

Mock Test-6

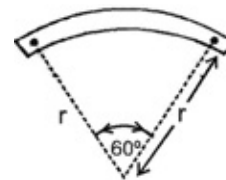
General Instructions

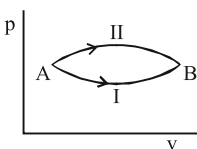
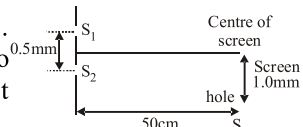
- This question booklet contains 150 Multiple Choice Questions (MCQs).
Section-A: Physics & Chemistry - 50 Questions each and
Section-B: Mathematics - 50 Questions.
- Choice and sequence for attempting questions will be as per the convenience of the candidate.
- Read each question carefully.
- Determine 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

- The fundamental frequency of a closed end organ pipe is n . Its length is doubled and radius is halved. Its frequency will become nearly
(a) $n/2$ (b) $n/3$ (c) n (d) $2n$
- If the density of a small planet is the same as that of earth, while the radius of the planet is 0.2 times that of the earth, the gravitational acceleration on the surface of the planet is
(a) $0.2g$ (b) $0.4g$ (c) $2g$ (d) $4g$
- Which of the following statement is correct ?
(a) Gauss's law is valid only for symmetrical charge distributions.
(b) Gauss's law is valid only for charge placed in vacuum.
(c) The electric field calculated by Gauss's law is the field due to the charges inside the Gaussian surface.
(d) The flux of the electric field through a closed surface due to all the charges is equal to the flux due to the charges enclosed by the surface.
- Wavefront is the locus of all points, where the particles of the medium vibrate with the same
(a) phase (b) amplitude
(c) frequency (d) period
- A bar magnet of length ' l ' and magnetic dipole moment ' M ' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be
(a) $\frac{3}{\pi}M$
(b) $\frac{2}{\pi}M$
(c) $\frac{M}{2}$
(d) M
- The transformer voltage induced in the secondary coil of a transformer is mainly due to
(a) a varying electric field
(b) a varying magnetic field
(c) the vibrations of the primary coil
(d) the iron core of the transformer
- In the experiment of potentiometer, at balance point, there is no current in the
(a) main circuit
(b) galvanometer circuit
(c) potentiometer circuit
(d) both main and galvanometer circuits
- Radiations of two photon's energy, twice and ten times the work function of metal are incident on the metal surface successively. The ratio of maximum velocities of photoelectrons emitted in two cases is
(a) 1:2 (b) 1:3 (c) 1:4 (d) 1:1



9. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{j} - 4\hat{i} + \alpha\hat{k}$, then the value of α is
 (a) 1/2 (b) -1/2 (c) 1 (d) -1
10. A wire has a mass 0.3 ± 0.003 g, radius 0.5 ± 0.005 mm and length 6 ± 0.06 cm. The maximum percentage error in the measurement of its density is
 (a) 1 (b) 2 (c) 3 (d) 4
11. In a transistor, the change in base current from 100 μ A to 125 μ A causes a change in collector current from 5 mA to 7.5 mA, keeping collector-to-emitter voltage constant at 10 V. What is the current gain of the transistor?
 (a) 200 (b) 100 (c) 50 (d) 25
12. If the terminal speed of a sphere of gold (density = 19.5 kg/m³) is 0.2 m/s in a viscous liquid (density = 1.5 kg/m³), find the terminal speed of a sphere of silver (density = 10.5 kg/m³) of the same size in the same liquid
 (a) 0.4 m/s (b) 0.133 m/s
 (c) 0.1 m/s (d) 0.2 m/s
13. Two gases A and B having the same temperature T, same pressure P and same volume V are mixed. If the mixture is at the same temperature T and occupies a volume V, the pressure of the mixture is
 (a) 2P (b) P (c) P/2 (d) 4P
14. A system goes from A to B via two processes I and II as shown in figure. If ΔU_1 and ΔU_2 are the changes in internal energies in the processes I and II respectively, then
 (a) relation between ΔU_1 and ΔU_2 can not be determined
 (b) $\Delta U_1 = \Delta U_2$
 (c) $\Delta U_1 < \Delta U_2$
 (d) $\Delta U_1 > \Delta U_2$
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15. Two capacitors of capacitance C are connected in series. If one of them is filled with dielectric substance k, what is the effective capacitance?
 (a) $\frac{kC}{(1+k)}$ (b) $C(k+1)$
 (c) $\frac{2kC}{1+k}$ (d) None of these
16. Two identical circular loops of metal wire are lying on a table without touching each other. Loop-A carries a current which increases with time. In response, the loop-B
 (a) remains stationary
 (b) is attracted by the loop-A
 (c) is repelled by the loop-A
 (d) rotates about its CM, with CM fixed (CM is the centre of mass)
17. A proton moving with a velocity 3×10^5 m/s enters a magnetic field of 0.3 tesla at an angle of 30° with the field. The radius of curvature of its path will be (e/m for proton = 10^8 C/kg)
 (a) 2 cm (b) 0.5 cm
 (c) 0.02 cm (d) 1.25 cm
18. A wire suspended vertically from one of its ends is stretched by attaching a weight of 200N to the lower end. The weight stretches the wire by 1 mm. Then the elastic energy stored in the wire is
 (a) 0.2 J (b) 10 J (c) 20 J (d) 0.1 J
19. A car is moving in a circular horizontal track of radius 10 m with a constant speed of 10 m/s. A bob is suspended from the roof of the car by a light wire of length 1.0 m. The angle made by the wire with the vertical is
 (a) 0° (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{4}$
20. The least coefficient of friction for an inclined plane inclined at angle α with horizontal in order that a solid cylinder will roll down without slipping is
 (a) $\frac{2}{3} \tan \alpha$ (b) $\frac{2}{7} \tan \alpha$
 (c) $\tan \alpha$ (d) $\frac{5}{7} \tan \alpha$
21. If the magnetic dipole moment of an atom of diamagnetic material, paramagnetic material and ferromagnetic material are denoted by μ_d , μ_p and μ_f respectively, then
 (a) $\mu_d = 0$ and $\mu_p \neq 0$ (b) $\mu_d \neq 0$ and $\mu_p = 0$
 (c) $\mu_p = 0$ and $\mu_f \neq 0$ (d) $\mu_d \neq 0$ and $\mu_f \neq 0$
22. In Young's double slit experiment shown in figure S_1 and S_2 are coherent sources and S is the screen having a hole at a point 1.0mm away from the central line. White light (400 to 700nm) is sent through the slits. Which wavelength passing through the hole has strong intensity?
 (a) 400 nm (b) 700 nm
 (c) 500 nm (d) 667 nm
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23. The equation of plane progressive wave motion is

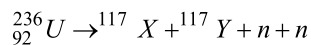
$$y = a \sin \frac{2\pi}{\lambda}(vt - x). \text{ Velocity of the particle is}$$

- (a) $y \frac{dv}{dx}$ (b) $v \frac{dy}{dx}$
 (c) $-y \frac{dv}{dx}$ (d) $-v \frac{dy}{dx}$

24. If a body cools down from 80°C to 60°C in 10 min when the temperature of the surrounding is 30°C , then the temperature of the body after next 10 min will be

- (a) 50°C (b) 48°C
 (c) 30°C (d) None of these

25. In a fission reaction



the binding energy per nucleon of X and Y is 8.5 MeV whereas of ${}^{236}\text{U}$ is 7.6 MeV. The total energy liberated will be about

- (a) 2000 MeV (b) 200 MeV
 (c) 2 MeV (d) 200 keV

26. An audio signal represented as $25 \sin 2\pi(2000 t)$ amplitude modulated by a carrier wave : $60 \sin 2\pi(100,000)t$. The modulation index of the modulated signal is

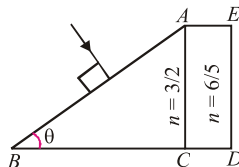
- (a) 25% (b) 41.6% (c) 50% (d) 75%

27. A ball of mass 10 g moving perpendicular to the plane of the wall strikes it and rebounds in the same line with the same velocity. If the impulse experienced by the wall is 0.54 Ns, the velocity of the ball is

- (a) 27 ms^{-1} (b) 3.7 ms^{-1}
 (c) 54 ms^{-1} (d) 37 ms^{-1}

28. In Fig. ABC is the cross section of a right - angled prism and ACDE is the cross section of a glass slab. The value of θ so that incident normally on the face AB does not cross the face AC is (given $\sin^{-1}(3/5) = 37^\circ$).

- (a) $\theta \leq 37^\circ$
 (b) $\theta < 37^\circ$
 (c) $\theta \leq 53^\circ$
 (d) $\theta < 53^\circ$



29. Two bodies of masses 2 kg and 4 kg are moving with velocities 2 m/s and 10 m/s respectively along same direction. Then the velocity of their centre of mass will be

- (a) 8.1 m/s (b) 7.3 m/s
 (c) 6.4 m/s (d) 5.3 m/s

30. Two beams of light having intensities I and 4I interfere to produce a fringe pattern on a screen.

The phase difference between the beams is $\frac{\pi}{2}$ at point A and π at point B. Then the difference between the resulting intensities at A and B is

- (a) 2I (b) 4I (c) 5I (d) 7I

31. A straight wire of diameter 0.5 mm carrying a current of 1 A is replaced by another wire of 1 mm diameter carrying same current. The strength of magnetic field far away is

- (a) twice the earlier value
 (b) same as the earlier value
 (c) one-half of the earlier value
 (d) one-quarter of the earlier value

32. An inductor, a resistor and a capacitor are joined in series with an AC source. As the frequency of the source is slightly increased from a very low value, the reactance of the

- (a) inductor increases (b) resistor increases
 (c) capacitor increases (d) circuit increases

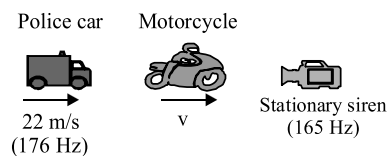
33. A ring of mass m and radius r is melted and then moulded into a sphere. The moment of inertia of the sphere will be

- (a) more than that of the ring
 (b) less than than of the ring
 (c) equal to that of the ring
 (d) None of these

34. A drop of oil is placed on the surface of water. Which of the following statements is correct?

- (a) It will remain on it as a sphere
 (b) It will spread as a thin layer
 (c) It will partly be a spherical droplet and partly a thin film
 (d) It will float as a distorted drop on the water surface

35. A police car moving at 22 m/s, chases a motorcyclist. The policeman sounds his horn at 176 Hz, while both of them move towards a stationary siren of frequency 165 Hz. The speed of the motorcycle, if it is given that he does not observe any beats is

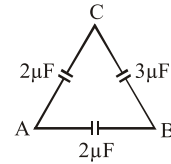


- (a) 33 m/s (b) 22 m/s (c) zero (d) 11 m/s

36. The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7 mm, is 4.4 m/s. The period of oscillation is
 (a) 0.01 s (b) 10 s (c) 0.1 s (d) 100 s
37. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3 V, then the speed of satellite B will be:
 (a) 3V/4 (b) 6V (c) 12V (d) 3V/2
38. Unpolarized light is incident on a plane sheet on water surface. The angle of incidence for which the reflected and refracted rays are perpendicular to each other is $\left(\mu \text{ of water} = \frac{4}{3}\right)$
 (a) $\sin^{-1}\left(\frac{4}{3}\right)$ (b) $\tan^{-1}\left(\frac{3}{4}\right)$
 (c) $\tan^{-1}\left(\frac{4}{3}\right)$ (d) $\sin^{-1}\left(\frac{1}{3}\right)$
39. The wavelength of radiation is λ_0 when an electron jumps from third to second orbit of hydrogen atom. For the electron to jump from the fourth to the second orbit of the hydrogen atom, the wavelength of radiation emitted will be
 (a) $\frac{16}{25}\lambda_0$ (b) $\frac{20}{27}\lambda_0$
 (c) $\frac{27}{20}\lambda_0$ (d) $\frac{25}{16}\lambda_0$
40. A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is
 (a) mv^2 (b) $\frac{3}{2}mv^2$
 (c) $2mv^2$ (d) $4mv^2$
41. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10 N, the mass of the block (in kg) is (take $g = 10 \text{ m/s}^2$)
 (a) 1.6 (b) 4.0 (c) 2.0 (d) 2.5
42. Three capacitors are connected in the arms of a triangle ABC as shown in figure 5 V is applied

between A and B. The voltage between B and C is

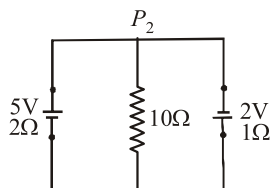
- (a) 2V
 (b) 1V
 (c) 3V
 (d) 1.5V



43. A particle of mass 10 gm is describing S.H.M. along a straight line with period of 2 sec and amplitude of 10 cm. Its kinetic energy when it is at 5 cm from its equilibrium position is
 (a) $37.5\pi^2 \text{ erg}$ (b) $3.75\pi^2 \text{ erg}$
 (c) $375\pi^2 \text{ erg}$ (d) $0.375\pi^2 \text{ erg}$
44. Two waves having the intensities in the ratio of 9 : 1 produce interference. The ratio of maximum to the minimum intensity, is equal to
 (a) 2:1 (b) 4:1 (c) 9:1 (d) 10:8
45. A particle is going parallel to x-axis with constant speed v at a distance a from the axis. Then its angular velocity about an axis passing through the origin O, at the instant when radial vector of the particle makes angle θ with the x-axis is
 (a) $\frac{v}{a}\sin^2\theta$ (b) $\frac{v}{2a}\cos^2\theta$
 (c) $\frac{a}{v}\sin\theta$ (d) $\frac{v^2}{a^2}\sin^2\theta$
46. Currents of a 10 ampere and 2 ampere are passed through two parallel thin wires A and B respectively in opposite directions. Wire A is infinitely long and the length of the wire B is 2 m. The force acting on the conductor B, which is situated at 10 cm distance from A will be
 (a) $8 \times 10^{-5} \text{ N}$ (b) $5 \times 10^{-5} \text{ N}$
 (c) $8\pi \times 10^{-7} \text{ N}$ (d) $4\pi \times 10^{-7} \text{ N}$
47. A force of 10^3 newton, stretches the length of a hanging wire by 1 millimetre. The force required to stretch a wire of same material and length but having four times the diameter by 1 millimetre is
 (a) $4 \times 10^3 \text{ N}$ (b) $16 \times 10^3 \text{ N}$
 (c) $\frac{1}{4} \times 10^3 \text{ N}$ (d) $\frac{1}{16} \times 10^3 \text{ N}$

48. Two coils, one primary of 500 turns and one secondary of 25 turns, are wound on an iron ring of mean diameter 20 cm and cross-sectional area 12 cm^2 . If the permeability of iron is 800, the mutual inductance is :
- (a) 0.48 H (b) 2.4 H (c) 0.12 H (d) 0.24 H

49. A 5V battery with internal resistance 2Ω and a 2V battery with internal resistance 1Ω are connected to a 10Ω resistor as shown in the figure.



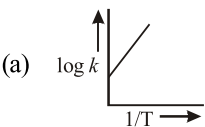
The current in the 10Ω resistor is

- (a) $0.27 \text{ A } P_2 \text{ to } P_1$ (b) $0.03 \text{ A } P_1 \text{ to } P_2$
 (c) $0.03 \text{ A } P_2 \text{ to } P_1$ (d) $0.27 \text{ A } P_1 \text{ to } P_2$
50. Water rises to a height of 10 cm in capillary tube and mercury falls to a depth of 3.1 cm in the same capillary tube. If the density of mercury is 13.6 and the angle of contact for mercury is 135° , the approximate ratio of surface tensions of water and mercury is
- (a) 1:0.15 (b) 1:3 (c) 1:6 (d) 1.5:1

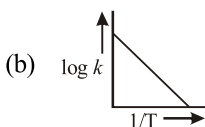
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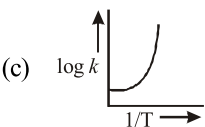
51. Which of the following lanthanoid ions is diamagnetic ?
 (At nos. Ce = 58, Sm = 62, Eu = 63, Yb = 70)
 (a) Sm^{2+} (b) Eu^{2+} (c) Yb^{2+} (d) Ce^{2+}
52. For *fcc* if AB is just like the rock salt like structure then, A^+ and B^- are located at –
 (a) A^+ - Tetrahedral voids ; B^- - Corner
 (b) A^+ - Corner and faces ; B^- - Octahedral voids
 (c) A^+ - Octahedral voids ; B^- - Corner and faces
 (d) A^+ - Corner and faces ; B^- - Octahedral and tetrahedral voids
53. Second and successive electron affinity of an element
 (a) is always successive (energy is released)
 (b) is always positive (energy is absorbed)
 (c) can be positive or negative
 (d) is always zero
54. Hydrogenation of benzoyl chloride in the presence of Pd and BaSO_4 gives
 (a) benzyl alcohol (b) benzaldehyde
 (c) benzoic acid (d) phenol

55. XeO_4 molecule is tetrahedral having :
 (a) Two $\text{p}\pi - \text{d}\pi$ bonds
 (b) One $\text{p}\pi - \text{d}\pi$ bonds
 (c) Four $\text{p}\pi - \text{d}\pi$ bonds
 (d) Three $\text{p}\pi - \text{d}\pi$ bonds
56. When CuSO_4 is electrolysed using platinum electrodes,
 (a) copper is liberated at cathode, sulphur at anode.
 (b) copper is liberated at cathode, oxygen at anode.
 (c) sulphur is liberated at cathode, oxygen at anode.
 (d) oxygen is liberated at cathode, copper at anode.
57. Silver is monovalent and has atomic mass of 108. Copper is divalent and has an atomic mass of 63.6. The same electric current is passed for the same length of time through a silver coulometer and a copper coulometer. If 27.0 g of silver is deposited, then the corresponding amount of copper deposited is
 (a) 63.60 g (b) 31.80 g
 (c) 15.90 g (d) 7.95 g
58. XeF_6 dissolves in anhydrous HF to give a good conducting solution which contains:
 (a) H^+ and XeF_7^- ion
 (b) HF_2^- and XeF_5^+ ions
 (c) HXeF_6^+ and F^- ions
 (d) none of these
59. Primary and secondary amines can be distinguished by:
 (a) Schiff's reagent
 (b) Carbylamine reaction
 (c) Hoffmann's bromamide reaction
 (d) Biuret reaction
60. A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH solution gives.
 (a) benzyl alcohol and sodium formate.
 (b) sodium benzoate and methyl alcohol.
 (c) sodium benzoate and sodium formate.
 (d) benzyl alcohol and methyl alcohol
61. Which of the following modes of expressing concentration is independent of temperature ?
 (a) Molarity (b) Molality
 (c) Formality (d) Normality

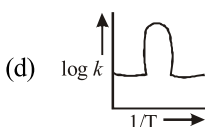
75. Select the correct statement
- The non-stoichiometric form of NaCl is yellow and that of KCl is blue lilac.
 - Solids containing F-centres (Farbe) are paramagnetic
 - Conduction by electrons is known as *n*-type super conduction
 - All the above are correct
76. What is the decreasing order of strength of the bases ?
 OH^- , NH_2^- , $\text{HC} \equiv \text{C}^-$ and CH_3CH_2^- ?
- $\text{CH}_3\text{CH}_2^- > \text{NH}_2^- > \text{HC} \equiv \text{C}^- > \text{OH}^-$
 - $\text{HC} \equiv \text{C}^- > \text{CH}_3\text{CH}_2^- > \text{NH}_2^- > \text{OH}^-$
 - $\text{OH}^- > \text{NH}_2^- > \text{HC} \equiv \text{C}^- > \text{CH}_3\text{CH}_2^-$
 - $\text{NH}_2^- > \text{HC} \equiv \text{C}^- > \text{OH}^- > \text{CH}_3\text{CH}_2^-$
77. A graph plotted between $\log k$ vs $1/T$ for calculating activation energy is shown by
- 

(a)



(b)
- 

(c)



(d)
78. The geometry of the compound $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ is
- square planar
 - pyramidal
 - tetrahedral
 - octahedral
79. Which of the following statements is correct?
- RNA controls the synthesis of proteins.
 - The sugar present in DNA is D-(–)-ribose.
 - RNA has double stranded α -helix structure.
 - DNA mainly occurs in the cytoplasm of the cell.
80. A colloidal solution is subjected to an electrical field. The particles move towards anode. The coagulation of same sol is studied using NaCl, BaCl_2 and AlCl_3 solutions. Their coagulating power should be
- $\text{NaCl} > \text{BaCl}_2 > \text{AlCl}_3$
 - $\text{BaCl}_2 > \text{AlCl}_3 > \text{NaCl}$
 - $\text{AlCl}_3 > \text{BaCl}_2 > \text{NaCl}$
 - $\text{BaCl}_2 > \text{NaCl} > \text{AlCl}_3$
81. On electrolysis of dilute sulphuric acid using platinum electrodes, the product obtained at the anode will be
- hydrogen
 - oxygen
 - hydrogen sulphide
 - Sulphur dioxide
82. How many EDTA (ethylenediaminetetraacetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion?
- One
 - Two
 - Six
 - Three
83. The stability of lyophilic colloids is due to which of the following?
- Charge on their particles
 - Large size of their particles
 - Small size of their particles
 - A layer of dispersion medium
84. Which of the following is not correct regarding terylene ?
- Step-growth polymer
 - Synthetic fibre
 - Condensation polymer
 - Thermosetting plastic
85. An ideal gas obeying kinetic theory of gases can be liquefied if
- its temperature is more than critical temperature T_c
 - its pressure is more than critical pressure P_c
 - its pressure is more than P_c at a temperature less than T_c
 - it cannot be liquefied at any value of P and T
86. Doping of AgCl crystals with CdCl_2 results in
- Frenkel defect
 - Schottky defect
 - Substitutional cation vacancy
 - Formation of F-centres
87. Benzene can be obtained in the reaction:
- Ethene + 1, 3-butadiene
 - Trimerisation of ethyne
 - Reduction of PhCHO
 - All of these
88. In countries nearer to polar region, the roads are sprinkled with CaCl_2 . This is
- to minimise the snow fall
 - to minimise pollution
 - to minimise the accumulation of dust on the road
 - to minimise the wear and tear of the roads

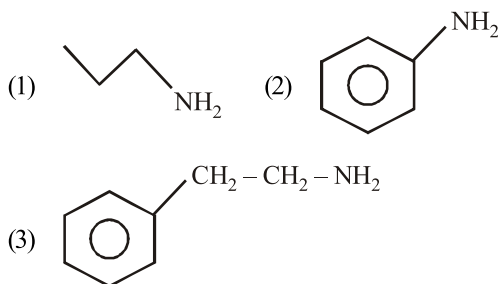
89. Acetanilide on nitration followed by alkaline hydrolysis mainly gives:

- (a) *o*-Nitroaniline
 (b) *p*-Nitroaniline
 (c) *m*-Nitroaniline
 (d) 2,4,6-Trinitroaniline

90. A substance initial concentration (a) reacts according to zero order kinetics. What will be the time for the reaction to go to completion

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

91. Arrange the following amines in the decreasing order of their basicity



- (a) $1 > 3 > 2$ (b) $3 > 2 > 1$
 (c) $1 > 2 > 3$ (d) $2 > 1 > 3$

92. If $1\frac{1}{2}$ moles of oxygen combine with Al to form Al_2O_3 the weight of Al used in the reaction is (Al = 27)

- (a) 27 g (b) 54 g (c) 49.5 g (d) 31 g

93. Which of the following terms indicates to the arrangement of different protein subunits in a multiprotein complex?

- (a) Primary structure
 (b) Secondary structure
 (c) Tertiary structure
 (d) Quaternary structure

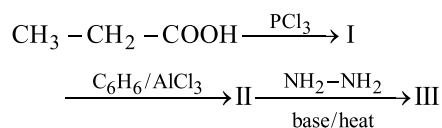
94. If chloroform is left open in air in the presence of sunlight, it gives

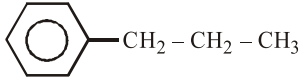
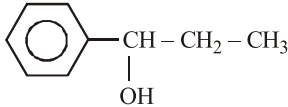
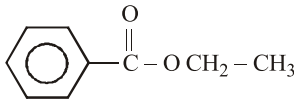
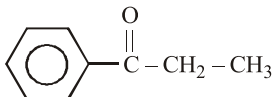
- (a) carbon tetrachloride
 (b) carbonyl chloride
 (c) mustard gas
 (d) lewisite

95. Which one of the following alcohols is least soluble in water?

- (a) CH_3OH (b) C_3H_7OH
 (c) C_4H_9OH (d) $C_{10}H_{21}OH$

96. The final product (III) obtained in the reaction sequence –



- (a) 
- (b) 
- (c) 
- (d) 

97. Which of the following statements is not true about enzyme inhibitors?

- (a) Inhibit the catalytic activity of the enzyme
 (b) Prevent the binding of substrate
 (c) Generally a strong covalent bond is formed between an inhibitor and an enzyme
 (d) Inhibitors can be competitive or non-competitive

98. Identify the incorrect statement among the following.

- (a) Br_2 reacts with hot and strong NaOH solution to give NaBr and H_2O .
 (b) Ozone reacts with SO_2 to give SO_3 .
 (c) Silicon reacts with NaOH(aq) in the presence of air to give Na_2SiO_3 and H_2O .
 (d) Cl_2 reacts with excess of NH_3 to give N_2 and HCl.

99. MnO_4^- has the strongest and weakest oxidising power in

- (a) alkaline and acidic medium.
 (b) alkaline and neutral medium.
 (c) acidic and neutral medium.
 (d) acidic and alkaline medium.

100. 3 moles of ethanol react with one mole of phosphorus tribromide to form 3 moles of bromoethane and one mole of X. Which of the following is X?

- (a) H_3PO_4 (b) H_3PO_2
 (c) HPO_3 (d) H_3PO_3

SECTION-B

MATHEMATICS

1. Given $n(U) = 20, n(A) = 12, n(B) = 9, n(A \cap B) = 4$, where U is the universal set, A and B are subsets of U , then $n((A \cup B)^c) =$
 (a) 17 (b) 9 (c) 11 (d) 3
2. Which of the following functions are periodic?
 (a) $f(x) = \log x, x > 0$
 (b) $f(x) = e^x, x \in R$
 (c) $f(x) = x - [x], x \in R$
 (d) $f(x) = x + [x], x \in R$
3. The least difference between the roots, in the first quadrant $\left(0 \leq x \leq \frac{\pi}{2}\right)$, of the equation $4 \cos x(2 - 3 \sin^2 x) + (\cos 2x + 1) = 0$ is
 (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$
4. If S_n denotes the sum of n terms of an A.P., then $S_{n+3} - 3S_{n+2} + 3S_{n+1} - S_n =$
 (a) 0 (b) 1 (c) $\frac{1}{2}$ (d) 2
5. The values of k for which the line $(k-3)x - (4-k^2)y + k^2 - 7k + 6 = 0$ is parallel to the x -axis, is
 (a) 3 (b) 2 (c) 1 (d) 4
6. If OA and OB are the tangents from the origin to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ and C is the centre of the circle, the area of the quadrilateral $OACB$ is
 (a) $\frac{1}{2} \sqrt{c(g^2 + f^2 - c)}$
 (b) $\sqrt{c(g^2 + f^2 - c)}$
 (c) $c \sqrt{g^2 + f^2 - c}$
 (d) $\frac{\sqrt{g^2 + f^2 - c}}{c}$
7. Let $z = \log_2(1+i)$, then $(z + \bar{z}) + i(z - \bar{z}) =$
 (a) $\frac{\ln 4 + \pi}{\ln 4}$ (b) $\frac{\pi - \ln 4}{\ln 2}$
 (c) $\frac{\ln 4 - \pi}{\ln 4}$ (d) $\frac{\pi + \ln 4}{\ln 2}$
8. Six dice are thrown. The probability that different numbers will turn up is :
 (a) $\frac{129}{1296}$ (b) $\frac{1}{54}$ (c) $\frac{5}{324}$ (d) $\frac{5}{54}$
9. If $y = (1 + x^{1/4})(1 + x^{1/2})(1 - x^{1/4})$, then $\frac{dy}{dx}$ is equal to
 (a) 1 (b) -1 (c) x (d) \sqrt{x}
10. Identify the false statements
 (a) $\sim [p \vee (\sim q)] \equiv (\sim p) \vee q$
 (b) $[p \vee q] \vee (\sim p)$ is a tautology
 (c) $[p \wedge q] \wedge (\sim p)$ is a contradiction
 (d) $\sim [p \vee q] \equiv (\sim p) \vee (\sim q)$
11. The mean of 13 observations is 14. If the mean of the first 7 observations is 12 and that of the last 7 observations is 16, what is the value of the 7th observation ?
 (a) 12 (b) 13 (c) 14 (d) 15
12. In how many ways can 12 gentlemen sit around a round table so that three specified gentlemen are always together?
 (a) $9!$ (b) $10!$ (c) $3!10!$ (d) $3!9!$
13. If $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j} + \hat{k}$, $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\alpha \vec{a} + \beta \vec{b} + \gamma \vec{c} = -3(\hat{i} - \hat{k})$, then the ordered triplet (α, β, γ) is
 (a) $(2, -1, -1)$ (b) $(-2, 1, 1)$
 (c) $(-2, -1, 1)$ (d) $(2, 1, -1)$
14. If $y = a \log x + bx^2 + x$ has its extreme value at $x = 1$ and $x = 2$, then (a, b) is :
 (a) $\left(1, \frac{1}{2}\right)$ (b) $\left(\frac{1}{2}, 2\right)$
 (c) $\left(2, \frac{-1}{2}\right)$ (d) $\left(\frac{-2}{3}, \frac{-1}{6}\right)$

15. Let R be the relation over the set of straight lines of a plane, such that $l_1 R l_2 \Leftrightarrow l_1 \perp l_2$. Then, R is
- symmetric
 - reflexive
 - transitive
 - an equivalence relation
16. Evaluate integral $\int \frac{\sin(x+a)}{\sin(x+b)} dx$.
- $x \cos(a-b) + \sin(a-b) \log|\sin(x+b)| + C$
 - $x \sin(a-b) + \cos(a-b) \log|\sin(x+b)| + C$
 - $x \cos(a+b) + \sin(a+b) \log|\sin(x-b)| + C$
 - $x \sin(a+b) + \cos(a+b) \log|\sin(x-b)| + C$
17. If A is idempotent and $A+B=I$, then which of the following is false?
- B is idempotent
 - $AB=0$
 - $BA=0$
 - None of these
18. If $(\sqrt{2})^x + (\sqrt{3})^x = (\sqrt{13})^{x/2}$, then the number of values of x is
- 2
 - 4
 - 1
 - None of these
19. The value of a for which the function $f(x) = a \sin x + (1/3) \sin 3x$ has an extremum at $x = \pi/3$ is
- 1
 - 1
 - 0
 - 2
20. Let L be the line of intersection of the planes $2x + 3y + z = 1$ and $x + 3y + 2z = 2$. If L makes an angle α with the positive x-axis, then $\cos \alpha$ equals
- 1
 - $\frac{1}{\sqrt{2}}$
 - $\frac{1}{\sqrt{3}}$
 - $\frac{1}{2}$
21. A boat is to be manned by eight men of whom 2 can only row on bow side and 3 can only row on stroke side, the number of ways in which the crew can be arranged is
- 4360
 - 5760
 - 5930
 - None of these
22. A bag contains 4 red and 4 blue balls. Four balls are drawn one by one from the bag, then find the probability that the drawn balls are in alternate colour.
- $\frac{35}{6}$
 - $\frac{2}{35}$
 - $\frac{3}{35}$
 - $\frac{6}{35}$
23. If the middle point of the sides of a triangle ABC are (0, 0); (1, 2) and (-3, 4), then the area of triangle is
- 40
 - 20
 - 10
 - 60
24. $\lim_{n \rightarrow \infty} \frac{5^{n+1} + 3^n - 2^{2n}}{5^n + 2^n + 3^{2n+3}}$ is equal to
- 5
 - 3
 - 1
 - 0
25. If p and q be the roots of the quadratic equation $x^2 - (\alpha - 2)x - \alpha - 1 = 0$ then minimum value of $p^2 + q^2$ is equal to
- 2
 - 3
 - 6
 - 5
26. The area of the region lying between the line $x - y + 2 = 0$ and the curve $x = \sqrt{y}$ is
- 9
 - 9/2
 - 10/3
 - None of these
27. The function $f(x) = \frac{1 - \sin x + \cos x}{1 + \sin x + \cos x}$ is not defined at $x = \pi$. The value of $f(\pi)$, so that $f(x)$ is continuous at $x = \pi$, is
- $-\frac{1}{2}$
 - $\frac{1}{2}$
 - 1
 - 1
28. If $(r+1)^{\text{th}}$ term is $\frac{3.5 \dots (2r-1)}{r!} \left(\frac{1}{5}\right)^r$, then this is the term of binomial expansion
- $\left(1 - \frac{2}{5}\right)^{1/2}$
 - $\left(1 - \frac{2}{5}\right)^{-1/2}$
 - $\left(1 + \frac{2}{5}\right)^{-1/2}$
 - $\left(1 + \frac{2}{5}\right)^{1/2}$
29. If $A + B + C = \pi$, then $\cos 2A + \cos 2B + \cos 2C + 4 \sin A \sin B \sin C$ is equal to:
- 0
 - 1
 - 2
 - 3
30. $\left(x + \frac{1}{x}\right)^2 + \left(x^2 + \frac{1}{x^2}\right)^2 + \left(x^3 + \frac{1}{x^3}\right)^2$ upto n terms is
- $\frac{x^{2n} - 1}{x^2 - 1} \times \frac{x^{2n+2} + 1}{x^{2n}} + 2n$
 - $\frac{x^{2n} + 1}{x^2 + 1} \times \frac{x^{2n+2} - 1}{x^{2n}} - 2n$
 - $\frac{x^{2n} - 1}{x^2 - 1} \times \frac{x^{2n} - 1}{x^{2n}} - 2n$
 - None of these

31. Two pairs of straight lines have the equations $y^2 + xy - 12x^2 = 0$ and $ax^2 + 2hxy + by^2 = 0$. One line will be common among them if
 (a) $a = -3(2h + 3b)$ (b) $a = 8(h - 2b)$
 (c) $a = 2(b + h)$ (d) Both (a) and (b)
32. If the focal distance of an end of the minor axis of any ellipse (referred to its axis as the axes of x and y respectively) is k and the distance between the foci is $2h$, then its equation is
 (a) $\frac{x^2}{k^2} + \frac{y^2}{k^2 + h^2} = 1$ (b) $\frac{x^2}{k^2} + \frac{y^2}{h^2 - k^2} = 1$
 (c) $\frac{x^2}{k^2} + \frac{y^2}{k^2 - h^2} = 1$ (d) $\frac{x^2}{k^2} + \frac{y^2}{h^2} = 1$
33. The value of $(1 + 2\omega + \omega^2)^{3n} - (1 + \omega + 2\omega^2)^{3n}$ is :
 (a) 0 (b) 1 (c) ω (d) ω^2
34. Let p is a non-singular matrix such that $1 + p + p^2 + \dots + p^n = O$ (O denotes the null matrix), then p^{-1} is
 (a) p^n (b) $-p^n$
 (c) $-(1 + p + \dots + p^n)$ (d) None of these
35. The value of $\int \frac{x \sin^{-1} x}{\sqrt{1-x^2}} dx$ is equal to :
 (a) $\sqrt{1-x^2} \sin^{-1} x + C$
 (b) $x \sin^{-1} x + C$
 (c) $x - \sqrt{1-x^2} \sin^{-1} x + C$
 (d) $\sqrt{(\sin^{-1} x) + C}$
36. The constraints $-x_1 + x_2 \leq 1$, $-x_1 + 3x_2 \leq 9$, $x_1, x_2 \geq 0$ define on
 (a) Bounded feasible space
 (b) Unbounded feasible space
 (c) Both bounded and unbounded feasible space
 (d) None of these
37. If $x \in (7\pi, 8\pi)$, then $\tan^{-1} \sqrt{\frac{1 - \cos x}{1 + \cos x}} =$
 (a) $-\frac{x}{2}$ (b) $\frac{x}{2}$
 (c) $4\pi - \frac{x}{2}$ (d) None of these
38. The equations $2x + 3y + 4 = 0$; $3x + 4y + 6 = 0$ and $4x + 5y + 8 = 0$ are
 (a) consistent with unique solution
 (b) inconsistent
 (c) consistent with infinitely many solutions
 (d) None of the above
39. The value of $\int_0^{\frac{\pi}{4}} \log_e(1 + \tan x) dx$ is
 (a) π (b) $\frac{\pi^2}{4}$
 (c) $\pi \log_e 2$ (d) $\frac{\pi}{8} \log_e 2$
40. If $y = \log^n x$, where \log^n means $\log \log \log \dots$ (repeated n time), then $x \log x \log x \log^2 x \log^3 x \dots \log^{n-1} x \log^n x \frac{dy}{dx}$ is equal to
 (a) $\log x$ (b) $\log^n x$ (c) $\frac{1}{\log x}$ (d) 1
41. Let $f(x)$, $g(x)$ be two continuously differentiable functions satisfying the relationships $f'(x) = g(x)$ and $f''(x) = -f(x)$. Let $h(x) = [f(x)]^2 + [g(x)]^2$. If $h(0) = 5$, then $h(10) =$
 (a) 10 (b) 5
 (c) 15 (d) None of these
42. The line, $\frac{x-2}{3} = \frac{y+1}{2} = \frac{z-1}{-1}$ intersects the curve $xy = c^2$, $z = 0$ if c is equal to
 (a) ± 1 (b) $\pm \frac{1}{3}$
 (c) $\pm \sqrt{5}$ (d) None of these

43. If $f(x) = \begin{cases} 2x+a & ; x \geq -1 \\ bx^2+3 & ; x < -1 \end{cases}$ and

$g(x) = \begin{cases} x+4 & ; 0 \leq x \leq 4 \\ -3x-2 & ; -2 < x < 0 \end{cases}$

If domain of $g(f(x))$ is $[-1, 4]$, then –

- (a) $a=0, b>5$ (b) $a=2, b>7$
 (c) $a=2, b>10$ (d) $a=0, b \in \mathbb{R}$

44. If $f(x) = \begin{cases} x-1, & x < 0 \\ \frac{1}{4}, & x = 0, \text{ then} \\ x^2, & x > 0 \end{cases}$

- (a) $\lim_{x \rightarrow 0^+} f(x) = 1$
 (b) $\lim_{x \rightarrow 0^-} f(x) = 1$
 (c) $f(x)$ is discontinuous at $x = 0$
 (d) None of these

45. A force $F = 2i + j - k$ acts at a point A, whose position vector is $2i - j$. The moment of F about the origin is

- (a) $i + 2j - 4k$ (b) $i - 2j - 4k$
 (c) $i + 2j + 4k$ (d) $i - 2j + 4k$

46. The solution to the differential equation

$$\frac{dy}{dx} = \frac{yf'(x) - y^2}{f(x)}$$

where $f(x)$ is a given function is

- (a) $f(x) = y(x+c)$ (b) $f(x) = cxy$
 (c) $f(x) = c(x+y)$ (d) $yf(x) = cx$

47. If $a_n = 2n + 1$ and $C_r = {}^n C_r$ then

$$a_0 C_0^2 + a_1 C_1^2 + a_2 C_2^2 + \dots + a_n C_n^2 =$$

- (a) $(n-1)({}^{2n}C_n)$ (b) $n({}^{2n}C_n)$
 (c) $(n+1)({}^{2n}C_n)$ (d) $(n+1)({}^n C_{n/2})$

48. The maximum value of $z = 6x + 8y$ subject to constraints $2x + y \leq 30, x + 2y \leq 24$ and $x \geq 0, y \geq 0$ is

- (a) 90 (b) 120 (c) 96 (d) 240

49. If $A = \begin{bmatrix} 2 & 1 \\ 0 & x \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} \frac{1}{2} & \frac{1}{6} \\ 0 & \frac{1}{x} \end{bmatrix}$, then the value

of x is equal to

- (a) -3 (b) 3 (c) -2 (d) 6

50. If the mean of a binomial distribution is 25, then its standard deviation lies in the interval given below

- (a) $[0, 5)$ (b) $(0, 5]$ (c) $[0, 25)$ (d) $(0, 25]$