SECTION I

1. In which process the PV indicator diagram is a straight line parallel to volume axis

(a) Isothermal (b) Isobaric

(c) Irreversible (d) Adiabatic

2. A body executes simple harmonic motion under the action of force F_1 with a time period $\frac{4}{5}$ sec. If the force is changed to F_2 it executes simple harmonic motion with time period $\frac{3}{5}$ sec. If both forces F_1 and F_2 act simultaneously in the same direction on the body, its time period will be

(a) $\frac{12}{25}$ sec. (b) $\frac{24}{25}$ sec.

(c) $\frac{35}{24}$ sec. (d) $\frac{15}{12}$ sec.

3. A diatomic gas is heated at constant pressure. What fraction of the heat energy is used to increase the internal energy

(a) $\frac{3}{5}$ (b) $\frac{3}{7}$

(c) $\frac{5}{7}$ (d) $\frac{5}{9}$

4. In interference pattern, the energy is

(a) Created at the maximum

(b) destroyed at the minimum

(c) Conserved but redistributed

(d) All the above

5. A red flower kept in green light will appear

(a) Red (b) Yellow

(c) Black (d) White

6. A band playing music at a frequency f is moving towards a wall at a speed v_b. A motorist is following the band with a speed v_m. If v be the speed of the sound, the expression for beat frequency heard by motorist is

(a) $\frac{v+v_m}{v+v_b}f$ (b) $\frac{v+v_m}{v-v_b}f$

(c) $\frac{2v_b(v+v_m)}{v^2-v_b^2}f$ (d) $\frac{2v_m(v+v_b)}{v^2-v_m^2}f$

7. An eye specialist prescribes spectacles having a combination of a convex lens of focal length 40 cm in contact with a concave lens of focal length 25 cm. The power of this lens combination will be

(a) $+1.5D$ (b) $-1.5D$

(c) $+6.67D$ (d) $-6.67D$

8. When light wave suffer reflection at the interface between air and glass, the change of phase of reflected wave is equal to

(a) zero (b) $\pi/2$

(c) π (d) 2π

9. A lens behaves as a converging lens in air and diverging lens in water. The refractive index of the material of the lens is

(a) equal to that of water (b) less than that of water

(c) greater than that of water (d) nothing can be predicted

10. The work function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately

(a) 540 nm (b) 400 nm

(c) 310 nm (d) 220 nm

11. The electron emitted in beta radiation originates from

(a) inner orbits of atoms

(b) free electron existing in nuclei

(c) decay of neutron in the nucleus

(d) photon escaping from the nucleus

12. If elements with principal quantum number n > 4 were not allowed in nature, then, the number of possible elements would be

(a) 32 (b) 60

(c) 18 (d) 4

13. The magnifying power of telescope is high if

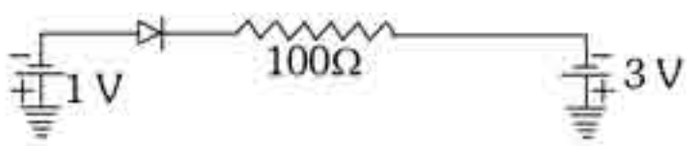
(a) both objective and eye-piece have short focal length

(b) both objective and eye-piece have long focal length

(c) the objective has a long focal length and the eye piece has a short focal length.

(d) the objective has a short focal length and the eye piece has a long focal length.

14. What is the current through an ideal PN-junction diode shown in figure below ?



(a) Zero (b) 10 mA

(c) 20 mA (d) 50 mA

15. The output form of a full wave rectifier is

(a) an AC voltage

(b) a DC voltage

(c) zero

(d) a pulsating unidirectional voltate

16. Suitable impurities are added to a semiconductor depending on its use. This is done to

(a) increase its life

(b) enable it to withstand high voltage

(c) increase its electrical conductivity

(d) increase its electrical resistivity

17. Absorption of X-Rays is maxmum in which of the following material sheet of same thickness ?

(a) *Cu* (b) *Au*

(c) *Be* (d) *Pb*

18. Lenz's law is a consequence of the law of Conservation of

(a) Charge (b) Mass

(c) Momentum (d) Energy

19. A magnetic needle is kept in a non-uniform magnetic field. It experiences

(a) A force only but not a tourque

(b) a force and torque both

(c) a torque only but not a force

(d) neither a torque nor a force

20. The magnitude of magnetic induction for a current carrying toriod of uniform cross-section is

(a) uniform over the whole cross-section

(b) maximum on the outer edge

(c) maximum on the inner edge

(d) maximum at the center of cross-section

21. Isogonic lines are those for which

(a) declination is the same at all places on the line

(b) angle of dip is the same at all places on the line

(c) the value of horizontal component of earth's magnetic field is the same

(d) All of the above.

22. An electric current passes through a long straight wire. At a distance 5 cm from the wire, the magnetic field is B. The field at 20 cm from the wire would be

(a) 2B (b) B/4

(c) B/2 (d) B

23. An ammeter and a voltmeter of resistance R are connected in series to an electric cell of negligible internal resistance. Their readings are A and V respectively. If another resistance R is connected in parallel with the voltmeter, then

(a) both A and V will increase

(b) both a and V will decrease

(c) A will decrease and V will increase

(d) A will increase and V will decrease

24. The core of trSolformer is laminated to reduce the effect of

(a) Copper losses (b) Flux leakage

(c) Hysteresis loss (d) Eddy current

25. The average power dissipation in pure inductance is

(a) $\frac{1}{2}LI^2$ (b) $2LI^2$

(c) $\frac{1}{4}LI^2$ (d) Zero

26. The charge given to any conductor resides on its outer surface, because

(a) the free charge tends to be in its minimum potential energy state

(b) the free charge tends to be in its minimum kinetic energy state

(c) the free charge tends to be in its maximum potential energy state

(d) the free charge tends to be in its maximum kinetic energy state

27. n identical mercury droplets charged to the same potential V coalesce to form a single bigger drop. The potential of new drop will be

(a) $\frac{V}{n}$ (b) nV

(c) nV^2 (d) $n^{2/3}V$

28. For protecting sensitive equipment from external magnetic field, it should be

(a) wrapped with insulation around it when passing current through it

(b) placed inside an iron can

(c) surrounded with *Cu* sheet

(d) placed inside aluminium can

29. The potential difference across the terminals of a battery is 50V when 11A current is drawn and 60V when 1A current is drawn. The *e.m.f.* and the internal resistance of the battery are

(a) 62V, 2Ω (b) 63V, 1Ω

(c) 61V, 1Ω (d) 64V, 2Ω

30. Four resistance 10Ω, 5Ω, 7Ω and 3Ω are connected so that they form the sides of a rectangle *AB*, *BC*, *CD*, and *DA* respectively. Another resistance of 10Ω is connected across the diagonal *AC*. The equivalent resistance between A and B is

(a) 2Ω (b) 5Ω

(c) 7Ω (d) 10Ω

31. The potential energy of a charged parallel plate capacitor is U_o if a slab of dielectric constant k is inserted between the plates, then the new potential energy will be

(a) $\frac{U_o}{k}$ (b) $U_o k^2$

(c) $\frac{U_o}{k^2}$ (d) U_o^2

32. Two similar heater coils separately take 10 minutes to boil a certain amount of water. If both coils are connected in series, time taken to boil the same amount of water will be

(a) 15 minutes (b) 20 minutes

(c) 7.5 minutes (d) 25 minutes

33. Same current is being passed through a copper voltmeter and a silver voltmeter. The rate of increase in weights of the cathode of the two voltmeters will be proportional to

(a) Atomic masses (b) Atomic number

(c) Relative densities (d) None of the above

34. Two equal and opposite charge (+q and – q) are situated at *x* distance from each other, the value of potential at very far point will depend upon

(a) only on q (b) only on *x*

(c) on qx (d) on $\frac{q}{x}$

35. In a potentiometer of one metre length, an unknown *e.m.f.* voltage source is balanced at 60 cm length of potentiometer wire, while a 3 volt battery is balanced at 45 cm length. Then the *e.m.f.* of the unknown voltage source is

(a) 3V (b) 2.25V

(c) 4V (d) 4.5V

36. A car travelling on a straight path moves with uniform velocity V_1 for some time and with velocity V_2 for next equal time, the average velocity is given by

(a) $\sqrt{V_1 V_2}$ (b) $\left(\frac{V_1 + V_2}{2}\right)$

(c) $\left(\frac{1}{V_1} + \frac{1}{V_2}\right)^{-1}$ (d) $2\left(\frac{1}{V_1} + \frac{1}{V_2}\right)^{-1}$

37. A particle of mass m moves in a circular path radius r under the action of a force $\frac{mv^2}{r}$. The work done during its motion over half of the circumference of the circular path will be

(a) $\left(\frac{mv^2}{r}\right) \times 2\pi r$ (b) $\left(\frac{mv^2}{r}\right) \times \pi r$

(c) $\frac{(2\pi r)}{\left(\frac{mv^2}{r}\right)}$ (d) Zero

38. Dimensions of self inductance are

(a) $MLT^{-2}A^{-3}$ (b) $ML^{-2}T^{-1}A^{-2}$

(c) $ML^2T^{-2}A^{-2}$ (d) $ML^2T^{-2}A^{-1}$

39. A car of mass m is moving with momentum p. If μ be the coefficient of friction between the tyres and the road, what will be stopping distance due to friction alone

(a) $\frac{p^2}{2\mu g}$ (b) $\frac{p^2}{2m\mu g}$

(c) $\frac{p^2}{2m^2\mu g}$ (d) $\frac{p^2}{2mg}$

40. A neutron is moving with velocity u. It collides head on and elastically with an atom of mass number A. If the initial kinetic energy of the neutron be E. how much kinetic energy will be retained by the neutron after collision

(a) $\left(\frac{A}{A+1}\right)^2 E$ (b) $\frac{A}{(A+1)^2} E$

(c) $\left(\frac{A-1}{A+1}\right)^2 E$ (d) $\frac{A-1}{(A+1)^2} E$

41. If the momentum of a particle is increased by 20%,then its kinetic energy increases by

(a) 44% (b) 66%

(c) 80% (d) 30%

42. Three point masses, each of mass M are placed at the corners of an equilateral triangle of side L. The moment of inertia of this system about an axis along one side of the triangle is

(a) $\frac{1}{3}ML^2$ (b) $\frac{3}{2}ML^2$

(c) $\frac{3}{4}ML^2$ (d) ML^2

43. A thin circular ring of mass M and radius R is rotating about its axis with a constant angular velocity ω. Two objects, each of mass m, are connected gently to the ring. The ring now rotates with an angular velocity

(a) $\frac{\omega M}{M+m}$ (b) $\frac{\omega(M-2M)}{(M+2m)}$

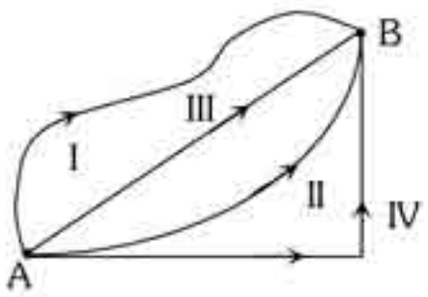
(c) $\frac{\omega(M+2m)}{M}$ (d) $\frac{\omega M}{M+2m}$

44. A satellite of mass m is moving in a circular orbit of radius R above the surface of a planet of mass M and radius R. The amount of work done to shift the satellite to higher orbit of radius 2R is

(a) mgR (b) $\frac{mgR}{6}$

(c) $\frac{mMgR}{(M+m)}$ (d) $\frac{mMgR}{6(M+m)}$

45. In a gravitational force field a particle is taken from A to B along different paths as shown in figure. Then



(a) Work done along path I will be maximum.

(b) Work done along path III will be minimum.

(c) Work done along path IV will be minimum.

(d) Work done along all the paths will be the same.

46. A wire of length L and area of cross-section A is made of material of Young's modulus y. If the wire is stretched by the amount x, the work done is

(a) $\frac{yAx^2}{2L}$ (b) yAx^2L

(c) $\frac{yAx}{2L}$ (d) $\frac{yAx^2}{L}$

47. The potential energy of a molecule increases when it is brought to the surface from the interior of a liquid because

(a) At the free liquid surface gravitational potential energy is more

(b) Work has to be done to move a molecule to the surface against the repulsive component of the inter molecular forces

(c) Work has to de done to move a molecule to the surface against the attraction from other molecules

(d) The temperature of the liquid surface is always more than that of the interior of the liquid

48. When a ven der Waals' gas undergoes free expSolion then its temperature

(a) Decreases

(b) Increases

(c) Does not change

(d) Depends upon the nature of the gas

49. A cylinder of radius r and of thermal conductivity K_1 is surrounded by a cylindrical shell of inner radius r and outer radius $2r$ made of a material of thermal conductivity K_2. The effective thermal conductivity of the system is

(a) $\frac{1}{3}(K_1+2K_2)$ (b) $\frac{1}{2}(2K_1+3K_2)$

(c) $\frac{1}{4}(3K_2+2K_1)$ (d) $\frac{1}{4}(K_1+3K_2)$

50. The tungsten filament of an electric lamp has a surface area A and a power rating P. If the emissivity of the filament is $\in$ and σ is Stefan's constant, the steady temperature of the filament will be

(a) $T=\left(\frac{P}{A\in\sigma}\right)^4$ (b) $T=\left(\frac{P}{A\in\sigma}\right)$

(c) $T=\left(\frac{A\in\sigma}{P}\right)^{\frac{1}{4}}$ (d) $T=\left(\frac{P}{A\in\sigma}\right)^{\frac{1}{4}}$

SECTION II

51. Natural rubber is

(a) A polymer of 1, 3-butadiene

(b) A polymer of ethylene

(c) A polymer of 2-methyl–1, 3-butadiene

(d) A polymer of styrene

52. In the reaction $Cl_2 + CH_4 \xrightarrow{h\nu} CH_3Cl + HCl$, presence of a small amount of oxygen

(a) Increases the rate of reaction for a brief period of time

(b) Decreases the rate of reaction for a brief period of time

(c) Does not affect the rate of reaction

(d) Completely stops the reaction

53. An example of a lipid is

(a) Lard (b) Keratin

(c) Glutathione (d) Oxytocin

54. Which of the following reagents can be used for distinguishing the three classes of alcohols

(a) Fenton's reagent (b) Lucas reagent

(c) Schiff's reagent (d) Tollen's reagent

55. The monomer of cellulose is

(a) Fructose (b) Galactose

(c) Glucose (d) None of these

56. Test for an ester is

(a) Biuret test (b) Hydroxamic acid test

(c) Mullicken test (d) Liebermann nitroso test

57. Number of resonating structures for Dewar's benzene will be

(a) One (b) Two

(c) Three (d) Four

58. Which of the following reactions can be used for the synthesis of an alkene

(a) Chugaev reaction

(b) Dakin reaction

(c) Reimer-Tiemann reaction

(d) Wurtz-Fitting reaction

59. The reaction $R_2C = N\,NH_2 \xrightarrow{C_2H_5ONa} R_2CH_2 + N_2$ is called

(a) Clemmensen reduction (b) Hunsdiecker reaction

(c) Tischenko reaction (d) Wolff-Kishner reduction

60. Which one of the following cations gives a brick red flame by flame test

(a) Ba^{2+} (b) Sr^{2+}

(c) Ca^{2+} (d) Zn^{2+}

61. Glauber's salt is

(a) $Na_2SO_4.10H_2O$ (b) $Na_2S_2O_3.5H_2O$

(c) $CuSO_4.5H_2O$ (d) $Na_2B_4O_7.10H_2O$

62. The most basic element is

(a) Fluorine (b) Iodine

(c) Chlorine (d) Bromine

63. Ammonia is a Lewis base and it forms complexes with many cations. Which one of the following cations does not form a complex with ammonia

(a) Ag^+ (b) Cu^{2+}

(c) Cd^{2+} (d) Pb^{2+}

64. Which of the following substances consists of only one element

(a) Marble (b) Sand

(c) Diamond (d) Glass

65. The compound which does not show paramagnetism, is

(a) $[Cu(NH_3)_4]Cl_2$ (b) $[Ag(NH_3)_4]Cl$

(c) NO (d) NO_2

66. For which element of first trSolition series the oxidation potential value $(M \rightarrow M^2 + 2e^-)$ is lowest

(a) Mn (b) Fe

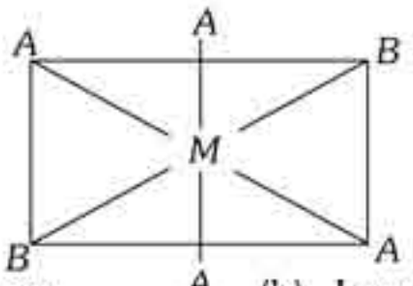
(c) Ni (d) Cu

67. A compound of Zinc which is white in cold state and yellow in hot state, is

(a) ZnS (b) ZnO

(c) $ZnCl_2$ (d) $ZnSO_4$

68. The isomer is



(a) Dextro isomer (b) Laevo isomer

(c) Cis-isomer (d) Trans-isomer

69. Lead nitrate on heating gives lead oxide, nitrogen dioxide and oxygen. This reaction is known as

(a) Combustion (b) Combination

(c) Displacement (d) Decomposition

70. The equivalent weight of potassium permanganate ($KMnO_4$) in neutral medium will be

(a) Atomic weight (b) $\frac{\text{Atomic weight}}{2}$

(c) $\frac{\text{Atomic weight}}{3}$ (d) $\frac{\text{Atomic weight}}{5}$

71. An element forms a solid oxide which when is dissolved in water forms an acidic solution. The element is

(a) Neon (b) Sodium

(c) Phosphorus (d) Sulphur

72. What is the product obtained when $MnSO_4$ in solution is boiled with PbO_2 and concentrated HNO_3

(a) MnO_2 (b) $HMnO_4$

(c) Mn_3O_4 (d) $PbMnO_4$

73. Which one of the following is an example of a true peroxide

(a) NO_2 (b) MnO_2

(c) BaO_2 (d) SO_2

74. The number of d-electrons in $[Cr(H_2O)_4]^{3+}$ is

(a) 2 (b) 3

(c) 4 (d) 5

75. Co-ordination number for copper (Cu) is

(a) 1 (b) 6

(c) 8 (d) 12

76. Silver nitrate on heating gives

(a) AgO and NO_2 (b) AgO, NO and O_2

(c) Ag and NO_2 (d) Ag, NO_2 and O_2

77. Which emits β-particles

(a) ${}_1H^3$ (b) ${}_6C^{14}$

(c) ${}_{19}K^{40}$ (d) All

78. The molarity of 98% H_2SO_4 ($d = 1.8\ g/ml$) by weight is

(a) $6\ M$ (b) $18\ M$

(c) $10\ M$ (d) $4\ M$

79. 20 ml of 10 N HCl are mixed with 10 ml of 36 N H_2SO_4 and the mixture is made one litre. Normality of the mixture will be

(a) $0.56\ N$ (b) $0.50\ N$

(c) $0.40\ N$ (d) $0.35\ N$

80. The energy of an electron in the 3rd orbit of an atom is $-E$. The energy of an electron in the first orbit will be

(a) $-3E$ (b) $-\frac{E}{3}$

(c) $-\frac{E}{9}$ (d) $-9E$

81. For the chemical reaction $A \rightarrow E$ it is found that the rate of the reaction doubles when the concentration of A is increased four times. The order in A for this reaction is

(a) Two (b) One

(c) Zero (d) Half

82. What is X in the nuclear reaction ${}^{14}_{7}N + {}^{1}_{1}H \rightarrow {}^{15}_{8}O + X$

(a) ${}^{1}_{1}H$ (b) ${}^{1}_{0}n$

(c) γ (d) ${}^{0}_{-1}e$

83. Which of the following is related with the colloidal solution

(a) Tyndall effect (b) Fajan's rule

(c) Le Chatelier's principle (d) Aufbau principle

84. Who discovered that cathode rays are made up of electrons

(a) William Crookes (b) G.J. Stoney

(c) R.A. Millikan (d) J. J. Thomson

85. The valency of the element having atomic number 9 is

(a) 1 (b) 2

(c) 3 (d) 4

86. One mole of N_2O_4 is heated in a flask with a volume of 10 dm^3. At equilibrium 1.708 mole of NO_2 and 0.146 mole of N_2O_4 were found at 134 $^{\circ}C$. The equilibrium constant will be

(a) 250 mol dm^{-3} (b) 300 mol dm^{-3}

(c) 200 mol dm^{-3} (d) 230 mol dm^{-3}

87. Which one of the following is paramagnetic

(a) O_2 (b) N_2

(c) He (d) NH_3

88. The compound which is non-linear:

(a) CO_2 (b) CS_2

(c) $HgCl_2$ (d) H_2O

89. The end product of 4n series is

(a) ${}_{82}Pb^{208}$ (b) ${}_{82}Pb^{207}$

(c) ${}_{82}Pb^{209}$ (d) None of the above

90. From the knowledge of the position of radium in the periodic table, which of the following statements would you expect to be false

(a) $RaSO_4$ is insoluble in water.

(b) $RaSO_4$ is insoluble in HNO_3.

(c) $RaSO_4$ is a white solid.

(d) $RaSO_4$ is a colourless liquid.

91. Hexa – 2ene – 4 – yne is

(a) $CH_3-CH_2-C\equiv C-CH=CH_2$

(b) $CH_3-C\equiv C-CH=CH-CH_3$

(c) $CH_3CH_2-CH=CH-C\equiv CH$

(d) $CH_3-C\equiv C-CH_2-CH=CH_2$

92. The number of unpaired electrons in carbon atom is

(a) One (b) Two

(c) Three (d) Four

93. Towards electrophilic reagents

(a) Ethene is more reactive than ethyne

(b) Ethene is less reactive than ethyne

(c) Both have equal reactivity

(d) The reactivity of both cannot be predicted

94. Which statement is correct

(a) Ethanol is more acidic than phenol

(b) Phenol is more acidic than ethanol

(c) Phenol is more acidic than benzoic acid

(d) Acidity of phenol and benzoic acid is about equal

95. Which Chloride is least reactive with the hydrolysis point of view

(a) CH_3Cl (b) CH_3CH_2Cl

(c) $(CH_3)_3CCl$ (d) $CH_2=CH-Cl$

96. The reaction of acetone with PCl_5 gives

(a) CH_3COCH_2Cl (b) $CH_3COCHCl_2$

(c) $CH_3-\overset{Cl\ Cl}{\overset{\diagdown\ \diagup}{C}}-CH_3$ (d) $ClCH_2COCH_2Cl$

97. In the preparation of Nylon-6 from cyclohexanone oxime use is made of a rearrangement reaction. This rearrangement reaction is called

(a) Wolff rearrangement (b) Amadori rearrangement

(c) Curtius rearrangement (d) Beckmann rearrangemnt

98. On heating a mixture of sodium benzoate and sodalime, is formed

(a) Toluene (b) Phenol

(c) Benzene (d) Benzoic acid

99. In the following reaction :

$2CH_2=CH_2+S_2Cl_2 \rightarrow$ Product. The product is

(a) Mustard gas (b) Lewisite

(c) Polythene (d) Teflon

100. What is the initial product of the acidic hydrolysis of a cyanide

(a) A primary amide (b) An isocyanide

(c) An isocyanate (d) A nitrile

SECTION III

101. The area of the triangle whose vertices (1.0), (7.0) and (4, 4) is

(a) 8 (b) 10
(c) 12 (d) 14

102. The area enclosed within the curve $|x|+|y|=4$ is

(a) 16 (b) 24
(c) 32 (d) 8

103. Equation of the line passing through the point (1, 2) and perpendicular to $3x+4y+5=0$ is

(a) $3y=4x-2$ (b) $3y=4x+2$
(c) $3y=4x+3$ (d) $3y=4x-3$

104. The intercept on the line $y=x$ by the circle $x^2+y^2-2x=0$ is AB. Equation of the circle on AB as a diameter is

(a) $x^2+y^2-x-y=0$ (b) $x^2+y^2-x+y=0$
(c) $x^2+y^2+x+y=0$ (d) $x^2+y^2+x-y=0$

105. The radius of the circle in which the sphere $x^2+y^2+z^2+2x-2y-4z-19=0$, is cut by the plane $x+2y+2z+7=0$, is

(a) 1 (b) 2
(c) 3 (d) 4

106. The locus of the vertices of the family of parabola $6y=2a^3x^2+3a^2x-12a$ is

(a) $xy=\frac{105}{64}$ (b) $xy=\frac{64}{105}$
(c) $xy=\frac{35}{16}$ (d) $xy=\frac{16}{35}$

107. The eccentricity of an ellipse whose centre is at the origin is $\frac{1}{2}$, if one of the directrices is $x=4$, then the equation of the ellipse is

(a) $4x^2+y^2=6$ (b) $4x^2+y^2=12$
(c) $x^2+4y^2=12$ (d) $x^2+4y^2=6$

108. The angle between two lines $\frac{x}{2}=\frac{y}{2}=\frac{z}{-1}$ and $\frac{x-1}{2}=\frac{y-1}{2}=\frac{z-1}{2}$ is

(a) $Cos^{-1}\left(\frac{4}{9}\right)$ (b) $Cos^{-1}\left(\frac{1}{3}\right)$
(c) $Cos^{-1}\left(\frac{2}{9}\right)$ (d) $Cos^{-1}\left(\frac{5}{9}\right)$

109. If the plane $2ax-3ay+4az+6=0$ passes through the mid-point of the line joining the centres of the spheres $x^2+y^2+z^2+6x-8y-2z=13$ and $x^2+y^2+z^2-10x+4y-2z=8$, then a is equal to

(a) 1 (b) –1
(c) 2 (d) –2

110. A random variable X has the probability distribution

X	1	2	3	4	5	6	7	8
P(X)	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the events $E=\{X$ is a prime number$\}$ and $F=\{X<4\}$, then $P(E\cup F)$ is

(a) 0.77 (b) 0.87
(c) 0.35 (d) 0.50

111. The points A, B, C whose position vectors are resp., $2i+j+k, i-3j-5k$ and $ai-3j+k$, forms a right-angled triangle with $\angle C=\pi/2$, then the values of a are

(a) 1 & 2 (b) –1 & –2
(c) 1 & –2 (d) –1 & 2

112. If $\vec{a}\times\left(\vec{b}\times\vec{c}\right)=\left(\vec{a}\times\vec{b}\right)\times\vec{c}$, where $\vec{a},\vec{b}$ and $\vec{c}$ are any three vectors such that $\vec{b}.\vec{c}\neq 0$, and $\vec{a}.\vec{b}\neq 0$ then $\vec{a}$ and $\vec{c}$ are

(a) Perpendicular (b) Parallel
(c) Inclined at an angle $\frac{\pi}{3}$ (d) Inclined at an angle $\frac{\pi}{6}$

113. Let $\vec{a}, \vec{b}, \vec{c}$ be three non-zero vectors such that no two of these are collinear. If the vector $\vec{a}+2\vec{b}$ is collinear with $\vec{c}$, then $\vec{a}+2\vec{b}+6\vec{c}$ equals

(a) $\lambda\vec{a}$ ($\lambda \neq 0$, a scalar) (b) $\lambda\vec{b}$ ($\lambda \neq 0$, a scalar)

(c) $\lambda\vec{c}$ ($\lambda \neq 0$, a scalar) (d) 0

114. If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $\vec{a}+\vec{b}+\vec{c}=0$ and $|\vec{a}|=7, |\vec{b}|=5, |\vec{c}|=3$, then the angle between the vectors $\vec{b}$ and $\vec{c}$ is

(a) 30° (b) 45°

(c) 60° (d) 90°

115. The differential equation, whose solution is $Ax^2+by^2=1$, where A and B are arbitrary constants, is of

(a) Second order and second degree

(b) Second order and first degree

(c) First order and second degree

(d) First order and first degree

116. The order and degree of the differential equation $\left(1+4\frac{dy}{dx}\right)^{2/3}=4\frac{d^2y}{dx^2}$ are respectively

(a) $1, \frac{2}{3}$ (b) 3, 2

(c) 2, 3 (d) $2, \frac{2}{3}$

117. If A and B are two events such that $P(A \cup B)=\frac{5}{6}$, $P(A \cap B)=\frac{1}{3}$ and $P(\overline{B})=\frac{1}{3}$, then the value of $P(A)$ is

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$

(c) $\frac{1}{2}$ (d) $\frac{2}{3}$

118. If bag A contains 2 white and 3 red balls and bag B contains 4 white and 5 red balls. A ball is selected randomly from a randomly selected bag and is found to be red. Then the probability that it is selected from bag B is

(a) $\frac{25}{52}$ (b) $\frac{5}{18}$

(c) $\frac{21}{52}$ (d) $\frac{13}{18}$

119. The mean and the variance of a binomial distribution are 4 and 2 respectively, then the probability of two successes is

(a) $\frac{28}{256}$ (b) $\frac{42}{256}$

(c) $\frac{56}{256}$ (d) $\frac{72}{256}$

120. If there students A, B, C can solve a problem with probabilities $\frac{1}{3}, \frac{1}{4}$ and $\frac{1}{5}$ respectively, then the probability that the problem will be solved is

(a) $\frac{3}{5}$ (b) $\frac{4}{5}$

(c) $\frac{2}{5}$ (d) $\frac{47}{60}$

121. If $z^2+z+1=0$, where z is a complex number then the value of $\left(z+\frac{1}{z}\right)^2+\left(z^2+\frac{1}{z^2}\right)^2+\left(z^3+\frac{1}{z^3}\right)^2+\ldots\ldots+\left(z^6+\frac{1}{z^6}\right)^2$ is

(a) 6 (b) 12

(c) 18 (d) 24

122. The local minimum of the function $f(x)=\frac{x}{2}+\frac{2}{x}$ is

(a) at $x=2$ (b) at $x=-2$

(c) at $x=0$ (d) at $x=1$

123. If $0<x<\pi$ and $\cos x+\sin x=\frac{1}{2}$, then the value of $\tan x$ is

(a) $\frac{2-\sqrt{7}}{3}$ (b) $-\frac{4+\sqrt{7}}{3}$

(c) $-\frac{1+\sqrt{7}}{3}$ (d) $-\frac{2+\sqrt{7}}{3}$

124. The number of real solutions of the equation $x^2-3|x|+2=0$ is

(a) 1 (b) 2

(c) 3 (d) 4

125. The value of a for which one root of the quadratic equation $(a^2-5a+3)x^2+(3a-1)x+2=0$, is twice of the other root, is

(a) $\frac{2}{3}$ (b) $-\frac{2}{3}$

(c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

126. If the function $f(x)=2x^3-9ax^2+12a^2x+1$, where $a>0$, attains its maximum and minimum at p and q respectively and $p^2=q$, then a equals

(a) 1 (b) 2

(c) 3 (d) $\frac{1}{2}$

127. If $A^2-A+I=0$, then A^{-1} is equal to

(a) A (b) $I+A$

(c) $I-A$ (d) $A-I$

128. The solutions of the equation $4\cos^2 x+6\sin^2 x=5$ are

(a) $x=n\pi\pm\frac{\pi}{4}$ (b) $x=n\pi\pm\frac{\pi}{3}$

(c) $x=n\pi\pm\frac{\pi}{2}$ (d) $x=n\pi\pm\frac{2\pi}{3}$

129. If $\lim_{x\to 0}\frac{\log(x+a)-\log a}{x}+k\lim_{x\to e}\frac{\log x-1}{x-e}=1$, then the value of k is

(a) $1-\frac{1}{a}$ (b) $e(1-a)$

(c) $e\left(1-\frac{1}{a}\right)$ (d) $e(1+a)$

130. The value of $\lim_{x\to\infty}\left(\frac{x-3}{x+2}\right)^x$, for $x\in R$, is

(a) e^5 (b) e^{-5}

(c) e (d) e^{-1}

131. The sum of the series $1+\frac{4}{5}+\frac{7}{5^2}+\frac{10}{5^3}+\ldots\ldots$ upto ∞, is

(a) $\frac{35}{16}$ (b) $\frac{37}{16}$

(c) $\frac{39}{16}$ (d) 3

132. The Geometric mean of $1.2.2^2,\ldots\ldots,2^n$ is

(a) $2^{n/2}$ (b) $n^{(n+1)/2}$

(c) $2^{n(n+1)/2}$ (d) $2^{(n-1)/2}$

133. If $y=\log x^x$, then the value of $\frac{dy}{dx}$ is

(a) $x^x(1+\log x)$ (b) $\log(ex)$

(c) $\log\left(\frac{e}{x}\right)$ (d) $\log\left(\frac{x}{e}\right)$

134. If $z=x+iy$ and $z^{1/3}=a-ib$, then $\frac{x}{a}-\frac{y}{b}=k(a^2-b^2)$ when the value of k is

(a) 4 (b) 3

(c) 2 (d) 1

135. If $(x+iy)=\sqrt{\frac{1+2i}{3+4i}}$, then $(x^2+y^2)^2=$

(a) 5 (b) $\frac{1}{5}$

(c) $\frac{2}{5}$ (d) $\frac{5}{2}$

136. If the first, second and last terms of an arithmetic series are a, b and c respectively then the number of terms is

(a) $\frac{b+c-2a}{b-a}$ (b) $\frac{b+c+2a}{b-a}$

(c) $\frac{b+c-2a}{b+a}$ (d) $\frac{b+c+2a}{b+a}$

137. The term independent of x in $\left[\sqrt{x}-\frac{2}{x}\right]^{18}$ is

(a) ${}^{18}C_{12}2^8$ (b) ${}^{18}C_6 2^{12}$

(c) ${}^{18}C_6 2^4$ (d) ${}^{18}C_{12}2^6$

138. If $A=\begin{bmatrix}x & 1\\ 1 & 0\end{bmatrix}$ and A^2 is the identity matrix, then $x=$

(a) -1 (b) 0

(c) 1 (d) 2

139. If A^T, B^T are transpose matrices of the square matrices A, B respectively, then $(AB)^T$ is equal to

(a) $A^T B^T$ (b) AB^T

(c) BA^T (d) $B^T A^T$

140. If $\sin\theta + \operatorname{cosec}\theta = 3$, then $\sin^2\theta + \operatorname{cosec}^2\theta =$

(a) 7 (b) 9

(c) 11 (d) 5

141. $\lim\limits_{x\to 0} \dfrac{x\cos x + \sin x}{x^2 + \tan x}$ is equal to

(a) -1 (b) 0

(c) 1 (d) 2

142. If the function $f: N \to N$ is defined by $f(x) = \sqrt{x}$, then $\dfrac{f(25)}{f(16) + f(1)}$ is equal to

(a) $\frac{5}{6}$ (b) $\frac{5}{7}$

(c) $\frac{5}{3}$ (d) 1

143. $\int \dfrac{1}{1+\cos x + \sin x} dx =$

(a) $\log\left|1 + \tan\frac{x}{2}\right| + c$ (b) $\frac{1}{2}\log\left|1 + \tan\frac{x}{2}\right| + c$

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

144. $\int \dfrac{x^4 + x^2 + 1}{x^2 - x + 1} dx =$

(a) $\frac{x^3}{3} - \frac{x^2}{2} + x + c$ (b) $\frac{x^3}{3} + \frac{x^2}{2} + x + c$

(c) $\frac{x^3}{3} - \frac{x^2}{2} - x + c$ (d) $\frac{x^3}{3} + \frac{x^2}{2} - x + c$

145. $\int_0^{\pi/2} \dfrac{\sqrt{\cos x}}{\sqrt{\cos x} + \sqrt{\sin x}} dx =$

(a) 0 (b) $\pi/4$

(c) $\pi/3$ (d) $\pi/2$

146. $\int_0^{\pi} \dfrac{x}{1+\sin x} dx =$

(a) 0 (b) $\pi/4$

(c) $\pi/2$ (d) π

147. The matrix $\begin{bmatrix} \lambda & -1 & 4 \\ -3 & 0 & 1 \\ -1 & 1 & 2 \end{bmatrix}$ is invertible if

(a) $\lambda \neq -17$ (b) $\lambda \neq -18$

(c) $\lambda \neq -19$ (d) $\lambda \neq -20$

148. $\int \sin^3 x . \cos^2 x dx =$

(a) $\frac{\sin^5 x}{5} - \frac{\sin^3 x}{3} + c$ (b) $\frac{\sin^5 x}{5} + \frac{\sin^3 x}{3} + c$

(c) $\frac{\cos^5 x}{5} - \frac{\cos^3 x}{3} + c$ (d) $\frac{\cos^5 x}{5} + \frac{\cos^3 x}{3} + c$

149. The area enclosed between the curves $y^2 = x$ and $y = |x|$ is

(a) $\frac{1}{6}$ (b) $\frac{1}{3}$

(c) $\frac{2}{3}$ (d) 1

150. $\int_0^{\pi/2} \log\sin x \, dx =$

(a) $-\pi\log 2$ (b) $\pi\log 2$

(c) $-\frac{\pi}{2}\log 2$ (d) $\frac{\pi}{2}\log 2$