

Paper:	B.E_B.Tech
Set Name:	SET 30
Exam Date:	30 July 2022
Exam Shift:	2
Language:	English

Topic:	Physics-Section A
Item No:	1
Question ID:	15477154561
Question Type:	MCQ
Question:	If current (I) , kinetic energy (K) and charge (Q) are taken as the fundamental quantities, The dimensional representation of power will be :
A:	$[K^{-1} Q I^{-1}]$
B:	$[K I Q^{-1}]$
C:	$[K Q I^{-1}]$
D:	$[K^{-1} Q^{-1} I]$

Topic:	Physics-Section A
Item No:	2
Question ID:	15477154562
Question Type:	MCQ
Question:	Two trucks A and B are approaching each other on a straight path with the velocities of 16 m/s and 20 m/s respectively. When they are 200 m apart their drivers see each other and applies the breaks simultaneously. If the truck A decelerates with 2 m/s^2 and truck B decelerates with 4 m/s^2 , what is the distance between them when they finally stop?
A:	14 m
B:	114 m
C:	86 m
D:	64 m

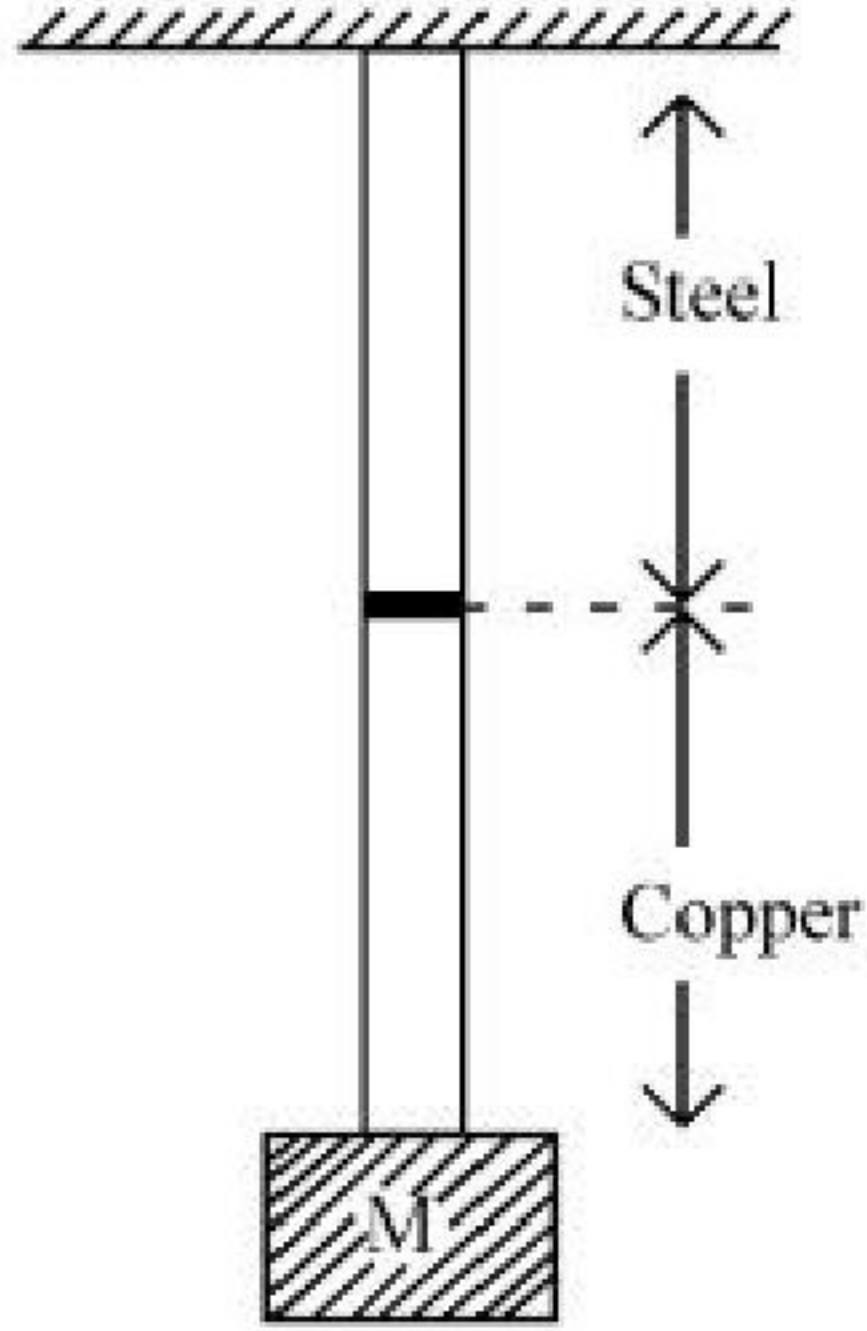
Topic:	Physics-Section A
Item No:	3
Question ID:	15477154563
Question Type:	MCQ
Question:	A bullet of mass 10 gram is fired with velocity of 100 m/s from the gun of mass 1 kg . Recoil speed of the gun is :
A:	$1 \frac{\text{m}}{\text{s}}$

B:	$10 \frac{m}{s}$
C:	$0.5 \frac{m}{s}$
D:	$0.1 \frac{m}{s}$

Topic:	Physics-Section A
Item No:	4
Question ID:	15477154564
Question Type:	MCQ
Question:	A mass of 0.5 kg is attached to one end of a massless spring whose natural length is 1 m and spring constant is 800 N/m The other end of the spring is fixed while the mass moves in a circular path in a horizontal plane with an angular speed of 20 rad/s. The extension in the length of the spring will be :
A:	$\frac{1}{10} \text{ m}$
B:	$\frac{1}{4} \text{ m}$
C:	$\frac{1}{3} \text{ m}$
D:	$\frac{1}{5} \text{ m}$

Topic:	Physics-Section A
Item No:	5
Question ID:	15477154565
Question Type:	MCQ
Question:	The time period of X planet of our solar system is 8 years. The distance of earth from the sun is $1.5 \times 10^{11} \text{ m}$. The distance of the X planet from the sun will be :
A:	$3\sqrt{2} \times 10^{11} \text{ m}$
B:	$3 \times 10^{11} \text{ m}$
C:	$6 \times 10^{11} \text{ m}$
D:	$12 \times 10^{11} \text{ m}$

Topic:	Physics-Section A
Item No:	6
Question ID:	15477154566
Question Type:	MCQ

Question:	A block of mass M is attached to a wire. The upper part of wire is made of steel and lower part of wire of copper (as shown in figure) . Both parts have the same area of cross section . Neglecting the mass of wires, the ratio of longitudinal strain developed in steel and copper wires is : (Given, Young's modulus of steel = $2 \times 10^{11} \text{ N/m}^2$ and Young's modulus of copper = $1.5 \times 10^{11} \text{ N/m}^2$) 
A:	$\frac{3}{5}$
B:	$\frac{4}{5}$
C:	$\frac{4}{3}$
D:	$\frac{3}{4}$

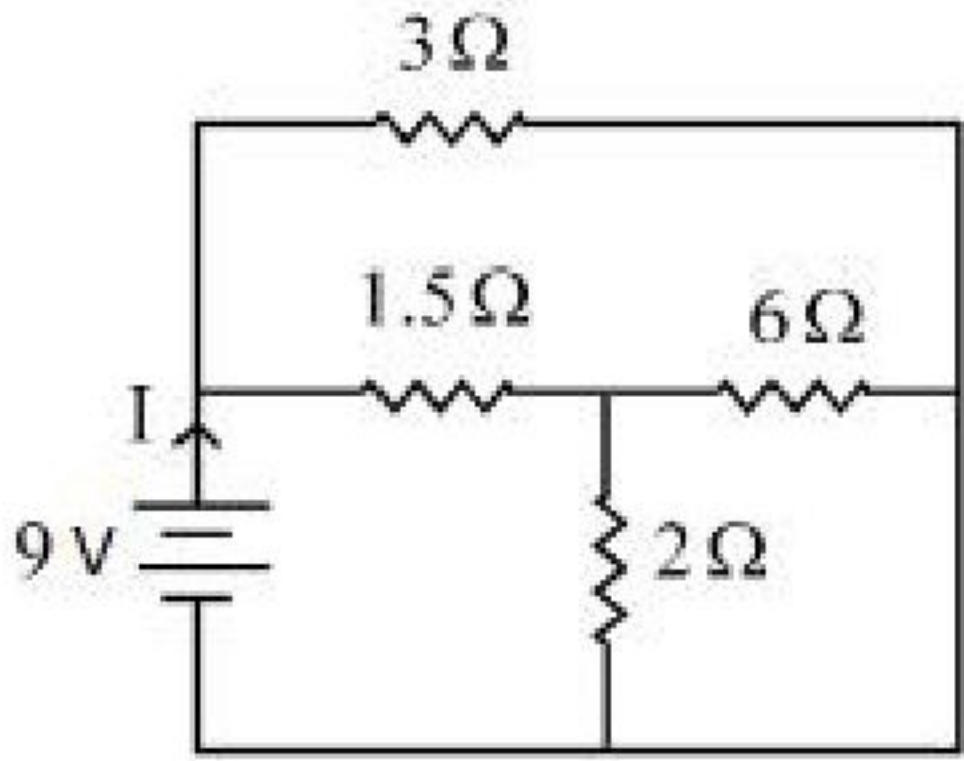
Topic:	Physics-Section A
Item No:	7
Question ID:	15477154567
Question Type:	MCQ
Question:	A Carnot engine is operating between the two reservoirs of temperature 227°C and 127°C respectively. If the engine performs $1.04 \times 10^5 \text{ J}$ work per cycle. Then, the heat absorbed from hot reservoir per cycle will be :
A:	$2.08 \times 10^4 \text{ J}$
B:	$1.04 \times 10^5 \text{ J}$
C:	$5.20 \times 10^5 \text{ J}$
D:	$2.36 \times 10^5 \text{ J}$

Topic:	Physics-Section A
Item No:	8
Question ID:	15477154568
Question Type:	MCQ

Question:	If the r.m.s speed of oxygen at room temperature is $\sqrt{56} \text{ m/s}$. The r.m.s speed of nitrogen at the same temperature is _____.
A:	$8\sqrt{2} \text{ m/s}$
B:	8 m/s
C:	16 m/s
D:	7 m/s

Topic:	Physics-Section A
Item No:	9
Question ID:	15477154569
Question Type:	MCQ
Question:	An oscillating simple pendulum of time period T_0 is placed in a lift which is accelerating upwards with 2.5 m/s^2 . The time period of pendulum in the lift will be (if $g = 10 \text{ m/s}^2$)
A:	T_0
B:	$\frac{2}{\sqrt{5}} T_0$
C:	$\frac{2}{\sqrt{3}} T_0$
D:	$\frac{T_0}{4}$

Topic:	Physics-Section A
Item No:	10
Question ID:	154771545610
Question Type:	MCQ
Question:	A charge q is uniformly distributed along the length L of a rod. It is then bent in the shape of a semicircle. The magnitude of electric field at the centre of semicircle will be :
A:	$\frac{q}{2 \epsilon_0 L^2}$
B:	$\frac{q}{2\pi \epsilon_0 L^2}$
C:	$\frac{q}{2\pi \epsilon_0 L}$
D:	$\frac{q}{4\pi^2 \epsilon_0 L}$

Topic:	Physics-Section A
Item No:	11
Question ID:	154771545611
Question Type:	MCQ
Question:	The current I drawn out of the battery connected in the given circuit is: 
A:	5 A
B:	6 A
C:	7 A
D:	8 A

Topic:	Physics-Section A
Item No:	12
Question ID:	154771545612
Question Type:	MCQ
Question:	In an A.C circuit , V & I are given by $V = 250 \sin (100 t)$ volt and $I = 10 \sin (100 t + \frac{\pi}{3})$ A respectively The power dissipated in the circuit is:
A:	2500 W
B:	625 W
C:	1250 W
D:	$625\sqrt{2}$ W

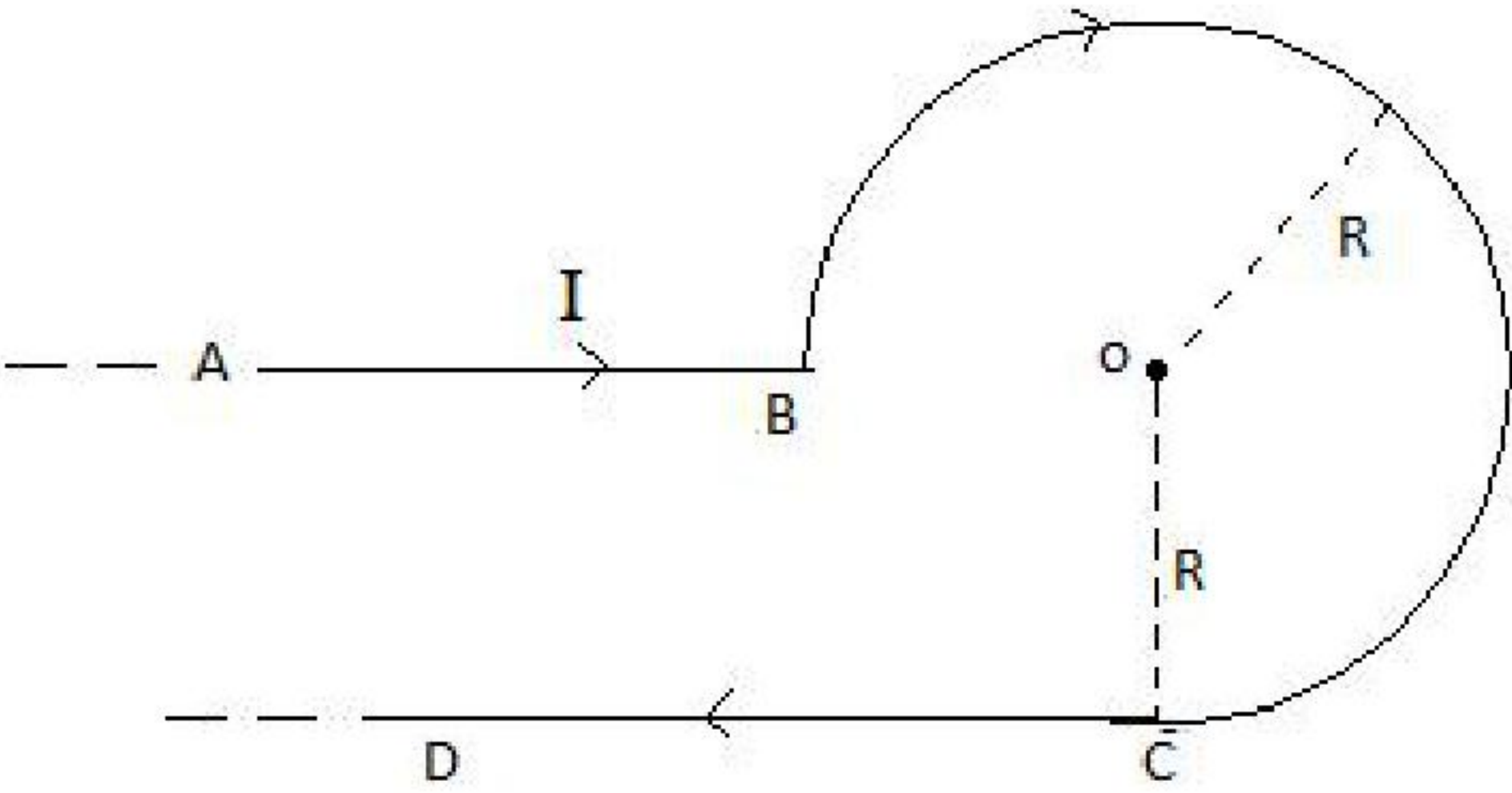
Topic:	Physics-Section A
Item No:	13
Question ID:	154771545613
Question Type:	MCQ
Question:	A plane electromagnetic wave propagating in free space has amplitude of electric field of $900 \frac{N}{C}$. The amplitude of magnetic field will be : _____
A:	9 μT
B:	27 μT

C:	$3 \mu\text{T}$
D:	270 GT

Topic:	Physics-Section A
Item No:	14
Question ID:	154771545614
Question Type:	MCQ
Question:	Two polaroids P_1 and P_2 are placed parallel to each other with common axis. The light of intensity I_0 passes through a polaroid sheet P_1 and then passes through polaroid P_2 . If P_2 is now rotated by 60° , then the intensity of the output light from P_2 will be:
A:	$\frac{I_0}{2}$
B:	$\frac{I_0}{4}$
C:	Zero
D:	$\frac{I_0}{8}$

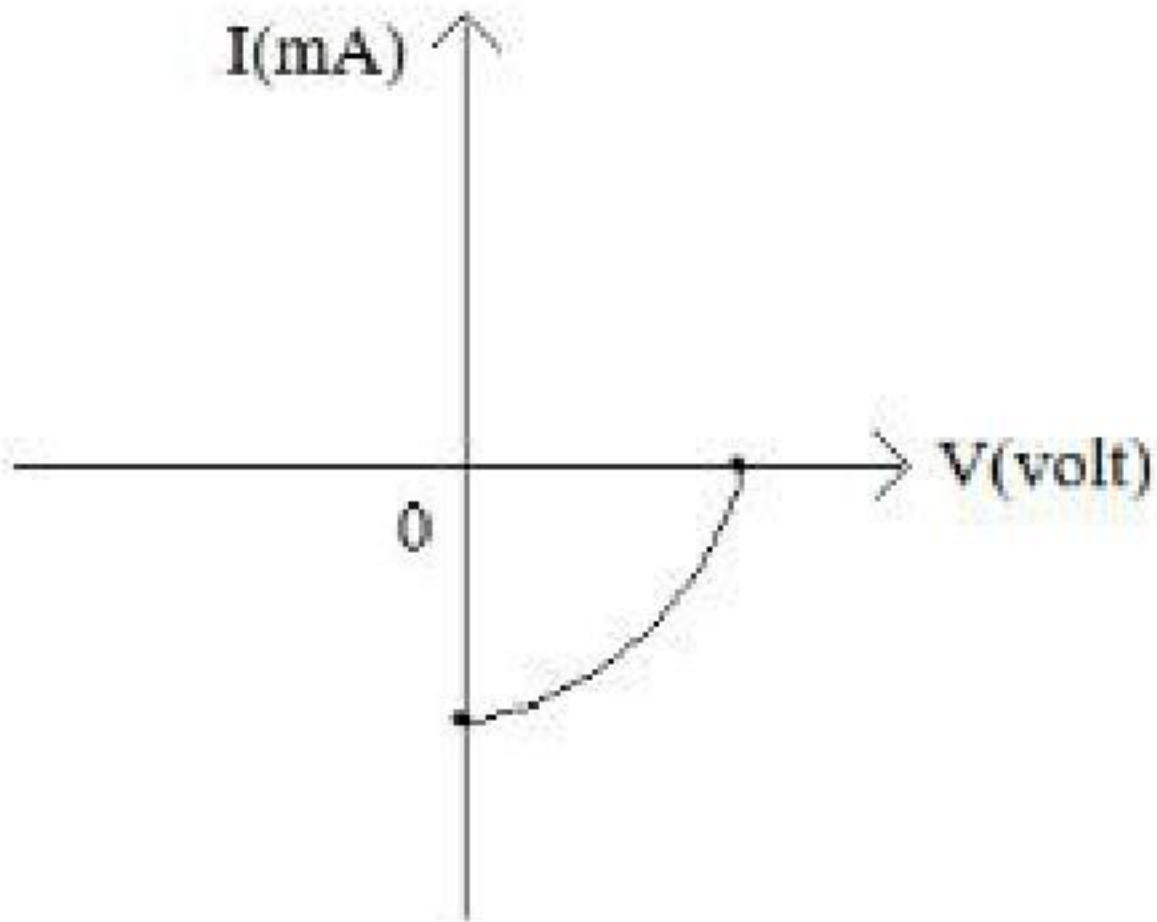
Topic:	Physics-Section A
Item No:	15
Question ID:	154771545615
Question Type:	MCQ
Question:	A wire of length 8 m is bent to form a circular loop in y-z plane. A current of 0.5 A is flowing in anticlockwise direction in it, the magnetic dipole moment of the loop is:
A:	$-8 \hat{i} \text{ A m}^2$
B:	$\frac{8}{\pi} \hat{i} \text{ A m}^2$
C:	$-4\pi \hat{i} \text{ A m}^2$
D:	$4\pi \hat{i} \text{ A m}^2$

Topic:	Physics-Section A
Item No:	16
Question ID:	154771545616
Question Type:	MCQ

Question:	In the following loop, magnitude of the magnetic field produced at the centre (O) of the loop is : (Assume AB and CD are infinitely extended): 
A:	$\frac{\mu_o I}{4\pi R} \left(\frac{3}{2} \pi \right)$
B:	$\frac{\mu_o I}{2\pi R}$
C:	$\frac{\mu_o I}{4\pi R} \left(\frac{3}{2} \pi + 1 \right)$
D:	$\frac{\mu_o I}{4\pi R} \left(\frac{3}{2} \pi - 1 \right)$

Topic:	Physics-Section A
Item No:	17
Question ID:	154771545617
Question Type:	MCQ
Question:	Using Boh'r model of quantization of angular momentum the relation between the radius 'r' of the n th allowed orbit of quantum number 'n' for an electron in hydrogen atom is:
A:	$r \propto n^{\frac{1}{2}}$
B:	$r \propto n^2$
C:	$r \propto \left(\frac{1}{n} \right)^2$
D:	$r \propto \left(\frac{1}{n} \right)^{\frac{1}{2}}$

Topic:	Physics-Section A
Item No:	18
Question ID:	154771545618
Question Type:	MCQ

Question:	 The I-V characteristics given in above figure is related to:
A:	Photodiode in reverse bias
B:	LED in forward bias
C:	Zener diode
D:	Solar cell

Topic:	Physics-Section A
Item No:	19
Question ID:	154771545619
Question Type:	MCQ
Question:	The de Broglie wavelength associated with an electron, accelerated through a potential difference of 15056 V, is:
A:	0.1 Å
B:	1 Å
C:	10 Å
D:	100 Å

Topic:	Physics-Section A
Item No:	20
Question ID:	154771545620
Question Type:	MCQ
Question:	An amplitude modulate wave consists of following components : Carrier component = 5 V peak value Lower side band component = 2.5 V peak value Upper side band component = 2.5 V peak value The amplitude of modulating signal is:
A:	1 V
B:	1.25 V
C:	2.5 V
D:	5 V

Topic:	Physics-Section B
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Item No:	21
Question ID:	154771545621
Question Type:	Numeric Answer
Question:	A nuclear physicist performed an experiment on the scattering of alpha particles by thin metal foil of gold. The alpha particles were accelerated up to kinetic energy 3.2 Mev. The estimation of the radius of the nucleus of gold element ($Z = 79$) by him is $\underline{\hspace{2cm}} \times 10^{-16} \text{ m}$ (Take $\frac{1}{4\pi \epsilon_o} = 9 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$)

Topic:	Physics-Section B
Item No:	22
Question ID:	154771545622
Question Type:	Numeric Answer
Question:	A ring is placed at the bottom of a trough containing four immiscible liquids of refractive indices 1.0, 2.0, 3.0 and 4.0 poured one above the other of heights 10 cm, 20 cm, 30 cm, and 40 cm respectively. The apparent depth at which the ring appears, when seen from outside is $\underline{\hspace{2cm}}$ cm.

Topic:	Physics-Section B
Item No:	23
Question ID:	154771545623
Question Type:	Numeric Answer
Question:	A sinusoidal voltage $V(t) = 200 \sin 2000 t$ volt is applied to a series LCR circuit in which $L = 10 \text{ mH}$, $C = 25 \mu\text{F}$ and $R = 100 \Omega$. The impedance of the circuit is $\underline{\hspace{2cm}} \Omega$

Topic:	Physics-Section B
Item No:	24
Question ID:	154771545624
Question Type:	Numeric Answer
Question:	A cell sends a current through a resistance 4Ω for time t and sends current through another resistance 16Ω for the same time t. If the same amount of heat is developed in both the resistances, then the internal resistance of the cell is $\underline{\hspace{2cm}} \Omega$

Topic:	Physics-Section B
Item No:	25
Question ID:	154771545625
Question Type:	Numeric Answer

Question:	Combination of four parallel plate air capacitors is shown in figure. Separation between the plate P_1 & P_2 is $\frac{d}{3}$ and separation between the plates P_2 and P_3 is d. The equivalent capacitance of the configuration is _____ μF. (Given $\frac{\epsilon_0 A}{d} = 4\mu\text{F}$. Where A=Area of plates)
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Topic:	Physics-Section B
Item No:	26
Question ID:	154771545626
Question Type:	Numeric Answer
Question:	A particle executing SHM has its velocity 20 cm s^{-1} at mean position and acceleration of 25 cm s^{-2} at one of its extreme position. The amplitude of the particle will be _____ cm.

Topic:	Physics-Section B
Item No:	27
Question ID:	154771545627
Question Type:	Numeric Answer
Question:	A water drop of radius 1 cm is broken into eight equal droplets. Surface tension of water is 0.075 N m^{-1} . The gain in surface energy is _____ $\times 10^{-7}\text{ J}$. (Take $\pi = 3.14$)

Topic:	Physics-Section B
Item No:	28
Question ID:	154771545628
Question Type:	Numeric Answer
Question:	A fly wheel of mass 10 kg and radius 50 cm is rotating at a rate of 360 rpm . Assuming mass to be concentrated at the rim, the constant retarding torque required to stop the rotation of wheel in 6 rotations will be $x\pi\text{ Nm}$. The value of x is _____

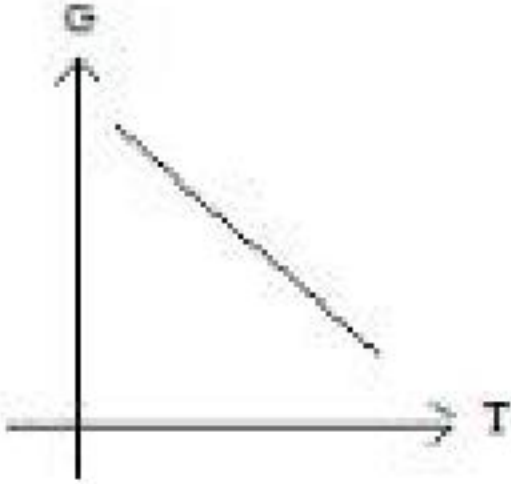
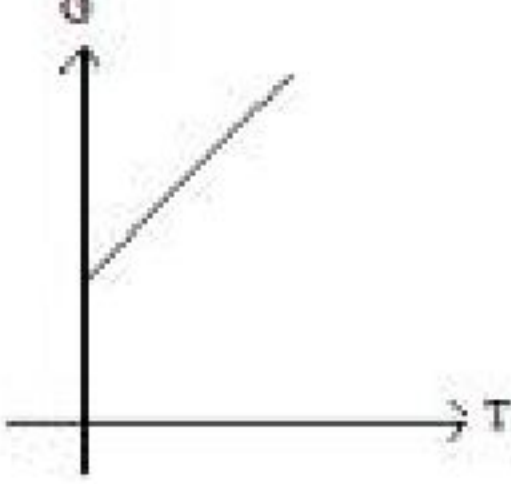
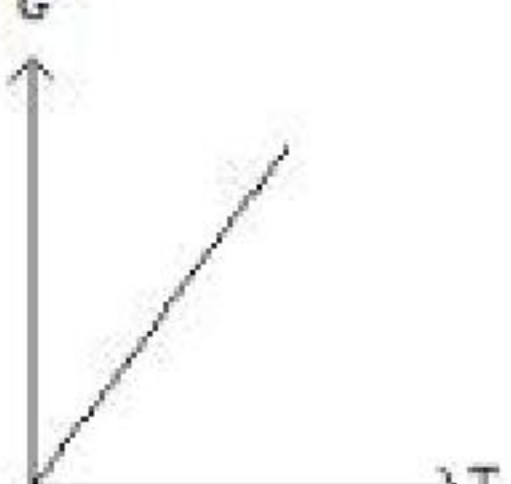
Topic:	Physics-Section B
Item No:	29
Question ID:	154771545629
Question Type:	Numeric Answer
Question:	A body moving horizontally on a smooth surface with a speed of 20 ms^{-1} splits into two parts and continue to move in the same direction . The masses of two parts are in the ratio of 1:2. The smaller part moves with a speed of 30 ms^{-1} . The fractional change in the kinetic energy is given by $\frac{1}{x}$. The value of x is _____

Topic:	Physics-Section B
Item No:	30
Question ID:	154771545630
Question Type:	Numeric Answer
Question:	Two projectiles are thrown towards each other at 15° and 45° angles respectively with the horizontal at the same speed. The difference between the horizontal distances traveled by the two projectiles is 80 m. The initial speed of the projectiles is _____ ms^{-1} [Given $g = 10 \text{ ms}^{-2}$]

Topic:	Chemistry-Section A
Item No:	31
Question ID:	154771545631
Question Type:	MCQ
Question:	Combination of temperature and pressure causing the greatest deviation from ideal gas behaviour is;
A:	100° C and 8 atm
B:	100° C and 4 atm.
C:	-100° C and 8 atm
D:	0° C and 4 atm

Topic:	Chemistry-Section A
Item No:	32
Question ID:	154771545632
Question Type:	MCQ
Question:	When the kinetic energy of an electron is increased nine times, the wavelength of the de-Broglie wave associated with it would become :
A:	One-third
B:	Three times
C:	Two third

D:	One sixth
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Topic:	Chemistry-Section A
Item No:	33
Question ID:	154771545633
Question Type:	MCQ
Question:	Which of the following is the plot of Gibb's free energy (G) vs temperature (T), at constant pressure, for a pure substance?
A:	
B:	
C:	
D:	

Topic:	Chemistry-Section A
Item No:	34
Question ID:	154771545634
Question Type:	MCQ

Question:	Freundlich's adsorption isotherm (in terms of concentration) is given by the expression; $\frac{x}{m} = K \cdot C^{1/n}$. The possible conclusions that can be drawn from the expression are : (A) When $\frac{1}{n} = 1$, the adsorption is directly proportional to concentration. (B) When $\frac{1}{n} = 0$, the adsorption is independent of concentration. (C) When $n = 0$, a plot of x/m vs C is a line parallel to x-axis (D) When $n = 0$, a plot of x/m vs C is a curve. Choose the correct option from the following :
A:	(A) and (B) only
B:	(B) and (D) only
C:	(B), (C) and (D) only
D:	(A), (B) and (C) only

Topic:	Chemistry-Section A
Item No:	35
Question ID:	154771545635
Question Type:	MCQ
Question:	For Periodic Table which of the following statements are TRUE A. Shielding increases as we go down in the group. B. Shielding increases sharply across the period. C. Ionization enthalpy increases down the group. D. Metallic character increases down the group. E. Electronegativity decreases down the group. Choose the correct answer from the following options :
A:	B, C and E Only
B:	A, D, and E only
C:	A, C, D and E only
D:	A, D and E only

Topic:	Chemistry-Section A
Item No:	36

Question ID:	154771545636										
Question Type:	MCQ										
Question:	Match List I with List II <table border="1"> <thead> <tr> <th>List I</th><th>List II</th></tr> </thead> <tbody> <tr> <td>A. Cyanide Process</td><td>I. Vapour phase refining</td></tr> <tr> <td>B. Froth flotation process</td><td>II. Aluminium</td></tr> <tr> <td>C. Hall-Heroult process</td><td>III. Dressing of ZnS</td></tr> <tr> <td>D. Mond process</td><td>IV. Extraction of Au</td></tr> </tbody> </table> Choose the correct answer from the options given below :	List I	List II	A. Cyanide Process	I. Vapour phase refining	B. Froth flotation process	II. Aluminium	C. Hall-Heroult process	III. Dressing of ZnS	D. Mond process	IV. Extraction of Au
List I	List II										
A. Cyanide Process	I. Vapour phase refining										
B. Froth flotation process	II. Aluminium										
C. Hall-Heroult process	III. Dressing of ZnS										
D. Mond process	IV. Extraction of Au										
A:	A-IV, B-III, C-II, D-I										
B:	A-I, B-II, C-III, D-IV										
C:	A-II, B-III, C-IV, D-I										
D:	A-III, B-II, C-IV, D-I										

Topic:	Chemistry-Section A
Item No:	37
Question ID:	154771545637
Question Type:	MCQ
Question:	The hardness of water is generally expressed in terms of CaCO_3 equivalent. The possible reasons are as follows: (A) Its molar mass is 100, so the calculations become easier. (B) It decomposes at a temperature, 1200 K. (C) It is insoluble in water. (D) It is moisture insensitive. Choose correct option from the following for the reasons.
A:	(A) and (B) only
B:	(A) and (D) only
C:	(B) and (D) only
D:	(A), (B), and (C) only

Topic:	Chemistry-Section A
Item No:	38
Question ID:	154771545638
Question Type:	MCQ

Question:	The correct option for relative covalent nature of compounds is
A:	$\text{KF} > \text{KI}$
B:	$\text{SnCl}_4 > \text{SnCl}_2$
C:	$\text{KF} > \text{LiF}$
D:	$\text{NaCl} > \text{HCl}$

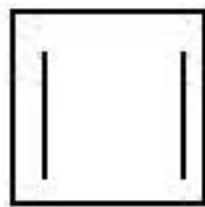
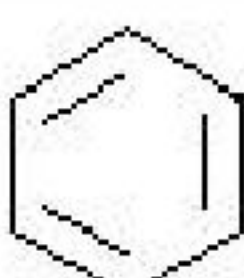
Topic:	Chemistry-Section A
Item No:	39
Question ID:	154771545639
Question Type:	MCQ
Question:	The E° (volt) values are : $\text{Al}^{3+} / \text{Al}$, -1.66 , $\text{Sc}^{3+} / \text{Sc}$, -2.08 , $\text{Fe}^{3+} / \text{Fe}^{2+}$, $+0.77$, $\text{Hg}_2^{2+} / \text{Hg}$, $+0.79$. Arrangement of cations, Al^{3+} , Sc^{3+} , Fe^{3+} and Hg_2^{2+} in decreasing order of oxidizing strength is
A:	$\text{Al}^{3+} > \text{Sc}^{3+} > \text{Fe}^{3+} > \text{Hg}_2^{2+}$
B:	$\text{Hg}_2^{2+} > \text{Fe}^{3+} > \text{Sc}^{3+} > \text{Al}^{3+}$
C:	$\text{Hg}_2^{2+} > \text{Fe}^{3+} > \text{Al}^{3+} > \text{Sc}^{3+}$
D:	$\text{Sc}^{3+} > \text{Al}^{3+} > \text{Fe}^{3+} > \text{Hg}_2^{2+}$

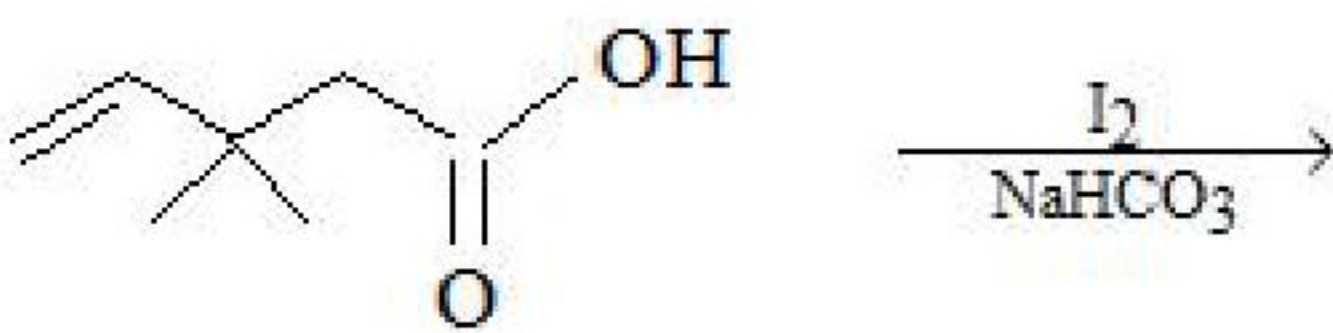
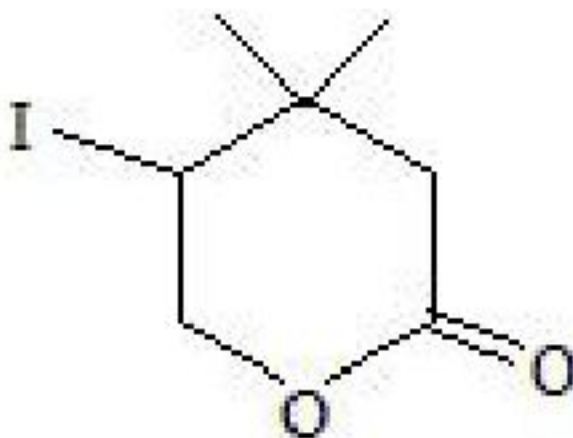
Topic:	Chemistry-Section A
Item No:	40
Question ID:	154771545640
Question Type:	MCQ
Question:	In low and high spin octahedral Co^{3+} complexes the number of electrons in t_{2g} level respectively will be . (given At. no. of Co, 27)
A:	6 and 3
B:	6 and 4
C:	3 and 4
D:	4 and 6

Topic:	Chemistry-Section A
Item No:	41
Question ID:	154771545641
Question Type:	MCQ
Question:	Which of the following is not a component of photochemical smog?
A:	Ozone
B:	Peroxyacetyl nitrate
C:	Nitric oxide

D:	Sulphur dioxide
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Topic:	Chemistry-Section A
Item No:	42
Question ID:	154771545642
Question Type:	MCQ
Question:	Glycerol can be separated from spent-lye on industrial scale by using
A:	TLC technique
B:	Distillation under reduced pressure
C:	Differential Extraction
D:	Crystallization

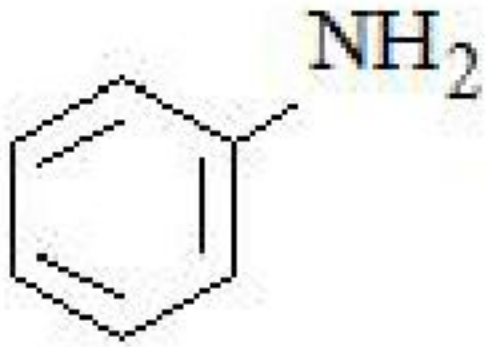
Topic:	Chemistry-Section A
Item No:	43
Question ID:	154771545643
Question Type:	MCQ
Question:	Which of the following is unstable?
A:	
B:	
C:	
D:	

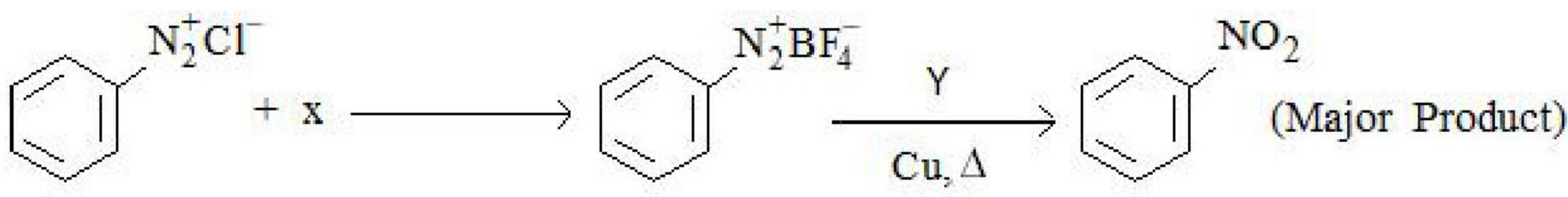
Topic:	Chemistry-Section A
Item No:	44
Question ID:	154771545644
Question Type:	MCQ
Question:	Major product of the following reaction is 
A:	

B:	
C:	
D:	

Topic:	Chemistry-Section A
Item No:	45
Question ID:	154771545645
Question Type:	MCQ
Question:	For the above conversion, the correct sequential addition of reagents is-
A:	(i) Mg (ii) CO ₂ , dry ether (iii) H ₂ O
B:	(i) NaOH (ii) C ₂ H ₅ OH (iii) HCl
C:	(i) NaCN (ii) H ₂ O (iii) HCl
D:	(i) KMnO ₄ (ii) HCl

Topic:	Chemistry-Section A
Item No:	46
Question ID:	154771545646
Question Type:	MCQ
Question:	Which one of the following compounds can be prepared in good yield by Hoffmann bromamide degradation reaction?
A:	
B:	
C:	

D:	
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Topic:	Chemistry-Section A
Item No:	47
Question ID:	154771545647
Question Type:	MCQ
Question:	 Consider the given chemical reaction, identify X and Y
A:	X = BF ₃ Y = HNO ₃
B:	X = HBF ₄ Y = NaNO ₂
C:	X = HBF ₄ Y = HNO ₃
D:	X = BF ₃ Y = NaNO ₂

Topic:	Chemistry-Section A
Item No:	48
Question ID:	154771545648
Question Type:	MCQ
Question:	Given below are two statements: Statement I: In Nylon 6, the monomer unit is caprolactam. Statement II: The monomer unit in Nylon 6 is synthesized from cyclohexanone. 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

Topic:	Chemistry-Section A
Item No:	49
Question ID:	154771545649
Question Type:	MCQ

Question:	Given below are two statements: Statement I: Glycogen is highly branched polysaccharide and commonly known as animal starch due to its similarity with amylopectin. Statement II: Amylose is water insoluble and constitutes about 15-20% of starch. 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

Topic:	Chemistry-Section A
Item No:	50
Question ID:	154771545650
Question Type:	MCQ
Question:	In the ring test of NO_3^- ion what is the oxidation number of iron in the complex (brown ring) $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$?
A:	+2
B:	+1
C:	+3
D:	+5

Topic:	Chemistry-Section B
Item No:	51
Question ID:	154771545651
Question Type:	Numeric Answer
Question:	The density of 4 molal solution of NaOH is 1.160 g mL^{-1} . The molarity of the solution is _____ M. (Given : Molar mass of NaOH = 40 g mol^{-1}) (nearest integer)

Topic:	Chemistry-Section B
Item No:	52
Question ID:	154771545652
Question Type:	Numeric Answer
Question:	On the basis of MO. theory, the number of molecules from the following which have bond order two, is _____. $\text{O}_2, \text{O}_2^+, \text{N}_2^{2-}, \text{C}_2, \text{B}_2$

Topic:	Chemistry-Section B
Item No:	53
Question ID:	154771545653
Question Type:	Numeric Answer
Question:	31 g of ethylene glycol is mixed with 500 g of water. The freezing point of the aqueous solution is _____ K. (in nearest integer) (K_f of water = $1.86 \text{ K kg mol}^{-1}$) [Molar mass of C, H, O are 12, 1, 16 gmol^{-1}]

Topic:	Chemistry-Section B
Item No:	54
Question ID:	154771545654
Question Type:	Numeric Answer
Question:	50 mL of 0.1 M CH_3COOH is titrated against 0.1 M NaOH solution. When 10 mL of NaOH is added, the pH of the solution becomes _____ $\times 10^{-1}$. (nearest integer) Given: $\text{pK}_a(\text{CH}_3\text{COOH}) = 4.8$, $\log 2 = 0.3$

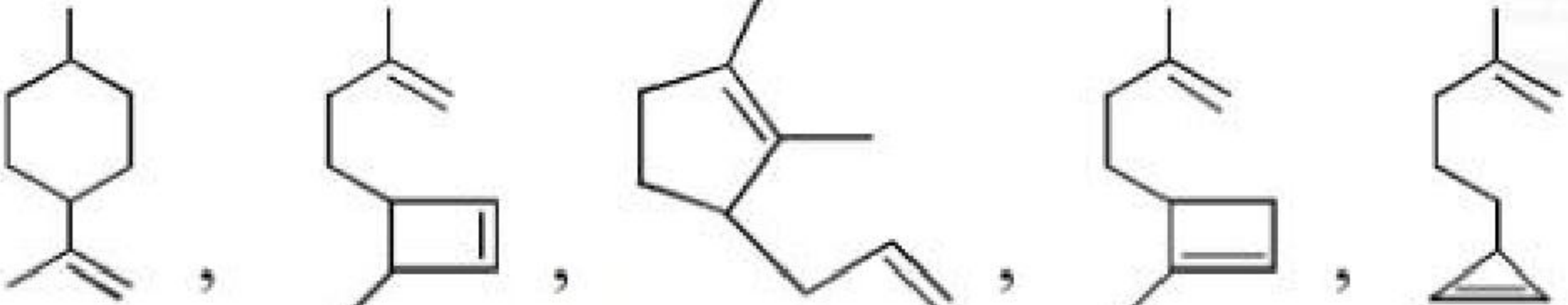
Topic:	Chemistry-Section B
Item No:	55
Question ID:	154771545655
Question Type:	Numeric Answer
Question:	For the given cell $\text{Zn(s)} \mid \text{Zn}^{2+}(\text{C}_1, \text{M}) \parallel \text{Zn}^{2+}(\text{C}_2, \text{M}) \mid \text{Zn(s)}$ the change in Gibbs energy (ΔG) will be zero when $\frac{\text{C}_1}{\text{C}_2}$ is equal to _____.

Topic:	Chemistry-Section B								
Item No:	56								
Question ID:	154771545656								
Question Type:	Numeric Answer								
Question:	$X \rightarrow Y + Z$								
	X decomposes at 700 K to give Y and Z. The results of two measurements are :								
	<table><tr><td>Initial concentration of X / (mol/L)</td><td>6.0</td><td>12.0</td></tr><tr><td>Half life / s</td><td>1.0</td><td>2.0</td></tr></table>			Initial concentration of X / (mol/L)	6.0	12.0	Half life / s	1.0	2.0
	Initial concentration of X / (mol/L)	6.0	12.0						
Half life / s	1.0	2.0							
The rate constant for the reaction is _____ (in appropriate unit)									

Topic:	Chemistry-Section B
Item No:	57
Question ID:	154771545657
Question Type:	Numeric Answer
Question:	Consider the molecules / ions given below XeO_3, BF_4^-, I_3^-, SF_6, PCl_5 The ratio of number of molecules having sp^3d hybridisation to those having sp^3 hybridisation is _____

Topic:	Chemistry-Section B
Item No:	58
Question ID:	154771545658
Question Type:	Numeric Answer
Question:	The number of coloured and paramagnetic ions from the following in aqueous solution are _____. Ti^{3+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Cu^+, Ti^{4+}, Zn^{2+}, Sc^{3+} Given Atomic no. Sc, 21; Ti, 22; Co, 27; Ni, 28; Cu, 29; Zn, 30

Topic:	Chemistry-Section B
Item No:	59
Question ID:	154771545659
Question Type:	Numeric Answer
Question:	The number of isomeric compounds (structural isomers only) possible with the molecular formula $\text{C}_5\text{H}_{10}\text{O}_2$, which do not react with metallic sodium is _____.

Topic:	Chemistry-Section B
Item No:	60
Question ID:	154771545660
Question Type:	Numeric Answer
Question:	Among the following, how many hydrocarbon (s) with formula $\text{C}_{10}\text{H}_{16}$ which on reaction with acidic potassium permanganate yield(s) same product ? _____ 

Topic:	Mathematics-Section A
Item No:	61
Question ID:	154771545661
Question Type:	MCQ
Question:	Let $f: \mathbb{R} - \{5\} \rightarrow \mathbb{R}$ be defined as $f(x) = \frac{2x^2 + 3x - 2}{x - 5}$. Then f is
A:	one-one and onto
B:	one-one but not onto
C:	onto but not one-one
D:	neither one-one nor onto

Topic:	Mathematics-Section A
Item No:	62
Question ID:	154771545662
Question Type:	MCQ
Question:	Let $z_1 = 1 + 2i, z_2 = 2 + i, \frac{1}{z_1} + \frac{1}{z_2} = \frac{6}{w}$, and $z = \frac{iw}{2 - \bar{w}}$. Consider the statements (S₁) $z = \frac{5}{\sqrt{17}}$ (S₂) $\arg(z) + \arg(w) = \tan^{-1}\left(\frac{5}{3}\right)$. Then
A:	both (S ₁) and (S ₂) are wrong
B:	only (S ₁) is correct
C:	only (S ₂) is correct
D:	both (S ₁) and (S ₂) are correct

Topic:	Mathematics-Section A
Item No:	63
Question ID:	154771545663
Question Type:	MCQ

Question:	If the system of linear equations $\lambda x + y - z = -1$ $x - y - 3z = 2$ $-x + y + z = \mu$ has infinitely many solutions, then the equation of the line passing through the points $(\lambda + 2\mu, 2\lambda + \mu)$ and $(1, \lambda\mu)$ is
A:	$4x - 6y = -5$
B:	$2x - 2y = 5$
C:	$2x - 2y = -1$
D:	$4x + 6y = 5$

Topic:	Mathematics-Section A
Item No:	64
Question ID:	154771545664
Question Type:	MCQ
Question:	Let A be a matrix and $\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} A \begin{bmatrix} 2 & 0 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. If A and A^2 are the roots of the quadratic equation $ax^2 + bx + 3 = 0$, then $a + b - ab$ is equal to
A:	-34
B:	50
C:	-390
D:	438

Topic:	Mathematics-Section A
Item No:	65
Question ID:	154771545665
Question Type:	MCQ
Question:	The sum of all values of n, for which ${}^{n-1}C_4 - {}^{n-1}C_3 - \frac{5}{4} {}^{n-2}P_2 < 0$, is
A:	40
B:	45
C:	55
D:	56

Topic:	Mathematics-Section A
Item No:	66
Question ID:	154771545666

Question Type:	MCQ
Question:	The coefficient of x^{1011} in the expression $(1 + 2x)^{2022} + 2x(1 + 2x)^{2021} + (2x)^2(1 + 2x)^{2020} + \dots + (2x)^{2022}$ is
A:	$^{2022}C_{1011}$
B:	$^{2022}C_{1011} \times (2)^{1011}$
C:	$^{2023}C_{1011} \times (2)^{1011}$
D:	$^{2023}C_{1011}$

Topic:	Mathematics-Section A
Item No:	67
Question ID:	154771545667
Question Type:	MCQ
Question:	For $ \alpha \geq 1$, let $5^{4-2\alpha}$, 63 , $5^{2\alpha-1}$ be in A.P. with the common difference d . Let S_n denote the sum of the first n terms of an A.P., whose first term is α^2 and the common difference is d . If $S_{30} - S_{15} = 30k$, then k is equal to
A:	715
B:	695
C:	684
D:	683

Topic:	Mathematics-Section A
Item No:	68
Question ID:	154771545668
Question Type:	MCQ
Question:	$2 \sum_{n=2}^{\infty} \frac{n(2n^2 + 3)}{(n+1)!}$ is equal to
A:	$2(e + 7)$
B:	$2e + 1$
C:	$2e + 9$
D:	$2(e + 1)$

Topic:	Mathematics-Section A
Item No:	69
Question ID:	154771545669
Question Type:	MCQ

Question:	Let $f(x) = \begin{cases} \frac{\sin(ax + 3x) + \sin x}{x}, & x < 0 \\ 2, & x = 0 \\ \frac{(x + 6bx^2)^{\frac{1}{3}} - x^{\frac{1}{3}}}{3x^{\frac{4}{3}}}, & x > 0 \end{cases}$ be continuous at $x = 0$. If $(1 - k) f\left(\frac{7}{18}\right) = ab$, then k is equal to
A:	-6
B:	15
C:	-13
D:	8

Topic:	Mathematics-Section A
Item No:	70
Question ID:	154771545670
Question Type:	MCQ
Question:	If $y(x) = \tan x - \int_0^{2x} (x^2 - xt + 1) \sin t \, dt$, then at $x = \frac{\pi}{3}$, the value of $2y''' - y''$ is equal to
A:	158
B:	$159 - 4\sqrt{3}$
C:	126
D:	$127 - 4\sqrt{3}$

Topic:	Mathematics-Section A
Item No:	71
Question ID:	154771545671
Question Type:	MCQ
Question:	Let $A_k = \int_{k\pi}^{(k+1)\pi} e^{-x} \sin x \, dx$, $k = 0, 1, 2, \dots, 20$. Then $\sum_{k=0}^{20} A_k$ is equal to
A:	$\left(\frac{e^\pi + 1}{e^\pi - 1}\right)(1 - e^{-20\pi})$

B:	$\frac{1}{2} \left(\frac{e^{\pi} + 1}{e^{\pi} - 1} \right) (1 - e^{-21\pi})$
C:	$\left(\frac{e^{\pi} + 1}{e^{\pi} - 1} \right) (1 - e^{-21\pi})$
D:	$\frac{1}{2} \left(\frac{e^{\pi} + 1}{e^{\pi} - 1} \right) (1 - e^{-20\pi})$

Topic:	Mathematics-Section A
Item No:	72
Question ID:	154771545672
Question Type:	MCQ
Question:	$\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{n(n^2 + k^2)}{(n^4 + n^2k^2 + k^4)}$ is equal to
A:	$\frac{\pi}{\sqrt{3}}$
B:	$\frac{2\pi}{3\sqrt{3}}$
C:	$\frac{\pi}{2\sqrt{3}}$
D:	$\frac{\pi}{3}$

Topic:	Mathematics-Section A
Item No:	73
Question ID:	154771545673
Question Type:	MCQ
Question:	If $y = y(x)$ satisfies the differential equation $x dy + \left(x \tan \left(\frac{y}{x} \right) - y \right) dx = 0, x > 0$, and $y(1) = \frac{\pi}{2}$, then a value of $y(\sqrt{2})$ is
A:	$\frac{\pi}{3\sqrt{2}}$
B:	$\frac{3}{2\sqrt{2}}$
C:	$\frac{1}{2\sqrt{2}}$
D:	$\frac{3\pi}{2\sqrt{2}}$

Topic:	Mathematics-Section A
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Item No:	74
Question ID:	154771545674
Question Type:	MCQ
Question:	Let the area enclosed by the solution curve $y = y(x)$ of the differential equation $\frac{dy}{dx} + \frac{x-2}{y-b} = 2$, $b > 0$, $y(5) = 0$ is 13π . Let $y = y(x)$ intersect the y -axis at the points P and Q . If the tangents to $y = y(x)$ at P and Q meet at T , then the area of ΔPTQ is
A:	13.5
B:	13
C:	14.5
D:	15

Topic:	Mathematics-Section A
Item No:	75
Question ID:	154771545675
Question Type:	MCQ
Question:	If foci of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{12} = 1$ and the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$ coincide, then the eccentricity of the hyperbola, with foci $(0, \pm\sqrt{10})$ passing through the point $(a, a+1)$, is
A:	2
B:	$\sqrt{2}$
C:	$\frac{3}{\sqrt{5}}$
D:	$\sqrt{\frac{5}{2}}$

Topic:	Mathematics-Section A
Item No:	76
Question ID:	154771545676
Question Type:	MCQ
Question:	Let the curves $y^2 = kx$ and $xy = -1$ have a common tangent, whose slope is $\frac{1}{2}$. Then k can NOT lie in the interval
A:	$(2, 4]$
B:	$(-3, -1)$
C:	$[-4, -3)$
D:	$(1, 3)$

Topic:	Mathematics-Section A
Item No:	77
Question ID:	154771545677
Question Type:	MCQ
Question:	Let $ax + by + cz + 3 = 0$ be the plane which bisects the acute angle between the planes $2x - y - 2z + 3 = 0$ and $3x - 2y + 6z + 8 = 0$. Then $a + b + c$ is equal to
A:	-31
B:	28
C:	$\frac{14}{15}$
D:	-28

Topic:	Mathematics-Section A														
Item No:	78														
Question ID:	154771545678														
Question Type:	MCQ														
Question:	If the mean and median of the data <table><tr><td>x</td><td>0 – 10</td><td>10 – 20</td><td>20 – 30</td><td>30 – 40</td><td>40 – 50</td><td></td></tr><tr><td>f</td><td>3</td><td>6</td><td>2</td><td>x</td><td>y</td><td>$\Sigma f = 20$</td></tr></table> are equal, then xy^2 is equal to	x	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50		f	3	6	2	x	y	$\Sigma f = 20$
x	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50										
f	3	6	2	x	y	$\Sigma f = 20$									
A:	54														
B:	80														
C:	100														
D:	108														

Topic:	Mathematics-Section A
Item No:	79
Question ID:	154771545679
Question Type:	MCQ
Question:	The angle of elevation of the top P of a vertical tower for a person standing at a point A on the horizontal ground due north of the tower is 45° . Another person B is standing 50 m west of A on the ground. If the angle of elevation of P at B is 30° then the height (in meters) of the tower is
A:	$25\sqrt{2}$
B:	$50\sqrt{2}$
C:	$25\sqrt{6}$

D:	$\frac{50}{\sqrt{3}-1}$
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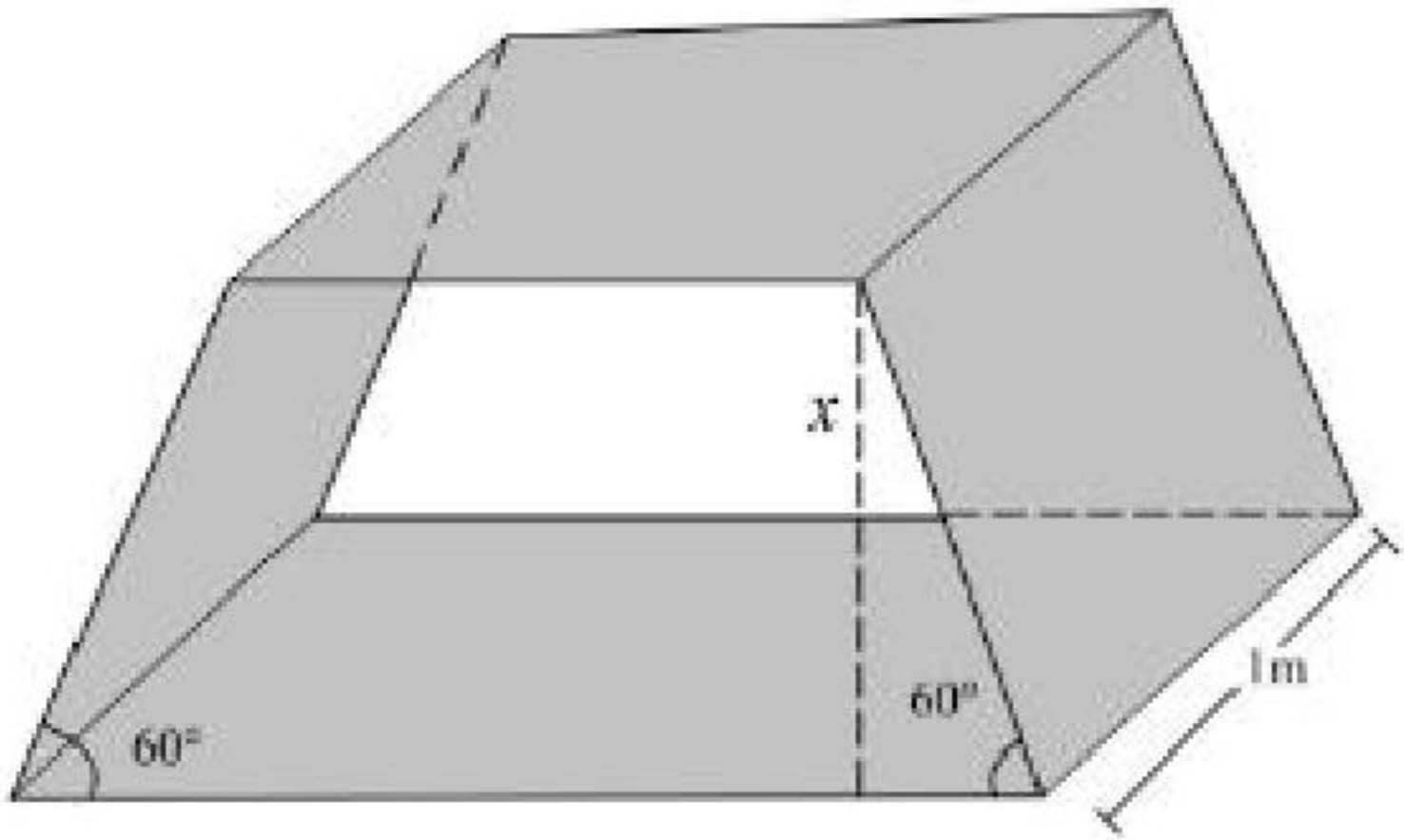
Topic:	Mathematics-Section A
Item No:	80
Question ID:	154771545680
Question Type:	MCQ
Question:	Which of the following is a contradiction?
A:	$((\sim p) \vee q) \Rightarrow \sim (p \Rightarrow q)$
B:	$(\sim (p \Rightarrow q)) \wedge (\sim p)$
C:	$(p \Rightarrow q) \wedge p$
D:	$(\sim p) \wedge (\sim q)$

Topic:	Mathematics-Section B
Item No:	81
Question ID:	154771545681
Question Type:	Numeric Answer
Question:	The number of solutions of the equation $ x^2 + 3x + 2 + x + 5 - 2 = 0$, $x \in \mathbb{R}$, is _____.

Topic:	Mathematics-Section B
Item No:	82
Question ID:	154771545682
Question Type:	Numeric Answer
Question:	If p_1 and p_2 , respectively, are the second largest and the fourth largest prime numbers in the factorization of the coefficient of x^{30} in the expansion of $\left(x^2 + 2 + \frac{1}{x^2}\right)^{-5} (1 + x^2)^{40}$, then $p_1 + p_2$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	83
Question ID:	154771545683
Question Type:	Numeric Answer
Question:	The number of integral values of b for which $2x^3 - 3x^2 - 12x + b = 0$ has three distinct real roots is _____.

Topic:	Mathematics-Section B
Item No:	84
Question ID:	154771545684

Question Type:	Numeric Answer
Question:	An air duct is made of a thick metallic sheet. The duct is open from front and back. Its cross-section is a trapezium of base angles 60° and area 1.5 m^2. Its length is 1 m. (see the figure). If its height $x = x_0$ (in metres) so that the area of the metallic sheet used for its construction is minimum, then $16 (x_0)^4$ is equal to _____. 

Topic:	Mathematics-Section B
Item No:	85
Question ID:	154771545685
Question Type:	Numeric Answer
Question:	If the area enclosed by the curves $y = x^2$, $y^3 = x$, $x = -1$ and $y = x^2$, $y^3 = x$, $x = 1$, above the line $x = 2y$ is $\frac{n}{n+1}$, then n is equal to _____.

Topic:	Mathematics-Section B
Item No:	86
Question ID:	154771545686
Question Type:	Numeric Answer
Question:	Let $A(0, a+2)$, $B(0, a)$, $C(-2, 0)$ and $D(2, 0)$ be four points and the lines AD and BC intersect at $P(x, y)$. If the locus of P is the curve $f(x, y) = 0$ and the tangent at the point $(4, \gamma)$ on this curve is $\frac{x}{\alpha} + \frac{y}{\beta} = 1$, then $\alpha(\beta - \gamma)$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	87
Question ID:	154771545687
Question Type:	Numeric Answer
Question:	Let L_1 be a line in the yz - plane with y and z intercepts $\frac{1}{4}$ and $\frac{1}{C}$ ($C > 0$) respectively. Let L_2 be the line in the xz - plane with x and z intercepts $\frac{1}{3}$ and $-\frac{1}{C}$ respectively. If the shortest distance between L_1 and L_2 is $\frac{1}{5}$, then C^2 is equal to _____.

Topic:	Mathematics-Section B
Item No:	88
Question ID:	154771545688
Question Type:	Numeric Answer
Question:	Let $OABC$ be a parallelogram, O be the origin, $A(2, 4, -5)$ and $C(b, 2, 3)$. If $P(a, a, a)$ and $Q(9 - a^2, 3, a - 1)$, $a \in \mathbb{N}$, are two points such that the projection of $\overrightarrow{OP}$ on $\overrightarrow{OB}$ is 2 and $\overrightarrow{OQ}$ makes acute angles with all three co-ordinate axes, then $ \overrightarrow{OB} ^2 + \overrightarrow{AC} ^2$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	89
Question ID:	154771545689
Question Type:	Numeric Answer
Question:	The probability distribution of a random variable X is $P(X = i) = \frac{1}{2^i}$, $i = 1, 2, 3, \dots$. The variance of X is equal to _____.

Topic:	Mathematics-Section B
Item No:	90
Question ID:	154771545690
Question Type:	Numeric Answer
Question:	Let $S = \left\{ \theta \in [0, 2\pi] - \left\{ \frac{\pi}{2}, \frac{3\pi}{2} \right\} : \sin^{-1}(\sin \theta) + \cos^{-1}(\cos \theta) + \tan^{-1}(\tan \theta) = \frac{4\pi}{5} \right\}$. Then $\frac{30}{\pi} \sum_{\theta \in S} \theta$ is equal to _____.