

Very Similar

MODEL TEST PAPER

for AIEEE-2006

Time : 3 hrs.

(Based on new pattern)

Maximum Marks : 540

Instructions:

1. This question paper contains **180** questions: **1-60** Physics, **61-120** Chemistry, **121-180** Mathematics.
2. For every correct answer 3 marks will be credited to your account, 1 mark will be deducted for every wrong answer and no marks will be awarded for unattempted questions.
3. Use of Trigonometric table, Calculator or any other helping device is restricted.
4. Useful data : **At.wt./ Mol.wt.** : KMnO_4 : 158; Cu : 63.5; NaOH : 40; HCl : 36.5; Mg : 24; H : 1; He : 4; C : 12; N : 14; O : 16; Na : 23; P : 31; S : 32; Cl : 35.5; Ca : 40; Zn : 65; Ag : 108.
Atomic No : H : 1; He : 2; Li : 3; Be : 4; B : 5; C : 6; N : 7; O : 8; F : 9; Na : 11; Mg : 12; Al : 13; Si : 14; Fe : 26; Co : 27; Ni : 28; Cu : 29; Zn : 30; Rb : 37
Constants : $g = 10 \text{ m/s}^2$, $R = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$ or $0.0821 \text{ atm litre K}^{-1}\text{mol}^{-1}$, $e = 1.6 \times 10^{-19} \text{ C}$, $N_0 = 6.023 \times 10^{23}$, $m_p = 1.6 \times 10^{-27} \text{ kg}$, $m_e = 9.11 \times 10^{-31} \text{ kg}$, $h = 6.6 \times 10^{-34} \text{ Js}$.

PHYSICS

1. The velocity of a particle is given by $v = at^2 + bt + c$, where v is measured in m/s and t is measured in second. The unit of
(a) a is m/s (b) b is m/s
(c) c is m/s
(d) a and b is same but that of c is different.
2. The percentage errors in the measurement of mass and speed are 1% and 2% respectively. What is the percentage error in the kinetic energy?
(a) 5% (b) 2.5%
(c) 3% (d) 1.5%.
3. A boat crosses the river in shortest possible time. The speed of the boat in still water is 13 m/s. The average speed of the boat while crossing the river comes out to be 12 m/s. What is the velocity of flow of river?
(a) 25 m/s (b) 1 m/s
(c) (12/13) m/s (d) none of these.
4. The angular speed of the minute hand of a clock in degrees per second is
(a) 0.01 (b) 0.1
(c) 1.0 (d) none of these.
5. Two boys are left in the middle of a frictionless floor. One boy of mass 20 kg gives a blow lasting one milli-second and of 100 N to the other. He himself will move with a velocity of
(a) 1 m/s (b) 0.5 m/s
(c) 0.01 m/s (d) 0.005 m/s.
6. The increase in energy of a brass rod of length 0.2 m and cross-sectional area 1 cm^2 when compressed with a load of 5 kg-wt. along its length is (Y of brass = $1.0 \times 10^{11} \text{ N/m}^2$, $g = 9.8 \text{ ms}^{-2}$).
(a) 2.4×10^5 joule (b) 4.2×10^{-5} joule
(c) 2.4×10^{-5} joule (d) none of these.
7. Smoothing the surface in contact beyond a certain limit raises friction because
(a) irregularities are increased
(b) surface projections are sharpened
(c) area of actual contact increases
(d) none of these.
8. A body of mass M is raised from the surface of the earth to an altitude equal to the radius of the earth. The potential energy gained by the body will be
(a) $MgR/2$ (b) MgR
(c) $2MgR$ (d) none of these.
9. A neutron is moving with a 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 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) $\frac{A-1}{(A+1)^2} E$.

10. The centre of mass of system of particles does not depend on the

- (a) masses of the particles
- (b) forces on the particles
- (c) position of the particles
- (d) relative separation of the particles.

11. A disc rolls down an inclined plane having inclination 30° without slipping. What will be its acceleration down the inclined plane?

- (a) $g/2$ (b) $g/3$
- (c) $2g/3$ (d) none of these.

12. Assuming the earth as a sphere of uniform density, the acceleration due to gravity half way towards the centre of the earth will be

- (a) $0.75g$ (b) $0.50g$
- (c) $0.25g$ (d) $0.125g$.

13. A projectile is fired vertically upwards. It escapes from the earth when fired with velocity v . If it is to be fired at 45° with the horizontal, what should be its velocity to enable it escape from the gravitational pull of the earth?

- (a) $\sqrt{2}v$ (b) $v/\sqrt{2}$
- (c) v (d) some other velocity.

14. The modulus of rigidity of a liquid is

- (a) zero (b) 1
- (c) infinity
- (d) a value not one of those mentioned above.

15. A person is carrying a bucket in one hand and a fish in the other hand. If he puts fish in the bucket, how will the load carried by the person change?

- (a) no change (b) it will be more
- (c) it will be less
- (d) it will depend on the mass of the fish.

16. Eight drops of water, each of radius 2 mm are falling through air at a terminal velocity of 8 cm/s. If they coalesce to form a single drop, the terminal velocity of the combined drop will be

- (a) 8 cm/s (b) 16 cm/s
- (c) 24 cm/s (d) 32 cm/s.

17. A wooden stick 2 m long is floating on the surface of water, the surface tension of water is 0.07 N/m. By

putting soap solution on one side of the stick, the surface tension is reduced to 0.06 N/m. The net force on the stick will be

- (a) 0.01 N (b) 0.02 N
- (c) 0.06 N (d) 0.07 N.

18. A cylinder of radius R made of material of thermal conductivity K_1 is surrounded by cylindrical shell of inner radius R and outer radius $2R$ made of a material of thermal conductivity K_2 . The two ends of the combined system are maintained at two different temperatures. There is no loss of heat across the cylindrical surface and the system is in the steady state. The effective thermal conductivity of the system is

- (a) $K_1 + K_2$ (b) $\frac{K_1 K_2}{(K_1 + K_2)}$
- (c) $\frac{K_1 + 3K_2}{4}$ (d) $\frac{(3K_1 + K_2)}{4}$

19. The temperature of the source of a Carnot heat engine is 0°C and that of sink is -39°C . The efficiency of a heat engine is

- (a) zero (b) 14.3%
- (c) 39% (d) none of these.

20. A current carrying wire is placed along east-west in a magnetic field directed northwards. If the current in the wire is directed eastwards, what will be the direction of force on the wire?

- (a) due west (b) due south
- (c) vertically upwards (d) vertically downwards.

21. If the average velocity of the molecules of a gas is doubled, then what happens to their root mean square velocity?

- (a) doubled (b) halved
- (c) becomes $\sqrt{2}$ times (d) becomes $1/\sqrt{2}$ times.

22. A monoatomic ideal gas initially at 17°C is suddenly compressed to one eighth of its original volume. The temperature after compression is

- (a) 17°C (b) 136°C
- (c) 887°C (d) none of these.

23. The cause of Fraunhofer lines is

- (a) reflection of radiations by chromosphere
- (b) absorption of radiation by chromosphere
- (c) emission of radiations by chromosphere
- (d) transmission of radiations by chromosphere.

24. What happens when a sound wave is reflected from

the boundary of a denser medium? The compression of the incident wave is returned as

- (a) crest (b) trough
(c) compression (d) rarefaction.

25. A transverse wave is given by $y = A \sin \pi(ft - x/\lambda)$. The maximum particle velocity is 4 times the wave velocity, when

- (a) $\lambda = \frac{\pi A}{4}$ (b) $\lambda = \frac{\pi A}{2}$
(c) $\lambda = \pi A$ (d) $\lambda = 2\pi A$

26. What causes reverberation?

- (a) reflection (b) refraction
(c) diffraction (d) interference.

27. A tunnel is made along a chord inside the earth and a ball is released in it. What will be the time period of oscillation of the ball?

- (a) $2\pi\sqrt{\frac{R}{2g}}$ (b) $2\pi\sqrt{\frac{R}{g}}$
(c) $2\pi\sqrt{\frac{2R}{g}}$ (d) $\pi\sqrt{\frac{R}{g}}$.

28. The masses of the three wires of copper are in the ratio of 1 : 3 : 5 and their lengths are in the ratio of 5 : 3 : 1. The ratio of their electrical resistances is

- (a) 1 : 3 : 5 (b) 5 : 3 : 1
(c) 1 : 15 : 25 (d) 125 : 15 : 1

29. Two small spheres each carrying a charge q are placed 1 m apart. The electric force between them is F . If one sphere is taken around the other, the work done is

- (a) F (b) $2\pi F$
(c) $F/2\pi$ (d) zero.

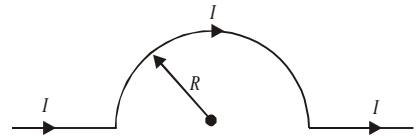
30. A parallel plate capacitor is connected across a 2 volt battery and charged. The battery is then disconnected and a glass slab is introduced between the plates. Which of the following pairs of quantities decrease?

- (a) charge and potential difference
(b) potential difference and energy stored
(c) energy stored and capacitance
(d) capacitance and charge.

31. How does the maximum voltage (V) that can be given to a spherical conductor vary with its radius R ?

- (a) $V \propto \frac{1}{R^2}$ (b) $V \propto \frac{1}{R}$
(c) $V \propto R$ (d) $V \propto R^2$.

32. An infinite long straight wire is bent into a semicircle of radius R , as shown in the figure. A current I is sent through the conductor.



The magnetic field at the centre of the semicircle is

- (a) infinite (b) zero
(c) $\frac{\mu_0 I}{4R}$ (d) $\frac{\mu_0 I(\pi+1)}{4\pi R}$

33. A proton enters a magnetic field with velocity parallel to the magnetic field. The nature of the path followed by the proton will be

- (a) straight line (b) circle
(c) helix (d) parabola.

34. A magnetised straight wire of length l and dipole moment p_m is bent into a semicircle. The dipole moment of the bent wire will be

- (a) p_m (b) $\frac{p_m}{\pi}$
(c) $\frac{p_m}{2\pi}$ (d) $\frac{2p_m}{\pi}$.

35. Which of the following is most suitable as the core of transformers?

- (a) steel (b) alnico
(c) soft iron (d) none of these.

36. In a transformer the voltage is stepped up from 220 volt to 440 volt. If the current in the primary was 1.0 ampere, that in the secondary should be

- (a) 0.5 A (b) between 0.5 and 1 A
(c) 1 A (d) more than 1 A.

37. In an a.c. circuit capacitive reactance = inductive reactance. The phase difference between the current and the voltage will be

- (a) zero (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{2}$ (d) π .

38. The refractive index is equal to the tangent of the angle of polarisation. It is called

- (a) Brewster's law (b) Malus law
 (b) Bragg's law (d) Grimald's law.

39. The amplitude of the light waves emerging from the two slits in Young's experiment is in the ratio 2 : 3. The intensity of the minimum to that of the consecutive maximum will be in the ratio of

- (a) 2 : 3 (b) 4 : 9
 (c) 1 : 9 (d) none of these.

40. The critical angle of water with respect to air is θ . What is the angular range in which the fish just below the surface of water can see objects outside?

- (a) $\theta/2$ (b) θ
 (c) 2θ (d) none of these.

41. We have a right angled isosceles prism. Its refractive index is 1.5. If we incident a ray normally on one of the two perpendicular surfaces, which of the following phenomenon will take place?

- (a) dispersion (b) total internal reflection
 (c) refraction (d) reflection.

42. A far sighted person can see clearly beyond 100 cm distance. If he wants to see clearly an object at 40 cm distance, then the power of the lens he shall require is

- (a) + 1.5 D (b) - 1.5 D
 (c) + 3.0 D (d) - 3.0 D.

43. The rest mass of photon is

- (a) zero (b) 1.67×10^{35} kg
 (c) infinite (d) 1 amu.

44. A particle of mass 10^{-30} kg is moving with velocity equal to 10^6 m/s. The wavelength of the particle is equal to

- (a) 6.6 m (b) 6.6 cm
 (c) 0.66 mm (d) 0.66 nm.

45. An electron moving with a velocity 8×10^7 enters a parallel plate capacitor. The electric intensity is 4×10^8 volt/metre. To keep the beam undeflected in its path its magnetic field applied is

- (a) 0.5 T (b) 5 T
 (c) 50 T (d) 500 T.

46. The ionisation potential of hydrogen atom is 13.6 volt. The energy required to remove an electron in the $n = 4$ state of the hydrogen atom is

- (a) 27.2 eV (b) 13.6 eV
 (c) 1.5 eV (d) 0.85 eV.

47. The frequency of the incident light falling on a photosensitive metal plate is doubled, the kinetic energy of the emitted photoelectrons is

- (a) double the earlier value
 (b) unchanged
 (c) more than doubled
 (d) less than doubled.

48. The current gain α of a transistor in common base mode is 0.995. Its gain β in the common emitter mode is

- (a) 99.5 (b) 1.005
 (c) 200 (d) 100.

49. The ratio of momentum of an electron and an alpha particle which are accelerated from rest by a potential difference of 100 V is

- (a) 1 (b) $\sqrt{\frac{2m_e}{m_\alpha}}$
 (c) $\sqrt{\frac{m_e}{m_\alpha}}$ (d) $\sqrt{\frac{m_e}{2m_\alpha}}$

50. If the binding energies per nucleon in Li^7 and He^4 nuclei are respectively 5.60 MeV and 7.06 MeV, then the energy of the reaction : $\text{Li}^7 + p \rightarrow 2 \text{He}^4$ is

- (a) 19.6 MeV (b) 2.4 MeV
 (c) 8.4 MeV (d) 17.3 MeV.

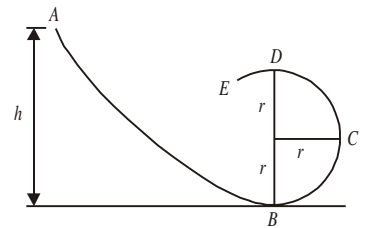
51. What is the name of the semiconductor material having high negative coefficient of resistivity?

- (a) thermistor (b) transistor
 (c) resistor (d) thyristor.

52. A motor boat covers the distance between two spots on the river in $t_1 = 8$ hr and $t_2 = 12$ hr down stream and upstream respectively. The time required for the boat to cover this distance in still water is

- (a) 4.3 hr (b) 9.6 hr
 (c) 0.21 hr (d) 0.42 hr.

53. In figure, ABCD is a channel in a vertical plane, part BCDE being circular with radius r . A ball is released from A and slides without friction and without rolling. It will complete the loop path if



It will complete the loop path if

- (a) h is greater than $5r/2$
 (b) h is less than $5r/2$
 (c) it will not complete the loop
 (d) h is equal to $7r/5$.

54. A uniform chain is held on a frictionless table with one fifth of its length hanging over the edge. If the chain has a length l and mass m , then the work required to pull the hanging part back on the table is

- (a) $\frac{mg}{50l}$ (b) $\frac{50ml}{g}$
 (c) $\frac{50mg}{l}$ (d) $\frac{mgl}{50}$

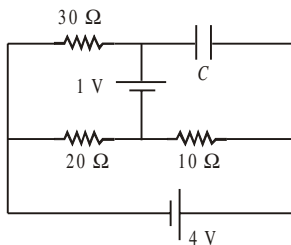
55. A man is travelling along a straight line joining two sources each of 1000 vib/sec. How fast should he move, so that he may hear 15 beats per second?

(velocity of sound = 330 m/s)

- (a) 1.46 m/s (b) 2.48 m/s
 (c) 3.93 m/s (d) 0.53 m/s.

56. Find the potential difference between the plates of the capacitor C in the circuit shown. The internal resistance of the sources are negligible.

- (a) -2 volt
 (b) +1 volt
 (c) +2 volt



- (d) -1 volt.

57. An intrinsic semiconductor at absolute zero of temperature behaves as

- (a) an insulator (b) a semiconductor
 (c) a metallic conductor
 (d) a superconductor.

58. Four independent waves are expressed as

- (i) $y_1 = a_1 \sin \omega t$ (ii) $y_2 = a_2 \sin 2\omega t$
 (iii) $y_3 = a_3 \cos \omega t$ (iv) $y_4 = a_4 \sin(\omega t + \pi/3)$

The interference is possible between

- (a) (i) and (iii) (b) (i) and (iv)
 (c) (iii) and (iv) (d) not possible at all.

59. The nuclear radius of a nucleus with nucleon number 10 is 3×10^{-15} metre. Then the nuclear radius of a nucleus with nucleon number 80 is

- (a) 3×10^{-15} metre (b) 1.5×10^{-15} metre
 (c) 6×10^{-15} metre (d) 4.5×10^{-15} metre.

60. Energy levels A, B, C of a certain atom correspond

to increasing values of energy i.e. $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of the radiation corresponding to the transition C to B, B to A and C to A respectively, which of the following relations is correct?

- (a) $\lambda_3 = \lambda_1 + \lambda_2$ (b) $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$
 (c) $\lambda_1 + \lambda_2 + \lambda_3 = 0$ (d) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$.

CHEMISTRY

61. When a copper sulphate solution is treated with potassium iodide and excess of hypo solution is added in resulting solution, a white precipitate is formed. The white precipitate is due to

- (a) $\text{Na}_2\text{S}_4\text{O}_6$ (b) CuI_2
 (c) CuI (d) NaI .

62. An organic compound has 4% sulphur. The molecular weight of the compound will be

- (a) 100 (b) 200
 (c) 400 (d) 800.

63. Sodium carbonate reacts with SO_2 gas to give

- (a) Na_2SO_4 (b) NaHSO_4
 (c) Na_2SO_3 (d) NaHSO_3 .

64. The wax which is used in the manufacture of candles, contains

- (a) saturated hydrocarbons
 (b) esters (c) alcohols
 (d) higher ethers.

65. Which of the following statement is correct about the positive catalyst?

- (a) it increases the energy of activation
 (b) it increases the amount of products
 (c) it increases the rate of forward and backward reactions
 (d) it initiates a chemical reaction.

66. When two gases hydrogen and helium are filled in two different containers whose volumes and weights are same, which of the following statements is correct about two gases?

- (a) both the gases have same pressure
 (b) both the gases have equal number of molecules
 (c) molecules of H_2 will be more
 (d) molecules of He will be more.

67. In manufacture of caustic soda which of the following is obtained as a by-product?

- (a) oxygen (b) nitrogen
(c) chlorine (d) common salt.

68. Which of the following compounds does not react with iodine and sodium hydroxide?

- (a) propanal (b) ethyl alcohol
(c) acetaldehyde (d) acetone.

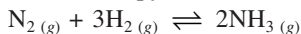
69. Benzaldehyde is converted into benzyl alcohol by

- (a) Fittig reaction (b) Wurtz reaction
(c) Cannizzaro reaction (d) Wurtz-Fittig reaction.

70. Which of the following is conjugate base of $[C_2H_5NH_3]^+$?

- (a) $[C_2H_5NH]^-$ (b) $[C_2H_5NH_3]OH$
(c) $C_2H_5NH_2$ (d) all of these.

71. At $227^\circ C$ the enthalpy of the reaction



is found to be -22.40 K cal. The enthalpy at constant volume will be (given $R = 1.98 \times 10^{-3}$ Kcal K^{-1} mol^{-1})

- (a) -22.40 (b) 22.40
(c) -20.42 (d) 20.42

72. Which one of the following reactions is said to be a Friedel Craft's reaction?

- (a) $C_6H_5CH_3 + CH_3CH_2Cl \xrightarrow{AlCl_3} C_6H_5C_2H_5 + CH_3Cl$
(b) $C_6H_5Cl + CH_3CH_2Cl \xrightarrow{AlCl_3} C_6H_5C_2H_5 + Cl_2$
(c) $C_6H_6 + CH_3CH_2Cl \xrightarrow{AlCl_3} C_6H_5C_2H_5 + HCl$
(d) none of these.

73. The pH of 10^{-10} M $Mg(OH)_2$ solution will be

- (a) 10 (b) 6
(c) 4 (d) 7.001

74. If uncertainty in position of an electron is zero, the uncertainty in its momentum will be

- (a) less than $h/4\pi$ (b) greater than $h/4\pi$
(c) zero (d) infinite.

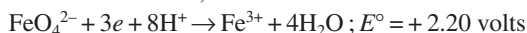
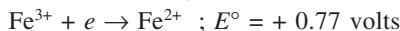
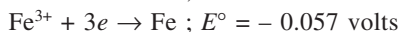
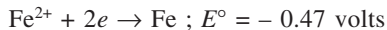
75. Half-life of a radioactive disintegration ($A \rightarrow B$) having rate constant 231 sec^{-1} , will be

- (a) 3.0×10^{-2} sec (b) 3.0×10^{-3} sec
(c) 2.31×10^{-2} sec (d) 2.31×10^{-3} sec.

76. Didymium catalyst is

- (a) neodymium (b) praseodymium
(c) both (a) and (b) (d) none of these.

77. Reduction potentials of some half reactions are given as :



Which of the following statements is correct?

- (a) neither Fe^{3+} nor Fe^{2+} have any tendency to reduce Fe
(b) FeO_4^{2-} is the weakest oxidising agent
(c) ΔG value for $FeO_4^{2-} \rightarrow Fe^{3+}$ will be large and positive
(d) reactions with negative values for E° are more strongly oxidising than oxygen.

78. Which of the following metals has the lowest metallic conductivity?

- (a) silver (b) copper
(c) sodium (d) zinc.

79. When ammonia (NH_3) reacts with calcium hypochlorite, which of the following is main product of the reaction?

- (a) Ca_3N_2 (b) NH_4Cl
(c) N_2 (d) CaO .

80. Which of the following species has the lowest value of pK_a ?

- (a) H_3PO_4 (b) $H_2PO_4^-$
(c) HPO_4^{2-} (d) all have equal value.

81. When cupric oxide (CuO) is heated in the current of ammonia, which of the following is not the product formed?

- (a) Cu (b) N_2
(c) H_2O (d) Cu_3N_2 .

82. Which of the following oxyacids of phosphorus is monobasic and reducing in nature?

- (a) metaphosphoric acid
(b) pyrophosphoric acid
(c) hypophosphoric acid
(d) hypophosphorous acid.

83. Which of the following compounds is not reduced by ozone?

- (a) BaO_2 (b) Ag_2O
(c) Na_2O_2 (d) $K_4[Fe(CN)]_6$.

84. When the vapours of benzene are passed through a red hot tube

- (a) diphenyl is formed
(b) diphenyl benzene is formed

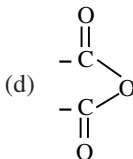
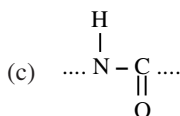
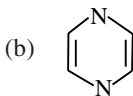
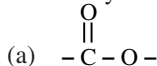
- (c) both (a) and (b) are correct
(d) both (a) and (b) are wrong.
- 85.** The reaction, $C_6H_6 \xrightarrow[AlCl_3]{CO + HCl} C_6H_5CHO$ is known as
(a) Reimer-Tiemann reaction
(b) Perkin's reaction
(c) Gattermann Koch reaction
(d) Gattermann aldehyde synthesis.
- 86.** The product formed by heating sodium phenoxide with CO_2 at $140^\circ C$ on treatment with HCl gives
(a) phenyl acetic acid (b) cinnamic acid
(c) benzoic acid (d) salicylic acid.
- 87.** The reaction of benzaldehyde with ammonia (NH_3) gives
(a) benzaldehyde ammonia
(b) benzaldimine (c) hydrobenzamide
(d) benzamide.
- 88.** The energy required to send hydrogen electron from $n = 1$ to $n = 2$ will be
(a) 13.6 eV (b) 27.2 eV
(c) 10.2 eV (d) 1.02 eV.
- 89.** The ionization energy of hydrogen atom is 13.6 eV. The ionization energy of Li^{2+} ion will be
(a) 13.6 eV (b) 40.8 eV
(c) 122.4 eV (d) 84.6 eV.
- 90.** When the value of $n + l$ is not more than three which of the following sub shells is not possible to exist?
(a) $2s$ (b) $3s$
(c) $3p$ (d) $2p$.
- 91.** Hypnotic chloretone is obtained by
(a) condensation of acetone with chloroform
(b) condensation of acetaldehyde with carbon tetrachloride
(c) condensation of acetone with bleaching powder
(d) condensation of acetaldehyde with bleaching powder.
- 92.** The conversion of aliphatic compounds into aromatic compounds is known as
(a) aromatisation (b) hydroforming
(c) catalytic reforming (d) conformation.
- 93.** Amorphous solids are
(a) solids in true sense (b) liquids in true sense
(c) supercooled liquids
(d) substances with definite melting point.
- 94.** In a crystal the atoms are located at the position of
(a) maximum potential energy
(b) minimum potential energy
(c) zero potential energy
(d) infinite potential energy.
- 95.** Sodium metal crystallises in bcc lattice with the cell edge, $a = 4.29 \text{ \AA}$. The radius of sodium atom is
(a) 4.29 \AA (b) 2.145 \AA
(c) 1.86 \AA (d) 2.86 \AA .
- 96.** The enzyme which can catalyse the conversion of glucose to ethanol is
(a) invertase (b) maltase
(c) zymase (d) diastase.
- 97.** The rate constants for the forward and backward reactions of hydrolysis of ester are 1.1×10^{-2} and 1.5×10^{-3} per minute respectively. The equilibrium constant of the reaction will be
(a) 1.1×10^{-2} (b) 1.5×10^{-3}
(c) 1.65×10^{-5} (d) 7.33
- 98.** Naturally occurring boron consists of two isotopes having atomic weights 10.01 and 11.01. The atomic weight of naturally occurring boron is 10.81. The percentage of each isotope in natural boron is
(a) 20% and 80% respectively
(b) 80% and 20% respectively
(c) 30% and 70% respectively
(d) 70% and 30% respectively.
- 99.** The substances which produce NH_2^- in liquid ammonia are
(a) acids (b) bases
(c) both (a) and (b) (d) none of these.
- 100.** Which of the following substances are formed when lithium is heated in air?
(a) $Li_2O + LiO_2$ (b) Li_2O_2
(c) LiO_2 (d) $Li_2O + Li_3N$.
- 101.** Which of the following compounds is most stable?
(a) LiF (b) LiCl
(c) LiBr (d) LiI.
- 102.** The name hydrargyrum stands for
(a) Ag (b) Hg
(c) He (d) Ho.

103. Ketones $\left[\begin{array}{c} \text{R} - \text{C} - \text{R}_1 \\ || \\ \text{O} \end{array} \right]$, where R and R₁ are alkyl

groups, can be obtained in one step by

- (a) hydrolysis of esters
- (b) oxidation of primary alcohols
- (c) oxidation of tertiary alcohols
- (d) reaction of acid halides with alcohols.

104. Which one of the following chemical units is essentially found in enzymes?



105. Which of the following substances is used to make non-stick cookware?

- (a) polystyrene
- (b) PVC
- (c) polytetrafluoroethylene
- (d) poly (ethylene terephthalate).

106. Which of the following substances is not a organophosphorus insecticide?

- (a) malathion
- (b) parathion
- (c) phosdrin
- (d) rotenone.

107. The number of conformations possible for ethane is

- (a) two
- (b) four
- (c) eight
- (d) infinite.

108. Which one of the following is incorrect?

- (a) at equilibrium $\Delta G = 0$
- (b) at equilibrium, $\Delta G = \Delta G^\circ + RT \log K_e$
- (c) at equilibrium, $\Delta G^\circ = -RT \log K_e$
- (d) $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$.

109. Which of the following reactions has negative ΔS value?

- (a) $\text{H}_2 + \text{CH}_3\text{CH} = \text{CH}_2 \rightarrow \text{CH}_3\text{CH}_2 - \text{CH}_3$
- (b) $\begin{array}{c} \text{CH}_2 - \text{CH}_2 \\ \diagdown \quad / \\ \text{CH}_2 \end{array} \longrightarrow \text{CH}_3\text{CH} = \text{CH}_2$
- (c) $\text{CH}_3\text{COO}^- (aq) + \text{H}_3\text{O}^+ (aq) \rightarrow \text{CH}_3\text{COOH} + \text{H}_2\text{O}$
- (d) all of these.

110. Which one of the following is correct order of basic strength?

- (a) $\text{NH}_3 > \text{CH}_3\text{NH}_2 > \text{NF}_3$
- (b) $\text{CH}_3\text{NH}_2 > \text{NH}_3 > \text{NF}_3$
- (c) $\text{NF}_3 > \text{CH}_3\text{NH}_2 > \text{NH}_3$
- (d) $\text{NH}_3 > \text{NF}_3 > \text{CH}_3\text{NH}_2$.

111. Which of the following expressions does not represent the equilibrium constant (K_e) of water?

- (a) $\frac{[\text{H}_3\text{O}^+][\text{OH}^-]}{[\text{H}_2\text{O}]^2}$
- (b) $\frac{K_w}{(55.5)^2}$
- (c) $\frac{10^{-14}}{(55.5)^2}$
- (d) $[\text{H}_3\text{O}^+][\text{OH}^-]$

112. Which one of the following is correct statement?

- (a) a strong acid must be stronger than H_3O^+
- (b) a weak acid must be stronger than H_3O^+
- (c) weak acids are weaker than H_2O
- (d) weak bases are stronger than OH^- .

113. Which of the following species is not amphoteric?

- (a) NH_3
- (b) HCO_3^-
- (c) NH_4^+
- (d) HF.

114. Mercury acts as a superconductor at

- (a) 4 K
- (b) 8 K
- (c) 6 K
- (d) 10 K.

115. In which of the following interactions H_2SO_4 acts as a base?

- (a) $\text{H}_2\text{SO}_4 + \text{HNO}_2$
- (b) $\text{H}_2\text{SO}_4 + \text{HNO}_3$
- (c) $\text{H}_2\text{SO}_4 + \text{HClO}_4$
- (d) none of these.

116. Which of the following compounds actually exists?

- (a) BF_3
- (b) BH_3
- (c) BF_5
- (d) all of these.

117. Which of the following reactive carbon intermediates is called triplet carbene?

- (a) $\begin{array}{c} | \\ -\text{C}:\ominus \\ | \end{array}$
- (b) $-\text{C} \begin{array}{l} \diagup \\ \diagdown \end{array}$
- (c) $-\dot{\text{C}}-$
- (d) $-\overset{\oplus}{\text{C}} \begin{array}{l} \diagup \\ \diagdown \end{array}$

118. The reverse of heterolytic cleavage of covalent bond is known as

- (a) covalent bonding
- (b) co-ordinate covalent bonding
- (c) dipole-dipole interaction
- (d) van der Waal's forces.

119. Which of the following pairs has both the species having nearly same ionization energy?

- (a) O_2 and F (b) O_2 and Xe
(c) O_2^+ and F^- (d) O and N.

120. Which of the following compounds can oxidise the molecular oxygen?

- (a) PtF_6 (b) XeF_6
(c) SiF_4 (d) $HClO$.

MATHEMATICS

121. If $\sec\theta - \tan\theta = -2/3$, then θ lies in the

- (a) first quadrant (b) second quadrant
(c) third quadrant (d) fourth quadrant.

122. If T_p, T_q, T_r are the p th, q th and r th terms of an

A.P., then $\det \begin{bmatrix} T_p & T_q & T_r \\ p & q & r \\ 1 & 1 & 1 \end{bmatrix}$ is equal to

- (a) 1 (b) -1
(c) 0 (d) pqr .

123. If $2x^{1/3} + 2x^{-1/3} = 5$, then x is equal to

- (a) 1 or -1 (b) 2 or $1/2$
(c) 8 or $1/8$ (d) 4 or $1/4$.

124. The number of common tangents to the circles

$$x^2 + y^2 + 2x + 8y - 23 = 0$$

$$x^2 + y^2 - 4x - 10y + 19 = 0$$

- (a) one (b) two
(c) three (d) four.

125. The distance of the point (α, β) from X -axis is

- (a) α (b) β
(c) $|\alpha|$ (d) $|\beta|$.

126. The n th term of the sequence $5 + 55 + 555 + \dots$ is

- (a) $5 \times 10^{n-1}$ (b) $5 \times 11^{n-1}$
(c) $\frac{5}{9}(10^n - 1)$ (d) none of these.

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

- (a) 0 (b) 1
(c) 3 (d) 2.

128. In a triangle ABC ,

- (a) $\sin(A + B) + \sin C = 0$
(b) $\cos(A + B) + \cos C = 0$
(c) $A + B + C = \pi/2$ (d) $\sin \frac{A+B}{2} + \cos \frac{C}{2} = 0$.

129. Minimum value of $\tan^2\theta + \cot^2\theta$ is

- (a) -2 (b) 2
(c) 1 (d) 3.

130. The expression

$$(1 - x)^{-2} = 1 + 2x + 3x^2 + 4x^3 + \dots + \infty$$

is not valid for

- (a) $x = 1/2$ (b) $x = -1/2$
(c) $x = 1/\sqrt{3}$ (d) $x = 2/\sqrt{3}$.

131. The conditions $x \geq 0, y \geq 0$ in a linear programming problem are called

- (a) structural constraints
(b) redundant constraints
(c) non-negativity constraints
(d) none of these.

132. If p and q are the coefficients of x^n in $(1 + x)^{2n}$ and $(1 - 4x)^{-1/2}$, $|x| < 1/4$, then

- (a) $p = q$ (b) $p = 2q$
(c) $q = 2p$ (d) $p + q = {}^{2n}C_n$.

133. The arithmetic mean between the roots of $x^2 + bx + c = 0$ is 5, while the geometric mean between them is 4. The values of b and c are

- (a) 5, 4 (b) -10, 16
(c) -5, 4 (d) 10, 16.

134. If the roots of the equation,

$$px^2 + 2qx + r = 0$$

$$qx^2 - 2\sqrt{pr}x + q = 0$$

are simultaneously real, then

- (a) $p = q, r \neq 0$ (b) $2q = \pm \sqrt{pr}$
(c) $p/q = q/r$ (d) $q = r \neq 0$.

135. A train travelling at a speed of 72 km/hr is brought to rest by application of brakes. If the distance travelled by the train before coming to rest is 200 m, the acceleration produced by the breaks is

- (a) 1 m/sec² (b) 1 m/sec
(c) -1 m/sec (d) -1 m/sec².

136. If z_1 and z_2 be any two complex numbers, then which one of the following is not true?

- (a) $|z_1 - z_2| \leq |z_1| + |z_2|$
(b) $|z_1 - z_2| \leq |z_1| - |z_2|$
(c) $|z_1 + z_2| \leq |z_1| + |z_2|$
(d) $|z_1 - z_2| \geq |z_1| - |z_2|$.

137. If the first term of an infinite G.P. is equal to twice the sum of all the terms that follows it, then the common ratio is

- (a) 2 (b) 1
(c) 1/2 (d) 1/3.

138. If $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ be the arithmetic mean between a and b , then the value of n is

- (a) 1 (b) 0
(c) -1/2 (d) -1.

139. $\lim_{x \rightarrow \pi/4} \frac{2\sqrt{2} - (\sin x + \cos x)^3}{1 - \sin 2x}$ is equal to

- (a) $\frac{3}{2\sqrt{2}}$ (b) $3\sqrt{2}$
(c) $\frac{-3}{\sqrt{2}}$ (d) $\frac{3}{\sqrt{2}}$.

140. The relation $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) = 2\tan^{-1}x$ holds for all x in

- (a) $[-1, 1]$ (b) $[0, 1]$
(c) $[0, \infty)$ (d) $(-1, 1)$.

141. $5^{1/2} \cdot 5^{1/4} \cdot 5^{1/8} \dots$ to ∞ is equal to

- (a) $\log_{10}5$ (b) 5
(c) $\sqrt{5}$ (d) 1.

142. $\int_{1/e}^{e^2} \left| \frac{\log_e x}{x} \right| dx$ is

- (a) 3/2 (b) 5/2
(c) 3 (d) 5.

143. $\lim_{x \rightarrow 0} [\cos x]$ is equal to

- (a) 1 (b) 0
(c) does not exist (d) none of these.

144. A person travels from his house to his office at a speed of 30 km/hour and returns at a speed of 20 km/hour. His average speed of the two trips taken together is

- (a) 25 km/hour (b) 24.5 km/hour
(c) 24 km/hour (d) none of these.

145. For a discrete bivariate data $b_{yx} = -0.9$ and $b_{xy} = -0.4$, coefficient of correlation $\rho(X, Y)$ for this data is

- (a) 0.6 (b) 0.06
(c) -0.06 (d) -0.6

146. The statement $2\cot^{-1}x = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ holds only if

- (a) $|x| \leq 1$ (b) $x \leq 1$
(c) $|x| \geq 1$ (d) $x \geq 1$.

147. $\int |x^3| dx$ is equal to

- (a) $\pm \frac{x^4}{4} + C$ (b) $\frac{x^4}{4} + C$
(c) $\frac{x^3|x|}{4} + C$ (d) none of these.

148. $\lim_{x \rightarrow \infty} \frac{e^x - e^{-x}}{e^x + e^{-x}}$ is equal to

- (a) 1 (b) -1
(c) 0 (d) none of these.

149. If $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then A^n is equal to

- (a) nA (b) $2^n A$
(c) $2^{n-1} A$ (d) none of these.

150. If $\rho(x, y) = 0.6$ and $b_{yx} = -0.9$, then b_{xy} is equal to

- (a) 0.4 (b) -0.4
(c) 0.36 (d) none of these.

151. The range of the function $f(x) = \frac{\sin(\pi[x])}{x^4 + 1}$ is

- (a) $(-1, 1)$ (b) $[-1, 1]$
(c) $\{-1, 1\}$ (d) $\{0\}$.

152. The vector $\frac{2}{7}\hat{i} + \frac{3}{7}\hat{j} - \frac{6}{7}\hat{k}$ is a

- (a) null vector (b) unit vector
(c) vector whose components are (2, 3, -6)
(d) vector which is equally inclined to the axes.

153. If the normal to the curve $y = f(x)$ at the point (3, 4) makes an angle $3\pi/4$ with positive x -axis, then $f'(3)$ is

- (a) -1 (b) -3/4
(c) 4/3 (d) 1.

154. If \vec{a} and \vec{b} be two vectors such that $\vec{a} \cdot \vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$, then

- (a) \vec{a} is parallel to \vec{b}
(b) \vec{a} is perpendicular to \vec{b}
(c) \vec{a} is a null vector
(d) either \vec{a} or \vec{b} is a null vector.

155. 5 tickets are drawn successively with replacement from a box containing 100 tickets, numbered from 1 to 100. The probability that all the tickets bear numbers divisible by 10, is

- (a) $\left(\frac{9}{10}\right)^5$ (b) $\left(\frac{1}{10}\right)^5$
 (c) $\left(\frac{9}{100}\right)^5$ (d) none of these.

156. The probability of throwing an ace in a single throw of an unbiased dice is

- (a) $1/6$ (b) 0
 (c) 1 (d) $2/3$.

157. $\lim_{x \rightarrow 0} \left(\frac{\tan x - x}{x} \right) \cos \frac{1}{x}$

- (a) does not exist (b) equals 0
 (c) equals 1
 (d) exists and is different from 0 and 1 .

158. $\tan 75^\circ + \cot 75^\circ$ is equal to

- (a) $2\sqrt{3}$ (b) $2 + \sqrt{3}$
 (c) $2 - \sqrt{3}$ (d) 4 .

159. If $\det A = 3$ and A is of order 2×2 , then $\det 4A$ is equal to

- (a) 3 (b) 12
 (c) 48 (d) 36 .

160. The system of equations,

$$\begin{aligned} x + y + z &= 6, & x + 2y + 3z &= 14 \\ x + 3y + 5z &= 20 \end{aligned}$$

- (a) a unique solution
 (b) only finitely many solutions
 (c) infinitely many solutions
 (d) no solution.

161. If I_n is identity matrix of order n , then $(I_n)^{-1}$

- (a) does not exist (b) $= I_n$
 (c) $= 0$ (d) $= nI_n$.

162. Equation of the sphere which passes through the points $(a, 0, 0)$, $(0, b, 0)$, $(0, 0, c)$ and $(0, 0, 0)$ is

- (a) $x^2 + y^2 + z^2 - ax - by - cz = 0$
 (b) $x^2 + y^2 + z^2 - ax + by + cz = 0$
 (c) $x^2 + y^2 + z^2 + ax - by - cz = 0$
 (d) $x^2 + y^2 + z^2 - ax + by - cz = 0$.

163. Octal representation of the number 0.1875 is

- (a) $(0.15)_8$ (b) $(0.41)_8$
 (c) $(0.14)_8$ (d) none of these.

164. Three like parallel forces, each of magnitude P , act at the vertices of a triangle ABC . The resultant of

these forces passes through the

- (a) incentre (b) centroid
 (c) orthocentre (d) none of these.

165. If $a > 0$, then $\sum_{n=1}^{\infty} \left(\frac{a}{a+1} \right)^{n-1}$ equals

- (a) a (b) $a + 1$
 (c) $\frac{a}{2a+1}$ (d) $\frac{a+1}{2a+1}$.

166. Let $y = \begin{cases} x, & x > 0 \\ 0, & x = -0 \\ -x, & x < 0 \end{cases}$, then at $x = 0$, y is

- (a) derivable (b) not continuous
 (c) continuous but not derivable
 (d) none of these.

167. $\lim_{n \rightarrow \infty} \frac{\sqrt{1} + \sqrt{2} + \sqrt{3} + \dots + \sqrt{n}}{n^{3/2}}$ is equal to

- (a) 0 (b) 1
 (c) $3/2$ (d) $\int_0^1 \sqrt{x} dx$.

168. If $G(x) = -\sqrt{25 - x^2}$, then $\lim_{x \rightarrow 1} \frac{G(x) - G(1)}{x - 1}$ has the value

- (a) $1/24$ (b) $1/5$
 (c) $-\sqrt{24}$ (d) $1/\sqrt{24}$.

169. The equation of the curve which passes through

the point $(1, 1)$ and for which $\frac{dy}{dx} = 2x + 2$ is

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

170. If Z is any complex number, then $\text{Amp} Z + \text{Amp} \bar{Z} =$

- (a) 0 or 2π (b) 0
 (c) 2π (d) none of these.

171. To find the numerical value of $\int_{-2}^2 (px^3 + qx + r) dx$

it is necessary to know the values of the constants

- (a) p (b) q
 (c) r (d) p and r .

172. Let $P(x) = a_0 + a_1x^2 + a_2x^4 + \dots + a_nx^{2n}$ be a polynomial in a real variable x with $0 < a_0 < a_1 < a_2 < \dots < a_n$. The function $P(x)$ has

- (a) neither a maximum nor a minimum
 (b) only one maximum (c) only one minimum

(d) only one maximum and only one minimum.

173. There exists a triangle ABC satisfying the conditions

- (a) $b \sin A = a, a > b$ (b) $b \sin A > a, a > b$
(c) $b \sin A < a, a = b, A = \pi/2$
(d) $b \sin A < a$.

174. $(0, 0)$ is a vertex of a square and $5x - 12y + 26 = 0$ is the equation of one of its sides. The area of the square is

- (a) 4 sq. units (b) 676 sq. units
(c) 169 sq. units (d) $\frac{169}{4}$ sq. units.

175. The lengths of the sides of a triangle are 3, 4 and 5. Its circumradius is

- (a) 1 (b) 5
(c) $5/2$ (d) none of these.

176. Let the vectors $\vec{a}, \vec{b}, \vec{c}$ and \vec{d} be such that $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = \vec{0}$. Let P_1 and P_2 be the planes determined by the pairs of vectors \vec{a}, \vec{b} , and \vec{c}, \vec{d} respectively, then the angle between P_1 and P_2 is

- (a) 0 (b) $\pi/4$
(c) $\pi/3$ (d) $\pi/2$.

177. Coefficient of x^n in the expansion of $(1 - 2x + 3x^2 + 4x^3 + \dots)^{-n}$ is

(a) ${}^{2n}C_n$ (b) ${}^{2n}C_n n!$

(c) $\frac{2n!}{n!}$ (d) none of these.

178. The number of ways in which $2n$ persons can be divided into n couples is

- (a) $\frac{2n!}{n!n!}$ (b) $\frac{2n!}{n!2^n}$
(c) $\frac{2n!}{2^n}$ (d) none of these.

179. The number of ways in which 52 cards can be divided equally amongst four players is

- (a) $\frac{52!}{(13!)^4}$ (b) $\frac{52!}{(13!)^4 \times 4!}$
(c) $\frac{52!}{(13!)^4 \times 4}$ (d) none of these.

180. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $\text{adj}(\text{adj } A)$ is equal to

- (a) $\begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$
(c) $\begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix}$ (d) none of these.