Joint Entrance Examination (Main) - JEE(Main)

Paper Name	B.E/B.Tech.(Paper I)
Test Date	26-06-2022
Slot	SLOT - 1
Lang	English

Q:1
Topic Name: Mathematics-Section A

ItemCode:101061

Question: Let $f(x) = \frac{x-1}{x+1}, x \in \mathbf{R} - \{0, -1, 1\}$. If $f^{n+1}(x) = f(f^{n}(x))$ for all $n \in \mathbf{N}$, then $f^{6}(6) + f^{7}(7)$ is equal to :

A $\frac{7}{6}$

B $-\frac{3}{2}$

C $\frac{7}{12}$

D $-\frac{11}{12}$

Q:2
Topic Name: Mathematics-Section A

ItemCode:101062

Question: Let $A = \left\{z \in \mathbf{C} : \left|\frac{z+1}{z-1}\right| < 1\right\}$

and $B = \left\{z \in \mathbf{C} : \arg\left(\frac{z-1}{z+1}\right) = \frac{2\pi}{3}\right\}$.

Then $A \cap B$ is :

A a portion of a circle centred at $\left(0, -\frac{1}{\sqrt{3}}\right)$ that lies in the second and third quadrants only

B a portion of a circle centred at $\left(0, -\frac{1}{\sqrt{3}}\right)$ that lies in the second quadrant only

C an empty set

D a portion of a circle of radius $\frac{2}{\sqrt{3}}$ that lies in the third quadrant only

Q:3
Topic Name: Mathematics-Section A

ItemCode:101063

Question: Let A be a 3×3 invertible matrix. If $|\text{adj}(24A)| = |\text{adj}(3\,\text{adj}(2A))|$, then $|A|^2$ is equal to :

A 6^6

B	2^{12}
C	2^6
D	1

Q:4
Topic Name: Mathematics-Section A

ItemCode:101064

Question: The ordered pair (a, b), for which the system of linear equations

$3x-2y+z=b$

$5x-8y+9z=3$

$2x+y+az=-1$

has no solution, is :

A	$\left(3, \frac{1}{3}\right)$
B	$\left(-3, \frac{1}{3}\right)$
C	$\left(-3, -\frac{1}{3}\right)$
D	$\left(3, -\frac{1}{3}\right)$

Q:5
Topic Name: Mathematics-Section A

ItemCode:101065

Question: The remainder when $(2021)^{2023}$ is divided by 7 is :

A	1
B	2
C	5
D	6

Q:6
Topic Name: Mathematics-Section A

ItemCode:101066

Question: $\lim\limits_{x\to\frac{1}{\sqrt{2}}} \frac{\sin(\cos^{-1}x)-x}{1-\tan(\cos^{-1}x)}$ is equal to :

A	$\sqrt{2}$
B	$-\sqrt{2}$
C	$\frac{1}{\sqrt{2}}$

D $-\frac{1}{\sqrt{2}}$

Q:7
Topic Name: Mathematics-Section A

ItemCode:101067

Question: Let $f, g : \mathbf{R} \to \mathbf{R}$ be two real valued functions defined as $f(x) = \begin{cases} -|x+3| & , \ x < 0 \\ e^x & , \ x \geq 0 \end{cases}$ and $g(x) = \begin{cases} x^2 + k_1 x & , \ x < 0 \\ 4x + k_2 & , \ x \geq 0 \end{cases}$, where k_1 and k_2 are real constants. If (gof) is differentiable at $x = 0$, then $(gof)(-4) + (gof)(4)$ is equal to :

A $4(e^4+1)$

B $2(2e^4+1)$

C $4e^4$

D $2(2e^4-1)$

Q:8
Topic Name: Mathematics-Section A

ItemCode:101068

Question: The sum of the absolute minimum and the absolute maximum values of the function $f(x) = |3x - x^2 + 2| - x$ in the interval $[-1, 2]$ is :

A $\frac{\sqrt{17}+3}{2}$

B $\frac{\sqrt{17}+5}{2}$

C 5

D $\frac{9-\sqrt{17}}{2}$

Q:9
Topic Name: Mathematics-Section A

ItemCode:101069

Question: Let S be the set of all the natural numbers, for which the line $\frac{x}{a} + \frac{y}{b} = 2$ is a tangent to the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at the point (a, b), $ab \neq 0$. Then :

A $S = \phi$

B $n(S) = 1$

C	$S=\{2k : k \in \mathbf{N}\}$
D	$S=\mathbf{N}$

Q:10
Topic Name: Mathematics-Section A

ItemCode:101070

Question: The area bounded by the curve $y=\lvert x^2-9\rvert$ and the line $y=3$ is :

A	$4(2\sqrt{3}+\sqrt{6}-4)$
B	$4(4\sqrt{3}+\sqrt{6}-4)$
C	$8(4\sqrt{3}+3\sqrt{6}-9)$
D	$8(4\sqrt{3}+\sqrt{6}-9)$

Q:11
Topic Name: Mathematics-Section A

ItemCode:101071

Question: Let R be the point (3, 7) and let P and Q be two points on the line $x+y=5$ such that PQR is an equilateral triangle. Then the area of ΔPQR is :

A	$\frac{25}{4\sqrt{3}}$
B	$\frac{25\sqrt{3}}{2}$
C	$\frac{25}{\sqrt{3}}$
D	$\frac{25}{2\sqrt{3}}$

Q:12
Topic Name: Mathematics-Section A

ItemCode:101072

Question: Let C be a circle passing through the points A(2, -1) and B(3, 4). The line segment AB is not a diameter of C. If r is the radius of C and its centre lies on the circle $(x-5)^2+(y-1)^2=\frac{13}{2}$, then r^2 is equal to :

A	32
B	$\frac{65}{2}$
C	$\frac{61}{2}$
D	30

Q:13

Topic Name: Mathematics-Section A

ItemCode:101073

Question: Let the normal at the point P on the parabola $y^2=6x$ pass through the point $(5, -8)$. If the tangent at P to the parabola intersects its directrix at the point Q, then the ordinate of the point Q is :

A -3

B $-\frac{9}{4}$

C $-\frac{5}{2}$

D -2

Q:14

Topic Name: Mathematics-Section A

ItemCode:101074

Question: If the two lines $l_1 : \frac{x-2}{3} = \frac{y+1}{-2}, z=2$ and $l_2 : \frac{x-1}{1} = \frac{2y+3}{\alpha} = \frac{z+5}{2}$ are perpendicular, then an angle between the lines l_2 and $l_3 : \frac{1-x}{3} = \frac{2y-1}{-4} = \frac{z}{4}$ is :

A $\cos^{-1}\left(\frac{29}{4}\right)$

B $\sec^{-1}\left(\frac{29}{4}\right)$

C $\cos^{-1}\left(\frac{2}{29}\right)$

D $\cos^{-1}\left(\frac{2}{\sqrt{29}}\right)$

Q:15

Topic Name: Mathematics-Section A

ItemCode:101075

Question: Let the plane $2x+3y+z+20=0$ be rotated through a right angle about its line of intersection with the plane $x-3y+5z=8$. If the mirror image of the point $\left(2, -\frac{1}{2}, 2\right)$ in the rotated plane is B(a, b, c), then :

A $\frac{a}{8} = \frac{b}{5} = \frac{c}{-4}$

B $\frac{a}{4} = \frac{b}{5} = \frac{c}{-2}$

C	$\frac{a}{8} = \frac{b}{-5} = \frac{c}{4}$
D	$\frac{a}{4} = \frac{b}{5} = \frac{c}{2}$

Q:16
Topic Name: Mathematics-Section A

ItemCode:101076

Question: If $\vec{a} \cdot \vec{b} = 1$, $\vec{b} \cdot \vec{c} = 2$ and $\vec{c} \cdot \vec{a} = 3$, then the value of $\left[\vec{a} \times (\vec{b} \times \vec{c}), \vec{b} \times (\vec{c} \times \vec{a}), \vec{c} \times (\vec{b} \times \vec{a})\right]$ is :

A	0
B	$-6\vec{a} \cdot (\vec{b} \times \vec{c})$
C	$12\vec{c} \cdot (\vec{a} \times \vec{b})$
D	$-12\vec{b} \cdot (\vec{c} \times \vec{a})$

Q:17
Topic Name: Mathematics-Section A

ItemCode:101077

Question: Let a biased coin be tossed 5 times. If the probability of getting 4 heads is equal to the probability of getting 5 heads, then the probability of getting atmost two heads is :

A	$\frac{275}{6^5}$
B	$\frac{36}{5^4}$
C	$\frac{181}{5^5}$
D	$\frac{46}{6^4}$

Q:18
Topic Name: Mathematics-Section A

ItemCode:101078

Question: The mean of the numbers a, b, 8, 5, 10 is 6 and their variance is 6.8. If M is the mean deviation of the numbers about the mean, then 25 M is equal to :

A	60
B	55
C	50
D	45

Q:19
Topic Name: Mathematics-Section A

ItemCode:101079

Question: Let $f(x)=2\cos^{-1}x+4\cot^{-1}x-3x^2-2x+10,\ x\in[-1,1]$. If [a, b] is the range of the function f, then $4a-b$ is equal to :

A	11
B	$11-\pi$
C	$11+\pi$
D	$15-\pi$

Q:20
Topic Name: Mathematics-Section A

ItemCode:101080

Question: Let $\Delta, \nabla \in \{\wedge, \vee\}$ be such that $p \nabla q \Rightarrow ((p \Delta q) \nabla r)$ is a tautology. Then $(p \nabla q) \Delta r$ is logically equivalent to :

A	$(p \Delta r) \vee q$
B	$(p \Delta r) \wedge q$
C	$(p \wedge r) \Delta q$
D	$(p \nabla r) \wedge q$

Q:21
Topic Name: Mathematics-Section B

ItemCode:101081

Question: The sum of the cubes of all the roots of the equation $x^4-3x^3-2x^2+3x+1=0$ is _____.

Q:22
Topic Name: Mathematics-Section B

ItemCode:101082

Question: There are ten boys $B_1, B_2, \ldots, B_{10}$ and five girls $G_1, G_2, \ldots, G_5$ in a class. Then the number of ways of forming a group consisting of three boys and three girls, if both B_1 and B_2 together should not be the members of a group, is _____.

Q:23
Topic Name: Mathematics-Section B

ItemCode:101083

Question: Let the common tangents to the curves $4(x^2+y^2)=9$ and $y^2=4x$ intersect at the point Q. Let an ellipse, centered at the origin O, has lengths of semi-minor and semi-major axes equal to OQ and 6, respectively. If e and l respectively denote the eccentricity and the length of the latus rectum of this ellipse, then $\frac{l}{e^2}$ is equal to _____.

Q:24
Topic Name: Mathematics-Section B

ItemCode:101084

Question: Let $f(x) = \max\{|x+1|, |x+2|, ..., |x+5|\}$. Then $\int_{-6}^{0} f(x)\,dx$ is equal to _____.

Q:25
Topic Name: Mathematics-Section B

ItemCode:101085

Question: Let the solution curve $y = y(x)$ of the differential equation $(4+x^2)dy - 2x(x^2+3y+4)dx = 0$ pass through the origin. Then $y(2)$ is equal to _____.

Q:26
Topic Name: Mathematics-Section B

ItemCode:101086

Question: If $\sin^2(10°)\sin(20°)\sin(40°)\sin(50°)\sin(70°) = \alpha - \frac{1}{16}\sin(10°)$, then $16+\alpha^{-1}$ is equal to _____.

Q:27
Topic Name: Mathematics-Section B

ItemCode:101087

Question: Let $A = \{n \in \mathbf{N} : \text{H.C.F. } (n, 45) = 1\}$ and
Let $B = \{2k : k \in \{1, 2, ..., 100\}\}$. Then the sum of all the elements of $A \cap B$ is _____.

Q:28
Topic Name: Mathematics-Section B

ItemCode:101088

Question: The value of the integral $\frac{48}{\pi^4}\int_0^{\pi}\left(\frac{3\pi x^2}{2} - x^3\right)\frac{\sin x}{1+\cos^2 x}\,dx$ is equal to _____.

Q:29
Topic Name: Mathematics-Section B

ItemCode:101089

Question: Let $A = \sum_{i=1}^{10}\sum_{j=1}^{10}\min\{i, j\}$ and $B = \sum_{i=1}^{10}\sum_{j=1}^{10}\max\{i, j\}$. Then $A + B$ is equal to _____.

Q:30
Topic Name: Mathematics-Section B

ItemCode:101090

Question: Let $S = (0, 2\pi) - \left\{\frac{\pi}{2}, \frac{3\pi}{4}, \frac{3\pi}{2}, \frac{7\pi}{4}\right\}$. Let $y = y(x)$, $x \in S$, be the solution curve of the differential equation $\frac{dy}{dx} = \frac{1}{1+\sin 2x}$, $y\left(\frac{\pi}{4}\right) = \frac{1}{2}$. If the sum of abscissas of all the points of intersection of the curve $y = y(x)$ with the curve $y = \sqrt{2}\sin x$ is $\frac{k\pi}{12}$, then k is equal to _____.

Q:31
Topic Name: Physics-Section A

ItemCode:101001

Question: An expression for a dimensionless quantity P is given by $P = \frac{\alpha}{\beta} \log_e\left(\frac{kt}{\beta x}\right)$; where α and β are constants, x is distance; k is Boltzmann constant and t is the temperature. Then the dimensions of α will be :

A	$[M^0 L^{-1} T^0]$
B	$[M L^0 T^{-2}]$
C	$[M L T^{-2}]$
D	$[M L^2 T^{-2}]$

Q:32
Topic Name: Physics-Section A

ItemCode:101002

Question: A person is standing in an elevator. In which situation, he experiences weight loss ?

A	When the elevator moves upward with constant acceleration
B	When the elevator moves downward with constant acceleration
C	When the elevator moves upward with uniform velocity
D	When the elevator moves downward with uniform velocity

Q:33
Topic Name: Physics-Section A

ItemCode:101003

Question: An object is thrown vertically upwards. At its maximum height, which of the following quantity becomes zero ?

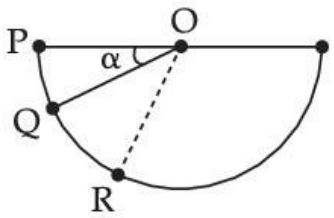
A	Momentum
B	Potential Energy
C	Acceleration
D	Force

Q:34
Topic Name: Physics-Section A

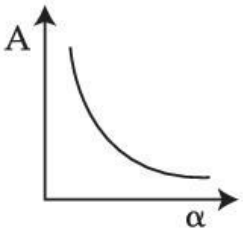
ItemCode:101004

Question:

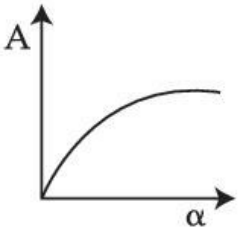
A ball is released from rest from point P of a smooth semi-spherical vessel as shown in figure. The ratio of the centripetal force and normal reaction on the ball at point Q is A while angular position of point Q is α with respect to point P. Which of the following graphs represent the correct relation between A and α when ball goes from Q to R ?



A



B



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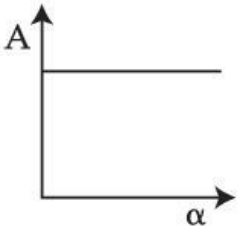

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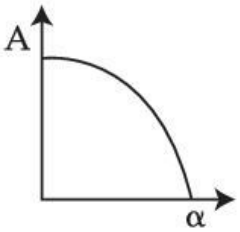


Q:35
Topic Name: Physics-Section A

ItemCode:101005

Question:

A thin circular ring of mass M and radius R is rotating with a constant angular velocity 2 $rads^{-1}$ in a horizontal plane about an axis vertical to its plane and passing through the center of the ring. If two objects each of mass m be attached gently to the opposite ends of a diameter of ring, the ring will then rotate with an angular velocity (in $rads^{-1}$).

A

$$\frac{M}{(M+m)}$$

B

$$\frac{(M+2m)}{2M}$$

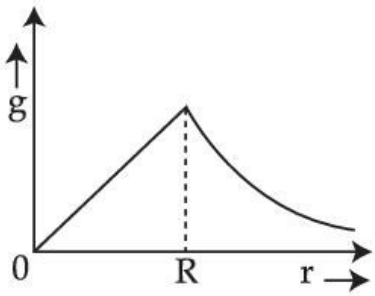
C $\frac{2M}{(M+2m)}$

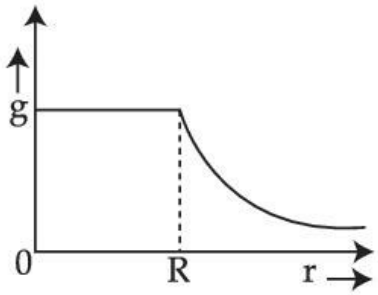
D $\frac{2(M+2m)}{M}$

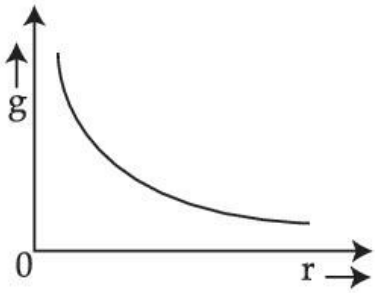
Q:36
Topic Name: Physics-Section A

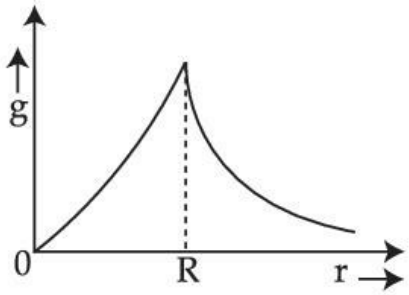
ItemCode:101006

Question: The variation of acceleration due to gravity (g) with distance (r) from the center of the earth is correctly represented by :
(Given R = radius of earth)

A 

B 

C 

D 

Q:37
Topic Name: Physics-Section A

ItemCode:101007

Question: The efficiency of a Carnot's engine, working between steam point and ice point, will be :

A 26.81%

B 37.81%

C	47.81%
D	57.81%

Q:38
Topic Name: Physics-Section A

ItemCode:101008

Question: Time period of a simple pendulum in a stationary lift is 'T'. If the lift accelerates with $\frac{g}{6}$ vertically upwards then the time period will be :
(Where g=acceleration due to gravity)

A	$\sqrt{\frac{6}{5}}\,T$
B	$\sqrt{\frac{5}{6}}\,T$
C	$\sqrt{\frac{6}{7}}\,T$
D	$\sqrt{\frac{7}{6}}\,T$

Q:39
Topic Name: Physics-Section A

ItemCode:101009

Question: A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats 1.4. Vessel is moving with speed v and is suddenly brought to rest. Assuming no heat is lost to the surrounding and vessel temperature of the gas increases by :
(R=universal gas constant)

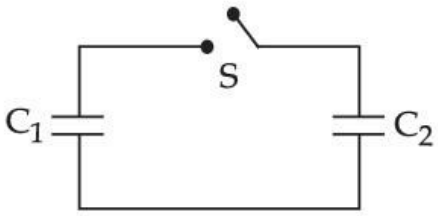
A	$\frac{Mv^2}{7R}$
B	$\frac{M\,v^2}{5R}$
C	$2\,\frac{M\,v^2}{7R}$
D	$7\,\frac{M\,v^2}{5R}$

Q:40
Topic Name: Physics-Section A

ItemCode:101010

Question:

Two capacitors having capacitance C_1 and C_2 respectively are connected as shown in figure. Initially, capacitor C_1 is charged to a potential difference V volt by a battery. The battery is then removed and the charged capacitor C_1 is now connected to uncharged capacitor C_2 by closing the switch S. The amount of charge on the capacitor C_2, after equilibrium, is :



A	$\frac{C_1C_2}{(C_1+C_2)}V$
B	$\frac{(C_1+C_2)}{C_1C_2}V$
C	$(C_1+C_2)V$
D	$(C_1-C_2)V$

Q:41
Topic Name: Physics-Section A

ItemCode:101011

Question:

Given below two statements : One is labelled as Assertion (A) and other is labelled as Reason (R).

Assertion (A) : Non-polar materials do not have any permanent dipole moment.

Reason (R) : When a non-polar material is placed in an electric field, the centre of the positive charge distribution of it's individual atom or molecule coincides with the centre of the negative charge distribution.

In the light of above statements, choose the most appropriate answer from the options given below.

A	Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**.
B	Both **(A)** and **(R)** are correct and **(R)** is not the correct explanation of **(A)**.
C	**(A)** is correct but **(R)** is not correct.
D	**(A)** is not correct but **(R)** is correct.

Q:42
Topic Name: Physics-Section A

ItemCode:101012

Question:

The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\phi=(5t^3+4t^2+2t-5)$ Weber. If the resistance of the coil is 5 ohm, then the induced current through the coil at $t=2$ s will be,

A	15.6 A
B	16.6 A

C	17.6 A
D	18.6 A

Q:43
Topic Name: Physics-Section A

ItemCode:101013

Question: An aluminium wire is stretched to make its length, 0.4% larger. The percentage change in resistance is :

A	0.4%
B	0.2%
C	0.8%
D	0.6%

Q:44
Topic Name: Physics-Section A

ItemCode:101014

Question: A proton and an alpha particle of the same velocity enter in a uniform magnetic field which is acting perpendicular to their direction of motion. The ratio of the radii of the circular paths described by the alpha particle and proton is :

A	1 : 4
B	4 : 1
C	2 : 1
D	1 : 2

Q:45
Topic Name: Physics-Section A

ItemCode:101015

Question: If Electric field intensity of a uniform plane electro magnetic wave is given as

$$E = -301.6 \sin(kz-\omega t)\,\hat{a}_x + 452.4 \sin(kz-\omega t)\,\hat{a}_y \ \frac{V}{m}.$$

Then, magnetic intensity 'H' of this wave in Am^{-1} will be :

[Given : Speed of light in vacuum $c = 3\times10^8$ ms^{-1}, Permeability of vacuum $\mu_0 = 4\pi\times10^{-7}$ NA^{-2}]

A	$+0.8 \sin(kz-\omega t)\,\hat{a}_y + 0.8 \sin(kz-\omega t)\,\hat{a}_x$.
B	$+1.0\times10^{-6} \sin(kz-\omega t)\,\hat{a}_y + 1.5\times10^{-6} (kz-\omega t)\,\hat{a}_x$
C	$-0.8 \sin(kz-\omega t)\,\hat{a}_y - 1.2 \sin(kz-\omega t)\,\hat{a}_x$
D	$-1.0\times10^{-6} \sin(kz-\omega t)\,\hat{a}_y - 1.5\times10^{-6} \sin(kz-\omega t)\,\hat{a}_x$

Q:46
Topic Name: Physics-Section A

ItemCode:101016

Question: In free space, an electromagnetic wave of 3 GHz frequency strikes over the edge of an object of size $\frac{\lambda}{100}$, where λ is the wavelength of the wave in free space. The phenomenon, which happens there will be :

A	Reflection
B	Refraction
C	Diffraction
D	Scattering

Q:47
Topic Name: Physics-Section A

ItemCode:101017

Question: An electron with speed v and a photon with speed c have the same de-Broglie wavelength. If the kinetic energy and momentum of electron are E_e and p_e and that of photon are E_{ph} and p_{ph} respectively. Which of the following is correct ?

A	$\frac{E_e}{E_{ph}} = \frac{2c}{v}$
B	$\frac{E_e}{E_{ph}} = \frac{v}{2c}$
C	$\frac{p_e}{p_{ph}} = \frac{2c}{v}$
D	$\frac{p_e}{p_{ph}} = \frac{v}{2c}$

Q:48
Topic Name: Physics-Section A

ItemCode:101018

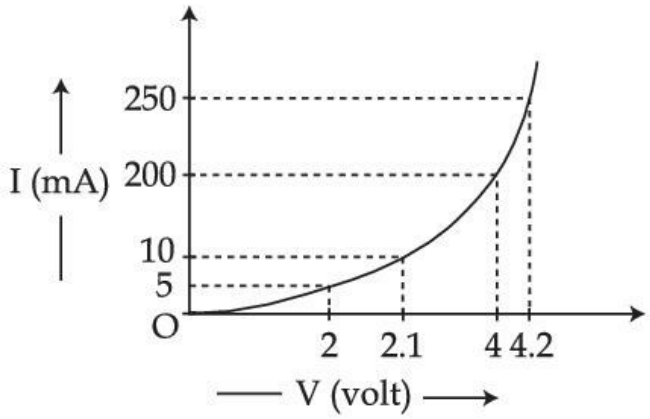
Question: How many alpha and beta particles are emitted when Uranium $_{92}U^{238}$ decays to lead $_{82}Pb^{206}$?

A	3 alpha particles and 5 beta particles
B	6 alpha particles and 4 beta particles
C	4 alpha particles and 5 beta particles
D	8 alpha particles and 6 beta particles

Q:49
Topic Name: Physics-Section A

ItemCode:101019

Question: The I-V characteristics of a p-n junction diode in forward bias is shown in the figure. The ratio of dynamic resistance, corresponding to forward bias voltage of 2 V and 4 V respectively, is :



A	1 : 2
B	5 : 1
C	1 : 40
D	20 : 1

Q:50
Topic Name: Physics-Section A

ItemCode:101020

Question: Choose the correct statement for amplitude modulation :

A	Amplitude of modulating signal is varied in accordance with the information signal.
B	Amplitude of modulated signal is varied in accordance with the information signal.
C	Amplitude of carrier signal is varied in accordance with the information signal.
D	Amplitude of modulated signal is varied in accordance with the modulating signal.

Q:51
Topic Name: Physics-Section B

ItemCode:101021

Question: A fighter jet is flying horizontally at a certain altitude with a speed of 200 ms^{-1}. When it passes directly overhead an anti-aircraft gun, a bullet is fired from the gun, at an angle θ with the horizontal, to hit the jet. If the bullet speed is 400 m/s, the value of θ will be _____°.

Q:52
Topic Name: Physics-Section B

ItemCode:101022

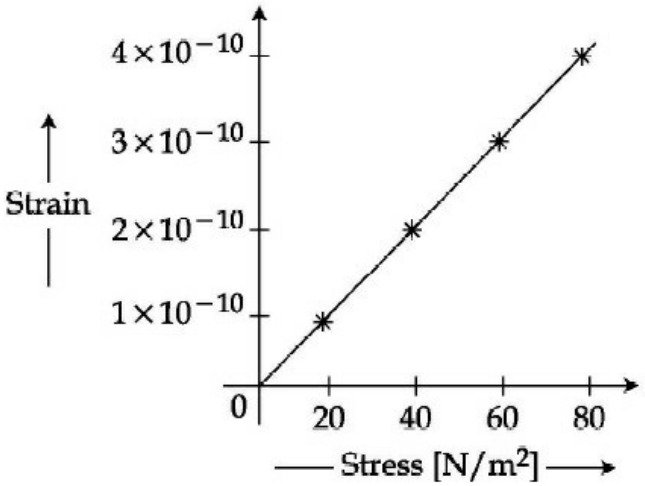
Question: A ball of mass 0.5 kg is dropped from the height of 10 m. The height, at which the magnitude of velocity becomes equal to the magnitude of acceleration due to gravity, is _____m. [Use $g = 10\ m/s^2$]

Q:53
Topic Name: Physics-Section B

ItemCode:101023

Question:

The elastic behaviour of material for linear stress and linear strain, is shown in the figure. The energy density for a linear strain of 5×10^{-4} is _____ kJ/m^3. Assume that material is elastic upto the linear strain of 5×10^{-4}.



Q:54
Topic Name: Physics-Section B

ItemCode:101024

Question:

The elongation of a wire on the surface of the earth is 10^{-4} m. The same wire of same dimensions is elongated by 6×10^{-5} m on another planet. The acceleration due to gravity on the planet will be _____ ms^{-2}. (Take acceleration due to gravity on the surface of earth = 10 ms^{-2})

Q:55
Topic Name: Physics-Section B

ItemCode:101025

Question:

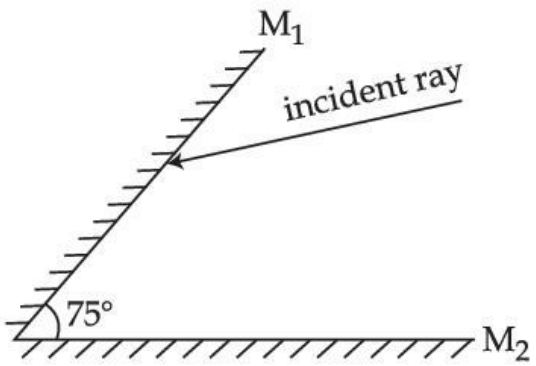
A 10 Ω, 20 mH coil carrying constant current is connected to a battery of 20 V through a switch. Now after switch is opened current becomes zero in 100 μs. The average e.m.f. induced in the coil is _____ V.

Q:56
Topic Name: Physics-Section B

ItemCode:101026

Question:

A light ray is incident, at an incident angle θ_1, on the system of two plane mirrors M_1 and M_2 having an inclination angle 75° between them (as shown in figure). After reflecting from mirror M_1 it gets reflected back by the mirror M_2 with an angle of reflection 30°. The total deviation of the ray will be _____ degree.



Q:57

Topic Name: Physics-Section B

ItemCode:101027

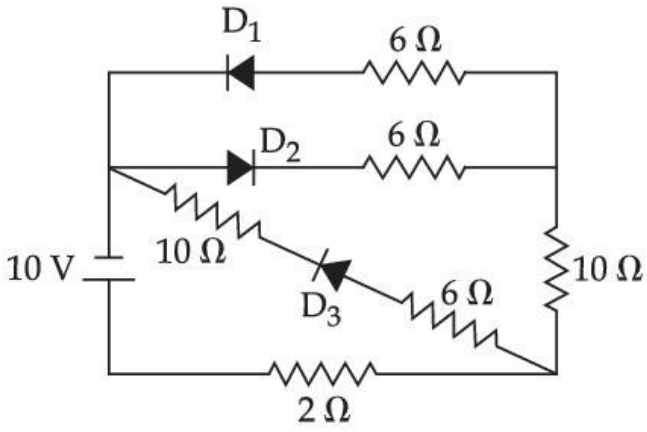
Question: In a vernier callipers, each cm on the main scale is divided into 20 equal parts. If tenth vernier scale division coincides with nineth main scale division. Then the value of vernier contant will be _____ $\times 10^{-2}$ mm.

Q:58

Topic Name: Physics-Section B

ItemCode:101028

Question: As per the given circuit, the value of current through the battery will be _____ A.

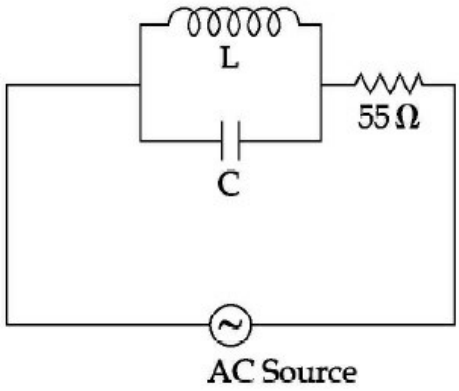


Q:59

Topic Name: Physics-Section B

ItemCode:101029

Question: A 110 V, 50 Hz, AC source is connected in the circuit (as shown in figure). The current through the resistance 55 Ω, at resonance in the circuit, will be _____ A.



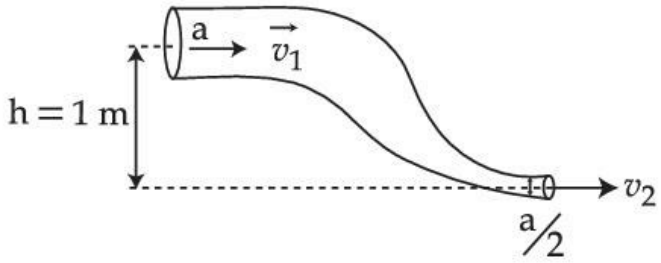
Q:60

Topic Name: Physics-Section B

ItemCode:101030

Question:

An ideal fluid of density 800 kgm^{-3}, flows smoothly through a bent pipe (as shown in figure) that tapers in cross-sectional area from a to $\frac{a}{2}$. The pressure difference between the wide and narrow sections of pipe is 4100 Pa. At wider section, the velocity of fluid is $\frac{\sqrt{x}}{6}$ ms^{-1} for $x =$ _____. (Given $g = 10\ ms^{-2}$)



Q:61
Topic Name: Chemistry-Section A

ItemCode:101031

Question:

A commercially sold conc. HCl is 35% HCl by mass. If the density of this commercial acid is 1.46 g/mL, the molarity of this solution is :
(Atomic mass : Cl = 35.5 amu, H = 1 amu)

A	10.2 M
B	12.5 M
C	14.0 M
D	18.2 M

Q:62
Topic Name: Chemistry-Section A

ItemCode:101032

Question:

An evacuated glass vessel weighs 40.0 g when empty, 135.0 g when filled with a liquid of density 0.95 g mL^{-1} and 40.5 g when filled with an ideal gas at 0.82 atm at 250 K. The molar mass of the gas in g mol^{-1} is :
(Given : R = 0.082 L atm K^{-1} mol^{-1})

A	35
B	50
C	75
D	125

Q:63
Topic Name: Chemistry-Section A

ItemCode:101033

Question: If the radius of the 3rd Bohr's orbit of hydrogen atom is r_3 and the radius of 4th Bohr's orbit is r_4. Then :

A	$r_4 = \frac{9}{16} r_3$
B	$r_4 = \frac{16}{9} r_3$
C	$r_4 = \frac{3}{4} r_3$
D	$r_4 = \frac{4}{3} r_3$

Q:64
Topic Name: Chemistry-Section A

ItemCode:101034

Question: Consider the ions/molecule

$$O_2^+, O_2, O_2^-, O_2^{2-}$$

For increasing bond order the correct option is :

A	$O_2^{2-} < O_2^- < O_2 < O_2^+$
B	$O_2^- < O_2^{2-} < O_2 < O_2^+$
C	$O_2^- < O_2^{2-} < O_2^+ < O_2$
D	$O_2^- < O_2^+ < O_2^{2-} < O_2$

Q:65
Topic Name: Chemistry-Section A

ItemCode:101035

Question: The $\left(\frac{\partial E}{\partial T}\right)_P$ of different types of half cells are as follows :

A	B	C	D
1×10^{-4}	2×10^{-4}	0.1×10^{-4}	0.2×10^{-4}

(Where E is the electromotive force)

Which of the above half cells would be preferred to be used as reference electrode ?

A	A
B	B
C	C
D	D

Q:66
Topic Name: Chemistry-Section A

ItemCode:101036

Question: Choose the correct stability order of group 13 elements in their +1 oxidation state.

A	Al < Ga < In < Tl
B	Tl < In < Ga < Al
C	Al < Ga < Tl < In
D	Al < Tl < Ga < In

Q:67
Topic Name: Chemistry-Section A

ItemCode:101037

Question: Given below are two statements :

Statement I : According to the Ellingham diagram, any metal oxide with higher ΔG° is more stable than the one with lower ΔG°.

Statement II : The metal involved in the formation of oxide placed lower in the Ellingham diagram can reduce the oxide of a metal placed higher in the diagram.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

A	Both **Statement I** and **Statement II** are correct.
B	Both **Statement I** and **Statement II** are incorrect.
C	**Statement I** is correct but **Statement II** is incorrect.
D	**Statement I** is incorrect but **Statement II** is correct.

Q:68
Topic Name: Chemistry-Section A

ItemCode:101038

Question: Consider the following reaction :

$$2HSO_4^-(aq) \xrightarrow[(2)\ Hydrolysis]{(1)\ Electrolysis} 2HSO_4^- + 2H^+ + \mathbf{A}$$

The dihedral angle in product **A** in its solid phase at 110 K is :

A	104°
B	111.5°
C	90.2°
D	111.0°

Q:69
Topic Name: Chemistry-Section A

ItemCode:101039

Question: The correct order of melting point is :

A	Be > Mg > Ca > Sr

B	$Sr > Ca > Mg > Be$
C	$Be > Ca > Mg > Sr$
D	$Be > Ca > Sr > Mg$

Q:70
Topic Name: Chemistry-Section A

ItemCode:101040

Question: The correct order of melting points of hydrides of group 16 elements is :

A	$H_2S < H_2Se < H_2Te < H_2O$
B	$H_2O < H_2S < H_2Se < H_2Te$
C	$H_2S < H_2Te < H_2Se < H_2O$
D	$H_2Se < H_2S < H_2Te < H_2O$

Q:71
Topic Name: Chemistry-Section A

ItemCode:101041

Question: Consider the following reaction :

$$A + \text{alkali} \rightarrow B \text{ (Major Product)}$$

If B is an oxoacid of phosphorus with no P–H bond, then A is :

A	White P_4
B	Red P_4
C	P_2O_3
D	H_3PO_3

Q:72
Topic Name: Chemistry-Section A

ItemCode:101042

Question: Polar stratospheric clouds facilitate the formation of :

A	$ClONO_2$
B	$HOCl$
C	ClO
D	CH_4

Q:73
Topic Name: Chemistry-Section A

ItemCode:101043

Given below are two statements :

Statement I : In 'Lassaigne's Test', when both nitrogen and sulphur are present in an organic compound, sodium thiocyanate is formed.

Statement II : If both nitrogen and sulphur are present in an organic compound, then the excess of sodium used in sodium fusion will decompose the sodium thiocyanate formed to give NaCN and Na_2S.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

Question:

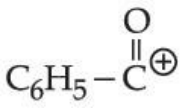
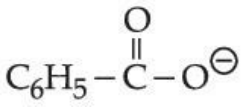
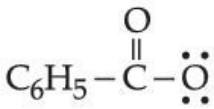
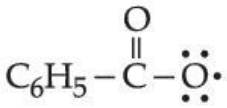
A	Both **Statement I** and **Statement II** are correct.
B	Both **Statement I** and **Statement II** are incorrect.
C	**Statement I** is correct but **Statement II** is incorrect.
D	**Statement I** is incorrect but **Statement II** is correct.

Q:74
Topic Name: Chemistry-Section A

ItemCode:101044

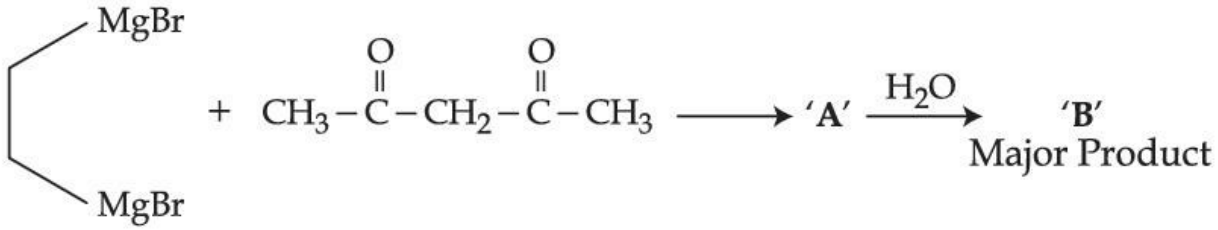
$$(C_7H_5O_2)_2 \xrightarrow{h\nu} [X] \rightarrow 2\dot{C}_6H_5 + 2CO_2$$

Question: Consider the above reaction and identify the intermidiate 'X'

A	
B	
C	
D	

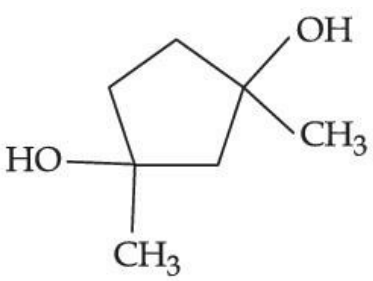
Q:75
Topic Name: Chemistry-Section A

ItemCode:101045



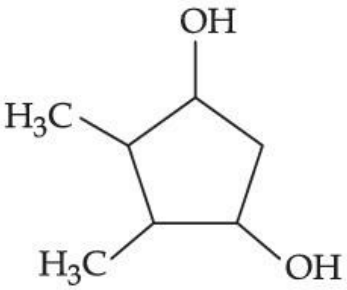
Question: Consider the above reaction sequence and identify the product **B.**

A

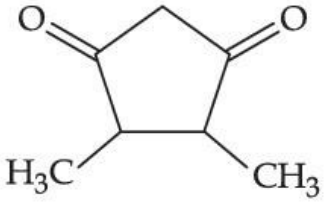


B

C



D

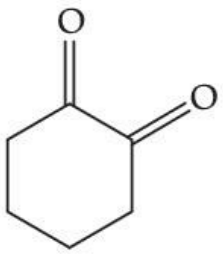


Q:76
Topic Name: Chemistry-Section A

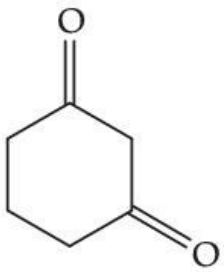
ItemCode:101046

Question: Which will have the highest enol content ?

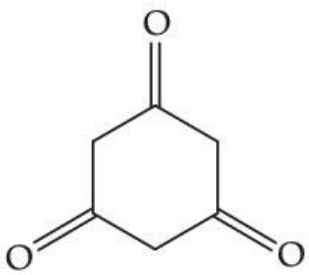
A



B



C



D

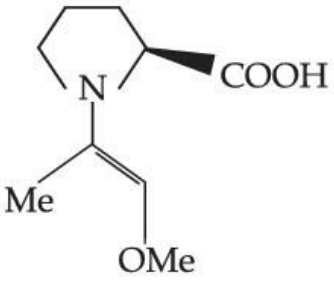
Q:77
Topic Name: Chemistry-Section A

ItemCode:101047

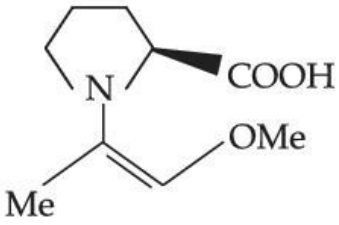
Question: Among the following structures, which will show the most stable enamine formation ?

(Where Me is $-CH_3$)

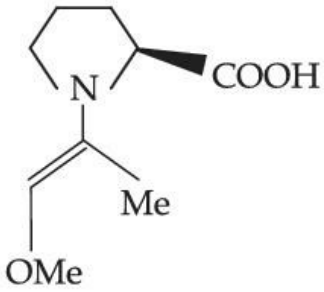
A



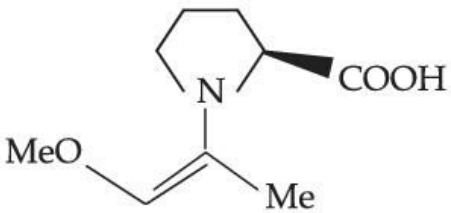
B



C



D



Q:78
Topic Name: Chemistry-Section A

ItemCode:101048

Which of the following sets are **correct** regarding polymer ?

(A) Copolymer : Buna-S

(B) Condensation polymer : Nylon-6,6

(C) Fibres : Nylon-6,6

(D) Thermosetting polymer : Terylene

(E) Homopolymer : Buna-N

Question: Choose the **correct** answer from given options below :

A	(A), (B) and (C) are correct
B	(B), (C) and (D) are correct
C	(A), (C) and (E) are correct
D	(A), (B) and (D) are correct

Q:79
Topic Name: Chemistry-Section A

ItemCode:101049

Question: A chemical which stimulates the secretion of pepsin is :

A	Anti histamine
B	Cimetidine
C	Histamine
D	Zantac

Q:80
Topic Name: Chemistry-Section A

ItemCode:101050

Question: Which statement is **not** true with respect to nitrate ion test ?

A	A dark brown ring is formed at the junction of two solutions.
B	Ring is formed due to nitroferrous sulphate complex.
C	The brown complex is $[Fe(H_2O)_5\ (NO)]SO_4$.
D	Heating the nitrate salt with conc. H_2SO_4, light brown fumes are evolved.

Q:81
Topic Name: Chemistry-Section B

ItemCode:101051

Question:

For complete combustion of methanol

$$CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

the amount of heat produced as measured by bomb calorimeter is 726 kJ mol^{-1} at 27°C. The enthalpy of combustion for the reaction is $-x$ kJ mol^{-1}, where x is _____. (Nearest integer)

(Given : $R = 8.3\ JK^{-1}\ mol^{-1}$)

Q:82

Topic Name: Chemistry-Section B

ItemCode:101052

Question:

A 0.5 percent solution of potassium chloride was found to freeze at -0.24°C. The percentage dissociation of potassium chloride is _____. (Nearest integer)

(Molal depression constant for water is 1.80 K kg mol^{-1} and molar mass of KCl is 74.6 g mol^{-1})

Q:83

Topic Name: Chemistry-Section B

ItemCode:101053

Question:

50 mL of 0.1 M CH_3COOH is being titrated against 0.1 M NaOH. When 25 mL of NaOH has been added, the pH of the solution will be _____ $\times 10^{-2}$. (Nearest integer)

(Given : $pK_a\ (CH_3COOH) = 4.76$)

$\log 2 = 0.30$

$\log 3 = 0.48$

$\log 5 = 0.69$

$\log 7 = 0.84$

$\log 11 = 1.04$

Q:84

Topic Name: Chemistry-Section B

ItemCode:101054

Question:

A flask is filled with equal moles of A and B. The half lives of A and B are 100 s and 50 s respectively and are independent of the initial concentration. The time required for the concentration of A to be four times that of B is _____s.

(Given : $\ln 2 = 0.693$)

Q:85

Topic Name: Chemistry-Section B

ItemCode:101055

Question:

2.0 g of H_2 gas is adsorbed on 2.5 g of platinum powder at 300 K and 1 bar pressure. The volume of the gas adsorbed per gram of the adsorbent is _____ mL.

(Given : $R = 0.083$ L bar $K^{-1}\ mol^{-1}$)

Q:86

Topic Name: Chemistry-Section B

ItemCode:101056

Question: The spin-only magnetic moment value of the most basic oxide of vanadium among V_2O_3, V_2O_4 and V_2O_5 is _____ B.M. (Nearest integer)

Q:87

Topic Name: Chemistry-Section B

ItemCode:101057

Question: The spin-only magnetic moment value of an octahedral complex among $CoCl_3 \cdot 4NH_3$, $NiCl_2 \cdot 6H_2O$ and $PtCl_4 \cdot 2HCl$, which upon reaction with excess of $AgNO_3$ gives 2 moles of AgCl is _____ B.M. (Nearest Integer)

Q:88

Topic Name: Chemistry-Section B

ItemCode:101058

Question: On complete combustion 0.30 g of an organic compound gave 0.20 g of carbon dioxide and 0.10 g of water. The percentage of carbon in the given organic compound is _____. (Nearest Integer)

Q:89

Topic Name: Chemistry-Section B

ItemCode:101059

Question: Compound 'P' on nitration with dil. HNO_3 yields two isomers (A) and (B). These isomers can be separated by steam distillation. Isomers (A) and (B) show the intramolecular and intermolecular hydrogen bonding respectively. Compound (P) on reaction with conc. HNO_3 yields a yellow compound 'C', a strong acid. The number of oxygen atoms is present in compound 'C' _____.

Q:90

Topic Name: Chemistry-Section B

ItemCode:101060

Question: The number of oxygens present in a nucleotide formed from a base, that is present only in RNA is _____.