MOTION

Nurturing potential through education

ONLINE TEST PAPER

JEE MAIN - 2016

DATE : 10-4-2016

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PART - I [MATHEMATICS]

1. For $x \in R$, $x \neq 0$, if $y(x)$ is a differentiable function such that

$x\int_1^x y(t)dt = (x+1)\int_1^x t\,y(t)$, then $y(x)$ equals:

(A) $Cx^3 e^{\frac{1}{x}}$ (B) $\frac{C}{x^2}e^{-\frac{1}{x}}$

(C) $\frac{C}{x^3}e^{-\frac{1}{x}}$ (D) $\frac{C}{x}e^{-\frac{1}{x}}$

2. The number of distinct real values of ◯ for which the lines $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z+3}{\lambda^2}$ and $\frac{x-3}{1} = \frac{y-2}{\lambda^2} = \frac{z-1}{2}$ are coplanar is :

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

3. A straight line through origin O meets the lines $3y = 10 - 4x$ and $8x + 6y + 5 = 0$ at points A and B respectively. Then O divides the segment AB in the ratio :

(A) 4: 1 (B) 3 : 4
(C) 2 : 3 (D) 1 : 2

4. ABC is a triangle in a plane with vertices A(2, 3, 5), B(−1, 3, 2) and C(λ, 5, μ). If the median through A is equally inclined to the coordinate axes, then the value of $(\lambda^3 + \mu^3 + 5)$ is :

(A) 1348 (B) 1130
(C) 1077 (D) 676

5. The solution of the differential equation $\frac{dy}{dx} + \frac{y}{2}\sec x = \frac{\tan x}{2y}$, where $0 \le x < \frac{\pi}{2}$, and $y(0) = 1$, is given by :

(A) $y^2 = 1 + \frac{x}{\sec x + \tan x}$

(B) $y = 1 - \frac{x}{\sec x + \tan x}$

(C) $y = 1 + \frac{x}{\sec x + \tan x}$

(D) $y^2 = 1 + \frac{x}{\sec x + \tan x}$

6. The mean of 5 observations is 5 and their variance is 124. If three of the observations are 1, 2 and 6; then the mean deviation from the mean of the data is :

Note : According to 12.4 answer is A else is Bonus.

(A) 2.8 (B) 2.6
(C) 2.4 (D) 2.5

7. If $A = \begin{bmatrix} -4 & -1 \\ 3 & 1 \end{bmatrix}$, then the determinant of the matrix $(A^{2016} - 2A^{2015} - A^{2014})$ is :

(A) 2014 (B) −175
(C) 2016 (D) −25

8. The sum $\sum_{r=1}^{10}(r^2+1)\times(r!)$ is equal to :

(A) $10 \times (11!)$ (B) $11 \times (11!)$
(C) $(11!)$ (D) $101 \times (10!)$

9. Let ABC be a triangle whose circumcentre is at P. If the position vectors of A, B, C and P are $\vec{a}$, $\vec{b}$, $\vec{c}$ and $\frac{\vec{a}+\vec{b}+\vec{c}}{4}$ respectively, then the position vector of the orthocentre of this triangle, is :

(A) $\vec{a} + \vec{b} + \vec{c}$ (B) $\vec{0}$

(C) $\frac{(\vec{a}+\vec{b}+\vec{c})}{2}$ (D) $\left(\frac{\vec{a}+\vec{b}+\vec{c}}{2}\right)$

10. An experiment succeeds twice as often as it fails. The probability of at least 5 successes in the six trials of the this experiment is :

(A) $\frac{192}{729}$ (B) $\frac{496}{729}$

(C) $\frac{240}{729}$ (D) $\frac{256}{729}$

11. Let $f(x) = \sin^4 x + \cos^4 x$. Then f is an increasing function in the interval :

(A) $\left]\frac{5\pi}{8}, \frac{3\pi}{4}\right[$ (B) $\left]\frac{\pi}{2}, \frac{5\pi}{8}\right[$

(C) $\left]0, \frac{\pi}{4}\right[$ (D) $\left]\frac{\pi}{4}, \frac{\pi}{2}\right[$

12. A hyperbola whose transverse axis is along the major axis of the conic, $\frac{x^2}{3} + \frac{y^2}{4} = 4$ and has vertices at the foci of this conic. If the eccentricity of the hyperbola is $\frac{3}{2}$, then which of the following points does NOT lie on it?

(A) $(5, 2\sqrt{3})$ (B) $(0, 2)$

(C) $(\sqrt{5}, 2\sqrt{2})$ (D) $(\sqrt{10}, 2\sqrt{3})$

13. The contrapositive of the following statement,
"If the side of a square doubles, then its area increases four times", is :
(A) If the area of a square increases four times, then its side is doubled.
(B) If the area of a square increaeses four times, then its side is not doubled.
(C) If the area of a square does not increase four times, then its side is not doubled.
(D) If the side of a square is not doubled, then its area does not increase four times.

14. $\lim\limits_{x\to 0} \frac{(1-\cos 2x)^2}{2x\tan x - x\tan 2x}$ is :

(A) 2 (B) $-\frac{1}{2}$

(C) –2 (D) $\frac{1}{2}$

15. A ray of linght is incident along a line which meets another line, 7x – y + 1 = 0, at the point (0, 1). The ray is then reflected from this point along the line, y + 2x = 1. Then the equation of the line of incidence of the ray of light is :
(A) 41x – 25y + 25 = 0
(B) 41x + 38y + 38 = 0
(C) 41x + 38y – 38 = 0
(D) 41x + 25y – 25 = 0

16. Let $a_1, a_2, a_3, \ldots\ldots, a_n, \ldots$ be in A.P. If $a_3 + a_7 + a_{11} + a_{15} = 72$, then the sum of its first 17 terms is equal to :
(A) 204 (B) 612
(C) 153 (D) 306

17. Let A be a 3 × 3 matrix such that $A^2 - 5A + 71 = O$.

Statement-I :– $A^{-1} = \frac{1}{7}(5I - A)$.

Statement-II :– The polynomial $A^3 - 2A^2 - 3A + I$ can be reduced to $5(A - 4I)$.

Then:
(A) Both the statement are true.
(B) Statement-I is true, but Statement-II is flase.
(C) Statement-I is false, but Statement-II is true.
(D) Both the statement are false.

18. Let $a, b \in R, (a \neq 0)$. If the function f defined as

$$f(x) = \begin{cases} \frac{2x^2}{a} & , \quad 0 \le x < 1 \\ a & , \quad 1 \le x < \sqrt{2} \\ \frac{2b^2 - 4b}{x^3} & , \quad \sqrt{2} \le x < \infty \end{cases}$$

is continuous in the interval $[0, \infty)$, then an ordered pair (a, b) is :

(A) $(\sqrt{2}, 1 - \sqrt{3})$ (B) $(-\sqrt{2}, 1 + \sqrt{3})$

(C) $(-\sqrt{2}, 1 - \sqrt{3})$ (D) $(\sqrt{2}, -1 + \sqrt{3})$

19. The integral $\int \frac{dx}{(1+\sqrt{x})\sqrt{x - x^2}}$ is equal to :
(where C is a constant of integration.)

(A) $-2\sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}} + C$ (B) $2\sqrt{\frac{1+\sqrt{x}}{1-\sqrt{x}}} + C$

(C) $-\sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}} + C$ (D) $-2\sqrt{\frac{1+\sqrt{x}}{1-\sqrt{x}}} + C$

20. The angle of elevation of the top of a vertical tower from a point A, due east of it is 45°. The angle of elevation of the top of the same tower from a point B, due south of A is 30°. If the distance between A and B is $54\sqrt{2}$ m, then the height of the tower (in metres), is:

(A) 108 (B) $54\sqrt{3}$

(C) $36\sqrt{3}$ (D) 54

21. If x is a solution of the equation $\sqrt{2x+1} - \sqrt{2x-1} = 1, \left(x \geq \frac{1}{2}\right)$, then $\sqrt{4x^2-1}$ is eaual to :

(A) 2 (B) $\frac{3}{4}$

(C) $2\sqrt{2}$ (D) $\frac{1}{2}$

22. The value of the integral

$\int_4^{10} \frac{[x^2]dx}{[x^2-28x+196]+[x^2]}$, where [x] denotes the greatest integer less than or equal to x, is :

(A) 3 (B) 7

(C) $\frac{1}{3}$ (D) 6

23. Let z = 1 + ai be a complex number, a > 0, such that z^3 is a real number. Then the sum $1 + z + z^2 + ... + z^{11}$ is equal to :

(A) $1365\sqrt{3}$ i (B) $1250\sqrt{3}$ i

(C) $-1250\sqrt{3}$ i (D) $-1365\sqrt{3}$ i

24. Equation of the tangent to the circle, at the point (1, –1), whose centre is the point of intersection of the straight lines x – y = 1 and 2x + y = 3 is :

(A) x + 4y + 3 = 0 (B) x – 3y – 4 = 0

(C) 4x + y – 3 = 0 (D) 3x – y – 4 = 0

25. Let $P = \{\theta : \sin\theta - \cop\theta = \sqrt{2}\cos\theta\}$ and $Q = \{\theta : \sin\theta + \cos\theta = \sqrt{2}\sin\theta\}$ be two sets. Then :

(A) $P \subset Q$ and $Q - P \neq \phi$

(B) P = Q

(C) $Q \not\subset P$ (D) $P \not\subset Q$

26. If the coefficients of x^{-2} and x^{-4} in the expansion of $\left(x^{\frac{1}{3}} + \frac{1}{2x^{\frac{1}{3}}}\right)^{18}$, (x > 0), are m and n respectively, then $\frac{m}{n}$ is equal to :

(A) $\frac{4}{5}$ (B) 182

(C) 27 (D) $\frac{5}{4}$

27. It $\frac{^{n+2}C_6}{^{n-2}P_2} = 11$, then n satisfies the equation:

(A) $n^2 + 2n - 80 = 0$

(B) $n^2 + 5n - 84 = 0$

(C) $n^2 + 3n - 108 = 0$

(D) $n^2 + n - 110 = 0$

28. If A > 0, B > 0 and $A + B = \frac{\pi}{6}$, then the minimum value of tanA + tanB is :

(A) $\frac{2}{\sqrt{3}}$ (B) $2 - \sqrt{3}$

(C) $\sqrt{3} - \sqrt{2}$ (D) $4 - 2\sqrt{3}$

29. P and Q are two distinct points on the parabola, $y^2 = 4x$, with parameters t and t_1 respectively. If the normal at P passes through Q, then the minimum value of t_1^2 is:

(A) 6 (B) 2

(C) 4 (D) 8

30. Let C be a curve given by $y(x) = 1 + \sqrt{4x-3}$, $x > \frac{3}{4}$. If P is a point on C, such that the tangent at P has slope $\frac{2}{3}$, then a point through whicht the normal at P passes, is:

(A) (3, –4) (B) (1, 7)

(C) (2, 3) (D) (4, –3)

PART - II [PHYSICS]

1. The resistance of an electrical toaster has a temperature dependence given by $R(T) = R_0[(T - T_0)]$ in its range of operation. At $T_0 = 300$ K, $R = 100\Omega$ and at T = 500 K, $R = 120\Omega$. The toaster is connected to a voltage source at 200 V and its temperature is raised at a constant rate from 300 to 500 K in 30 s. The total work done in raising the temperature is :

(1) 300 J (2) $400 \ln \frac{5}{6}$ J

(3) $200 \ln \frac{2}{3}$ J (4) $400 \ln \frac{1.5}{1.3}$ J

2. A Carnot freezer takes heat from water at 0°C inside it and rejects it to the room at a temperature of 27°C. The latent heat of ice is 336×10^3 J kg^{-1}. if 5 kg of water at 0°C is converted into ice at 0°C by the freezer, then the energy consumed by the freezer is close to :

(1) 1.67×10^5 J (2) 1.68×10^6 J

(3) 1.51×10^5 J (4) 1.71×10^7 J

3. A toy-car, blowing its horn, is moving with a steady spped of 5 m/s, away from a wall. An observer, towards whom the toy car is moving, is able to hear 5 beats per second. If the velocity of sound in air is 340 m/s, the frequency of the horn of the toy car is close to :

(1) 170 Hz (2) 680 Hz

(3) 340 Hz (4) 510 Hz

4. A photoelectric surface is illuminated successively by monochromatic light of wavelengths A and $\frac{\lambda}{2}$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that in the first case, the work function of the surface is :

(1) $\frac{hc}{3\lambda}$ (2) $\frac{3hc}{\lambda}$

(3) $\frac{hc}{\lambda}$ (4) $\frac{hc}{2\lambda}$

5. In an engine the piston undergoes vertical simple harmonoic motion with amplitude 7 cm. A washer rests on top of the piston and moves with it. The motor speed is slowly increased. The frequency of the piston at which the washer no longer stays in contact with the pistion, is close to :

(1) 0.1 Hz (2) 0.7 Hz

(3) 1.2 Hz (4) 1.9 Hz

6. To determine refractive index of glass slab using a travelling microscope, minimum number of readings required are :

(1) Two (2) Three

(3) Four (4) Five

7. A fighter plane of length 20 m, wing span (distane from tip of one wing to the tip of the other wing) of 15 m and height 5 m is flying towards east over Delhi. It speed is 240 ms^{-1}. The earth's magnetic field over Delhi is 5×10^{-5} T with the declination angle ~ 0° and dip of θ such that $\sin\theta = \frac{2}{3}$. If the voltage developed is V_B between the lower and upper side of the plane and V_W between the tips of the wings then V_B and V_W are close to :

(1) V_B = 40 mV; V_W = 135 mV with left side of pilot at higher voltage

(2) V_B = 40 mV; V_W = 135 mV with right side of pilot at higher voltage

(3) V_B = 45 mV; V_W = 120 mV with right side of pilot at higher voltage

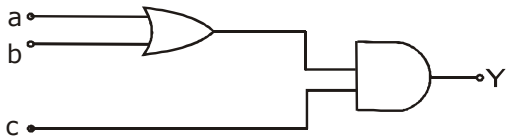
(4) V_B = 45 mV; V_W = 120 mV with left side of pilot at higher voltage

8. A neutron moving with a speed 'υ' makes a head on collision with a stationary hydrogen atom in ground state. The minimum kinetic energy of the neutron for which inelastic collision will take place is :

(1) 12.1 eV (2) 16.8 eV

(3) 10.2 eV (4) 20.4 eV

9. To get an output 1 from the circuit shown in figure the input must be :



(1) a = 0, b = 0, c = 1

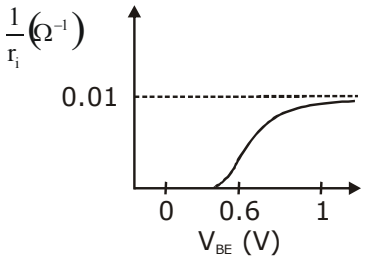
(2) a = 1, b = 0, c = 0

(3) a = 1, b = 0, c = 1

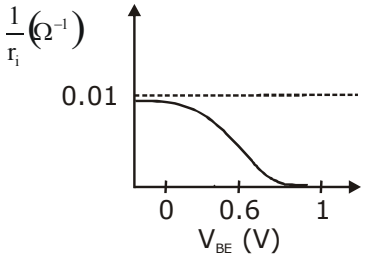
(4) a = 0, b = 1, c = 0

10. A realistic graph depiciting the variation of thhe reciprocal of input resistance in an input charcteristics measurement in a common emitter transistor configuration is :

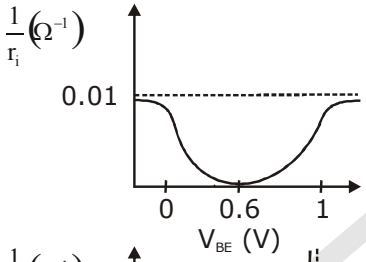
(1)



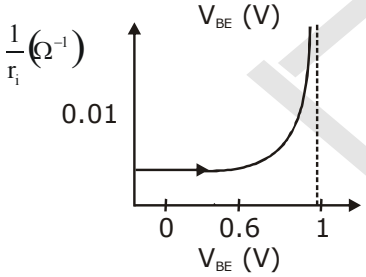
(2)



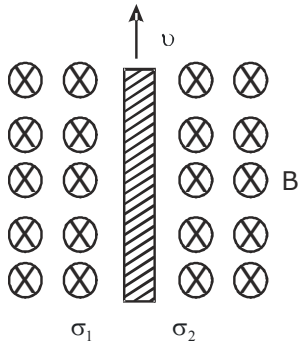
(3)



(4)



11. Consider a thin metallic sheet perpendicular to the plane of the paper moving with speed 'υ' in a uniform magnetic field B going into the plane ofthe paper (See figure.) If charge densities σ_1 and σ_2 are induced on the left and right surfaces, respectively, of the sheet then (ignore fringe effects.) :



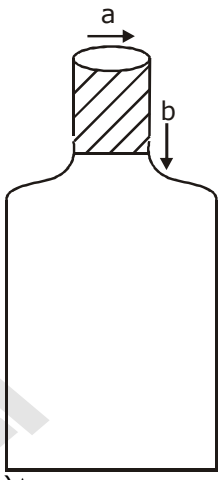
(1) $\sigma_1 = \frac{\epsilon_0 \upsilon B}{2}$, $\sigma_2 = \frac{-\epsilon_0 \upsilon B}{2}$

(2) $\sigma_1 = \frac{-\epsilon_0 \upsilon B}{2}$, $\sigma_2 = \frac{\epsilon_0 \upsilon B}{2}$

(3) $\sigma_1 = \epsilon_0 \upsilon B$, $\sigma_2 = -\epsilon_0 \upsilon B$

(4) $\sigma_1 = \sigma_2 = \epsilon_0 \upsilon B$

12. A bottle has an opening of radius a and length b. A cork of length b and radius (a + ΔA) where ($\Delta a << a$) is compressed to fit into the opening completely (See figure). If the bulk modulus of cork is B and frictional coefficient between the bottle and cork is μ then the force needed to push the cork into the bottle is :



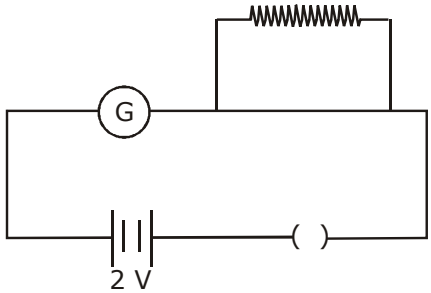
(1) ($\pi\mu$B b)Δa

(2) ($4\pi\mu$B b)Δa

(3) ($2\pi\mu$B b)Δa

(4) ($\pi\mu$B b)a

13. A galvanometer has a 50 division scale. Battery has no internal resistance. It is found that there is deflection of 40 divisions when R = 2400 Ω. Deflection becomes 20 divisions when resistance taken from resistance box is 4900 Ω. Then we can conclude :



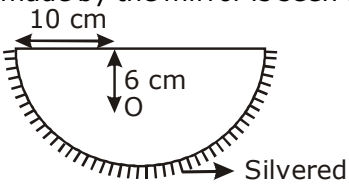
(1) Current sensitivity of galvanometer is 20 μA/ division.

(2) Full scale deflection current is 2 mA.

(3) Resistance of galvanometer is 200 Ω.

(4) Resistance required on R.B. for a deflection of 10 divisions is 9800 Ω.

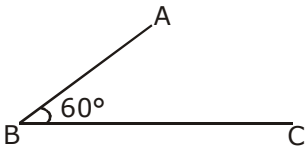
14. A hemispherical glass body of radius 10 cm and refractive index 1.5 is silvered on its curved surface . A small air bubble is 6 cm below the flat surface inside it along the axis. The position of the image of the air bubble made by the mirror is seen :



(1) 16 cm below flat surface
(2) 14 cm below flat surface
(3) 20 cm below flat surface
(4) 30 cm below flat surface

15. The ratio (R) of output resistance r_0, and the input resistance r_i in measurements of input and output characteristics of a transistor is typically in the range :
(1) R ~ 0.1 – 1.0 (2) R ~ 10^2 – 10^3
(3) R ~ 0.1 – 0.01 (4) R ~ 1 – 10

16. In the figure shown ABC is a uniform wire. If centre of mass of wire lies vertically below point A, then $\frac{BC}{AB}$ is close to :



(1) 1.5 (2) 3
(3) 1.85 (4) 1.37

17. A modulated signal $C_m(t)$ has the form $C_m(t)$ = 30 sin 300πt + 10 (cos 200πt – cos 400πt). The carrier frequency $f_{c'}$ the modulating frequency (message frequency) $f_{\omega'}$ and the modulation index μ are respectively given by :

(1) f_c = 150 Hz; f_ω =30 Hz ; $\mu = \frac{1}{3}$

(2) f_c = 200 Hz; f_ω =50 Hz ; $\mu = \frac{1}{2}$

(3) f_c = 200 Hz; f_ω =30 Hz ; $\mu = \frac{1}{2}$

(4) f_c = 150 Hz ; f_ω = 50 Hz ; $\mu = \frac{2}{3}$

18. Astronaut of mass 'm' is working on a satelite which is placed 'h' distance from earth. Earth has mass 'M' and radius 'R'. Then the gravitational force which is working on astronaut is -
(1) Zero, because passenger does not feel heaviness

(2) $0 < F_G < \frac{GMm}{R^2}$

(3) $\frac{GMm}{(R+h)^2} < F_G < \frac{GMm}{R^2}$

(4) $F_G = \frac{GMm}{(R+h)^2}$

19. A,B,C and D are four different physical quantities having different dimensions. None of them is dimensionless. But we know that the equation AD = C In (BD) holds true. Then which of the combination is not a meaningful quantity ?

(1) $\frac{(A-C)}{D}$ (2) $\frac{C}{BD} - \frac{AD^2}{C}$

(3) A^2 B^2C^2 (4) $\frac{A}{B} - C$

20. Two stars are 10 light years away from the earth. They are seen through a telescope of objective diameter 30 cm. The wavelength of light is 600nm. To see the stars just resolved by the telescope, the minimum distance between them should be (1 light year = 9.46 × 10^{15}m) of the order of :
(1) 10^{11} km (2) 10^8 km
(3) 10^{10} km (4) 10^6 km

21. Consider an electromagnetic wave propagating in vacuum. Choose the correct statement :
For an electromagnetic wave propagating in + y directionn the

(1) electric field is $\vec{E} = \frac{1}{\sqrt{2}} E_{yz}(x, t)\,\hat{z}$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}} Bz(x, t)\,\hat{y}$. For an electromagnetic wave propagating in + y direction

(2) the electric field is $\vec{E} = \frac{1}{\sqrt{2}} E_{yz}(x, t)\,\hat{y}$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}} B_{yz}(x, t)\,\hat{z}$

For an electromagnetic wave propagating in + x direction the electric field is

(3) $\vec{E} = \frac{1}{\sqrt{2}} E_{yz}(y, z, t)\left(\hat{y}+\hat{z}\right)$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}} B_{yz}(y, z, t)\left(\hat{y}+\hat{z}\right)$

For an electromagnetic wave propagating in + x direction the electric field

(4) $\vec{E} = \frac{1}{\sqrt{2}} E_{yz}(x, t)\left(\hat{y}-\hat{z}\right)$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}} B_{yz}(x, t)\left(\hat{y}+\hat{z}\right)$

22. A particle of mass M is moving in a circle of fixedradius R in such a way that its centripetal accelerationn at time t is given by n^2Rt^2 where n is a constant. The power delivered to the particle by the force acting on it, it :

(1) $M n R^2 t^2$ (2) $M n R^2 t$

(3) $\frac{1}{2} M n^2 R^2 t^2$ (4) $M n^2 R^2 t$

23. Cement, sand and seree are dropped in rotating cylidrical drum to make concrete mixture. If rotating speed of drum is very high then contents are attached to wall of drum and mixture is not formed correctly. If radius of drum is 1.25 m and its axis is horizontal, then the required maximum rotating speed to make good mixture in rpm is -

(1) 8.0 (2) 1.3
(3) 0.4 (4) 27.0

24. A thin 1 m long rod has a radiuus of 5 mm. A force of 50πkN is applied at one end to determine its Young's modulus. Assume that the force is exactly known. If the least count in the measurement of all lengths is 0.01 mm, which of the following statements is false ?

(1) $\frac{\Delta Y}{Y}$ gets minimum contribution from the uncertainty in the length.

(2) $\frac{\Delta Y}{Y}$ gets its maximum contribution from the uncertainty in strain.

(3) The maximum value of Y that can be determined is 10^{14} N/m^2

(4) The figure of merit is the largest for the length of the rod.

25. A conducting metal circular-wire-loop of radius r is placed perpendicular to a magnetic field which varies with time as $B = B_0e^{-t/\tau}$, where B_0 and τ are constants, at time = 0. If the resistance of the loop is R then the heat generated in the loop after a long time ($t \to \infty$) is :

(1) $\frac{\pi^2r^4B_0^2 R}{\tau}$ (2) $\frac{\pi^2r^4B_0^2}{2\tau R}$

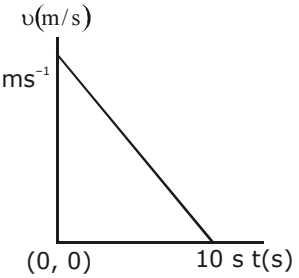
(3) $\frac{\pi^2r^4B_0^4}{2\tau R}$ (4) $\frac{\pi^2r^4B_0^2}{\tau R}$

26. Within a spherical charge distribution of charge density $\rho(r)$, N equipotential surfaces of potential V_0, $V_0 + \Delta V$, $V_0 + 2\Delta V$, ... $V_0 + N\Delta V$ ($\Delta V>0$), area drawn and have increasing radii r_0, r_1, r_2 ..... r_N, respectively. If the difference in the radii ofthe surfaces is constant for all values of V_0 and ΔV them :

(1) $\rho(r)\alpha r$ (2) $\rho(r)$ = constant

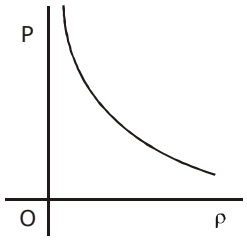
(3) $\rho(r)\alpha \frac{1}{r}$ (4) $\rho(r)\alpha \frac{1}{r^2}$

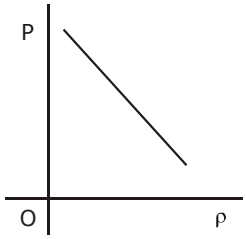
27. Velocity-time graph for a body of mass 10 kg is shown in figure. Work-done on the body in first two seconds of the motion is :

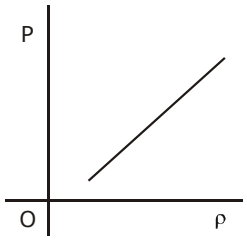


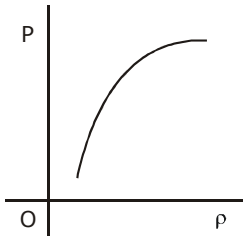
(1) –4500 J
(2) 12000 J
(3) –9300 J
(4) –12000 J

28. Which of the following shows the correct relationship between the pressure 'P' and density ρ of an ideal gas at constnat temperature ?

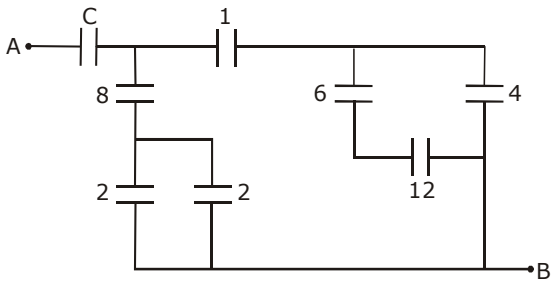
(1)


(2)


(3)


(4)


29. Figure shows a network of capacitors where the numbers indicates capacitances in mircro Farad. The value of capacitance C if the equivalent capacitance between point A and B is to be 1 μF is :



(1) $\frac{33}{23}\mu F$ (2) $\frac{34}{23}\mu F$

(3) $\frac{31}{23}\mu F$ (4) $\frac{32}{23}\mu F$

30. A particle of mass m is acted upon by a force F given by the empirical law $F = \frac{R}{t^2}\upsilon(t)$

If this law is to be tested experimentally by observing the motion starting from rest, the best way is to plot :

(1) $\upsilon(t)$ against t^2

(2) log $\upsilon(t)$ against $\frac{1}{t^2}$

(3) log $\upsilon(t)$ against t

(4) log $\upsilon(t)$ against $\frac{1}{t}$

PART - III [CHEMISTRY]

1. Assertion : Among the carbon allotropes, diamond is an insulator, wherea, graphite is a good conductor of electricity.
Reason : Hybridization of carbon in diamond and graphite are sp^3 and sp^2, respectively.
(A) Assertion is incorec statement, but the reason is correct.
(B) Both assertion and reason are incorrect
(C) but the reason is not the correct explanation for the assertion.
(D) Both assertion and reason are correct, and the reason is the correct explanation for the assertion.

2. The rate law for the reaction below is given by the expression k [A] [B]
$A + B \rightarrow$ Product
If the concentration of B is increased from 0.1 to 0.3 mole, keeping the value of A at 0.1 mole, the rate constant will be :
(A) 9k (B) k/3
(C) k (D) 3k

3. Which of the following is an example of homoleptic complex ?
(A) $[Co(NH_3)_6]Cl_3$ (B) $[Co(NH_3)_4Cl_2]$
(C) $[Pt(NH_3)_2Cl_2]$ (D) $[Co(NH_3)_5Cl]Cl_2$

4. Observation of "Rhumann's purple" is confirmatory test for the presence of :
(A) Protein (B) Reducing sugar
(C) Starch (D) Cupric ion

5. Fluorination of an aromatic ring is easily accomplished by treating a diazonium salt with HBF_4. Which of the following conditions is correct about this reaction ?
(A) NaF/Cu (B) $NaNO_2$/Cu
(C) Cu_2O/H_2O (D) Only heat

6. Which of the following polymers is synthesized using a free radical polymerization technique ?
(A) Terylene (B) Nylon 6, 6
(C) Melamine polymer (D) Teflon

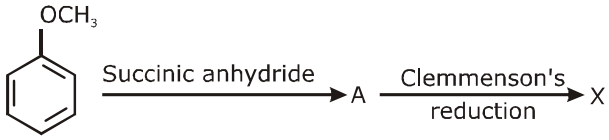
7. An aqueous solution of a salt MX_2 at certain temperature has a van't Hoff factor of 2. The degree of dissociation for this solution of the salt is :
(A) 0.80 (B) 0.50
(C) 0.67 (D) 0.33

8. The commercial name for calcium oxide is :
(A) Limestone (B) Milk of lime
(C) Slaked lime (D) Quick lime

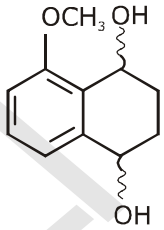
9. Extraction of copper by smelting uses silica as an additive to remove.
(A) FeO (B) Cu_2S
(C) Cu_2O (D) FeS

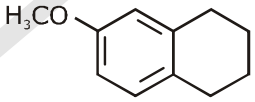
10. Identify the correct statement :
(A) Iron corrodes in oxygen-free water.
(B) by forming na impermeable barrier at its surface.
(C) Corrosion of iron can be minimized by forming a contact with another metal with a higher reduction potential.
(D) Iron corrodes more repidly in salt water because its electrochemical potential is higher.

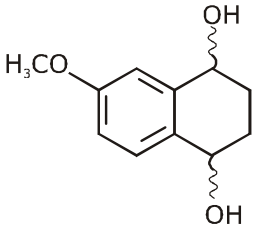
11. Consider the reaction sequence below :

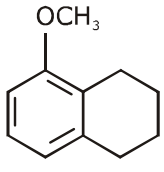


X is :

(A) 

(B) 

(C) 

(D) 

12. Gold numbers of some colloids are : Gelatin : 0.005 - 0.01, Gum Arabic : 0.15 - 0.25 ; Oleate : 0.04 - 1.0; Starch : 15 - 25. Which among these is a better protective colloid ?
(A) Oleate (B) Gum Arabic
(C) Starch (D) Gelatin

13. Aqueous solution of which salt will not contain ions with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6$?

(A) NaF (B) CaI_2

(C) NaCl (D) KBr

14. Sodium extract is heated with concentrated HNO_3 before testing for halogens because :

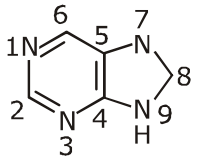
(A) Ag_2S and AgCN are soluble in acidic medium.

(B) Ag reacts faster with halides in acidic medium.

(C) S^{2-} and CN^-, if present, are decomposed by conc. HNO_3 and hence do not interfere in the test.

(D) Silver halides are totalliy insoluble in nitric acid.

15. The "N" which does not contribute to the basicity for the compound is :



(A) N 1 (B) N 7

(C) N 3 (D) N 9

16. A solid XY kept in an evacuated sealed container undergoes decomposition to form a mixture of gases X and Y at temperature T. The equilibrium pressure is 10 bar in this vessel. K_p for this reaction is :

(A) 5 (B) 100

(C) 25 (D) 10

17. The bond angle H-X-H is the greatest in teh compound :

(A) NH_3 (B) H_2O

(C) PH_3 (D) CH_4

18. If 100 mole of H_2O_2 decompose at 1 bar and 300 K, the work done (kJ) by one mole of $O_2(g)$ as it expands against 1 bar pressure is :

$2H_2O_2(I) \rightleftharpoons 2H_2O(l) + O_2(g)$

($R = 8.3\ J\ K^{-1}\ mol^{-1}$)

(A) 498.00 (B) 62.25

(C) 249.00 (D) 124.50

19. The correct statement about the synthesis of erythritol ($C(CH_2OH)_4$) used in the preparation of PETN is :

(A) The synthesis requires three aldol condensations and one Cannizzaro reation.

(B) The synthesis requires two aldol condensations and two Cannizzaro reactions.

(C) Alpha hydrogens of ethanol and methanol are involved in this reaction.

(D) The synthesis requires four aldol condensations between methanol and ethanol.

20. Which one of the following substances used in dry cleaning is a better strategy to control environmental pollution ?

(A) Tetrachloroethylene

(B) Sulphur dioxide

(C) Carbon dioxide

(D) Nitrogen dioxide

21. The following statements concern elements in the periodic table. Which of the following is true ?

(A) For group 15 elements, the stability of +5 oxidation state increases down the group.

(B) All the elements in Group 17 are gases.

(C) Elements of Group 16 have lower ionization enthalpy values compared to those of Group 15 in the corresponding periods.

(D) The Group 13 elements are all metals.

22. Which of the following is a bactericidal antibiotic' ?

(A) Ofloxacin (B) Tetracycline

(C) Chloramphenicol (D) Erythromycin

23. Identify the reaction which does not liberate hydrogen :

(A) Reaction of zinc with aqueous alkali.

(B) Electrolysis of acidified water using Pt electrodoes.

(C) Reaction of lithium hydride with B_2H_6.

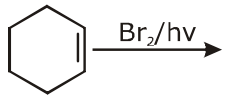
(D) Allowing a solution of sodium in liquid ammonia to stand.

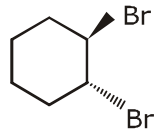
24. Initially, the root mean square (rms) velocity of N_2 molecules at certain temperature is u. If this temperature is doubled and all the nitrogen molecules dissociate into nitrogen atoms, then the new rms velocity will be :

(A) u/2 (B) 14u

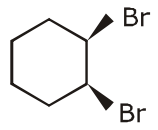
(C) 4u (D) 2u

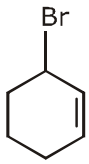
25. Bromination of cyclohexene under conditions given below yields :



(A) 

(B) 

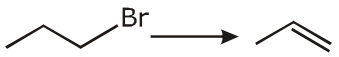
(C) 

(D) 

26. The volume of 0.1 N dibasic acid sufficient to neutralize 1 g of a base that furnishes 0.04 mole of OH^- in aqueous solution is :
(A) 200 mL (B) 800 mL
(C) 600 mL (D) 400 mL

27. The transition metal ions responsible for color in ruby and emerald are, respectively :
(A) Co^{3+} and Cr^{3+} (B) Cr^{3+} and Cr^{3+}
(C) Cr^{3+} and Co^{3+} (D) Co^{3+} and Co^{3+}

28. Which one of the following reagents is not suitable for the elimination reaction ?



(A) NaI (B) $NaOH/H_2O$
(C) $NaOH/H_2O$-EtOH (D) NaOEt/EtOH

29. Oxidation of succinate ion produces ethylene and carbon dioxide gases. On passing 0.2 Faraday electricity through an aqueous solution of potassium succinate, the total number of gases (at both cathode and anode) at STP (1 atm and 273 K) is :
(A) 8.96 L (B) 4.48 L
(C) 6.72 L (D) 2.24 L

30. Identify the incorrect statement :
(A) Rhombic and monoclinic sulphur have S_8 molecules.
(B) S_2 is paramagnetic like oxygen.
(C) The S-S-S bond angles in the S_8 and S_6 rings are the same.
(D) S_8 ring has a crown shape.