Lakshya

LAKSHYA ADVANCED UNIT TEST (LAUT)

Test No.		Question Booklet Serial No.
1051391	**Physics :** Horizontal circular motion (kinematics and dynamics) - uniform and non uniform , banking of tracks **Chemistry :** Redox Complete ,Gaseous State Complete **Mathematics :** Circles (60% weightage), St lines (40% weightage)	091016

Date : 09/10/2016 **Maximum Marks : 264** **Time Allottted : 3 Hours**

Please read the instructions carefully.

1. Immediately fill the particulars on this page of the Test Booklet with Blue/Black ball point pen. Use of pencil is strictly prohibited.
2. The answer sheet is kept inside this test booklet. When you are directed to open the test booklet, take out the answer sheet and fill in the particulars carefully.
3. The test booklet consists of 60 questions. The maximum marks are 264.
4. **PCM Paper** is divided into 3 Sections.
   (a) **Section I (01 – 10)** consists of 10 multiple choice questions which have **ONE OR MORE THAN ONE** correct answer. Each question carries +4 marks for correct answer and -1 marks for incorrect response.
   (b) **Section II (01 - 02)** contains 2 Matrix Match type questions. Statements in the first column have to be matched with statements in the second column. 2 marks if you darken the bubble corresponding to only the correct answer and 0 mark in all other cases.
   (c) **Section III (01 – 08)** contains 8 Integer Type questions with single digit integer as answer, ranging from 0 to 9 and each question carries +4 marks for correct answer and 0 mark for incorrect response.
5. Use Black Ball Pen only for writing/marking responses on side-1 and side-2 of the Answer sheet. Use of pencil is strictly prohibited.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, paper, mobile phone, any electronic device, etc. except the admit card inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the test booklet only. This space is given at the bottom of each page.
8. On completion of the test, the candidate must hand over the answer sheet to the invigilator on duty in the room/hall. However, the candidates are allowed to take away this test booklet with them.
9. Do not fold or make any stray marks on the answer sheet.

Advice :

1. It is recommended to select easy questions and optimize your score.
2. Students are advised not to spend too much time on a particular question.

Do not open this booklet unless instruction is given

PART A - PHYSICS

SECTION I (Multiple Answer Correct)

Section I consists of 10 multiple choice questions which have one or more than one correct answer. Each question carries +4 marks for correct answer and -1 mark otherwise.

1. An amusement park ride called "The Spinning Terror" is a large vertical drum which spins so fast that everyone inside stays pinned against the wall when the floor drops away

a) The minimum linear velocity is $\omega_{min} = \sqrt{\frac{g}{\mu R}}$ for everyone to stay inside.

b) The minimum linear velocity is $\upsilon_{min} = \sqrt{\frac{g}{\mu R}}$ for everyone to stay inside.

c) The mínimum angular velocity is $\omega_{min} = \sqrt{\frac{gR}{\mu}}$ for everyone to stay inside.

d) The minimum linear velocity is $\upsilon_{min} = \sqrt{\frac{gR}{\mu}}$ for everyone to stay inside.

2. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. If follows that

a) its velocity is constant
b) its acceleration is constant
c) its kinetic energy is constant
d) it moves in a circular path

3. A particle is moving on a circular path of radius 2 m with constant angular velocity ω. In time $t = \frac{\pi}{3\omega}$,

a) the magnitude of displacement is 2 m
b) the magnitude of displacement is $\frac{4\pi}{3}$ m
c) distance travelled by particle is $\frac{2\pi}{3}$ m
d) distance travelled by particle is 2 m

4. A ceiling fan is turning at $\frac{1}{\pi}$ rpm. A bug is moving on the blade with velocity v_0 = 1 cm/s towards the axis of the fan with respect to blade. Then,

a) the speed of the bug at distance 30 cm from the axis of fan is $\sqrt{2}$ cm/s
b) the acceleration of the bug at distance 30 cm from axis of fan is $\frac{1}{30}$ cm/s^2
c) the acceleration of the bug at distance 30 cm from axis of fan is 1 cm/s^2
d) None of the above

5. If a particle is moving on a circular path with increasing speed, then which of the following options are correct?

a) Acceleration and velocity never be perpendicular to each other
b) Acceleration is always directed towards centre
c) Angular acceleration and angular velocity are along the axis of rotation in the same direction
d) Tangential acceleration and angular acceleration are always perpendicular to each other

6. A cyclist is moving on a circular path of radius R with increasing speed. The rate of increase of speed is a_0 which is uniform. The coefficient of friction between tyre and horizontal ground is μ.

a) Friction is directed towards centre

b) Maximum angle of inclination with vertical is $\tan^{-1}\mu$

c) Friction is not directed towards centre

d) Friction provides tangential as well as centripetal acceleration

7. A cyclist is moving on a circular path of radius $\sqrt{3}$ m. The coefficient of friction between tyre and ground is $\mu_s = \frac{1}{\sqrt{3}}$.

a) The maximum speed of cyclist to safe riding is $\sqrt{10}$ m/s

b) The maximum inclination with vertical is 30^0

c) Friction provides required centripetal acceleration

d) The line of action of net contact force is passing through the centre of gravity of cyclist system

8. A car is moving with a speed of 10m/s on a circular path of radius 25m. Driver of car applies the brakes producing a uniform deceleration of $3m/s^2$. Then,

a) the centripetal acceleration of car just after applying the brake is $4m/s^2$

b) the acceleration just after applying the brake is $5\ m/s^2$

c) the acceleration is directed towards the centre just after applying the brake

d) The angle between acceleration and velocity just after applying the brake is 127^0

9. A particle is moving along a circular path. The angular velocity, linear velocity, angular acceleration and centripetal acceleration of the particle at any instant are $\vec{\omega}, \vec{\upsilon}, \vec{a}, \vec{a_c}$ respectively. Which of the following relations are correct?

a) $\vec{\omega} \perp \vec{v}$

b) $\vec{\omega} \perp \vec{a}$

c) $\vec{\omega} \perp \vec{a_c}$

d) $\vec{v} \perp \vec{a_c}$

10. A smooth circular road of radius *r* is banked for a speed υ = 40km/hr. A car of mass m attempts to go on the Circular road. The friction coefficient between the tyre and the road is negligible. The correct statements are :

a) The car can not make a turn without skidding.

b) If the car turns at a speed less than 40 km/hr, it slips down.

c) If the car turns at the correct speed of 40 km/hr, the forcé by the road on the car is equal to $m\upsilon^2/r$.

d) If the car turns at the correct speed of 40 km/hr, the force by the road on the car is greater than mg as well as greater than $m\upsilon^2/r$.

SECTION II (Matrix Match Type)

Section II consists of 2 matrix match type questions in which each row have one or more than one match. Each question carries 2 marks for each correct row and 0 marks for incorrect response. No negative marking.

1. Match the Column I with Column II and select the correct option from the given codes.

	Column -I		Column-II
A)	Motion of a particle on circular path with increasing speed ($v \neq 0$)	P)	Acceleration is directed towards centre
B)	Motion of a car on circular path with constant speed	Q)	Acceleration is not directed towards centre
C)	Motion of cyclist on circular path with decreasing speed ($v \neq 0$)	R)	Centripetal acceleration is non-zero
D)	Motion of a particle on a circular path with constant angular acceleration	S)	Friction is not directed towards centre

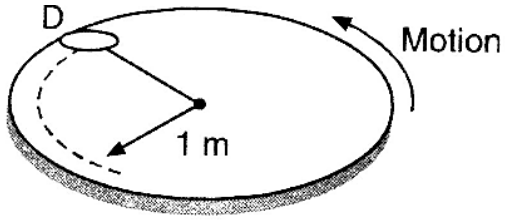
2. A particle moves on a circular path of radius 7m with constant speed 7m/s. Match the Column I with Column II and mark the correct option given below.

	Column –I		Column-II
A)	The magnitude of displacement in metre of the particle during travelling the quarter of circle.	P)	6.3
B)	The magnitude of average velocity in m/s during travelling quarter of circle.	Q)	7
C)	The magnitude of acceleration in m/s^2 of the particle.	R)	$\frac{\pi}{2}$
D)	The magnitude of average acceleration in m/s^2 during travelling a quarter of circle.	S)	$7\sqrt{2}$

SECTION III (Integer Type)

Section III consists of 8 Integer type questions. Each is allotted +4 marks for correct response and 0 marks for incorrect response.

1. The 4 kg disk D is attached to the end of a cord as shown in figure. The other end of the cord is tied at the centre of a platform. If the platform is rotating rapidly and the disk is placed on it and released from rest as shown, determine the time, in seconds, it takes for the disk to reach a speed great enough to break the cord. The maximum tension the cord can sustain is 100 N and the coefficient of kinetic friction between the disk and the platform is $\mu_k = 0.1$. Take $g = 10ms^{-2}$



2. A stone of mass 16 kg is attached to a string 144 m long and is whirled in a horizontal circle. The maximum tension the string can stand is 16N. The maximum velocity of revolution that can be given to the stone without breaking the string is twice the value of n, find n.

3. A wheel rotates with constant acceleration of 2 rad s^{-2} . If the wheel starts from rest, the number of revolution it makes in the first ten second will be approximately square of n, find n.

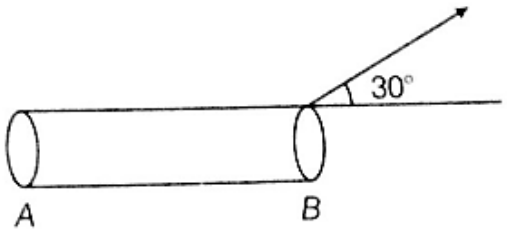
4. On a dry road, the maximum permissible speed of a car in a circular path is $10ms^{-1}$. If the road becomes wet, the maximum speed is $5\sqrt{2}$. If the coefficient of friction for dry road is μ, then that for the wet road is $\frac{\mu}{p}$, find p.

5. In amusement parks there is a device called rotor where people stand on a platform inside a large cylinder that rotates about a vertical axis. When the rotor reaches a certain angular velocity, the platform drops away. If the minimum coefficient of friction for the people not to slide down is $\frac{n}{10}$, find n. Take the radius to be 2m and time period of revolution to be 2 s.

6. A car is moving in a circular path of radius 50m, on a flat rough horizontal ground. The mass of the car is 1000 kg. At a certain moment, when the speed of the car 5m/s, the driver is increasing speed at the rate of $1m/s^2$. If the value of static friction on tyres at this moment, in newtons is $100 \times n^{3/2}$. Find n.

7. An object is moving in a circle at constant speed v. The magnitude of the rate of change of momentum of the object is proportional to v^n. find value of n.

8. The instantaneous velocity of point B of the given rod of length 0.5 m is 3 m/s in the represented direction. The angular velocity of the rod for minimum velocity of end A is ω rad/s. Find the value of ω



PART B - CHEMISTRY

(Atomic Weight - C - 12, O - 16, K - 39, Mn - 55)

SECTION I (Multiple Answer Correct)

Section I consists of 10 multiple choice questions which have one or more than one correct answer. Each question carries +4 marks for correct answer and -1 mark otherwise.

1. Four gas balloons A, B, C, D of equal volumes containing, Hg_2, N_2O, CO, CO_2 respectively were picked with needle and immersed in a tank containing CO_2. Which of them will shrink after some time ?

a) A b) B
c) C d) both A and D

2. 2.0 g of a tri-atomic gaseous element was found to occupy a volume of 448ml at 76cm of Hg and 273K. The mass of its atom is ?

a) 33.3 amu b) 5.53×10^{-23} g
c) 33.3 g d) 5.53 amu

3. 1 mol BaF_2 + 2 mol $H_2SO_4 \rightarrow$ resulting mixture will be neutralised by ?

a) 1 mol of KOH b) 2 mol of $Ca(OH)_2$
c) 4 mol KOH d) 2 mol of KOH

4. The oxidation number of Cr = + 6 in

a) $FeCrO_4$ b) $KCrO_3Cl$
c) CrO_5 d) $[Cr(OH)_4]^-$

5. Which of the following reactions is not a redox reaction ?

a) $H_2O_2 + KOH \longrightarrow KHO_2 + H_2O$

b) $Cr_2O_7^{2-} + 2\overset{\ominus}{O}H \longrightarrow 2CrO_4^{2-} + H_2O$

c) $Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + CO_2 + H_2O$

d) $H_2O_2 \longrightarrow H_2O + \frac{1}{2}O_2$

6. Which of the following statements is/are correct?

In the reaction $xCu_3P + yCr_2O_7^{2-} \longrightarrow Cu^{2+} + H_3PO_4 + Cr^{3+}$

a) Cu in Cu_3P is oxidised to Cu^{2+} whereas P in Cu_3P is also oxidised to PO_4^{3-}

b) Cu in Cu_3P is oxidised to Cu^{2+} whereas P in Cu_3P is reduced to H_3PO_4.

c) In the conversion of Cu_3P to Cu^{2+} and H_3PO_4, 11 electrons are involved.

d) The value of *x* is 6.

7. In the redox reaction $2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$

a) $S_2O_3^{2-}$ gets oxidised to $S_4O_6^{2-}$ b) $S_2O_3^{2-}$ gets reduced to $S_4O_6^{2-}$
c) I_2 gets reduced to I^- d) I_2 gets oxidised to I^-

8. Which of the following act both as oxidising as well as reducing agents?

a) HNO_2 b) SO_2
c) H_2O_2 d) H_2S

9. A certain gas is at a temperature of 350 K. If the temperature is raised to 700K the average translational kinetic energy of the gas will

a) remain constant
b) increase by a factor of 2
c) increase by a factor of the square root of 2
d) increase by a factor of square root of 2

10. A mixture of 2 mole of O_2 (g) and 1 mol of N_2(g) is maintained in a rigid container at constant temperature. When additional N_2(g) is put into the container at constant temperature, the pressure doubles. How many moles of N_2 are in the final mixture ?

a) 2
b) 3
c) 4
d) 5

SECTION II (Matrix Match Type)

Section II consists of 2 matrix match type questions in which each row have one or more than one match. Each question carries 2 marks for each correct row and 0 marks for incorrect response. No negative marking.

1. Match the reactions in column I with the coefficients x and y given in column II.

	Column –I Reaction		Column-II The coefficients of x and y are
A)	$xCu + yHNO_3 \longrightarrow Cu(NO_3)_2 + NO + NO_2 + H_2O$	P)	2 and 6
B)	$xKI + yBaCrO_4 \xrightarrow{H^{\oplus}} I_2 + CrCl_3$	Q)	6 and 2
C)	$xAs_2S_3 + yNO_3^- \longrightarrow AsO_4^{3-} + NO + SO_4^{2-}$	R)	3 and 28
D)	$4P + 3OH^- + 3H_2O \longrightarrow xPH_3 + yH_2PO_2^-$	S)	1 and 3

2. On the left column, some reactions are indicated and on the right column, properties of reactions are described. Match them appropriately, and select the correct code.

	Column –I		Column-II
A)	$N_2(5.00\ g) + H_2(1.00\ g) \longrightarrow NH_3$	P)	First reactant is the limiting reagent.
B)	$N_2(3\ g) + F_2(10\ g) \longrightarrow N_2F_4$	Q)	Mass of reactant = Mass of product
C)	$S(1.0\ g) + O_2(1.0\ g) \longrightarrow SO_2$	R)	Stoichiometric amounts of reactants.
D)	$\underset{100ml,0.2M}{2H_3PO_4} + \underset{200ml,0.3M}{3Ba(OH)_2} \longrightarrow Ba_2(PO_4)_2 + H_2O$	S)	Second reactant is the limiting reactant.

SECTION III (Integer Type)

Section III consists of 8 Integer type questions. Each is allotted +4 marks for correct response and 0 marks for incorrect response.

1. If x mL 5 M HCl is mixed with 20 mL 2 M HCl, a 2.6 M HCl is produced. The x is

2. If mole-fraction of ethanol in a ethanol-water mixture is 0.125, the number of moles of water per mol of ethanol in the mixture is

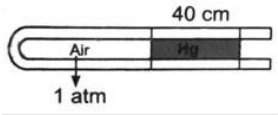
3. 1.9 g of $CH_x\ Br_y$ has the same number of atoms as in 0.6 g of H_2O. The value of x + y is (M (Br) = 80)

4. If the following redox reaction is balanced with smallest whole number coefficient
$Cr_2O_7^{2-} + H^+ + Ni \longrightarrow Cr^{3+} + Ni^{2+}$ the stoichiometric coefficient of Ni in the balanced reaction is

5. Consider the following redox reaction : $NO_2^- + H^+ + xe^- \longrightarrow NO + H_2O$. The value of x is

6. If Cu_2S is treated with acidic solution of $KMnO_4$, it is oxidized completely to Cu^{2+} and SO_2 is liberated. Moles of $KMnO_4$ required for complete oxidation of 1.25 mol of Cu_2S is

7. Air is trapped in a horizontal glass tube by 40 cm mercury column as shown below :



If the tube is held vertical keeping the open end up, length of air column shrink to 1.9cm. Length in cm by which the mercury column shifts down is

8. If an ideal gas at 100 K is heated to 109 K, the pressure increases by x%, x is

PART C - MATHS

SECTION I (Multiple Answer Correct)

Section I consists of 10 multiple choice questions which have one or more than one correct answer. Each question carries +4 marks for correct answer and -1 mark otherwise.

1. Let x, y be variables satisfying the equation $x^2 + y^2 + 8x - 10y - 40 = 0$. Let $a = \max\left\{\sqrt{(x+2)^2+(y-3)^2}\right\}$ and $b = \min\left\{\sqrt{(x+2)^2+(y-3)^2}\right\}$, then

a) $a + b = 18$ b) $a + b = \sqrt{2}$

c) $a - b = 4\sqrt{2}$ d) $ab = 73$

2. Common tangents are drawn to two circles $x^2 + y^2 = 1$ and $(x-4)^2 + (y-4)^2 = 4$. If the intersection points of transverse common tangents with the direct common tangents are A, B, C and D, then

a) ABCD is a cyclic quadrilateral

b) Equation of circumcircle of Δ ABC is $x^2 + y^2 - 4x - 4y = 0$

c) Equation of circumcircle of Δ ABC is $x^2 + y^2 - 5x - 5y = 0$

d) ABCD is a square

3. If α, β, χ are the parameters of points A, B, C on circle $x^2 + y^2 = a^2$ and if the triangle ABC be equilateral, then

a) $\sum\cos\alpha = 0$ b) $\sum\sin\alpha = 0$

c) $\sum\tan\alpha = 0$ d) $\sum\cot\alpha = 0$

4. Let S_1 and S_2 be two circles passing through (2, 3) and touching the coordinate axes and S be the circle passing through common points of S_1 and S_2 and radius equal to G.M. of radius of S_1 and S_2, then

a) $S \equiv 0$ cuts y-axis is but not the x-axis b) $S \equiv 0$ cuts $y = x$

c) Radius of director circle of $S \equiv 0$ is $\sqrt{26}$ d) A.M. of radius of S_1 and S_2 is 5

5. If the line $|y| = x - \alpha$; where $\alpha > 0$ does not meet the circle $x^2 + y^2 - 10x + 21 = 0$, then

a) $\alpha < 5 - 2\sqrt{2}$ b) $\alpha > 5 + 2\sqrt{2}$

c) $\alpha \in (5-2\sqrt{2},\ 5+2\sqrt{2})$ d) $\alpha \in (-1, 1)$

6. If the lines $3x - 4y + 4 = 0$ and $6x - 8y - 7 = 0$ are tangents to the same circle, then

a) Radius of the circle = 3/4 b) Radius of the circle = 3/2

c) Centre of the circle lies on $12x - 16y + 1 = 0$ d) Centre of the circle lies on $12x - 16y + 31 = 0$

7. The lines $(m-2)x + (2m-5)y = 0$; $(m-1)x + (m^2-7)y - 5 = 0$ and $x + y - 1 = 0$ are

a) Concurrent for three values of 'm' b) Concurrent for one value of 'm'

c) Concurrent for no value of 'm' d) are parallel for $m = 3$

8. If $x^2 + 2hxy + y^2 = 0$ ($h \neq 1$) represents the equations of the straight lines through the origin which make an angles α with the straight line $y + x = 0$, then

a) $\sec 2\alpha = h$ b) $\cos\alpha = \sqrt{\dfrac{1+h}{2h}}$

c) $m_1 + m_2 = -2\sec 2\alpha$ d) $\cot\alpha = \sqrt{\dfrac{h+1}{h-1}}$

9. The equation of the line passing through (2, 3) and making an intercept of 2 units between the lines $y + 2x = 5$ And $y + 2x = 3$ is

a) $5x - 4y + 2 = 0$ b) $3x + 4y = 18$

c) $x = 2$ d) $y = 3$

10. The equation of the diagonal of the square formed by the pairs of lines $xy + 4x - 3y - 12 = 0$ and $xy - 3x + 4y - 12 = 0$ is

a) $x - y = 0$ b) $x + y + 1 = 0$

c) $x + y = 0$ d) $x - y + 1 = 0$

SECTION II (Matrix Match Type)

Section II consists of 2 matrix match type questions in which each row have one or more than one match. Each question carries 2 marks for each correct row and 0 marks for incorrect response. No negative marking.

1. Match the following Column I with Column II

	Column -I		Column-II
A)	The distance between the lines $(x + 7y)^2 + 4\sqrt{2}(x + 7y) - 42 = 0$ is	P)	2
B)	If the sum of the distance of a point from two perpendicular lines in plane is 1, then its locus is $\|x\| + \|y\| = k$, where k is equal to	Q)	7
C)	If $6x + 6y + m = 0$ is acute angle bisector of lines $x + 2y + 4 = 0$ and $4x + 2y - 1 = 0$, then m is equal to	R)	3
D)	Area of the triangle formed by the lines $y^2 - 9xy + 18x^2 = 0$ and $y = 6$ is	S)	1

2. Match the following:

	Column -I		Column-II
A)	The value of k for which $4x^2 + 8xy + ky^2 = 9$ is the equation of pair of straight lines, is	P)	3
B)	If the sum of the slopes of the lines given by $x^2 - 2Cxy - 7y^2 = 0$ is four times their product, then the value of C is	Q)	–3
C)	If the gradient of one of the lines $x^2 + hxy + 2y^2 = 0$ is twice that of the other, then h =	R)	2
D)	If the lines $ax^2 + 2hxy + by^2 = 0$ are equally inclined to the lines $ax^2 + 2hxy + by^2 + \lambda(x^2 + y^2) = 0$, then the value of λ can be	S)	4

SECTION III (Integer Type)

Section III consists of 8 Integer type questions. Each is allotted +4 marks for correct response and 0 marks for incorrect response.

1. If the line $3x - 4y - 8 = 0$ divides the circumference of the circle with centre (2, -3) in the ratio 1 : 2, then the radius of the circle is

2. If two circles each of unit radius intersect orthogonally. The common area of the circles is $\frac{\pi}{\lambda}-1$. Then the value of λ =

3. For the circle $x^2 + y^2 = r^2$, the value of r for which the area enclosed by the tangents drawn from the point P(6, 8) to the circle and the chord of contact is maximum, is

4. Tangents are drawn to the circle $x^2 + y^2 = 1$ at the points where it is met by the circles $x^2 + y^2 - (\lambda + 6)x + (8 - 2\lambda)y - 3 = 0$, λ being parameter. The locus of point intersection of these tangents is $px + qx + 10 = 0$, then $p + q$ =

5. If the radius of circumcircle of the ΔTPQ where PQ is chord of contact corresponding to point T with respect to circle $x^2 + y^2 - 2x + 4y - 11 = 0$ is 6 units. Then the minimum distance of T from the director circle of the given circle is $12 - 4\sqrt{K} \Rightarrow K =$

6. In a ΔABC, AB is parallel to y-axis, BC is parallel to x-axis, centroid is at(2, 1). If median through C is $x - y = 1$, then the slope of median through A is

7. If the orthocenter of the triangle formed by $2x + 3y - 1 = 0$, $x + 2y - 1 = 0$, $ax + by - 1 = 0$ is at the origin then $\frac{b-a}{4} =$

8. The area of the rhombus ABCD is 24. The equation of the diagonal BD is $4x + 3y + 2 = 0$ and A = (3, 2). The length of the side of the rhombus is