SHARJAH INDIAN SCHOOL

SECOND TERM EXAM – NOVEMBER 2009

Class : XI (Girls Wing)
Subject : PHYSICS
Day & Date: Monday, 23.11.2009

Time Allotted : 3 hrs.
Max. Marks : 100

General Instructions

1. *All questions are compulsory..*
2. *There are 30 questions in total. Question Nos. 1 to 8 carry 1 mark each. Questions 9 – 18 carry 2 marks each. Question 19 – 27 carry 3 marks each and Questions 28 to 30 carry 5 marks each.*
3. *There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all three questions of 5 marks each. You have to attempt only one of the given choices in such questions.*
4. *Use of calculators is not permitted.*

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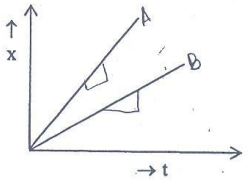
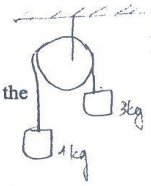
1. Which of the length measurements is the most accurate and why?
   (a) 500.0 cm (b) 0.005 cm (c) 5.00 cm.
2. If the speed of a body and radius of the circular path are doubled, what will be the change in centripetal force?
3. A lift is accelerated upwards. Will the apparent weight of a person inside the lift increase, decrease or remain the same relative to real weight?
4. Two bodies m_1 and m_2 ($m_1 > m_2$) have equal kinetic energies. Which will have more momentum?
5. If the ice on the polar caps of the earth melts, how will it affect the duration of the day?
6. Can a pendulum oscillate in an artificial satellite?
7. Why is steel more elastic than rubber?
8. Hydrostatic pressure is a scalar quantity even though pressure is force divided by area. Why?
9. Calculate the percentage error in density, if mass of the substance is $M = (20 \pm 0.2)$ kg and volume $V = (10 \pm .1)\ m^3$?
10. The displacement–time graph of two cars A and B are shown in figure. Which of the two cars moves faster?



11. At what angle do forces P + Q and P – Q act so that their resultant is $\sqrt{3P^2 + Q^2}$?
12. Derive the expression for work done in moving a body up an inclined plane.
13. Two masses m = 3 kg and m = 4 kg are connected to the free ends of an inextensible string which passes over a frictionless pulley suspended by a inextensible string to a rigid support as in figure. Calculate (i) acceleration of the system (ii) tension in the string.



14. A particle moves from position $\vec{r}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$ to position $\vec{r}_2 = 14\hat{i} + 13\hat{j} - 9\hat{k}$ under the action of force $4\hat{i} + \hat{j} + 3\hat{k}$ N. Calculate the work done.

OR

State and prove work–energy theorem.

15. Equal torques are applied on a solid cylinder and hollow sphere. Both have same mass and radius. The cylinder rotates about its axis and the sphere rotates about its diameter. Which will acquire grater speed?
16. Derive the relation between torque and moment of inertia of the body.
17. A 2 kg stone is weighed by a spring balance at the pole and at the equator. Where will the weight be maximum?

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18. When the pressure on a sphere is increased by 80 atmospheres, then its volume decreases by 0.01%. Find the bulk modulus of elasticity of the material of sphere.

19. A projectile is projected with velocity υ making an angle θ with horizontal direction, find (a) time of flight (b) horizontal range

OR

There are two displacement vectors, one of magnitude 3m and other of magnitude 4m. How should the two vectors be added so that the magnitude of resultant vector be (a) 7m (b) 1m (c) 5m ?

20. The displacement (in metre) of a particle moving along x-axis is given by $x = 18t + 5t^2$. Calculate (i) instantaneous velocity at $t = 2$ s
    (ii) average velocity between $t = 2$ s and $t = 3$ s
    (iii) instantaneous acceleration

21. Derive an expression for the safe velocity for negotiating a curve by a body on a banked road with frictional coefficient μ .

22. A stone is dropped from a height h. Prove that the total energy at any point in its path is mgh.

23. Define rigid body. Name two kinds of motion which a rigid body can execute. For the equilibrium of a body, two conditions need to be satisfied. State them.

24. Define escape velocity. Obtain an expression for the escape velocity of an object of mass m from the surface the earth of mass M and radius R.

25. Define Impulse. A cricket ball of mass 150g moving with speed of 12 m/s is hit by a bat so that the ball is turned back with a velocity of 20 m/s. Calculate the impulse received by the ball.

26. A solid cylinder of mass 20kg rotates about its axis with angular speed 100 rad/s. The radius of the cylinder is 0.25m. What is the kinetic energy associated with the rotation of the cylinder? What is the magnitude of angular momentum of the cylinder about its axis?

27. Explain why –
    (a) The blood pressure in humans is greater at the feet than at the brain?
    (b) Why is mercury preferred as a barometric substance over water?

28. (a) State Hooke's Law.
    (b) Derive an expression for elastic potential energy in a stretched wire and show that elastic energy density = ½ × stress × strain.

OR

    (a) State Pascal's Law.
    (b) A tank with a square of area $1m^2$ is divided by a vertical partition in the middle. The bottom of the partition has a small hinged door of area $20cm^2$. The tank is filled with water and an acid of relative density 1.7 in the other, both to a height of 4m. Calculate the force necessary to keep the door closed.

29. (a) Prove that acceleration due to gravity varies with height as $g^1 = g\left(1-\frac{2h}{R}\right)$

    (b) Draw graph showing variation of acceleration due to gravity with
    (i) height above surface of earth (ii) depth below the surface of earth.

OR

    (a) What is the difference between gravitational potential and gravitational potential energy?
    (b) Derive the expression for gravitational potential energy.

30. (a) State the parallel axes theorem.
    (b) Write the expression for moment of inertia of the thin rod about an axis perpendicular to it and passing through mid point.
    (c) An energy of 484 J is spent in increasing the speed of a flywheel from 60 rpm. to 360 r.p.m. Find the moment of inertia of the flywheel.

OR

    (a) Derive the expression for rotational kinetic energy of a rigid body.
    (b) In the H Cl molecule, the separation between the nuclei of the two atoms is about 1.27 A° ($1A° = 10^{-10}$ m). Find the approximate location of the centre of mass of the molecule, given that the chlorine atom is about 35.5 times as massive as a hydrogen atom and all the mass of an atom is concentrated in its nucleus.

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29. (a) State Kepler's laws of planetary motion.
    (b) Derive an expression for gravitational potential energy near the surface of earth.

    OR

    (a) Define Escape Velocity.
    (b) Derive an expression for escape velocity.
    (c) How is it related to orbital velocity near the surface of earth?
    (d) Write reason why the moon does not have an atmosphere around it.

30. (a) State parallel axes theorem and perpendicular axes theorem.
    (b) Write an expression for moment of inertia of a ring about an axis through the centre and perpendicular to its plane. Hence, find an expression for moment of inertia about
    (i) diameter (ii) tangent parallel to the diameter of the ring.

    OR

    A body is projected with a velocity u at an angle of θ with the horizontal.
    Derive relations for (i) path followed (ii) time of flight (iii) maximum height
    (iv) horizontal range (v) maximum range

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1. Write the dimensional formulae of (i) Angular Acceleration (ii) Moment of Force
2. A ball takes t sec to fall from a height h_1 and $2t$ sec to fall from a height h_2. Find $\frac{h_1}{h_2}$.
3. Is it possible to have a two dimensional motion with an acceleration only in one dimension. Illustrate.
4. What happens to the linear momentum of a system when the force is absent?
5. Draw a graph showing the variation of kinetic energy of a freely falling body with its height above the ground.
6. What is the radius of gyration of a circular disc rotating about its diameter?
7. Friction is a non conservative force. Why?
8. A satellite requires no fuel for revolution around the earth. Why?
9. The velocity of a body falling freely from a height h varies as $g^p h^q$ where g is the acceleration due to gravity. By dimensional analysis determine the values of p and q.
10. Derive an expression for displacement by drawing velocity-time graph of a particle moving along x axis with a uniform positive acceleration.
11. Two equal vectors have their resultant equal to either of them. What is the angle between them?
12. State and prove work-energy theorem.
13. The SI and CGS units of energy are joule and erg respectively. Using the method of dimensions find the relation between the units.
14. The angle between two vectors $\vec{A}$ and $\vec{B}$ is 45°. Find the ratio of $\vec{A}.\vec{B}$ and $|\vec{A}\times\vec{B}|$.
15. Derive an expression for kinetic energy of rotating body.

    OR

    Derive the relation $L = I\omega$ for a rotating body.
16. The escape velocity of a body of mass 10kg is equal to v. What will be the escape velocity for a body of mass 50kg? Why?
17. If the maximum range of a projectile is numerically equal to the time of flight, find the velocity of projection.
18. Write two conditions for the equilibrium of a rigid body.
19. (a) State the laws of friction.
    (b) Ball bearings are used in machinery. Write reason.

20. State Newton's second law of motion.
With the help of this deduce the law of conservation of momentum.

OR

State Newton's first law of motion.
A player throws a ball with an initial velocity 29.4 m/s. After how long the ball returns to player's hand?

21. (a) Find an expression for the optimum speed of a car moving along a banked road to avoid wear and tear on its tyres.
    (b) An aircraft executes a horizontal loop at a speed of 720 km/hr with its wings banked at 15°. What is the radius of the loop?

22. A car and truck have same kinetic energy at a certain instant while they are moving along the same parallel road.
    (a) Which one will have greater momentum? Why?
    (b) If the mass of the truck is 100 times greater than that of car, find the ratio of their velocities.

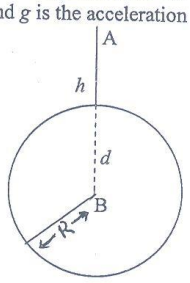
23. (a) As the earth approaches near the sun in its path it moves faster. Why?
    (b) Determine the duration of the day if it suddenly shrinks to ½ of its present radius while the mass remains unchanged.

24. Three bodies of masses m, m, 2m placed at the three vertices of an equilateral triangle of side ℓ. Determine the location of centre of mass.

25. A body is displaced from $(2\hat{i}-3\hat{j}+4\hat{k})$ to $4\hat{i}+\hat{j}+5\hat{k}$ by a constant force given by $F=(-\hat{i}+2\hat{j}+3\hat{k})$ Newton
    (a) Calculate the work done.
    (b) Find the cosine of the angle between force and displacement.

26. A car travels with a uniform velocity 72 km/hr. the driver applies brakes and the car comes to rest with a uniform retardation in 10 sec.
Find (i) retardation (ii) velocity after 3 sec. (iii) distance travelled by the car after the brakes are applied.

27. Earth can be considered as a sphere of radius R and mass M. A is a point at a height h above the earth's surface, B is another point at a depth d below the earth's surface and g is the acceleration due to gravity on the surface.



    (a) Obtain the formula to evaluate acceleration due to gravity at A.
    (b) What is the value of acceleration due to gravity at B ?

28. (a) Distinguish between elastic and inelastic collision.
    (b) Derive an expression for the final velocities of two bodies undergoing head on collision (elastic) in one dimension.
    (c) Can a body have energy with out momentum? Explain.

OR

    (a) What is meant by centripetal acceleration?
    (b) Derive an expression for centripetal acceleration in terms of angular velocity.
    (c) Express centripetal acceleration in terms of frequency.

SHARJAH INDIAN SCHOOL

SECOND TERM EXAMINATION NOV- 2011

Class :XI(Boys Wing)
Subject:Physics
Day & Date:Saturday,19-11-2011

Time Allotted:3 hrs
Max.Marks:70

1. Give examples for the following:
   a)A dimension less,unitless physical quantity.
   b) A dimension less quantity but having unit in SI system .
2. SI system is coherent system of unit.Why?
3. The displacement of a particle varies with time as $\sqrt{x} = 7 + t$.Find the velocity?
4. A horse cannot pull a cart in empty space.why?
5. Is it possible that a body to be in accelerated motion under a force acting on it yet no work is being done by the force write example.
6. When an apple falls towards the earth,the earth moves towards the apple.Why is the earth's motion not noticeable ?
7. Write an example for a motion in which angular momentum remains constant ?
8. Why the beams used in the construction of bridges have a cross section of the type 'I' ?
9. A stone is thrown upward from the ground with a velocity 'u'
   a) What is the maximum height attained by the stone?
   b) Check the correctness of the equation obtained in (a)
10. The velocity of sound 'v' through a medium may depend up on density 'p'of the medium and modulus of elasticity 'E'.Deduce an expression for the velocity of sound in the medium by dimensional analysis.
11. Derive the position-velocity relation of a body moving with uniform acceleration by Calculus method.
12. Linear momentum of a body is increased by 100%.Find the percentage increase in kinetic energy.

    OR

    Kinetic energy of a body is increased by 300%.Find the percentage increase in linear momentum.
13. What is impulse ? why is it danger to jump from a height to a marble floor than to a heap of sand ?
14. How does the centre of mass of a shell move when it explodes.why?
15. A force 'F' produces an elongation 'l' in a wire.What force is required to produce the same elongation in a wire of same material and radius but length twice the first one ?
16. Show that the weight of all bodies is zero at the centre of the earth ?
17. Show that the potential energy per unit volume of a stretched wire is given by
    ½ x stress x strain:
18. What are the conditions to be satisfied for the mechanical equilibrium of a body ?
19. A ball of mass 'm' is projected at an angle with the ground .It is found that its kinetic energy at the highest point is 75% of that at the point of projection.
    a) Find the angle of projection.
    b) Write another angle which produces the same range ?
    c) Which is the angle preferred by athletes in throws?
    Write reason.
20. a) State parallelogram law of Vectors.
    b) Find the angle between two non zero vectors $\vec{A}$ and $\vec{B}$ if $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$
21. a) State Newton's third law of motion.
    b) Find an expression for recoil velocity of the gun when a bullet is fired from it.

    OR

    a) State Newton's first law of motion.
    b) A player throws a ball with an initial velocity 29.4 m/s .After how long the ball returns to player's hand.

22. a) Define the angle of friction ?

b) Show that the coefficient of friction $\mu = \tan \theta$.

c) Find the force of friction acting on a body of mass 5kg on a plane at an angle of friction 30^{o}

23. a) Distinguish between elastic and inelastic collision?

b) The bob of a simple pendulum of length 2m is released from a horizontal position A. What is the speed with which the bob arrives at the lower most point B, given that 10% of the energy of the bob is dissipated by air resistance ? ($g = 10m/s^2$)

24. a) Derive the relation $L = I\omega$ for a rotating body.

b) What will be the effect on the length of the day if the earth is suddenly collapsed in to a sphere of smaller radius. Why ?

25. Derive an expression for the gravitational potential energy near the surface of earth.

26. A boy of mass 30kg climbs on a rope which can with stand a maximum tension of 400N, will the rope break if the child.

a) Climbs up with an acceleration of $4m/s^2$

b) Slips down with an acceleration of $6m/s^2$

c) Climbs with a uniform speed of 2m/s (Given $g = 10m/s^2$)

27. The moment inertia of a circular disc about a perpendicular axis through the centre is $MR^2 / 2$.

a) Find the moment of inertia of the disc about an axis through any diameter?

b) State the theorem used.

c) A soild cylinder of mass 10kg rotates about its axis with an angular velocity 50 rad/s. The radius of the cylinder is 0.20m. Find the kinetic energy of rotation.

28. a) Show that a body falls freely under gravity obeys the law of conservation of energy.

b) A bus and a car moving with the speed same kinetic energy is brought to rest by applying an equal retardation force by the brake system. Which one will come to rest at a shorter distance? Give reason

OR

a) Derive an expression for the potential energy of a stretched spring ?

b) Draw a graph showing the variation of force and displacement of the stretched spring.

c) What does area under the graph represent ?

29. a) Define escape velocity ?

b) Derive an expression for escape velocity?

c) State and prove Kepler's third law of planetary motion.

OR

a) Derive an expression for the orbital velocity of a satellite revolving round the earth ?

b) What are geostationary satellites and polar satellites.?

c) What is meant by weightlessness?

30. a) State and prove Bernoulli's theorem

b) Name any two applications of the theorem.

c) Write the limitations of Bernoulli's theorem

OR

a) State Stoke's law?

b) Define terminal velocity and find an expression for it in the case of a sphere falling through a viscous liquid.

SHARJAH INDIAN SCHOOL

SECOND TERM EXAMINATION NOVEMBER - 2012

Class : XI (Boys Wing)
Subject: Physics
Day & Date: Sunday, 25.11.2012

Time Allotted:3 Hrs
Max.Marks:70

General Instructions

1.All questions are compulsory.

2. There are 29 questions in total. Questions 1–8 carry 1 mark each, questions 9-16 carry 2 marks each, questions 17-25 carry 3marks each and questions 27-29 carry 5 marks each. Question 26 is a value-based question and carries 4 marks.

3. There is no overall choice. However, an internal choice has been provided on one question of 2 marks, one question of 3 marks and all three questions of 5 marks each. You have to attempt only one of the given choices in such questions.

4. Use of calculators is not permitted.

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1. Is it possible for a body to be accelerated , if its speed is constant ? If it is so give an example. 1

2. Draw the displacement-time graph of an object moving under a constant force on a smooth surface. 1

3. Why does a cyclist lean to one side, while going along a curve? In what direction does he lean? 1

4. A force of 5N changes the velocity. of a body from 10 m/s to 20 m/s in 5 s. How much force is required to bring about the same change in 2 s ? 1

5. A metal rig is melted and a solid sphere is made out of it. What happens to the M.I. of the body about a vertical axis through the centre? Give reason. 1

6. A sphere is rolling. What is the ratio of rotational energy to total kinetic energy. 1

7. State Newton's universal law of gravitation. 1

8. What do you mean by geostationary satellites ? 1

9. The rotational kinetic energy of a body is given by $E = \frac{1}{2} I\omega^2$ where 'ω' is the angular velocity of the body. Use this equation to get the dimensional formula for I. 2

10. Find the angle of projection at which the horizontal range and maximum height of a projectile are equal. 2

OR

Prove that the maximum horizontal range is four times the maximum height attained by the projectile, when fired at an inclination so as to have maximum horizontal range.

11. Give reason : 2

a) China wares (ceramics) are wrapped in straw or paper before packing.

b) A heavy rifle does not kick as strongly as a light rifle using the same cartridges moving with the same speed.

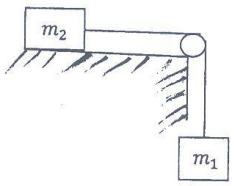
12. A man weighs 70 kg. He stands on weighing machine in a lift which is moving 2

a) upwards with a uniform speed of 10 m/s.

b) downwards with a uniform acceleration of 5 ms^{-2}.

What would be the readings on the scale in each case? What would be the reading if the lift mechanism failed and it came down freely under gravity. Take $g = 10ms^{-2}$.

13. Derive an expression for Tension and acceleration of a body m_1, connected to another mass m_2 kept on a smooth horizontal surface as shown. 2



14. A body of mass 5 kg initially at rest is subjected to a force of 20N. What is the kinetic energy acquired by the body at the end of 10 s? 2

15. Derive an expression for elastic potential energy stored in a spring of spring constant k. 2

16. Show that angular momentum of a satellite of mass Ms revolving round the earth of mass Me in an orbit of radius 'r' is equal to $[GMe\ Ms^2r]^{1}/_{2}$ 2

17. Assuming the frequency 'ν' of a vibrating string depends upon the load (F) applied, length of the string 'L' and mass per unit length 'm' prove that.

$'\nu' = \frac{K}{L}\sqrt{F/m}$ where k is a dimensionless constant.

OR

Convert 1 joule to erg.

18. a) Show that the path of a projectile fired a an angle 'θ' with the x-axis is a parabola.
b) What is the minimum number of coplanar vectors of different magnitudes which can give zero resultant? Explain. 3

19. Define angle of repose. Show that angle of repose is equal to angle of friction. 3

20. A force of 36N is acting on an object of mass 9 kg at an angle of 30° with the vertical. Find the acceleration of the body which moves in the horizontal direction. 3

21. Springs A and B are identical except that 'A' in stiffer than B. ie, force constant $k_A > K_B$ in which spring is more work extended, if
i) they are stretched by the same amount ?
ii) they are stretched by the same force ? 3

22. Define angle of banking. Derive an expression for maximum velocity of vehicle on a banked road. 3

23. Prove that the area of parallelogram with sides $\vec{A}$ and $\vec{B}$ is $|\vec{A} \times \vec{B}|$ 3

24. What will be the duration of the day, if the earth suddenly shrinks to $\frac{1}{64}$ of its original volume, mass remaining unchanged ? 3

25. Derive an expression for the variation of acceleration due to gravity at a depth 'd' assuming the earth as a uniform sphere of density ' ρ'. Also find the value of acceleration due to gravity at the centre of the earth. 3

26. A passenger arriving in a new town wishes to go from the station to a hotel located 10km away on a straight road from the station. A cabman takes him along a circuitous path 23 km long and reaches the hotel in 28 min. What is a) the average speed of the taxi.
b) the magnitude of average velocity?
c) Is the act of the cabman justified ? Why?
d) What value do you expect from the cabman? 4

27. a) Derive an equation for the distance travelled in the n^{th} second of an object which is uniformly accelerated from 'u' with acceleration a.
b) The displacement in meters of a particle, moving along the x axis is given by 18 t +5 t^2. Calculate the instantaneous velocity and acceleration at t =2s.

OR

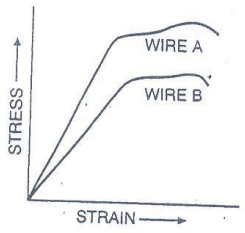
a) Derive an expression for centripetal acceleration in terms of frequency 'ν' of the body going in a circular path of radius 'r' with speed v.
b) Derive the relation $\theta = \omega_o t + \frac{1}{2}\alpha t^2$ using the method of calculus where symbols have their usual meanings. 5

28. a) State Kepler's laws of planetary motion.
b) Prove the law of areas. 5

OR

a) Derive an expression for escape velocity of a planet of mass M and Radius R.
b) If the radii of two planets be r_1 and r_2 and their mean densities be d_1 and d_2, prove that the ratio of acceleration due to gravities on the planets will be $r_1d_1 : r_2d_2$.

29. a) State Hookes law.
b) The stress versus strain graphs for wires of two materials A and B are as shown.
i) Which material has greater value of young's modulus? Why?
ii) Which material is more ductile?
iii) Which of the two is the stronger material?



c) A steel wire of length 5.0m and cross-section 3×10^{-5} m^2 stretches by the same amount as a copper wire of length 3m and cross-section 4×10^{-5} m^2 under a given load. What is the ratio of Youngs modulus of steel to that of copper?

OR

a) Derive an expression for the potential energy stored per unit volume of a stretched wire.
b) The edges of an aluminium cube are 10cm long. One face of the cube is firmly fixed to a vertical wall. A mass of 100kg is then attached to the opposite face of the cube. The shear modulus of aluminum is 25GPa. What is the vertical deflection of this face ? Take g =9.8 ms^{-2} 5