Joint Entrance Examination (Main) - JEE(Main)

Paper Name	B.E/B.Tech.(Paper I)
Test Date	28-06-2022
Slot	SLOT - 2
Lang	English

Q:1
Topic Name: Mathematics-Section A

ItemCode:101261

Question: Let $R_1 = \{(a, b) \in \mathbf{N} \times \mathbf{N} : |a-b| \leq 13\}$ and $R_2 = \{(a, b) \in \mathbf{N} \times \mathbf{N} : |a-b| \neq 13\}$. Then on $\mathbf{N}$:

A	Both R_1 and R_2 are equivalence relations
B	Neither R_1 nor R_2 is an equivalence relation
C	R_1 is an equivalence relation but R_2 is not
D	R_2 is an equivalence relation but R_1 is not

Q:2
Topic Name: Mathematics-Section A

ItemCode:101262

Question: Let $f(x)$ be a quadratic polynomial such that $f(-2)+f(3)=0$. If one of the roots of $f(x)=0$ is -1, then the sum of the roots of $f(x)=0$ is equal to :

A	$\frac{11}{3}$
B	$\frac{7}{3}$
C	$\frac{13}{3}$
D	$\frac{14}{3}$

Q:3
Topic Name: Mathematics-Section A

ItemCode:101263

Question: The number of ways to distribute 30 identical candies among four children C_1, C_2, C_3 and C_4 so that C_2 receives atleast 4 and atmost 7 candies, C_3 receives atleast 2 and atmost 6 candies, is equal to :

A	205
B	615
C	510
D	430

Q:4
Topic Name: Mathematics-Section A

ItemCode:101264

Question: The term independent of x in the expansion of $(1 - x^2 + 3x^3)\left(\frac{5}{2}x^3 - \frac{1}{5x^2}\right)^{11}$, $x \neq 0$ is :

A	$\frac{7}{40}$
B	$\frac{33}{200}$
C	$\frac{39}{200}$
D	$\frac{11}{50}$

Q:5
Topic Name: Mathematics-Section A

ItemCode:101265

Question: If n arithmetic means are inserted between a and 100 such that the ratio of the first mean to the last mean is 1 : 7 and a + n = 33, then the value of n is :

A	21
B	22
C	23
D	24

Q:6
Topic Name: Mathematics-Section A

ItemCode:101266

Question: Let $f, g : \mathbf{R} \to \mathbf{R}$ be functions defined by

$$f(x) = \begin{cases} [x] & , \ x < 0 \\ |1 - x| & , \ x \geq 0 \end{cases} \text{ and } g(x) = \begin{cases} e^x - x & , \ x < 0 \\ (x-1)^2 - 1 & , \ x \geq 0 \end{cases}$$

where $[x]$ denote the greatest integer less than or equal to x. Then, the function fog is discontinuous at exactly :

A	one point
B	two points
C	three points
D	four points

Q:7
Topic Name: Mathematics-Section A

ItemCode:101267

Question: Let $f : \mathbf{R} \to \mathbf{R}$ be a differentiable function such that $f\left(\frac{\pi}{4}\right) = \sqrt{2}$, $f\left(\frac{\pi}{2}\right) = 0$ and $f'\left(\frac{\pi}{2}\right) = 1$ and let $g(x) = \int_x^{\pi/4} \left(f'(t)\sec t + \tan t \sec t f(t)\right) dt$ for $x \in \left[\frac{\pi}{4}, \frac{\pi}{2}\right)$. Then $\lim\limits_{x \to \left(\frac{\pi}{2}\right)^-} g(x)$ is equal to :

A	2
B	3
C	4
D	-3

Q:8
Topic Name: Mathematics-Section A

ItemCode:101268

Question: Let $f : \mathbf{R} \to \mathbf{R}$ be a continuous function satisfying $f(x) + f(x+k) = n$, for all $x \in \mathbf{R}$ where $k > 0$ and n is a positive integer. If $I_1 = \int_0^{4nk} f(x)dx$ and $I_2 = \int_{-k}^{3k} f(x)dx$, then :

A	$I_1 + 2I_2 = 4nk$
B	$I_1 + 2I_2 = 2nk$
C	$I_1 + nI_2 = 4n^2k$
D	$I_1 + nI_2 = 6n^2k$

Q:9
Topic Name: Mathematics-Section A

ItemCode:101269

Question: The area of the bounded region enclosed by the curve $y = 3 - \left|x - \frac{1}{2}\right| - |x+1|$ and the x-axis is :

A	$\frac{9}{4}$
B	$\frac{45}{16}$
C	$\frac{27}{8}$
D	$\frac{63}{16}$

Q:10
Topic Name: Mathematics-Section A

ItemCode:101270

Question: Let $x=x(y)$ be the solution of the differential equation $2y\,e^{x/y^2}\,dx + \left(y^2-4xe^{x/y^2}\right)dy = 0$ such that $x(1)=0$. Then, $x(e)$ is equal to :

A	$e\,\log_e(2)$
B	$-e\,\log_e(2)$
C	$e^2\,\log_e(2)$
D	$-e^2\,\log_e(2)$

Q:11
Topic Name: Mathematics-Section A

ItemCode:101271

Question: Let the slope of the tangent to a curve $y=f(x)$ at (x, y) be given by $2\tan x(\cos x-y)$. If the curve passes through the point $\left(\pi/4, 0\right)$, then the value of $\int_0^{\pi/2} y\,dx$ is equal to :

A	$(2-\sqrt{2})+\frac{\pi}{\sqrt{2}}$
B	$2-\frac{\pi}{\sqrt{2}}$
C	$(2+\sqrt{2})+\frac{\pi}{\sqrt{2}}$
D	$2+\frac{\pi}{\sqrt{2}}$

Q:12
Topic Name: Mathematics-Section A

ItemCode:101272

Question: Let a triangle be bounded by the lines $L_1 : 2x+5y=10$; $L_2 : -4x+3y=12$ and the line L_3, which passes through the point P(2, 3), intersects L_2 at A and L_1 at B. If the point P divides the line-segment AB, internally in the ratio 1 : 3, then the area of the triangle is equal to :

A	$\frac{110}{13}$
B	$\frac{132}{13}$
C	$\frac{142}{13}$
D	$\frac{151}{13}$

Q:13

Topic Name: Mathematics-Section A

ItemCode: 101273

Question: Let $a > 0, b > 0$. Let e and l respectively be the eccentricity and length of the latus rectum of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. Let e' and l' respectively be the eccentricity and length of the latus rectum of its conjugate hyperbola. If $e^2 = \frac{11}{14}l$ and $(e')^2 = \frac{11}{8}l'$, then the value of $77a + 44b$ is equal to :

A	100
B	110
C	120
D	130

Q: 14

Topic Name: Mathematics-Section A

ItemCode: 101274

Question: Let $\vec{a} = \alpha\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = -2\hat{i} + \alpha\hat{j} + \hat{k}$, where $\alpha \in \mathbf{R}$. If the area of the parallelogram whose adjacent sides are represented by the vectors $\vec{a}$ and $\vec{b}$ is $\sqrt{15(\alpha^2 + 4)}$, then the value of $2|\vec{a}|^2 + (\vec{a}\cdot\vec{b})|\vec{b}|^2$ is equal to :

A	10
B	7
C	9
D	14

Q: 15

Topic Name: Mathematics-Section A

ItemCode: 101275

Question: If vertex of a parabola is $(2, -1)$ and the equation of its directrix is $4x - 3y = 21$, then the length of its latus rectum is :

A	2
B	8
C	12
D	16

Q: 16

Topic Name: Mathematics-Section A

ItemCode:101276

Question: Let the plane $ax+by+cz=d$ pass through $(2, 3, -5)$ and is perpendicular to the planes $2x+y-5z=10$ and

$3x+5y-7z=12$.

If a, b, c, d are integers $d > 0$ and gcd $(|a|, |b|, |c|, d)=1$, then the value of $a+7b+c+20d$ is equal to :

A	18
B	20
C	24
D	22

Q:17
Topic Name: Mathematics-Section A

ItemCode:101277

Question: The probability that a randomly chosen one-one function from the set {a, b, c, d} to the set {1, 2, 3, 4, 5} satisfies $f(a)+2f(b)-f(c)=f(d)$ is :

A	$\frac{1}{24}$
B	$\frac{1}{40}$
C	$\frac{1}{30}$
D	$\frac{1}{20}$

Q:18
Topic Name: Mathematics-Section A

ItemCode:101278

Question: The value of $\lim\limits_{n\to\infty} 6\tan\left\{\sum\limits_{r=1}^{n}\tan^{-1}\left(\frac{1}{r^2+3r+3}\right)\right\}$ is equal to :

A	1
B	2
C	3
D	6

Q:19
Topic Name: Mathematics-Section A

ItemCode:101279

Question: Let $\vec{a}$ be a vector which is perpendicular to the vector $3\hat{i} + \frac{1}{2}\hat{j} + 2\hat{k}$. If $\vec{a} \times (2\hat{i} + \hat{k}) = 2\hat{i} - 13\hat{j} - 4\hat{k}$, then the projection of the vector $\vec{a}$ on the vector $2\hat{i} + 2\hat{j} + \hat{k}$ is :

A	$\frac{1}{3}$
B	1
C	$\frac{5}{3}$
D	$\frac{7}{3}$

Q:20
Topic Name: Mathematics-Section A

ItemCode:101280

Question: If $\cot\alpha = 1$ and $\sec\beta = -\frac{5}{3}$, where $\pi < \alpha < \frac{3\pi}{2}$ and $\frac{\pi}{2} < \beta < \pi$, then the value of $\tan(\alpha+\beta)$ and the quadrant in which $\alpha+\beta$ lies, respectively are :

A	$-\frac{1}{7}$ and IVth quadrant
B	7 and Ist quadrant
C	-7 and IVth quadrant
D	$\frac{1}{7}$ and Ist quadrant

Q:21
Topic Name: Mathematics-Section B

ItemCode:101281

Question: Let the image of the point P(1, 2, 3) in the line $L: \frac{x-6}{3} = \frac{y-1}{2} = \frac{z-2}{3}$ be Q. Let R (α, β, γ) be a point that divides internally the line segment PQ in the ratio 1 : 3. Then the value of $22(\alpha+\beta+\gamma)$ is equal to _____.

Q:22
Topic Name: Mathematics-Section B

ItemCode:101282

Question: Suppose a class has 7 students. The average marks of these students in the mathematics examination is 62, and their variance is 20. A student fails in the examination if he/she gets less than 50 marks, then in worst case, the number of students can fail is _____.

Q:23
Topic Name: Mathematics-Section B

ItemCode:101283

Question: If one of the diameters of the circle $x^2+y^2-2\sqrt{2}x - 6\sqrt{2}y + 14 = 0$ is a chord of the circle $\left(x - 2\sqrt{2}\right)^2 + \left(y - 2\sqrt{2}\right)^2 = r^2$, then the value of r^2 is equal to _____.

Q:24
Topic Name: Mathematics-Section B

ItemCode:101284

Question: If $\lim\limits_{x \to 1} \dfrac{\sin\left(3x^2 - 4x + 1\right) - x^2 + 1}{2x^3 - 7x^2 + ax + b} = -2$, then the value of $(a-b)$ is equal to _____.

Q:25
Topic Name: Mathematics-Section B

ItemCode:101285

Question: Let for $n = 1, 2, ..., 50$, S_n be the sum of the infinite geometric progression whose first term is n^2 and whose common ratio is $\dfrac{1}{(n+1)^2}$. Then the value of $\dfrac{1}{26} + \sum\limits_{n=1}^{50}\left(S_n + \dfrac{2}{n+1} - n - 1\right)$ is equal to _____.

Q:26
Topic Name: Mathematics-Section B

ItemCode:101286

Question: If the system of linear equations

$2x - 3y = \gamma + 5,$

$\alpha x + 5y = \beta + 1$, where $\alpha, \beta, \gamma \in \mathbf{R}$ has infinitely many solutions, then the value of $|9\alpha + 3\beta + 5\gamma|$ is equal to _____.

Q:27
Topic Name: Mathematics-Section B

ItemCode:101287

Question: Let $A = \begin{pmatrix} 1+i & 1 \\ -i & 0 \end{pmatrix}$ where $i = \sqrt{-1}$. Then, the number of elements in the set $\left\{n \in \{1, 2, ..., 100\} : A^n = A\right\}$ is _____.

Q:28
Topic Name: Mathematics-Section B

ItemCode:101288

Question: Sum of squares of modulus of all the complex numbers z satisfying $\bar{z} = iz^2 + z^2 - z$ is equal to _____.

Q:29
Topic Name: Mathematics-Section B

ItemCode:101289

Question: Let $S=\{1, 2, 3, 4\}$. Then the number of elements in the set $\{f: S\times S \to S : f \text{ is onto and } f(a, b)=f(b, a) \geq a \ \forall \ (a, b) \in S\times S\}$ is _____.

Q:30
Topic Name: Mathematics-Section B

ItemCode:101290

Question: The maximum number of compound propositions, out of $p\vee r\vee s$, $p\vee r\vee\sim s$, $p\vee\sim q\vee s$, $\sim p\vee\sim r\vee s$, $\sim p\vee\sim r\vee\sim s$, $\sim p\vee q\vee\sim s$, $q\vee r\vee\sim s$, $q\vee\sim r\vee\sim s$, $\sim p\vee\sim q\vee\sim s$ that can be made simultaneously true by an assignment of the truth values to p, q, r and s, is equal to _____.

Q:31
Topic Name: Physics-Section A

ItemCode:101201

Question: Velocity (v) and acceleration (a) in two systems of units 1 and 2 are related as $v_2 = \frac{n}{m^2}v_1$ and $a_2 = \frac{a_1}{mn}$ respectively. Here m and n are constants. The relations for distance and time in two systems respectively are :

A $\frac{n^3}{m^3}L_1 = L_2$ and $\frac{n^2}{m}T_1 = T_2$

B $L_1 = \frac{n^4}{m^2}L_2$ and $T_1 = \frac{n^2}{m}T_2$

C $L_1 = \frac{n^2}{m}L_2$ and $T_1 = \frac{n^4}{m^2}T_2$

D $\frac{n^2}{m}L_1 = L_2$ and $\frac{n^4}{m^2}T_1 = T_2$

Q:32
Topic Name: Physics-Section A

ItemCode:101202

Question: A ball is spun with angular acceleration $\alpha=6t^2-2t$ where t is in second and α is in $rads^{-2}$. At $t=0$, the ball has angular velocity of 10 $rads^{-1}$ and angular position of 4 rad. The most appropriate expression for the angular position of the ball is :

A $\frac{3}{2}t^4 - t^2 + 10t$

B $\frac{t^4}{2} - \frac{t^3}{3} + 10t + 4$

C $\frac{2t^4}{3} - \frac{t^3}{6} + 10t + 12$

D	$2t^4 - \frac{t^3}{2} + 5t + 4$

Q:33
Topic Name: Physics-Section A

ItemCode:101203

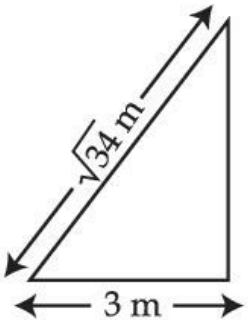
Question: A block of mass 2 kg moving on a horizontal surface with speed of 4 ms^{-1} enters a rough surface ranging from $x = 0.5$ m to $x = 1.5$ m. The retarding force in this range of rough surface is related to distance by $F = -kx$ where $k = 12\ Nm^{-1}$. The speed of the block as it just crosses the rough surface will be :

A	zero
B	1.5 ms^{-1}
C	2.0 ms^{-1}
D	2.5 ms^{-1}

Q:34
Topic Name: Physics-Section A

ItemCode:101204

Question: A $\sqrt{34}$ m long ladder weighing 10 kg leans on a frictionless wall. Its feet rest on the floor 3 m away from the wall as shown in the figure. If F_f and F_w are the reaction forces of the floor and the wall, then ratio of F_w/F_f will be :
(Use $g = 10\ m/s^2$.)



A	$\frac{6}{\sqrt{110}}$
B	$\frac{3}{\sqrt{113}}$
C	$\frac{3}{\sqrt{109}}$
D	$\frac{2}{\sqrt{109}}$

Q:35
Topic Name: Physics-Section A

ItemCode:101205

Question: Water falls from a 40 m high dam at the rate of 9×10^4 kg per hour. Fifty percentage of gravitational potential energy can be converted into electrical energy. Using this hydro electric energy number of 100 W lamps, that can be lit, is :
(Take $g=10\ ms^{-2}$)

A	25
B	50
C	100
D	18

Q:36
Topic Name: Physics-Section A

ItemCode:101206

Question: Two objects of equal masses placed at certain distance from each other attracts each other with a force of F. If one-third mass of one object is transferred to the other object, then the new force will be :

A	$\frac{2}{9}$ F
B	$\frac{16}{9}$ F
C	$\frac{8}{9}$ F
D	F

Q:37
Topic Name: Physics-Section A

ItemCode:101207

Question: A water drop of radius 1 μm falls in a situation where the effect of buoyant force is negligible. Co-efficient of viscosity of air is $1.8\times10^{-5}\ Nsm^{-2}$ and its density is negligible as compared to that of water $10^6\ gm^{-3}$. Terminal velocity of the water drop is :
(Take acceleration due to gravity $=10\ ms^{-2}$)

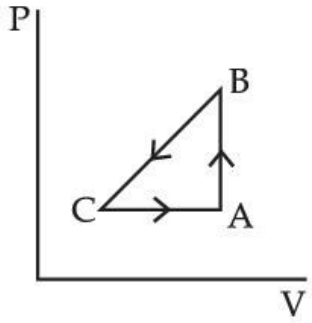
A	$145.4\times10^{-6}\ ms^{-1}$
B	$118.0\times10^{-6}\ ms^{-1}$
C	$132.6\times10^{-6}\ ms^{-1}$
D	$123.4\times10^{-6}\ ms^{-1}$

Q:38
Topic Name: Physics-Section A

ItemCode:101208

Question:

A sample of an ideal gas is taken through the cyclic process ABCA as shown in figure. It absorbs, 40 J of heat during the part AB, no heat during BC and rejects 60 J of heat during CA. A work of 50 J is done on the gas during the part BC. The internal energy of the gas at A is 1560 J. The workdone by the gas during the part CA is :



A	20 J
B	30 J
C	−30 J
D	−60 J

Q:39
Topic Name: Physics-Section A

ItemCode:101209

Question:

What will be the effect on the root mean square velocity of oxygen molecules if the temperature is doubled and oxygen molecule dissociates into atomic oxygen ?

A	The velocity of atomic oxygen remains same
B	The velocity of atomic oxygen doubles
C	The velocity of atomic oxygen becomes half
D	The velocity of atomic oxygen becomes four times

Q:40
Topic Name: Physics-Section A

ItemCode:101210

Question:

Two point charges A and B of magnitude $+8\times10^{-6}$ C and -8×10^{-6} C respectively are placed at a distance d apart. The electric field at the middle point O between the charges is 6.4×10^{4} NC^{-1}. The distance 'd' between the point charges A and B is :

A	2.0 m
B	3.0 m
C	1.0 m
D	4.0 m

Q:41
Topic Name: Physics-Section A

ItemCode:101211

Question: Resistance of the wire is measured as 2 Ω and 3 Ω at 10°C and 30°C respectively. Temperature co-efficient of resistance of the material of the wire is :

A	$0.033\ ^{\circ}C^{-1}$
B	$-0.033\ ^{\circ}C^{-1}$
C	$0.011\ ^{\circ}C^{-1}$
D	$0.055\ ^{\circ}C^{-1}$

Q:42
Topic Name: Physics-Section A

ItemCode:101212

Question: The space inside a straight current carrying solenoid is filled with a magnetic material having magnetic susceptibility equal to 1.2×10^{-5}. What is fractional increase in the magnetic field inside solenoid with respect to air as medium inside the solenoid ?

A	1.2×10^{-5}
B	1.2×10^{-3}
C	1.8×10^{-3}
D	2.4×10^{-5}

Q:43
Topic Name: Physics-Section A

ItemCode:101213

Question: Two parallel, long wires are kept 0.20 m apart in vacuum, each carrying current of x A in the same direction. If the force of attraction per meter of each wire is 2×10^{-6} N, then the value of x is approximately :

A	1
B	2.4
C	1.4
D	2

Q:44
Topic Name: Physics-Section A

ItemCode:101214

Question: A coil is placed in a time varying magnetic field. If the number of turns in the coil were to be halved and the radius of wire doubled, the electrical power dissipated due to the current induced in the coil would be :
(Assume the coil to be short circuited.)

A	Halved
B	Quadrupled
C	The same
D	Doubled

Q:45
Topic Name: Physics-Section A

ItemCode:101215

Question: An EM wave propagating in x-direction has a wavelength of 8 mm. The electric field vibrating y-direction has maximum magnitude of 60 Vm^{-1}. Choose the correct equations for electric and magnetic fields if the EM wave is propagating in vacuum :

A

$$E_y = 60\sin\left[\frac{\pi}{4} \times 10^3 \ (x - 3 \times 10^8 t)\right]\hat{j} \ Vm^{-1}$$

$$B_z = 2\sin\left[\frac{\pi}{4} \times 10^3 \ (x - 3 \times 10^8 t)\right]\hat{k} \ T$$

B

$$E_y = 60\sin\left[\frac{\pi}{4} \times 10^3 \ (x - 3 \times 10^8 t)\right]\hat{j} \ Vm^{-1}$$

$$B_z = 2 \times 10^{-7} \sin\left[\frac{\pi}{4} \times 10^3 \ (x - 3 \times 10^8 t)\right]\hat{k} \ T$$

C

$$E_y = 2 \times 10^{-7} \sin\left[\frac{\pi}{4} \times 10^3 \ (x - 3 \times 10^8 t)\right]\hat{j} \ Vm^{-1}$$

$$B_z = 60\sin\left[\frac{\pi}{4} \times 10^3 \ (x - 3 \times 10^8 t)\right]\hat{k} \ T$$

D

$$E_y = 2 \times 10^{-7} \sin\left[\frac{\pi}{4} \times 10^4 \ (x - 4 \times 10^8 t)\right]\hat{j} \ Vm^{-1}$$

$$B_z = 60\sin\left[\frac{\pi}{4} \times 10^4 \ (x - 4 \times 10^8 t)\right]\hat{k} \ T$$

Q:46
Topic Name: Physics-Section A

ItemCode:101216

Question: In young's double slit experiment performed using a monochromatic light of wavelength λ, when a glass plate ($\mu = 1.5$) of thickness $x\lambda$ is introduced in the path of the one of the interfering beams, the intensity at the position where the central maximum occurred previously remains unchanged. The value of x will be :

A 3

B 2

C 1.5

D 0.5

Q:47
Topic Name: Physics-Section A

ItemCode:101217

Question: Let K_1 and K_2 be the maximum kinetic energies of photo-electrons emitted when two monochromatic beams of wavelength λ_1 and λ_2, respectively are incident on a metallic surface. If $\lambda_1 = 3\lambda_2$ then :

A $K_1 > \frac{K_2}{3}$

B $K_1 < \frac{K_2}{3}$

C $K_1 = \frac{K_2}{3}$

D $K_2 = \frac{K_1}{3}$

Q:48
Topic Name: Physics-Section A

ItemCode:101218

Question: Following statements related to radioactivity are given below :

(A) Radioactivity is a random and spontaneous process and is dependent on physical and chemical conditions.

(B) The number of un-decayed nuclei in the radioactive sample decays exponentially with time.

(C) Slope of the graph of $\log_e$ (no. of undecayed nuclei) Vs. time represents the reciprocal of mean life time (τ).

(D) Product of decay constant (λ) and half-life time ($T_{1/2}$) is not constant.

Choose the **most appropriate** answer from the options given below :

A (A) and (B) only

B (B) and (D) only

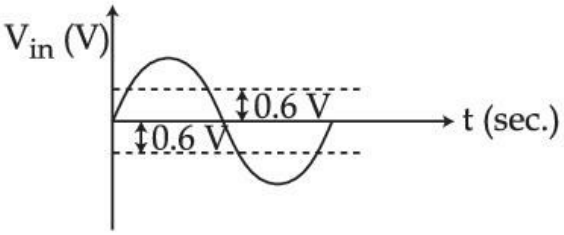
C (B) and (C) only

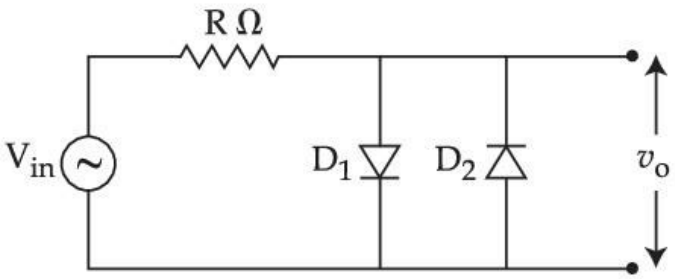
D (C) and (D) only

Q:49
Topic Name: Physics-Section A

ItemCode:101219

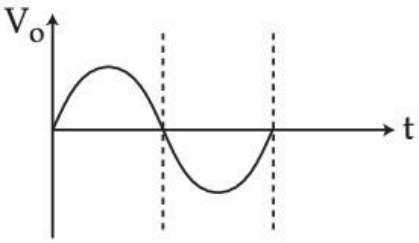
In the given circuit the input voltage V_{in} is shown in figure. The cut-in voltage of p-n junction diode (D_1 or D_2) is 0.6 V. Which of the following output voltage (V_o) waveform across the diode is **correct** ?



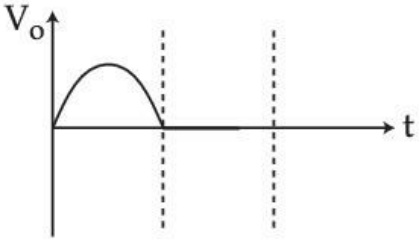


Question:

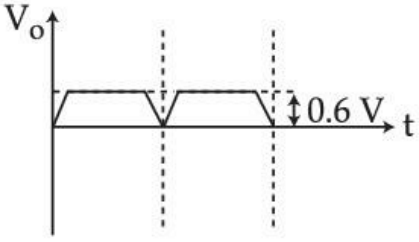
A



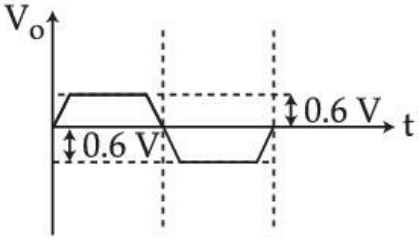
B



C



D



Q:50

Topic Name: Physics-Section A

ItemCode:101220

Amplitude modulated wave is represented by

$V_{AM} = 10\left[1 + 0.4\cos(2\pi \times 10^4 t)\right]\cos(2\pi \times 10^7 t)$. The total bandwidth of the amplitude modulated wave is :

Question:

A 10 kHz

B 20 MHz

C 20 kHz

D 10 MHz

Q:51

Topic Name: Physics-Section B

ItemCode:101221

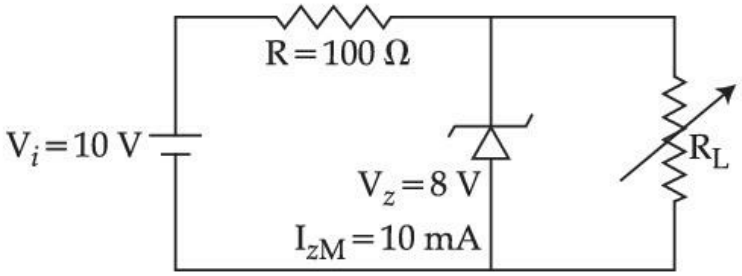
Question: A student in the laboratory measures thickness of a wire using screw gauge. The readings are 1.22 mm, 1.23 mm, 1.19 mm and 1.20 mm. The percentage error is $\frac{x}{121}\%$. The value of x is _____.

Q:52

Topic Name: Physics-Section B

ItemCode:101222

Question: A zener of breakdown voltage $V_Z = 8\ V$ and maximum zener current, $I_{ZM} = 10\ mA$ is subjected to an input voltage $V_i = 10\ V$ with series resistance $R = 100\ \Omega$. In the given circuit R_L represents the variable load resistance. The ratio of maximum and minimum value of R_L is _____.



Q:53

Topic Name: Physics-Section B

ItemCode:101223

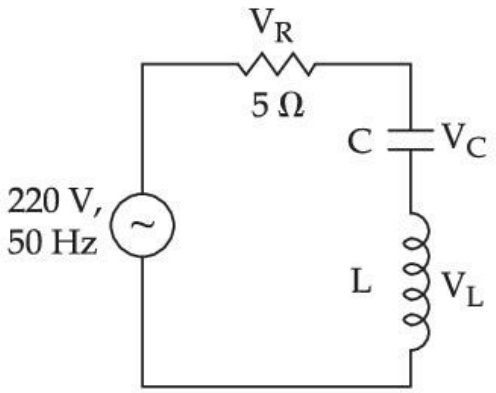
Question: In a Young's double slit experiment, an angular width of the fringe is 0.35° on a screen placed at 2 m away for particular wavelength of 450 nm. The angular width of the fringe, when whole system is immersed in a medium of refractive index 7/5, is $\frac{1}{\alpha}$. The value of α is _____.

Q:54

Topic Name: Physics-Section B

ItemCode:101224

Question: In the given circuit, the magnitude of V_L and V_C are twice that of V_R. Given that $f = 50$ Hz, the inductance of the coil is $\frac{1}{K\pi}$ mH. The value of K is _____.



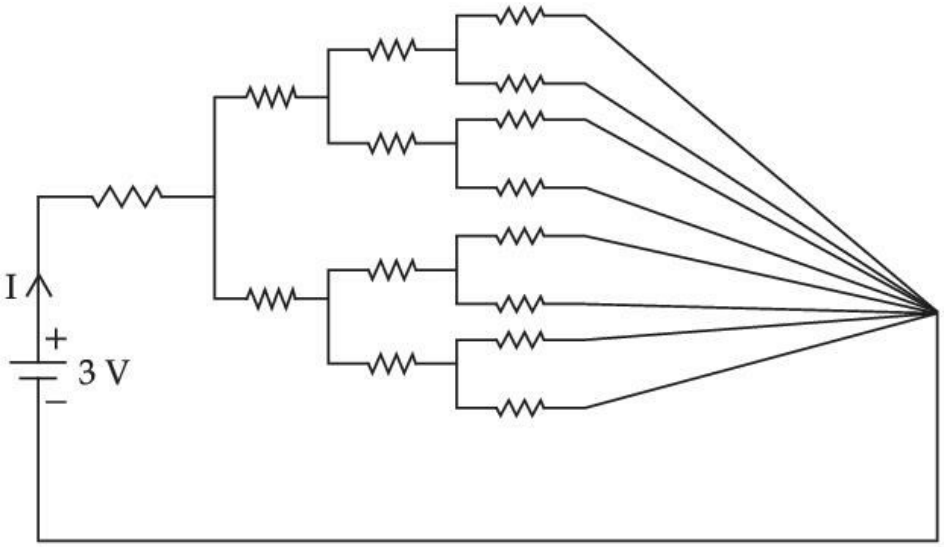
Q:55

Topic Name: Physics-Section B

ItemCode:101225

Question:

All resistances in figure are 1 Ω each. The value of current 'I' is $\frac{a}{5}$ A. The value of a is _____.

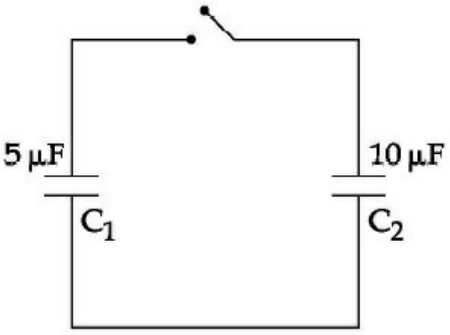


Q:56
Topic Name: Physics-Section B

ItemCode:101226

Question:

A capacitor C_1 of capacitance 5 μF is charged to a potential of 30 V using a battery. The battery is then removed and the charged capacitor is connected to an uncharged capacitor C_2 of capacitance 10 μF as shown in figure. When the switch is closed charge flows between the capacitors. At equilibrium, the charge on the capacitor C_2 is _____ μC.



Q:57
Topic Name: Physics-Section B

ItemCode:101227

Question:

A tunning fork of frequency 340 Hz resonates in the fundamental mode with an air column of length 125 cm in a cylindrical tube closed at one end. When water is slowly poured in it, the minimum height of water required for observing resonance once again is _____ cm.

(Velocity of sound in air is 340 ms^{-1})

Q:58
Topic Name: Physics-Section B

ItemCode:101228

Question: A liquid of density 750 kgm^{-3} flows smoothly through a horizontal pipe that tapers in cross-sectional area from $A_1 = 1.2 \times 10^{-2} m^2$ to $A_2 = \frac{A_1}{2}$. The pressure difference between the wide and narrow sections of the pipe is 4500 Pa. The rate of flow of liquid is _____ $\times 10^{-3}$ $m^3 s^{-1}$.

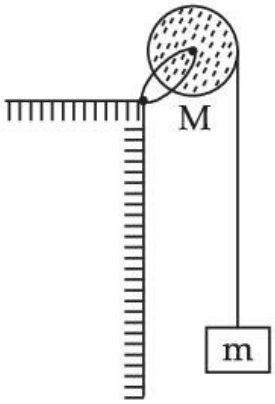
Q:59

Topic Name: Physics-Section B

ItemCode:101229

Question: A uniform disc with mass M = 4 kg and radius R = 10 cm is mounted on a fixed horizontal axle as shown in figure. A block with mass m = 2 kg hangs from a massless cord that is wrapped around the rim of the disc. During the fall of the block, the cord does not slip and there is no friction at the axle. The tension in the cord is _____ N.

(Take g = 10 ms^{-2})

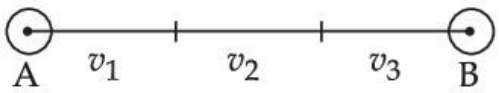


Q:60

Topic Name: Physics-Section B

ItemCode:101230

Question: A car covers AB distance with first one-third at velocity v_1 ms^{-1}, second one-third at v_2 ms^{-1} and last one-third at v_3 ms^{-1}. If $v_3 = 3v_1$, $v_2 = 2v_1$ and $v_1 = 11$ ms^{-1} then the average velocity of the car is _____ ms^{-1}.



Q:61

Topic Name: Chemistry-Section A

ItemCode:101231

Question: Compound A contains 8.7% Hydrogen, 74% Carbon and 17.3% Nitrogen. The molecular formula of the compound is,

Given : Atomic masses of C, H and N are 12, 1 and 14 amu respectively.

The molar mass of the compound A is 162 g mol^{-1}.

A	$C_4H_6N_2$
B	C_2H_3N
C	C_5H_7N

D	$C_{10}H_{14}N_2$

Q:62
Topic Name: Chemistry-Section A

ItemCode:101232

Consider the following statements :

(A) The principal quantum number 'n' is a positive integer with values of 'n' = 1, 2, 3, ...

(B) The azimuthal quantum number 'l' for a given 'n' (principal quantum number) can have values as 'l' = 0, 1, 2, ... n

(C) Magnetic orbital quantum number 'm_l' for a particular 'l' (azimuthal quantum number) has $(2l+1)$ values.

(D) $\pm 1/2$ are the two possible orientations of electron spin.

(E) For $l = 5$, there will be a total of 9 orbital

Question: Which of the above statements are **correct** ?

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

Q:63
Topic Name: Chemistry-Section A

ItemCode:101233

Question: In the structure of SF_4, the lone pair of electrons on S is in.

A	equatorial position and there are two lone pair - bond pair repulsions at 90°.
B	equatorial position and there are three lone pair - bond pair repulsions at 90°.
C	axial position and there are three lone pair - bond pair repulsion at 90°.
D	axial position and there are two lone pair - bond pair repulsion at 90°.

Q:64
Topic Name: Chemistry-Section A

ItemCode:101234

A student needs to prepare a buffer solution of propanoic acid and its sodium salt with pH 4.

The ratio of $\frac{[CH_3CH_2COO^-]}{[CH_3CH_2COOH]}$ required to make buffer is _____.

Question: Given : $K_a(CH_3CH_2COOH) = 1.3 \times 10^{-5}$

A	0.03
B	0.13
C	0.23
D	0.33

Q:65
Topic Name: Chemistry-Section A

ItemCode:101235

Question: Match **List - I** with **List - II** :

	List - I		**List - II**
(A)	negatively charged sol	(I)	$Fe_2O_3 \cdot xH_2O$
(B)	macromolecular colloid	(II)	CdS sol
(C)	positively charged sol	(III)	Starch
(D)	Cheese	(IV)	a gel

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

A	(A) - (II), (B) - (III), (C) - (IV), (D) - (I)
B	(A) - (II), (B) - (I), (C) - (III), (D) - (IV)
C	(A) - (II), (B) - (III), (C) - (I), (D) - (IV)
D	(A) - (I), (B) - (III), (C) - (II), (D) - (IV)

Q:66
Topic Name: Chemistry-Section A

ItemCode:101236

Question: Match **List - I** with **List - II** :

	List - I (Oxide)		**List - II (Nature)**
(A)	Cl_2O_7	(I)	Amphoteric
(B)	Na_2O	(II)	Basic
(C)	Al_2O_3	(III)	Neutral
(D)	N_2O	(IV)	Acidic

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

A	(A) - (IV), (B) - (III), (C) - (I), (D) - (II)
B	(A) - (IV), (B) - (II), (C) - (I), (D) - (III)
C	(A) - (II), (B) - (IV), (C) - (III), (D) - (I)
D	(A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Q:67
Topic Name: Chemistry-Section A

ItemCode:101237

Question: In the metallurgical extraction of copper, following reaction is used :

$FeO + SiO_2 \rightarrow FeSiO_3$

FeO and $FeSiO_3$ respectively are.

A	gangue and flux.
B	flux and slag.

C	slag and flux.
D	gangue and slag.

Q:68
Topic Name: Chemistry-Section A

ItemCode:101238

Question: Hydrogen has three isotopes : protium (^1H) , deuterium (^2H or D) and tritium (^3H or T) . They have nearly same chemical properties but different physical properties. They differ in

A	number of protons.
B	atomic number.
C	electronic configuration.
D	atomic mass.

Q:69
Topic Name: Chemistry-Section A

ItemCode:101239

Question: Among the following, basic oxide is :

A	SO_3
B	SiO_2
C	CaO
D	Al_2O_3

Q:70
Topic Name: Chemistry-Section A

ItemCode:101240

Question: Among the given oxides of nitrogen ; N_2O, N_2O_3, N_2O_4 and N_2O_5, the number of compound/(s) having N – N bond is :

A	1
B	2
C	3
D	4

Q:71
Topic Name: Chemistry-Section A

ItemCode:101241

Question: Which of the following oxoacids of sulphur contains "S" in two different oxidation states ?

A	$H_2S_2O_3$
B	$H_2S_2O_6$
C	$H_2S_2O_7$
D	$H_2S_2O_8$

Q:72
Topic Name: Chemistry-Section A

ItemCode:101242

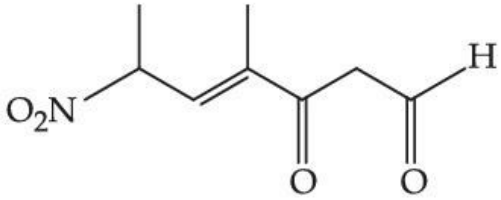
Question: Correct statement about photo-chemical smog is :

A	It occurs in humid climate.
B	It is a mixture of smoke, fog and SO_2.
C	It is reducing smog.
D	It results from reaction of unsaturated hydrocarbons.

Q:73
Topic Name: Chemistry-Section A

ItemCode:101243

Question: The correct IUPAC name of the following compound is :

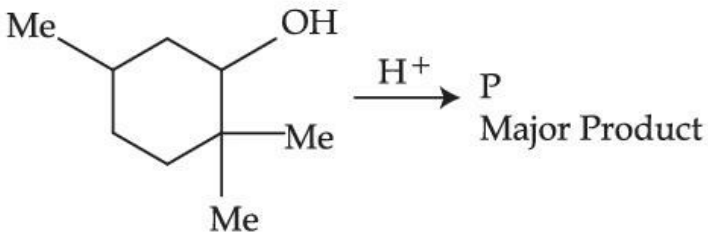


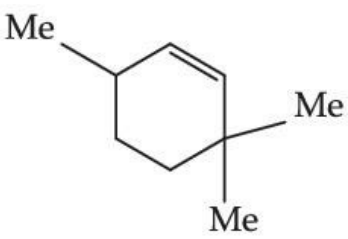
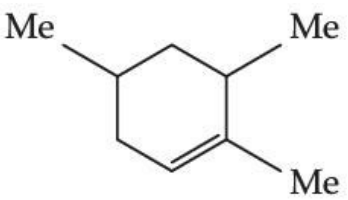
A	4-methyl-2-nitro-5-oxohept-3-enal
B	4-methyl-5-oxo-2-nitrohept-3-enal
C	4-methyl-6-nitro-3-oxohept-4-enal
D	6-formyl-4-methyl-2-nitrohex-3-enal

Q:74
Topic Name: Chemistry-Section A

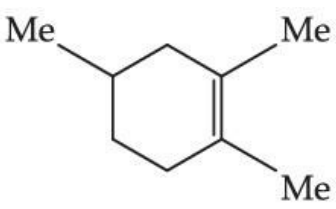
ItemCode:101244

Question: The major product (P) of the given reaction is
(where, Me is $-CH_3$)

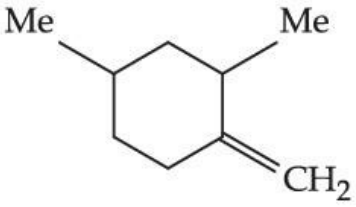


A	
B	

C



D



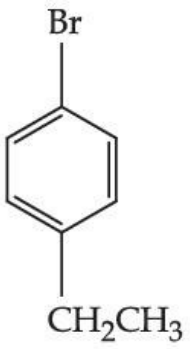
Q:75
Topic Name: Chemistry-Section A

ItemCode:101245

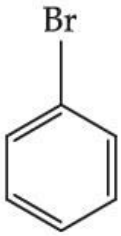
$$A \xrightarrow[(ii)\ CN^-]{(i)\ Cl_2,\ \Delta} \text{4-Bromophenyl acetic acid.}$$
$$(iii)\ H_2O/H^+$$

Question: In the above reaction 'A' is

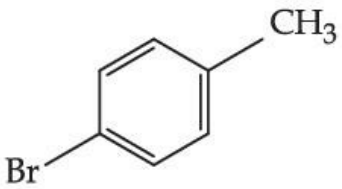
A



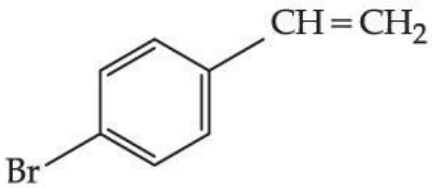
B



C



D

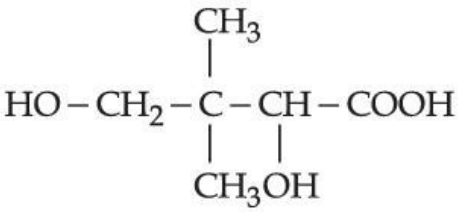


Q:76
Topic Name: Chemistry-Section A

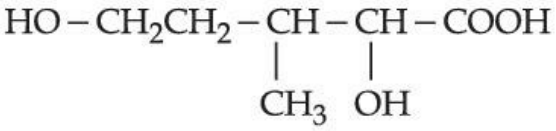
ItemCode:101246

Question: Isobutyraldehyde on reaction with formaldehyde and K_2CO_3 gives compound 'A'. Compound 'A' reacts with KCN and yields compound 'B', which on hydrolysis gives a stable compound 'C'. The compound 'C' is

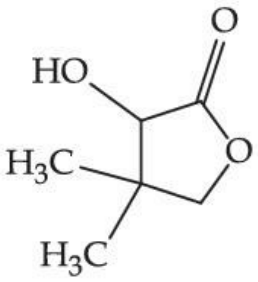
A



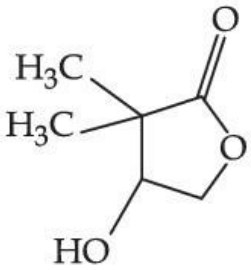
B



C



D

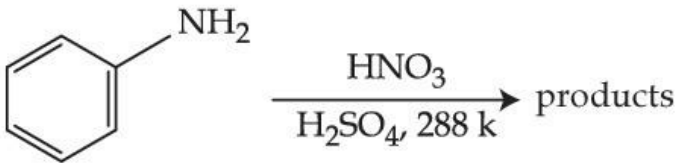


Q:77
Topic Name: Chemistry-Section A

ItemCode:101247

Question:

With respect to the following reaction, consider the given statements :



(A) o-Nitroaniline and p-nitroaniline are the predominant products.

(B) p-Nitroaniline and m-nitroaniline are the predominant products.

(C) HNO_3 acts as an acid.

(D) H_2SO_4 acts as an acid.

Choose the **correct** option.

A (A) and (C) are correct statements.

B (A) and (D) are correct statements.

C (B) and (D) are correct statements.

D (B) and (C) are correct statements.

Q:78
Topic Name: Chemistry-Section A

ItemCode:101248

Given below are two statements, one is **Assertion (A)** and other is **Reason (R)**.

Assertion (A) : Natural rubber is a linear polymer of isoprene called *cis*-polyisoprene with elastic properties .

Reason (R) : The *cis*-polyisoprene molecules consist of various chains held together by strong polar interactions with coiled structure.

Question: In the light of the above statements, choose the **correct** one from the options given below :

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

Q:79
Topic Name: Chemistry-Section A

ItemCode:101249

When sugar 'X' is boiled with dilute H_2SO_4 in alcoholic solution, two isomers 'A' and 'B' are formed. 'A' on oxidation with HNO_3 yields saccharic acid where as 'B' is laevorotatory. The compound 'X' is :

Question:

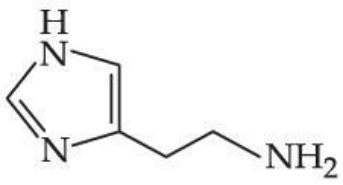
A	Maltose
B	Sucrose
C	Lactose
D	Strach

Q:80
Topic Name: Chemistry-Section A

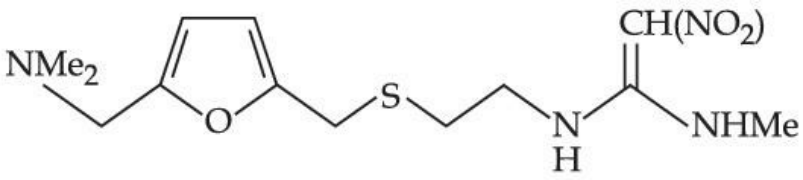
ItemCode:101250

Question: The drug tegamet is :

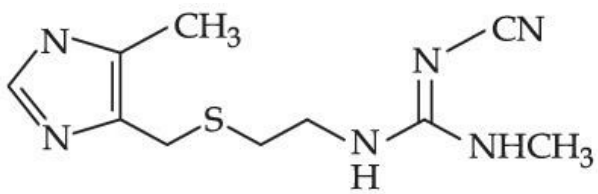
A



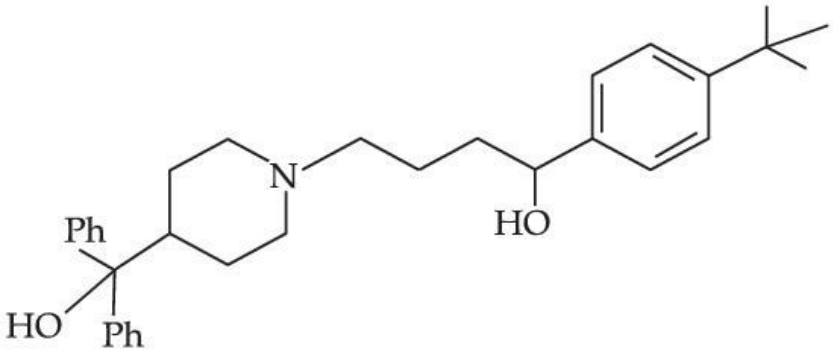
B



C



D



Q:81
Topic Name: Chemistry-Section B

ItemCode:101251

Question: 100 g of an ideal gas is kept in a cylinder of 416 L volume at 27°C under 1.5 bar pressure. The molar mass of the gas is _____ g mol^{-1}. (Nearest integer)
(Given : R = 0.083 L bar K^{-1} mol^{-1})

Q:82
Topic Name: Chemistry-Section B

ItemCode:101252

Question: For combustion of one mole of magnesium in an open container at 300 K and 1 bar pressure, $\Delta_C H^{\ominus} = -601.70$ kJ mol^{-1}, the magnitude of change in internal energy for the reaction is _____ kJ . (Nearest integer)
(Given : R = 8.3 J K^{-1} mol^{-1})

Q:83
Topic Name: Chemistry-Section B

ItemCode:101253

Question: 2.5 g of protein containing only glycine ($C_2H_5NO_2$) is dissolved in water to make 500 mL of solution. The osmotic pressure of this solution at 300 K is found to be 5.03×10^{-3} bar. The total number of glycine units present in the protein is _____ .
(Given : R = 0.083 L bar K^{-1} mol^{-1})

Q:84
Topic Name: Chemistry-Section B

ItemCode:101254

Question: For the given reactions

$Sn^{2+} + 2e^- \rightarrow Sn$

$Sn^{4+} + 4e^- \rightarrow Sn$

the electrode potentials are ; $E^{o}_{Sn^{2+}/Sn} = -0.140$ V and $E^{o}_{Sn^{4+}/Sn} = 0.010$ V. The magnitude of standard electrode potential for Sn^{4+}/Sn^{2+} i.e. $E^{o}_{Sn^{4+}/Sn^{2+}}$ is _____ $\times 10^{-2}$ V.
(Nearest integer)

Q:85
Topic Name: Chemistry-Section B

ItemCode:101255

Question: A radioactive element has a half life of 200 days. The percentage of original activity remaining after 83 days is _____ . (Nearest integer)

(Given : antilog $0.125 = 1.333$,

antilog $0.693 = 4.93$)

Q:86
Topic Name: Chemistry-Section B

ItemCode:101256

Question: $[Fe(CN)_6]^{4-}$

$[Fe(CN)_6]^{3-}$

$[Ti(CN)_6]^{3-}$

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

$[Co(CN)_6]^{3-}$

Among the given complexes, number of paramagnetic complexes is _____ .

Q:87
Topic Name: Chemistry-Section B

ItemCode:101257

Question: (a) $CoCl_3.4\ NH_3$, (b) $CoCl_3 \cdot 5NH_3$, (c) $CoCl_3 \cdot 6NH_3$ and (d) $CoCl(NO_3)_2 \cdot 5NH_3$. Number of complex(es) which will exist in *cis-trans* form is/are _____.

Q:88
Topic Name: Chemistry-Section B

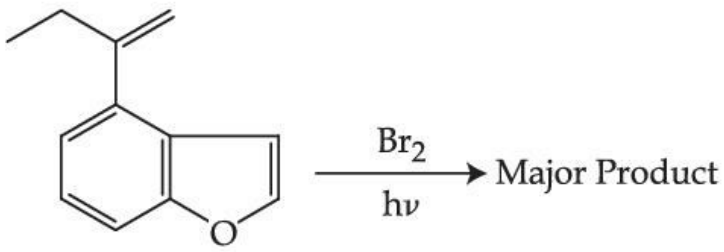
ItemCode:101258

Question: The complete combustion of 0.492 g of an organic compound containing 'C', 'H' and 'O' gives 0.793g of CO_2 and 0.442 g of H_2O. The percentage of oxygen composition in the organic compound is _____. (nearest integer)

Q:89
Topic Name: Chemistry-Section B

ItemCode:101259

Question: The major product of the following reaction contains _____ bromine atom(s).



Q:90
Topic Name: Chemistry-Section B

ItemCode:101260

Question: 0.01 M $KMnO_4$ solution was added to 20.0 mL of 0.05 M Mohr's salt solution through a burette. The initial reading of 50 mL burette is zero. The volume of $KMnO_4$ solution left in the burette after the end point is _____ mL. (nearest integer)