DELHI PUBLIC SCHOOL, DURGAPUR

QUESTION BANK & REVISION SHEET FOR BLOCK TEST-I (2018-19)

CLASS-XI

SUBJECT: PHYSICS

Physical world and Measurement **Kinematics** **Laws of motion**

1. Find out the dimension of a and b in the following expressions:
   (a) $v^2 = u^2 + as^{\frac{1}{2}}$ (b) $E = \frac{a - t^2}{bx}$ (c) $x = a + bt + ct^2 + dt^3$ (d) $P = \frac{a + bx}{t}$
2. Where, u, v, s, E and P are the initial velocity, final velocity, displacement, energy and power respectively. The length and radius of a cylinder are respectively (10 ± 0.2)cm and (5 ± 0.3)cm. Calculate the percentage error in finding its volume.
3. Two resistances $R_1 = (25 \pm 0.1)\Omega$ and $R_2 = (3 \pm 0.4)\Omega$ are connected in series. Calculate the relative error in measuring their equivalent resistance.
4. Convert the following using the tabular method:
   (a) 6.67×10^{-11} Nm^2kg^{-2} into CGS unit. (b) 4 joule into erg. (c) 25 N into dyne.
5. For what value of p, are the vectors $\vec{A} = 2\hat{i} + p\hat{j} - 2\hat{k}$ and $\vec{B} = 3\hat{i} - \hat{j} + 2\hat{k}$ (a) parallel (b) perpendicular to each other?
6. State triangle law of vector addition. Hence derive the magnitude and direction of the resultant of two vectors, inclined at certain angle with respect to each other.
7. Calculate the angle between the two vectors $\vec{A} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{B} = 2\hat{i} + \hat{j} + 4\hat{k}$.
8. Draw the velocity-time graph for the following cases:
   (a) a pendulum is oscillating.
   (b) a car is parked at the roadside.
   (c) an object falling freely under gravity.
   (d) A boy going to school with a constant velocity, then comes back too home with same velocity after the dispersal of school.
9. Calculate the range of projectile. For what value of the angle of projection, will the range of a projectile be maximum?
10. What will be the ratio of ranges of two projectiles, which are thrown with the angle of projections, complimentary to each other?
11. State the parallelogram law of vector addition. Under what condition, the resultant becomes perpendicular to one of the vectors?
12. Find the angle between two equal vectors, whose resultant is equal to either of the vectors.
13. What do you mean by rectangular resolution of vector?
14. Prove the equation of motion using calculus method: (a) $v^2 = u^2 + 2as$. (b) $s = ut + \frac{1}{2}at^2$.
15. Derive the relation between linear and angular acceleration.
16. Why is centrifugal force called a pseudo force?
17. Calculate the ratio of the speeds of a hour hand and a minute hand, whose lengths are 14 cm each.
18. An object is launched at a velocity of 20 m/s in a direction making an angle of 30° upward with the horizontal.
    a) What is the maximum height reached by the object?
    b) What is the total flight time (between launch and touching the ground) of the object?

c) What is the horizontal range (maximum x above ground) of the object?
d) What is the magnitude of the velocity of the object just before it hits the ground?

19. Show that, a given gun will shoot three times as high when elevated at an angle of 60^0 as when fired at angle of 30^0, but will carry the same distance on the horizontal plane.

20. A ball is kicked at an angle of 35° with the ground.
a) What should be the initial velocity of the ball so that it hits a target that is 30 meters away at a height of 1.8 meters?
b) What is the time for the ball to reach the target?
21. A particle P is moving along a straight line with a velocity of 5 ms^{-1} and another particle Q has a velocity of 12 ms^{-1} at an angle of 30^0 to the path of P. Find the speed of Q relative to P.

22. Can an object, having zero velocity, have acceleration?
23. Two cars are moving in the same direction with speed 30 km/hr. they are separated by a distance of 5 km. what is the speed of a car moving in the opposite direction if it meets these two cars at an interval of 4 mins?
24. A police van moving at a speed of 30 km/hr fires a bullet at a thief's car moving at a speed of 190 km/hr. if the muzzle speed of the bullet is 150 km/hr, find speed of the bullet the thief's car will observe.
25. Three boys A, B and C are situated at the vertices of an equilateral triangle of side 'd' at t=0. Each of the boys moves with constant speed 'v'. A always moves towards B, B towards C and C towards A. At what time and where will they meet each other?

Work, Energy & Power & Gravitation

1. Define work. Write down its SI unit. Define 1J work.
2. How can you explain about positive, negative and zero work? Give examples of each type.
3. Why is the work done on a body by centripetal force is zero?
4. Derive the dimension of work done.
5. Find out the relation between 1J and 1 erg.
6. Express work done in terms of rectangular components.
7. Explain work done by a variable force may be measured graphically?
8. What is the work done by a coolie, who is walking along a platform, carrying a suitcase?
9. Is it possible that a body, be in accelerated motion under a force acting on the body, yet no work is being done by the force? Explain your answer giving a suitable example.
10. Define the term energy. What are its units and dimension?
11. Name the different types of energy.
12. What is mechanical energy? What are its two forms?
13. Derive an expression of the kinetic energy of a body of mass 'm', moving with a velocity of 'v'.
14. Derive an expression of the kinetic energy of a body using calculus method.
15. State and explain work-energy theorem.
16. Prove the work-energy theorem for a variable force using calculus method.
17. Give some examples of potential energy of a body, due to its position and its configuration.
18. Define gravitational potential energy. Derive an expression of it.
19. What do you mean by conservative force?
20. Show analytically that, gravitational force is a conservative force.
21. State and prove the principle of conservation of mechanical energy.
22. Prove that, total mechanical energy of a body falling freely under gravity is constant.
23. Plot the variation of P.E. and K.E. of a body during its free fall.

24. Derive the expression of potential energy of a elastic stretched spring. Also, plot the variation of energy of a spring with the displacement.
25. Write a short note on: Einstein's mass-energy equivalence.
26. State the principle of conservation of energy.
27. What are the different types of collision? Write down the characteristics of elastic collision.
28. Prove that, in an elastic one-dimensional collision between two bodies, the relative velocity of approach is equal to the relative velocity of separation. Hence derive the expression of their final velocities.
29. What can you say about the final velocities of two objects of equal masses, when they collide elastically?
30. Show that, in perfectly inelastic collision, energy is invariably lost.
31. Write a short note on: Elastic collision in two dimensions.
32. What is meant by coefficient of restitution? What is its significance?
33. Define the term Power. Write its unit and dimension.
34. How is the instantaneous power related with force and velocity?
35. Define kilowatt-hour. Convert it into Joule.
36. Write down the difference between gravitation and gravity.
37. State and explain Newton's law of gravitation. Why G is called universal constant?
38. Write down the value, unit and dimension of G.
39. Derive the relation between g and G.
40. Derive the variation of g with respect to the distance of an object from the centre of the earth. Hence draw the relevant graph.
41. Why do we feel heavier in the poles than in the equator?
42. State Kepler's laws of planetary motion.
43. Define escape velocity of earth. Derive its expression.
44. What is the value of escape velocity for earth?
45. Derive an expression for the velocity and time period of a satellite moving around the earth.
46. Show that, the escape velocity is $\sqrt{2}$ times the orbital velocity of a satellite, revolving close to earth.
47. Write short notes on: Geo-stationary satellite, Polar satellite, Parking orbit.
48. Mention some evidences in support of existence of gravitational force.
49. State and explain the superposition principle of gravitational force.
50. Derive the expression of gravitational potential energy using the calculus method.
51. Deduce Newton's law of gravitation from Kepler's third law.
52. How does weightlessness arise in various situations?

System of Particle of a rigid body and rotational dynamics

1. What do you mean by centre of mass?
2. Write an expression of the location of centre of mass of a two particle system.
3. Show that, in absence of any external force, the velocity of centre of mass remains constant.
4. Show that, the total linear momentum of a system of particles is conserved in absence of any external force.
5. Show that, total linear momentum of a system is equal to the product of the total mass of the system and the velocity of the centre of mass.
6. If three point masses *m1*, *m2* and *m3* are situated at the vertices of an equilateral triangle of side *a*, then what will be the coordinates of the centre of mass of the system?
7. What is a rigid body? Give examples.
8. What is meant by rotational motion of a rigid body?
9. Derive three equations of rotational motion under constant angular acceleration from first principle.

10. On what factors does the turning effect of a force depend? What is this turning effect called?
11. Define torque. Write down its unit and dimension.
12. State and explain the principle of moments of rotational equilibrium.
13. What is a couple? Write its effect.
14. Show that the moment of a couple is irrespective of the position of the centre of rotation.
15. How is the direction of torque predicted?
16. Define the term angular momentum. Write its unit and dimension.
17. Show that the angular momentum is produced only by the angular component of linear momentum.
18. Express angular momentum in terms of the linear momentum and position vectors.
19. Deduce the relation between torque and angular momentum.
20. Prove and explain Kepler's second law of planetary motion.
21. Prove that the rate of change of total angular momentum of a system of particles about a reference point is equal to the total torque acting on the system.
22. State and explain the concept of moment of inertia.
23. Distinguish between stable, unstable and neutral equilibrium.
24. Derive the relation between rotational kinetic energy and moment of inertia for a system of n number of particles.
25. State and explain the theorem of perpendicular axis theorem.
26. State and explain the theorem of parallel axis theorem.
27. Derive the relation between torque and moment of inertia.
28. Derive the relation between angular momentum and moment of inertia.
29. State and explain the principle of conservation of angular momentum.
30. Explain different types of rolling motion.

SYLLABUS

1. Physical world and Measurement
2. Kinematics
3. Laws of motion
4. Work, Energy and Power
5. System of particles of a rigid body and rotational dynamics
5. Gravitation