# Mock Joint Entrance Examination (MJEE)-2014

Instructions for the Candidates

1. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   A) To have access to the Question Booklet, tear off the stapled-sealon the booklet. Do not accept a booklet without stapled-seal/ an open booklet.
   B) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
   C) After this verification is over, the Test Booklet Code should be entered in the OMR Sheet .
2. Each item has four alternative responses marked (A), (B), (C) nd (D). You have to darken the circle as indicated below on the correct response against each item.
   Example :

   (A) (B) (C) (D)
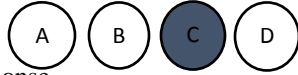
   where (C) is the correct response.
3. Read instructions given inside carefully.
4. Rough Work is to be done in the end of this booklet.
5. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
6. You have to return the OMR Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall.
7. **Use only Blue/Black Ball point pen.**
8. **Use of any Mobile Phone, calculator or log table etc., is prohibited.**
9. In case of any discrepancy in the English and Bengali versions, English version will be taken as final.

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MATHEMATICS
Category: I

(Question no 1-30 carry one marks each for which only one option is correct. Any wrong answer will lead to deduction of $\frac{1}{3}$ marks.)

1. An equation $a \sin x + b \cos x = c$ where $|c| > \sqrt{a^2 + b^2}$ has :
   a) One unique solution
   b) Infinite number of solution
   c) No solution
   d) None of these

2. If [x] denotes the greatest integer function, then the value of $\int_{0.5}^{4.5}[x]dx + \int_{-1}^{1}[x]dx$ is:
   a) 9
   b) 8
   c) 7
   d) 6

3. The domain of the function f(x)= $\sqrt{log_{10}x^2}$ is :
   a) $x \geq 0$
   b) $|x| \geq 1$
   c) $|x| \leq 1$
   d) $|x| \geq 4$

4. Let function f: $R \rightarrow R$ be defined by f(x)= 2x+ $\sin x$ for x ε R. Then f is :
   a) one-one and onto
   b) one-one but not onto
   c) onto but not one-one
   d) neither one-one nor onto

5. The angle between tangents to the curves $y = x^2$ and $x = y^2$ at (1,1) is:
   a) 0
   b) $\tan^{-1} 1$
   c) $\tan^{-1}\frac{3}{4}$
   d) $\tan^{-1}\frac{1}{3}$

6. What is the area bounded by the curves $y = $ x $\sin x$ and x-axis between x=0 and x=2π (in square unit)?
   a) π
   b) 2π
   c) 3π
   d) 4π

7. If x is a real no, the maximum value of $\frac{3x^2+9x+17}{3x^2+9x+7}$ is:
   a) 41
   b) 1
   c) $\frac{17}{7}$
   d) $\frac{1}{4}$

8. If the lines $x^2 - 2pxy - y^2 = 0$ and $x^2 - 2qxy - y^2 = 0$ bisects angels between each other, then :
   a) $p + q = 1$
   b) $pq = 1$
   c) $pq + 1 = 0$
   d) $p^2 + pq + q^2 = 0$

9. The number of real solution of the equation $e^x = x$ is :
   a) 2
   b) 3
   c) 1
   d) 0

10. The sum of the infinite series $1 + (1 + a)x + (1 + a + a^2)x^2 + (1 + a + a^2 + a^3)x^3 + $ .... where $0 < a$, $n < 1$ is :
    a) $\frac{1}{(1-n)(1-a)}$
    b) $\frac{1}{(1-n)(1-an)}$
    c) $\frac{1}{(1-a)(1-an)}$
    d) none of these

11. There are four letter boxes in a post office. In how many ways can a man post 8 distinct letter:
    a) 8×8
    b) 8^4
    c) 4^8
    d) 8_{p_4}

12. Given five line segments of lengths 2,3,4,5,6 units. Then the number of triangles that can be formed by joining these lines is:
    a) 5_{C_3}
    b) $5_{C_3} - 3$
    c) $5_{C_3} - 2$
    d) $5_{C_3} - 1$

13. If n is a positive integer, then $2.4^{2n+1} + 3^{3n+1}$ is divisible by
    a) 2
    b) 9
    c) 11
    d) 27

3

14. The sum of the co-efficients in the expansion of $(1 + x - 3x^2)^{3148}$ is :
   a) 8
   b) 7
   c) −1
   d) 1

15. If the value of the third order determinant is 11,then the value of the square of the determinant formed by the co-factors will be:
   a) 11
   b) 121
   c) 1131
   d) 14641

16. If $\int e^x \left(\log x + \frac{1}{x^2}\right) dx = f(x)g(x) + c$ then
   a) $f(x) = e^x, g(x) = \log x$
   b) $f(x) = \log x + \frac{1}{x}, g(x) = e^x$
   c) $f(x) = \log x - \frac{1}{x}, g(x) = e^x$
   d) none of these

17. The value of $x \to \infty, \frac{1}{n}\sum_{r=1}^{n}\left(\frac{r}{n}\right)^k$ is:
   a) $\frac{1}{k+1}$
   b) $\frac{1}{k}$
   c) $\frac{1}{k-1}$
   d) $\frac{1}{2k}$

18. The area of the plane region bounded by the curves $x + 2y^2 = 0$ and $x + 3y^2 = 1$ is equal to:
   a) $\frac{4}{3}$
   b) $\frac{5}{3}$
   c) $\frac{1}{3}$
   d) $\frac{2}{3}$

19. If $3x^2 + 4ky^2 = 24$ be the equation of the rectangular hyperbola value of k is :
   a) $-\frac{4}{3}$
   b) $\frac{2}{3}$
   c) $-\frac{2}{3}$
   d) $\frac{4}{3}$

20. If $f(x) = x^2 + 3x - 4$ is defined in closed interval[-4,1] by Rolle's then at which point is justified that is :
   a) $x = -2$
   b) $x = -\frac{3}{2}$
   c) $x = 0$
   d) none of these

21. If $y = ax + \frac{b}{x}$ where a,b are constant and if $x^2y_2 + xy_1 = ky$ then the value of k=?
   a) $a + b$
   b) $\frac{a}{b}$
   c) ab
   d) 1

22. If $x^y = e^{x-y}$ then $\frac{dy}{dx} =?$ at $x = 1$
   a) -2
   b) 0
   c) 1
   d) none of these

23. If $\left(\frac{d^2y}{dx^2}\right)^3 = \sqrt{1 + \frac{dy}{dx}}$,order and degree be:
   a) 3,2
   b) 2,4
   c) 3,6
   d) 2,6

24. Two unequal quantity where A.M=18 and G.M=6 then H.M=?
   a) 2
   b) 1
   c) -2
   d) 4

25. If α, β are roots of $x^2 - 7x + 1 = 0$ then the value of $\left\{\frac{1}{(\alpha-7)^2} + \frac{1}{(\beta-7)^2}\right\}$ is:
   a) 45
   b) 47
   c) 49
   d) 51

26. Let $(1 + x)(1 + x^2)(1 + x^4)(1 + x^8)(1 + x^{16})(1 + x^{32}) = 1 + x + x^2 + \cdots + x^n$ the nth value of n is:
   a) 63
   b) 32
   c) 127
   d) *None of these*

27. There are 10 rooms as pattern shown bellow. 8 balls are to placed in 10 rooms such that no 2 balls are in same room and no row is empty. The number of ways of placement is :

a) 44

c) 210

b) 630

d) 30

28. If the line $2x + \sqrt{6}\,y = 2$ touches the hyperbola $x^2 - 2y^2 = 4$ then the root of contact is:

   a) $(4, -\sqrt{6})$ c) $(2, -\sqrt{6})$

   b) $(-4, \sqrt{6})$ d) *None of these*

29. Let $y = (1+x)(1+x^2)(1+x^4)\ldots\ldots(1+x^{2^n})$ then $(\frac{dy}{dx})_{x=0}$ is equal to(n is finite positive integer)

   a) 0   c) 2

   b) 1   d) None of these

30. Let $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \cdots \infty}}}$ then $(2y - 1)\frac{dy}{dx}$ equals to

   a) $\sin x$ c) $-\sin x$

   b) $\cos x$ d) None of the above

Category: II

(Question no 31-37 carry two marks each for which only one option is correct. Any wrong answer will lead to deduction of $\frac{2}{3}$ marks.)

31. If $\sin A = \frac{1}{\sqrt{10}}$ and $\sin B = \frac{1}{\sqrt{5}}$ where A and B are constant then $(1 + \tan A)(1 + \tan B)$ equals to :

   a) 1   c) 2

   b) $\sqrt{2}$ d) None of the these

32. The radius of the circle which touches the line $y = 3x$ at (2,6) and also touches the circle $x^2 + y^2 = 4$ is:

   a) 6   c) 8

   b) 7   d) 9

33. If $\int_0^1 kxe^{x^2}\,dx = e - 1$, The value of k=?

   a) 2   c) e

   b) 0   d) $\frac{2}{e}$

34. If $A^{-1} = \begin{pmatrix} 3 & -4 \\ 5 & -6 \end{pmatrix}$ then A=?

   a) $\begin{pmatrix} \frac{3}{2} & -2 \\ \frac{5}{2} & -3 \end{pmatrix}$ c) $\begin{pmatrix} \frac{3}{2} & 2 \\ -\frac{5}{2} & -\frac{3}{2} \end{pmatrix}$

   b) $\begin{pmatrix} -3 & 2 \\ -\frac{5}{2} & \frac{3}{2} \end{pmatrix}$ d) None of these

35. If $P(A - B) = \frac{1}{3}, P(A) = \frac{1}{2}, P(B) = \frac{1}{3}$ then only B will happen the probability is:

   a) $\frac{2}{3}$ c) $\frac{5}{6}$

   b) $\frac{1}{6}$ d) $\frac{1}{3}$

36. A combination lock on a suitcase has three wheels each labeled with 9 digits from 1 to 9. If an opening combination is a particular sequence of three digits with no repeats, the probability of a person guessing the right combination is :

   a) $\frac{1}{500}$ c) $\frac{1}{252}$

   b) $\frac{1}{504}$ d) $\frac{1}{250}$

37. In a triangle PQR, angle R=π/2. If $\tan\frac{P}{2}$ and $\tan\frac{Q}{2}$ are the roots of the equation $ax^2 + bx + c = 0$; $(a \neq 0)$ then which one is true ?
   a) $a + b = c$
   b) $b + c = a$
   c) $c + a = b$
   d) $b = c$

Category: III

(Question no 38-40 carry two marks each for which one and more than one option may be correct. There will be no negative marks)

38. If f(x) be a polynomial satisfying $\{f(x) - 1\}\{f(y) - 1\} = f(xy) - 1$ and f(3)=10 then which of the following is/are correct ?
   a) $f(1) = 2$
   b) $f(5) - f(3) = f(4) - 1$
   c) $f(0) = 0$
   d) $f(2) = 5$

39. The value of $\int_3^4 \frac{dx}{\sqrt[3]{\log x}}$ is:
   a) Less than 1
   b) More than $\frac{3}{2e^{1/3}}$
   c) More than $(\sqrt[3]{16} - \sqrt[3]{19})$
   d) Less than 2

40. If the tangents of the angles A and B of a triangle ABC satisfy the equation $abx^2 - c^2x + ab = 0$ then:
   a) $\tan A = \frac{a}{b}$
   b) $\tan B = \frac{b}{a}$
   c) $\cos C = 0$
   d) $\sin^2 A + \sin^2 B + \sin^2 C = 2$

PHYSICS
Category: I

41. A particle moves along x-axis as $x = 4(t-2) + a(t-2)^2$ which of the following is true?
    a) The initial velocity of particle is 4
    b) The acceleration of a particle is 2a
    c) The particle is at origin at t=0
    d) None of the above

42. For an object thrown at 45^0 to horizontal, the maximum height(H) and horizontal range(R) are related as
    a) R= 16 H
    b) R= 8 H
    c) R= 4 H
    d) R= 2 H

43. The movement of inertia of a circular disc about an axis passing through the circumference perpendicular to the plane of the disc is:
    a) MR^2
    b) $3/2\ MR^2$
    c) $1/2MR^2$
    d) $4/3\ MR^2$

44. A Planet has twice the radius but the mean density is 1⁄4 th as compared to earth. What is the ratio of escape velocity from earth to that from the planet?
    a) 3:1
    b) 1:2
    c) 1:1
    d) 2:1

45. A block of ice at -10^0 C is slowly heated and convert to steam at 100^0C. Which of the following curves represent this phenomenon qualitatively?
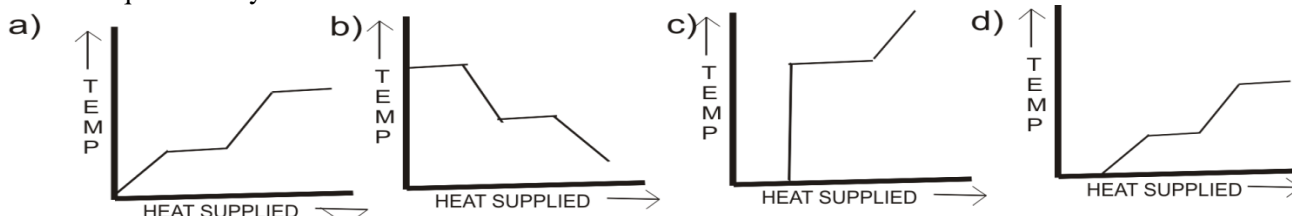
46. What will be the ratio of temperature of sun and moon? If the wavelength of their maximum emission radiation rates are 140Å and 4200Å respectively?
    a) 1:30
    b) 30:1
    c) 42:14
    d) 14:42

47. A string vibrates according to the equation $y = 5\sin(2\pi x/3)\cos 20\pi t$ where x and y are in cm and t in second. The distance between two adjacent nodes is :
    a) 3 cm
    b) 4.5 cm
    c) 6 cm
    d) 1.5 cm

48. Four charges equal to –Q are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium, the value of q is :
    a) $-\frac{Q}{4}(1 + 2\sqrt{2})$
    b) $\frac{Q}{4}(1 + 2\sqrt{2})$
    c) $-\frac{Q}{2}(1 + 2\sqrt{2})$
    d) $\frac{Q}{2}(1 + 2\sqrt{2})$

49. An ammeter reads up to 1A. Its internal résistance is 0.81Ω. To increase the range to 10A the value of the required shunt is :
    a) 0.03Ω
    b) 0.3Ω
    c) $0.9\ \Omega$
    d) 0.09Ω

50. The resultant force on the current loop PQRS due to a long current carrying conductor will be:
    a) 10^{-4}N
    b) 3.6×10^{-4}N
    c) 1.8×10^{-4}N
    d) 5×10^{-4}N
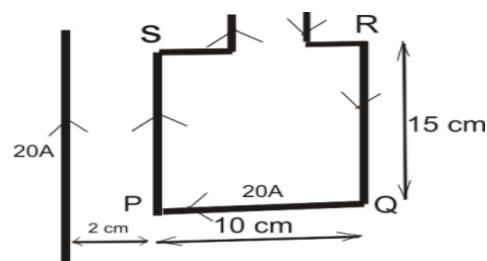
51. Two identical, photo cathodes receive light of frequencies f_1 and f_2. If the velocities of the photoelectrons (of mass m) coming out respectively V_1 and V_2 then

a) $V_1^2 - V_2^2 = \frac{2h}{m}(f_1 - f_2)$ c) $V_1^2 + V_2^2 = \frac{2h}{m}(f_1 - f_2)$

b) $V_1 + V_2 = \left[\frac{2h}{m}(f_1 - f_2)\right]^{1/2}$ d) $V_1 - V_2 = \left[\frac{2h}{m}(f_1 - f_2)\right]^{1/2}$

52. If the error in the measurement of the radius of a sphere is 2% then the error in the determination of volume of the sphere will be:

a) 8 %   c) 4%

b) 2 %   d) 6%

53. A particle moving in a straight line has velocity and displacement equation as

$$v = 4\sqrt{1 + s}$$

Where v in m/s and s in m. The initial velocity of the particle is:

a) 4 m/s   c) 2 m/s

b) 16 m/s   d) 0

54. The position vectors of two body of masses 1kg and 3kg are $(\vec{i} + 2\vec{j} + \vec{k})$ and $(\overrightarrow{-3i} - 2\vec{j} + \vec{k})$ respectively. The position vector of the centre of mass is:

a) $(\overrightarrow{2i} - \vec{j} - \vec{k})$ c) $(\overrightarrow{-i} + \vec{j} + \overrightarrow{k})$

b) $(-\overrightarrow{2i} - \vec{j} + \vec{k})$ d) $(\overrightarrow{-2i} + \vec{k})$

55. A spring of force constant 'k' is divided into three portions. What will be the force constant of every portion?

a) k c) $3k$

b) $\frac{K}{3}$ d) $\frac{k}{\sqrt{3}}$

56. A metallic sphere of volume V falls through glycerine with a terminal velocities $2ms^{-1}$. If we drop a ball of volume 8V of a same metal into a column of glycerine, the terminal velocity of the ball will be:

a) $2ms^{-1}$ c) $8ms^{-1}$

b) $4ms^{-1}$ d) $16ms^{-1}$

57. A particle executes a simple harmonic motion of time period T, Find the time taken by the particle to go directly from its mean position to half the amplitude?

a) $\frac{T}{2}$ c) $\frac{T}{8}$

b) $\frac{T}{4}$ d) $\frac{T}{12}$

58. Two parallel wires carrying current I and 2I have magnetic field B at the mid point between theme. If the current 2I is switched off, the magnetic field at the point will be:

a) B c) $2B$

b) $\frac{B}{2}$ d) $3B$

59. The intensity of each coherent source is I_0 which of the following gives the intensity at a point where phase difference between superimposing waves is θ?

a) $I_0(1 + \cos\theta)$ c) $2I_0\cos^2\frac{\theta}{2}$

b) $4I_0\cos^2\frac{\theta}{2}$ d) $2I_0\cos\theta$

60. The half life of a radio active substance is 5 minutes. The fraction of the sample of this isotope that will remain after 30 minutes is:
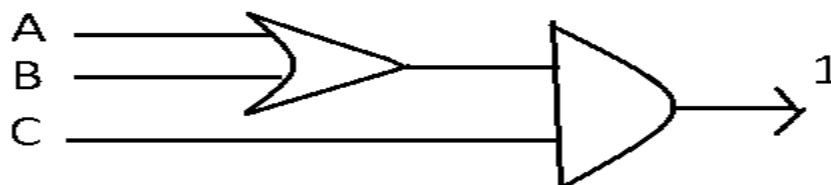
a) $\frac{1}{6}$ c) $\frac{1}{32}$

b) $\frac{1}{36}$ d) $\frac{1}{64}$

61. To get an output 1 from the circuit shown in the figure, the output must be

a) A=0,B=1,C=0   c) A=1,B=0,C=1

b) A=1,B=0,C=0   d) A=1,B=1,C=0

62. In a circuit the value of equivalent resistance of an inductance at t=0 and t= D are respectively?
    a) 0 and D
    b) D and 0
    c) 0 and 0
    d) D and D

63. In Fission the heavy nucleus breaks up into fragments as :
    a) The breaking only releases neutrons
    b) The breaking releases binding energy
    c) The breaking gives energy from packing friction
    d) The breaking only gives grater binding energy

64. The intensity distribution of blackbody radiation with the rise in temperature gives :
    a) Increase in area and shift of peak to lower wavelength
    b) Area unchanged and shift of peak to lower wavelength
    c) Increase in area and shift of peak to higher wavelength
    d) Area unchanged and shift of peak to higher wavelength

65. The bulb of a thermometer should have the property
    a) Spherical or Cylindrical
    b) Surface area maximum for a given volume
    c) Surface area minimum for a given volume
    d) The shape immaterial

66. A satellite of mass m is having round the planet of mass M in circular orbit of radius r in orbital equilibrium. The total energy of the planet in this orbit is :
    a) $-\dfrac{GMm}{2r}$
    b) $-\dfrac{GMm}{r}$
    c) $\dfrac{GMm}{r}$
    d) $\dfrac{GMm}{2r}$

67. In a hydrogen atom the electron stops rotating the nucleus and comes to rest. Now due to Coulomb's attraction the proton and the electron will hit at same point, when the electron come down through
    a) $\dfrac{r_1}{2}$
    b) $\dfrac{m_p r_1}{m_e}$
    c) $\dfrac{m_e r_1}{m_p}$
    d) $\dfrac{m_p r_1}{m_p + m_e}$

68. What will be the distance of the object when a concave mirror produces a real image of magnification m? The focal length of the mirror f is:
    a) $(m-1)\dfrac{f}{m}$
    b) $(m-1)f$
    c) $(m+1)\dfrac{f}{m}$
    d) $(m+1)f$

69. Young's modulus of perfectly rigid body material is :
    a) Infinite
    b) Zero
    c) 10×10^{10} Pascal
    d) 1×10^{10} Pascal

70. Which of the following statement is true for an n-type semiconductor?
    a) Donor level lies closely bellow the bottom of the conduction band
    b) Donor level lies closely above the top of the valence band
    c) The donor level lies at the halfway mark of the forbidden energy gap
    d) None of the above

Category: II

(Question no 71-77 carry two marks each for which only one option is correct. Any wrong answer will lead to deduction of $\frac{2}{3}$ marks.)

71. A Carnot engine operating between temperature T_1 and T_2 has efficiency $\frac{1}{6}$. When T_2 is lowerd by 62K, its efficiency increase to $\frac{1}{3}$. Then T_1 and T_2 are respectively :
    a) 372K and 330K
    b) 330K and 268K
    c) 310K and 248K
    d) 372K and 310K

72. The range R of projectile is same when its maximum heights are h_1 and h_2. What is the relation between R, h_1 and h_2?
    a) $R = \sqrt{h_1 h_2}$
    b) $R = \sqrt{2 h_1 h_2}$
    c) $R = 2\sqrt{h_1 h_2}$
    d) $R = 4\sqrt{h_1 h_2}$

73. A parallel plate capacitor has the space between its plates filled by two slabs of thickness $\frac{d}{2}$ each and dielectric constant k_1 and k_2, d is the plate separation of the capacitor. The capacitance of the capacitor is:
    a) $\dfrac{2\varepsilon_0 d}{A}\left(\dfrac{k_1 + k_2}{k_1 k_2}\right)$
    b) $\dfrac{2\varepsilon_0 A}{d}(k_1 + k_2)$
    c) $\dfrac{2\varepsilon_0 A}{d}\left(\dfrac{k_1 + k_2}{k_1 k_2}\right)$
    d) $\dfrac{2\varepsilon_0 A}{d}\left(\dfrac{k_1 - k_2}{k_1 k_2}\right)$

74. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the coulomb attraction between the proton and electron. If a_0 be the radius of the ground state orbit, m is the mass and e is the charge of the electron and ε_0 is the vacuum permittivity, the speed of electron is:

a) 0

b) $\dfrac{e}{\sqrt{m\,\varepsilon_0\,a_0}}$

c) $\dfrac{e}{\sqrt{4\pi m\,\varepsilon_0\,a_0}}$

d) $\sqrt{\dfrac{4\pi m \varepsilon_0\,a_0}{e}}$

75. For a Galilean telescope (objective converging lens and eye piece diverging lens) focusing final image at infinity the angular magnification and length of the tube are :

a) $\dfrac{|f_e|}{|f_0|}$ and $(|f_0| + |f_e|)$

b) $\dfrac{|f_0|}{|f_e|}$ and $(|f_0| - |f_e|)$

c) $\dfrac{|f_e|}{|f_0|}$ and $(|f_0| - |f_e|)$

d) $\dfrac{|f_e|}{|f_0|}$ and $(|f_0| + |f_e|)$

76. Two bar magnets each of length $2l$ and magnetic M_1 and M_2 ($M_2 > M_1$) placed along North-South, one exactly above the others but M_1 pointing North and M_2 pointing South. If the neutral point for the arrangement is at a disc d from the center then the position of the neutral point and Earth's horizontal component will be :

a) Along the axis of the magnets and $B_H = \dfrac{\mu_0(M_2 - M_1)}{4\pi(d^2 + l^2)^{3/2}}$

b) Perpendicular to the axis and $B_H = \dfrac{\mu_0 2d(M_2 - M_1)}{4\pi(d^2 - l^2)^2}$

c) Along the axis of the magnets and $B_H = \dfrac{\mu_0 2d(M_2 - M_1)}{4\pi(d^2 - l^2)^2}$

d) Perpendicular to the axis and $B_H = \dfrac{\mu_0(M_2 - M_1)}{4\pi(d^2 + l^2)^{3/2}}$

77. For a thermo-couple the thermo e.m.f (ε) varies with the temperature of the hot junction(θ) in such a way so that at neutral temperature

a) $\dfrac{d\varepsilon}{d\theta} = 0$ and $\dfrac{d^2\varepsilon}{d\theta^2} > 0$

b) $\dfrac{d\varepsilon}{d\theta} = 0$ and $\dfrac{d^2\varepsilon}{d\theta^2} = 0$

c) $\dfrac{d\varepsilon}{d\theta} = 0$ and $\dfrac{d^2\varepsilon}{d\theta^2} < 0$

d) $\dfrac{d\varepsilon}{d\theta} > 0$ and $\dfrac{d^2\varepsilon}{d\theta^2} > 0$

Category: III

(Question no 78-80 carry two marks each for which one and more than one option may be correct. There will be no negative marks)

78. Peaks in X-ray distribution characteristic arise due to :
   a) Excitation of the target atom at its de-excitation
   b) Jumping of the outermost electrons to higher levels and de-excitation
   c) Jumping of the ground level electrons to higher levels and de-excitation
   d) Displacing of ground level electrons and their filling up by the neighboring electrons

79. The force exerted on a charge in a magnetic field(B) be zero. This is possible only when:
   a) The charge is rest or the velocity of the charge is parallel to the magnetic field
   b) The charge moves along the direction of B
   c) The charge moves along the opposite direction of B
   d) The charge moves along any direction of B

80. A simple pendulum with a bob of mass 'm' is suspended from the roof of a car moving with a horizontal acceleration is :
   a) The string makes an angle of $\tan^{-1}\dfrac{a}{g}$ with the vertical
   b) The string makes an angle of $\tan^{-1}(1 - \dfrac{a}{g})$ with the vertical
   c) The tension in the string is $m\sqrt{a^2 + g^2}$
   d) The tension in the string is $m\sqrt{g^2 - a^2}$

CHEMISTRY
Category: I

(Question no 81-110 carry one marks each for which only one option is correct. Any wrong answer will lead to deduction of $\frac{1}{3}$ marks.)

81. In acidic medium, H_2O_2 acts as a reducing agent in its reaction with:
    a) $FeSO_4$
    b) $KMnO_4$
    c) K_2MnO_4
    d) $K_4[Fe(CN)_6]$

82. How many molecules of CO_2 formed when 1mg of 100% pure $CaCO_3$ treated with excess HCl acid:
    a) 6.023×10^{21}
    b) 6.023×10^{23}
    c) 6.023×10^{19}
    d) 6.023×10^{18}

83. Among the following, the pair in which the two species are not iso-structural is a :
    a) SiF_4 and SF_6
    b) IO_3^- and XeO_3
    c) BH_4^- and WH_4^+
    d) PF_6^- and SF_6

84. $Ag^+ + NH_3 \leftrightarrows [Ag(NH_3)]^+$; $K_1 = 3.5 \times 10^{-3}$
       $[Ag(NH_3)]^+ + NH_3 \leftrightarrows [Ag(NH_3)_2]^+$; $K_2 = 1.7 \times 10^{-3}$
    The formation constant of $[Ag(NH_3)_2]^+$ is :
    a) 5.95×10^{-6}
    b) 6.08×10^6
    c) 6.08×10^{-9}
    d) None of these

85. For a weak acid Pk_a is 4.8. What will be the ratio of concentration of acid and salt in pH 5.8 solution:
    a) 10
    b) 3
    c) 9
    d) 0.1

86. The reaction, $Ag^{2+}(aq) + Ag(s) \leftrightarrows 2Ag^+(aq)$ is an example of:
    a) Reduction reaction
    b) Oxidation reaction
    c) Disproportion reaction
    d) None of these

87. $CH_3COOH \xrightarrow{LiAlH_4} X \xrightarrow[300^0C]{Cu} Y \xrightarrow[NaOH]{dil} Z$, in the above reaction Z is:
    a) Butanol
    b) Aldol
    c) Keton
    d) Acetal

88. In deborane the two H-B-H bond angles are nearly :
    a) $60^0, 120^0$
    b) $95^0, 120^0$
    c) $95^0, 150^0$
    d) $120^0, 180^0$

89. The ionization energy of a hydrogen atom is 13.6eV. The energy of the third –lowest electronic level in doubly ionized Lithium(Z=3) is:
    a) -28.7eV
    b) -54.4eV
    c) -122.4eV
    d) -13.6eV

90. Which of the following reaction led to the discovery of the neutrons?
    a) $^{14}_{6}C + ^{1}_{1}P \rightarrow ^{14}_{7}N + ^{1}_{0}n$
    b) $^{9}_{4}Be + ^{4}_{2}He \rightarrow ^{12}_{6}C + ^{1}_{0}n$
    c) $^{11}_{5}B + ^{2}_{1}D \rightarrow ^{12}_{6}C + ^{1}_{0}n$
    d) $^{8}_{4}Be + ^{4}_{2}He \rightarrow ^{11}_{6}C + ^{1}_{0}n$

91. Which of the following arrangement correctly represent a decreasing order of bond angles?
    a) $NH_3 > PH_3 > AsH_3$
    b) $NH_3 > H_2O > F_2O$
    c) $NO_2^+ > NO_2^- > NO_2$
    d) $CH_4 > H_2O > NH_3$

92. At high temperature and low pressure, the Vanderwaal's equation is reduced to :
    a) $\left(P + \frac{a}{V_m^2}\right) V_m = RT$
    b) $PV_m = RT$
    c) $P(V_m - b) = RT$
    d) $\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$

93. Which of the following acids is not a peroxo acid?
    a) CF_3CO_3H
    b) $H_2S_2O_6$
    c) $H_2S_2O_7$
    d) H_2SO_5

94. When a copper sulphate solution is treated with an excess of KCN , it gives:
    a) $Cu(CN)_2$ and $(CN)_2$
    b) $K_2[Cu(CN)_4]$
    c) $K_3[Cu(CN)_4]$
    d) $(CN)_2$

95. Which of the following hydroxides of alkaline earth elements is amphoteric?
   a) $Be(OH)_2$
   b) $Ca(OH)_2$
   c) $Sr(OH)_2$
   d) $Mg(OH)_2$

96. Reduction of NO_3^- in an alkaline solution with Zn gives:
   a) NO_2
   b) H_2
   c) NH_3
   d) NO

97. The relative strength of the bond holding as Lewis acid are in the order :
   a) $BBr_3 > Bcl_3 > BF_3$
   b) $BF_3 > Bcl_3 > BBr_3$
   c) $BI_3 > BF_3 > BBr_3$
   d) $BI_3 > BBr_3 > BBr_3 > BF_3$

98. Which of the following compounds exhibits stereo isomerism?
   a) 2-Methyl-1-butene
   b) 3-Methyl-1-butyne
   c) 3-Methyl butanoic acid
   d) 2-Methyl butanoic acid

99. Which of the followingcan't be hydrolyzed by aqueous NaOH ?
   a) $PhCH_2Cl$
   b) $CH_2 = CH - CH_2Cl$
   c) $CH_2 = CH - Cl$
   d) $CH_3CH(Cl)\ CH_3$

100.   The compound which is not used in diazo-coupling reaction is :
   a) β- Naphthol
   b) N,N- dimethylaniline
   c) Phenol
   d) benzene sulfonic acid

101.   Which of the following contents the greatest number of atoms?
   a) $1.0gm\ of\ Butane$
   b) $1.0gm\ of\ Nitrogen$
   c) $1.0gm\ of\ Silver$
   d) $1.0gm\ of\ Water$

102.   The equivalent weight of $Na_2S_2O_3$ in the reaction $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$ is:
   a) M
   b) $\frac{M}{8}$
   c) $\frac{M}{0.5}$
   d) $\frac{M}{2}$

103.   Equal volumes of 0.50M HCl,0.25M NaOH and 2.75M NaCl are mixed. The molarity of the NaCl solution is:
   a) 2.75 M
   b) 0.50 M
   c) 2.00 M
   d) 1.00 M

104.   The solubility in water of a sparingly soluble salt AB_2 is 1.0×10^{-5}mol L^{-1}.Its solubility product will be:
   a) 4×10^{-5}
   b) 4×10^{-10}
   c) 1×10^{-15}
   d) 1×10^{-10}

105.   Among the following the most stable salt of iron is:
   a) $FeSO_4.H_2O$
   b) $FeSO_4.(NH_4)_2SO_4.6H_2O$
   c) $FeCl_2$
   d) $FeCO_3$

106.   In Which of the following iron is paramagnetic?
   a) Zn^{2+}
   b) N^{3-}
   c) Mn^{2+}
   d) Cu^+

107.   Which of the following has the greatest reducing power?
   a) HF
   b) HI
   c) HCl
   d) HBr

108.   Which of the following compounds does not hydrolyze in water?
   a) $SnCl_4$
   b) PCl_3
   c) PCl_5
   d) NF_3

109.   Which of the following is the strongest acid?
   a) Benzoic acid
   b) Formic acid
   c) 2-Hydroxybenzoic acid
   d) p- Hydroxybenzoic acid

110.   The following quantum number are possible for how many orbital's? where n=3,l=2,m=+2
   a) 1
   b) 2
   c) 3
   d) 4

Category: II

(Question no 111-117 carry two marks each for which only one option is correct. Any wrong answer will lead to deduction of $\frac{2}{3}$ marks.)

111. Dihedral angle in the eclipsed conformation of ethane in Newman projection is:
 a) 180^0 c) 0^0
 b) 60^0 d) 45^0

112. The heats of combustion of C_nH_{2n+2}, carbon and hydrogen are a,b and calories respectively. What will be the heat of formation of C_nH_{2n+2}
 a) $(na + nc) - (a + b)$ c) $na + nb + nc$
 b) $(nb + nc) + (c - a)$ d) $\frac{na+nb}{2} - nc$

113. KF combines with HF to form KHF_2. The compound contains the species:
 a) K^+, F^- and H^+ c) K^+ and $[HF_2]^-$
 b) K^+, F^- and HF d) $[KHF]^+$ and F^-

114. A follows first order reaction, $A \rightarrow$ product concentration of A, changes from 0.1 M to 0.025 M in 40 min. Find the rate of the reaction of A when concentration of A is 0.01 M.
 a) $3.47 \times 10^{-4} Mmin^{-1}$ c) $1.73 \times 10^{-4} Mmin^{-1}$
 b) $3.47 \times 10^{-5} Mmin^{-1}$ d) $1.73 \times 10^{-5} Mmin^{-1}$

115. The potential of cell for the reaction $M(S) + 2H^+(1M) \rightarrow H_2(g)(1\ atm) + M^{2+}(0.1M)$ is 1.5V. The standard reduction potential for $\frac{M^{2+}}{M}$ couple is :
 a) 0.1470 V c) 14.70 V
 b) 1.47 V d) None of these

116. Which of the following peroxides is not known?
 c) BaO_2 c) SrO_2
 d) CrO_5 d) BeO_2

117. 0.049 gm of H₂SO₄ is dissolved per litre of the given solution. The PH of this solution will be:
 a) 1 c) 3
 b) 2 d) 2.3

Category: III

(Question no 118-120 carry two marks each for which one and more than one option may be correct. There will be no negative marks)

118. Intermolecular hydrogen bonding is possible in case of
 a) N-methylaniline c) N-N-dimethylaniline
 b) $Nitrobenzene$ d) Methylamine

119. Which of the following statements are correct ?
 a) In $Al_2 Cl_6$ each Al atom is sp³ hybridized
 b) In $Al_2 Cl_6$, each of the bridging chlorine atoms forms a normal covalent bond with one Al atom and a coordinate covalent bond with another.
 c) The reaction of $Fe_2 O_3(s)$ with Al(s) is endothermic
 d) Alums are represented by the general formula $M^{2+}M^{3+}(SO_4)_2 .12H_2O$

120. A solution of a colourless slat(H) on boiling with excess NaOH produces a nonflammable gas. The gas evaluation ceases after some time. Upon addition of Zn dust to the same solution, the gas evolution restarts. The colourless salt(s)(H) is/are:
 a) NH_4NO_3 c) $(NH_4)_2SO_4$
 b) NH_4Cl d) NH_4NO_2

MJEE-2014 ANSWER KEY----**SET X**

1.C	2.A	3.B	4.A	5.C	6.D	7.A	8.C	9.D	10.B
11.C	12.B	13.C	14.D	15.D	16.C	17.A	18.A	19.A	20.A
21.A	22.B	23.D	24.A	25.B	26.A	27.A	28.A	29.A	30.B
31.C	32.D	33.A	34.A	35.B	36.B	37.A	38.A,B,D	39.A,B,C,D	40.A,B,C,D
41.D	42.D	43.A	44.D	45.A	46.B	47.C	48.C	49.D	50.A
51.A	52.D	53.A	54.B	55.C	56.C	57.D	58.A	59.B	60.D
61.C	62.B	63.D	64.A	65.B	66.A	67.B	68.C	69.A	70.A
71.D	72.D	73.C	74.C	75.C	76.C	77.C	78.A,D	79.A,B,C	80.A,D
81.C	82.D	83.A	84.A	85.D	86.C	87.B	88.B	89.C	90.B
91.A	92.B	93.D	94.C	95.A	96.B	97.A	98.D	99.C	100.D
101.A	102.A	103.D	104.A	105.B	106.C	107.B	108.D	109.C	110.A
111.C	112.B	113.C	114.A	115.**B**	116.D	117.C	118.A,C	119.A,B,D	120.A,D