DAV PUBLIC SCHOOLS,ODISHA ZONE-II
QUESTION BANK
HALF YEARLY EXAMINATION(2015-16)
CLASS –XI, SUBJECT-PHYSICS (042)

SECTION-A (ONE MARK)

UNIT-I

1.Write the name of the uncharged particle which is emitted by nucleus in β-decay.
2.Derive the SI unit Joule(j) in term of fundamental units.
3. Write the dimensional formula for Gravitational constant.
4. Who proposed the wave theory of light.
5. Name two physical quantities whose dimensions are same.
6.Write two physical quantities having the dimensions ($M^1L^2T^{-2}$).
7.What are the dimensions of Resistance?
8.What are the dimensions of angle?
9. Give the number of significant figures in 6.200×10^0 sec.
10.How much is the range of gravitational force? What are the messenger particles for this force ?

UNIT-II

11. Draw the position time graph for an object moving with negative velocity
12.What is the angle between velocity vector and acceleration vector in uniform circular motion?
13.What does the slope of velocity-time graph represent?
14.A ball is thrown straight up. What is it's velocity & acceleration at the top ?
15. Define a null vector
16. Under what condition is the average velocity equal to the instantaneous velocity
17. When is the magnitude of the resultant of two vectors equal to either of them?
18.What is the angular velocity of rotation of earth ?
19.The position coordinate of a moving particle is given by $x= 6 + 18t + 9t^2$ (x is in m and t is in seconds). What is the velocity at t = 2 sec?
20.What is the angular velocity of the hour hand of clock?
21.The position coordinate of a moving particle is given by $x = 5t^2 - 2t + 5$ (x is in mt and t is in seconds). What is the velocity at t = 2 sec?
22.What is the angle between velocity vector and acceleration vector at the highest point of a projectile.

UNIT-III

23.A ball of mass 10 kg strikes against a wall at an angle of 45^0 and is reflected at the same angle . Find the change of momentum.
24. Action and reaction are equal and opposite. Why do they not balance each other?
25. A body is acted upon by a number of external forces. Can it remain at rest ?
26. Is impulse a scalar or vector quantity? Write its SI unit.

UNIT-IV

27. A body is moving unidirectional under the influence of a source of constant power, How its displacement depends on time t ?
28. A particle is able to just complete a vertical circle of radius r, what is its minimum velocity at the highest point ?
29.If angular momentum of a system is conserved and it's moment of inertia is decreased, what will happen to its rotational KE?
30. A force F = 5i +6j-4k acting on a body produces a displacement S = 6i+5k.What is the work done by the force?
31.A light body and a heavy body have the same momentum. Which one will have greater kinetic Energy?
32..What do you mean by conservative force ?
33. Why does a heavy rifle not kicks as strong as a light rifle using the same bullet?

UNIT-V

34.Give an example each for a body , where the centre of mass lies inside the body and outside the body .
35.Write the formula for the co- ordinates of the center of mass of two particles mass of m_1 and m_2 located at the points (x_1,y_1) and (x_2, y_2) respectively.
36. Two identical particles move towards each other with velocity 2v and v respectively. what is the velocity of the centre of mass ?

37. A particle performs uniform circular motion with an angular momentum L, if the frequency of the particle's motion is doubled and kinetic energy is halved, How its angular momentum changes?
38. Is it necessary that centre of mass should always lies inside the body ?

SECTION-B (2-MARKS)

UNIT-I

1. State the rules for counting the number of significant figures in a measurement.
2. Write the formula for the co- ordinates of the center of mass of two particles mass of m_1 and m_2 located at the points (x_1, y_1) and (x_2, y_2) respectively.
3. The error in the measurement of radius of a sphere is 2 % .What would be the error in the volume of the sphere?
4. The two sides of a rectangle are (5.7 ± 0.1) m and (3.4 ± 0.2) m. Find the % error in its area.
5. When a potential difference of V= (102±5) V is applied across a conductor a current of (11±0.2) A flows through it. Find the % error in its resistance
6. A physical quantity Q is given by $X = \frac{A^2 B^{\frac{3}{2}}}{C^4 D^{\frac{1}{2}}}$ .The percentage error in A, B, C, D are 1%, 2%, 4% and 2% respectively. Find the percentage error in X.
7. If the errors involved in the measurements of a side and mass of a cube are 3% and 4% respectively, what is the maximum permissible error in the density of the material?
8.. A physical quantity p is related to four observables a, b, c and d as follows

$$P = \frac{a3b2}{\sqrt{cd}}$$

The percentage errors of measurement in a , b , c and d are in 1% , 3% , 4% , 2% respectively.
What is the percentage error in the quantity p ?
9. The parallex of a heavenly body measured from two points diametrically opposite on equator of earth is 2.0 minutes. If radius of earth is 6400km, calculate distance of heavenly body.

UNIT-II

10 A ball thrown up is caught by the thrower after 4s. How high did it go and with what velocity was it thrown?
11. Two forces whose magnitude are in the ratio of 3:5 give a resultant of 35N.If the angle of inclination be 60^0,calculate the magnitude of each force.
12. A body moving along x- direction has at any instant its x-co-ordinate is given by $x= a + bt+ ct^2$, what is the acceleration of the particle.
13..Draw the velocity- time graph for a uniformly accelerated motion. Use this graph to obtain a relation between the initial velocity (u) and final velocity (v),displacement(s) and acceleration (a)
14. Find the angle of projection for a projectile motion whose range R is n times the maximum height?
15. A ball is thrown vertically upwards .
Draw its
i. Velocity-time curve
ii. Acceleration –time curve
16. The distance x travelled by a body in a straight line is directly proportional to t^2 .Decide on the type of motion associated. If $x \alpha t^3$ what change will you observe ?
17. Show that the resultant of two vectors **A** and **B** inclined at an angle Θ is $R = (A^2+B^2+2AB\cos\Theta)^{1/2}$
18. A jet airplane travelling at the speed of 500 km/h ejects its products of combustion at the speed of 1500 km/h relative to the jet plane .What is the speed of the latter with respect to an observer on the ground ?
19. Using the calculus method obtain the equation of motion:- $v^2 – u^2 = 2as$
20..A motorboat is racing towards north at a speed of 25 km/h and water current in that region is 10 km/h in the direction of 60^0 east of south. Find the magnitude and direction of the resultant velocity of the boat.
21. Using the calculus method obtain the equation of motion $s = ut + \frac{1}{2}(at^2)$.
22. Two forces whose magnitude are in the ratio of 3:5 give a resultant of 35N.If the angle of inclination be 60^0,calculate the magnitude of each force.
23. At what angle do the forces (P + Q) and (P – Q) inclined each other so that their resultant force become $\sqrt{(3P^2 + Q^2)}$?
24. Find the components of A = 2i+3j along the direction of the vectors i +j and i-j.
25. Draw the following graphs for an object under free fall.

(a). Variation of acceleration with respect to time. (b). Variation of velocity with respect to time.

26.If $|\vec{A}+\vec{B}|=|\vec{A}-\vec{B}|$ Find the angle $\vec{A}$ and $\vec{B}$.

27.Find the angle of projection at which horizontal range and maximum height are equal.

28..The motion of a particle of a mass m is given by, $y=ut+1/2gt^2$.Find the force acting on the particle.

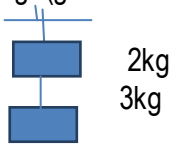
UNIT-III

29.Why Newton's second law is called the real law of motion?

30. Give one examples of each of inertia of rest and inertia of motion .

31.Newton's second law is a local relation .Explain with example.

32.Two blocks of mass 3 kg and 2 kg are suspended from a rigid support s by two inextensible wires each of length 1 m. the whole system has an upward acceleration of 0.2 ms^{-2}. Find the tension in each string. ($g=9.8\ ms^{-2}$)



33. If a passenger is sitting in a moving train throws up a coin then mention the condition in which the coin will fall
(a) Ahead of him (b). Back of him.

34.Derive velocity of recoil of a gun applying law of conservation of momentum.

35.Derive momentum- impulse theorem

36.In the given arrangement, if the points P and Q move down with a velocity u, find the velocity of M.

UNIT-IV

37.A raindrop of mass 1 g is falling from a height of 1 km. It hits the ground with a speed of 50 ms^{-1}-

a. What is the work done by the gravitational force?

b. While falling down an opposing resistive force also acts on it. What is the work done by the resisti ve force?

38.. State and prove work energy theorem for a constant force.

39.What is meant by negative and zero work ? Give examples of each type ?

40. A bullet of mass 50 g moving with a velocity of 400 m/s strikes a wall and goes out from the other side with a velocity of 100 m/s. Calculate the work done in passing through the wall.

41. A car of mass 1000 kg moving with a speed of 30 ms^{-1} collides with the block of stationary lorry of mass 9000kg. Calculate the speed of the vehicles immediately after the collision if they remained jammed together.

42.State and prove theorem that relates the work done by force to change in kinetic energy of the body.

43.Calcuate the work done by a car against gravity in moving along a straight horizontal road. The mass of the car is 400kg and the distance moved is 2m.

UNIT-V

44.Two solid spheres of the same mass are made of metals of different densities, which of them has larger moment of inertia?.

45. A shell explodes while at rest. Discuss the momentum and energy conservation.

46 .A rope of negligible mass is wound round a hollow cylinder of mass 3kg and radius 40 cm. What is angular acceleration of the cylinder . If the rope pulled with a force of 30N ? What is linear acceleration of the rope?

47.On ,what factor does the position of centre of mass of a rigid body depends?

SECTION-C (3-MARKS)

UNIT-I

1.The value G in CGS system is 6.67×10^{-8} dyne cm^2g^{-2}.Calcuate the value in SI units.

2.Assume that the escape velocity of planet depends upon the gravitational constant (G),radius(R) of the planet and also its density (D) .Derive formula for escape velocity from dimensional analysis.

3. Assuming that the mass M of the largest stone that can be moved by a flowing river depends upon 'v' the velocity ,'ρ' the density of water and on 'g' , the acceleration due to gravity. Show that M varies with the sixth power of the velocity of flow.

4.Energy (E) depends on universal gravitational constant (G), Planck's constant (h) and velocity of light (c). Use the method of dimensions to derive the formula for energy.

5. If the time period of a simple pendulum depends on its length and acceleration due to gravity then derive the relation between them using dimensional analysis?

6. Universal gravitational constant (G), depends on speed of light (c), acceleration due to gravity (g) and pressure (p). Use the method of dimensions to derive the formula for gravitational constant G.

7.The critical velocity(V_c) of a viscous liquid, flowing through a capillary tube, can be assumed to be depend on the:

a. Density (ρ) of the liquid
b. Coefficient of viscosity(η) of the liquid
c. Radius(r) of the tube.

Use the method of dimensions to obtain a relation between V_c and these quantities.

8. Find the value of 16 Joule / minute in a system, which has 100 g,100cm and 1 min as fundamental units .

UNIT-II

9.A body dropped from top of a tower falls through 40m during the last two seconds of its fall. Find the height of tower where g value is 9.8 m/s^2.

10.(i) What do you understand by resultant vector?

(ii) Given that $\vec{A} + \vec{B} = \vec{R}$ and $A^2 + B^2 = R^2$. Find the angle between $\vec{A}$ and $\vec{B}$.

11.What is the change in momentum between the initial and final points of the projectile path, if the range is maximum?

12.The displacement (in meter) of a particle moving along x-axis is given by $x = 18t + 5t^2$.

Calculate:

(i) The instantaneous velocity at t=4 sec
(ii) Average velocity between t=4 sec and t=5sec.
(iii) Instantaneous acceleration.

13.A body covers 12 m in 2nd second and 20 m in 4th second. How much distance will it cover in 4 seconds after the 5th second?

14Using graphical method, derive the equation of motion $s = ut + 1/2\, at^2$. Symbols have their usual meaning

15.Define relative velocity of one object w.r.t. another object. Draw position –time graphs for two objects moving along a straight line; when their relative velocity is (i) zero (ii) positive and (iii) negative. .

16.A passenger arriving in a new town wishes to go from the station to a hotel located 10 km away on a straight road from the station. A dishonest cabman takes him along a circuitous path 23 km long and reaches the hotel in 28 minutes. What is (i) the average speed of the taxi and (ii) the magnitude of average velocity ? Are the two equal?

17. Derive velocity -displacement relation by calculus method .

18. Define centripetal acceleration .Derive an expression for centripetal acceleration of a particle moving with uniform speed along a circular path of radius r .Explain about the direction of centripetal acceleration.

19. Calculate the area of a triangle determined by the two vectors: A= 3i + 4j and B= -3i+7j.

20. State triangle law of vector addition. Give analytical treatment to find magnitude of resultant vector .

21.Draw the graphs for the following.

i. position-time graph for a body in retarded motion.
ii. Velocity-time graph for a body in uniform motion.
iii. Acceleration-time graph of a body in free fall.

22.State the parallelogram law of vector addition and hence prove the law of sines.

23.The position of a particle is given by $\mathbf{R} = 3t\hat{i} + 2t^2\hat{j} + 5\hat{k}$ where t is in sec.

a. Find the velocity and acceleration of the particle.

b. What is the magnitude and direction of velocity of the particle at t=3s.

24. Derive the equation $S_{nth} = u + \frac{a}{2}(2n-1)$ using velocity ~ time graph.

25. In a harbor wind is blowing at the speed of 72 km/h and the flag on the mast of a boat anchored in the harbor flutters along the NE direction. If the boat starts moving at a speed of 51 km/h to the north, what is the magnitude and direction of the speed of flag on the mast of the boat?

26.A fighter plane flying horizontally at an altitude of 1.5 km with speed 720 km/h passes directly overhead an anti-aircraft gun. At what angle from the vertical should the gun be fired for the shell with muzzle speed 600 m/s to hit the plane? At what minimum altitude should the pilot fly the plane to avoid being hit?(Take g = 10 m/s2).

27.The equation of the trajectory of an oblique projectile is $Y = \sqrt{3}X - gx^2/2v^2\cos 2\theta$,What is the initial velocity and the angle of projection of the projectile.

28..An athlete travels 1.5 times around a circular track in a time of 50 seconds. The diameter of the track is 10m .What is the (a) average speed (b) the magnitude of the average velocity.

UNIT-III

29.A body of mass m is placed on a rough surface with coefficient of friction μ inclined at Θ, if the mass is in equilibrium , then establish relation between μ and Θ.

30.Three identical blocks , each having a mass m, are pushed by a force F on a frictionless table as shown in figure

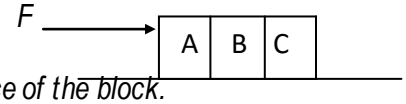
(i) What is the acceleration of the blocks

(ii)What force does A

(III)What force does A apply on B

(IV)What force does B apply on C

(V)Show action- reaction pairs on the contact surface of the block.



31.Give reason

(I) Static friction is a self adjusting friction.

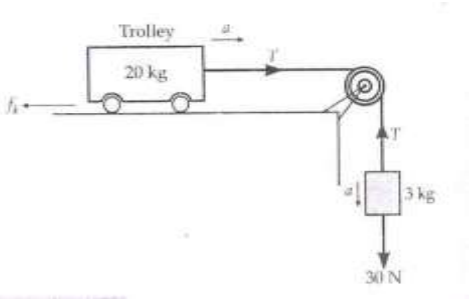
(ii)Kinetic friction is always less than the limiting friction.

(iii) Is it possible to expect the co efficient of friction to be more than 1?

32.State Newton's 's second law of motion ? (b) Obtain the usual formula relating force, mass and acceleration.

33.Define angle of friction and angle of repose. Hence derive a relation between them.

34.What is the acceleration of the block and the trolley system, if the coefficient of kinetic friction between the trolley and the surface is0.04? What is the tension in the string? Neglect the mass of string.(take g= 10 m/s^2



35.Explain with proper diagram why pulling as easier than pushing.

36.A man of mass m = 70 kg, stands on a weighing machine inside an elevator. What is the reading in the weighing machine if (a)The elevator is mars with uniform speed of 5 m / s (b)The elevator accelerates up ward at 5 m / s^2 (c)The elevator accelerates down ward at 5 m / s^2

37. Derive the law of conservation of linear momentum from Newton third law of motion.

38. Two blocks of mass m_1 and m_2 are connected by alight spring of smooth horizontal surface. The two masses are pulled apart and then released; prove that the ratio of their acceleration is inversely pro portional to their masses.

39.A block lies on the floor

i) What is the magnitude of the frictional force on it from the floor?

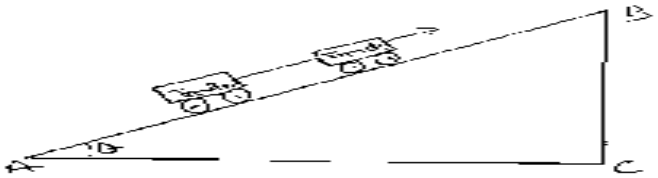
ii)If horizontal force is 5N is applied to the block , but the block does not move what is the magnitude of the frictional force on it

iii)If the maximum value of static frictional force on this block is 10N , will the block move if the horizontally applied force is 5N .

40. A truck tows a trailer of mass 1200 kg at a speed of10 m/s on a level road. The tension in the coupling is 1000N . What is power extended on the trailer?

41. Two masses 8 kg and 12 kg are connected at the two ends of a light inextensible string that goes over

42. Find the tension in the coupling when the truck ascends a road having an inclination of 1 in 6. Assume that the frictional resistance on the inclined plane is the same as that on the level road.

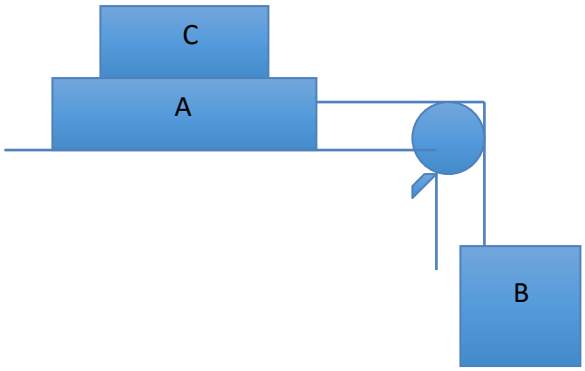


43. Two masses m_1 and m_2 are connected to the ends of a string passing over a pulley. Find the tension and acceleration associated.

44 Distinguish between static friction ,limiting friction and kinetic friction. How do they vary with the applied force,

explain by diagram.
45. What do you mean by equilibrium of concurrent forces? Prove that under the action of three concurrent forces F1,F2 **& F_3** , a body will be in equilibrium when **$F_1+F_2+F_3=0$.**
46.Define the term impulse .Give it's S.I. unit. Prove that the impulse of a force is equal to the change in momentum .
47.Define angle of friction .Find an expression for the work done against friction when a body is made to slide up an inclined plane.
48.A circular race track of radius 300 m is banked at an angle of 15^0.If the coefficient of friction between the wheels of a race car and the road is 0.2 ,what is the
(i) optimum speed of the race car to avoid wear and tear on itstyres, and
(ii) maximum permissible speed to avoid slipping ?
49.A constant retarding force of 50 N is applied to a body of mass 20 kg moving initially with a speed of 15 m/s. How long does it take to stop?

50. The masses A and B are 10 kg and 5 kg are resp. Calculate the minimum mass of C which may stop A from slipping. Coefficient of static friction between A and table is 0.2.



51. How will you find work done by a variable force? What is the significance of F-x graph ?
52. State and prove the law of linear momentum
53..i. Define angle of friction and angle of repose.
ii. Derive the relation between coefficient of friction and angle of friction.
54. A block A of mass 4 kg is placed on another block B of mass 5 kg and the block B rests on a smooth horizontal table. For sliding block A on B, a horizontal force of 12 N is required to be applied on A. How much maximum force can be applied on B so that both A and B move together. Also find acceleration produced by this force .
55.A monkey of mass 40 kg climbs on a rope which stands a maximum tension of 600 N. In which of the following cases will the rope break.
a) When the monkey climbs up with an acceleration of 6 ms^{-2}
b) When the monkey climbs down with an acceleration 4 ms^{-2}
When the monkey climbs up with a uniform speed of 5 ms^{-1}

UNIT-IV

56.What is a collision ? Discuss elastic and inelastic collision of two bodies with example
57.State Work-energy theorem. Proof the same for a variable force.
58. Derive an expression for kinetic energy of a body by calculus method .Establish a relation between Kinetic energy and linear momentum .
59. A bullet weighing 10 gram is fired with a velocity of 800 metre per second after passing through a mud wall 1 metre thick its velocity decreases to 100 m/s. Find the average resistance offered by the mud wall.
60.Give a brief account of elastic collision of 2 dimensions.
61.Prove the law of conservation of mechanical energy for a freely falling object. Also plot the graph of potential and kinetic energy versus position in this case.

62.A block of mass 2 kg is pulled upon a smooth inclined of angle 30^0 with the horizontal if the block moves with an acceleration of 1 ms^{-2}, find the average power delivered by the pulling force at a time 4 s after the motion starts.
63.Prove that in one dimensional elastic collision , the two bodies of same masses exchange there velocities.
64. Prove that some kinetic energy is always lost in an elastic collision in one dimension.
65 What is meant by potential energy of a spring? Obtain an expression for potential energy of a spring and plot a graph of potential and kinetic energy versus distance for a spring.

66.What is an inelastic collision? When does the collision perfectly inelastic? A moving body collides with a stationary body different mass. After Perfectly inelastic collision, both the bodies stick together and move with a common velocity. Derive an expression for this common velocity.

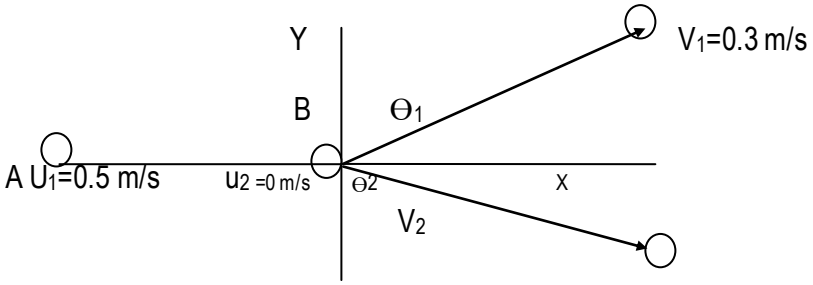
UNIT-V

67.State that theorem of parallel axes ? Find the moment of inertia of a disc, about on axis perpendicular to plane of disc and through its centre.
68. What is the moment of inertia of a ring about a tangent to the circle of the ring?
69. Describe stable, unstable and neutral equilibrium.
70. Obtain an expression for position vector of centre of mass of a two particle system.
71. Deduce the relation between torque and angular momentum.
72. State and prove law of conservation of angular momentum.
73. a. State the theorem of perpendicular axis.
b. Find the moment of inertia of a sphere about a tangent to the sphere
74. Two bodies, a ring and a solid cylinder rule down the same inclined plane without slipping, they start from rest. The radii of the bodies are identical which of the bodies reaches the ground with maximum velocity.
75.If the earth is suddenly shrinks to 1/64th of its original volume, mass remaining constant. Then how would the duration of the day change?
76. What is torque? Write its formula in vector form. Why is it easier to open or close a door by applying force near the hinge?
77. The moments of inertia of two rotating bodies A and B are I_A and I_B . ($I_A > I_B$) and their angular momenta are equal. Which one has greater Kinetic energy.
78. Derive an expression for angular momentum of a body in polar co-ordinates.
79. Find the centre of mass of three particles at the vertices of an equilateral triangle .The masses of the particles are 100 g , 150 g and 200 g respectively. Each side of the equilateral triangle is 0.5 m long.
80. Write the general formula for moment of inertia of a system of n particles. State the theorem of
(i)parallel axes and (ii) perpendicular axes , used in the calculation of moment of inertia.
81. What is centre of mass? Show that the centre of mass of two particle system of equal masses lie at the centre of the line joining them.
82.Three bodies a ring, a solid cylinder and a solid sphere roll down the same inclined plane without slipping .They start from rest .The radii of the bodies are identical .Which of the bodies reaches the ground with maximum velocity?
83.What is moment of inertia . Write its dimensional formula. Establish relationship of moment of inertia with
i) Torque ii) K.E
84. What constant torque should be applied to a disc of mass 10 kg and diameter 50cm so that it acquires an angular velocity
of 2π rad/s in 4s? The disc is initially at rest and rotates about an axis through the centre of the disc and in a plane perpendicular to the disc
85.A 3m long ladder weighing 20 kg leans on a frictionless wall. Its feet rest on the floor 1 m from the wall. Find the reaction forces of the wall and the floor.
86.A star of mass = two solar masses and radius10^6km rotates about its axis with an angular speed of 10^{-6}rad/s. What is the angular speed of the star, when it collapses due to inward gravitational forces to a radius of 10^4km?

87.A ball moving with a speed of 9m/s strikes an identical ball at rest, such that after collision, the direction of each ball makes an angle of 300 with the original direction. Find the speeds of two balls after collision.
88.. Two springs have spring constants K_A and K_B such that $K_A < K_B$ are applied with same force.
Then which spring will store more energy?

89. A particle $\overrightarrow{m}$oves from position $r_1 = 3i + 2j - 6k$ to position $r_2 = 14\,i + 13\,j - 9k$ under the action of a force $F = 4i + j + 3k$. Calculate the work done by the force.

90. Consider the collision depicted in given fig. to be between two billiard balls with equal masses $m_1 = m_2$. The first ball is called the cue while the second ball called the target. The billiard player wants to 'sink' the target ball in a corner pocket, which is at an angle $\theta_2 = 37°$. Assume that the collision is elastic and that friction and rotational motion are not important. Obtain θ_1.



SECTION-D, (VALUE BASED -4 MARKS)

1. .Kiran and Rajan were going to market they spotted a man who left a black bag in the corner of a stall and ran away. They went near it and heard some ticking sound coming from it . They immediately called police and alerted the people nearby. By their alertness, a major tragedy was overcome.

(i) What quality of Kiran and Rajan do you appreciate?

(ii)A bomb at rest explores into 2 fragments of mass 3.0 kg and 1.0 kg .The total KE of fragment is 6×10^4J. Calculate the KE of bigger fragment.

(iii) In which type of collisions elastic or inelastic momentum is conserved?

2. Pratyush a student of class xi, went to railway station to see up his friend, At platform he saw a boy about 10 years old was carrying a heavy load in his head. Suddenly a man came and put a heavy bag on his head. pratyush could not tolerate the pain of the boy .He went to him , helped him to pick up the bag and asked why you, don't go to school, the boy replied my parents are unable to send me to school as they are very poor .After knew all about the boy Pratyush motivated the boy to go school.

i) What does this tell you about the nature of Pratyush?

ii) When a work done is said to be positive

iii)If a boy support a bag of 18 kg on his head , Calculate work done by him if he moves a distances of 50m on a horizontal road

3..Rahul was coming to his home from school. The weather was very cold. He noticed that a old man was lying on a road side. He was shivering ,Rahul started rubbing the hands and feet of the old man.After some time, the old manopened his eyes and sat on the ground .Rahul helped the man to his home .

(i) Why Rahul rubbed the hands and feet of the man ?

(ii) What are the values shown by Rahul ?

4 Rama went to railway station to see off his uncle .At platform he saw that old coolei was carrying heavy load on his head. suddenly the coolie tripped and a baggage fell off his head . The owner of the bag started shouting at the old man . Rama could not tolerate this . He went to the old man ,helped him in picking up the baggage and offered to carry some load for him.

a)What does this tell you about the nature of Rama.

b)A man weighing 55 kg supports a body of 20 kg on his head . Calculate the work done by him if he moves through a distance 20 m on a horizontal road.

c)When is the work done is negative.

5.Rahul went to a mall to purchase certain goods. There he noticed an old lady struggling with her shopping. Immediately he showed her the lift and explained to her how it carries the load from one floor to the next. Even then the old lady was not convinced. Then Rahul took her in the lift and showed her how to operate it.
The old lady was very happy.

(a) What values does Rahul possess?

(b) An elevator which can carry a maximum load of 1800 kg is moving up with a constant speed of 2 m/s. The frictional force opposing the motion is 4000 N. Determine the minimum power delivered by the motor to the elevator in watts as well as in horse power.

6 Sara was afraid on going anywhere by air. But she couldn't avoid going by an air. Her friend Hema who knew her problem was with her. Inside the plane Hema saw that Sara was quiet and feeling uncomfortable. She tried to talk to Sara but she didn't answer. As the plane was about to take off, Hema started fighting with Sara without any cause for diverting her mind. While fighting Sara didn't realize that plane had taken off and how she was in air. She felt very happy to overcome her fear.

(a) What values do you associate with Hema?

(b) A bomb of mass 40 kg is dropped from an aeroplane at a height of 1km above the ground. What is its kinetic energy

(i) at the end of 10 s?

(ii) on reaching the ground?

7.Manu went to railway station to see off his uncle. At platform, he saw that an old coolie was carrying heavy load on his head. Suddenly the coolie tripped and a baggage fell off his head. The owner of the bag started shouting at the old man. Manu couldn't tolerate this. He went to the old man, helped him in picking up the baggage and offered him to carry some baggage for him.

(i) What does this tell you about the nature of manu?

(ii) A man weighing 55kg supports a body of 20kg on his head. Calculate the work done by him if he moves a distance of 20m(a) on horizontal road(ii)upon a smooth inclined plane of vertical component 0.2.(take $g=10m/s^2$)

8. A fast moving train collided against a stationary train . Moving train was damaged very badly and the passengers were injured seriously . This accident took place near the village of Robin. When he came to know about the accident, he started shouting. Villagers gathered on the sight of accident. Robin immediately informed the nearby police station on telephone. He started helping the villagers to evacuate the injured persons from the train. Police party came the accident sight along with ambulances and fire brigades. The injured passengers were shifted to the nearby hospital for treatment. [4]

(i). Why was fast moving train damaged very badly?

(ii). What are the values displayed by Robin?

9.Riya and Monu lived with their parents .Their parents worked very hard to meet their requirements. They both realised that they could get their mother a washing machine by saving their pocket money as they both knew about the utility of washing machine and it could save their mother's time as well . So , both of them started saving their pocket money and within a year, they presented a washing machine to their mother.

What qualities of children do you appreciate ?

The spin dryer of washing machine revolving at 15 rps and after some time , it slows down to 5 rps while making 50 revolutions . Find

a. Angular acceleration
b. The time taken

For rotation about fixed axis, which part of angular velocity ω change ?

SECTION-E (5-MARKS)

UNIT-II

1.State parallelogram law of vectors addition. Find analytically the magnitude and direction of resultant vector.

Write down relation between $\vec{A}$ and $\vec{B}$ in each case .

(i) $\vec{A} + \vec{B} = \vec{C}$ and A+B=C

(ii) $\vec{A} + \vec{B} = \vec{A} - \vec{B}$

(ii) $\vec{A} + \vec{B} = \vec{C}$ and $A^2 + B^2 = C^2$

2.

(a) Show that the path of a projectile is parabolic.

(b) Determine the condition of maximum horizontal range.

(c) Find the angle of projection for which the projectile has same horizontal range .

3.A body is projected horizontally from the top of a building of height h. Velocity of projection is u. Find

i) The time it will take to reach the ground.

ii) Horizontal distance from foot of building where it will strike the ground.

iii) Velocity with which the body reach the ground.

4.Define the term relative velocity.

(a) Draw the position time graph of two objects moving with different velocities and one overtakes the other.

(b) Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T minute. A man cycling with a speed of 20 km/h in the direction A to B notices that a bus goes past him every 18 minutes in the direction of his motion, and every 6 minutes in the opposite direction. What is the period T of the bus service and with what speed do the busses ply on the road?

5.. A particle is executing uniform horizontal circular motion with a speed 'v' along a circular path of radius 'r'.

(a) Why do we regard the particle as having an accelerated motion, even though its speed is constant?

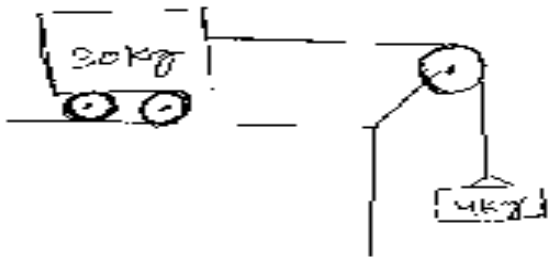
(b) Obtain the expression for this acceleration

(c) Write this expression in vector form.

(d) Show that this acceleration is centripetal in nature.

UNIT-III

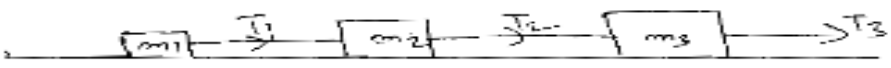
6.Compute the acceleration of the block and trolley system as shown. If the coefficient of kinetic friction between the trolley and the surface is 0.04, what is tension in the string? ($g=10\ m/s^2$)



7. State Newton's second law of motion. Hence deduce Newton's first law and Newton's third law from it .

8.What is meant by banking of roads ? What is the need for banking a road ? Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle θ .The coefficient of friction between the wheels and the road is μ

9.Three blocks are connected as shown on a horizontal frictionless table, and pulled to the right with a force of $T_3=60$ N.



If $m_1=10$ kg, $m_2=20$ kg and $m_3=30$ kg Prove that $T_1/T_2 = 1/3$

10..Define angle of friction. A body is lying on an inclined plane, inclined at an angle θ to the horizontal. Draw the free body diagram for the forces acting on the body and obtain an expression for minimum value of force needed to just slide down an inclined plane.

11.(a) State the laws of limiting friction.

(b) Derive the expression for maximum velocity with which a car can round a level curved road.

(c) Prove that a safe turn should neither be fast nor be sharp.

12.State and derive conservation theorem of linear momentum.

A bomb at rest explodes into three fragments of equal masses. Two fragments fly off at right angles to each other with velocities of 9m/s and 12 m/s. Calculate speed of the third fragment.

13.A block of mass 2kg slides on an inclined plane which makes an angle 30^o with the horizontal .

The coefficient of friction between the block and the surface is $\sqrt{3}/2$.

i) What force should be applied to the block so that the block move down without acceleration .

ii) What force should be applied to the block so that the block moves up without acceleration?

14..(a)Why are circular road banked? Deduce an expression from the angle of banking?

(b) A circular race track of radius 300m is banked at an angle 15^0. If the coefficient of friction between the wheel of race car and road is 0.2. What is the

(i) Optimum speed of the race car to around wear and tear on its tyres.

(ii) Maximum permissible speed to avoid slipping?

UNIT-IV

15.Discuss elastic collision in one dimension. Obtain expression for velocities of the two bodies after such a collision.

16.Consider a mass m attached with a string L moving in a vertical circle. Find the expression for

(i). Tension at any point in the string.

(ii). Velocity required at the lowest point of the vertical circle so that the object can move safely in the vertical circle.

UNIT-V

17.Prove that the angular momentum of a particle is twice the product of its mass and areal velocity .
How does it lead to the kepler's second law of planetary motion?

18.Define moment of inertia? Derive an expression for moment of inertia of a disc about one of it diameters?

19 i)Derive the relations (a) $L=I\omega$ b) $\tau = I\alpha$ ii) What is law of conservation of angular momentum?

20.. Explain the concept of torque of a force about a given centre of rotation .Show that the torque is given by the product of the force and its lever arm.

A man is standing on the centre of a rotating table with his arms stretched outwards. The table is rotating freely with an angular speed of 24 revolutions per minute. Now the man withdraws his hands towards his chest and thereby reduces his moment of inertia to 3/5 times' original moment of inertia .Calculate the angular speed of the man when he withdraws his hands.

21.Define moment of inertia .Derive an expression for M.I. of a thin rod of length L and mass M about an axis passing through its centre and perpendicular to its length .

Calculate the moment of inertia of a ring of mass 2 g and radius 2 cm about (i) an axis passing through its centre and

22.A uniform rod of length 1 m having mass 1kg rests against a smooth wall at an angle of 30° with the ground. Calculate the force exerted by the ground on the road.

23..Define center of mass of a system of particle. Hence derive an expression for the center of mass of a two particle system.Three point masses of 1kg,2kg and 3kg lie at (1,2),(0,-1) and (2,-3) respectively. Calculate the co-ordinate of center of mass of the system.

24.Obtain an expression for linear acceleration of a cylinder rolling down an inclined plane and hence find the condition for the cylinder to roll down the inclined plane without slipping .