



Time: 3 Hours

JEE MAIN TOT GT-2

Max. Marks: 300 M

**SECTION – I****(SINGLE CORRECT ANSWER TYPE)**

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.

**Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.**

**MATHEMATICS**

- If  $|Z - 1| + |Z + 3| \leq 18$ , then the range of values of  $|Z - 9|$  is  
 A)  $[1, 19]$                       B)  $[1, 18]$                       C)  $[1, 9]$                       D)  $[2, 5]$
- The average weight of a class of 14 students is 45 kg the teacher is included, the average weight increases by 1kg then the weight of teacher is  
 A) 60                                  B) 48                                  C) 46                                  D) 54
- The sum of all real roots of the equation  $|x - 2|^2 - 3|x - 2| + 2 = 0$  is  
 A) 2                                  B) 4                                  C) 6                                  D) 8
- ABCD is a quadrilateral, 4,5,6 and 7 points are marked respectively on the sides AB, BC, CD and DA then the number of triangles with vertices on different sides is  
 A) 342                                  B) 458                                  C) 638                                  D) 562
- $(1 + \sqrt{3})^6 + (1 - \sqrt{3})^6 =$   
 A) 348                                  B) 416                                  C) 198                                  D) 296
- If  $t_n$  denotes  $n^{\text{th}}$  term of the series  $3 + 4 + 7 + 12 + \dots$  then  $t_{30}$   
 A) 841                                  B) 844                                  C) 638                                  D) 756
- Consider the statements  
**r: If 5 is greater than 7, then  $1+5=6$**   
**s: If  $\pi$  is irrational, then  $\pi + 2$  is rational the truth values of r and s are respectively**  
 A) T, T                                  B) T, F                                  C) F, T                                  D) F, F
- If  $P = \{(x, y) : y = 4^x, x \in R\}$  and  $Q = \{(x, y) : y = x, x \in R\}$  then  $P \cap Q$   
 A) is a null set                                  B) is a singleton set  
 C) is an infinite set                                  D) have two elements in common
- The equation of the plane contains the line  $\frac{1-x}{3} = \frac{y-2}{2} = \frac{z}{1}$  and the point  $(1, 1, 1)$  is  
 A)  $x + y + z = 3$                       B)  $x + y - z = 3$                       C)  $x + y + 2z = 4$                       D)  $3x + y + z = 5$

10. If  $(x_1, y_1), (x_2, y_2)$  are extremities of a focal chord of the parabola  $y^2 = 4x$  then  $6x_1x_2 + 3y_1y_2 =$   
 A) -2                                      B) -6                                      C) 2                                      D) 6
11. The sides of a rhombus ABCD are parallel to the lines,  $x - y + 2 = 0$  and  $7x - y + 3 = 0$ . If the diagonals of the rhombus intersect at P(1,2) and the vertex A (different from the origin) is on the y-axis, then the ordinate of A is :  
 A) 2                                      B)  $\frac{5}{2}$                                       C)  $\frac{7}{2}$                                       D)  $\frac{7}{4}$
12.  $\int_{\pi/2}^{\pi} \sqrt{1 + \cos 2x} dx =$   
 A)  $-\sqrt{2}$                                       B)  $\sqrt{2}$                                       C) 0                                      D)  $\sqrt{3}$
13. Area bounded by the curve  $x(y^2 + 4) = 8$  and Y axis is  
 A)  $\pi$                                       B)  $\frac{\pi}{2}$                                       C)  $2\pi$                                       D)  $4\pi$
14. The solution of the differential equation  $f(x)dy + y^2 dx = y.f^1(x)dx$   
 A)  $xy + cy = f(x)$                                       B)  $xy = f(x) + c$                                       C)  $xy = f(x) + cx$                                       D)  $y = x + f(x) + c$
15. Sum of values P for which,  $x + y + z = 1, x + 2y + 4z = p$  and  $x + 4y + 10z = p^2$  have a solution is  
 A) 1                                      B) 2                                      C) 3                                      D) 8
16. Let  $\vec{a} = 2\vec{i} + \vec{j} - 2\vec{k}$  and  $\vec{b} = \vec{i} + \vec{j}$  let  $\vec{c}$  be a vector such that  $|\vec{c} - \vec{a}| = 3, |(\vec{a} \times \vec{b}) \times \vec{c}| = 3$  and the angle between  $\vec{c}$  and  $\vec{a} \times \vec{b}$  be  $30^\circ$  then  $\vec{a} \cdot \vec{c} =$   
 A) 2                                      B)  $\frac{1}{8}$                                       C)  $\frac{25}{8}$                                       D) 8
17.  $\lim_{x \rightarrow 0} \frac{(\sin x - x)^2 + (1 - \cos x^3)}{x^5 \sin x} =$   
 A) 0.52                                      B) 0.62                                      C) 0.72                                      D) 0.82
18. If  $\cos(x + y) + e^{x+y} = 2$  then  $\frac{dy}{dx} =$   
 A) 1                                      B) -1                                      C) 0                                      D) 2
19.  $f(x) = \frac{x}{1 + x \tan x}, x \in \left(0, \frac{\pi}{2}\right)$  then  $f(x)$   
 A) has one minima point                                      B) has one maxima point  
 C) increasing                                      D) decreasing
20.  $\sum_{r=0}^{\infty} \cot^{-1}(1 + r + r^2) =$   
 A)  $\pi$                                       B)  $\frac{\pi}{2}$                                       C)  $2\pi$                                       D)  $3\pi$

**SECTION-II**

**(Numerical Value Answer Type)**

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers. .

Marking scheme: +4 for correct answer, 0 in all other cases.

21. The equation of the locus of the mid points of the chord of the circle  $x^2 + y^2 = 4$  that subtends a right angle at its centre is a circle of the form  $x^2 + y^2 = r^2$ , then  $r =$
22. The distance between the foci of the ellipse  $x = 5 \cos \theta, y = 13 \sin \theta$  is
23.  $\int \frac{1}{(x^2 + 4)(x^2 + 9)} dx = \frac{1}{K} \left[ \frac{1}{l} \tan^{-1} \frac{x}{l} - \frac{1}{m} \tan^{-1} \frac{x}{m} \right]$  then  $\frac{m}{l} =$
24. A unbiased die is thrown twice and the sum of the numbers appearing on the upper face is observed to be 6. The probability that the number 4 has appeared at least once is
25. If  $\vec{a} = -\vec{i} + \vec{j} + \vec{k}$  and  $\vec{b} = 2\vec{i} + \vec{k}$  then  $\vec{c}$  is a vector coplanar with  $\vec{a}, \vec{b}$  and perpendicular to  $\vec{c}$  and  $\vec{a} \cdot \vec{c} = 7$  is of the form  $x\vec{i} + y\vec{j} + z\vec{k}$ , then  $(x + y + z) =$

**SECTION – I**  
**(SINGLE CORRECT ANSWER TYPE)**

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**PHYSICS**

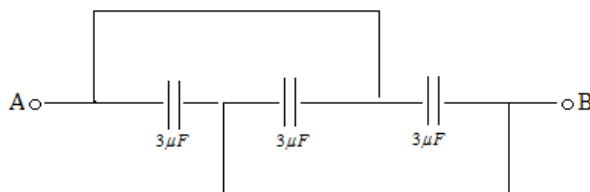
26. The equation of stationary wave is  $y = -4\sin\left(\frac{\pi x}{5}\right)\cos(100\pi t)$ . The amplitude of the progressive wave which produced the stationary wave is

A) 1m                                      B) 2m                                      C) 4m                                      D) 8m

27. A charge  $Q$  is placed at each of the opposite corners of a square. A charge  $q$  is placed at each of the other two corners. If the net electrical force on  $Q$  is zero, then  $Q/q$  equals

A) -1                                      B) 1                                      C)  $-1/\sqrt{2}$                                       D)  $-2\sqrt{2}$

28. The equivalent capacity between the points 'A' and 'B' in the following figure will be



A)  $9\ \mu\text{F}$                                       B)  $1\ \mu\text{f}$                                       C)  $4.5\ \mu\text{F}$                                       D)  $6\ \mu\text{F}$

29. When a battery connected across a resistor of  $16\ \Omega$ , the voltage across the resistor is 12V. When the same battery is connected across a resistor of  $10\ \Omega$ , voltage across it is 11V. The internal resistance of the battery in ohm is

A)  $10/7$                                       B)  $20/7$                                       C)  $25/7$                                       D)  $30/7$

30. The resistance of a wire is 5 ohm at  $50^\circ\text{C}$  and 6 ohm at  $100^\circ\text{C}$ . The resistance of the wire at  $0^\circ\text{C}$  will be:

A) 2 ohm                                      B) 1 ohm                                      C) 4 ohm                                      D) 3 ohm

31. Magnetic field induction at the center of a circular coil of radius 5cm and carrying a current 0.9A is (in SI units) ( $\epsilon_0$ =absolute permittivity of air in S.I. unit velocity of light  $c = 3 \times 10^8\ \text{ms}^{-1}$ )

A)  $\frac{1}{\epsilon_0 \cdot 10^{16}}$                                       B)  $\frac{10^{16}}{\epsilon_0}$                                       C)  $\frac{\epsilon_0}{10^{16}}$                                       D)  $10^{16}\epsilon_0$

32. The time constant of inductance coil is 3milli sec. When a  $90\ \Omega$  resistance is joined in series, then the time constant becomes 0.5 milli sec. The inductance and the resistance of the coil are

A) 54 mH,  $18\ \Omega$                                       B) 14 mH,  $42\ \Omega$                                       C) 42 mH,  $14\ \Omega$                                       D) 14mH,  $60\ \Omega$

33. The equation of an alternating voltage is  $E = 220 \sin(\omega t + \pi/6)$  and the equation of the current in the circuit is  $I = 10 \sin(\omega t + \pi/6)$ . The the impedance of the circuit is

A)  $10\ \Omega$                                       B)  $22\ \Omega$                                       C)  $11\ \Omega$                                       D)  $17\ \Omega$

34. A parallel plate condenser consists of two circular plates each of radius 2cm separated by a distance of 0.1mm. A time varying potential difference of  $5 \times 10^{13}\ \text{V/ms}$  is applied across the plates of the condenser. The displacement current is

A) 5.50 A                                      B)  $5.56 \times 10^2\ \text{A}$                                       C)  $55.6 \times 10^3\ \text{A}$                                       D)  $2.28 \times 10^4\ \text{A}$

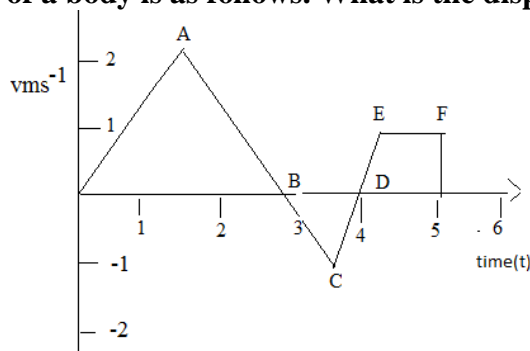
35. An electron is accelerated in an electric field of  $40\ \text{V cm}^{-1}$ . If  $e/m$  of electron is  $1.76 \times 10^{11}\ \text{CKg}^{-1}$ , the acceleration is

A)  $14.0 \times 10^{14}\ \text{ms}^{-2}$                                       B)  $14.0 \times 10^{10}\ \text{ms}^{-2}$                                       C)  $7.0 \times 10^{10}\ \text{ms}^{-2}$                                       D)  $7.04 \times 10^{14}\ \text{ms}^{-2}$

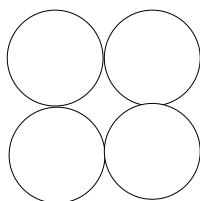
36. In system, a particle A of mass  $m$  and charge  $-2q$  is moving in the nearest orbit around a very heavy particle B having charge  $+q$ . Assuming Bohar's model of the atom to be applicable to this system, the orbital angular velocity of the particle A is

A)  $\frac{2\pi m^2 q^2}{\epsilon_0 h^4}$                                       B)  $\frac{3\pi m^2 q^2}{\epsilon_0^3 h^4}$                                       C)  $\frac{2\pi m q^4}{\epsilon_0^2 h^3}$                                       D)  $\frac{5\pi m^2 q^3}{\epsilon_0^3 h^2}$

- 37 If an object is placed 10 cm in front of a convex mirror of focal length 20cm, then distance of the image from the mirror is  
 A)  $10/3$  cm                      B)  $20/3$  cm                      C) 10 cm                      D)  $40/3$  cm
- 38 Through a narrow slit of width 2mm, diffraction pattern is formed on a screen kept at a distance 2m from the slit. The wavelength of the light used is  $6330\text{\AA}$  and falls normal to the slit and screen. Then the distance between the two minima on either side of the central maximum is  
 A) 12.7 mm                      B) 1.27 mm                      C) 2.532 mm                      D) 25.3 mm
- 39 Three forces  $F_1 = a(i + j + k)$ ,  $F_2 = 2i - 3j + 4k$  and  $F_3 = 8i - 7j + 6k$  act simultaneously on a particle. If the particle is in equilibrium, the value of a is  
 A) 10                      B) -10                      C) 8                      D) 2
- 40 The velocity time graph of a body is as follows. What is the displacement in 5sec?



- 1) 2m                      B) 3m                      C) 4m                      D) 5m
- 41 The variation of horizontal and vertical distances with time are given by  $y=8t-4.9t^2$ ,  $x=6t$  with MKS units. Then, the velocity of projection is  
 A) 8 m/s                      B) 6m/s                      C) 10 m/s                      D) 14 m/s
- 42 A body of mass 2kg slides down with an acceleration of  $3\text{ m/s}^2$  on a rough inclined plane having a slope of  $30^\circ$ . The external force required to take the same body up the plane with the same acceleration will be ( $g=10\text{m/s}^2$ )  
 A) 4N                      B) 20N                      C) 14N                      D) 6N
- 43 A pump of 200 W lifts 2 Kg of water per second from a depth of 10 m and pumps out with a velocity of  
 A)  $200\text{ms}^{-1}$                       B)  $2\text{ ms}^{-1}$                       C)  $10\text{ms}^{-1}$                       D)  $5\text{ ms}^{-1}$
- 44 Four identical spheres each of mass m and R are arranged touching each other on horizontal surfaces as shown in figure. Find the centre of mass of the system from the centre of any sphere.



- A) 2R                      B)  $R/\sqrt{3}$                       C) R/2                      D)  $\sqrt{2}R$
- 45 In materials like aluminium and copper, the correct order of magnitude of various elastic moduli is:  
 A) Young's moduli < shear moduli < bulk moduli  
 B) Bulk moduli < shear moduli < Young's moduli  
 C) Shear moduli < Young's moduli < bulk moduli  
 D) Bulk moduli < Young's moduli < shear moduli

**SECTION- II**

**(Numerical Value Answer Type)**

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46. The compressibility of water is  $4 \times 10^{-5}$  per unit atmospheric pressure . The decrease in volume of  $100 \text{ cm}^3$  water under a pressure of 100 atm will be  $\text{cm}^3$  ?
47. At the mouth of the tap, the area of cross-section is  $2.0 \text{ cm}^2$  and the speed of water is 3m/s. The area of cross-section of the water column 80 cm below the tap in  $\text{cm}^2$  is
48. A particle moves according to the equation  $x = a \cos\left(\frac{\pi}{2}t\right)$ . The distance covered by it in terms of amplitude the time interval between  $t=0$  to  $t=3\text{s}$  is
49. A metal wire is suspended vertically from a rigid support . When loaded with a weight in air, it extends by 0.4 mm and when the weight is immersed completely in water , the extension is reduced to 0.2 mm. Then the relative density of the material of the suspended weight is
50. The co-efficient of real expansion of a liquid is  $7 \times 10^{-4} / ^\circ \text{C}$ . The co-efficient of liner expansion of the vessel is  $1 \times 10^{-5} / ^\circ \text{C}$ . The co-efficient of apparent expansion of the liquid in the order of  $10^{-5} / ^\circ \text{C}$

**SECTION – I**

**(SINGLE CORRECT ANSWER TYPE)**

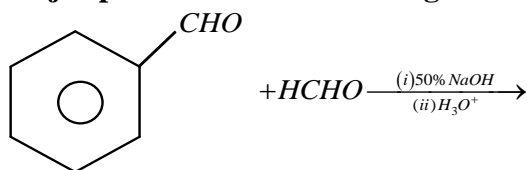
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**CHEMISTRY**

51. A stream of electrons from a heated filament was passed between two charged plates kept at a potential difference  $V$  esu . If  $e$  and  $m$  are charge and mass of an electron , respectively , then the value of  $h / \lambda$  (where  $\lambda$  is wavelength associated with electron wave) is given by  
 A)  $mev$                                       B)  $2 mev$                                       C)  $\sqrt{mev}$                                       D)  $\sqrt{2mev}$
52. In which of the following molecules all bond lengths are not equal ?  
 A)  $SF_6$                                       B)  $PCl_5$                                       C)  $BCl_3$                                       D)  $CCl_4$
53. At very high pressures, the compressibility factor of one mole of a gas is given by :  
 A)  $1 + \frac{Pb}{RT}$                                       B)  $\frac{Pb}{RT}$                                       C)  $1 - \frac{Pb}{RT}$                                       D)  $1 - \frac{b}{(VRT)}$
54. Which one of the following cannot function as an oxidizing agent ?  
 A)  $I^-$                                       B)  $S_{(s)}$                                       C)  $NO_{3(aq)}^-$                                       D)  $Cr_2O_7^{2-}$
55. The numbers of protons , electrons and neutrons in a molecule of heavy water are respectively  
 A) 8,10,11                                      B) 10,10,10                                      C) 10,11,10                                      D) 11,10,10
56. Which of the following atoms has the highest first ionization energy ?  
 A) Rb                                      B) Na                                      C) K                                      D) Sc
57. The active mass of water if density of water is 1 g/cc is \_\_\_\_\_  
 A) 5.55                                      B) 55.5                                      C) 0.55                                      D) data is sufficient
58. Chlorine act as bleaching agent only in presence of  
 A) dry air                                      B) Moisture                                      C) Sunlight                                      D) Pure oxygen
59. Which one of the following is not a state function ?  
 A) Internal energy                                      B) Work                                      C) Entropy                                      D) Free energy
60. How many corners of  $SiO_4$  units are shared in the formation of three dimensional silicates ?  
 A) 3                                      B) 2                                      C) 4                                      D) 1

61. Kjeldahl's Method cannot be used for the estimation of nitrogen in  
 A) Azo Benzene                      B) Quinoline                      C) Para nitro benzoic acid D) All of these
62. The number of  $\pi$  electrons present in anthracene  
 A) 6                                      B) 10                                      C) 5                                      D) 14
63. The most abundant metal in the earth crust is  
 A) Al                                      B) Fe                                      C) Ca                                      D) Na
64. The one that is extensively used as a piezo electric material is  
 A) Tridymite                      B) amorphous boron C) Quartz                      D) mica
65. Which of the following has the maximum number of unpaired electrons  
 A)  $Fe^{+2}$                                       B)  $Ni^{+3}$                                       C)  $Cu^{+}$                                       D) Zn
66. The half – life period of a first order reaction in 15 minutes . The amount of substance left after one hour will be :  
 A) 1/4 of the original amount                      B) 1/8 of the original amount  
 C) 1/16 of the original amount                      D) 1/32 of the original amount
67. Major products of the following reactions are :



- A)  $CH_3OOH$  and                      B) and
- C)  $HCOOH$  and                      D)  $CH_3OH$  and  $HCOOH$

68. The lowest  $P^{ka}$  is that of  
 A) ethanol                      B) Propanol                      C) Propane                      D) Phenol
69. In the sequence of reaction (z) is  
 $C_2H_5Br \xrightarrow{\text{Moist } Ag_2O} (X) \xrightarrow[170^\circ C]{\text{Con } H_2SO_4} (Y) \xrightarrow{HBr} Z$   
 A) ethylene Bromide                      B) ethylidene Bromide                      C) ethyl Bromide                      D) Vinyl Bromide
70.  $C_6H_6 \xrightarrow[50^\circ-60^\circ C]{HNO_3+H_2SO_4} A \xrightarrow{Sn+HCl} B \xrightarrow{CH_3COCl} C$  Then 'C' is  
 A) Aniline                      B) Nitro Benzene                      C) Acetanilide                      D) Benzedine Aniline

### SECTION-II

#### (Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

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71. Considering  $H_2O$  as weak field ligand . The number of unpaired electrons in  $[Mn(H_2O)_6]^{+2}$  will be
72.  $K_2HgI_4$  is 40% ionized in aqueous solution . The value of its vantHoff factor (i) is
73. When an electric current is passed through acidified water, 112 ml of hydrogen gas at N.T.P was collected at the cathode in 965 seconds. The current passed in ampere is .....
74.  $LiCl$  has rock salt structure, with an edge length of  $6.0A^0$  .If anions are in contact, the radius of chloride ion is .....  $A^0$
75. What is the  $P^H$  of  $10^{-4} MOH$  solution at 330K, if  $K_w$  at 330. K is  $10^{-13.6}$ ?