JEE MAIN

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QUESTION PAPER

2022

JOINT ENTRANCE EXAMINATION - MAIN

PREVIOUS YEAR QUESTION PAPER

Paper:	B.E_B.Tech
Set Name:	SET 22
Exam Date:	28 July 2022
Exam Shift:	2
Langauge:	English

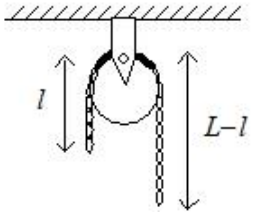
Topic:	Physics-Section A
Item No:	1
Question ID:	**15477154521**
Question Type:	MCQ
Question:	Consider the efficiency of carnot's engine is given by $\eta=\frac{\alpha\beta}{\sin\theta}\log e\frac{\beta x}{kT}$, where α and β are constants. If T is temperature, k is Boltzmann constant , θ is angular displacement and x has the dimensions of length. Then, choose the incorrect option :
A:	Dimensions of β is same as that of force.
B:	Dimensions of $\alpha^{-1}x$ is same as that of energy.
C:	Dimensions of $\eta^{-1}\sin\theta$ is same as that of $\alpha\beta$.
D:	Dimensions of α is same as that of β.

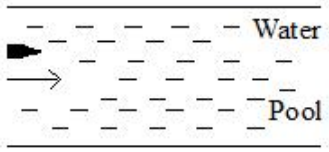
Topic:	Physics-Section A
Item No:	2
Question ID:	**15477154522**
Question Type:	MCQ
Question:	At time t = 0 a particle starts travelling from a height $7\hat{z}$ cm in a plane keeping z coordinate constant. At any instant of time it's position along the $\hat{x}$ and $\hat{y}$ directions are defined as 3t and $5t^3$ respectively. At t = 1s acceleration of the particle will be
A:	$-30\hat{y}$
B:	$30\hat{y}$
C:	$3\hat{x}+15\hat{y}$
D:	$3\hat{x}+15\hat{y}+7\hat{z}$

Topic:	Physics-Section A
Item No:	3
Question ID:	**15477154523**
Question Type:	MCQ

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Question:	A pressure-pump has a horizontal tube of cross sectional area 10 cm^2 for the outflow of water at a speed of 20 m/s. The force exerted on the vertical wall just in front of the tube which stops water horizontally flowing out of the tube, is : [given: density of water = 1000 kg/m^3]
A:	300 N
B:	500 N
C:	250 N
D:	400 N

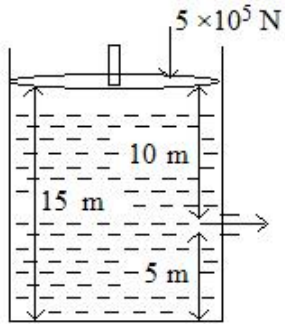
Topic:	Physics-Section A
Item No:	4
Question ID:	**15477154524**
Question Type:	MCQ
Question:	A uniform metal chain of mass m and length 'L' passes over a massless and frictionless pulley. It is released from rest with a part of its length 'l' is hanging on one side and rest of its length 'L - l' is hanging on the other side of the pully. At a certain point of time, when $l = \frac{L}{x}$, the acceleration of the chain is $\frac{g}{2}$. The value of x is _____. 
A:	6
B:	2
C:	1.5
D:	4

Topic:	Physics-Section A
Item No:	5
Question ID:	**15477154525**
Question Type:	MCQ
Question:	A bullet of mass 200 g having initial kinetic energy 90 J is shot inside a long swimming pool as shown in the figure. If it's kinetic energy reduces to 40 J within 1 s, the minimum length of the pool, the bullet has to travel so that it completely comes to rest is 

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A:	45 m
B:	90 m
C:	125 m
D:	25 m

Topic:	Physics-Section A
Item No:	6
Question ID:	**15477154526**
Question Type:	MCQ
Question:	Assume there are two identical simple pendulum clocks. Clock - 1 is placed on the earth and Clock - 2 is placed on a space station located at a height h above the earth surface. Clock - 1 and Clock - 2 operate at time periods 4 s and 6 s respectively. Then the value of h is - (consider radius of earth R_E = 6400 km and g on earth 10 m/s^2)
A:	1200 km
B:	1600 km
C:	3200 km
D:	4800 km

Topic:	Physics-Section A
Item No:	7
Question ID:	**15477154527**
Question Type:	MCQ
Question:	Consider a cylindrical tank of radius 1m is filled with water. The top surface of water is at 15 m from the bottom of the cylinder. There is a hole on the wall of cylinder at a height of 5 m from the bottom. A force of 5×10^5 N is applied an the top surface of water using a piston. The speed of ifflux from the hole will be : (given atmospheric pressure $P_A = 1.01 \times 10^5$ Pa , density of water $\rho_w = 1000$ kg/m^3 and gravitational acceleration g = 10 m/s^2) 
A:	11.6 m/s
B:	10.8 m/s
C:	17.8 m/s

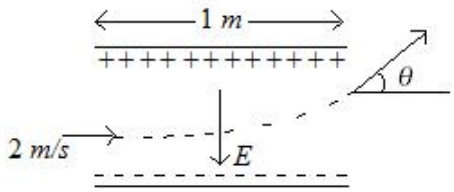
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D:	14.4 m/s

Topic:	Physics-Section A
Item No:	8
Question ID:	**15477154528**
Question Type:	MCQ
Question:	A vessel contains 14 g of nitrogen gas at a temperature of 27°C. The amount of heat to be transferred to the gas to double the r.m.s speed of its molecules will be : Take R = 8.32 J mol^{-1} k^{-1}.
A:	2229 J
B:	5616 J
C:	9360 J
D:	13,104 J

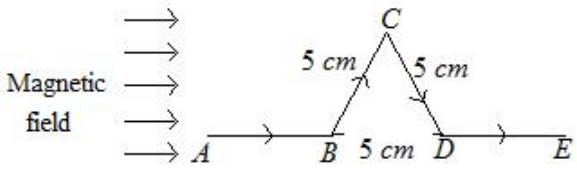
Topic:	Physics-Section A
Item No:	9
Question ID:	**15477154529**
Question Type:	MCQ
Question:	A slab of dielectric constant K has the same cross-sectional area as the plates of a parallel plate capacitor and thickness $\frac{3}{4}$ d, where d is the separation of the plates. The capacitance of the capacitor when the slab is inserted between the plates will be : (Given C_o = capacitance of capacitor with air as medium between plates.)
A:	$\frac{4KC_0}{3+K}$
B:	$\frac{3KC_0}{3+K}$
C:	$\frac{3+K}{4KC_0}$
D:	$\frac{K}{4+K}$

Topic:	Physics-Section A
Item No:	10
Question ID:	**154771545210**
Question Type:	MCQ

Question:	A uniform electric field E = (8m/e) V/m is created between two parallel plates of length 1 m as shown in figure, (where m = mass of electron and e = charge of electron). An electron enters the field symmetrically between the plates with a speed of 2 m/s. The angle of the deviation (θ) of the path of the electron as it comes out of the field will be _____. 
A:	$\tan^{-1}(4)$
B:	$\tan^{-1}(2)$
C:	$\tan^{-1}\left(\frac{1}{3}\right)$
D:	$\tan^{-1}(3)$

Topic:	Physics-Section A
Item No:	11
Question ID:	**154771545211**
Question Type:	MCQ
Question:	Given below are two statements : **Statement I** : A uniform wire of resistance 80 Ω is cut into four equal parts. These parts are now connected in parallel. The equivalent resistance of the combination will be 5 Ω. **Statement II**: Two resistances 2R and 3R are connected in parallel in a electric circuit.The value of thermal energy developed in 3R and 2R will be in the ratio 3:2. In the light of the above statements, choose the ***most appropriate*** answer from the option 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:	Physics-Section A
Item No:	12

Question ID:	**154771545212**
Question Type:	MCQ
Question:	A triangular shaped wire carrying 10 A current is placed in a uniform magnetic field of 0.5 T, as shown in figure. The magnetic force on segment CD is (Given BC = CD = BD = 5 cm.) 
A:	0.126 N
B:	0.312 N
C:	0.216 N
D:	0.245 N

Topic:	Physics-Section A
Item No:	13
Question ID:	**154771545213**
Question Type:	MCQ
Question:	The magnetic field at the center of current carrying circular loop is B_1. The magnetic field at a distance of $\sqrt{3}$ times radius of the given circular loop from the center on its axis is B_2. The value of B_1/B_2 will be
A:	9 : 4
B:	12 : $\sqrt{5}$
C:	8 : 1
D:	5 : $\sqrt{3}$

Topic:	Physics-Section A
Item No:	14
Question ID:	**154771545214**
Question Type:	MCQ
Question:	A transformer operating at primary voltage 8 kV and secondary voltage 160 V serves a load of 80 kW. Assuming the transformer to be ideal with purely resistive load and working on unity power factor, the loads in the primary and secondary circuit would be
A:	800 Ω and 1.06 Ω
B:	10 Ω and 500 Ω
C:	800 Ω and 0.32 Ω
D:	1.06 Ω and 500 Ω

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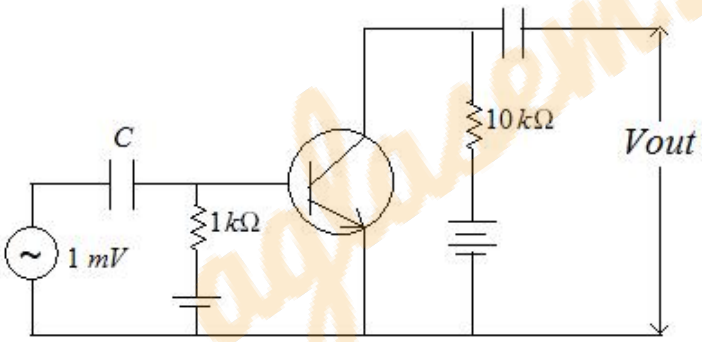
Topic:	Physics-Section A
Item No:	15
Question ID:	**154771545215**
Question Type:	MCQ
Question:	Sun light falls normally on a surface of area 36 cm^2 and exerts an average force of 7.2×10^{-9} N within a time period of 20 minutes. Considering a case of complete absorption, the energy flux of incident light is
A:	25.92×10^2 W/cm^2
B:	8.64×10^{-6} W/cm^2
C:	6.0 W/cm^2
D:	0.06 W/cm^2

Topic:	Physics-Section A
Item No:	16
Question ID:	**154771545216**
Question Type:	MCQ
Question:	The power of a lens (biconvex) is 1.25 m^{-1} in particular medium. Refractive index of the lens is 1.5 and radii of curvature are 20 cm and 40 cm respectively. The refractive index of surrounding medium:
A:	1.0
B:	$\frac{9}{7}$
C:	$\frac{3}{2}$
D:	$\frac{4}{3}$

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Topic:	Physics-Section A
Item No:	17
Question ID:	**154771545217**
Question Type:	MCQ
Question:	Two streams of photons, possessing energies equal to five and ten times the work function of metal are incident on the metal surface successively. The ratio of maximum velocities of the photoelectron emitted, in the two cases respectively, will be
A:	1 : 2
B:	1 : 3
C:	2 : 3
D:	3 : 2

Topic:	Physics-Section A
Item No:	18
Question ID:	**154771545218**
Question Type:	MCQ
Question:	A radioactive sample decays $\frac{7}{8}$ times its original quantity in 15 minutes. The half-life of the sample is
A:	5 min
B:	7.5 min
C:	15 min
D:	30 min

Topic:	Physics-Section A
Item No:	19
Question ID:	**154771545219**
Question Type:	MCQ
Question:	An n.p.n transistor with current gain $\beta = 100$ in common emitter configuration is shown in figure. The output voltage of the amplifier will be 
A:	0.1 V
B:	1.0 V
C:	10 V
D:	100 V

Topic:	Physics-Section A
Item No:	20
Question ID:	**154771545220**
Question Type:	MCQ
Question:	A FM Broad cast transmitter, using modulating signal of frequency 20 kHz has a deviation ratio of 10. The Bandwidth required for transmission is:
A:	220 kHz

B:	180 kHz
C:	360 kHz
D:	440 kHz

Topic:	Physics-Section B
Item No:	21
Question ID:	**154771545221**
Question Type:	Numeric Answer
Question:	A ball is thrown vertically upwards with a velocity of 19.6 ms^{-1} from the top of a tower. The ball strikes the ground after 6 s. The height from the ground up to which the ball can rise will be $\left(\frac{k}{5}\right)$ m.The value of k is _____ (use g = 9.8 m/s^2)

Topic:	Physics-Section B
Item No:	22
Question ID:	**154771545222**
Question Type:	Numeric Answer
Question:	The distance of centre of mass from end A of a one dimensional rod (AB) having mass density $\vartheta = \vartheta_0\left(1-\frac{x^2}{L^2}\right)$ kg/m and length L (in meter) is $\frac{3L}{\alpha}$ m. The value of α is _____. (where x is the distance from end A)

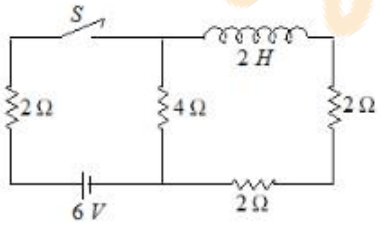
Topic:	Physics-Section B
Item No:	23
Question ID:	**154771545223**
Question Type:	Numeric Answer
Question:	A string of area of cross-section 4 mm^2 and length 0.5 m is connected with a rigid body of mass 2 kg. The body is rotated in a vertical circular path of radius 0.5 m. The body acquires a speed of 5 m/s at the bottom of the circular path. Strain produced in the string when the body is at the bottom of the circle is _____ $\times 10^{-5}$. (use young's modulus 10^{11} N/m^2 and g = 10 m/s^2)

Topic:	Physics-Section B
Item No:	24
Question ID:	**154771545224**
Question Type:	Numeric Answer

Question:	At a certain temperature, the degrees of freedom per molecule for gas is 8. The gas performs 150 J of work when it expands under constant pressure. The amount of heat absorbed by the gas will be _____ J.

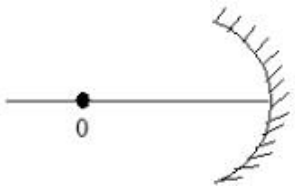
Topic:	Physics-Section B
Item No:	25
Question ID:	**154771545225**
Question Type:	Numeric Answer
Question:	The potential energy of a particle of mass 4 kg in motion along the x-axis is given by $U = 4(1 - \cos 4x)$ J. The time period of the particle for small oscillation $(\sin\theta \simeq \theta)$ is $\left(\frac{\pi}{K}\right)$ s. The value of K is _____.

Topic:	Physics-Section B
Item No:	26
Question ID:	**154771545226**
Question Type:	Numeric Answer
Question:	An electrical bulb rated 220 V, 100 W, is connected in series with another bulb rated 220 V, 60 W. If the voltage across combination is 220 V, the power consumed by the 100 W bulb will be about _____W.

Topic:	Physics-Section B
Item No:	27
Question ID:	**154771545227**
Question Type:	Numeric Answer
Question:	For the given circuit the current through battery of 6 V just after closing the switch 'S' will be _____ A. 

Topic:	Physics-Section B
Item No:	28
Question ID:	**154771545228**
Question Type:	Numeric Answer

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Question:	An object 'o' is placed at a distance of 100 cm in front of a concave mirror of radius of curvature 200 cm as shown in the figure. The object starts moving towards the mirror at a speed 2 cm/s. The position of the image from the mirror after 10 s will be at _____ cm. 

Topic:	Physics-Section B
Item No:	29
Question ID:	**154771545229**
Question Type:	Numeric Answer
Question:	In an experiment with a convex lens, The plot of the image distance (v') against the object distance (μ') measured from the focus gives a curve $v'\ \mu'=225$. If all the distances are measured in cm. The magnitude of the focal length of the lens is _____ cm.

Topic:	Physics-Section B
Item No:	30
Question ID:	**154771545230**
Question Type:	Numeric Answer
Question:	In an experiment to find acceleration due to gravity (g) using simple pendulum, time period of 0.5 s is measured from time of 100 oscillation with a watch of 1 s resolution. If measured value of length is 10 cm known to 1 mm accuracy, The accuracy in the determination of g is found to be x %. The value of x is _____.

Topic:	Chemistry-Section A
Item No:	31
Question ID:	**154771545231**
Question Type:	MCQ
Question:	Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R** **Assertion A :** Zero orbital overlap is an out of phase overlap. **Reason R :** It results due to different orientation / direction of approach of orbitals. In the light of the above statements, choose the ***correct*** answer 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

Topic:	Chemistry-Section A
Item No:	32
Question ID:	**154771545232**
Question Type:	MCQ
Question:	The correct decreasing order for metallic character is
A:	Na > Mg > Be > Si > P
B:	P > Si > Be > Mg > Na
C:	Si > P > Be > Na > Mg
D:	Be > Na > Mg > Si > P

Topic:	Chemistry-Section A
Item No:	33
Question ID:	**154771545233**
Question Type:	MCQ
Question:	Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R** **Assertion A** : The reduction of a metal oxide is easier if the metal formed is in liquid state than solid state. **Reason R** : The value of $\Delta G^{\ominus}$ becomes more on negative side as entropy is higher in liquid state than solid state. In the light of the 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 but 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

Topic:	Chemistry-Section A
Item No:	34
Question ID:	**154771545234**
Question Type:	MCQ
Question:	The products obtained during treatment of hard water using Clark's method are :
A:	$CaCO_3$ and $MgCO_3$

B:	$Ca(OH)_2$ and $Mg(OH)_2$
C:	$CaCO_3$ and $Mg(OH)_2$
D:	$Ca(OH)_2$ and $MgCO_3$

Topic:	Chemistry-Section A
Item No:	35
Question ID:	**154771545235**
Question Type:	MCQ
Question:	**Statement I** : An alloy of lithium and magnesium is used to make aircraft plates. **Statement II** : The magnesium ions are important for cell-membrane integrity. In the light the above statements, choose the ***correct*** answer from the options given below
A:	Both Statement I and Statement II are true
B:	Both Statement I and Statement II are false
C:	Statement I is true but Statement II is false
D:	Statement I is false but Statement II is true

Topic:	Chemistry-Section A
Item No:	36
Question ID:	**154771545236**
Question Type:	MCQ
Question:	White phosphorus reacts with thionyl chloride to give
A:	PCl_5, SO_2 and S_2Cl_2
B:	PCl_3, SO_2 and S_2Cl_2
C:	PCl_3, SO_2 and Cl_2
D:	PCl_5, SO_2 and Cl_2

Topic:	Chemistry-Section A
Item No:	37
Question ID:	**154771545237**
Question Type:	MCQ
Question:	Concentrated HNO_3 reacts with Iodine to give
A:	HI, NO_2 and H_2O
B:	HIO_2, N_2O and H_2O
C:	HIO_3, NO_2 and H_2O
D:	HIO_4, N_2O and H_2O

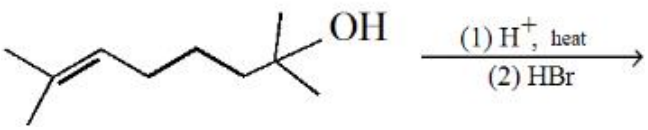
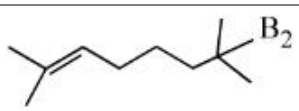
Topic:	Chemistry-Section A
Item No:	38
Question ID:	**154771545238**
Question Type:	MCQ
Question:	Which of the following pair is not isoelectronic species? (At. no. Sm, 62; Er, 68; Yb, 70; Lu, 71; Eu, 63; Tb, 65; Tm, 69)
A:	Sm^{2+} and Er^{3+}
B:	Yb^{2+} and Lu^{3+}
C:	Eu^{2+} and Tb^{4+}
D:	Tb^{2+} and Tm^{4+}

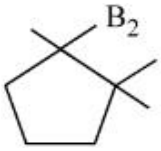
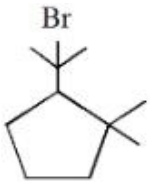
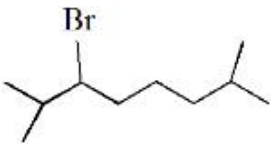
Topic:	Chemistry-Section A
Item No:	39
Question ID:	**154771545239**
Question Type:	MCQ
Question:	Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R** **Assertion A :** Permanganate titrations are not performed in presence of hydrochloric acid. **Reason R :** Chlorine is formed as a consequence of oxidation of hydrochloric acid. In the light of the above statements, choose the ***correct*** answer 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

Topic:	Chemistry-Section A
Item No:	40
Question ID:	**154771545240**
Question Type:	MCQ

Question:	Match **List I** with **List II** **List I (Complex)** / **List II (Hybridization)** A. $Ni(CO)_4$ — I. sp^3 B. $[Ni(CN)_4]^{2-}$ — II. sp^3d^2 C. $[Co(CN)_6]^{3-}$ — III. d^2sp^3 D. $[CoF_6]^{3-}$ — IV. dsp^2 Choose the correct answer from the options given below :
A:	A-IV, B-I, C-III, D-II
B:	A-I, B-IV, C-III, D-II
C:	A-I, B-IV, C-II, D-III
D:	A-IV, B-I, C-II, D-III

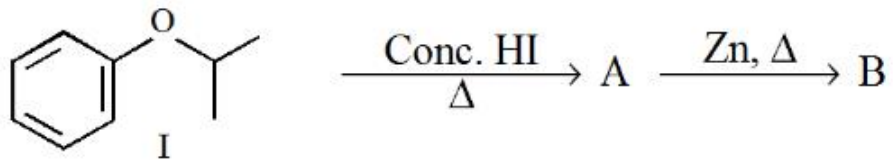
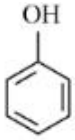
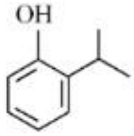
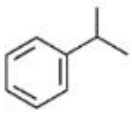
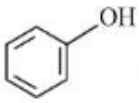
Topic:	Chemistry-Section A
Item No:	41
Question ID:	**154771545241**
Question Type:	MCQ
Question:	Dinitrogen and dioxygen, the main constituents of air do not react with each other in atmosphere to form oxides of nitrogen because
A:	N_2 is unreactive in the condition of atmosphere.
B:	Oxides of nitrogen are unstable.
C:	Reaction between them can occur in the presence of a catalyst.
D:	The reaction is endothermic and require very high temperature.

Topic:	Chemistry-Section A
Item No:	42
Question ID:	**154771545242**
Question Type:	MCQ
Question:	The major product in the given reaction is 
A:	

B:	
C:	
D:	

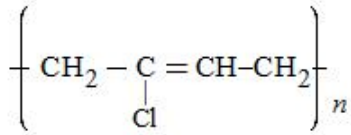
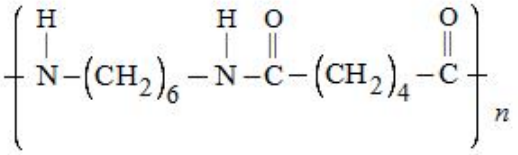
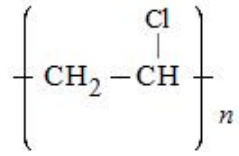
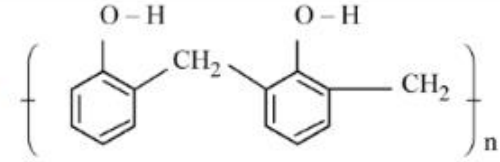
Topic:	Chemistry-Section A
Item No:	43
Question ID:	**154771545243**
Question Type:	MCQ
Question:	Arrange the following in increasing order of reactivity towards nitration A. p-xylene B. bromobenzene C. mesitylene D. nitrobenzene E. benzene Choose the correct answer from the options given below
A:	C < D < E < A < B
B:	D < B < E < A < C
C:	D < C < E < A < B
D:	C < D < E < B < A

Topic:	Chemistry-Section A
Item No:	44
Question ID:	**154771545244**
Question Type:	MCQ

Question:	Compound I is heated with Conc. HI to give a hydroxy compound A which is further heated with Zn dust to give compound B. Identify A and B. 
A:	A =  , B = 
B:	A =  , B = 
C:	A =  , B = 
D:	A =  , B = 

Topic:	Chemistry-Section A
Item No:	45
Question ID:	**154771545245**
Question Type:	MCQ
Question:	Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R** **Assertion A** : Aniline on nitration yields ortho, meta & para nitro derivatives of aniline. **Reason R** : Nitrating mixture is a strong acidic mixture. In the light of the above statements, choose the ***correct*** answer 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

Topic:	Chemistry-Section A
Item No:	46
Question ID:	**154771545246**

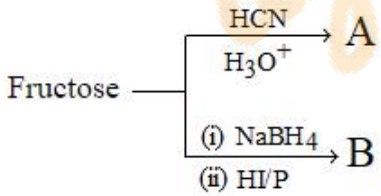
Question Type:	MCQ
Question:	Match **List I** with **List II** **List I (Polymer)** / **List II (Nature)** A.  — I. Thermosetting polymer B.  — II. Fibers C.  — III. Elastomer D.  — IV. Thermoplastic polymer Choose the correct answer from the options given below :
A:	A-II, B-III, C-IV, D-I
B:	A-III, B-II, C-IV, D-I
C:	A-III, B-I, C-IV, D-II
D:	A-I, B-III, C-IV, D-II

Topic:	Chemistry-Section A
Item No:	47
Question ID:	**154771545247**
Question Type:	MCQ
Question:	Two statements in respect of drug-enzyme interaction are given below **Statement I :** Action of an enzyme can be blocked only when an inhibitor blocks the active site of the enzyme. **Statement II :** An inhibitor can form a strong covalent bond with the enzyme. In the light of the above statements, choose the ***correct*** answer from the options given below
A:	Both Statement I and Statement II are true
B:	Both Statement I and Statement II are false
C:	Statement I is true but Statement II is false

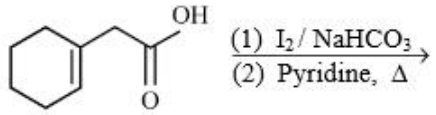
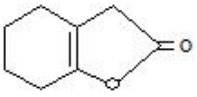
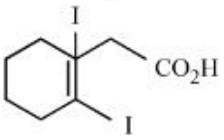
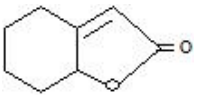
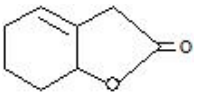
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D:	Statement I is false but Statement II is true

Topic:	Chemistry-Section A
Item No:	48
Question ID:	**154771545248**
Question Type:	MCQ
Question:	Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R** **Assertion A** : Thin layer chromatography is an adsorption chromatography. **Reason R** : A thin layer of silica gel is spread over a glass plate of suitable size in thin layer chromatography which acts as an adsorbent. In the light of the above statements, choose the ***correct*** answer 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

Topic:	Chemistry-Section A
Item No:	49
Question ID:	**154771545249**
Question Type:	MCQ
Question:	The formulas of A and B for the following reaction sequence  are
A:	$A = C_7H_{14}O_8$, $B = C_6H_{14}$
B:	$A = C_7H_{13}O_7$, $B = C_7H_{14}O$
C:	$A = C_7H_{12}O_8$, $B = C_6H_{14}$
D:	$A = C_7H_{14}O_8$, $B = C_6H_{14}O_6$

Topic:	Chemistry-Section A
Item No:	50
Question ID:	**154771545250**

Question Type:	MCQ
Question:	 Find out the major product for the above reaction.
A:	
B:	
C:	
D:	

Topic:	Chemistry-Section B
Item No:	51
Question ID:	**154771545251**
Question Type:	Numeric Answer
Question:	2L of 0.2M H_2SO_4 is reacted with 2L of 0.1M NaOH solution, the molarity of the resulting product Na_2SO_4 in the solution is _____ millimolar. (Nearest integer)

Topic:	Chemistry-Section B
Item No:	52
Question ID:	**154771545252**
Question Type:	Numeric Answer
Question:	Metal M crystallizes into a fcc lattice with the edge length of 4.0×10^{-8} cm. The atomic mass of the metal is _____ g/mol. (Nearest integer) (Use : $N_A = 6.02 \times 10^{23}$ mol^{-1}, density of metal, M = 9.03g cm^{-3})

Topic:	Chemistry-Section B
Item No:	53
Question ID:	**154771545253**
Question Type:	Numeric Answer

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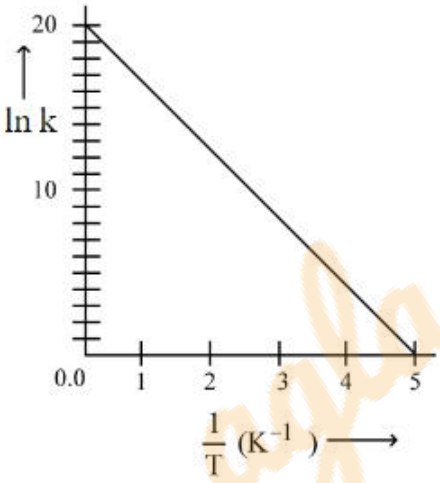
Question:	If the wavelength for an electron emitted from H-atom is 3.3×10^{-10} m, then energy absorbed by the electron in its ground state compared to minimum energy required for its escape from the atom, is _____ times. (Nearest integer) [Given : h = 6.626×10^{-34} J s] Mass of electron = 9.1×10^{-31} kg

Topic:	Chemistry-Section B
Item No:	54
Question ID:	**154771545254**
Question Type:	Numeric Answer
Question:	A gaseous mixture of two substances A and B, under a total pressure of 0.8 atm is in equilibrium with an ideal liquid solution. The mole fraction of substance A is 0.5 in the vapour phase and 0.2 in the liquid phase. The vapour pressure of pure liquid A is _____ atm. (Nearest integer)

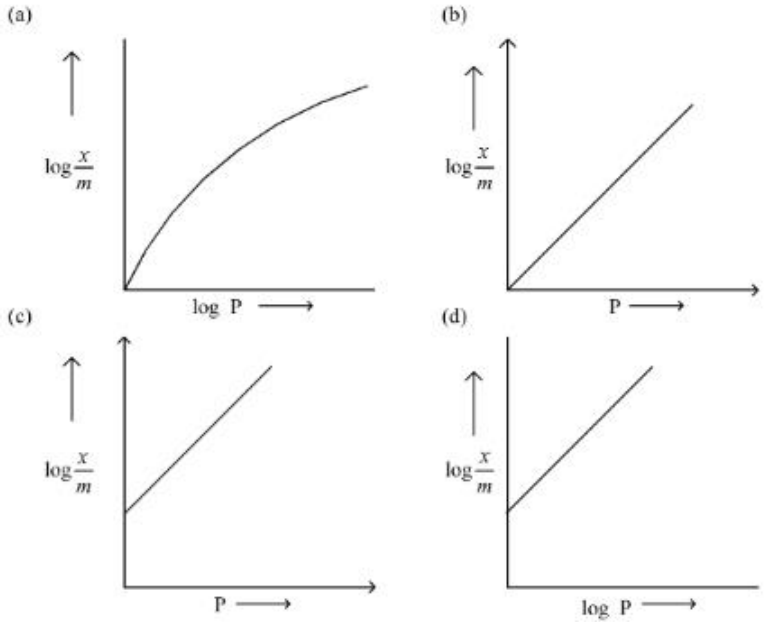
Topic:	Chemistry-Section B
Item No:	55
Question ID:	**154771545255**
Question Type:	Numeric Answer
Question:	At 600K, 2 mol of NO are mixed with 1 mol of O_2. $2NO_{(g)} + O_2(g) \rightleftharpoons 2NO_2(g)$ The reaction occurring as above comes to equilibrium under a total pressure of 1 atm. Analysis of the system shows that 0.6 mol of oxygen are present at equilibrium. The equilibrium constant for the reaction is _____. (Nearest integer)

Topic:	Chemistry-Section B
Item No:	56
Question ID:	**154771545256**
Question Type:	Numeric Answer
Question:	A sample of 0.125g of an organic compound when analyzed by Duma's method yields 22.78 mL of nitrogen gas collected over KOH solution at 280 K and 759 mm Hg. The percentage of nitrogen in the given organic compound is _____. (Nearest integer) Given : (a) The vapour pressure of water of 280 K is 14.2 mm Hg. (b) R = 0.082 L atm K^{-1} mol^{-1}

Topic:	Chemistry-Section B
Item No:	57
Question ID:	**154771545257**
Question Type:	Numeric Answer
Question:	On reaction with stronger oxidizing agent like KIO_4, hydrogen peroxide oxidizes with the evolution of O_2. The oxidation number of I in KIO_4 changes to _____.

Topic:	Chemistry-Section B
Item No:	58
Question ID:	**154771545258**
Question Type:	Numeric Answer
Question:	For a reaction, given below is the graph of ln k vs $\frac{1}{T}$. The activation energy for the reaction is equal to _____ cal mol^{-1}. (nearest integer) (Given : R = 2 cal K^{-1} mol^{-1}) 

Topic:	Chemistry-Section B
Item No:	59
Question ID:	**154771545259**
Question Type:	Numeric Answer

Question:	Among the following the number of curves not in accordance with Freundlich adsorption isotherm is _____. 

Topic:	Chemistry-Section B
Item No:	60
Question ID:	**154771545260**
Question Type:	Numeric Answer
Question:	Among the following the number of state variables is _____. Internal energy (U) Volume (V) Heat (q) Enthalpy (H)

Topic:	Mathematics-Section A
Item No:	61
Question ID:	**154771545261**
Question Type:	MCQ
Question:	Let $S=\left\{x\in[-6,3]-\{-2,2\}:\frac{\lvert x+3\rvert-1}{\lvert x\rvert-2}\geq 0\right\}$ and $T=\left\{x\in\mathbb{Z}:x^2-7\lvert x\rvert+9\leq 0\right\}$. Then the number of elements in S∩T is :
A:	7
B:	5
C:	4
D:	3

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Topic:	Mathematics-Section A
Item No:	62
Question ID:	**154771545262**
Question Type:	MCQ
Question:	Let α, β be the roots of the equation $x^2 - \sqrt{2}x + \sqrt{6} = 0$ and $\frac{1}{\alpha^2}+1$, $\frac{1}{\beta^2}+1$ be the roots of the equation $x^2 + ax + b = 0$. Then the roots of the equation $x^2 - (a + b - 2)x + (a + b + 2) = 0$ are :
A:	non-real complex numbers
B:	real and both negative
C:	real and both positive
D:	real and exactly one of them is positive

Topic:	Mathematics-Section A
Item No:	63
Question ID:	**154771545263**
Question Type:	MCQ
Question:	Let A and B be any two 3×3 symmetric and skew symmetric matrices respectively. Then which of the following is **NOT** true?
A:	$A^4 - B^4$ is a smmetric matrix
B:	AB – BA is a symmetric matrix
C:	$B^5 - A^5$ is a skew-symmetric matrix
D:	AB + BA is a skew-symmetric matrix

Topic:	Mathematics-Section A
Item No:	64
Question ID:	**154771545264**
Question Type:	MCQ
Question:	Let $f(x) = ax^2 + bx + c$ be such that $f(1) = 3$, $f(-2) = \lambda$ and $f(3) = 4$. If $f(0) + f(1) + f(-2) + f(3) = 14$, then λ is equal to :
A:	-4
B:	$\frac{13}{2}$
C:	$\frac{23}{2}$
D:	4

Topic:	Mathematics-Section A

Item No:	65
Question ID:	**154771545265**
Question Type:	MCQ
Question:	The function $f : \mathbb{R} \to \mathbb{R}$ defined by $f(x) = \lim\limits_{n\to\infty} \dfrac{\cos(2\pi x) - x^{2n}\sin(x-1)}{1+x^{2n+1}-x^{2n}}$ is continuous for all x in :
A:	$\mathbb{R} - \{-1\}$
B:	$\mathbb{R} - \{-1, 1\}$
C:	$\mathbb{R} - \{1\}$
D:	$\mathbb{R} - \{0\}$

Topic:	Mathematics-Section A
Item No:	66
Question ID:	**154771545266**
Question Type:	MCQ
Question:	The function $f(x) = xe^{x(1-x)}, x \in \mathbb{R}$, is :
A:	increasing in $\left(-\frac{1}{2}, 1\right)$
B:	decreasing in $\left(\frac{1}{2}, 2\right)$
C:	increasing in $\left(-1, -\frac{1}{2}\right)$
D:	decreasing in $\left(-\frac{1}{2}, \frac{1}{2}\right)$

Topic:	Mathematics-Section A
Item No:	67
Question ID:	**154771545267**
Question Type:	MCQ
Question:	The sum of the absolute maximum and absolute minimum values of the function $f(x) = \tan^{-1}(\sin x - \cos x)$ in the interval $[0, \pi]$ is :
A:	0
B:	$\tan^{-1}\left(\frac{1}{\sqrt{2}}\right) - \frac{\pi}{4}$
C:	$\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$
D:	$\frac{-\pi}{12}$

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Topic:	Mathematics-Section A
Item No:	68
Question ID:	**154771545268**
Question Type:	MCQ
Question:	Let $x(t)=2\sqrt{2}\cos t\sqrt{\sin 2t}$ and $y(t)=2\sqrt{2}\sin t\sqrt{\sin 2t}$, $t\in\left(0,\frac{\pi}{2}\right)$. Then $\frac{1+\left(\frac{dy}{dx}\right)^2}{\frac{d^2y}{dx^2}}$ at $t=\frac{\pi}{4}$ is equal to :
A:	$\frac{-2\sqrt{2}}{3}$
B:	$\frac{2}{3}$
C:	$\frac{1}{3}$
D:	$\frac{-2}{3}$

Topic:	Mathematics-Section A
Item No:	69
Question ID:	**154771545269**
Question Type:	MCQ
Question:	Let $I_n(x)=\int_0^x\frac{1}{\left(t^2+5\right)^n}dt, n=1,2,3,....$ Then :
A:	$50I_6-9I_5=xI_5'$
B:	$50I_6-11I_5=xI_5'$
C:	$50I_6-9I_5=I_5'$
D:	$50I_6-11I_5=I_5'$

Topic:	Mathematics-Section A
Item No:	70
Question ID:	**154771545270**
Question Type:	MCQ
Question:	The area enclosed by the curves $y=\log_e(x+e^2)$, $x=\log_e\left(\frac{2}{y}\right)$ and $x=\log_e 2$, above the line $y=1$ is :
A:	$2+e-\log_e 2$
B:	$1+e-\log_e 2$

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C:	$e - \log_e 2$
D:	$1 + \log_e 2$

Topic:	Mathematics-Section A
Item No:	71
Question ID:	**154771545271**
Question Type:	MCQ
Question:	Let $y = y(x)$ be the solution curve of the differential equation $\frac{dy}{dx} + \frac{1}{x^2-1}y = \left(\frac{x-1}{x+1}\right)^{1/2}$, $x > 1$ passing through the point $\left(2, \sqrt{\frac{1}{3}}\right)$. Then $\sqrt{7}\, y(8)$ is equal to :
A:	$11 + 6\log_e 3$
B:	19
C:	$12 - 2\log_e 3$
D:	$19 - 6\log_e 3$

Topic:	Mathematics-Section A
Item No:	72
Question ID:	**154771545272**
Question Type:	MCQ
Question:	The differential equation of the family of circles passing through the points $(0, 2)$ and $(0, -2)$ is :
A:	$2xy\frac{dy}{dx} + (x^2 - y^2 + 4) = 0$
B:	$2xy\frac{dy}{dx} + (x^2 + y^2 - 4) = 0$
C:	$2xy\frac{dy}{dx} + (y^2 - x^2 + 4) = 0$
D:	$2xy\frac{dy}{dx} - (x^2 - y^2 + 4) = 0$

Topic:	Mathematics-Section A
Item No:	73
Question ID:	**154771545273**
Question Type:	MCQ
Question:	Let the tangents at two points A and B on the circle $x^2 + y^2 - 4x + 3 = 0$ meet at origin O $(0, 0)$. Then the area of the triangle OAB is :
A:	$\frac{3\sqrt{3}}{2}$

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

Topic:	Mathematics-Section A
Item No:	74
Question ID:	**154771545274**
Question Type:	MCQ
Question:	Let the hyperbola $H:\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ pass through the point $\left(2\sqrt{2},-2\sqrt{2}\right)$. A parabola is drawn whose focus is same as the focus of H with positive abscissa and the directrix of the parabola passes through the other focus of H. If the length of the latus rectum of the parabola is e times the length of the latus rectum of H, where e is the eccentricity of H, then which of the following points lies on the parabola ?
A:	$\left(2\sqrt{3}, 3\sqrt{2}\right)$
B:	$\left(3\sqrt{3}, -6\sqrt{2}\right)$
C:	$\left(\sqrt{3}, -\sqrt{6}\right)$
D:	$\left(3\sqrt{6}, 6\sqrt{2}\right)$

Topic:	Mathematics-Section A
Item No:	75
Question ID:	**154771545275**
Question Type:	MCQ
Question:	Let the lines $\frac{x-1}{\lambda}=\frac{y-2}{1}=\frac{z-3}{2}$ and $\frac{x+26}{-2}=\frac{y+18}{3}=\frac{z+28}{\lambda}$ be coplanar and P be the plane containing these two lines. Then which of the following points does **NOT** lie on P?
A:	$(0, -2, -2)$
B:	$(-5, 0, -1)$
C:	$(3, -1, 0)$
D:	$(0, 4, 5)$

Topic:	Mathematics-Section A
Item No:	76
Question ID:	**154771545276**
Question Type:	MCQ

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Question:	A plane P is parallel to two lines whose direction ratios are $-2, 1, -3$ and $-1, 2, -2$ and it contains the point $(2, 2, -2)$. Let P intersect the co-ordinate axes at the points A, B, C making the intercepts α, β, γ. If V is the volume of the tetrahedron OABC, where O is the origin, and $p = \alpha + \beta + \gamma$, then the ordered pair (V, p) is equal to :
A:	$(48, -13)$
B:	$(24, -13)$
C:	$(48, 11)$
D:	$(24, -5)$

Topic:	Mathematics-Section A
Item No:	77
Question ID:	**154771545277**
Question Type:	MCQ
Question:	Let S be the set of all $a \in \mathbb{R}$ for which the angle between the vectors $\vec{u} = a(\log_e b)\hat{i} - 6\hat{j} + 3\hat{k}$ and $\vec{v} = (\log_e b)\hat{i} + 2\hat{j} + 2a(\log_e b)\hat{k}, (b > 1)$ is acute. Then S is equal to :
A:	$\left(-\infty, -\frac{4}{3}\right)$
B:	Φ
C:	$\left(-\frac{4}{3}, 0\right)$
D:	$\left(\frac{12}{7}, \infty\right)$

Topic:	Mathematics-Section A
Item No:	78
Question ID:	**154771545278**
Question Type:	MCQ
Question:	A horizontal park is in the shape of a triangle OAB with AB = 16. A vertical lamp post OP is erected at the point O such that $\angle PAO = \angle PBO = 15^0$ and $\angle PCO = 45^0$, where C is the midpoint of AB. Then $(OP)^2$ is equal to
A:	$\frac{32}{\sqrt{3}}\left(\sqrt{3}-1\right)$
B:	$\frac{32}{\sqrt{3}}\left(2-\sqrt{3}\right)$
C:	$\frac{16}{\sqrt{3}}\left(\sqrt{3}-1\right)$

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D:	$\frac{16}{\sqrt{3}}\left(2-\sqrt{3}\right)$

Topic:	Mathematics-Section A
Item No:	79
Question ID:	**154771545279**
Question Type:	MCQ
Question:	Let A and B be two events such that $P(B\|A)=\frac{2}{5}$, $P(A\|B)=\frac{1}{7}$ and $P(A\cap B)=\frac{1}{9}$. Consider (S1) $P(A'\cup B)=\frac{5}{6}$, (S2) $P(A'\cap B')=\frac{1}{18}$ Then
A:	Both (S1) and (S2) are true
B:	Both (S1) and (S2) are false
C:	Only (S1) is true
D:	Only (S2) is true

Topic:	Mathematics-Section A
Item No:	80
Question ID:	**154771545280**
Question Type:	MCQ
Question:	Let p : Ramesh listens to music. q : Ramesh is out of his village. r : It is Sunday. s : It is Saturday. Then the statement "Ramesh listens to music only if he is in his village and it is Sunday or Saturday" can be expressed as
A:	$((\sim q)\wedge(r\vee s))\Rightarrow p$
B:	$(q\wedge(r\vee s))\Rightarrow p$
C:	$p\Rightarrow(q\wedge(r\vee s))$
D:	$p\Rightarrow((\sim q)\wedge(r\vee s))$

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Topic:	Mathematics-Section B
Item No:	81
Question ID:	**154771545281**
Question Type:	Numeric Answer
Question:	Let the coefficients of the middle terms in the expansion of $\left(\frac{1}{\sqrt{6}}+\beta x\right)^4$, $(1-3\beta x)^2$ and $\left(1-\frac{\beta}{2}x\right)^6$, $\beta>0$, respectively form the first three terms of an A.P. If d is the common difference of this A.P. , then $50-\frac{2d}{\beta^2}$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	82
Question ID:	**154771545282**
Question Type:	Numeric Answer
Question:	A class contains b boys and g girls. If the number of ways of selecting 3 boys and 2 girls from the class is 168, then b + 3 g is equal to _____.

Topic:	Mathematics-Section B
Item No:	83
Question ID:	**154771545283**
Question Type:	Numeric Answer
Question:	Let the tangents at the points P and Q on the ellipse $\frac{x^2}{2}+\frac{y^2}{4}=1$ meet at the point $R(\sqrt{2}, 2\sqrt{2}-2)$. If S is the focus of the ellipse on its negative major axis, then $SP^2 + SQ^2$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	84
Question ID:	**154771545284**
Question Type:	Numeric Answer
Question:	If $1+(2+{}^{49}C_1+{}^{49}C_2+\ldots+{}^{49}C_{49})({}^{50}C_2+{}^{50}C_4+\ldots+{}^{50}C_{50})$ is equal to $2^n \cdot m$, where m is odd, then n + m is equal to _____.

Topic:	Mathematics-Section B
Item No:	85
Question ID:	**154771545285**
Question Type:	Numeric Answer

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Question:	Two tangent lines l_1 and l_2 are drawn from the point (2, 0) to the parabola $2y^2 = -x$. If the lines l_1 and l_2 are also tangent to the circle $(x-5)^2 + y^2 = r$, then 17r is equal to_____.

Topic:	Mathematics-Section B
Item No:	86
Question ID:	**154771545286**
Question Type:	Numeric Answer
Question:	If $\frac{6}{3^{12}} + \frac{10}{3^{11}} + \frac{20}{3^{10}} + \frac{40}{3^9} + ... + \frac{10240}{3} = 2^n \cdot m$, where m is odd, then $m \cdot n$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	87
Question ID:	**154771545287**
Question Type:	Numeric Answer
Question:	Let $S = [-\pi, \frac{\pi}{2}) - \left\{-\frac{\pi}{2}, -\frac{\pi}{4}, -\frac{3\pi}{4}, \frac{\pi}{4}\right\}$. Then the number of elements in the set $A = \left\{\theta \in S : \tan\theta\left(1+\sqrt{5}\tan(2\theta)\right) = \sqrt{5} - \tan(2\theta)\right\}$ is _____.

Topic:	Mathematics-Section B
Item No:	88
Question ID:	**154771545288**
Question Type:	Numeric Answer
Question:	Let $z = a + ib$, $b \neq 0$ be complex numbers satisfying $z^2 = \bar{z} \cdot 2^{1-\lvert z\rvert}$. Then the least value of $n \in \mathbb{N}$, such that $z^n = (z+1)^n$, is equal to _____.

Topic:	Mathematics-Section B
Item No:	89
Question ID:	**154771545289**
Question Type:	Numeric Answer
Question:	A bag contains 4 white and 6 black balls. Three balls are drawn at random from the bag. Let X be the number of white balls, among the drawn balls. If σ^2 is the variance of X, then $100\sigma^2$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	90
Question ID:	**154771545290**

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Question Type:	Numeric Answer
Question:	The value of the integral $\int_0^{\frac{\pi}{2}} 60\frac{\sin(6x)}{\sin x}\,dx$ is equal to _____.

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