

Mock Test-1

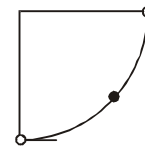
General Instructions

- This question booklet contains 150 Multiple Choice Questions (MCQs).
Section-A: Physics & Chemistry - 50 Questions each and
Section-B: Mathematics - 50 Questions.
- Choice and sequence for attempting questions will be as per the convenience of the candidate.
- Read each question carefully.
- Determine the one correct answer out of the four available options given for each question.
- Each question with correct response shall be awarded one (1) mark. There shall be no negative marking.
- No mark shall be granted for marking two or more answers of same question, scratching or overwriting.
- Duration of paper is 3 Hours.

SECTION-A

PHYSICS

1. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds in every circular loop. The average velocity and average speed for each circular loop respectively, is
(a) 0, 10 m/s (b) 10 m/s, 10 m/s
(c) 10 m/s, 0 (d) 0, 0
2. The distance of the centres of moon and earth is D . The mass of earth is 81 times the mass of the moon. At what distance from the centre of the earth, the gravitational force will be zero?
(a) $\frac{D}{2}$ (b) $\frac{2D}{3}$ (c) $\frac{4D}{3}$ (d) $\frac{9D}{10}$
3. In kinetic theory of gases, it is assumed that molecules
(a) have same mass but can have different volume
(b) have same volume but mass can be different
(c) have different mass as well as volume
(d) have same mass but negligible volume.
4. Beats are the result of
(a) diffraction
(b) destructive interference
(c) constructive and destructive interference
(d) superposition of two waves of nearly equal frequency
5. A capacitor of capacitance C is charged to a potential V . If it carries a charge Q , then the energy stored in it is
(a) $\frac{1}{2}CV$ (b) QV
(c) $\frac{1}{2}QV^2$ (d) $\frac{1}{2}QV$
6. An elastic string of unstretched length L and force constant k is stretched by a small length x . It is further stretched by another small length y . The work done in the second stretching is :
(a) $\frac{1}{2}ky^2$ (b) $\frac{1}{2}k(x^2 + y^2)$
(c) $\frac{1}{2}k(x + y)^2$ (d) $\frac{1}{2}ky(2x + y)$
7. A particle starts with S.H.M. from the mean position as shown in figure below. Its amplitude is A and its time period is T . At one time, its speed is half that of the maximum speed. What is this displacement at that time?
(a) $\frac{\sqrt{2}A}{3}$ (b) $\frac{\sqrt{3}A}{2}$
(c) $\frac{2A}{\sqrt{3}}$ (d) $\frac{3A}{\sqrt{2}}$



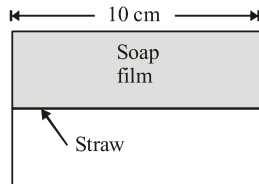
8. 100% modulation in FM means
- actual frequency deviation $>$ maximum allowed frequency deviation
 - actual frequency deviation = maximum allowed frequency deviation
 - actual frequency deviation \geq maximum allowed frequency deviation
 - actual frequency deviation $<$ maximum allowed frequency deviation

9. In an a.c. circuit, the r.m.s. value of current, I_{rms} is related to the peak current, I_0 by the relation

- $I_{\text{rms}} = \sqrt{2} I_0$
- $I_{\text{rms}} = \pi I_0$
- $I_{\text{rms}} = \frac{1}{\pi} I_0$
- $I_{\text{rms}} = \frac{1}{\sqrt{2}} I_0$

10. A soap film of surface tension 3×10^{-2} formed in a rectangular frame can support a straw as shown in Fig. If $g = 10 \text{ ms}^{-2}$, the mass of the straw is

- 0.006 g
- 0.06 g
- 0.6 g
- 6 g



11. For which of the following substances, the magnetic susceptibility is independent of temperature?

- diamagnetics only
- paramagnetics only
- ferromagnetics only
- diamagnetics and paramagnetics both

12. If the distance between nuclei is 2×10^{-13} cm, the density of nuclear material is

- $3.21 \times 10^{-12} \text{ kg/m}^3$
- $1.6 \times 10^{-3} \text{ kg/m}^3$
- $2 \times 10^9 \text{ kg/m}^3$
- $1 \times 10^{17} \text{ kg/m}^3$

13. Which metal will be suitable for a photoelectric cell using light of wavelength 4000 \AA . The work functions of sodium and copper are respectively 2.0 eV and 4.0 eV.

- Sodium
- Copper
- Both
- None of these

14. A system consists of three particles, each of mass m and located at (1, 1), (2, 2) and (3, 3). The coordinates of the centre of mass are

- (1, 1)
- (2, 2)
- (3, 3)
- (6, 6)

15. Which one of the following statements is true?

- A scalar quantity is the one that is conserved in a process.
- A scalar quantity is the one that can never take negative values.

- A scalar quantity is the one that does not vary from one point to another in space.

- A scalar quantity has the same value for observers with different orientations of the axes.

16. A car moves at a speed of 20 ms^{-1} on a banked track and describes an arc of a circle of radius $40\sqrt{3}$ m. The angle of banking is ($g = 10 \text{ ms}^{-2}$)
- 25°
 - 60°
 - 45°
 - 30°

17. The length of elastic string, obeying Hooke's law is ℓ_1 metres when the tension is 4N and ℓ_2 metres when the tension is 5N. The length in metres when the tension is 9N is –

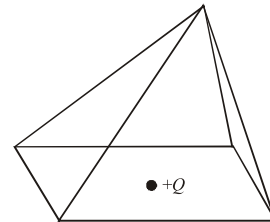
- $5\ell_1 - 4\ell_2$
- $5\ell_2 - 4\ell_1$
- $9\ell_1 - 8\ell_2$
- $9\ell_2 - 8\ell_1$

18. A moving coil galvanometer has resistance of 10Ω and full scale deflection of 0.01 A. It can be converted into voltmeter of 10 V full scale by connecting into resistance of

- 9.90Ω in series
- 10Ω in series
- 990Ω in series
- 0.10Ω

19. A point charge $+Q$ is positioned at the center of the base of a square pyramid as shown. The flux through one of the four identical upper faces of the pyramid is

- $\frac{Q}{16\epsilon_0}$
- $\frac{Q}{4\epsilon_0}$
- $\frac{Q}{8\epsilon_0}$
- None of these

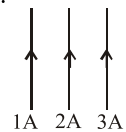


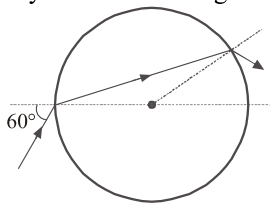
20. The dimensions of impulse are

- $[\text{MLT}^{-1}]$
- $[\text{MLT}^2]$
- $[\text{ML}^0\text{T}^{-2}]$
- $[\text{ML}^{-1}\text{T}^{-3}]$

21. Three wires are situated at the same distance. A current of 1A, 2A, 3A flows through these wires in the same direction. What is ratio of F_1/F_2 , where F_1 are force on 1 and F_2 on 2?

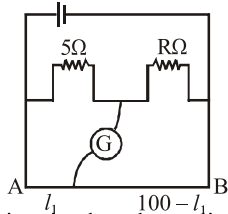
- $7/8$
- 1
- $9/8$
- None of these



22. The escape velocity of a body on the surface of the earth is 11.2 km/s. If the earth's mass increases to twice its present value and the radius of the earth becomes half, the escape velocity would become
 (a) 44.8 km/s (b) 22.4 km/s
 (c) 11.2 km/s (d) 5.6 km/s
23. For measuring voltage of any circuit, potentiometer is preferred to voltmeter because
 (a) the potentiometer is cheap and easy to handle.
 (b) calibration in the voltmeter is sometimes wrong.
 (c) the potential draws no current during measurement.
 (d) range of the voltmeter is not as wide as that of the potentiometer.
24. The ratio of the energy of an X-ray photon of wavelength 1 Å to that of visible light of wavelength 5000 Å is
 (a) 1 : 5000 (b) 5000 : 1
 (c) 1 : 25×10^6 (d) 25×10^6
25. A ray is incident at an angle 60° on a sphere which is made of material having refractive index $= \sqrt{3}$, find angle by which the emergent ray is deviated
 (a) 30°
 (b) 15°
 (c) 45°
 (d) 60°
- 
26. A radioactive sample contains 10^{-3} kg each of two nuclear species A and B with half-life 4 days and 8 days respectively. The ratio of the amounts of A and B after a period of 16 days is
 (a) 1 : 2 (b) 4 : 1 (c) 1 : 4 (d) 2 : 1
27. A hammer weighing 3 kg strikes the head of a nail with a speed of 2 ms^{-1} drives it by 1 cm into the wall. The impulse imparted to the wall is
 (a) 6Ns (b) 3Ns (c) 2Ns (d) 12Ns
28. A particle of mass 0.2 kg is moving in a circle of radius 1 m with $f = (2/\pi) \text{ sec}^{-1}$, then its angular momentum is :
 (a) $0.8 \text{ kg-m}^2/\text{s}$ (b) $2 \text{ kg-m}^2/\text{s}$
 (c) $8 \text{ kg-m}^2/\text{s}$ (d) $16 \text{ kg-m}^2/\text{s}$
29. A pipe open at both ends has a fundamental frequency f in air. The pipe is dipped vertically in water so that half of it is in water. The fundamental frequency of the air column is now :
 (a) $2f$ (b) f (c) $\frac{f}{2}$ (d) $\frac{3f}{4}$
30. What is cyclotron frequency of an electron with an energy of 100 eV in the magnetic field of 1×10^{-4} weber / m^2 if its velocity is perpendicular to magnetic field?
 (a) 0.7 MHz (b) 2.8 MHz
 (c) 1.4 MHz (d) 2.1 MHz
31. The current I passed in any instrument in alternating current circuit is $I = 2 \sin \omega t$ amp and potential difference applied is given by $V = 5 \cos \omega t$ volt then power loss in instrument is
 (a) 2.5 watt (b) 5 watt
 (c) 10 watt (d) zero
32. Eddy currents in the core of transformer can't be developed by
 (a) increasing the number of turns in secondary coil
 (b) taking laminated transformer
 (c) making step down transformer
 (d) using a weak a.c. at high potential
33. A body of mass 2 kg is placed on a horizontal surface having kinetic friction 0.4 and static friction 0.5. If the force applied on the body is 2.5 N, then the frictional force acting on the body will be [$g = 10 \text{ ms}^{-2}$]
 (a) 8N (b) 10N (c) 20N (d) 2.5N
34. In a photoelectric experiment, with light of wavelength λ , the fastest electron has speed v . If the exciting wavelength is changed to $5\lambda/4$, the speed of the fastest emitted electron will become
 (a) $v\sqrt{\frac{5}{4}}$ (b) $v\sqrt{\frac{5}{3}}$
 (c) less than $v\sqrt{\frac{5}{3}}$ (d) greater than $v\sqrt{\frac{5}{3}}$
35. The major contribution of magnetism in substances is due to
 (a) orbital motion of electrons
 (b) spin motion of electrons
 (c) equally due to orbital and spin motions of electrons
 (d) hidden magnets

36. The resistances in the two arms of the meter bridge are 5Ω and $R\Omega$, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6 l_1$. The resistance 'R' is:

- (a) 10Ω
 (b) 15Ω
 (c) 20Ω
 (d) 25Ω



37. When an object is placed at a distance of 25 cm from a mirror, the magnification is m_1 . The object is moved 15 cm further away with respect to the earlier position, and the magnification becomes m_2 . If $m_1/m_2 = 4$, the focal length of the mirror is :
 (a) 10 cm (b) 30 cm (c) 15 cm (d) 20 cm

38. A current I flows along the length of an infinitely long, straight, thin walled pipe. Then

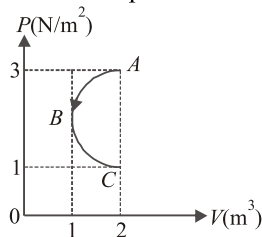
- (a) the magnetic field at all points inside the pipe is the same, but not zero
 (b) the magnetic field is zero only on the axis of the pipe
 (c) the magnetic field is different at different points inside the pipe
 (d) the magnetic field at any point inside the pipe is zero

39. A body moves a distance of 10 m along a straight line under the action of a force of 5 newtons. If the work done is 25 joules, the angle which the force makes with the direction of motion of body is

- (a) 0° (b) 30° (c) 60° (d) 90°

40. In P - V diagram shown in figure ABC is a semi-circle. The work done in the process ABC is

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

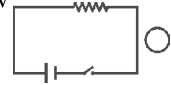


41. Water is flowing continuously from a tap having an internal diameter 8×10^{-3} m. The water velocity as it leaves the tap is 0.4 ms^{-1} . The diameter of the water stream at a distance 2×10^{-1} m below the tap is close to:

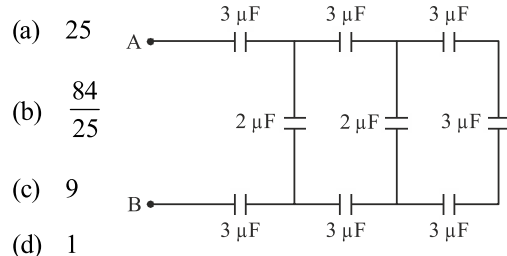
- (a) 7.5×10^{-3} m (b) 9.6×10^{-3} m
 (c) 3.6×10^{-3} m (d) 5.0×10^{-3} m

42. Consider the situation shown in figure. If the switch is closed and after some time it is opened again, the closed loop will show

- (a) a clockwise current
 (b) an anticlockwise current
 (c) an anticlockwise current and then clockwise
 (d) a clockwise current and then an anticlockwise current.



43. The equivalent capacitance between A and B is (in μF)



- (a) 25
 (b) $\frac{84}{25}$
 (c) 9
 (d) 1

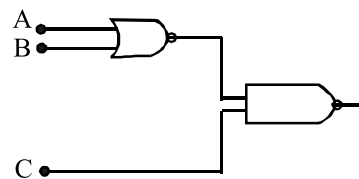
44. Moment of inertia does not depend upon

- (a) angular velocity of body
 (b) shape and size
 (c) mass
 (d) position of axis of rotation

45. A sound source emits frequency of 180 Hz when moving towards a rigid wall with speed 5 m/s and an observer is moving away from wall with speed 5 m/s. Both source and observer moves on a straight line which is perpendicular to the wall. The number of beats per second heard by the observer will be [Speed of sound = 355 m/s]

- (a) 5 beats/s (b) 10 beats/s
 (c) 6 beats/s (d) 8 beats/s

46. To get an output 1 from the circuit shown in the figure, the input must not be



- (a) $A=0, B=0, C=1$ (b) $A=1, B=0, C=0$
 (c) $A=1, B=0, C=1$ (d) $A=1, B=1, C=0$

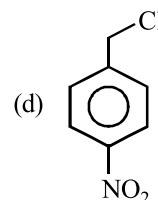
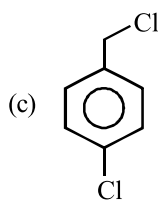
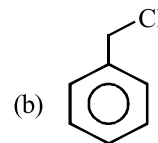
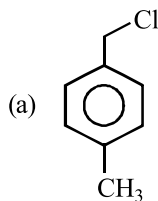
47. The ratio of the largest to shortest wavelengths in Brackett series of hydrogen spectra is

- (a) $25/9$ (b) $17/6$
 (c) $9/5$ (d) $4/3$

48. Which one did Rutherford consider to be supported by the results of experiments in which α -particles were scattered by gold foil?
- The nucleus of an atom is held together by forces which are much stronger than electrical or gravitational forces
 - The force of repulsion between an atomic nucleus and an α -particle varies with distance according to inverse square law
 - α -particles are nuclei of Helium atoms
 - Atoms can exist with a series of discrete energy levels
49. A simple pendulum attached to the ceiling of a stationary lift has a time period T. The distance y covered by the lift moving upwards varies with time t as $y = t^2$ where y is in metres and t in seconds. If $g = 10 \text{ m/s}^2$, the time period of pendulum will be
- $\sqrt{\frac{4}{5}}T$
 - $\sqrt{\frac{5}{6}}T$
 - $\sqrt{\frac{5}{4}}T$
 - $\sqrt{\frac{6}{5}}T$
50. A glass capillary tube of inner diameter 0.28 mm is lowered vertically into water in a vessel. The pressure to be applied on the water in the tube so that water level in the tube is same as that in the vessel (in N/m^2) is (surface tension of water = 0.07 N/m , atmospheric pressure = 10^5 N/m^2):
- 10^3
 - 99×10^3
 - 100×10^3
 - 101×10^3

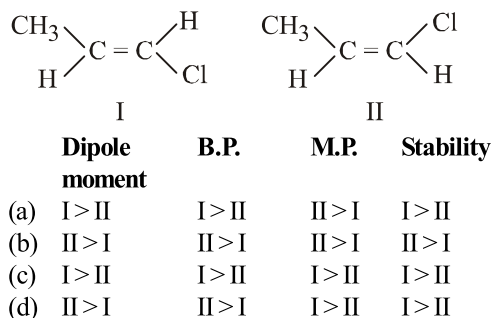
CHEMISTRY

51. The unit J Pa^{-1} is equivalent to
- m^3
 - cm^3
 - dm^3
 - None of these
52. A compound X of formula $\text{C}_3\text{H}_8\text{O}$ yields a ketone $\text{C}_3\text{H}_6\text{O}$ on oxidation. To which of the following class of compounds would X belong?
- Aldehyde
 - Tertiary alcohol
 - Secondary alcohol
 - Alkene
53. The element with which of the following outer electron configuration may exhibit the largest number of oxidation states in its compounds :
- $3d^5 4s^2$
 - $3d^8 4s^2$
 - $3d^7 4s^2$
 - $3d^6 4s^2$
54. The metal oxide which cannot be reduced to metal by carbon is
- Fe_2O_3
 - Al_2O_3
 - PbO
 - ZnO
55. In Arrhenius plot, intercept is equal to
- $\frac{-E_a}{R}$
 - $\ln A$
 - $\ln K$
 - $\log_{10} A$
56. Benzene reacts with $\text{CH}_3\text{COCl} + \text{AlCl}_3$ to give
- chlorobenzene
 - toluene
 - benzyl chloride
 - acetophenone
57. Which of the following is the incorrect statement?
- NaCl has 6 : 6 coordination and CsCl has 8 : 8 coordination.
 - In Na_2O each oxide ion is coordinated by 8Na^+ ions and each Na^+ ion by 4 oxide ions
 - CsCl structure transform to NaCl structure on heating
 - In CaF_2 structure each F^- ion is coordinated by 4 Ca^{2+} and vice-versa.
58. Which of the following statements is not valid for oxoacids of phosphorus?
- Orthophosphoric acid is used in the manufacture of triple superphosphate.
 - Hypophosphorous acid is a diprotic acid.
 - All oxoacids contain tetrahedral four coordinated phosphorus.
 - All oxoacids contain atleast one $\text{P}=\text{O}$ and one $\text{P}-\text{OH}$ group
59. Which of the following is most reactive towards $\text{S}_{\text{N}}2$ reaction?



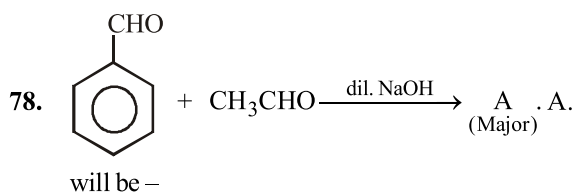
60. The equivalent conductance at infinite dilution of a weak acid such as HF
- can be determined by extrapolation of measurements of dilute solutions of HCl , HBr and HI .
 - can be determined by measurement of very dilute HF solutions.
 - can be determined from measurements of dilute solutions of NaF , NaCl and HCl .
 - is an undefined quantity.
61. Which functional group participates in disulphide bond formation in proteins?
- Thioester
 - Thioether
 - Thiol
 - Thiolactone

62. Secondary amines could be prepared by
 (a) reduction of nitriles
 (b) Hofmann bromamide reaction
 (c) reduction of amides
 (d) reduction of isonitriles
63. Among $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$ and $[\text{NiBr}_4]^{2-}$ species, the hybridisation state of Ni atoms are respectively:
 (a) sp^3, ds^2p, dsp^2 (b) sp^3, dsp^2, sp^3
 (c) dsp^2, sp^3, sp^3 (d) sp^3, sp^3, dsp^2
64. Specific conductance of a 0.1 N KCl solution at 23°C is $0.012 \text{ ohm}^{-1} \text{ cm}^{-1}$. Resistance of cell containing the solution at same temperature was found to be 55 ohm. The cell constant is
 (a) 0.0616 cm^{-1} (b) 0.66 cm^{-1}
 (c) 6.60 cm^{-1} (d) 660 cm^{-1}
65. The rate constant for the reaction
 $2\text{N}_2\text{O}_5 \longrightarrow 4\text{NO}_2 + \text{O}_2$, is $3.0 \times 10^{-5} \text{ sec}^{-1}$. If the rate is $2.40 \times 10^{-5} \text{ mol litre}^{-1} \text{ sec}^{-1}$, then the concentration of N_2O_5 (in mol litre^{-1}) is
 (a) 1.4 (b) 1.2 (c) 0.04 (d) 0.8
66. Cryolite is
 (a) Na_3AlF_6 and used in the electrolysis of alumina for decreasing electrical conductivity.
 (b) Na_3AlF_6 and used in the electrolysis of alumina for lowering the melting point of alumina.
 (c) Na_3AlF_6 and used in the electrolytic purification of alumina.
 (d) Na_3AlF_6 and used in the electrolysis of alumina.
67. Which of the following does not contain a hydrophilic structure?
 (a) Linseed oil (b) Lanolin
 (c) Glycogen (d) Rubber
68. Which one of the following is not correct for an ideal solution?
 (a) It must obey Raoult's law
 (b) $\Delta H = 0$
 (c) $\Delta H = \Delta V \neq 0$
 (d) All are correct
69. Which of the following is correct set of physical properties of the geometrical isomers?



70. Baking powder contains :
 (a) NaHCO_3 , $\text{Ca}(\text{H}_2\text{PO}_2)_2$ and starch
 (b) NaHCO_3 , $\text{Ca}(\text{H}_2\text{PO}_2)_2$
 (c) NaHCO_3 , starch
 (d) NaHCO_3
71. Which reaction is not feasible?
 (a) $2\text{KI} + \text{Br}_2 \rightarrow 2\text{KBr} + \text{I}_2$
 (b) $2\text{KBr} + \text{I}_2 \rightarrow 2\text{KI} + \text{Br}_2$
 (c) $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$
 (d) $2\text{H}_2\text{O} + 2\text{F}_2 \rightarrow 4\text{HF} + \text{O}_2$
72. Teflon and neoprene are
 (a) copolymers
 (b) condensation polymers
 (c) homopolymers
 (d) monomers
73. Which of the following reagents will convert *p*-methylbenzenediazonium chloride into *p*-cresol?
 (a) Cu powder (b) H_2O
 (c) H_3PO_2 (d) $\text{C}_6\text{H}_5\text{OH}$
74. According to IUPAC nomenclature sodium nitroprusside is named as:
 (a) Sodium pentacyanonitrosylferrate (III)
 (b) Sodium nitroferrocyanide
 (c) Sodium nitroferrocyanide
 (d) Sodium pentacyanonitrosylferrate (II)
75. One mole of calcium phosphide on reaction with excess water gives
 (a) one mole of phosphine
 (b) two moles of phosphoric acid
 (c) two moles of phosphine
 (d) one mole of phosphorus pentoxide
76. The rate constant of a reaction is $3.00 \times 10^3 \text{ L mol}^{-1} \text{ sec}^{-1}$. The order of this reaction will be:
 (a) 0 (b) 1 (c) 2 (d) 3

77. Which of the following statements is not true ?
- Paramagnetic substances are weakly attracted by magnetic field.
 - Ferromagnetic substances cannot be magnetised permanently.
 - The domains in antiferromagnetic substances are oppositely oriented with respect to each other.
 - Pairing of electrons cancels their magnetic moment in the diamagnetic substances.



- $C_6H_5CH(OH)CH_2CHO$
 - $C_6H_5CH=CH-CHO$
 - $C_6H_5CH_2CH_2CHO$
 - Both (b) & (c)
79. A blue colouration is not obtained when
- ammonium hydroxide dissolves in copper sulphate
 - copper sulphate solution reacts with $K_4[Fe(CN)_6]$
 - ferric chloride reacts with sod. ferrocyanide
 - anhydrous $CuSO_4$ is dissolved in water
80. Which of the following statements is not correct?
- Physical adsorption is due to van der Waal's forces.
 - Chemical adsorption first decreases with increase in temperature.
 - Physical adsorption is reversible.
 - Adsorption energy for a chemical adsorption is generally greater than that of physical adsorption.
81. When 0.01 mole of a cobalt complex is treated with excess silver nitrate solution, 4.305 g silver chloride is precipitated. The formula of the complex is
- $[Co(NH_3)_3Cl_3]$
 - $[Co(NH_3)_5Cl]Cl_2$
 - $[Co(NH_3)_6]Cl_3$
 - $[Co(NH_3)_4Cl_2]NO_3$

82. Match the columns

Column-I
(Type of solid)

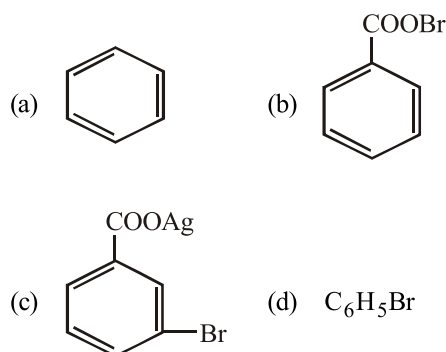
Column-II
(Example of solid)

- | | |
|--------------------|--------------|
| A. Molecular solid | I. Ag |
| B. Ionic solid | II. SiC |
| C. Metallic solid | III. CCl_4 |
| D. Covalent solid | IV. MgO |
- A-IV, B-III, C-I, D-II
 - A-II, B-IV, C-I, D-III
 - A-III, B-II, C-I, D-IV
 - A-III, B-IV, C-I, D-II

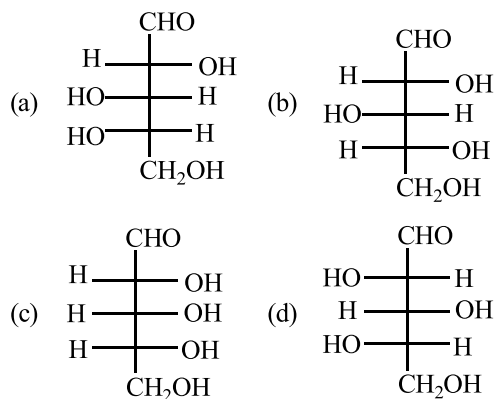
83. HBr reacts with $CH_2=CH-OCH_3$ under anhydrous conditions at room temperature to give

- $BrCH_2-CH_2-OCH_3$
- $H_3C-CH(Br)-OCH_3$
- CH_3CHO and CH_3Br
- $BrCH_2CHO$ and CH_3OH

84. Silver benzoate reacts with bromine to form



85. Which L-sugar on oxidation gives an optically active dibasic acid (2 COOH groups)?



86. A solution containing components A and B follows Raoult's law when
- A – B attraction force is greater than A – A and B – B
 - A – B attraction force is less than A – A and B – B
 - A – B attraction force remains same as A – A and B – B
 - volume of solution is different from sum of volume of solute and solvent
87. Find the charge in coulombs required to convert 0.2 mole VO_3^{-2} into VO_4^{-3} .
- 1.93×10^4
 - 9.65×10^4
 - 1.93×10^5
 - 9.65×10^5
88. The alcohol which does not give a stable compound on dehydration is
- ethyl alcohol
 - methyl alcohol
 - n-Propyl alcohol
 - n-Butyl alcohol
89. The simplest way to check whether a system is colloidal or not is by
- Tyndall effect
 - Brownian movement
 - Electrodialysis
 - Measuring particle size
90. CFC which is a main reason behind air pollution, is produced by
- sewage pollutant
 - aerosols
 - industrial remains
 - all the three
91. Which of the following halide is 2° ?
- Isopropyl chloride
 - Isobutyl chloride
 - n-propyl chloride
 - n-butyl chloride
92. The equilibrium constant for a reaction $\text{A} + 2\text{B} \rightleftharpoons 2\text{C}$ is 40. The equilibrium constant for reaction $\text{C} \rightleftharpoons \text{B} + \frac{1}{2}\text{A}$ is
- 40
 - $\left[\frac{1}{40}\right]^2$
 - $\frac{1}{40}$
 - $\left[\frac{1}{40}\right]^{1/2}$
93. Best method for preparing primary amines from alkyl halides without changing the number of carbon atoms in the chain is
- Hoffmann bromamide reaction
 - Gabriel phthalimide synthesis
 - Sandmeyer reaction
 - reaction with NH_3
94. Sulpha drugs are used for
- precipitating bacteria
 - removing bacteria
 - decreasing the size of bacteria
 - stopping the growth of bacteria
95. When petroleum is heated gradually, the first batch of vapours evolved will be rich in
- kerosene
 - petroleum ether
 - diesel
 - lubricating oil
96. On boiling an aqueous solution of KClO_3 with I_2 the products obtained are
- $\text{KIO}_3 + \text{Cl}_2$
 - $\text{KCl} + \text{I}_2\text{O}_5$
 - $\text{KIO}_4 + \text{Cl}_2$
 - No reaction takes place
97. In the reaction :
- $$\text{CH}_3\text{OH} \xrightarrow{\text{oxidation}} \text{A} \xrightarrow{\text{NH}_3} \text{B}; \text{A and B respectively are}$$
- $\text{HCHO}, \text{HCOONH}_4$
 - $\text{HCOOH}, \text{HCOONH}_4$
 - $\text{HCOOH}, \text{HCONH}_2$
 - $\text{HCHO}, \text{HCONH}_2$
98. The chemistry of lithium is very similar to that of magnesium even though they are placed in different groups. Its reason is
- Both are found together in nature
 - Both have nearly the same size
 - Both have similar electronic configuration
 - The ratio of their charge and size (i.e. charge density) is nearly the same
99. Consider the equation $Z = \frac{PV}{RT}$. Which of the following statements is correct?
- When $Z > 1$, real gases are easier to compress than the ideal gas
 - When $Z=1$, real gases get compressed easily
 - When $Z=1$, real gases are difficult to compress
 - When $Z > 1$, real gases are difficult to compress
100. How many propagation reactions occur simultaneously in a binary copolymerization process?
- 2
 - 4
 - 1
 - 3

SECTION-B

MATHEMATICS

1. Let $n(U) = 700$, $n(A) = 200$, $n(B) = 300$, $n(A \cap B) = 100$, then $n(A' \cap B')$ is equal to
 (a) 400 (b) 600
 (c) 300 (d) None of these
2. The domain and range of the relation R given by $R = \{(x, y) : y = x + \frac{6}{x}; \text{ where } x, y \in \mathbb{N} \text{ and } x < 6\}$ is
 (a) $\{1, 2, 3\}, \{7, 5\}$ (b) $\{1, 2\}, \{7, 5\}$
 (c) $\{2, 3\}, \{5\}$ (d) None of these
3. If $3f(x) - f\left(\frac{1}{x}\right) = \log x^4$, then $f(e^{-x})$ is
 (a) $1+x$ (b) $1/x$ (c) x (d) $-x$
4. The range of the function $f(x) = \sqrt{3x^2 - 4x + 5}$ is
 (a) $\left(-\infty, \sqrt{\frac{11}{3}}\right]$ (b) $\left(-\infty, \sqrt{\frac{11}{5}}\right]$
 (c) $\left[\sqrt{\frac{11}{3}}, \infty\right)$ (d) $\left[\sqrt{\frac{11}{5}}, \infty\right)$
5. The value of $\tan A + \tan(60^\circ + A) - \tan(60^\circ - A)$ is
 (a) $\tan 3A$ (b) $2 \tan 3A$
 (c) $3 \tan 3A$ (d) None of these
6. For which real values of x and y , the equation $\sec^2 \theta = \frac{4xy}{(x+y)^2}$ is possible?
 (a) $x=y$ (b) $x>y$
 (c) $x<y$ (d) None of these
7. If S_n denotes the sum of first n terms of an A.P., whose first term is a and $\frac{S_{nx}}{S_x}$ is independent of x , then $S_p =$
 (a) P^3 (b) P^2a (c) Pa^2 (d) a^3
8. The locus of the moving point whose coordinates are given by $(e^t + e^{-t}, e^t - e^{-t})$ where t is a parameter, is
 (a) $xy = 1$ (b) $x + y = 2$
 (c) $x^2 - y^2 = 4$ (d) $x^2 - y^2 = 2$
9. The length of the tangent drawn from any point on the circle $x^2 + y^2 + 2fy + \lambda = 0$ to the circle $x^2 + y^2 + 2fy + \mu = 0$, where $\mu > \lambda > 0$, is
 (a) $\sqrt{\mu - \lambda}$ (b) $\sqrt{\mu + \lambda}$
 (c) $\sqrt{\mu^2 - \lambda^2}$ (d) $m+1$
10. Find the length of intercept on the line $4y = 3x - 48$ by the parabola $y^2 = 64x$.
 (a) 9 (b) 1600 (c) $\frac{1600}{9}$ (d) $\frac{9}{1600}$
11. From eighty cards numbered 1 to 80, two cards are selected randomly. The probability that both the cards have the numbers divisible by 4 is given by
 (a) $\frac{21}{316}$ (b) $\frac{19}{316}$
 (c) $\frac{1}{4}$ (d) None of these
12. If z is a complex number such that $z + \bar{z} = 8 + 12i$, then the value of $|z^2|$ is equal to
 (a) 228 (b) 144 (c) 121 (d) 169
13. If $5x + 1 > -24$ and $5x - 1 < 24$, then $x \in (-a, a)$. The value of 'a' is
 (a) 2 (b) 3 (c) 4 (d) 5
14. The tens digits of $1! + 2! + 3! + \dots + 49!$ is
 (a) 1 (b) 2 (c) 3 (d) 4
15. In the binomial expansion $(a + bx)^{-3} = \frac{1}{8} + \frac{9}{8}x + \dots$, then the value of a and b are:
 (a) $a=2, b=3$ (b) $a=2, b=-6$
 (c) $a=3, b=2$ (d) $a=-3, b=2$
16. If $\frac{d}{dx} \left(\frac{1+x^4+x^8}{1+x^2+x^4} \right) = ax^3 + bx$, then
 (a) $a=4, b=2$ (b) $a=4, b=-2$
 (c) $a=-2, b=4$ (d) None of these
17. The mean weight per student in a group of seven students is 55 kg. If the individual weights of six students are 52, 58, 55, 53, 56 and 54, then the weight of the seventh student is
 (a) 55 kg (b) 60 kg (c) 57 kg (d) 50 kg

18. Let $f(x) = [x]^2 + [x + 1] - 3$ where $[x]$ = the greatest integer function. Then
- $f(x)$ is a many-one and into function
 - $f(x) = 0$ for infinite number of values of x
 - $f(x) = 0$ for only two real values
 - Both (a) and (b)

19. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$ and I is the unit matrix of

order 3, then $A^2 + 2A^4 + 4A^6$ is equal to

- $7A^8$
- $7A^7$
- $8I$
- $6I$

20. If $f(x) = \begin{cases} \frac{3 \sin \pi x}{5x}, & x \neq 0 \\ 2k, & x = 0 \end{cases}$ is continuous at $x = 0$,

then the value of k is equal to

- $\frac{3\pi}{10}$
- $\frac{3\pi}{5}$
- $\frac{\pi}{10}$
- $\frac{3\pi}{2}$

21. Which one of the following statements is correct in respect of the curve $4y - x^2 - 8 = 0$?

- The curve is increasing in $(-4, 4)$
- The curve is increasing in $(-4, 0)$
- The curve is increasing in $(0, 4)$
- The curve is decreasing in $(-4, 4)$

22. The value of the integral

$$\int_2^e \left\{ \frac{1}{\log_e x} - \frac{1}{(\log_e x)^2} \right\} dx$$
 is

- $e - \log_e 2$
- $e - \log_2 e$
- $e - 2\log_2 e$
- $e - \log_e 4$

23. The solution of $\frac{dy}{dx} = |x|$ is :

- $y = \frac{x|x|}{2} + c$
- $y = \frac{|x|}{2} + c$

- $y = \frac{x^2}{2} + c$
- $y = \frac{x^3}{2} + c$

24. If A, B and C are the vertices of a triangle whose position vectors are \vec{a}, \vec{b} and \vec{c} respectively and

G is the centroid of the ΔABC , then $\vec{GA} + \vec{GB} + \vec{GC}$ is

- $\vec{0}$
- $\vec{a} + \vec{b} + \vec{c}$
- $\frac{\vec{a} + \vec{b} + \vec{c}}{3}$
- $\frac{\vec{a} - \vec{b} - \vec{c}}{3}$

25. The determinant $\begin{vmatrix} x & \sin \theta & \cos \theta \\ -\sin \theta & -x & 1 \\ \cos \theta & 1 & x \end{vmatrix}$ is

independent of

- x only
- θ only
- x and θ both
- None of these

26. The normal to the curve $x = a(1 + \cos \theta), y = a \sin \theta$ at ' θ ' always passes through the fixed point

- (a, a)
- $(0, a)$
- $(0, 0)$
- $(a, 0)$

27. Which of the following is not the area of the region bounded by $y = e^x$ and $x = 0$ and $y = e$?

- $e - 1$
- $\int_1^e \ln(e + 1 - y) dy$

- $e - \int_0^1 e^x dx$
- $\int_1^e \ln y dy$

28. If two events A and B are such that $P(\bar{A}) = 0.3, P(B) = 0.4$ and $P(A \cap \bar{B}) = 0.5$

then $P\left(\frac{B}{A \cup \bar{B}}\right) =$

- 0.9
- 0.5
- 0.6
- 0.25

29. If $\omega (\neq 1)$ be a cube root of unity and $(1 + \omega^2)^n = (1 + \omega^4)^n$, then the least positive value of n is

- 2
- 3
- 5
- 6

30. If ${}^n C_r$ denotes the number of combination of n things taken r at a time, then the expression

$${}^n C_{r+1} + {}^n C_{r-1} + 2 \times {}^n C_r$$
 equals

- ${}^{n+1} C_{r+1}$
- ${}^{n+2} C_r$
- ${}^{n+2} C_{r+1}$
- ${}^{n+1} C_r$

31. The number of integral terms in the expansion of $(3^{1/2} + 2^{1/2})^{500}$ is

- (a) 128 (b) 129 (c) 251 (d) 512

32. The points (4, 7, 8), (2, 3, 4), (-1, -2, 1) and (1, 2, 5) are the vertices of a

- (a) parallelogram (b) rhombus
(c) rectangle (d) square

33. Let the sequence $\langle b_n \rangle$ of real numbers satisfies

the recurrence relation $b_{n+1} = \frac{1}{3} \left(2b_n + \frac{125}{b_n^2} \right)$, $b_n \neq 0$.

Then find $\lim_{n \rightarrow \infty} b_n$.

- (a) 10 (b) 15 (c) 5 (d) 25

34. Let p and q be any two logical statements and $r : p \rightarrow (\sim p \vee q)$. If r has a truth value F , then the truth values of p and q are respectively :

- (a) F, F (b) T, T (c) T, F (d) F, T

35. The inverse of $f(x) = \frac{2}{3} \frac{10^x - 10^{-x}}{10^x + 10^{-x}}$ is

- (a) $\frac{1}{3} \log_{10} \frac{1+x}{1-x}$ (b) $\frac{1}{2} \log_{10} \frac{2+3x}{2-3x}$

- (c) $\frac{1}{3} \log_{10} \frac{2+3x}{2-3x}$ (d) $\frac{1}{6} \log_{10} \frac{2-3x}{2+3x}$

36. If $\tan^{-1} \frac{x}{\pi} < \frac{\pi}{3}$, $x \in N$, then the maximum value of x is

- (a) 2 (b) 5
(c) 7 (d) None of these

37. If $A = \begin{bmatrix} 0 & 1 & 3 \\ 1 & 2 & 3 \\ 3 & a & 1 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & c \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$,

then the value of $a + c$ is equal to

- (a) 1 (b) 0
(c) 2 (d) none of these

38. Let $y = x^3 - 8x + 7$ and $x = f(t)$. If $\frac{dy}{dt} = 2$ and

$x = 3$ at $t = 0$, then the value of $\frac{dx}{dt}$ at $t = 0$ is

- (a) $\frac{2}{19}$ (b) $\frac{3}{5}$ (c) $\frac{-1}{17}$ (d) $\frac{5}{16}$

39. The projection of the vector $\hat{i} - 2\hat{j} + \hat{k}$ on the vector $4\hat{i} - 4\hat{j} + 7\hat{k}$ is equal to :

- (a) $\frac{19}{9}$ (b) $\frac{9}{19}$ (c) $\frac{\sqrt{3}}{19}$ (d) $\frac{19}{\sqrt{3}}$

40. The equation of the plane which makes with co-ordinate axes, a triangle with its centroid (α, β, γ) is

- (a) $\alpha x + \beta y + \gamma z = 3$ (b) $\alpha x + \beta y + \gamma z = 1$
(c) $\frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{\gamma} = 3$ (d) $\frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{\gamma} = 1$

41. If $\begin{vmatrix} 2a & x_1 & y_1 \\ 2b & x_2 & y_2 \\ 2c & x_3 & y_3 \end{vmatrix} = \frac{abc}{2} \neq 0$, then the area of the

triangle whose vertices are $\left(\frac{x_1}{a}, \frac{y_1}{a} \right), \left(\frac{x_2}{b}, \frac{y_2}{b} \right)$

and $\left(\frac{x_3}{c}, \frac{y_3}{c} \right)$ is

- (a) $\frac{1}{4} abc$ (b) $\frac{1}{8} abc$
(c) $\frac{1}{4}$ (d) $\frac{1}{8}$

42. The angle at which the curve $y = ke^{kx}$ intersects the y-axis is :

- (a) $\tan^{-1}(k^2)$ (b) $\cot^{-1}(k^2)$
(c) $\sin^{-1} \left(\frac{1}{\sqrt{1+k^4}} \right)$ (d) $\sec^{-1} \sqrt{1+k^4}$

43. The value of $\int_0^\pi x (\sin^4 x \cos^4 x) dx$ is

- (a) $\frac{3\pi^2}{64}$ (b) $\frac{3\pi^2}{128}$
(c) $\frac{3\pi^2}{256}$ (d) None of these

44. Shamli wants to invest ₹50,000 in saving certificates and PPF. She wants to invest atleast ₹ 15,000 in saving certificates and at least ₹ 20,000 in PPF. The rate of interest on saving certificates is 8% p.a. and that on PPF is 9% p.a. Formulation of the above problem as LPP to determine maximum yearly income, is
- (a) Maximize $Z = 0.08x + 0.09y$
Subject to, $x + y \leq 50,000$, $x \geq 15,000$,
 $y \geq 20,000$
- (b) Maximize $Z = 0.08x + 0.09y$
Subject to, $x + y \leq 50,000$, $x \geq 15,000$,
 $y \leq 20,000$
- (c) Maximize $Z = 0.08x + 0.09y$
Subject to, $x + y \leq 50,000$, $x \leq 15,000$,
 $y \geq 20,000$
- (d) Maximize $Z = 0.08x + 0.09y$
Subject to, $x + y \leq 50,000$, $x \leq 15,000$,
 $y \leq 20,000$
45. Suppose X follows a binomial distribution with parameters n and p, where $0 < p < 1$, if $P(X=r)/P(X=n-r)$ is independent of n and r, then
- (a) $p = \frac{1}{2}$ (b) $p = \frac{1}{3}$
- (c) $p = \frac{1}{4}$ (d) None of these
46. $\int \frac{x + \sqrt[3]{x^2} + \sqrt[6]{x}}{x(1 + \sqrt[3]{x})} dx$ is equal to
- (a) $\frac{3}{2}x^{2/3} + 6 \tan^{-1} x^{1/6} + C$
- (b) $\frac{3}{2}x^{2/3} - 6 \tan^{-1} x^{1/6} + C$
- (c) $-\frac{3}{2}x^{2/3} + 6 \tan^{-1} x^{1/6} + C$
- (d) None of these
47. The d.r. of normal to the plane through (1, 0, 0), (0, 1, 0) which makes an angle $\pi/4$ with plane $x + y = 3$ are
- (a) $1, \sqrt{2}, 1$ (b) $1, 1, \sqrt{2}$
- (c) $1, 1, 2$ (d) $\sqrt{2}, 1, 1$
48. The differential equation of all parabolas having their axes of symmetry coinciding with the axis of X is
- (a) $y \frac{d^2 y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$
- (b) $x \frac{d^2 x}{dy^2} + \left(\frac{dx}{dy}\right)^2 = 0$
- (c) $y \frac{d^2 y}{dx^2} + \frac{dy}{dx} = 0$
- (d) None of these
49. Let $f(x)$ be a continuous function such that the area bounded by the curve $y = f(x)$, x-axis and the lines $x = 0$ and $x = a$ is $\frac{a^2}{2} + \frac{a}{2} \sin a + \frac{\pi}{2} \cos a$, then
- $f\left(\frac{\pi}{2}\right) =$
- (a) 1 (b) $\frac{1}{2}$
- (c) $\frac{1}{3}$ (d) None of these
50. If X is a binomial Variate and $P(X)$ is the probability function then the value of X for which the value of $p(X)$ is the maximum, given $n = 9$, $p = \frac{1}{5}$ is
- (a) 3 or 2 (b) 2 or 1
- (c) 4 or 2 (d) none of these