BITSAT 2024 Memory Based Question Paper PDF

Physics

1. You measure two quantities as $A = 1.0\ m \pm 0.2\ m$, $B = 2.0\ m \pm 0.2\ m$. We should report correct value for $\sqrt{AB}$ as

A. $1.4\ m \pm 0.4\ m$

B. $1.41\ m \pm 0.15\ m$

C. $1.4\ m \pm 0.3\ m$

D. $1.4\ m \pm 0.2$

2. The dimensional formula of latent heat is:

A. $[M^0LT^{-2}]$

B. $[MLT^{-2}]$

C. $[M^0L^2T^{-2}]$

D. $[ML^2T^{-2}]$

3. The dimensions of coefficient of self inductance are

A. $[ML^{2}T^{-2}\ A^{-2}]]$

B. $[ML\ \ T^{-2}\ A^{-1}$

C. $[MLT^{-2}\ A^{-2}]]$

D. $[MLT^{-2}\ A^{-1}$

4. A particle is moving in a straight line. The variation of position ' x ' as a function of time ' t ' is given as $x = (t^3 - 6t^2 + 20t + 15)m$.

The velocity of the body when its acceleration becomes zero is:

A. 6 m/s

B. 10 m/s

C. 8 m/s

D. 4 m/s

5. The distance travelled by a particle starting from rest and moving with an acceleration $4/3\ ms^{-2}$, in the third second is:

A. 6 m

B. 4 m

C. 10/3 m

D. 19/3 m

6. A projectile is projected with velocity of 40 m/s at an angle θ with the horizontal. If R be the horizontal range covered by the projectile and after t seconds, its inclination with horizontal becomes zero, then the value of cot θ is
[Take, $g = 10\ m/s^2$]

A. $R/20t^2$

B. $R/10t^2$

C. $5R/t^2$

D. R/t^2

7. A rigid body rotates about a fixed axis with variable angular velocity equal to $\alpha - \beta t$, at the time t, where α,β are constants. The angle through which it rotates before it stops is

A. $\frac{\alpha^2}{2\beta}$

B. $\frac{\alpha^2-\beta^2}{2\alpha}$

C. $\frac{\alpha^2-\beta^2}{2\beta}$

D. $\frac{(\alpha-\beta)\alpha}{2}$

8. The range of the projectile projected at an angle of 15° with horizontal is 50 m. If the projectile is projected with same velocity at an angle of 45° with horizontal, then its range will be:

A. 50 m

B. $50\sqrt{2}$ m

C. 100 m

D. $100\sqrt{2}$ m

9. A particle of mass m is projected with a velocity ' u ' making an angle of 30° with the horizontal. The magnitude of angular momentum of the projectile about the point of projection when the particle is at its maximum height h is:

A. $\frac{\sqrt{3}}{16}\frac{mu^3}{g}$

B. $\frac{\sqrt{3}}{2}\frac{mu^2}{g}$

C. $\frac{mu^3}{\sqrt{2}g}$

D. zero

10. A body is thrown with a velocity of 9.8 ms making an angle of 30° with the horizontal. It will hit the ground after a time

A. 3.0 s

B. 2.0 s

C. 1.5 s

D. 1 s

11. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (where $m_2 > m_1$). If the acceleration of the system is $g/\sqrt{2}$, then the ratio of the masses m_1m_2 is:

A. $\frac{\sqrt{2}-1}{\sqrt{2}+1}$

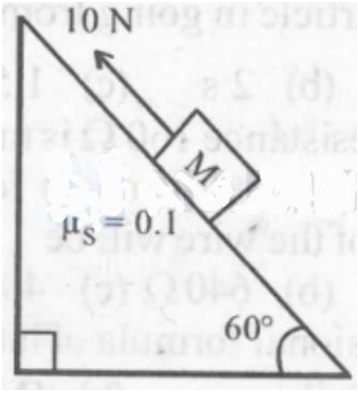
B. $\frac{1+\sqrt{5}}{\sqrt{5}-1}$

C. $\frac{1+\sqrt{5}}{\sqrt{2}-1}$

D. $\frac{\sqrt{3}+1}{\sqrt{2}-1}$

12. A block of mass 1 kg is pushed up a surface inclined to horizontal at an angle of 60° by a force of 10 N parallel to the inclined surface as shown in figure. When the block is pushed up by 10 m along inclined surface, the work done against frictional force is :

[g=10 m/s^2]



A. $5\sqrt{3}$ J

B. 5 J

C. 5×10^3 J

D. 10 J

13. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts moving upwards with an acceleration 1.0 m/s^2. If g = 10 ms^{-2}, the tension in the supporting cable is

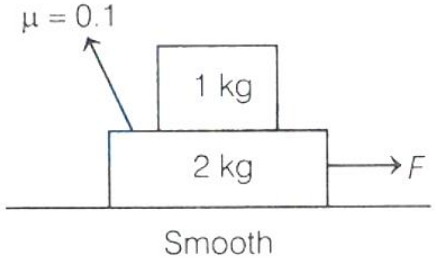
A. 8600 NB.

9680 NC.

11000 ND.

1200 N

14. A force of F − 0.5 N is applied on lower block as shown in figure. The work done by lower block
on upper block for a displacement of 3 m of the upper block with respect to ground is (Take, g = 10 m/s^2)



A. -0.5 J

B. 0.5 JC.

2 J

D. -2 J

15. A pendulum of mass 1 kg and length l = 1 m is released from rest at angle θ = 60°. The power delivered by all the forces acting on the bob at angle θ = 30° will be (Take, g = 10 m/s^2)

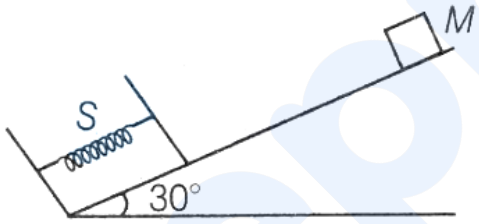
A. 13.4 W

B. 20.4 W

C. 24.6 W

D. zero

16. An ideal massless spring S can be compressed 1 m by a force of 100 N in equilibrium. The same spring is placed at the bottom of a frictionless inclined plane inclined at 30° to the horizontal. A 10 kg block M is released from rest at the top of the incline and is brought to rest momentarily after compressing the spring by 2 m. If g = 10 m/s^2, what is the speed of mass just before it touches the spring?



A. √20 m/s

B. √30 m/s

C. √10 m/s

D. √40 m/s

17. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m . It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m above the ground. The velocity attained by the ball is

A. 20 m/s

B. 40 m/s

C. 10√30 m/s

D. 10 m/s

18. A particle of mass 2 kg is on a smooth horizontal table and moves in a circular path of radius 0.6 m . The height of the table from the ground is 0.8 m. If the angular speed of the particle is 12rads^{-1}, the magnitude of its angular momentum about a point on the ground right under the centre of the circle is

A. 14.4 kg m^2 s^{-1}

B. 8.64 kg m^2 s^{-1}

C. 20.16 kg m^2 s^{-1}

D. 11.52 kg m^2 s^{-1}

19. A ball falling freely from a height of 4.9 m/s, hits a horizontal surface. If e = 3/4, then the ball will hit the surface, second time after

A. 1.0 s

B. 1.5 s

C. 2.0 s

D. 3.0 s

20. Two bodies of mass 1 kg and 3 kg have position vectors $\hat{i}+2\hat{j}+k$ and $-3\hat{i}-2\hat{j}+\hat{k}$ respectively. The magnitude of position vector of centre of mass of this system will be similar to the magnitude of vector :

A. $\hat{\mathrm{i}}-2\hat{\mathrm{j}}+\hat{\mathrm{k}}$

B. $-3\hat{i}-2\hat{j}+\hat{k}$

C. $-2\hat{i}+2\hat{k}$

D. $-2\hat{i}-\hat{j}+2\hat{k}$

21. The moment of inertia of a cube of mass m and side a about one of its edges is equal to

A. 2/3 ma^{22}

B. 4/3 ma

C. 3 ma^2

D. 8/3 ma^2

22. A body which is initially at rest at a height R above the surface of the Earth of radius R, falls freely towards the Earth, then its velocity on reaching the surface of the Earth is

A. $\sqrt{(2gR)}$

B. $\sqrt{(gR)}$

C. $\sqrt{\frac{3}{2}gR}$

D. $\sqrt{(4gR)}$

23. The distance between Sun and Earth is R. The duration of year if the distance between Sun and Earth becomes 3R will be:

A. $\sqrt{3}$ years

B. 3 years

C. 9 years

D. $3\sqrt{3}$ years

24. For a particle inside a uniform spherical shell, the gravitational force on the particle is

A. infinite

B. zero

C. $\frac{-Gm_1m_2}{r^2}$

D. $\frac{Gm_1\ m_2}{r^2}$

25. The kinetic energy of a satellite in its orbit around the earth is E. What should be the kinetic energy of the satellite so as to enable it to escape from the gravitational pull of the earth?

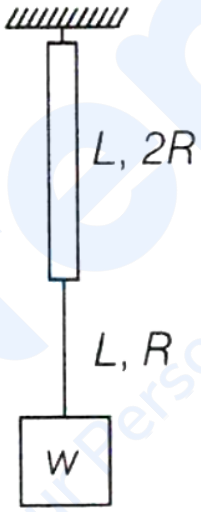
A. 4 E

B. 2 E

C. $\sqrt{2}$E

D. E

26. Two wires of the same material (Young's modulus = Y) and same length L but radii R and 2R respectively, are joined end to end and a weight ww is suspended from the combination as shown in the figure. The elastic potential energy in the system is



A. $\frac{3w^2L}{4\pi R^2Y}$

B. $\frac{3w^2L}{8\pi R^2Y}$

C. $\frac{5w^2L}{8\pi R^2Y}$

D. $\frac{w^2L}{\pi R^2Y}$

27. With rise in temperature, the Young's modulus of elasticity:

A. changes erratically

B. decreases

C. increases

D. remains unchanged

28. Young's modules of materials of a wire of Length ' L ' and cross-sectional area A is Y. If the length of the wire is doubled and cross-sectional area is halved then Young's modules will be:

A. Y/4

B. 4Y

C. Y

D. 2 Y

29. Pressure inside two soap bubbles are 1.01 and 1.02 atmosphere, respectively. The ratio of their volumes is:

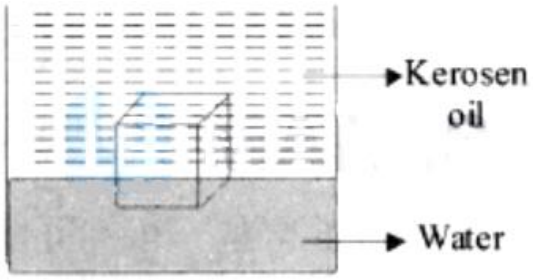
A. 4:1

B. 0.8:1

C. 8:1

D. 2:1

30. A cube of ice floats partly in water and partly in kerosene oil. The radio of volume of ice immersed in water to that in kerosene oil (specific gravity of Kerosene oil = 0.8, specific gravity of ice = 0.9)



A. 8:9

B.5:4

C. 9:10

D. 1:1

31. A solid metallic cube having total surface area 24 m^2 is uniformly heated. If its temperature is increased by 10°C, calculate the increase in volume of the cube.
(Given: $\alpha = 5.0 \times 10^{-4\circ} C^{-1}$)

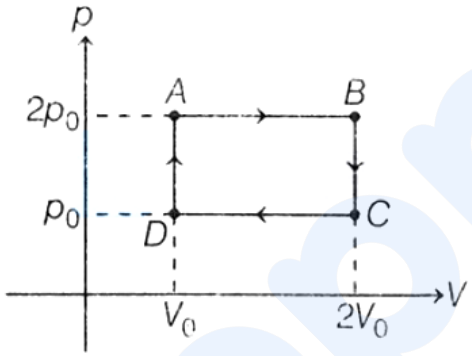
A. 2.4×10^6 cm^3

B. 1.2×10^5 cm^3

C. 6.0×10^4 cm^3

D. 4.8×10^5 cm^3

32. In the given cycle ABCDA, the heat required for an ideal monoatomic gas will be



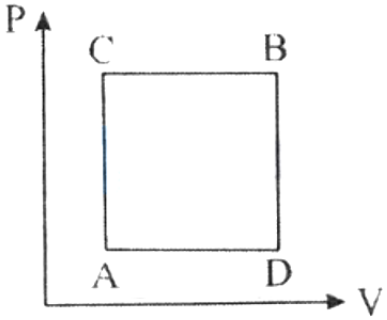
A. $_{p0}V_0$

B. $13/2$ $_{p0}V_{00}$

C. $11/2$ $_{p0}V$

D. 4 $_{p0}V_0$

33. A gas can be taken from A to B via two different processes ACB and ADB. When path ACB is used 60 J of heat flows into the system and 30J of work is done by the system. If path ADB is used work done by the system is 10 J. The heat Flow into the system in path ADB is :



A. 40 JB.

80 JC.

100 JD.

20 J

34. A source supplies heat to a system at the rate of 1000 W. If the system performs work at a rate of 200 W. The rate at which internal energy of the system increases

A. 1200 W

B. 600 W

C. 500 W

D. 800 W

35. On celcius scale the temperature of body increases by 40°C. The increase in temperature on Fahrenheit scale is:

A. 70°F

B. 68°F

C. 72 F

D. 75°F

36. In a mixture of gases, the average number of degree of freedoms per molecule is 6 . The rms speed of the molecule of the gas is c, then the velocity of sound in the gas is

A. $c/\sqrt{3}$

B. $c/\sqrt{2}$

C. $2c/3$

D. $3c/3$

37. The temperature of an ideal gas is increased from 200 K to 800 K . If r.m.s. speed of gas at 200 K is v_0. Then, r.m.s. speed of the gas at 800 K will be:

A. v_0

B. 4_{v0}

C. $v_0/4$

D. $2v_0$

38. Two vessels A and B are of the same size and are at same temperature. A contains 1 g of hydrogen and B contains 1 g of oxygen. P_A and P_B are the pressures of the gases in A and B respectively, then P_A/P_B is:

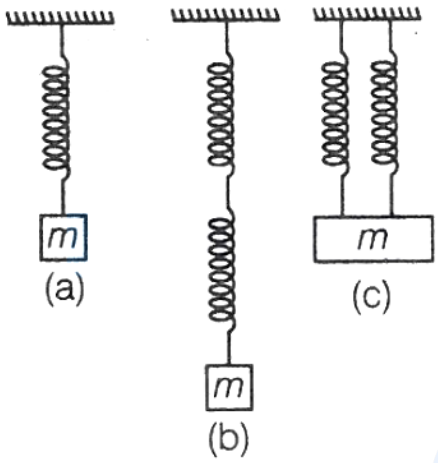
A. 8

B. 16

C. 32

D. 4

39. Five identical springs are used in the three configurations as shown in figure. The time periods of vertical oscillations in configurations (a), (b) and (c) are in the ratio.



A. $1 : \sqrt{2} : \frac{1}{\sqrt{2}}$

B. $2 : \sqrt{2} : \frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{2}} : 2 : 1$

D. $2 : \frac{1}{\sqrt{2}} : 1$

40. A particle executes simple harmonic motion between $x = -A$ and $x = +A$. If time taken by particle to go from $x = 0$ to $A/2$ is 2s; then time taken by particle in going from $x = A/2$ to A is:

A. 3 s

B. 2 s

C. 1.5 s

D. 4 s

41. A simple pendulum doing small oscillations at a place R height above earth surface has time period of $T_1 = 4$ s. T_2 would be it's time period if it is brought to a point which is at a height 2R from earth surface. Choose the correct relation [R = radius of Earth]:

A. $T_1 = T_2$

B. $2\ T_1 = 3\ T_2$

C. $3\ T_1 = 2\ T_2$

D. $2\ T_1 = T_2$

42. The speed of sound in oxygen at S.T.P. will be approximately:

(Given, $R = 8.3 JK^{-1}$, $\gamma = 1.4$)

A. 315 m/s

B. 333 m/s

C. 341 m/s

D. 325 m/s

43. A plane progressive wave is given by $y = 2 \cos 2\pi(330t - x)$m. The frequency of the wave is:

A. 165 Hz

B. 330 Hz

C. 660 Hz

D. 340 Hz

44. An oil drop of radius 1μ m is held stationary under a constant electric field of 3.65×10^4 N/C due to some excess electrons presence on it. If the density of oil drop is 1.26 g/cm^3, then number of excess electrons on the oil drop approximately are

[Take, $g = 10$ ms^{-2}]

A. 7

B. 12

C. 9

D. 8

45. The potential of a large liquid drop when eight liquid drops are combined is 20 V, then the potential of each single drop was

A. 10 V

B. 7.5 V

C. 5 V

D. 2.5 V

46. A dust particle of mass 4×10^{-12}mg in suspended in air under the influence of an electric field of 50 N/C directed vertically upwards. How many electrons were removed from the neutral dust particle? [Take, $g = 10\ m/s^2$]

A. 15

B. 8

C. 5

D. 4

47. Electric field at point (30,30,0) due to a charge of 0.008μC placed at origin will be, (coordinates are in cm)

A. $8000NC-18000NC-1$

B. $4000(\hat{i} + \hat{j})NC^{-1}$

C. $200\sqrt{2}(\hat{i} + \hat{j})NC^{-1}$

D. $400\sqrt{2}(\hat{i} + \hat{j})NC^{-1}$

48. If two charges q_1 and q_2 are separated with distance ' d ' and placed in a medium of dielectric constant K. What will be the equivalent distance between charges in air for the same electrostatic force?

A. $d\sqrt{K}$

B. $K\sqrt{d}$

C. $1.5d\sqrt{K}$

D. $2d\sqrt{K}$

49. Electric potential at a point 'P' due to a point charge of 5×10^{-9} C is 50 V. The distance of ' P ' from the point charge is:
(Assume, $1/4\pi\varepsilon_0 = 9 \times 10^{+9} Nm^2C^{-2}$)

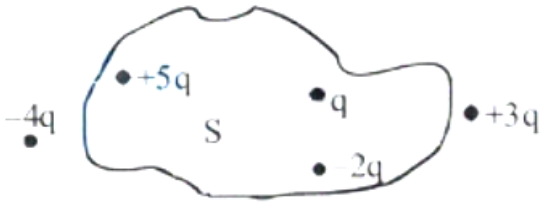
A. 3 cm

B. 9 cm

C. 90 cmD

. 0.9 cm

50. Five charges +q, +5q, −2q, + 3q and −4q are situated as shown in the figure, The electric flux due to this configuration through the surface S is:



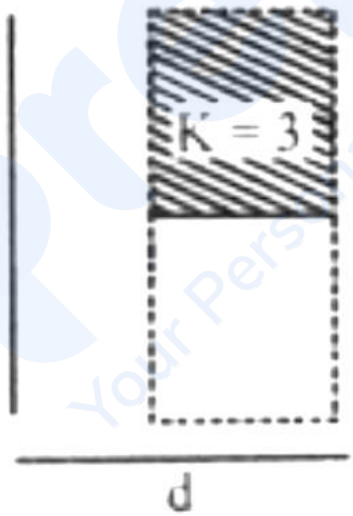
A. $5q/\epsilon_0$

B. $4q/\epsilon_0$

C. $3q/\epsilon_0$

D. q/ϵ_0

51. A parallel plate capacitor with plate area A and plate separation d = 2 m has a capacitance of 4μ F.The new capacitance of the system if half of the space between them is filled with a dielectric material of dielectric constant K = 3 (as shown in figure) will be:



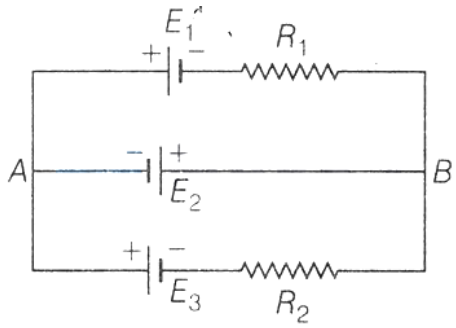
A. 2μ FB.

32μ FC.

6μ FD. 8

μ F

52. In the given circuit, $E_1 = E_2 = E_3 = 2$ V and $R_1 = R_2 = 4\Omega$, then current flowing through the branch AB is



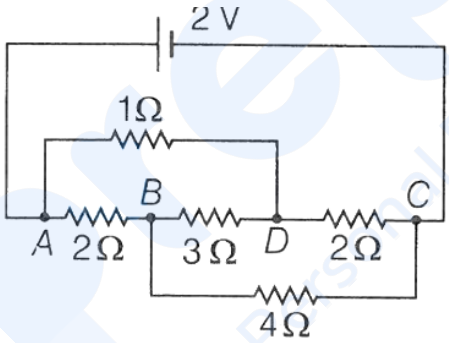
A. zero

B. 2A from A and B

C. 2A from B to A

D. 5A from B to B

53. In the following circuitdiagram, when 3Ω resistor is removed, then equivalent resistance of the network



A. increases

B. decreases

C. remains same

D. None of these

54. A conducting wire is stretched by applying a deforming force, so that its diameter decreases to 40% of original value. The percentage change in its resistance will be

A. 0.9%

B. 0.12%

C. 1.6%

D. 0.5%

55. A wire of resistance 160Ω is melted and drawn in wire of one-fourth of its length. The new resistance of the wire will be

A. 10Ω

B. 640Ω

C. 40Ω

D. 16Ω

56. Five cells each of emf E and internal resistance r send the same amount of current through an external resistance R whether the cells are connected in parallel or in series. Then the ratio (R/r) is

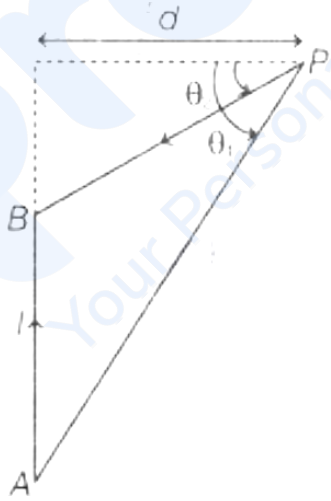
A. 2

B. 1/2

C. 1/5

D. 1

57. The straight wire AB carries a current I. The ends of the wire subtend angles θ_1 and θ_2 at the point P as shown in figure. The magnetic field at the point P is



A. $\frac{\mu_0 I}{4\pi d}(\sin\theta_1 - \sin\theta_2)$

B. $\frac{\mu_0 I}{4\pi d}(\sin\theta_1 + \sin\theta_2)$

C. $\frac{\mu_0 I}{4\pi d}(\cos\theta_1 - \cos\theta_2)$

D. $\frac{\mu_0 I}{4\pi d}(\cos\theta_1 + \cos\theta_2)$

58. A long straight wire of radius a carries a steady current 1. The current is uniformly distributed across its cross section. The ratio of the magnetic field at a/2 and 2a from axis of the wire is:

A. 1:4

B. 4:1

C. 1:1

D. 3:4

59. The electrostatic force $\left(\vec{F}_1\right)$ and magnetic force $\left(\vec{F}_2\right)$ acting on a charge q moving with velocity v can be written:

A. $\vec{F}_1 = q\vec{V} \cdot \vec{E}, \vec{F}_2 = q(\vec{B} \cdot \vec{V})$

B. $\vec{F}_1 = q\vec{B}, \vec{F}_2 = q(\vec{B} \times \vec{V})$

C. $\vec{F}_1 = q\vec{E}, \vec{F}_2 = q(\vec{V} \times \vec{B})$

D. $\vec{F}_1 = q\vec{E}, \vec{F}_2 = q(\vec{B} \times \vec{V})$

60. Inside a solenoid of radius 0.5 m , magnetic field is changing at a rate of 50×10^{-6} T/s. Acceleration of an electron placed at a distance of 0.3 m from axis of solenoid will be

A. $23 \times 10^{66} ms^{-2}$

B. 26×10 m/s^2

C. 1.3×10^9 ms^{-2}

D. 26×10^9 m/s^2

61. There are two long co-axial solenoids of same length l. The inner and outer coils have radii r_1 and r_2 and number of turns per unit length n_1 and n_2, respectively. The ratio of mutual inductance to the self-inductance of the inner-coil is:

A. $\frac{n_1}{n_2}$

B. $\frac{n_2}{n_1} \cdot \frac{n_1}{r_2}$

C. $\frac{n_2}{n_1} \cdot \frac{r_2^2}{r_1^2}$

D. $\frac{n_2}{n_1}$

62. A rectangular loop of length 2.5 m and width 2 m is placed at 60° to a magnetic field of 4 T . The loop is removed from the field in 10 sec. The average emf induced in the loop during this time is

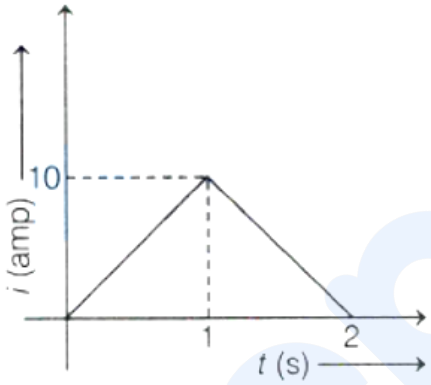
A. -2 V

B. $+2$ V

C. $+1$ V

D. -1 V

63. Find the average value of current shown graphically from t = 0 to t = 2 s.



A. 3 A

B. 5 A

C. 10 A

D. 4 A

64. In an ac circuit, an inductor, a capacitor and a resistor are connected in series with $X_L = R = X_C$. Impedance of this circuit is:

A. $2R^2$

B. Zero

C. R

D. $R\sqrt{2}$

65. An alternating voltage $V(t) = 220 \sin 100\pi t$ volt is applied to a purely resistive load of 50Ω. The time taken for the current to rise from half of the peak value to the peak value is:

A. 5 ms

B. 3.3 ms

C. 7.2 ms

D. 2.2 ms

66. A parallel plate capacitor consists of two circular plates of radius R = 0.1 m. They are separated by a short distance. If electric field between the capacitor plates changes as $\frac{dE}{dt} = 6 \times 10^{13} \frac{\text{V}}{\text{m} \times \text{s}}$, then the value of displacement current is

A. 15.25 A

B. 6.25 A

C. 16.67 A

D. 4.69 A

67. Electromagnetic waves travel in a medium with speed of 1.5×10^8 ms^{-1}. The relative permeability of the medium is 2.0 . The relative permittivity will be :

A. 5

B. 1

C. 4

D. 2

68. Power of biconvex lens is P diopter. When it is cut into two symmetrical halves by a plane containing the principal axis. The ratio of power of two halves is

A. 1:2

B. 2:1

C. 1:4

D. 1:1

69. The magnifying power of a telescope is 9. When it is adjusted for parallel rays, the distance between the objective and eyepiece is 20 cm. The ratio of focal length of objective lens to focal length of eyepiece is found to be m, then the value of m is

A. 8

B. 7

C. 9

D. 12

70. In normal adjustment, for a refracting telescope, the distance between objective and eye piece is 30 cm. The focal length of the objective, when the angular magnification of the telescope is 2, will be:

A. 20 cm

B. 30 cm

C. 10 cm

D. 15 cm

71. If the distance between object and its two times magnified virtual image produced by a curved mirror is 15 cm, the focal length of the mirror must be:

A. $10/3$ cm

B. -12 cm

C. -10 cm

D. 15 cm

72. Young's double slit experiment is performed in a medium of refractive index of 1.33 . The maximum intensity is I_0. The intensity at a point on the screen, where path difference between the light coming out from slits is $\lambda/4$, is

A. 0

B. $I_0/2$

C. $3I_0/8$

D. $2I/3$

73. In YDSE, monochromatic light falls on a screen 1.80 m from two slits separated by 2.08 mm . The first and second order bright fringes are separated by 0.553 mm . The wavelength of light used is

A. 520 nm

B. 639 nm

C. 715 nm

D. None of these

74. A microwave of wavelength 2.0 cm falls normally on a slit of width 4.0 cm . The angular spread of the central maxima of the diffraction pattern obtained on a screen 1.5 m away from the slit, will be:

A. 60◦

B. 45◦

C. 15

D. 30

75. The property of light which cannot be explained by Huygen's construction of wavefront is

A. Refraction

B. Reflection

C. Diffraction

D. Origin of spectra

76. When a light ray incidents on the surface of a medium, the reflected ray is completely polarized. Then the angle between reflected and refracted rays is

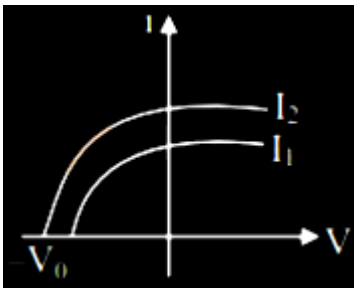
A. 45◦

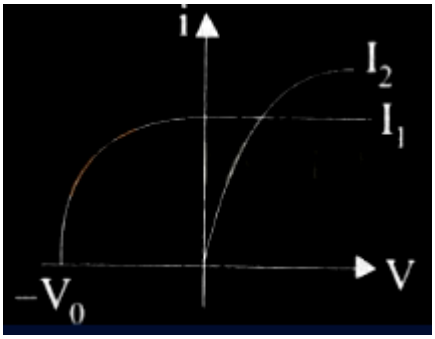
B. 90

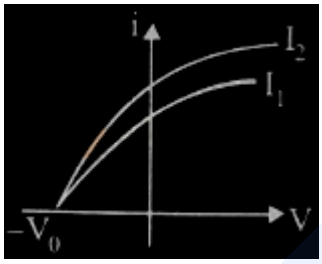
C. 120◦

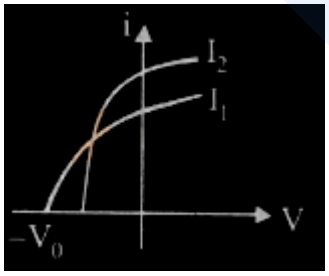
D. 180

77. Which figure shows the correct variation of applied potential difference (V) with photoelectric current (I) at two different intensities of light ($I_1 < I_2$) of same wavelengths:

A. 

B. 

C. 

D. 

78. The acceptor level of a p-type semiconductor is 6 eV. The maximum wavelength of light which can create a hole would be : Given hc = 1242eV nm .

A. 407 nm

B. 414 nm

C. 207 nm

D. 103.5 nm

79. When light is incident on a metal surface the maximum kinetic energy of emitted electrons

A. vary with intensity of light

B. vary with frequency of light

C. vary with speed of light

D. vary irregularly

80. If the kinetic energy of a free electron doubles, it's de-Broglie wavelength changes by the factor

A. 2

B. 1/2

C. $\sqrt{2}$

D. $1/\sqrt{2}$

81. Which of the following transitions of He^+ ion will give rise to spectral line which has same wavelength as the spectral line in hydrogen atom?

A. $n = 4$ to $n = 2$

B. $n = 6$ to $n = 5$

C. $n = 6$ to $n = 3$

D. None of these

82. The ratio of the shortest wavelength of Balmer series to the shortest wavelength of Lyman series for hydrogen atom is:

A. 4:1

B. 1:2

C. 1:4

D. 2:1

83. The minimum excitation energy of an electron revolving in the first orbit of hydrogen is

A. 3.4 eV

B. 8.5 eV

C. 10.2 eV

D. 13.6 eV

84. The atomic mass of $_6C^{12}$ is 12.000000 u and that of $_6C^{13}$ is 13.003354 u. The required energy to remove a neutron from $_6C^{13}$, if mass of neutron is 1.008665 u , will be:

A. 62.5 MeV

B. 6.25 MeV

C. 4.95 MeV

D. 49.5 MeV

85. The nucleus having highest binding energy per nucleon is

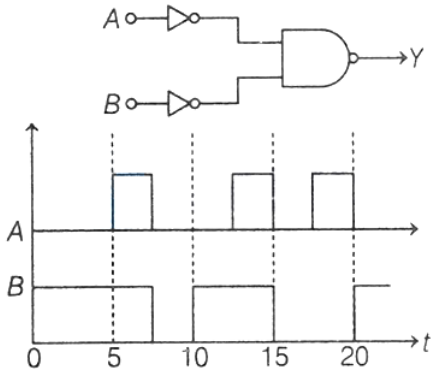
A. $^{16}_{8}O$

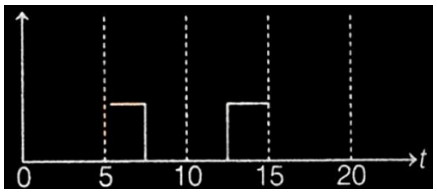
B. $^{56}_{26}Fe$

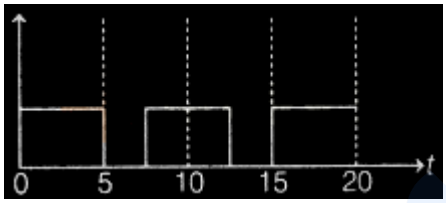
C. $^{208}_{84}Pb$

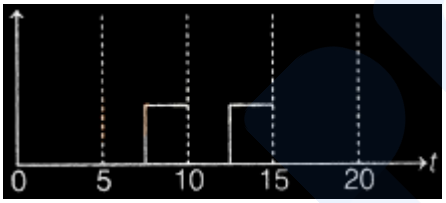
D. $^{4}_{2}He$

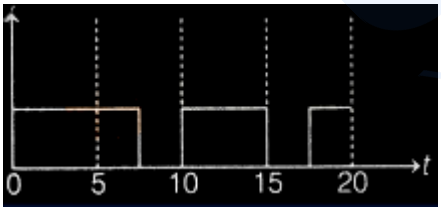
86. Identify the correct output signal Y in the given combination of gates for the given inputs A and B shown in the figure.



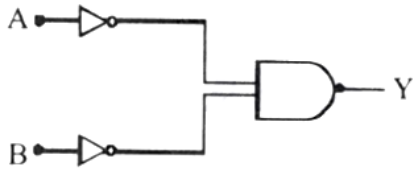
A. 

B. 

C. 

D. 

87. Identify the logic gate given in the circuit:



A. NAND - gate

B. OR - gate

C. AND gate

D. NOR gate

88. A reverse biased zener diode when operated in the breakdown region works as

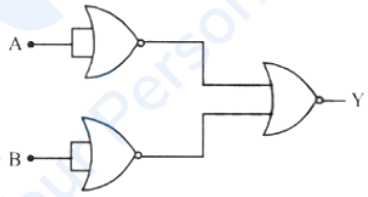
A. an amplifier

B. an oscillator

C. a voltage regulator

D. a rectifier

89. Identify the logic operation performed by the following circuit.



A. OR

B. AND

C. NOT

D. NAND

90. One main scale division of a vernier caliper is equal to m units. If m^{th} division of main scale coincides with $(n + 1)^{th}$ division of vernier scale, the least count of the vernier caliper is:

A. $\frac{n}{(n+1)}$

B. $\frac{m}{(n+1)}$

C. $\frac{1}{(n+1)}$

D. $\frac{m}{n(n+1)}$

Chemistry

1. 1 L closed flask contains a mixture of 4 g of methane and 4.4 g of carbon dioxide. The pressure inside the flask at 27°C is [Assume ideal behaviour of gases]:

A. 8.6 atm

B. 2.2 atm

C. 4.2 atm

D. 6.1 atm

2. In which mode of expression, the concentration of a solution remains independent of temperature?

A. Molarity

B. Normality

C. Fermality

D. Molality

3. The degeneracy of hydrogen atom that has energy equal to $\frac{-R_H}{9}$ is (where, R_H = Rydberg constant)

A. 6

B. 8

C. 5

D. 9

4. If the de-broglie wavelength of a particle of mass (m) is 100 times its velocity. Then, its value in terms of its mass (m) and plank constant (h) is

A. $\frac{1}{10}\sqrt{\frac{m}{h}}$

B. $10\sqrt{\frac{h}{m}}$

C. $\frac{1}{10}\sqrt{\frac{h}{m}}$

D. $10\sqrt{\frac{m}{h}}$

5. The energy of second orbit of hydrogen atom is -5.45×10^{-19} J. What is the energy of first orbit of Li^{2+} ion (in J) ?

A. -1.962×10^{-18}

B. -1.962×10^{-17}

C. $-3.924 \times 10^{-17}-$

D. -3.924×10^{18}

6. A photon of wavelength 3000Ã... strikes a metal surface. The work function of the metal is 2.13 eV. What is the kinetic energy of the emitted photoelectron?

($h = 6.626 \times 10^{-34}$Js)

A. 4.0 eV

B. 3.0 eV

C. 2.0 eV

D. 1.0 eV

7. A stream of electrons from a heated filament was passed between two charged plates kept at a potential difference V volt. If 'e' and m are charge and mass of an electron, respectively, then the value of h/λ (where λ is wavelength associated with electron wave) is given by:

A. $\sqrt{meV}$

B. $\sqrt{2meV}$

C. meV

D. 2meV

8. Electron affinity is positive, when

A. O changes into O^-

B. O^-changes to O^{2-}

C. O changes into O^+

D. O changes to O^{2+}

9. The ionic radii in (Ã…) of N^{3-}, O^{2-} and F^- are respectively.

A. 1.71, 1.40 and 1.36

B. 1.71, 1.36 and 1.40

C. 1.36, 1.40 and 1.71

D. 1.36, 1.71 and 1.40

10. Intramolecular hydrogen bonding is found in

A. o-nitrophenol

B. m-nitrophenol

C. p-nitrophenol

D. phenol

11. The hybridisation scheme for the central atom includes a d-orbital contribution in

A. I_3^-

B. PCl_3

C. NO_3^-

D. H_2Se

12. In the following species, how many species have same magnetic moment?

(i) Cr^{2+}
(ii) Mn^{3+}
(iii) Ni^{3+}
(iv) Sc^{2+}
(v) Zn^{2+}
(vi) V^{3+}
(vii) Ti^{+}

A. 1

B. 3

C. 2

D. 4

13. The spin only magnetic moment of Fe^{3+} ion (in BM) is approximately.

A. 4

B. 5

C. 6

D. 7

14. Which one of the following compounds is having maximum 'lone pair-lone pair' electron repulsions?

A. ClF_3

B. IF_5

C. SF_4

D. XeF_2

15. Identify the species having one ππ-bond and maximum number of canonical forms from the following:

A. SO_3

B. O_2

C. SO_2

D. CO_3^{2-}

16. $sp^3 d^2$ hybridisation is not displayed by :

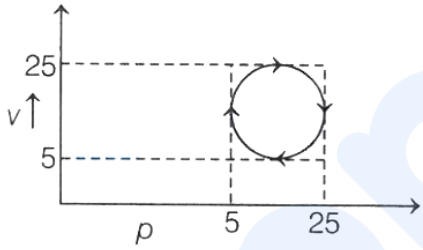
A. BrF_5

B. SF_6

C. $[CrF_6]^{3-}$

D. PF_5

17. What would be the amount of heat absorbed in the cyclic process shown below?



A. 5π J

B. 15π J

C. 25π J

D. 100π J

18. The bond dissociation energy of X_2, Y_2 and XY are in the ratio of 1 : 0.5 : 1. ΔH for the formation of XY is -200 kJ/mol. The bond dissociation energy of X_2 will be

A. 200 kJ/mol

B. 100 kJ/mol

C. 400 kJ/mol

D. 800 kJ/mol

19. Which of the following relation is not correct?

A. $\Delta H = \Delta U - P\Delta V$

B. $\Delta U = q + W$

C. $\Delta S_{svs} + \Delta S_{surr} \geq 0$

D. $\Delta G = \Delta H - T\Delta S$

20. The standard Gibbs energy (ΔG^0) for the following reaction is

$A(s) + B^{2+}(aq) \rightarrow A^{2+}(aq) + B(s)$, $Kc = 10^{12}$at

(K_c = equilibrium constant)

A. -150 kJ

B. -96.80 kJ

C. -68.47 kJ

D. -100 kJ

21. The combustion of benzene (L) gives $CO_2(g)$ and $H_2O(L)$. Given that heat of combustion of benzene at constant volume is -3263.9 kJ mol^{-1} at 25°C; heat of combustion (in $kJmol^{-1}$) of benzene at constant pressure will be:

($R = 8.314JK^{-1}$ mol^{-1})

A. 4152.6

B. 452.46

C. 3260

D. -3267.6

22. Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following:

A. $q = 0, \Delta T \neq 0, w = 0$

B. $q = 0, \Delta T < 0, w \neq 0$

C. $q = \neq 0, \Delta T = 0, w = 0$

D. $q = 0, \Delta T = 0, w = 0$

23. Le-Chateliers' principle is not applicable to

A. $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

B. $Fe(s) + S(s) \rightleftharpoons FeS(s)$

C. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

D. $N\ (g) + O_2(g) \rightleftharpoons 2NO(g)$

25. The pH of 1 N aqueous solutions of HCl, CH_3COOH and HCOOH follows the order:

A. $HCl > HCOOH > CH_3OOH$

B. $HCl = HCOOH > CH_3COOH$

C. $CH_3COOH > HCOOH > HCl$

D. $CH_3COOH = HCOOH > HCl$

26. 20 mL of 0.1 M acetic acid is mixed with 50 mL of potassium acetate. K_α of acetic acid $= 1.8 \times 10^{-5}$ at 27°C. Calculate the concentration of potassium acetate if pH of mixture is 4.8 .

A. 0.1 M

B. 0.04 M

C. 0.03 M

D. 0.02 M

27. What is the stoichiometric coefficient of SO_2 in the following balance reaction?

$$MnO_4^-(aq) + SO_2(g) \longrightarrow Mn^{2+}(aq) + HSO_4^-(aq)$$

(in acidic solution)

A. 5

B. 4

C. 3

D. 2

28. Volume of $M/8KMnO_4$ solution required to react completely with 25.0 cm^3 of $M/4FeSO_4$ in acidic medium is.

A. 8.0 mL

B. 5.0 mL

C. 15.0 mL

D. 10.0 mL

29. Which of the following is only a redox reaction but not a disproportionation reaction?

A. $4H_3PO_3 \rightarrow 3H_3PO_4 + PH_3$

B. $2H_2O_2 \rightarrow 2H_2O + O_2$

C. $P_4 + 3NaOH + 3H_2O \rightarrow 3NaH_2PO_2 + PH_3$

D. $P_4 + 8SOCl_2 \rightarrow 4PCl_3 + 2S_2Cl_2 + 4SO_2$

30. Among the following the correct statements are

I. LiH, BeH_2 and MgH_2 are saline hydrides with significant covalent character

II. Saline hydrides are volatile

III. Electron - precise hydrides are Lewis bases

IV. The formula for chromium hydride is CrH

A. I, III only

B. II, IV only

C. I, IV only

D. III, IV only

31. In which of the following reactions of H_2O_2 acts as an oxidising agent (either in acidic, alkaline or neutral medium)?

(i) $2Fe^{2+} + H_2O_2 \rightarrow$

(ii) $2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow$

(iii) $I_2 + H_2O_2 + 2OH^- \rightarrow$

(iv) $Mn^{2+} + H_2O_2 \rightarrow$

A. (ii),(iii)

B. (i), (iv)

C. (i), (iii)

D. (ii), (iv)

32. The strongest reducing agent among the following is:

A. SbH_3

B. NH_3

C. BiH_3

D. PH_3

33. The correct order of melting points of the following salts is

LiCl	LiF	LiI
I	II	III

A. I > II > IIII

B. II > I > III

C. III > II > I

D. II > III > I

34. Which among the following is used in detergent

A. Sodium acetate

B. Sodium stearate

C. Calcium stearate

D. Sodium lauryl sulphate

35. Thermal decomposition of lithium nitrate gives

A. LiO_2, O_2, NO_2

B. Li_2O, O_2, N_2O

C. Li_2O, O2, N_2

D. Li_2O, O_2, NO_2

36. The number of geometrical isomers possible for the compound, $CH_3CH = CH - CH = CH_2$ is

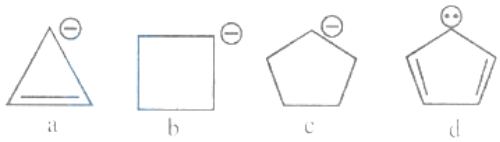
A. 2

B. 3

C. 4

D. 6

37. Correct order of stability of carbanion is



A. C > B > D > A

B. A > B > C > D

C. D > A > C > B

D. D > C > B > A

38. Which of the following is not correct about Grignard reagent?

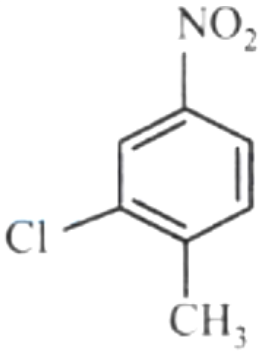
A. It is a nucleophile

B. Forms new carbon-carbon bond

C. Reacts with carbonyl compounds

D. It is an organomanganese compound

39. The IUPAC name of the following molecule is



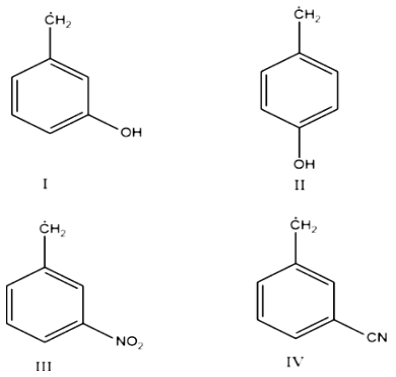
A. 2-Methyl-5 nitro-1-chlorobenzene

B. 3-Chloro-4 methyl-1-nitrobenzene

C. 2-Chloro-1 methyl-4-nitorbenzene

D. 2-Chloro-4 nitro-1-methylbenzene

40. Choose the correct stability order of the given free radicals.



A. I > II > III > IV

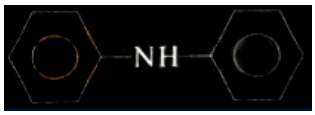
B. II > I > IV > III

C. II = I > IV > III

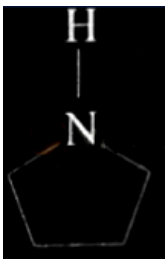
D. III > IV > II > I

41. Which of the following is strongest Bronsted base?

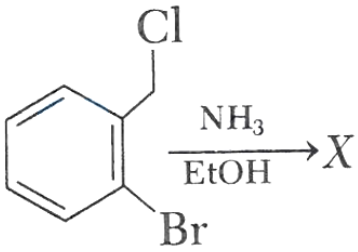
A. 

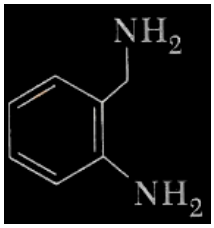
B. 

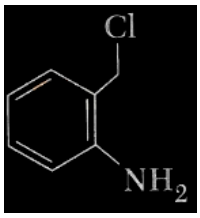
C. 

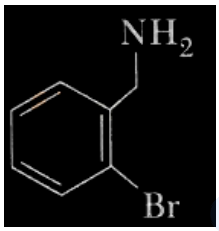
D. 

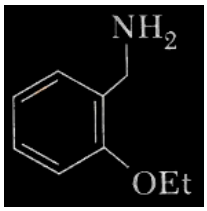
42. The major product X in the following given reaction is



A. 

B. 

C. 

D. 

43. The major product of the reaction between CH_3CH_2ONa and $(CH_3)_3CCl$ in ethanol is

A. $CH_3CH_2OC(CH_3)_3$

B. $CH_3=C(CH_3)_2$

C. $CH\ CH_2C(CH_3)_3$

D. $CH\ CH=CHCH_3$

44. Dinitrogen is a robust compound, but reacts at high altitude to form oxides. The oxide of nitrogen that can damage plant leaves and retard photosynthesis is :

A. NO

B. $NO_{3^{-}2}$

C. $NO^{2^{-}}$

D. NO

45. A decimolar solution potassium ferrocyanide is 50% dissociated at 300 K. The osmotic pressure of solution is ($R = 8.314 JK^{-1}\ mol^{-1}$)

A. 7.48 atm

B. 4.99 atm

C. 3.74 atm

D. 6.23 atm

46. 58.5 g of NaCl and 180 g of glucose were separately dissolved in 1000 mL of water. Identify the correct statement regarding the elevation of boiling point of the resulting solution.

A. NaCl solution will show higher elevation of boiling point.

B. Glucose solution will show higher elevation of boiling point.

C. Both the solution will show equal elevation of boiling point.

D. None will show boiling point elevation.

47. One molar concentration of a solution represents :

A. 1 mole of solute in 1 kg of solution.

B. 1 mole of solute in 1 L of solution.

C. 1 mole of solvent in 1 kg of solution.

D. 1 mole of solvent in 1 L of solution.

48. Which of the following substances show the highest colligative properties?

A. $0.1M BaCl_2$

B. $0.1M AgNO_3$

C. 0.1 M urea

D. $0.1M (NH_4)_3PO_4$

49. The pH of 0.5 L of 1.0 M NaCl solution after electrolysis for 965 s using 5.0 A current is,

A. 1.0

B. 12.7

C. 1.30

D. 13.0

50. Calculate the molarity of a solution containing 5 g of NaOH dissolved in the product of $H_2 - O_2$ fuel cell operated at 1 A current for 595.1 hours. (Assume F = 96500C/mol of electron and molecular weight of NaOH as 40 g mol^{-1}).

A. 0.625 M

B. 0.05 M

C. 0.1 M

D. 6.25 M

51. When the same quantity of electricity is passed through the aqueous solutions of the given electrolytes for the same amount of time, which metal will be deposited in maximum amount on the cathode?

A. $ZnSO_4$

B. $FeCl_3$

C. $AgNO_3$

D. $NiCl_2$

52. For the reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3$, the rate of disappearance of O_2 is 2×10^{-4} mol L^{-1} s^{-1}. The rate appearance of SO_3 is

A. 2×10^{-4} mol L^{-1} s^{1}

B. 4×10^{-4} mol L^{-1} s^{-1}

C. 1×10^{-1} mol L^{-1} s^{-1}

D. 6×10^{4} mol L^{1} ^{1}

53. If for a first order reaction, the value of A and E_a are $4 \times 10^{13}\ s^{-1}$ and 98.6 kJ mol^{-1} respectively, then at what temperature will its half life period be 10 minutes?

A. 330 K

B. 300 K

C. 330.95 K

D. 311.15 K

54. In the chemical reaction A → B, what is the order of the reaction? Given that, the rate of reaction doubles if the concentration of A is increased four times.

A. 2

B. 1.5

C. 0.5

D. 1

55. Calculate the activation energy of a reaction, whose rate constant doubles on raising the temperature from 300 K to 600 K .

A. 3.45 kJ/mol

B. 6.90 kJ/mol

C. 9.68 kJ/mol

D. 19.6 kJ/mol

56. In the reaction, A → products, If the concentration of the reactant is doubled rate of the reaction remains unchanged. The order of the reaction with respect to A is

A. 1

B. 2

C. 0.5

D. 0

57. In a first order reaction, the concentration of the reactant, decreases from 0.8 M to 0.4 M in 15 minutes. The time taken for the concentration to change from 0.1 M to 0.025 M is

A. 7.5 minutes

B. 15 minutes

C. 30 minutes

D. 60 minutes

58. The charge on colloidal particies is due to

A. presence of electrolyte

B. very small size of particles

C. adsorption of ions from the solution

D. can't be determined

59. The chemical composition of 'slag' formed during the smelting process in the extraction of copper is

A. $Cu_2O + FeS$

B. $FeSiO_3$

C. $CuFeS_2$

D. $Cu_2S + FeO$

60. Calamine, malachite, magnetite and cryolite, respectively, are

A. $ZnCO_3$, $CuCO_3 \cdot Cu(OH)_2$, Fe_3O_4, Na_3AlF_6

B. $ZnSO$, $Cu(OH)_2$, Fe_3O_4, Na_3AlF_6

C. $ZnSO_4$, $CuCO_3$, Fe_2O , AlF_3

D. $ZnCO_3$, $CuCO_3$, Fe_2O_3, Na_3AlF_6

61. In which of the following molecules, all bond lengths are not equal?

A. SF_6

B. PCl_5

C. BCl_3

D. CCl_4

62. The sol formed in the following unbalanced equation is

$As_2O_3 + H_2S \rightarrow$

A. As_2S_3

B. As S

C. As

D. S

63. Which of the following has least tendency to liberate H, from mineral acids?

A. Cu

B. Mn

C. Ni

D. Zn

64. The metal that shows highest and maximum number of oxidation state is:

A. Fe

B. Mn

C. Ti

D. Co

65. Hybridisation and geometry of $[Ni(CN)_4]^{2-}$ are

A. sp^3d and tetrahedral

B. sp^3 and square planar

C. sp and tetrahedral

D. dsp^2 and square planar

66. Match List I with List II.

	List I (Complex)		List II (Oxidation number of metal)
A.	$Ni(CO)_4$	I.	+1
B.	$[Fe(H_2O)_5NO]^{2+}$	II.	Zero
C.	$[Co(CO)_5]^{2-}$	III.	−1
D.	$[Cr_2(CO)_{10}]^{2-}$	IV.	−2

Choose the correct answer from the options given below:

A. A-II, B-I, C-IV, D-III

B. A-II, B-IV, C-I, D-III

C. A-II, B-III, C-I, D-IV

D. A-I, B-II, C-IV, D __III

67. Which of the following is correct order of ligand field strength?

A. $S^{2-} < NH_3 < en < CO < C_2O_4^{2-}$

B. $S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$

C. $NH_3 < en < CO < S^{2-} < C_2O_4^{2-}$

D. $S^{2-} < NH_3 < en < CO < C_2O_4^{2-}$

68. The correct statement among the following is;

A. Ferrocene has two cyclohexadiene rings coordinated to iron atom.

B. Ferrocene has two cyclopentadienyl anion rings bonded to iron (II) ion.

C. Perxenate ion is $[XeO_2\ F_2]^{2-}$

D. Perxenate ion is tetrahedral is shape.

69. The type of isomerism present in nitropentammine chromium (III) chloride is

A. optical

B. linkage

C. ionization

D. polymerisation.

70. Identify, from the following, the diamagnetic, tetrahedral complex

A. $[Ni(Cl)_4]^{2-}$

B. $[Co(C_2O_4)_3]^3$

C. $[Ni(CN)_4]^{2-}$

D. $[Ni(CO)_4]$

71. Ferrocene is:

A. $Fe(n^{52}- C_5H_5)_2$

B. $Fe(n^5 - C_5H_5)$

C. $Cr(n - C H_5$

D. $Os(n^5 - C_5H_5)_2$

72. The chemical name of calgon is

A. Sodium hexametaphosphite

B. Potassium hexametaphosphate

C. Calcium hexametaphosphate

D. Sodium hexametaphosphate

73. The complex with highest magnitude of crystal field splitting energy (Δ_0) is

A. $[Cr(OH_2)_6]^{3+}$

B. $[Ti(OH_2)_6]^{3+}$

C. $[Fe(OH)_6]^{3+}$

D. $[Mn(OH_2)_6]^{3+}$

74. IUPAC name of $[Pt(NH_3)_2Cl(NH_2CH_3)]$ Cl is

A. (Amino methane) chloro (diammine) platinum (II) chloride.

B. Chlorodiammine (methanamine) platinum(II) chloride.

C. Diamminechloro(methanamine) platinum(II) chloride.

D. Diamminechloro(methylamine) platinum(IV) chloride.

75. Which of the following complexes will exhibit maximum attraction to an applied magnetic field?

A. $[Zn(H_2O)_6]^{2+}$

B. $[Co(H\ O)\ ^{+}$

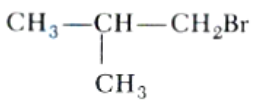
C. $[Co(en)_3]^{3+}$

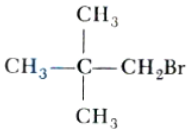
D. $[Ni(H_2O)_6]^{2+}$

76. In S_N2 substitution reaction of the type

$$R - Br + Cl^- \xrightarrow[BMF]{} R - Cl + Br^-$$

Which one of the following has highest relative rate

A. 

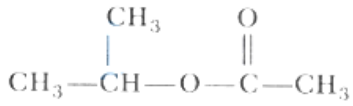
B. 

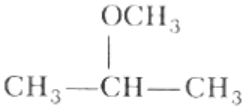
C. $CH\ _3CH_2Br$

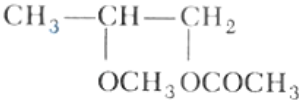
D. $CH\ \ CH\ \ CH_2Br$

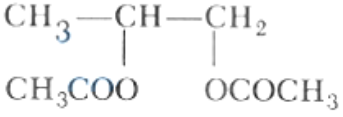
77. The final product in following reaction Y is,

$$CH_3CH = CH_2 \xrightarrow[\text{(ii) } NaBH_4]{\text{(i) } (CH_3COO)_2Hg, CH_3OH} Y$$

A. 

B. 

C. 

D. 

78. In the Victor-Meyer's test, the colour given by 1°.2° and 3° alcohols are respectively:

A. Red, colourless, blue

B. Red, blue, colourless

C. Colourless, red, blue

D. Red, blue, violet

79. What is X in the following reaction?

$$CO + 2H_2 \xrightarrow{x} CH_3OH$$

A. 623 K/300 atm

B. $KMnO_4/H^{\oplus}$

C. Zn/Δ

D. $ZnO - Cr_2O_3$, 200 − 300 atm, 573 − 673 K

80. An unknown alochol is treated with the "Lucas reagent" to determine whether the alcohol is primary, secondary or tertiary. Which alcohol reacts fastest and by what mechanism :

A. secondary alcohol by S_N1

B. tertiary alcohol by S_N1

C. secondary alcohol by S_N2

D. tertiary alcohol by S_N2

81. Which of the following compounds will undergo self aldol condensation in the presence of cold dilute alkali?

A. $CH_2 = CH - CHO$

B. $CH \equiv C - CHO$

C. C_6H_5CHO

D. CH_3CH_2CHO

82. An alkene X on ozonolysis gives a mixture of Propan-2-one and methanal. What is X?

A. Propene

B. 2-Methylpropene

C. 2-Methylbut-1-ene

D. 2-Methylbut-2-ene

83. Cheilosis and digestive disorders are due to deficiency of

A. Vitamin A

B. Thiamine

C. Riboflavin

D. Ascorbic acid

84. A tetrapeptide is made of naturally occuring alanine, serine, glycine and valine. If the C-terminal amino acid is alanine and N -terminal amino acid is chiral, the number of possible sequence of the tetrapeptide is

A. 4

B. 8

C. 6

D. 12

85. Which one of the following is a water soluble vitamin, that is not excreted easily?

A. Vitamin B_2

B. Vitamin B_1

C. Vitamin B_6

D. Vitamin B_{12}

86. Glycosidic linkage between C_1 of α-glucose and C_2 of β-fructose is found in

A. maltose

B. sucrose

C. lactose

D. amylose

87. The naturally occurring amino acid that contains only one basic functional group in its chemical structure is

A. arginine

B. lysine

C. asparagine

D. histidine

88. Which of the following is not a semi-synthetic polymer?

A. Cis-polyisoprene

B. Cellulose nitrate

C. Cellulose acetate

D. Vulcanised rubber

89. Zinc acetate - antimony trioxide catalyst used in the preparation of which polymer?

A. High density polythene

B. Teflon

C. Terylene

D. PVC

90. ..... is a potent vasodilator.

A. Histamine

B. SerotoninC.

Codeine

D. Cimetidine

Mathematics

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1. Roots of the equation $x^2 + bx - c = 0 (b,c > 0)$ are

A. both positive

B. both negative

C. of opposite sign

D. None of the above

2. Rational roots of the equation $2x^4 + x^3 - 11x^2 + x + 2 = 0$ are

A. 1/2 and 2

B. $\frac{1}{2}, 2, \frac{1}{4}, -2$

C. $\frac{1}{2}, 2, 3, 4$

D. $\frac{1}{2}, 2, \frac{3}{4}, -2$

3. If $\tan 15^\circ$ and $\tan 30^\circ$ are the roots of the equation

$x^2 + px + q = 0$, then $pq =$

A. $\frac{6\sqrt{3}+10}{\sqrt{3}}$

B. $\frac{10-6\sqrt{3}}{3}$

C. $\frac{10+6\sqrt{3}}{3}$

D. $\frac{10-6\sqrt{3}}{\sqrt{3}}$

4. The points represented by the complex number $1 + i, -2 + 3i, 5/3i$ on the argand plane are

A. Vertices of an equilateral triangle

B. Vertical of an isosceles triangle

C. Collinear

D. None of the above

5. The modulus of the complex number z such that $|z + 3 - i| = 1$ and $\arg(z) = \pi$ is equal to

A. 3

B. 2

C. 9

D. 4

6. If $z, \bar{z}, -z, -\bar{z}$ forms a rectangle of area $2\sqrt{3}$ square units, then one such z is

A. $1/2 + \sqrt{3}i$

B. $\frac{\sqrt{5}+\sqrt{3i}}{4}$

C. $\frac{3}{2} + \frac{\sqrt{3i}}{2}$

D. $\frac{\sqrt{3}+\sqrt{11i}}{2}$

7. If $z_1, z_2, \ldots z_n$ are complex numbers such that $|z_1| = |z_2| = \ldots = |z_n| = 1$, then $|z_1 + z_2 + \ldots + z_n|$ is equal to

A. $|z_1 z_2 z_3 \ldots z_n|$

B. $|z_1| + |z_2| + \ldots + |z_n|$

C. $\left|\frac{1}{z_1} + \frac{1}{z_2} + \ldots + \frac{1}{z_n}\right|$

D. n

8. If $|z_1| = 2$, $|z_2| = 3$, $|z_3| = 4$ and $|2z_1 + 3z_2 + 4z_3| = 4$, then absolute value of $8z_2z_3 + 27z_1z_3 + 64z_1z_2$ equals

A. 24

B.48

C. 72

D. 96

9. A person invites a party of 10 friends at dinner and place so that 4 are on one round table and 6 on the other round table. Total number of ways in which he can arrange the guests is

A. 10!/6!

B. 10!/24

C. 9!/24

D. None of these

10. How many different nine digit numbers can be formed from the number 223355888 by rearranging its digits so that the odd digits occupy even positions

A. 16

B. 36

C. 60

D. 100

11. If ${}^{22}P_{r+1} : {}^{20}P_{r+2} = 11 : 52$, then r is equal to

A. 3

B. 5

C. 7

D. 9

12. At an election a voter may vote for any number of candidates not exceeding the number to be elected. If 4 candidates are to be elected out of the 12 contested in the election and voter votes for at least one candidate, then the number of way of selections

A. 793

B. 298

C. 781

D. 1585

13. The number of arrangements of all digits of 12345 such that at least 3 digits will not come in its position is

A. 89

B. 109

C. 78

D. 57

14. If $a > 0, b > 0, c > 0$ and a, b, c are distinct, then $(a + b)(b + c)(c + a)$ is greater than

A. $2(a + b + c)$

B. $3(a + b + c)$

C. $6abc$

D. $8abc$

15. If $\sum_{k=1}^{n} k(k+1)(k-1) = pn^4 + qn^3 + tn^2 + sn$ where p, q, t and s are constants, then the value of s is equal to

A. – 1/4

B. – 1/2

C. 1/2

D. 1/4

16. There are four numbers of which the first three are in GP and the last three are in AP, whose common difference is 6 . If the first and the last numbers are equal, then two other numbers are

A. -2,4

B. -4,2

C. 2,6

D. None of the above

17. If $A = 1 + r^a + r^{2a} + r^{3a} + \ldots\infty$ and $B = 1 + r^b + r^{2b} + r^{3b} + \ldots\infty$, then a/b is equal to

A. $\log_B(A)$

B. $\log_{1-B}(1 - A)$

C. $\log_{\frac{B-1}{B}}\left(\frac{A-1}{A}\right)$

D. None of these

18. The sum of the infinite series

$1+\frac{5}{6}+\frac{12}{6^2}+\frac{22}{6^3}+\frac{35}{6^4}+\frac{51}{6^5}+\frac{70}{6^6}+\ldots..$ is equal to:

A. 425/216

B. 429/216

C. 288/125

D. 280/125

19. If $\tan^{-1}\left[\frac{1}{1+1.2}\right]+\tan^{-1}\left[\frac{1}{1+2.3}\right]+\ldots+\tan^{-1}\left[\frac{1}{1+n(n+1)}\right]=\tan^{-1}[x]$, then x isequal to

A. $\frac{1}{n+1}$

B. $\frac{n}{n+1}$

C. $\frac{1}{n+2}$

D. $\frac{n}{n+2}$

20. If arithmetic mean of two distinct positive real number a and b(a > b) be twice their geometric mean, then a : b =

A. $(2+\sqrt{3}):(2-\sqrt{3})$

B. $(2+\sqrt{5}):(2-\sqrt{5})$

C. $(2+\sqrt{2}):(2-\sqrt{2})$

D. None of these

21. If $y=\tan^{-1}\frac{1}{x^2+x+1}+\tan^{-1}\frac{1}{x^2+3x+3}$

$+\tan^{-1}\frac{1}{x^2+5x+7}+\ldots.$to n terms, then $\frac{dy}{dx}=$

A. $\frac{1}{x^2+n^2}-\frac{1}{x^2+1}$

B. $\frac{1}{(x+n)^2+1}-\frac{1}{x^2+1}$

C. $\frac{1}{x^2+(n+1)^2}-\frac{1}{x^2+1}$

D. None of these

22. The coefficient of x^2 term in the binomial expansion of $\left(\frac{1}{3}x^{\frac{1}{2}} + x^{\frac{-1}{4}}\right)^{10}$ is

A. 70/243

B. 60/423

C. 50/13

D. None of these

23. The coefficient of x^n in the expansion of $\frac{e^{7x}+e^x}{e^{3x}}$ is

A. $\frac{4^{n-1}+(-2)^n}{n!}$

B. $\frac{4^{n-1}+2^n}{n!}$

C. $\frac{4^n+(-2)^n}{n!}$

D. $\frac{4^{n-1}+(-2)^{n-1}}{n!}$

24. The coefficient of the highest power of x in the expansion of

$\left(x+\sqrt{x^2-1}\right)^8+\left(x-\sqrt{x^2-1}\right)^8$

A. 64

B. 128

C. 256

D. 512

25. If the 17^{th} and the 18^{th} terms in the expansion of $(2 + a)^{50}$ are equal, then the coefficient of x^{35} in the expansion of $(a + x)^{-2}$ is

A. -35

B. 3

C. 36

D. -36

26. Let A,B and C are the angles of a triangle and tan A/2 = 1/3, tan B/2 = 2/3. Then, tan C/2 is equal to

A. 7/9

B. 2/9

C. 1/3

D. 2/3

27. The sum of all values of x in [0,2π], for which sin x + sin 2x + sin 3x + sin 4x = 0 is equal to :

A. 8π

B. 11π

C. 12π

D. 9π

28. Number of solutions of equations sin9θ = sin θ in the interval [0,2π] is

A. 16

B. 17

C. 18

D. 15

29. The range of $(8\sin\theta + 6\cos\theta)^2 + 2$ is

A. (0,2)

B. [2,102]

C. $(-\infty,\infty)$

D. (2,1)

30. The locus of the point of intersection of the lines $x = a\left(\frac{1-t^2}{1+t^2}\right)$ and $y = \frac{2at}{1+t^2}$ represent (t being a parameter)

A. Circle

B. Parabola

C. Ellipse

D. Hyperbola

31. If the straight line $2x + 3y - 1 = 0, x + 2y - 1 = 0$ and $ax + by - 1 = 0$ form a triangle with origin as orthocentre, then (a,b) is equal to

A. (6,4)

B. (−3,3)

C. (−8,8)

D. (0,7)

33. The distance from the origin to the image of (1,1) with respect to the line $x + y + 5 = 0$ is

A. $7\sqrt{2}$

B. $3\sqrt{2}$

C. $6\sqrt{2}$

D. $4\sqrt{2}$

34. A(3,2,0), B(5,3,2), C(−9,6,−3) are three points forming a triangle. AD, the bisector of angle BAC meets BC in D. Find the co-ordinates of D.

A. $\frac{19}{8}, \frac{57}{15}, \frac{57}{15}$

B. $\frac{19}{8}, \frac{57}{16}, \frac{17}{16}$

C. (2,3,0)

D. (4,5,6)

35. The locus of the mid-point of a chord of the circle $x^2 + y^2 = 4$, which subtends a right angle at the origin is

A. $x + y = 2$

B. $x^{2\,2} + y^2 = 1$

C. $x + y^2 = 2$

D. $x + y = 1$

36. If p and q be the longest and the shortest distance respectively of the point $(-7,2)$ from any point (α,β) on the curve whose equation is $x^2 + y^2 - 10x - 14y - 51 = 0$, then G.M. of p

A. $2\sqrt{11}$

B. $5\sqrt{5}$

C. 13

D. 11

37. From a point A(0,3) on the circle $(x + 2)^2 + (y - 3)^2 = 4$, a chord AB is drawn and it is extended to a point Q such that $AQ = 2AB$. Then the locus of Q is

A. $(x + 4)^2 + (y - 3)^2 = 16$

B. $(x + 1)^2 + (y - 3)^2 = 32$

C. $(x + 1) + (y - 3) = 4$

D. $(x + 1) + (y - 3) = 1$

38. If the focus of parabola $(y - k)^2 = 4(x - h)$ always lies between the lines $x + y = 1$ and $x + y = 3$ then

A. $0 < h + k < 2$

B. $0 < h + k < 1$

C. $1 < h + k < 2$

D. $1 < h + k < 3$

39. Let L_1 be the length of the common chord of the curves $x^2 + y^2 = 9$ and $y^2 = 8x$, and L_2 be the length of the latus rectum of $y^2 = 8x$, then:

A. $L_1 \geq L_2$

B. $L_1 = L_2$

C. $L < L$

D. $\frac{L_1}{L_2} = \sqrt{2}$

40. The foci of hyperbola $4x^2 - 9y^2 - 1 = 0$ are

A. $(\pm\sqrt{13},0)$

B. $\left(\pm\frac{\sqrt{13}}{6},0\right)$

C. $\left(0,\pm\frac{\sqrt{3}}{6}\right)$

D. None of these

41. Given a real valued function ' f ' such that

$$f(x) = \begin{cases} \frac{\tan^2\{x\}}{x^2-[x]^2} & \text{for } x > 0 \\ 1 & \text{for } x = 0 \\ \sqrt{\{x\}\cot\{x\}} & \text{for } x < 0 \end{cases}$$

Then

A. LHL $= 1$

B. $\text{RHL} = \sqrt{\cot 1}$

$\lim_{x\to 0} f$ exist

C. (x)

D. $\lim_{x\to 0} f(x)$ does not exists

42. Let $f(x) = \sin x, g(x) = \cos x, h(x) = x^2$ then

$\lim_{x\to 1} \frac{f(g(h(x)))-f(g(h(1)))}{x-1} =$

A. 0

B. $-2\sin 1\cos(\cos 1)$

C. ∞

D. $-2\sin 1\cos 1$

43. The Boolean expression $\sim (p \vee q) \vee (\sim p \wedge q)$ is equivalent to

A. p

B. q

C. $\sim$q

D. $\sim$p

44. If p: 2 is an even number

q : 2 is a prime number,

r : $2 + 2 = 2^2$

Then the symbolic statement $p \rightarrow (q \vee r)$ means

A. 2 is an even number and 2 is a prime number or$2 + 2 = 2^2$

B. 2 is an even number then 2 is a prime number or $2 + 2 = 2^2$.

C. 2 is an even number or 2 is a prime number then $2 + 2 = 2^2$

D. If 2 is not even number then 2 is a primenumber $\alpha = 2 + 2 = 2^2$

45. Consider the following statements :

A: Rishi is a judge.

B : Rishi is honest.

C: Rishi is not arrogant.

The negation of the statement "if Rishi is a judge and he is not arrogant, then he is honest" is

A. $B \rightarrow (A \vee C)$

B. $(\sim B) \wedge (A \wedge C)$

C. $B \rightarrow ((\sim A) \vee (\sim C))$

D. $B \rightarrow (A \wedge C)$

46. If p : It raining today, q : I go to school, r : I shall meet any friends and s : I shall go for a movie, then which of the following is the proposition : 'If it does not rain or if I do not go to school, then I shall meet my friend and go for a movie'?

A. $\sim (p \wedge q) \Rightarrow (r \wedge s)$

B. $\sim (p \wedge \sim q) \Rightarrow (r \wedge s)$

C. $\sim (p \wedge q) \Rightarrow (r \vee s)$

D. None of these

47. Let p,q,r be three logical statements. Consider the compound statements

S_1 : $((\sim p) \vee q) \vee ((\sim p) \vee r)$ and

S : $p \rightarrow (q \vee r)$

Then, which of the following is NOT true?

A. If S_2 is true, then S_1 is true

B. If S_2 is false, then S_1 is false

C. If S_2 is false, then S_1 is true

D. If S_1 is false, then S_2 is false

48. Consider the following two propositions:

P_1 : $\sim (p \rightarrow \sim q)$

P_2 : $(p \wedge \sim q) \wedge ((\sim p) \vee q)$

If the proposition $p \rightarrow ((\sim p) \vee q)$ is evaluated as FALSE, then :

A. P_1 is TRUE and P_2 is FALSE

B. P_1 is FALSE and P_2 is TRUE

C. Both P_1 and P_2 are FALSE

D. Both P_1 and P_2 are TRUE

49. If the variance of the data 2, 3, 5, 8, 12 is σ^2 and the mean deviation from the median for this data is M , then $\sigma^2 - M =$

A. 10.2

B. 5.8

C. 10.6

D. 8.2

50. The mean of n items is X. If the first item is increased by 1, second by 2 and so on, the new mean is :

A. $\bar{X} + \frac{x}{2}$

B. $\bar{X} + x$

C. $\overline{X} + \frac{n+1}{2}$

D. None of these

51. The variance of 20 observations is 5. If each observation is multiplied by 2, then the new variance of the resulting observation is

A. $2^3 \times 5$

B. $2^2 \times 5$

C. 2×5

D. $2^4 \times 5$

52. If the function f(x), defined below, is continuous on the interval [0,8], then

$$f(x) = \begin{cases} x^2 + ax + b & ,0 \leq x < 2 \\ 3x + 2, & 2 \leq x \leq 4 \\ 2ax + 5b, & 4 < x \leq 8 \end{cases}$$

A. $a = 3, b = -2$

B. $a = -3, b = 2$

C. $a = -3, b = -2$

D. $a = 3, b = 2$

53. From the top of a cliff 50 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 45°. The height of tower is

A. 50 m

B. $50\sqrt{3}$ m

C. $50(\sqrt{3} - 1)$m

D. $50\left(1 - \frac{\sqrt{3}}{3}\right)$ m

54. ABC is a triangular park with AB = AC = 100 m. A TV tower stands at the mid-point of BC. The angles of elevation of the top of the tower
at A, B,C are $45^\circ, 60^\circ, 60^\circ$ respectively. The height of the tower is

A. 50 m

B. $50\sqrt{3}$ m

C. $50\sqrt{2}$ m

D. $50(3 - \sqrt{3})$m

55. In a statistical investigation of 1003 families of Calcutta, it was found that 63 families has neither a radio nor a TV, 794 families has a radio and 187 has TV. The number of families in that group having both a radio and a TV is

A. 36

B. 41

C. 32

D. None of these

56. Let R be the relation "is congruent to" on the set of all triangles in a plane is

A. Reflexive only

B. Symmetric only

C. Symmetric and reflexive only

D. Equivalence relation

57. Number of subsets of set of letter of word 'MONOTONE'.

A. 8

B. 256

C. 64

D. 32

58. In an examination, 62% of the candidates failed in English, 42% in Mathematics and 20% in both. The number of those who passed in both the subjects is

A. 11

B. 16

C. 18

D. None of these

59. If $A = \frac{1}{3}\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix}$ is an orthogonal matrix, then

A. $a = -2, b = -1$

B. $a = 2, b = 1$

C. $a = 2, b = -1$

D. $a = -2, b = 1$

60. If matrix $A = \begin{bmatrix} 3 & -2 & 4 \\ 1 & 2 & -1 \\ 0 & 1 & 1 \end{bmatrix}$ and $A^{-1} = \frac{1}{k}\text{adj}(A)$, then k is

A. 7

B. -7

C. 15

D. -11

61. If A and B are symmetric matrices of same order such that AB + BA = X and AB – BA = Y, then $(XY)^T$ =

A. XY

B. X^TY^T

C. -YX

D. $-Y^TX^T$

62 If $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}, P = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $X = APA^T$, then $A^T X^{50} A =$

A. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 2 & 1 \\ 0 & -1 \end{bmatrix}$

C. $\begin{bmatrix} 25 & 1 \\ 1 & -25 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 50 \\ 0 & 1 \end{bmatrix}$

63. If A is a square matrix of order 3 , then $|\text{Adj}(\text{Adj } A^2)| =$

A. $|A|^2$

B. $|A|^4$

C. $|A|^8$

D. $|A|^{16}$

64. Suppose p, q, r ≠ 0 and system of equation

(p + a)x + by + cz = 0

ax + (q + b)y + cz = 0

ax + by + (r + c)z = 0, has a non-trivial solution, then the value of $\frac{a}{p} + \frac{b}{q} + \frac{c}{r}$ is

A. -1

B. 0

C. 1

D. 2

65. If x is a complex root of the equation

$$\begin{vmatrix} 1 & x & x \\ x & 1 & x \\ x & x & 1 \end{vmatrix} + \begin{vmatrix} 1-x & 1 & 1 \\ 1 & 1-x & 1 \\ 1 & 1 & 1-x \end{vmatrix} = 0,$$

then $x^{2007} + x^{-2007} =$

A. 1

B. -1

C. -2

D. 2

66. The equations x – y + 2z = 4

3x + y + 4z = 6

x + y + z = 1 have

A. unique solution

B. infinitely many solutions

C. no solution

D. two solutions

67. If the system of linear equations $2x + y - z = 7$

$x - 3y + 2z = 1; x + 4y + \delta z = k$

where $\delta, k \in R$ has infinitely many solutions, then $\delta + k$ is equal to:

A. -3

B. 3

C. 6

D. 9

68. If $\cot\left(\cos^{-1} x\right) = \sec\left\{\tan^{-1}\left(\frac{a}{\sqrt{b^2-a^2}}\right)\right\}$

$b > a$, then x =

A. $\frac{b}{\sqrt{2b^2-a^2}}$

B. $\frac{\sqrt{b^2-a^2}}{ab}$

C. $\frac{a}{\sqrt{2b^2-a^2}}$

D. $\frac{\sqrt{b^2-a^2}}{a}$

69. If $\cos \cot^{-1}(1/2) = \cot(\cos^{-1} x)$, then the value of x is

A. $1/\sqrt{6}$

B. $-1/\sqrt{12}$

C. $2/\sqrt{6}$

D. $-2/\sqrt{6}$

70. Let [x] denote the greatest integer $\leq$ x. If f(x) = [x] and g(x) = |x|, then the value of $f\left(g\left(\frac{8}{5}\right)\right) - g\left(f\left(-\frac{8}{5}\right)\right)$ is

A. 2

B. -2

C. 1

D. -1

71. Number of real solution of $\sqrt{5-\log_2|x|}=3-\log_2|x|$ is equal to

A. 1

B. 2

C. 3

D. 4

72. $f(x)=\frac{\cos x}{\left[\frac{2x}{\pi}\right]+\frac{1}{2}}$, where x is not an integral multiple of π and [.] denotes the greatest integer function, is

A. an odd function

B. an even function

C. neither odd nor even

D. None of these

73. The function $f:\boldsymbol{R}\to\boldsymbol{R}$ defined by $f(x)=\frac{x}{\sqrt{1+x^2}}$ is

A. surjective but not injective

B. bijective

C. injective but not surjective

D. neither injective nor surjective

74. If f: R → R, g : R → R are defined by f(x) = 5x − 3,g(x) = x^2 + 3, then g$o f^{-1}$(3) is equal to

A. 25/3

B. 111/25

C. 9/25

D. 25/111

75. The domain of the real valued function

$f(x)=\sqrt{\frac{2x^2-7x+5}{3x^2-5x-2}}$ is

A. $(-\infty,-\frac{1}{3})\cup[1,2)\cup[\frac{5}{2},\infty)$

B. $(-\infty,1)\cup(2,\infty)$

C. $(-\frac{1}{3},\frac{5}{2}]$

D. $\left(-\infty,\frac{-1}{3}\right]\cup[\frac{5}{2},\infty)$

76. If a function f : R − {l} → R − {m} defined by $f(x) = x+3/x-2$ is a bijection, then $3l + 2m =$

A. 10

B. 12

C. 8

D. 14

77. $f(x) = \sin x + \cos x, g(x) = x^2 - 1$, then $g(f(x))$ is invertible if

A. $\frac{-\pi}{4} \leq x \leq \frac{\pi}{4}$

B. $\frac{-\pi}{2} \leq x \leq 0$

C. $\frac{-\pi}{2} \leq x \leq \pi$

D. $0 \leq x \leq \frac{\pi}{2}$

78. Let the function $g : (-\infty, \infty) \to (-\pi/2, \pi/2)$ be given by $g(u) = 2\tan^{-1}(e^u) - \pi/2$. Then, g is

A. even and is strictly increasing in $(0, \infty)$

B. odd and is strictly decreasing in $(-\infty, \infty)$

C. odd and is strictly increasing in $(-\infty, \infty)$

D. neither even nor odd, but is strictly increasing in $(-\infty, \infty)$

79. Let f be the function defined by

$$f(x) = \begin{cases} \frac{x^2-1}{x^2-2|x-1|-1}, & x \neq 1 \\ \frac{1}{2}, & x = 1 \end{cases}$$

A. The function is continuous for all values of x

B. The function is continuous only for $x > 1$

C. The function is continuous at $x = 1$

D. The function is not continuous at $x = 1$

80. If $f(x) = \begin{cases} \frac{x^2 \log(\cos x)}{\log(1+x)}, & x \neq 0 \\ 0, & x = 0 \end{cases}$, then at $x = 0$, $f(x)$ is

A. not continuous

B. continuous but not differentiable

C. differentiable

D. not continuous, but differentiable

81. $f(x) = \begin{cases} 4 & -\infty < x < -\sqrt{5} \\ x^2 - 1 & -\sqrt{5} \leq x \leq \sqrt{5} \\ 4 & \sqrt{5} \leq x < \infty \end{cases}$

If k is the number of points where $f(x)$ is not differentiable then k – 2 =

A. 2

B. 1

C. 0

D. 3

82. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, then $\frac{dy}{dx} =$

A. x+1/x

B. 1/1+x

C. $-1/(1+x)^2$

D. x/1+x

83. If $y = \tan^{-1}\left(\frac{\sqrt{x}-x}{1+x^{\frac{3}{2}}}\right)$, then $y'(1)$ is equal to

A. 0

B. 1/2

C. -1

D. $-1/4$

84. At $x = \frac{\pi^2}{4}$, $\frac{d}{dx}\left(\tan^{-1}(\cos\sqrt{x}) + \sec^{-1}(e^x)\right) =$

A. $\frac{1}{\sqrt{e^{\frac{\pi^2}{2}}-1}} - \frac{1}{\pi}$

B. $\frac{\pi}{4} + \frac{1}{\sqrt{e^{\pi^2}+e^{\pi^2/2}}}$

C. $\frac{1}{\sqrt{e^{\pi^2}+e^{\pi^2/2}}} + \frac{2}{\pi}\cot\left(\frac{\sqrt{\pi}}{2}\right)$

D. $\frac{1}{\sqrt{e^{\pi}}} + \frac{1}{\pi}$

85. The maximum area of rectangle inscribed in a circle of diameter R is

A. R^2

B. $R^2/2$

C. $R^2/4$

D. $R^2/8$

86. Consider the function $f(x) = \frac{|x-1|}{x^2}$, then $f(x)$ is

A. increasing in $(0,1) \cup (2, \infty)$

B. increasing in $(-\infty, 0) \cup (0, 1)$

C. decreasing in $(-\infty, 0) \cup (2, \infty)$

D. decreasing in $(0,1) \cup (2, \infty)$

87. The maximum volume (in cu. units) of the cylinder which can be inscribed in a sphere of radius 12 units is

A. $384\sqrt{3}\pi$

B. $768\sqrt{3}\pi$

C. $768\pi/\sqrt{3}$

D. $1152\pi/\sqrt{3}$

88. If the angle made by the tangent at the point (x_0, y_0) on the curve $x = 12(t + \sin t \cos t)$, $y = 12(1 + \sin t)^2$, $0 < t < \pi/2$, with the positive x -axis is $\pi/3$, then y0 is equal to

A. $6(3 + 2\sqrt{2})$

B. $3(7 + 4\sqrt{3})$

C. 27

D. 48

89. The altitude of a cone is 20 cm and its semivertical angle is 30^0. If the semi-vertical angle is increasing at the rate of 2^0 per second, then the radius of the base is increasing at the rate of

A. 30 cm/sec

B. 160/3 cm/sec

C. 10 cm/sec

D. 160 cm/sec

90. The point of inflexion for the curve $y = (x - a)^n$, where n is odd integer and $n \geq 3$ is

A. (a, 0)

B. (0, a)

C. (0, 0)

D. None of these

91. The population p(t) at time t of a certain mouse species satisfies the differential equation $\frac{dp(t)}{dt} = 0.5p(t) - 450$. If $p(0) = 850$, then the time at which the population becomes zero is :

A. 2 ln 18

B. ln 9

C. 1/2 ln 18

D. ln 18

92. $\int \frac{x^3-1}{x^3+x}dx =$

A. $x + \log|x| + 1/2\log(x^2 + 1) + \sin^{-1}(x) + c$

B. $x - \log|x| + 1/2\log(x^2 + 1) - \sin^{-1}(x) + c$

C. $x + \log|x| - 1/2\log(x^2 + 1) + \tan^{-1}(x) + c$

D. $x - \log|x| + 1/2\log(x^2 + 1) - \tan^{-1}(x) + c$

93. $\int \sqrt{x+\sqrt{x^2+2}}dx =$

A. $\frac{3}{2}(x+\sqrt{x+2})^{3/2} - 2\left(x+\sqrt{x^2+2}\right)^{1/4} + C$

B. $\frac{1}{3}\left(x+\sqrt{x^2+2}\right)^{3/2} - 2\left(x+\sqrt{x^2+2}\right)^{1/4} + C$

C. $\left(x+\sqrt{x^2+2}\right)^{-3/2} - 2\left(x+\sqrt{x^2+2}\right)^{-1/2} + C$

D. $\frac{\left(x+\sqrt{x^2+2}\right)^2-6}{3\sqrt{x+\sqrt{x^2+2}}} + C$

94. The value of $\int e^{\tan\theta}(\sec\theta - \sin\theta)d\theta$ is

A. $e^{\tan\theta}\sec\theta + c$

B. $e^{\tan\theta}\sin\theta + c$

C. $e^{\tan\theta}(\sec\theta + \sin\theta) + c$

D. $e^{\tan\theta}\cos\theta + c$

95. $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$ is

A. $\frac{\pi ab}{a+b}$

B. $\frac{ab}{2(a+b)}$

C. $\frac{\pi}{2ab(a+b)}$

D. $\frac{\pi(a+b)}{2ab}$

96. The value of definite integral $\int_0^{\pi/2} \log(\tan x)dx$ is

A. 0

B. π/4

C. π/2

D. π

97. $\int_5^9 \frac{\log 3x^2}{\log 3x^2+\log(588-84x+3x^2)}dx$ is equal to

A. 2

B. 1

C. 1/2

D. 4

98. The integral $\int \frac{x^2(x\sec^2 x+\tan x)}{(x\tan x+1)^2}dx$ is equal to

A. $-\frac{x^2}{x\tan x+1}+c$

B. 2 $\log_e$ |xsin x + cosx| + c

C. $-\frac{x^2}{x\tan x+1}+2\log_e|x\sin x+\cos x|+c$

D. $\frac{x^2}{x^2\tan x-1}-2\log_e|x\sin x+\cos x|+c$

99. $\lim_{n\to\infty}\prod_{r=3}^{\infty}\frac{r^3-8}{r^3+8}$ equals to

A. 2/7

B. 3/7

C. 4/7

D. 6/7

100. $\int_0^{\frac{\pi}{2}} \frac{\sin\left(\frac{\pi}{4}+x\right)+\sin\left(\frac{3\pi}{4}+x\right)}{\cos x+\sin x}dx =$

A. π/√2 B.

π/2√2 C.

π/3√2 D.

π/4√2

101. The line $y = mx$ bisects the area unclosed by lines $x = 0$, $y = 0$ and $x = 3/2$ and the curve $y = 1 + 4x - x^2$. Then, the value of m is

A. 13/6

B. 13/2

C. 13/5

D. 13/7

102. If a, c, b are in GP, then the area of the triangle formed by the lines $ax + by + c = 0$ with the coordinates axes is equal to

A. 1

B. 2

C. 1/2

D. None of these

103. The area enclosed by the curves $y = x^3$ and $y = \sqrt{x}$ is

A. 5/3 sq. units

B. 5/4 sq. units

C. 5/12 sq. unit

D. 12/5 sq. units

104. The area of the region bounded by the curves $x = y^2 - 2$ and $x = y$ is

A. 9/4

B. 9

C. 9/2

D. 9/7

105. If the area bounded by the curves $y = ax^2$ and $x = ay^2$, $(a > 0)$ is 3 sq units, then the value of a is

A. 2/3

B. 1/3

C. 1

D. 4

106. The solution of the differential equation $(x + 1)dy/dx - y = e^{3x}(x + 1)^2$ is

A. $y = (x + 1)e^{3x} + C$

B. $3y = (x + 1) + e^{3x} + C$

C. $\frac{3y}{x+1} = e^{3x} + C$

D. $ye^{-3x} = 3(x + 1) + C$

107. If $dy/dx - y \log_e 2 = 2^{\sin x}(\cos x - 1) \log_e 2$, then y

A. $2^{\sin x} + c2^x$

B. $2^{\cos x} + c2^{x-}$

C. $2^{\sin x} + c2^x$

D. $2^{\cos x} + c2^{-x}$

108. Let $\mathbf{a} = \hat{\mathbf{i}} - \hat{\mathbf{k}}, \mathbf{b} = x\hat{\mathbf{i}} + \hat{\mathbf{j}} + (1 - x)\hat{\mathbf{k}}$ and $\mathbf{c} = y\hat{\mathbf{i}} + x\hat{\mathbf{j}} + (1 + x - y)\hat{\mathbf{k}}$. Then, $[\mathbf{ab\ c}]$ depends on

A. only y

B. only x

C. both x and y

D. neither x nor y

109. Let ABC be a triangle and be $\vec{a}, \vec{b}, \vec{c}$ the position vectors of A,B,C respectively. Let D divide BC in the ratio 3 : 1 internally and E divide AD in the ratio 4 : 1 internally. Let BE meet AC in F. IfE divides BF in the ratio 3 : 2 internally then the position vector of F is

A. $\frac{\vec{a}+\vec{b}+\vec{c}}{3}$

B. $\frac{\vec{a}-2\vec{b}+3\vec{c}}{2}$

C. $\frac{\vec{a}+2\vec{b}+3\vec{c}}{2}$

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

110. If $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, then the value of

$$|\hat{i} \times (\vec{a} \times \hat{i})|^2 + |\hat{j} \times (\vec{a} \times \hat{j})|^2 + |\hat{k} \times (\vec{a} \times \hat{k})|^2$$

is equal to

A. 17

B. 18

C. 19

D. 20

111. The magnitude of projection of line joining (3,4, 5) and (4,6,3) on the line joining $(-1,2,4)$ and (1,0,5) is

A. 4/3

B. 2/3

C. 8/3

D. 1/3

112. The angle between the lines whose direction cosines are given by the equations $3l + m + 5n = = 0,6\ nm - 2nl + 5lm = 0$ is

A. $\cos^{-1}\left(\frac{1}{6}\right)$

B. $\cos^{-1}\left(-\frac{1}{6}\right)$

C. $\cos^{-1}\left(\frac{2}{3}\right)$

D. $\cos^{-1}\left(-\frac{5}{6}\right)$

113. Let the acute angle bisector of the two planes $x - 2y - 2z + 1 = 0$ and $2x - 3y - 6z + 1 = 0$ be the plane P. Then which of the following points lies on P?

A. $(3,1, -1/2)$

B. $(-2,0, -1/2)$

C. $(0,2, -4)$

D. $(4,0, -2)$

114. Let the foot of perpendicular from a point P(1,2, −1) to the straight line $L: \frac{x}{1} = \frac{y}{0} = \frac{z}{-1}$ be N. Let a line be drawn from P parallel to the plane x + y + 2z = 0 which meets L at point Q. If α is the acute angle between the lines PN and PQ , then cos α is equal to

A. $1/\sqrt{5}$

B. $\sqrt{3}/2$

C. $1/\sqrt{3}$

D. $1/2\sqrt{3}$

115. If the number of available constraints is 3 and the number of parameters to be optimise is 4, then

A. the objective function can be optimised

B. the constraint are short in number

C. the solution is problem oriented

D. None of the above

116. The probability of getting 10 in a single throw of three fair dice is

A. 1/6

B. 1/8

C. 1/9

D. 1/5

117. In a binomial distribution, the mean is 4 and variance is 3. Then, its mode is

A. 5

B. 6

C. 4

D. None of these

118. The probability that certain electronic component fails when first used is 0.10. If it does not fail immediately, the probability that it lasts for one year is 0.99. The probability that a new component will last for one year is

A. 0.9

B. 0.01

C. 0.119

D. 0.891

119. Given below is the distribution of a random variable X

$X = x$	1	2	3	4
$P(X = x)$	λ	2λ	3λ	4λ

If $\alpha = P(X < 3)$ and $\beta = P(X > 2)$, then $\alpha : \beta =$

A. 2:5

B. 3:4

C. 4:5

D. 3:7

120. A book contains 1000 pages. A page is chosen at random. The probability that the sum of the digits of the marked number on the page is equal to 9, is

A. 23/500

B. 11/200

C. 7/100

D. None of these

121. For two events A and B , if $P(A) = P(A/B) = 1/4$ and $P(B/A) = 1/2$, then which of the following is not true?

A. A and B are independent

B. $P(A'/B) = 3/4$

C. $P(B'/A') = 1/2$

D. None of these