstruction of proton from the carboxylic acid

(D) the deprotonation of $PhCH_2OH$

90. Which of the following fcc structures contains cations in the alternate tetrahedral voids

(A) Na_2O

(B) ZnS

(C) CaF_2

(D) CaO

91. In soap industry, glycerol can be separated from spent lye using the technique.

(A) differential extraction

(B) distillation under reduced pressure

(C) filteration

(D) chromatographic sepesation

92. 0.532g of chloro platinate of an organic base (mol wt. 244) gave 0.195 g of platinum on ignition. The number of nitrogen atoms per molecule of base is

(A) 1 (0ne)

(B) 2 (two)

(C) 3 (three)

(D) 4 (four)

93. The standard emf of a galvanic cell involving cell reaction with n=2 is found to be 0.295V at 25^0c. The equilibrium constant of the reaction would be.

(A) 2.0×10^{11}

(B) 4.0×10^{12}

(C) 1.0×10^{2}

(D) 1.0×10^{10}

94. A reaction occurs spontaneously if

(A) $T\Delta S < \Delta H$ and both ΔH and ΔS are +ve

(B) $T\Delta S > \Delta H$ and both ΔH and ΔS are +ve

(C) $T\Delta S = \Delta H$ and both ΔH and ΔS are +ve

(D) $T\Delta S > \Delta H$ and ΔH is +ve and ΔS is –ve

95. The conjugate acid of NH_2^- is

(A) N_2H_4

(B) NH_4^+

(C) NH_2OH

(D) NH_3

96. If the density of CH_3OH is 0.793 KgL^{-1}, what is the volume of methanol is needed for making 2.5 L of its 0.25 M solution?

(A) 20.2 ml

(B) 50.4 ml

(C) 25.2 ml

(D) 10.0 ml

97. Among the following the aromatic compound is

(A) 

(B) 

(C) 

(D) 

98. Only two isomeric monochloro derivatives are possible for

(A) n-butane

(B) 2, 4-dimethyl pentane

(C) benzene

(D) 2 - methyl butane

99. Major pollutant in Jet plane emission is

(A) SO_2

(B) CFC

(C) CO

(D) CCl_4

100. Galvanised iron is

(A) an alloy of iron with gallium

(B) iron used in a galvanometer

(C) iron coated with zinc

(D) an alloy of iron with zinc

MATHEMATICS

101. Sn denotes the sum of n terms of an AP, whose first term is a. If the common difference $d = S_n - k S_{n-1} + S_{n-2}$, then k is equal to

(A) 2

(B) 3

(C) 5

(D) 7

102. If Z_1 and Z_2 are two complex numbers such that $|Z_1| = |Z_2|$ and $\arg(Z_1) + \arg(Z_2) = \pi$, then Z_1 is equal to

(A) $2Z_2$

(B) Z_2

(C) $-Z_2$

(D) None of these

103. If Z_1, Z_2 and Z_3 represent the vertices of an equilateral triangle such that $|Z_1| = |Z_2| = |Z_3|$, then

(A) $Z_1 + Z_2 = Z_3$

(B) $Z_1 + Z_2 + Z_3 = 0$

(C) $Z_1 Z_2 = Z_3$

(D) $Z_1 - Z_2 = Z_3 - Z_2$

104. If the equation $x^2 + 2x + 3 = 0$ and $ax^2 + bx + c = 0$, a, b, c $\in$ R, have a common root, then a:b:c is

(A) 3 : 2 : 1

(B) 1 : 3 : 2

(C) 3 : 1 : 2

(D) 1 : 2 : 3

105. If a, b, c are in GP and $a^{\frac{1}{x}} = b^{\frac{1}{y}} = c^{\frac{1}{z}}$ then x, y, z are in

(A) AP

(B) GP

(C) HP

(D) None of these

106. If p, q, r and s are positive real numbers such that p + q + r + s = 2, then M = (p + q) (r + s) satisfies the relation, when

(A) $0 < M < 1$

(B) $1 < M < 2$

(C) $2 < M < 3$

(D) $3 < M < 4$

107. The sum of the infinite series $\frac{2^2}{2!}+\frac{2^4}{4!}+\frac{2^6}{6!}+....$is

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

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

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

(D) $\frac{(e^2+1)^2}{2e^2}$

108. If n is a positive integer, then $n^3 + 2n$ is divisible by

(A) 2

(B) 6

(C) 15

(D) 3

109. If a and b are the coefficients of x^r and x^{n-r} respectively in the expansion of $(1 + x)n$, then

(A) $a = b$

(B) $a + b = n^2$

(C) $a = nb$

(D) $a – b = n$

110. If $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$ and I is the unit matrix of order 2×2, then A^2 equals to

(A) $4A - 3I$

(B) $3A - 4I$

(C) $A - I$

(D) $A + I$

111. The value of λ, such that the system of equations $x - 2y + z = -4$, $2x - y + 2z = 2$ and $x + y + \lambda z = 4$ has no solutions, is

(A) 0

(B) 1

(C) $\neq 1$

(D) 3

112. If α, b and Υ are the roots of the equation $x^3+px+q=0$, then the value of the determinant $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$ is

(A) 0

(B) 2

(C) -2

(D) 1

113. If $n(U) = 700$, $n(A) = 200$, $n(B) = 300$ and $n(A \cap B) = 100$, then $n(A^1 \cap B^1)$ is equal to

(A) 300

(B) 350

(C) 400

(D) 500

114. Which of the following statement is not correct for the relation R defined by a R b, if and only if b lives within one kilometer from a?

(A) R is reflexive

(B) R is symmetric

(C) R is not anti-symmetric

(D) None of these

115. Let $f : R \rightarrow R$ be a function defined by $f(x) = \frac{x - m}{x - n}$, where $m \neq n$, then

(A) f is one-one and onto

(B) f is one-one and not onto

(C) f is many one and onto

(D) f is many one and into

116. The value of $(\tan 10^0+\tan 35^0) + \tan 10^0 \tan 35^0$ is

(A) 0

(B) 2

(C) -1

(D) 1

117. $\text{Sec}^2\,\theta = \dfrac{4xy}{(x+y)^2}$ is true, if

(A) $x + y \neq 0$

(B) $x = y, x \neq 0$

(C) $x = y$

(D) $x \neq 0, y = 0$

118. The minimum value of $9\tan^2\theta+4\cot^2\theta$ is

(A) 13

(B) 9

(C) 6

(D) 12

119. In ΔABC, if $\angle A = \dfrac{\pi}{2}$, then $\cos^2 B+\cos^2 C$ equals

(A) -2

(B) -1

(C) 1

(D) 0

120. In ΔABC, if $\frac{\text{Cos A}}{a} = \frac{\text{Cos B}}{b} = \frac{\text{Cos C}}{c}$ and a = 2, then area of triangle ΔABC is

(A) $\sqrt{2}$ sq. unit

(B) 2 sq. unit

(C) $\sqrt{3}$ sq. unit

(D) 3 sq. unit

121. The solution set of the equation $\sin^{-1}x=2\tan^{-1}x$ is

(A) {1, 2}

(B) {-1, 2}

(C) {-1, 1, 0}

(D) $\{1, \frac{1}{2}, 0\}$

122. The angle between the lines $\sqrt{3}x+y=1$ and $x+\sqrt{3}y=1$ is

(A) 30°

(B) 60°

(C) 90°

(D) 45°

123. A straight line through the point A(3,4) is such that its intercept between the axes is bisected at A. Its equation is

(A) $4x + 3y = 24$

(B) $3x + 4y = 25$

(C) $x + y = 7$

(D) $3x - 4y = -7$

124. What is the length of an equilateral triangle inscribed in the circle $x^2+y^2=\frac{4}{3}$?

(A) 2 units

(B) 3 units

(C) 4 units

(D) 5 units

125. The condition for a line $y=2x+c$ to touch the circle $x^2+y^2=16$ is

(A) $c = 10$

(B) $c^2 = 80$

(C) $c = 12$

(D) $c^2 = 64$

126. If a parabola has the origin as its focus and the line x=2 as the directrix. Then, the vertex of the parabola is at

(A) (2, 0)

(B) (0, 2)

(C) (1, 0)

(D) (0, 1)

127. The length of the major axis of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is three time the length of minor axis, then its eccentricity is

(A) $\frac{1}{3}$

(B) $\frac{1}{\sqrt{3}}$

(C) $\sqrt{\frac{2}{3}}$

(D) $\frac{2\sqrt{2}}{3}$

128. The length of the tangent from point (5, 1) to the circle $x^2+y^2+6x-4y-3=0$ is

(A) 81

(B) 29

(C) 7

(D) 21

129. $\lim_{x\to 1}\frac{x^m-1}{x^n-1}$ is equal to

(A) $\frac{n}{m}$

(B) $\frac{m}{n}$

(C) $\frac{2m}{n}$

(D) $\frac{2n}{m}$

130. If f(2)=4 and f '(2)=1, then $\lim_{x\to 2}\frac{xf(2)-2f(x)}{x-2}$ is equal to

(A) -2

(B) 1

(C) 2

(D) -1

131. If x is measured in degree, then $\frac{d}{dx}(\cos x)$ is equal to

(A) -sin x

(B) $\frac{180}{\pi}\sin x$

(C) $-\frac{\pi}{180}\sin x$

(D) sin x

132. If $y = \sec^{-1}\left(\frac{\sqrt{x}+1}{\sqrt{x}-1}\right)+\sin^{-1}\left(\frac{\sqrt{x}-1}{\sqrt{x}+1}\right)$ then $\frac{dy}{dx}$ is equal to

(A) 0

(B) $\frac{1}{\sqrt{x}+1}$

(C) 1

(D) $\sqrt{x}-1$

133. The minimum value of 2x+3y, when xy=6 is

(A) 9

(B) 12

(C) 8

(D) 6

134. The point (0, 5) is closer to the curve $x^2=2y$ at

(A) $(\sqrt{2},0)$

(B) (0, 0)

(C) $(2,\sqrt{2})$

(D) None of these

135. $\int \frac{1+\tan^2 x}{1-\tan^2 x} dx$ is equal to

(A) $\log\left(\frac{1-\tan x}{1+\tan x}\right)+c$

(B) $\log\left(\frac{1+\tan x}{1-\tan x}\right)+c$

(C) $\frac{1}{2}\log\left(\frac{1-\tan x}{1+\tan x}\right)+c$

(D) $\frac{1}{2}\log\left(\frac{1+\tan x}{1-\tan x}\right)+c$

136. Integral of $f(x)=\sqrt{1+x^2}$ with respect to x^2, is

(A) $\frac{2}{3}.\frac{(1+x^2)^{\frac{3}{2}}}{x}+c$

(B) $\frac{2}{3}x(1+x^2)^{\frac{3}{2}}+c$

(C) $\frac{2}{3}(1+x^2)^{\frac{3}{2}}+c$

(D) None of these

137. $\int_0^8 |x-5|dx$ is equal to

(A) 17

(B) 9

(C) 12

(D) 18

138. The area enclosed by the curves $y=x^3$ and $y=\sqrt{x}$ is

(A) $\frac{5}{3}$sq. unit

(B) $\frac{5}{4}$sq. unit

(C) $\frac{5}{12}$sq. unit

(D) $\frac{5}{8}$sq. unit

139. The solution of $\frac{dy}{dx} = \frac{ax + h}{by + k}$ represents a parabola, when

(A) $a = b = 0$

(B) $a = 1, b = 2$

(C) $a = 0, b \neq 0$

(D) $a = 2, b = 1$

140. The differential equation of all non-vertical lines in a plane is

(A) $\frac{d^2y}{dx^2} = 0$

(B) $\frac{d^2x}{dy^2} = 0$

(C) $\frac{dy}{dx} = 0$

(D) $\frac{dx}{dy} = 0$

141. A and B stand in a ring along with 10 other persons. If the arrangement is at random, then the probability that there are exactly 3 persons between A and B, is

(A) $\frac{1}{11}$

(B) $\frac{2}{11}$

(C) $\frac{3}{11}$

(D) $\frac{4}{11}$

142. The probability that the same number appears on throwing three dice simultaneously, is

(A) $\frac{1}{36}$

(B) $\frac{5}{36}$

(C) $\frac{3}{36}$

(D) $\frac{4}{13}$

143. For any two events A and B, if $P(A \cup B)=\frac{5}{6}$, $P(A \cap B)=\frac{1}{3}$, $P(B)=\frac{1}{2}$, then P(A) is

(A) $\frac{1}{2}$

(B) $\frac{2}{3}$

(C) $\frac{1}{3}$

(D) None of these

144. The position vector of P and Q are respectively a and b. If R is a point on PQ such that PR=5PQ, then the position vector of R is

(A) 5b - 4a

(B) 5b + 4a

(C) 4b - 5a

(D) 4b + 5a

145. If $\vec{a}.(\vec{b} \times \vec{c}) = 0$, then the correct statement is

(A) Out of $\vec{a}, \vec{b}, \vec{c}$ any two vectors are parallel

(B) $\vec{a}, \vec{b}, \vec{c}$ are coplanar

(C) any two are equal among $\vec{a}, \vec{b}, \vec{c}$

(D) None of these

146. If $\hat{a}, \hat{b}, \hat{c}$ are unit vectors satisfying $\hat{a} - \sqrt{3}\hat{b} + \hat{c} = 0$, then the angle between the vectors $\hat{a}$ and $\hat{c}$ is

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{6}$

(D) $\frac{\pi}{2}$

147. The resultant of two forces A and B is of magnitude A. If the force A is doubled, B remaining the same, then the angle between new resultant and the force B is

(A) 30°

(B) 45°

(C) 90°

(D) 60°

148. A point particle moves along a straight line such that $x=\sqrt{t}$, where t is time. The ratio of acceleration to cube of velocity is

(A) –1

(B) –2

(C) –3

(D) None of these

149. The centre of gravity of a rod of length L whose linear mass density varies as the square of the distance from one end is at

(A) $\frac{L}{3}$

(B) $\frac{3L}{5}$

(C) $\frac{2L}{5}$

(D) $\frac{3L}{4}$

150. The equation of displacement of a particle is $x(t)=5t^2-7t+3$. The acceleration at the moment when its velocity becomes 5 m/sec is

(A) 3 m/sec^2

(B) 8 m/sec^2

(C) 7 m/sec^2

(D) 10 m/sec^2