Central Board of Secondary Education

Question Paper Name :	B Tech 7 Apr 2013 Shift 1
Subject Name :	B. Tech
Duration :	180
Total Marks :	360
Display Marks:	Yes

B. Tech

Group Number :	1
Group Maximum Duration :	0
Group Minimum Duration :	180
Show Attended Group? :	No
Edit Attended Group? :	No
Break time :	0
Group Marks :	360

Mathematics Section A

Section Number :	1
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	30
Number of Questions to be attempted :	30
Section Marks :	120
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 1 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let A and B be two sets containing 2 elements and 4 elements respectively. The number of subsets of $A \times B$ having 3 or more elements is :

Options :

A. 219

B. 211

C. 256

D. 220

Question Number : 2 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

All the students of a class performed poorly in Mathematics. The teacher decided to give grace marks of 10 to each of the students. Which of the following statistical measures will not change even after the grace marks were given?

Options :

A. median

B. mode

C. variance

D. mean

Question Number : 3 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

$$\lim_{x \to 0} \frac{(1 - \cos 2x)\,(3 + \cos x)}{x \tan 4x}$$

is equal to

Options :

A. $-\frac{1}{4}$

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

C. 1

D. 2

Question Number : 4 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

At present, a firm is manufacturing 2000 items. It is estimated that the rate of change of production P w.r.t. additional number of workers x is given by

$$\frac{dp}{dx} = 100 - 12\sqrt{x}\ .$$

If the firm employs 25 more workers, then the new level of production of items is

Options :

A. 2500

B. 3000

C. 3500

D. 4500

Question Number : 5 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The area (in square units) bounded by the curves

$$y = \sqrt{x},$$
$$2y - x + 3 = 0,$$

x-axis, and lying in the first quadrant is :

Options :

A. 9

B. 36

C. 18

D. $\frac{27}{4}$

Question Number : 6 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Statement-1 : The value of the integral

$$\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\tan x}}$$

is equal to $\pi/6$

Statement-2 :

$$\int_a^b f(x)dx = \int_a^b f(a+b-x)dx.$$

Options :

A. Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1.

C. Statement- 1 is true; Statement-2 is False.

D. Statement-1 is false; Statement-2 is true.

Question Number : 7 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If

$$\int f(x)dx = \psi(x),$$

then

$$\int x^5 f(x^3)dx$$

is equal to

Options :

A. $$\frac{1}{3}\left[x^3\psi(x^3) - \int x^2\psi(x^3)dx\right] + C$$

B. $$\frac{1}{3}x^3\psi(x^3) - 3\int x^3\psi(x^3)dx + C$$

C. $$\frac{1}{3}x^3\psi(x^3) - \int x^2\psi(x^3)dx + C$$

D. $$\frac{1}{3}\left[x^3\psi(x^3) - \int x^3\psi(x^3)dx\right] + C$$

Question Number : 8 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If x, y, z are in A.P. and $\tan^{-1}x, \tan^{-1}y$ and $\tan^{-1}z$ are also in A.P., then :

Options :

A. $$x = y = z$$

B. $$2x = 3y = 6z$$

C. $$6x = 3y = 2z$$

D. $$6x = 4y = 3z$$

Question Number : 9 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The equation of the circle passing through the foci of the ellipse

$$\frac{x^2}{16} + \frac{y^2}{9} = 1$$

, and having centre at (0,3) is :

Options :

A. $x^2 + y^2 - 6y - 7 = 0$

B. $x^2 + y^2 - 6y + 7 = 0$

C. $x^2 + y^2 - 6y - 5 = 0$

D. $x^2 + y^2 - 6y + 5 = 0$

Question Number : 10 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If

$$y = \sec\left(\tan^{-1}x\right),$$

then $\frac{dy}{dx}$ at $x = 1$ is equal to :

Options :

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

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

C. 1

D. $\sqrt{2}$

Question Number : 11 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If the lines

$$\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$$

and

$$\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$$

are coplanar, then k can have :

Options :

A. any value

B. exactly one value

C. exactly two values

D. exactly three values

Question Number : 12 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A ray of light along

$$x + \sqrt{3}\ y = \sqrt{3}$$

gets reflected upon reaching X-axis, the equation of the reflected ray is :

Options :

A. $y = x + \sqrt{3}$

B. $\sqrt{3}\ y = x - \sqrt{3}$

C. $y = \sqrt{3}\ x - \sqrt{3}$

D. $\sqrt{3}\ y = x - 1$

Question Number : 13 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The x-coordinate of the incentre of the triangle that has the coordinates of mid points of its sides as $(0, 1)(1, 1)$ and $(1, 0)$ is :

Options :

A. $2 + \sqrt{2}$

B. $2 - \sqrt{2}$

C. $1 + \sqrt{2}$

D. $1 - \sqrt{2}$

Question Number : 14 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The term independent of x in expansion of

$$\left(\frac{x+1}{x^{2/3} - x^{1/3} + 1} - \frac{x-1}{x - x^{1/2}}\right)^{10}$$

is

Options :

A. 4

B. 120

C. 210

D. 310

Question Number : 15 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let T_n be the number of all possible triangles formed by joining vertices of an n-sided regular polygon. If $T_{n+1} - T_n = 10$, then the value of n is :

Options :

A. 7

B. 5

C. 10

D. 8

Question Number : 16 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The number of values of k, for which the system of equations :

$$(k+1)x + 8y = 4k$$
$$kx + (k+3)y = 3k - 1$$

has no solution, is

Options :

A. infinite

B. 1

C. 2

D. 3

Question Number : 17 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If the equations $x^2 + 2x + 3 = 0$ and

$$ax^2 + bx + c = 0,$$

$a, b, c \in R,$ have a common root, then $a : b : c$ is

Options :

A. $1:2:3$

B. $3:2:1$

C. $1:3:2$

D. $3:1:2$

Question Number : 18 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If z is a complex number of unit modulus and argument θ, then arg

$$\left(\frac{1+z}{1+z}\right)$$

equals :

Options :

A. $-\theta$

B. $\frac{\pi}{2}-\theta$

C. θ

D. $\pi-\theta$

Question Number : 19 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The real number k for which the equation, $2x^3+3x+k=0$ has two distinct real roots in $[0, 1]$

Options :

A. lies between 1 and 2

B. lies between 2 and 3

C. lies between -1 and 0

D. does not exist.

Question Number : 20 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The expression

$$\frac{\tan A}{1-\cot A}+\frac{\cot A}{1-\tan A}$$

can be written as:

Options :

A. $\sin A\ \cos A+1$

B. $\sec A\ \cos ecA+1$

C. $\tan A+\cot A$

D. $\sec A+\cos ecA$

Question Number : 21 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If the vectors

$$\vec{AB}=3\hat{i}+4\hat{k}$$

and

$$\vec{AC}=5\hat{i}-2\hat{j}+4\hat{k}$$

are the sides of a triangle ABC, then the length of the median through A is :

Options :

A. $\sqrt{18}$

B. $\sqrt{72}$

C. $\sqrt{33}$

D. $\sqrt{45}$

Question Number : 22 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Distance between two parallel planes $2x+y+2z=8$ and $4x+2y+4z+5=0$ is :

Options :

A. $\frac{3}{2}$

B. $\frac{5}{2}$

C. $\frac{7}{2}$

D. $\frac{9}{2}$

Question Number : 23 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A multiple choice examination has 5 questions. Each question has three alternative answers of which exactly one is correct. The probability that a student will get 4 or more correct answers just by guessing is :

Options :

A. $\frac{17}{3^5}$

B. $\frac{13}{3^5}$

C. $\frac{11}{3^5}$

D. $\frac{10}{3^5}$

Question Number : 24 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The circle passing through $(1, -2)$ and touching the axis of x at $(3, 0)$ also passes through the point :

Options :

A. $(-5, 2)$

B. $(2, -5)$

C. $(5, -2)$

D. $(-2, 5)$

Question Number : 25 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Given : A circle, $2x^2 + 2y^2 = 5$ and a parabola,

$$y^2 = 4\sqrt{5}\ x$$

.

Statement-1 : An equation of a common tangent to these curves is

$$y = x + \sqrt{5}$$

.

Statement-2 : If the line,

$$y = mx + \frac{\sqrt{5}}{m}(m \neq 0)$$

is their common tangent, then m satiesfies $m^4 - 3m^2 + 2 = 0$.

Options :

A. Statement-1 is true; Statement-2 is true; Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true; Statement-2 is true; Statement-2 is not a correct explanation for Statement-1.

C. Statement-1 is true; Statement-2 is false.

D. Statement-1 is false Statement-2 is true.

Question Number : 26 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

$ABCD$ is a trapezium such that AB and CD are parallel and $BC \perp CD$. If

$$\angle ADB = \theta,\ BC = p$$

and

$$CD = q,$$

then AB is equal to:

Options :

A. $$\frac{(p^2 + q^2)\sin\theta}{p\cos\theta + q\sin\theta}$$

B. $$\frac{p^2 + q^2\cos\theta}{p\cos\theta + q\sin\theta}$$

C. $$\frac{p^2 + q^2}{p^2\cos\theta + q^2\sin\theta}$$

D. $$\frac{(p^2 + q^2)\sin\theta}{(p\cos\theta + q\sin\theta)^2}$$

Question Number : 27 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The intercepts on x-axis made by tangents to the curve,

$$y = \int_0^x |t| dt, x \in R,$$

which are parallel to the line $y = 2x$, are equal to :

Options :

A. ± 1

B. ± 2

C. ± 3

D. ± 4

Question Number : 28 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The sum of first 20 terms of the sequence 0.7, 0.77, 0.777,.....,is

Options :

A. $\frac{7}{81}\left(179 - 10^{-20}\right)$

B. $\frac{7}{9}\left(99 - 10^{-20}\right)$

C. $\frac{7}{81}\left(179 + 10^{-20}\right)$

D. $\frac{7}{9}\left(99 + 10^{-20}\right)$

Question Number : 29 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If

$$P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$$

is the adjoint of a 3×3 matrix A and

$$|A| = 4,$$

then α is equal to :

Options :

A.

B. 11

C. 5

D. 0

Question Number : 30 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Consider :

Statement − I :

$$(p \wedge \sim q) \wedge (\sim p \wedge q)$$

is a fallacy.

Statement − II :

$$(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$$

is a tautology.

Options :

A. Statement - I is True; Statement -II is true; Statement-II is not a correct explanation for Statement-I

B. Statement -I is True; Statement -II is False.

C. Statement -I is False; Statement -II is True

D. Statement -I is True; Statement -II is True; Statement-II is a correct explanation for Statement-I

Physics Section A

Section Number :	2
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	30
Number of Questions to be attempted :	30
Section Marks :	120
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 31 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A circular loop of radius 0.3 cm lies center of the small loop is on the axis of the bigger loop. The distance between their centers is 15 cm. If a current of 2.0 A flows through the smaller loop, than the flux linked with bigger loop is

Options :

A. 9.1×10^{-11} weber

B. 6×10^{-11} weber

C. 3.3×10^{-11} weber

D. 6.6×10^{-9} weber

Question Number : 32 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In a hydrogen like atom electron make transition from an energy level with quantum number n to another with quantum number $(n-1)$. If

$$n >> 1,$$

the frequency of radiation emitted is proportional to :

Options :

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

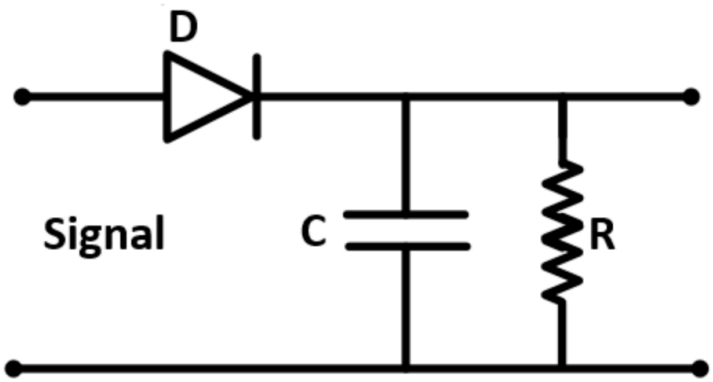
B. $\frac{1}{n^2}$

C. $\frac{1}{n^{\frac{3}{2}}}$

D. $\frac{1}{n^3}$

Question Number : 33 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A diode detector is used to detect an amplitude modulated wave of 60% modulation by using a condenser of capacity 250 picofarad in parallel with a load resistance 100 kilo *ohm*. Find the maximum modulated frequency which could be detected by it.



Options :

A. 10.62 *MHz*

B. $10.62\ kHz$

C. $5.31\ MHz$

D. $5.31\ kHz$

Question Number : 34 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The magnetic field in a travelling electromagnetic wave has a peak value of 20 nT. The peak value of electric field strength is :

Options :

A. $3V/m$

B. $6V/m$

C. $9V/m$

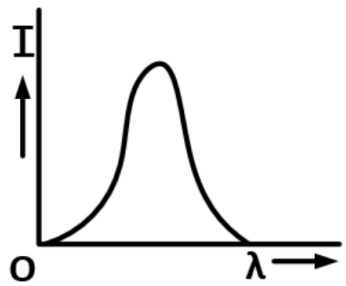
D. $12V/m$

Question Number : 35 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

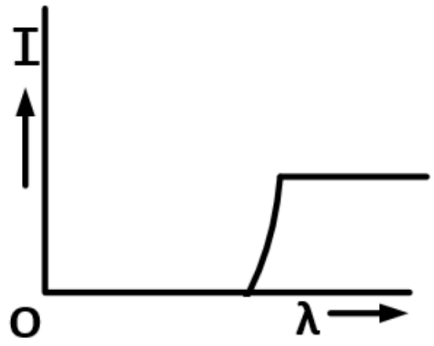
The anode voltage of a photocell is kept fixed. The wavelength λ of the light falling on the cathode is gradually changed. The plate current I of the photocell varies as follows :

Options :

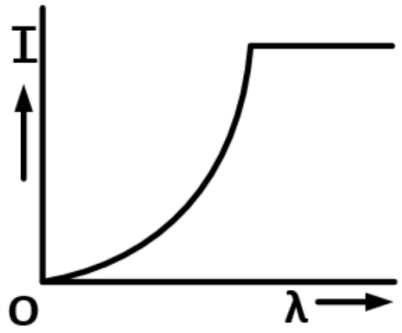
A.



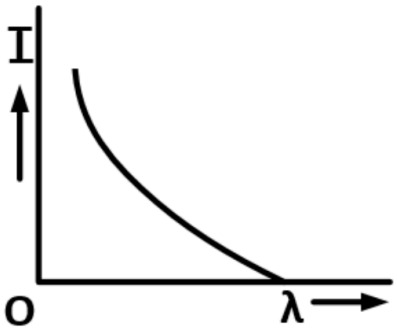
B.



C.



D.

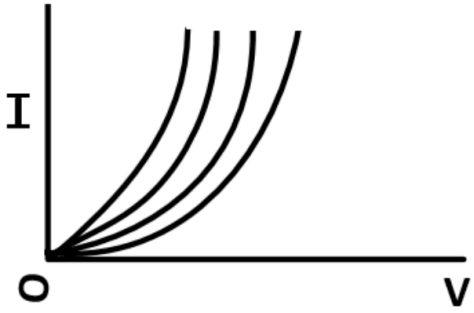


Question Number : 36 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

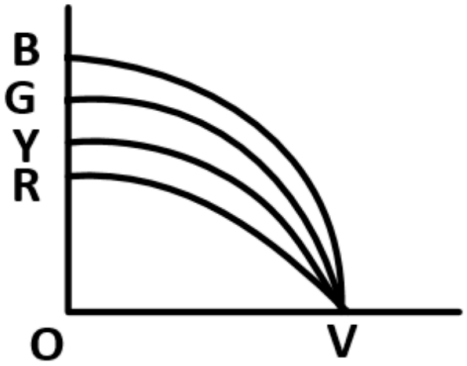
The I-*V* characteristic of an *LED* is

Options :

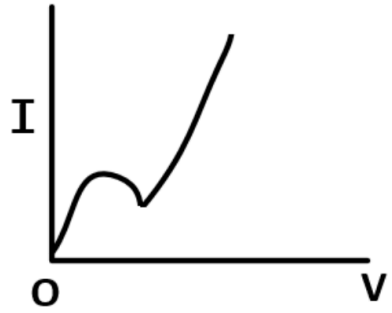
A.



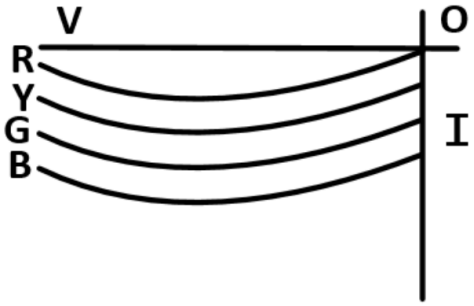
B.



C.

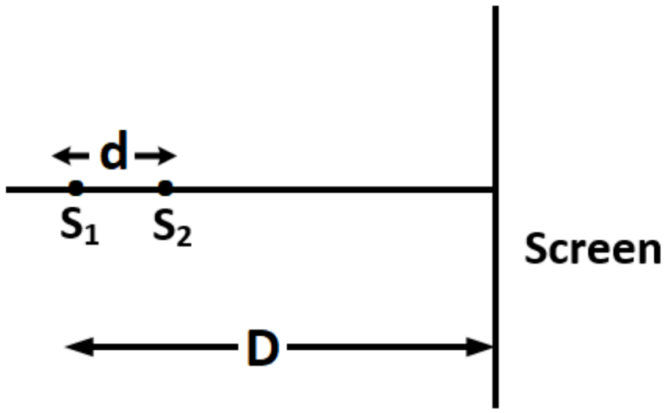


D.



Question Number : 37 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two coherent point sources S_1 and S_2 are separated by a small distance $'d'$ as shown. The fringes obtained on the screen will be



Options :

A. points

B. straight lines

C. semi-circles

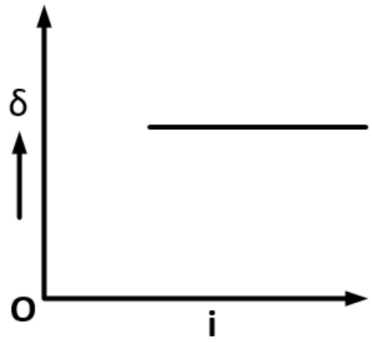
D. concentric circles

Question Number : 38 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

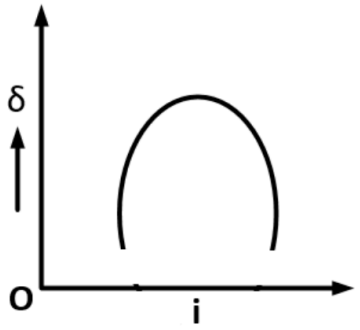
The graph between angle of deviation (δ) and angle of incidence (i) for a triangular prism is represented by

Options :

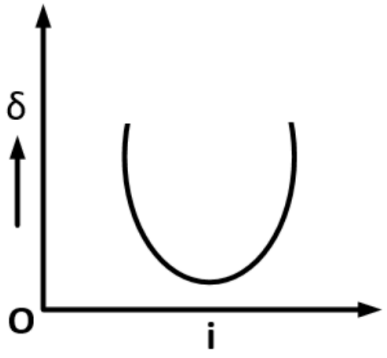
A.



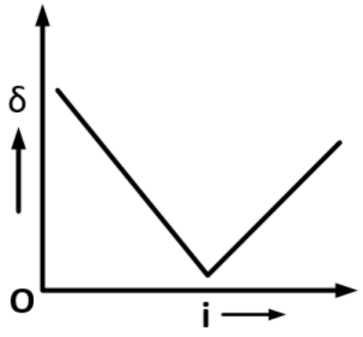
B.



C.

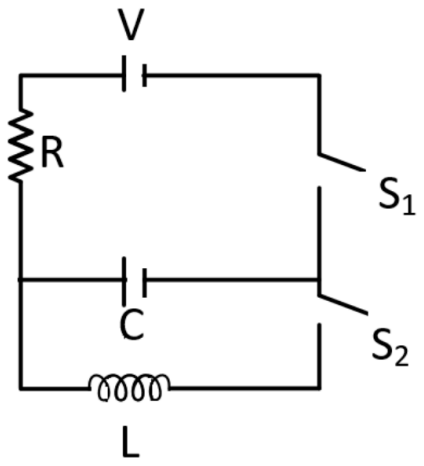


D.



Question Number : 39 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In an LCR circuit as shown below both switches are open initially. Now switch S_1 is closed, S_2 kept open. (q is charge on the capacitor and $\tau = RC$ is Capacitance time constant). Which of the following statement is correct ?



Options :

A. Work done by the battery is half of the energy dissipated in the resistor

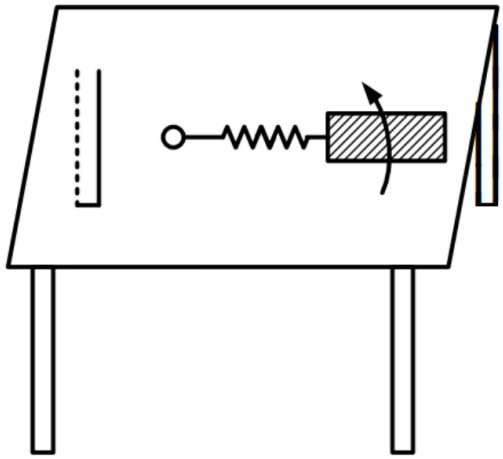
B. $t = \tau,\ q = CV/2$

C. At $t = 2\tau,\ q = CV\left(1 - e^{-2}\right)$

D. At $t = 2\tau,\ q = CV\left(1 - e^{-1}\right)$

Question Number : 40 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A metallic rod of length $'\ell'$ is tied to a string of length 2ℓ and made to rotate with angular speed w on a horizontal table with one end of the string fixed. If there is a vertical magnetic field $'B'$ in the region, the $e.m.f$ induced across the ends of the rod is



Options :

A. $\frac{2B\omega\ell}{2}$

B. $\frac{3B\omega\ell}{2}$

C. $\frac{4B\omega\ell^2}{2}$

D. $\frac{5B\omega\ell^2}{2}$

Question Number : 41 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Diameter of a plano-convex lens is 6 cm and thickness at the center is 3mm. If speed of light in material of lens is $2 \times 10^8\ m/s$, the focal length of the lens is

Options :

A. $15\ cm$

B. $20\ cm$

C. $30\ cm$

D. $10\ cm$

Question Number : 42 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A beam of unpolarised light of intensity I_0 is passed through a polaroid A and then through another polaroid B which is oriented so that its principal plane makes an angle of 45° relative to that of A. The intensity of the emergent light is

Options :

A. I_0

B. $\frac{I_0}{2}$

C. $\frac{I_0}{4}$

D. $\frac{I_0}{8}$

Question Number : 43 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two short bar magnets of length 1 cm each have magnetic moments 1.20 Am^2 and 1.00 Am^2 respectively. They are placed on a horizontal table parallel to each other with their N poles pointing towards the South. They have a common magnetic equator and are separated by a distance of 20.0 cm. The value of the resultant horizontal magnetic induction at the mid-point O of the line joining their centres is close to (Horizontal component of earth's magnetic induction is $3.6 \times 10.5 Wb/m^2$)

Options :

A. $3.6 \times 10.5\ Wb/m^2$

B. $2.56 \times 10.4\ Wb/m^2$

C. $3.50 \times 10.4\ Wb/m^2$

D. $5.80 \times 10.4\ Wb/m^2$

Question Number : 44 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The supply voltage to room is 120V. The resistance of the lead wires is 6Ω. A 60 W bulb is already switched on. What is the decrease of voltage across the bulb, when a 240 W heater is switched on in parallel to the bulb?

Options :

A. zero

B. 2.9 Volt

C. 13.3 Volt

D. 10.04 Volt

Question Number : 45 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

This questions has Statement - I and Statement - II. Of the four choices given after the Statements, choose the one that best describes into two Statements.

Statement - I **:** Higher the range, greater is the resistance of ammeter.

Statement - II **:** To increase the range of ammeter, additional shunt needs to be used across it.

Options :

A. Statement - I is true, Statement - II is true, Statement - II is the correct explanation of statement - I.

B. Statement - I is true, Statement - II is true, Statement - II is not the correct explanation of statement - I.

C. Statement - I is true, Statement - II is false

D. Statement - I is false, Statement - II is true

Question Number : 46 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two charges, each equals to q, are kept at $x = -a$ and $x = a$ on the x-axis. A particle of mass m and charge

$$q_0 = \frac{q}{2}$$

is placed at the origin. If charge q_0 is given a small displacement

$$(y << a)$$

along the y-axis, the net force acting on the particle is proportional to

Options :

A. y

B. $-y$

C. $\frac{1}{y}$

D. $-\frac{1}{y}$

Question Number : 47 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have equal cross sectional area A. When the piston is in equilibrium, the volume of the gas is V_0 and its pressure is P_0. The piston is slightly displaced from the equilibrium position and released,. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frquency

Options :

A. $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$

B. $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$

C. $\frac{1}{2\pi}\sqrt{\frac{A\gamma P_0}{V_0 M}}$

D. $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\gamma P_0}}$

Question Number : 48 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A sonometer wire of length 1.5 m is made of steel. The tension in it produces an elastic strain of 1%. What is the fundamental frequency of steel if density and elasticity of steel are $7.7 \times 10^3\ kg/m^3$ and $2.2 \times 10^{11}\ N/m^2$ respectively ?

Options :

A. $188.5\ Hz$

B. $178.2\ Hz$

C. $200.5\ Hz$

D. $770\ Hz$

Question Number : 49 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two capacitors C_1 and C_2 are charged to 120 V and 200 V respectively. It is found that connecting them together the potential on each one can be made zero. Then

Options :

A. $5C_1 = 3C_2$

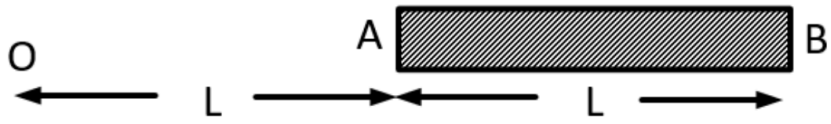
B. $3C_1 = 5C_2$

C. $3C_1 + 5C_2 = 0$

D. $9C_1 = 4C_2$

Question Number : 50 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A charge Q is uniformly distributed over a long rod AB of length L as shown in the figure. The electric potential at the point O lying at distance L from the end A is



Options :

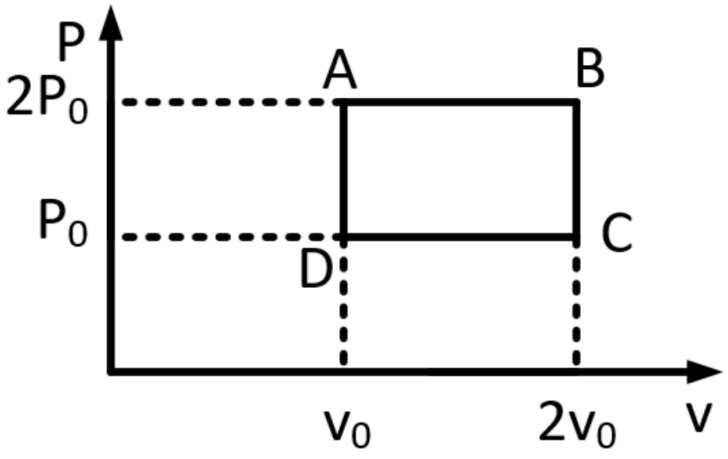
A. $\frac{Q}{8\pi\varepsilon_0 L}$

B. $\frac{3Q}{4\pi\varepsilon_0 L}$

C. $\frac{Q}{4\pi\varepsilon_0 L \ln 2}$

D. $\frac{Q \ln 2}{4\pi\varepsilon_0 L^s}$

Question Number : 51 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical



The above p-v diagram represents the thermodynamic cycle of an engine, operating with an ideal monatomic gas. The amount of heat, extracted from the source in a single cycle is

Options :

A. $p_0 v_0$

B. $\left(\frac{13}{2}\right)p_0v_0$

C. $\left(\frac{11}{2}\right)p_0v_0$

D. $4p_0v_0$

Question Number : 52 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Assume that a drop of liquid evaporates by decreases in its surface energy, so that its temperature remains unchanged. What should be the minimum radius of the drop for this to be possible ? The surface tension is T, density of liquid is ρ and L is its latent heat of vaporization.

Options :

A. $\rho L/T$

B. $\sqrt{T/\rho L}$

C. $T/\rho L$

D. $2T/\rho L$

Question Number : 53 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

What is the minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of $2R$?

Options :

A. $\frac{5GmM}{6R}$

B. $\frac{2GmM}{3R}$

C. $\frac{GmM}{2R}$

D. $\frac{GmM}{3R}$

Question Number : 54 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

This question has statement I and statement II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I: A point particle of mass m moving with speed v collides with stationary point particle of mass M. If the maximum energy loss possible is given as

$$f\left(\frac{1}{2}mv^2\right)$$

, then

$$f = \left(\frac{m}{M+m}\right).$$

Statement - II: Maximum energy loss occurs when the particles get stuck together as a result of the collision.

Options :

A. Statement - I is true, Statement - II is true; Statement - II is the correct explanation of Statement - I .

B. Statement - I is true, Statement - II is true; Statement - II is not the correct explanation of Statement - I.

C. Statement - I is true, Statement - II is false

D. Statement - I is false, Statement - II true.

Question Number : 55 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A uniform cylinder of length L and mass M having cross-sectional area A is suspended, with its length vertical, from a fixed point by a mass-less spring such that it is half submerged in a liquid of density σ at equilibrium position. The extension x_0 of the spring when it is in equilibrium is:

Options :

A. $$\frac{Mg}{k}$$

B. $$\frac{Mg}{k}\left(1-\frac{LA\sigma}{M}\right)$$

C. $$\frac{Mg}{k}\left(1-\frac{LA\sigma}{2M}\right)$$

D. $$\frac{Mg}{k}\left(1+\frac{LA\sigma}{M}\right)$$

Question Number : 56 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A hoop of radius r and mass m rotating with an angular velocity ω_0 is placed on a rough horizontal surface. The initial velocity of the center of the hoop is zero. What will be the velocity of the center of the hoop when it cases to slip?

Options :

A. $\frac{r\omega_0}{4}$

B. $\frac{r\omega_0}{3}$

C. $\frac{r\omega_0}{2}$

D. $r\omega_0$

Question Number : 57 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)$ m/s, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical. If g = 10 m/s^2, the equation of its trajectory is:

Options :

A. $y = x - 5x^2$

B. $y = 2x - 5x^2$

C. $4y = 2x - 5x^2$

D. $4y = 2x - 25x^2$

Question Number : 58 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of vacuum. If M = mass, L = length, T = time and A = electric current, then:

Options :

A. $\varepsilon_0 = \left[M^{-1}L^{-3}T^2A\right]$

B. $\varepsilon_0 = \left[M^{-1}L^{-3}T^4A^2\right]$

C. $\varepsilon_0 = \left[M^1L^2T^1A^2\right]$

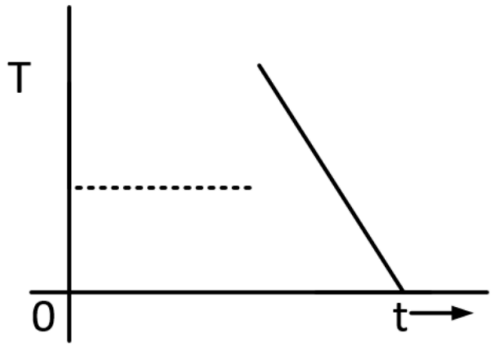
D. $\varepsilon_0 = \left[M^1L^2T^1A\right]$

Question Number : 59 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

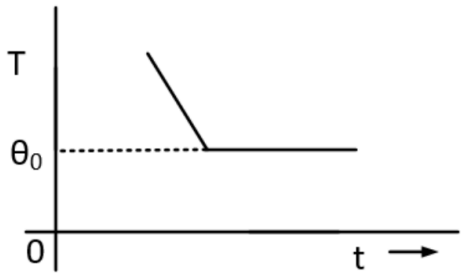
If a piece of metal is heated to temperature θ and then allowed to cool in a room which is at temperature θ_0, the graph between the temperature T of the metal and time t will be closest to

Options :

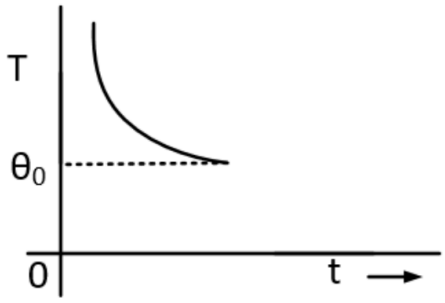
A.



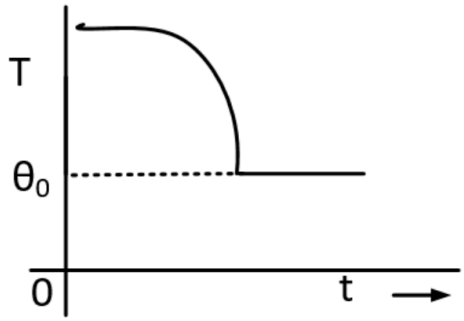
B.



C.



D.



Question Number : 60 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The amplitude of a damped oscillator decreases to 0.9 times its original magnitude in 5*s*. In another 10*s* it will decrease to α times its original magnitude, where α equals

Options :

A. 0.7

B. 0.81

C. 0.729

D. 0.6

Chemistry Section A

Section Number :	3
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	30
Number of Questions to be attempted :	30
Section Marks :	120
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 61 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0^{o}C. As it does so, it absorbs 208J of heat. The values of q and w for the process will be : (R = 8.314 J/mol K) (l n 7.5 = 2.01)

Options :

A. q = – 208 J, w = – 208 J

B. q = – 208 J, w = + 208 J

C. $q = +208\ J, w = +208\ J$

D. $q = +208\ J, w = -208\ J$

Question Number : 62 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

How many litres of water must be added to 1 litre of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2?

Options :

A. 0.1 L

B. 0.9 L

C. 2.0 L

D. 9.0 L

Question Number : 63 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

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

Options :

A. tertiary alcohol by S_N1

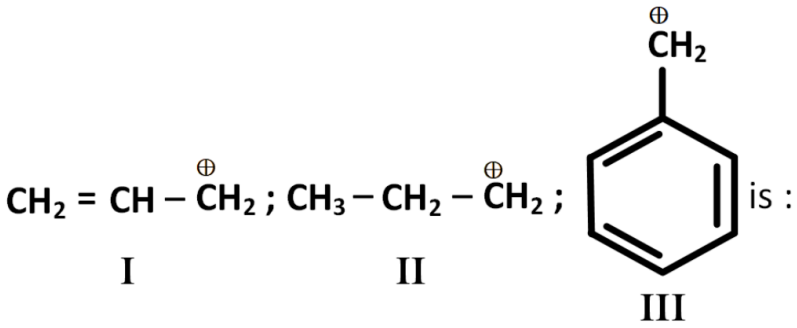
B. secondary alcohol by S_N2

C. tertiary alcohol by S_N2

D. secondary alcohol by S_N1

Question Number : 64 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The order of stability of the following carbocations :



Options :

A. III > II > I

B. II > III > I

C. I > II > III

D. III > I > II

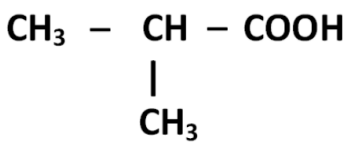
Question Number : 65 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

An organic compound A upon reacting with NH_3 gives B. On heating B gives C. C in presence of KOH reacts with Br_2 to given $CH_3CH_2NH_22$. A is :

Options :

A. CH_3COOH

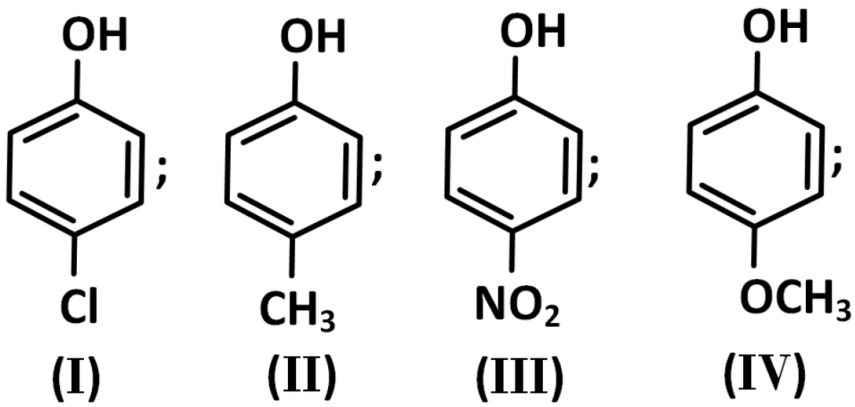
B. $CH_3CH_2CH_2COOH$

C. 

D. CH_3CH_2COOH

Question Number : 66 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Arrange the following compounds in order of decreasing acidity :



Options :

A. II > IV > I > III

B. I > II > III > IV

C. III > I > II > IV

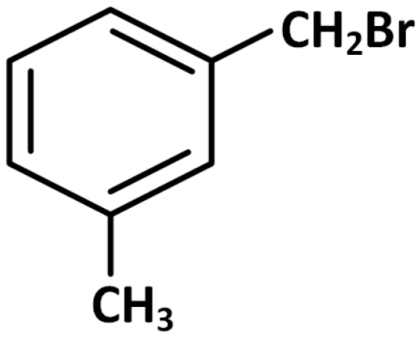
D. IV > III > I > II

Question Number : 67 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

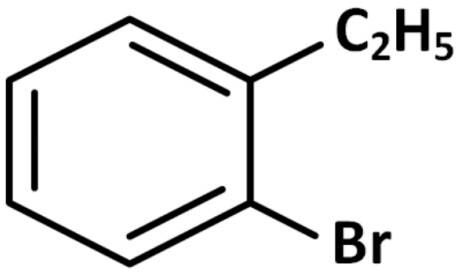
Compound (A), C_8H_9Br, gives a white precipitate when warmed with alcoholic $AgNO_3$. Oxidation of (A) gives an acid (B), $C_8H_6O_4$. (B) easily forms anhydride on heating. Identify the compound (A).

Options :

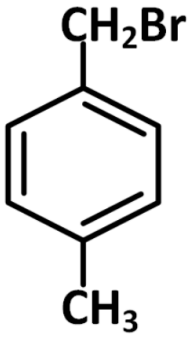
A.



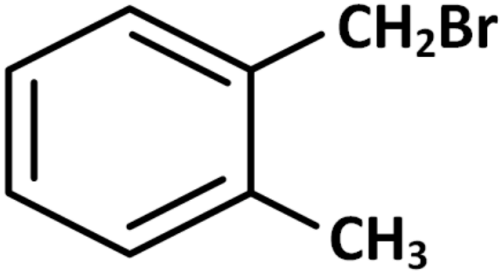
B.



C.



D.



Question Number : 68 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The gas leaked from a storage tank of the Union Carbide plant in Bhopal gas tragedy was:

Options :

A. Methylamine

B. Ammonia

C. Phosgene

D. Methyl isocyanate

Question Number : 69 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which of the following complex species is not expected to exhibit optical isomerism?

Options :

A. $[Co\ (en)_2\ Cl_2]^-$

B. $[Co\ (NH_3)_3\ Cl_3]$

C. $[Co\ (en)\ (NH_3)_2\ Cl_2]^+$

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

Question Number : 70 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Synthesis of each molecule of glucose in photosynthesis involves:

Options :

A. 10 molecules of ATP

B. 8 molecules of ATP

C. 6 molecules of ATP

D. 18 molecules of ATP

Question Number : 71 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A compound with molecular mass 180 is acylated with CH_3COCl to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is:

Options :

A. 2

B. 5

C. 4

D. 6

Question Number : 72 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The rate of a reaction doubles when its temperature changes from 300K to 310K. Activation energy of such a reaction will be:($R = 8.314\ JK^{-1}\ mol^{-1}$ and $\log 2 = 0.301$)

Options :

A. $48.6\ kJ\ mol^{-1}$

B. $58.5\ kJ\ mol^{-1}$

C. $60.5\ kJ\ mol^{-1}$

D. $53.6\ kJ\ mol^{-1}$

Question Number : 73 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which of the following arrangements does not represent the correct order of the property stated against it?

Options :

A. $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size

B. $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution

C. Sc < Ti < Cr < Mn : number of oxidation states

D. $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour

Question Number : 74 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Four successive members of the first row transition elements are listed below with atomic numbers. Which one of them is expected to have the highest $E^0_{M^{3+}/M^{2+}}$ value?

Options :

A. Mn (Z = 25)

B. Fe (Z = 26)

C. Co (Z = 27)

D. Cr (Z = 24)

Question Number : 75 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Given

$E^o_{Cr^{2+}/Cr}$ = -0.74 V; $E^o_{MnO_4^-/Mn^{2+}}$ = 1.51 V

$E^o_{Cr_2O_7^{2-}/Cr^{3+}}$ = 1.33 V; E^o_{Cl/Cl^-} = 1.36 V

Based on the data given above, strongest oxidising agent will be :

Options :

A. Cr^{3+}

B. Mn^{2+}

C. MnO_4^-

D. Cl^-

Question Number : 76 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The molarity of a solution obtained by mixing 750 mL of 0.5 (M) HCl with 250 mL of 2(M) HCl will be:

Options :

A. 1.00 M

B. 1. 75 M

C. 0.975 M

D. 0.875 M

Question Number : 77 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A solution of (–*l*) – chloro –1 – phenylethane in toluene racemises slowly in the presence of a small amount of $SbCl_5$, due to the formation of :

Options :

A. carbene

B. carbocation

C. free radical

D. carbanion

Question Number : 78 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of:

Options :

A. $Li_2 < Li_2^+ < Li_2^-$

B. $Li_2^+ < Li_2^- < Li_2$

C. $Li_2^- < Li_2^+ < Li_2$

D. $Li_2^- < Li_2 < Li_2^+$

Question Number : 79 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In which of the following pairs of molecules/ions, both the species are not likely to exist?

Options :

A. H_2^+ , He_2^{2-}

B. H_2^- , He_2^{2-}

C. H_2^{2+} , He_2

D. H_2^- , He_2^{2+}

Question Number : 80 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which one of the following molecules is expected to exhibit diamagnetic behaviour?

Options :

A. N_2

B. O_2

C. S_2

D. C_2

Question Number : 81 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar?

Options :

A. $S < Se < Ca < Ba < Ar$

B. $Ba < Ca < Se < S < Ar$

C. $Ca < Ba < S < Se < Ar$

D. $Ca < S < Ba < Se < Ar$

Question Number : 82 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The first ionization potential of Na is 5.1 eV. The value of electron gain enthalpy of Na+ will be:

Options :

A. -5.1 eV

B. -10.2 eV

C. $+2.55$ eV

D. -2.55 eV

Question Number : 83 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Energy of an electron is given by

$$E = -2.178 \times 10^{-18} J \left(\frac{Z^2}{n^2}\right)$$

. Wavelength of light required to excite an electron in an hydrogen atom from level n = 1 to n = 2 will be ($h = 6.62 \times 10^{-34}$ Js and $c = 3.0 \times 10^{8}$ ms^{-1})

Options :

A. 2.816×10^{-7} m

B. 6.500×10^{-7} m

C. 8.500×10^{-7} m

D. 1.214×10^{-7} m

Question Number : 84 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Consider the following reaction:

$$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$$

The value's of x, y and z in the reaction are, respectively :

Options :

A. 5, 2 and 16

B. 2, 5 and 8

C. 2, 5 and 16

D. 5, 2 and 8

Question Number : 85 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal M, present as M^{2+} and M^{3+} in its oxide. Fraction of the metal which exists as M^{3+} would be

Options :

A. 7.01%

B. 4.08%

C. 6.05%

D. 5.08%

Question Number : 86 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of CO_2. The empirical formula of the hydrocarbon is

Options :

A. C_2H_4

B. C_3H_4

C. C_6H_5

D. C_7H_8

Question Number : 87 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

For gaseous state, if most probable speed is denoted by C*, average speed by

$\overline{C}$

and mean square speed by C, then for a large number of molecules the ratios of these speeds are:

Options :

A. C*: $\overline{C}$: C = 1.128 : 1.225 : 1

B. C*: $\overline{C}$: C = 1.225 : 1.128 : 1

C. C*: $\overline{C}$: C = 1 : 1.225 : 1.128

D. C*: $\overline{C}$: C = 1 : 1.128 : 1.225

Question Number : 88 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which of the following exists as covalent crystals in the solid state?

Options :

A. Silicon

B. Sulphur

C. Phosphorous

D. Iodine

Question Number : 89 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The coagulating power of electrolytes having ions Na^+, Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order:

Options :

A. $Na^+ < Ba^{2+} < Al^{3+}$

B. $Al^{3+} < Ba^{2+} < Na^+$

C. $Ba^{2+} < Na^{+} < Al^{3+}$

D. $Al^{3+} < Na^{+} < Ba^{2+}$

Question Number : 90 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which of the following is the wrong statement?

Options :

A. O_3 molecule is bent

B. Ozone is violet-black in solid state

C. Ozone is diamagnetic gas

D. ONCl and ONO^{-} are isoelectronic