FIITJEE

JEE (Main)-2018

ALL INDIA TEST SERIES

PART TEST – I

Time Allotted: 3 Hours **Maximum Marks: 360**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Parts.
3. **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
4. Each part has only one section: **Section-A**.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with black pen for each character of your Enrolment No. and write your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Three Parts.

1. **Section-A (01 – 30, 31 – 60, 61 – 90)** *contains 90 multiple choice questions which have* ***only one correct answer****. Each question carries* ***+4 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

Name of the Candidate	
Enrolment No.	

Useful Data

PHYSICS

Acceleration due to gravity	$g = 10\ m/s^2$
Planck constant	$h = 6.6 \times 10^{-34}$ J-s
Charge of electron	$e = 1.6 \times 10^{-19}$ C
Mass of electron	$m_e = 9.1 \times 10^{-31}$ kg
Permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N\text{-}m^2$
Density of water	$\rho_{water} = 10^3\ kg/m^3$
Atmospheric pressure	$P_a = 10^5\ N/m^2$
Gas constant	$R = 8.314\ J\ K^{-1}\ mol^{-1}$

CHEMISTRY

Gas Constant	R	=	$8.314\ J\ K^{-1}\ mol^{-1}$
		=	0.0821 Lit atm $K^{-1}\ mol^{-1}$
		=	$1.987 \approx 2$ Cal $K^{-1}\ mol^{-1}$
Avogadro's Number	N_a	=	6.023×10^{23}
Planck's constant	h	=	6.625×10^{-34} J·s
		=	6.625×10^{-27} erg·s
1 Faraday		=	96500 coulomb
1 calorie		=	4.2 joule
1 amu		=	1.66×10^{-27} kg
1 eV		=	1.6×10^{-19} J

Atomic No: H=1, He = 2, Li=3, Be=4, B=5, C=6, N=7, O=8, N=9, Na=11, Mg=12, Si=14, Al=13, P=15, S=16, Cl=17, Ar=18, K =19, Ca=20, Cr=24, Mn=25, Fe=26, Co=27, Ni=28, Cu = 29, Zn=30, As=33, Br=35, Ag=47, Sn=50, I=53, Xe=54, Ba=56, Pb=82, U=92.

Atomic masses: H=1, He=4, Li=7, Be=9, B=11, C=12, N=14, O=16, F=19, Na=23, Mg=24, Al = 27, Si=28, P=31, S=32, Cl=35.5, K=39, Ca=40, Cr=52, Mn=55, Fe=56, Co=59, Ni=58.7, Cu=63.5, Zn=65.4, As=75, Br=80, Ag=108, Sn=118.7, I=127, Xe=131, Ba=137, Pb=207, U=238.

Physics

PART – I

SECTION – A
(One Options Correct Type)

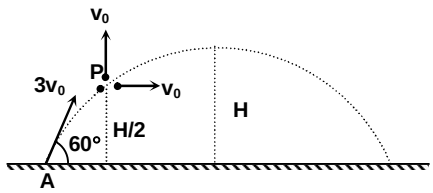
This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

1. A point mass performs straight line motion along positive x-axis. At t = 0 point mass is at point A(x_1, 0). It moves such that its velocity is given by $v = \frac{a}{x}$, where a is positive constant and x is the x-coordinate of position vector of point mass at a certain time t. Find the time required to move from A to B (x_2, 0)

(A) $\frac{x_2^2 - x_1^2}{2a}$ (B) $\frac{x_2^2 - x_1^2}{a}$

(C) $\frac{2x_2^2 - x_1^2}{2a}$ (D) $\frac{2x_2^2 - x_1^2}{a}$

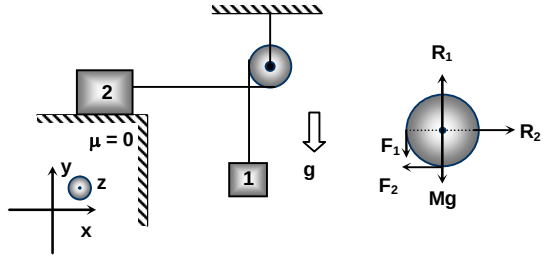
2. A particle of mass 3m is projected from point-A with speed $3v_0$ as shown in figure. When the particle is at point P, it explodes in three identical particles. Choose the INCORRECT statement regarding the physical quantities just before and just after explosion.



(A) The linear momentum of system can be conserved just before and just after explosion.
(B) The centre of mass of the system will trace same path as it will follow without explosion.
(C) The mechanical energy of the system remains conserved just before and just after explosion.
(D) The impulse given by the weight of particle during explosion is negligible as compared to that by the explosive forces.

Space for Rough work

3. The Letters A, B, C and D represent the sign (either + or –, consistent with the co-ordinate system shown in the figure). FBD of the pulley is also shown in the figure. The symbol a_{1y} and a_{2x} represent y and x components of magnitude of acceleration of block-1 and block-2 respectively



For Pulley :

$$\Sigma\vec{\tau}_{CM} = I_{CM}\alpha\hat{k} : [A]\ F_1 r\ +\ [B]\ F_2 r = I_{CM}\alpha_z$$

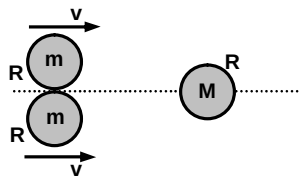
Constraint :

$$a_{1y} = [C]\, a_{2x} = [D]\ \alpha_z r$$

Choose correct option.

	A	B	C	D
(A)	–	+	–	+
(B)	+	–	–	+
(C)	+	–	–	–
(D)	+	–	+	+

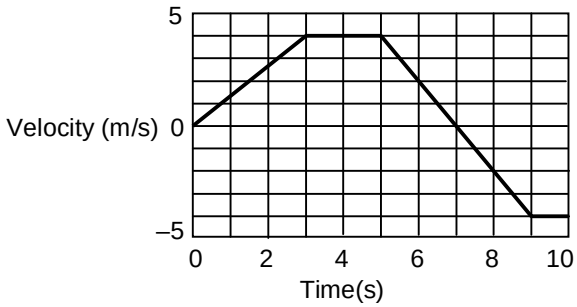
4. Two identical discs of mass m and of radius R touch each other and move with the same velocity perpendicularly to the line segment which joins their centres of mass, along the surface of a horizontal smooth tabletop. There is a third disc of mass M and of radius R at rest, at a point on the perpendicular bisector of the line segment joining the centres of mass of the two moving discs as shown in the figure. The two moving discs collide elastically with the third one, which is at rest. There is no friction between the rims of the discs. What should the ratio of M/m be in order that after the collision the two discs of mass m move perpendicularly to their initial velocity?



(A) 3 (B) 2

(C) $\sqrt{3}$ (D) $\sqrt{2}$

5. An object starts at the origin in a straight line. Its velocity versus time graph is shown in the figure. Which one of the following choices best gives the proper intervals(s) of time for which the object is moving away from the origin?



(A) Only for times 0 s < t < 3s

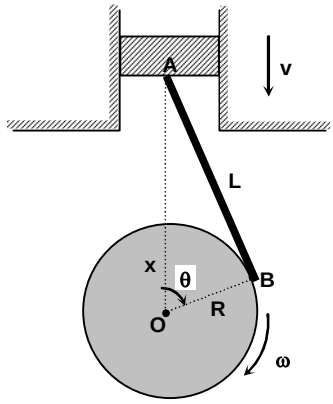
(B) Only for times 0 s < t < 5 s

(C) Only for times 3 s < t < 5s

(D) Only for times 0 s < t < 7 s

Space for Rough work

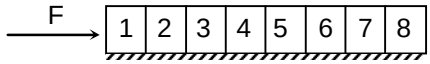
6. Find velocity of piston A in the given situation if angular velocity of wheel of radius R is ω (constant), in the clockwise sense. (O is fixed point)



(A) $\frac{xR\omega\sin\theta}{R\cos\theta + x}$ (B) $\frac{x^2\omega\sin\theta}{R\cos\theta - x}$

(C) $\frac{xR\omega\sin\theta}{R\cos\theta - x}$ (D) $\frac{R^2\omega\sin\theta}{R\cos\theta - x}$

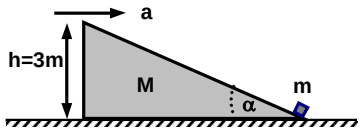
7. Ram pushes eight identical blocks on the horizontal frictionless surface with horizontal force F. The force that block-1 exerts at block-2 has magnitude F_{21} and the force that block-7 exerts on the block-8 is F_{87}. Find $\frac{F_{21}}{F_{87}}$



(A) 3 (B) 5

(C) 7 (D) 9

8. A wedge of mass M= 10kg, height h= 3m and angle of inclination $\alpha = 37^0$ is at rest at horizontal surface. There is a small point –like object (mass m =0.5kg) next to the slope as shown in the figure. At what acceleration must wedge be moved in order that the point like object reaches its top in a time t = 5s (Neglect the friction between point like object and wedge)



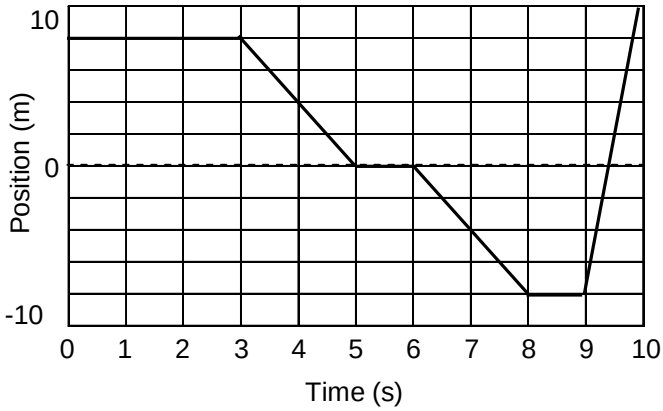
(A) $2m/s^2$ (B) $4m/s^2$

(C) $8m/s^2$ (D) $10\ m/s^2$

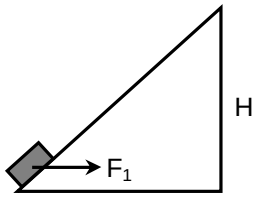
Space for Rough work

9. The position versus time graph of a particle moving along a straight line is shown. What is the total distance travelled by the particle from t = 0 s to t = 10s?

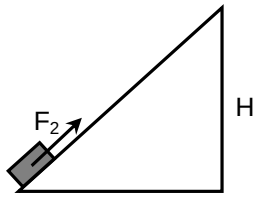
(A) 2m
(B) 18 m
(C) 26m
(D) 34m



10. An object of mass M starts from rest at the bottom of a fixed incline of height H. A person decides to push the object up the incline in one of two ways with an applied force shown in the diagram. In each of the trials, the object reaches the top of the incline with speed V. How would the work done by the person on the block compare for the two trials? Assume the same constant non-zero coefficient of kinetic friction between the incline and the object for both trials.



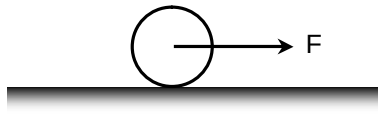
Trial 1
Force parallel to floor



Trial 2
Force parallel to incline

(A) More work would be done in Trial 1
(B) More work would be done in Trial 2
(C) It is impossible to determine for which trial there would be more work done without knowing the value of the speed V.
(D) It is impossible to determine for which trial there would be more work done without knowing the value of the coefficient of kinetic friction.

11. A uniform, solid cylinder having mass M and radius R is pulled by a horizontal force F acting through the center as shown. The cylinder rolls to the right without slipping. What is the magnitude of the force of friction between the cylinder and the ground?

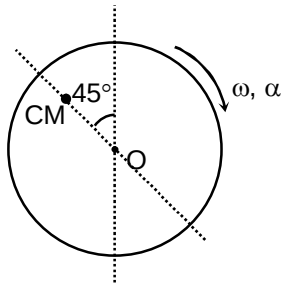


(A) F/4
(B) F/3
(C) F/2
(D) 2F/3

Space for Rough work

12. A particle is moving along straight line such that dot product of its acceleration $\vec{a}$ and velocity $\vec{v}$ is negative. How many times particle can be found at a distance d from the origin?
(A) One (B) Three
(C) Two (D) Can't be determined with given data

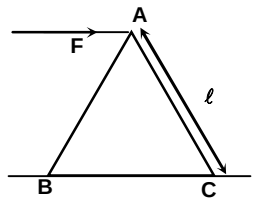
13. A solid sphere of mass m and radius R is rolling without slipping on a rough horizontal surface with angular acceleration α. Centre of mass of sphere lies at a distance $\frac{R}{\sqrt{2}}$ from the centre of sphere. Find the normal force applied by sphere on the surface at an instant when line joining centre of mass of sphere and centre of sphere makes an angle 45° with the vertical and angular velocity of sphere at this instant is ω.



(A) $mg+\frac{mR}{2}\left(\alpha-\omega^2\right)$ (B) $mg-\frac{mR}{2}\left(\alpha+\omega^2\right)$
(C) $mg-\frac{mR}{2}\left(\alpha-\omega^2\right)$ (D) $mg+\frac{mR}{2}\left(\alpha+\omega^2\right)$

14. A block of mass m = 5 kg is being whirled in a horizontal circle with the help of a string of length ℓ = 1m with constant speed v = 5 ms^{-1}. One end of the string is held fixed at a point O above the centre of the horizontal circle. Gravity exists vertically downwards. The force of tension exerted by the string on bob is $\vec{T}$. For this given situation, choose INCORRECT statement:
(A) Total force acting on mass is $m\vec{g}+\vec{T}-\frac{mv^2}{\ell}\hat{T}$
(B) Total force acting on mass is $m\vec{g}+\vec{T}$
(C) Net force on the particle is in the horizontal direction.
(D) Horizontal component of tension provides required centripetal force.

15. A triangular frame consists of three identical rods, each of mass m and length ℓ. It rests upright on a horizontal smooth surface with its lower right corner against a stop about which the frame could pivot. A horizontal force of magnitude F is applied to the upper corner of the frame as shown in the figure. What is the largest value of F may have without causing the frame to pivot upward about the stop?



(A) $\sqrt{3}$ mg (B) 3 mg
(C) $\frac{mg}{\sqrt{3}}$ (D) $\frac{3}{2}$mg

Space for Rough work

16. A massless spring of stiffness 400 N/m is fastened at left end to a vertical wall as shown in the figure I. Initially block C of mass 2 kg and block D of mass 5 kg rest on horizontal surface with block C in contact with spring (But not compressing it.) and the block D in contact with block C. Block C is moved leftward, compressing spring by a distance of 0.5 m and held in place while block D remains at rest as shown in the figure. Now Block C is released and it accelerates to the right towards block D. The surface is rough and the coefficient of friction between each block and surface is 0.1. The block collide instantaneously stick together and move right. Find the velocity of combined system just after collision.

(A) 2 m/s
(B) 3 m/s
(C) 4 m/s
(D) 6 m/s

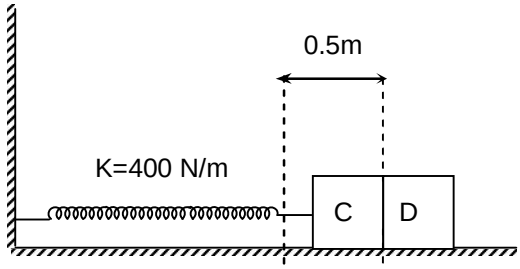


Figure-I

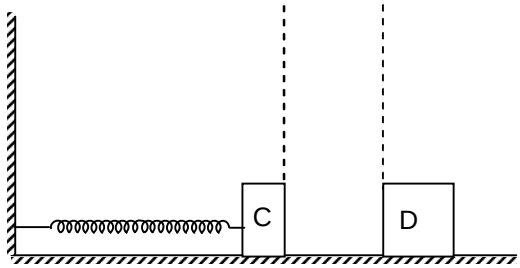
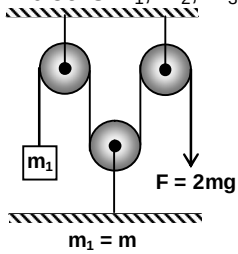
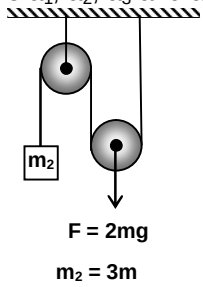
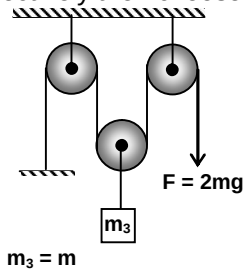


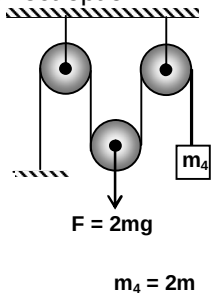
Figure-II

17. All the blocks are attached to an ideal rope which passes over an ideal pulley. If accelerations of blocks m_1, m_2, m_3, and m_4 are a_1, a_2, a_3 and a_4 respectively then choose the correct option.





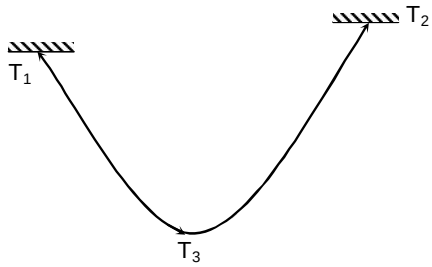




	a_1	a_2	a_3	a_4
(A)	g↑	2g↑	3g↑	g/2↓
(B)	g↑	2g/3↓	3g↑	g/2↓
(C)	2g/3↓	2g↑	3g↑	g↑
(D)	g↓	g/2↓	3g↓	2g/3↓

Space for Rough work

18. A string of mass m (can be non uniform as well) is suspended through two points which are not in same horizontal level. Tension in the string at the end points are T_1 and T_2 and at the lowest point is T_3. Mass of string in terms of T_1, T_2 and T_3 can be represented a {uniform gravity 'g' exists downwards)



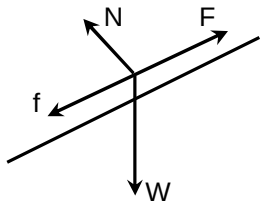
(A) $\frac{\sqrt{T_1^2 - T_3^2} + \sqrt{T_2^2 - T_3^2}}{g}$

(B) $\frac{(T_1 + T_2 - 2T_3)}{g}$

(C) $\frac{\sqrt{T_1^2 + T_2^2}}{g}$

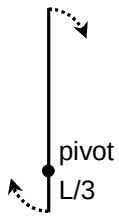
(D) $\frac{\sqrt{T_1^2 + T_3^2} + \sqrt{T_2^2 + T_3^2}}{g}$

19. An object is being pushed at constant speed on an inclined plane. The free body diagram of the object is shown with the gravitational force represented by W, the friction force by f, the applied external push parallel to the incline by F, and the normal force with surface by N. Which one of the following choices represents correct relationships between the forces?



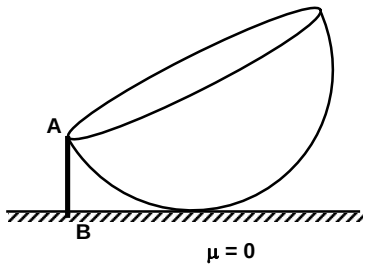
(A) N > W and F < f
(B) N < W and F > f
(C) N < W and F < f
(D) N = W and F > f

20. A uniform rod of mass M and length L is free to rotate about a frictionless pivot located L/3 from one end. The rod is released from rest incrementally away from being perfectly vertical, resulting in the rod rotating clockwise about the pivot. When the rod is horizontal, what is the magnitude of the tangential acceleration of its center of mass?



(A) g/6
(B) g/2
(C) g/4
(D) 2g/3

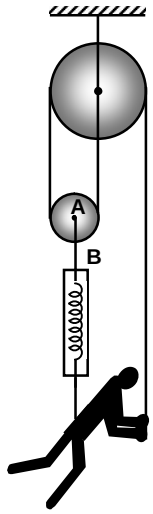
21. A uniform solid hemisphere of radius 10 m and mass 64 kg is placed with its curved surface on the smooth horizontal surface and a string AB of length 4m is attached to point A on its rim as shown in the figure. Find the tension in the string if hemisphere is in equilibrium.



(A) 320 N
(B) 640 N
(C) 180 N
(D) 360 N

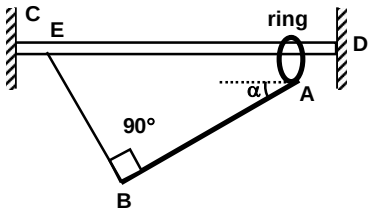
Space for Rough work

22. A man of mass 60 kg hangs himself from a massless spring balance, which itself suspended from an ideal string-pulley system as shown in the figure. The string AB can bear maximum 900 N. Choose correct statement.



(A) The man is never ever able to read his correct weight in the spring balance.
(B) If man is able to manage himself at rest, the spring balance reads his true weight.
(C) The maximum magnitude of acceleration, man can manage is 12.5 m/s^2 while moving upward.
(D) When man moves downward with acceleration 5 m/s^2, the spring balance will read 40 kg.

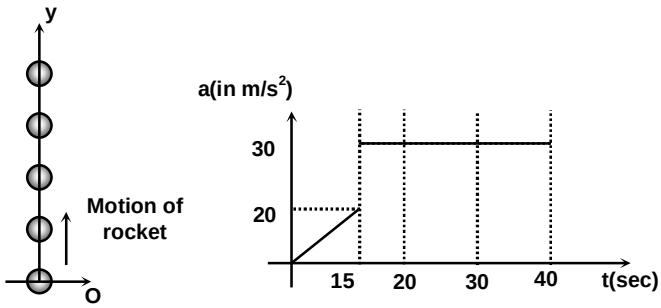
23. One end of a heavy uniform rod AB can slide along rough horizontal guiding surface CD with the help of massless ring as shown in the figure. The dimension of ring is negligible. BE is the ideal string. If $\angle$EBA is right angle and α is the angle between rod AB and horizontal when the rod is on the verge of sliding. Find the coefficient of friction between ring and horizontal guiding surface CD.



(A) $\frac{\tan\alpha}{2+\tan^2\alpha}$ (B) $\frac{\tan\alpha}{1+2\tan^2\alpha}$

(C) $\frac{\tan\alpha}{2-\tan\alpha}$ (D) $\frac{\tan\alpha}{1-\tan^2\alpha}$

24. A two stage rocket is fired vertically upward from rest with acceleration as shown in a-t graphs. After 15 sec, the first stage burns out and second stage ignites. Choose the INCORRECT statement regarding motion of rocket in the time interval $0 \le t \le 40$ s.



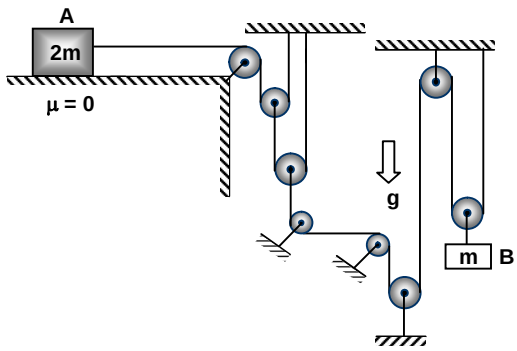
(A) At t = 15 sec, the speed of rocket is 15 0 m/s.
(B) At t = 20 sec, the speed of rocket is 300 m/s.
(C) In time interval t = 0 sec to t = 15 sec, the distance travelled by rocket is 750 m.
(D) In time interval t = 0 sec to t = 20 sec, the distance travelled by rocket is 1500 m.

Space for Rough work

25. A particle whose velocity is given as $\vec{v} = \hat{i} + 6t\hat{j}$ m/s is moving in x-y plane. At t = 0, particle is at origin. Find the radius of curvature of path at point $\left(\frac{\sqrt{2}}{3}\text{m}, \frac{2}{3}\text{m}\right)$

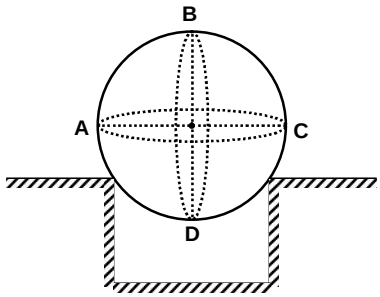
(A) 1.5 m
(B) 3.0 m
(C) 4.5 m
(D) 6.0 m

26. An ideal string-pulley system is shown in the figure and system is released from rest. Choose correct option.



(A) When mass B moves with speed 4 m/s, the speed of mass A is 1 m/s.
(B) When mass B moves with speed 1 m/s, the speed of mass A is 4 m/s.
(C) In the time interval in which the mass A covers distance 8 m, in the same time interval, mass B travels a distance 1 m.
(D) In the time interval in which the mass A covers distance 1 m, in the same time interval, mass B travels a distance 8 m.

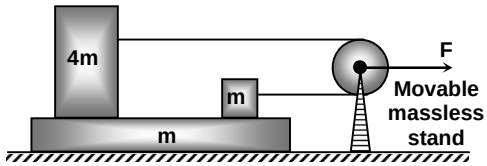
27. A sphere of mass m and radius r rolls without slipping over a tunnel of width $d = \frac{8r}{5}$ as shown in the figure. (in the figure, the sphere rolls perpendicular to the plane of the page). The velocity of centre of mass of sphere is v directed into the plane of the page. The maximum speed of a point on the sphere is



(A) $\frac{4v}{3}$
(B) $\frac{8v}{3}$
(C) $\frac{6v}{3}$
(D) $\frac{3v}{2}$

Space for Rough work

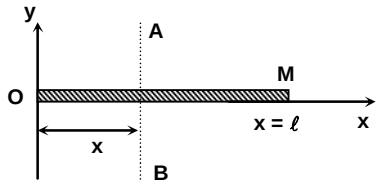
28. In the given figure, a long platform of mass m is placed on frictionless surface. Two blocks of masses 4m and m (where m = 10 kg) are placed on the platform. For both blocks, the coefficient of static friction with platform equal to 0.16 and the coefficient of kinetic friction equal to 0.10. The blocks are connected by



a light ideal string through a light pulley (mounted at a movable massless stand), which is acted upon by an unknown horizontal force F. If the acceleration of the platform is 2 m/s^2, find the value of unknown force F and acceleration of blocks 4m and m on a_1 and a_2 respectively.

	F(N)	**a_1(m/s^2)**	**a_2(m/s^2)**
(A)	180 N	2 m/s^2	8 m/s^2
(B)	180 N	8 m/s^2	2 m/s^2
(C)	90 N	2 m/s^2	8 m/s^2
(D)	90 N	8 m/s^2	2 m/s^2

29. A non uniform rod OM (of length ℓ m) is kept along x-axis and rotating about an axis AB, which is perpendicular to rod as shown in the figure. The rod has linear mass density that varies with the distance x from left end of the rod according to $\lambda = \lambda_0\left(\frac{x^3}{L^3}\right)$



Where unit of λ_0 is kg/m. What is the value of x so that moment of inertia of rod about axis AB (I_{AB}) is minimum?

(A) $\frac{7\ell}{15}$ (B) $\frac{2\ell}{5}$

(C) $\frac{8\ell}{15}$ (D) $\frac{4\ell}{5}$

30. Identical constant forces push two identical cars A and B continuously from a starting line to a finish line. The cars move on a frictionless horizontal surface. If car A is initially at rest and car-B is initially moving right with speed v_0. Choose the correct statement.
(A) Car-A has the larger change in momentum.
(B) Car-B has the larger change in momentum.
(C) Both cars have the same change in momentum.
(D) Not enough information is given to decide.

Space for Rough work

Chemistry

PART – II

SECTION – A
(One Options Correct Type)

This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

31. For a 3s-orbital

$$\psi(3s) = \frac{1}{a\sqrt{3}}\left(\frac{1}{a_0}\right)^{3/2}\left(6 - 6\sigma + \sigma^2\right)\in^{-\sigma/2},$$

Where $\sigma = \frac{2rZ}{3a_o}$

What is the maximum radial distance of node from nucleus?

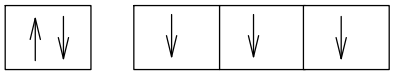
(A) $\frac{\left(3+\sqrt{3}\right)a_o}{Z}$ (B) $\frac{a_o}{Z}$

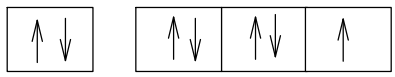
(C) $\frac{3}{2}\frac{\left(3+\sqrt{3}\right)a_o}{Z}$ (D) $\frac{2a_o}{Z}$

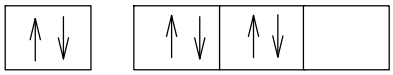
32. Calculate the minimum and maximum number of electrons which may have magnetic quantum number, m = +1 and spin quantum number $s = -\frac{1}{2}$ in chromium(Cr):

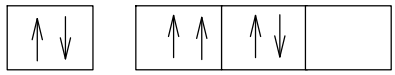
(A) 0, 1 (B) 1, 2
(C) 4, 6 (D) 2, 3

33. The orbital diagram in which both the Pauli's exclusion principle and Hund's rule violated is:

(A) 

(B) 

(C) 

(D) 

Space for Rough work

34. Listed in the table are forward and reverse rate constant for the reaction:

$2NO(g) \rightleftharpoons N_2(g) + O_2(g)$

Temperature (K)	$K_f\left[M^{-1}s^{-1}\right]$	$K_b\left[M^{-1}s^{-1}\right]$
1400	0.29	1.1×10^{-6}
1500	1.3	1.4×10^{-5}

Select the correct statement:

(A) Reaction is exothermic and value of equilibrium constant (K_{eq}) at 1400 K is 3.79×10^{-6}.

(B) Reaction is endothermic and value of equilibrium constant (K_{eq}) at 1400 K is 2.63×10^{5}.

(C) Reaction is exothermic and value of K_{eq} at 1400 K is 2.63×10^{5}.

(D) Reaction is endothermic and value of K_{eq}) at 1500 K is 9.28×10^{4}.

35. For a first order homogeneous gaseous reaction

$A \longrightarrow 2B + C$

If the total pressure after time t was P_t and after long time $(t \to \infty)$ was P_∞ then K in terms of P_t, P_∞ and t is

(A) $K = \dfrac{2.303}{t}\log\left(\dfrac{P_\infty}{P_\infty - P_t}\right)$

(B) $K = \dfrac{2.303}{t}\log\left(\dfrac{2P_\infty}{P_\infty - P_t}\right)$

(C) $K = \dfrac{2.303}{t}\log\left(\dfrac{2P_\infty}{3(P_\infty - P_t)}\right)$

(D) None of these

36. Which of the following is incorrect statement?

(A) Stoichiometry of a reaction tells about the order of the elementary reactions.

(B) For a zero order reaction, rate and the rate constant are identical.

(C) A zero order is controlled by factors other than concentration of reactants.

(D) A zero order reaction is an elementary reaction.

Space for Rough work

37. What will be the effect on the equilibrium constant on increasing temperature, if the reaction neither absorbs heat nor releases heat?
(A) Equilibrium constant will remain constant. (B) Equilibrium constant will decrease
(C) Equilibrium constant will increase. (D) Can not be predicted.

38. The conversion of ozone into oxygen is exothermic under what conditions is ozone is most stable?
$2O_3(g) \rightleftharpoons 3O_2(g)$
(A) At low pressure and low temperature. (B) At high pressure and high temperature.
(C) At high pressure and low temperature. (D) At low pressure and high temperature.

39. Consider the partial decomposition of A as
$2A(g) \rightleftharpoons 2B(g) + C(g)$
At equilibrium 700 ml gaseous mixture contains 100 ml of gas C at 10 atm and 300 K. What is the value of K_P for the reaction?
(A) $\frac{40}{7}$ (B) $\frac{1}{28}$
(C) $\frac{10}{28}$ (D) $\frac{28}{10}$

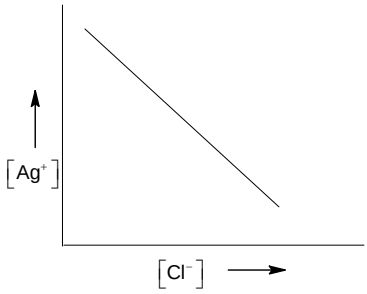
40. The equilibrium constant K_P for the reaction
$N_2O_4(g) \rightleftharpoons 2NO_2(g)$ is 4.5
What would be the average molar mass (in g/mol) of an equilibrium mixture of N_2O_4 and NO_2 formed by the dissociation of pure N_2O_4 at a total pressure of 2 atm?
(A) 69 (B) 57.5
(C) 80.5 (D) 85.5

41. What is the hydronium ion concentration of a 0.25 M HA solution ($K_a = 4 \times 10^{-8}$)
(A) 10^{-4} (B) 10^{-5}
(C) 10^{-7} (D) 10^{-10}

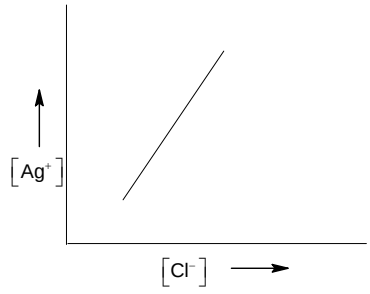
Space for Rough work

42. In a saturated solution of AgCl, NaCl is added gradually. The concentration of Ag^+ is plotted against the concentration of Cl^-, the graph appears as:

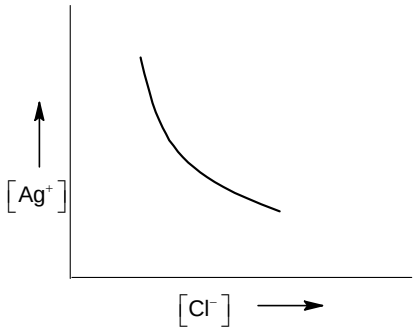
(A)



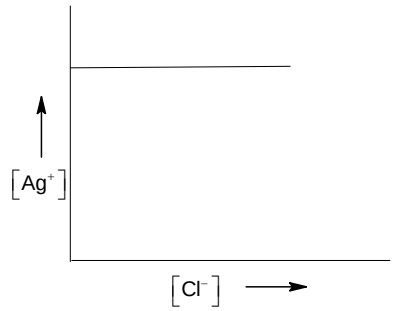
(B)



(C)



(D)



43. A solution is 0.01 M KI and 0.1 M KCl. If solid $AgNO_3$ is added to the solution, what is the $\left[I^-\right]$ when AgCl begins to precipitate?

$\left[K_{SP}(AgI) = 1.5\times10^{-16}; K_{SP}(AgCl) = 1.8\times10^{-10}\right]$

(A) 3.5×10^{-7} (B) 6.1×10^{-8}

(C) 2.2×10^{-7} (D) 8.3×10^{-8}

44. Solubility of AgCl in 0.2 M NaCl is x and that in 0.1 M $AgNO_3$ is y. Then which of the following is correct?

(A) x = y (B) x > y

(C) x < y (D) we cannot predict

45. The incorrect order of bond angle

(A) $CO_2 > CO_3^{2-} > CF_2Cl_2$ (B) $NO_2^+ > NO_3^- > NO_2^-$

(C) $XeF_2 > XeF_4 > XeCl_4$ (D) $PH_3 > AsH_3 > SbH_3$

Space for Rough work

46. All fluorine atoms are in same plane in
(A) CHF_3 (B) ClF_3
(C) $XeOF_4$ (D) All of these

47. Consider a P_y orbital of an atom and identify correct statement.
(A) s-orbital of another atom produce π bond when y is the bond formation axis.
(B) P_y - orbital of another produce σ bond when x is the bond formation axis.
(C) P_z - orbital of another atom produce π bond when x is the bond formation axis.
(D) d_{xy} – orbital of another atom produce π bond when x is the bond formation axis.

48. The set of d-orbitals which do not contain any d-orbital which is involved in hybridization of central atom in ICl_4^-
(A) $d_{z^2}, d_{x^2-y^2}$ (B) $d_{x^2-y^2}, d_{xy}, d_{yz}, d_{zx}$
(C) $d_{z^2}, d_{xy}, d_{yz}, d_{zx}$ (D) d_{xy}, d_{zx}, d_{yz}

49. Select the correct order of hydration energy of ions?
(A) $Li^+ > Na^+ > K^+$ (B) $Li^+ > K^+ > Na^+$
(C) $Cs^+ > Rb^+ > K^+$ (D) $Li^+ > Cs^+ > K^+$

50. Decomposition temperature of $CaCO_3(s)$ is approximately 900^oC. Which of the following decompose below 900^oC?
(A) $BeCO_3$, $MgCO_3$ (B) $SrCO_3$, $BaCO_3$
(C) $BeCO_3$, $BaCO_3$ (D) $MgCO_3$, $SrCO_3$

51. Select the correct order of basic strength?
(A) $KOH > Mg(OH)_2 > Al(OH)_3$ (B) $Al(OH)_3 > Mg(OH)_2 > KOH$
(C) $Mg(OH)_2 > KOH > Al(OH)_3$ (D) $KOH > Al(OH)_3 > Mg(OH)_2$

52. Be and Mg have zero value of electron affinity, because
(A) Be and Mg have $[He]2s^2$ and $[Ne]3s^2$ configuration respectively.
(B) 2s and 3s orbital are filled to their capacity.
(C) Be and Mg are unable to accept electron.
(D) All the above are correct.

Space for Rough work

53. Out of N, O, Ne, Na, Na^+, select the species which have maximum and minimum ionization energy
(A) Na^+, Na
(B) NO, Na
(C) Na^+, O
(D) Ne, N

54. The correct ionic radii order is
(A) $N^{3-} > O^{2-} > F^- > Na^+$
(B) $N^{3-} > Na^+ > O^{2-} > F^-$
(C) $Na^+ > O^{2-} > N^{3-} > F^-$
(D) $O^{2-} > F^- > Na^+ > N^{3-}$

55. Boron compounds behave as Lewis acid because of
(A) Acidic nature
(B) Covalent nature
(C) Ionic nature
(D) Vacant orbital

56. H_3BO_3 is
(A) Mono basic and weak Lewis acid
(B) Mono basic and weak Bronsted acid
(C) Mono basic acid and strong Lewis acid
(D) Tri basic acid and weak Bronsted acid

57. Graphite is a soft solid lubricant extremely difficult to smelt. The reason for this anomalous behaviour is that graphite:
(A) Has molecules of variable molecular masses like polymer
(B) Has carbon atom arranged in large plated of rings of strongly bonded carbon atoms with weak interplate bonds
(C) Is a non-crystalline substance
(D) Is an allotropic form of diamond

58. The reaction is balanced if
$5H_2O_2 + xClO_2 + 2OH^- \longrightarrow xCl^- + yO_2 + 6H_2O$
(A) x = 5, y = 2
(B) x = 2, y = 5
(C) x = 4, y = 10
(D) x = 5, y = 5

59. Consider the following reaction:
$xMnO_4^- + yC_2O_4^{2-} + 2H^+ \longrightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$
The values of x, y, z in the reaction are respectively:
(A) 2, 5 and 16
(B) 5, 2 and 8
(C) 5, 2 and 16
(D) 2, 5 and 8

60. Metal hydrides are ionic, covalent or molecular in nature. Among LiH, NaH, KH, RbH, CsH the correct order of increasing ionic character is
(A) LiH > NaH > CsH > KH > RbH
(B) LiH < NaH < KH < RbH < CsH
(C) RbH > CsH > NaH > KH > LiH
(D) NaH > CsH > RbH > LiH > KH

Space for Rough work

Mathematics

PART – III

SECTION – A
(One Options Correct Type)

This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

61. The solution to the differential equation $\frac{dy}{dx} = \frac{(x+y+1)^2}{xy-y+2x-2}$ is

(A) $e^{2y/x} = cx^4 + cx^3y$ (B) $e^{y/x} = cx^3 + cx^4y$

(C) $e^{\frac{2y+2}{x-1}} = cx^4 + cx^2y$ (D) none of these

62. Let a continuous function f(x) on $R \to R$ be defined such that it satisfies the relation $f(x) + f(x + 2y) + 3xy = 2f(2y - x) + 2y^2 \ \forall \ x, y \in R$. Then which of the following is true

(A) f(x) is an odd function (B) f(x) is one-one

(C) f(x) is into (D) f(x) is invertible

63. $\lim\limits_{n\to\infty}\left[\frac{1\cdot n + 2(n-1) + ... + n\cdot 1}{1^3 + 2^3 + ... + n^3} + 1\right]^n$ is equal to

(A) $\frac{2}{3}$ (B) e^2

(C) $e^{\frac{1}{2}}$ (D) $e^{\frac{2}{3}}$

64. Which of the following statements is NOT true (where [.] denote the greatest integer function and {.} denote fractional part function)

(A) $\{x^2\}$ is continuous as well as differentiable at x = 0

(B) $[x^2]$ is continuous as well as differentiable at x = 0

(C) $\sqrt{\{x\}^2}$ is continuous as well as differentiable at x = 0

(D) none of the above

Space for rough work

65. If $\frac{d^3x}{dy^3}\left(\frac{dy}{dx}\right)^5 = P\left(\frac{d^2y}{dx^2}\right)^2 - \frac{dy}{dx}\frac{d^3y}{dx^3}$ then value of 'P' is equal to

(A) 1 (B) 2
(C) 3 (D) none of these

66. $\int x^9\left(1+x^5\right)^{2/5} dx$ is equal to

(A) $\frac{5}{12}\left(1+x^5\right)^{12/5} + \frac{1}{14}\left(1+x^5\right)^{7/5} + C$ (B) $\frac{1}{12}\left(1+x^5\right)^{12/5} - \frac{1}{7}\left(1+x^5\right)^{7/5} + C$

(C) $\frac{5}{12}\left(1+x^5\right)^{12/5} - \frac{5}{7}\left(1+x^5\right)^{7/5} + C$ (D) none of these

67. If f(x) = x(x – 1)(x – 2)(x – 3)(x – 4)(x – 5) then value of $\int_0^5 \left[\frac{3f(x)-|f(x)|}{3f(x)+|f(x)|}\right] dx$ (where [.] denotes the greatest integer function) is equal to

(A) 10 (B) 15
(C) 6 (D) 9

68. If $f(x) = \cos(\pi \sin^2 x)$ and $g(x) = \cos(\pi \cos^2 x)$ then which of the following statements is true

(A) f(x) is aperiodic
(B) g(x) is aperiodic
(C) f(x) + g(x) is periodic with fundamental period π
(D) none of these

69. Let $S_n = \sum_{k=1}^{n} \frac{\tan^{-1}\left(\frac{k}{n}\right)}{n}$ and $T_n = \sum_{k=0}^{n-1} \frac{\tan^{-1}\left(\frac{k}{n}\right)}{n}$ for $n \in N$, then which of the following statements is false

(A) $S_n > \frac{\pi - \ln 4}{4}$ (B) $T_n < \frac{\pi - \ln 4}{4}$
(C) $\lim_{n\to\infty} S_n > \lim_{n\to\infty} T_n$ (D) none of these

Space for rough work

70. Let if $f(x)=\sum_{i=0}^{9} a_i x^i$ be a real valued function, $a_i \notin R^-$, where f(x) = 0 has two distinct negative roots. Then minimum number of distinct real roots of f(x) = 0 are
(A) 3 (B) 2
(C) 9 (D) not enough information

71. Area bounded by curve y = 1 and $y=\frac{\sin x+\cos x+|\sin x-\cos x|}{2}$ in $x \in [0, \pi]$ is
(A) $\frac{3\pi}{4}-\frac{1}{\sqrt{2}}-1$ (B) $\frac{3\pi}{4}-\frac{1}{\sqrt{2}}$
(C) $\pi+\sqrt{2}-3$ (D) $\pi-\sqrt{2}-1$

72. Number of points where function $f(x)=(1-\sin x-\cos x)\,\text{sgn}\left(x^2-\frac{\pi x}{2}\right)$ is discontinuous is
(A) 0 (B) 1
(C) 2 (D) 3

73. If $f(x)=\frac{1}{\sqrt{|x|-x}}$ and $g(x)=\cos\left(\ln\left(\frac{\sqrt{1-x^2}}{e^x}\right)\right)$, then domain of (fog)(x) is
(A) $(-\infty, 0)$ (B) $(-1, 0)$
(C) $(-1, 1)$ (D) $(0, 1)$

74. The curve for which square of sub tangent varies as subnormal is
(A) $(x + 2)^2 = y^3$ (B) $(x - 2)^3 = y^2$
(C) $x^2 = (y - 2)^3$ (D) $x^3 = (y + 2)^2$

75. Let f(x) be a 'n' degree polynomial function having 'n' real and distinct roots.
If g(x) = f′(x) + 100f(x), then minimum number of roots that g(x) must possesses is
(A) n (B) n + 1
(C) n – 1 (D) information is insufficient

76. Which of the following statement is true?
(A) $e^\pi < \pi^e$ (B) $\pi^3 > 3^\pi$
(C) $2^e > e^2$ (D) $\pi^{10} > 10^\pi$

Space for rough work

77. $\int_{-2}^{2} x^4 d(\ln x)$ is equal to

(A) $\frac{e^8 - e^{-8}}{4}$ (B) $\frac{64}{5}$

(C) 0 (D) none of these

78. Area bounded by the curve $f(x) = \frac{1}{x^2 + [x]^2 + 2\{x\} + 1 - 2x[x]}$ and x-axis between $x = -\frac{3}{2}$ and $x = \frac{5}{2}$ is equal to (where [.] denote the greatest integer function and {.} denote fractional part function)

(A) $\frac{1}{2}$ (B) 1

(C) 2 (D) 4

79. Area bounded by the curves $C_1 : x^2 + y^2 = 36$; $C_2 : y^2 = 5x$; $C_3 : y^2 = -5x$ is equal to

(A) $4\int_0^4 \left(\sqrt{36 - x^2} - 5x\right) dx$ (B) $2\int_0^4 \left(\sqrt{36 - x^2} - 5x\right) dx$

(C) $4\left(\int_0^{\sqrt{20}} \frac{y^2}{5} dy\right)$ (D) $4\left[9\pi - \left(\int_0^{\sqrt{20}} \left(\sqrt{36 - y^2} - \frac{y^2}{5}\right) dy\right)\right]$

80. $\int \frac{6x^{23} - 9x^8}{\left(x^{15} + x^9 + 1\right)^2} dx$ is equal to

(A) $-\frac{x^9}{x^{15} + x^9 + 1} + c$ (B) $\frac{3x^9}{\left(x^{15} + x^9 + 1\right)^3} - \frac{2x^3}{\left(x^{15} + x^9 + 1\right)^2} + c$

(C) $-\frac{x^{15} + x^6}{x^{15} + x^9 + 1} + c$ (D) none of these

81. Which of the following limits vanish? (i) $\lim_{x \to \infty} \frac{\sin x}{x}$ (ii) $\lim_{x \to \infty} \frac{\int_0^x e^t dt}{e^{x^2}}$ (iii) $\lim_{x \to 0} (\sin x)^{1/x^2}$

(A) (ii), (iii) (B) (i), (ii)

(C) (i), (iii) (D) (i), (ii), (iii)

Space for rough work

82. The statement $(p \vee \sim r) \vee (\sim p \wedge q \wedge r)$ is equivalent to
(A) $\sim(p \wedge q \wedge \sim r)$ (B) $(p \wedge \sim q) \vee r$
(C) $\sim(\sim p \wedge q \wedge \sim r)$ (D) $\sim(\sim p \wedge \sim q \wedge r)$

83. $\int \frac{3x^2+1}{x^6+2x^4+2x^3+x^2+2x+2}$ is equal to
(A) $\frac{x^5-2x^2}{x^3+x+1}+c$ (B) $-\cot^{-1}(x^3+x+1)+c$
(C) $\frac{x^3+x}{\left(x^6+2x^4+2x^3+x^2+2x+2\right)^2}$ (D) none of these

84. If $\sqrt{2y+x}+\sqrt{2y-x}$ = constant then $\frac{dy}{dx}$ is equal to
(A) $\frac{x}{4y-\sqrt{4y^2-x^2}}$ (B) $\frac{x}{4y+\sqrt{4y^2-x^2}}$
(C) $\frac{x}{4y+2\sqrt{4y^2-x^2}}$ (D) $\frac{x}{4y-2\sqrt{4y^2-x^2}}$

85. Consider the functions $f(x) = |x|^5$; $g(x) = \{\cos x\}$; $h(x) = [|\sin x|]$ (where [.] denote the greatest integer function and {.} denote fractional part function) then which of these functions is differentiable at x = 0?
(A) f(x) and g(x) (B) g(x) and h(x)
(C) f(x), g(x) and h(x) (D) f(x) and h(x)

86. If the line segment $y = 2x$, $-1 \le x \le 1$ is rotated about y-axis, then which of the following statements hold true for the solid so formed
(A) volume = $\frac{2\pi}{3}$, surface area = $\sqrt{5}\pi$ (B) volume = $\frac{4\pi}{3}$, surface area = $\sqrt{5}\pi+2\pi$
(C) volume = $\frac{2\pi}{3}$, surface area = $\sqrt{5}\pi+\pi$ (D) volume = $\frac{4\pi}{3}$, surface area = $2\sqrt{5}\pi$

Space for rough work

87. Let a relation be defined on a set of functions defined on R $\rightarrow$ R such that R = {(f, g)|f – g is an even function} then, relation R is
(A) reflexive, symmetric
(B) reflexive, transitive
(C) symmetric, transitive
(D) equivalence relation

88. If area bound by the curves $y = e^{ax^2}$, $y = e^{\frac{1}{8}}$ between x = 0 and x = 1 is minimum, then the value of 'a' is
(A) 1
(B) 2
(C) $\frac{1}{2}$
(D) none of these

89. Order and degree of the differential equation $\sin\left(\frac{dy}{dx}\right) = 2xy - 3\cos\frac{dy}{dx}$ respectively are
(A) order 1, degree 1
(B) order 1, degree not defined
(C) order 2, degree not defined
(D) none of these

90. Let the number of elements in a set A be 'n'. A set 'C' is defined such the C = {(x, y)| x, y $\in$ P(A) and x $\cap$ y = ϕ}, where P(A) is power set of A, then cardinal number of C is equal to
(A) 2^{2n}
(B) 3^n
(C) 2.3^n
(D) none of these

Space for rough work