

INTERNATIONAL INDIAN SCHOOL - DAMMAM

SECOND TERMINAL EXAMINATION – NOVEMBER 2014

CLASS XI

SUBJECT- PHYSICS

MAX MARKS: 70

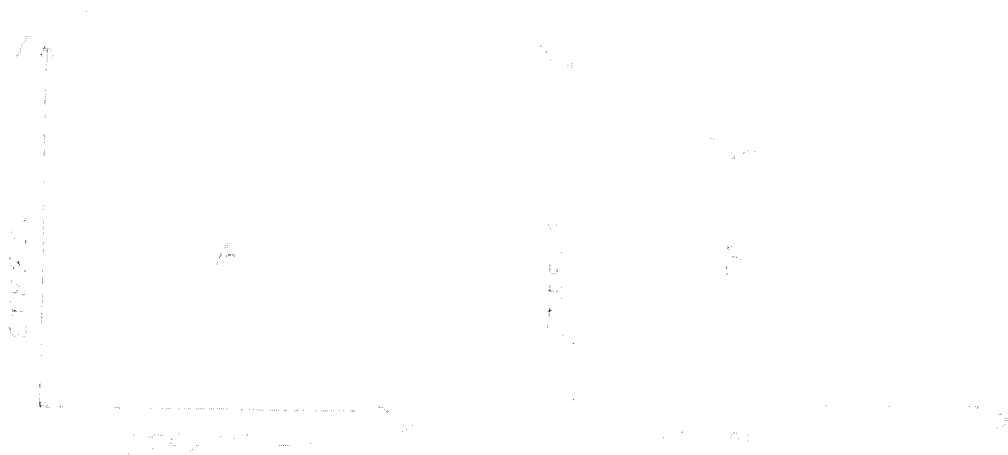
SET A

TIME: 3HOURS

GENERAL INSTRUCTIONS

All questions are compulsory

- There is no overall choice. However an internal choice has been provided in one question of two marks, one question of three marks, all three questions of five marks.
 - Question nos. 1 to 5 are very short answer type questions carrying one mark each.
 - Question nos.6 to 10 are short answer type questions carrying 2 marks each.
 - Question nos.11to22 are short answer type questions carrying 3 marks each.
 - Question no.23 is a value based question carrying 4 marks.
 - Question nos.24 to 26 are long answer type questions carrying 5 marks each.
 - Use of calculator is not permitted. However you may use log table if necessary.
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- What is the linear momentum of a body of mass 'm' and kinetic energy E?
 - What is the value of Young's modulus for a perfectly rigid body?
 - A flywheel is revolving with constant angular velocity. A chip of its rim breaks and flies away. What will be the effect on the angular velocity?
 - Work done on an object in a horizontal displacement on a frictionless plane is 63 J. What is the increase in kinetic energy?
 - Find the location of the centre of mass of a three particle system. Given that particles have identical mass and are located at $(0,0,0)$, $(a,0,0)$ and $(2a,0,0)$.
 - The stress- strain graphs for materials A and B are shown in figure given below



The graphs are drawn to the same scale.

- (a) Which of the materials has the greater Young's modulus?
(b) Which of the two is the stronger material?
7. Two billiard balls each of mass 0.05kg moving in opposite directions with a speed of 6m/s collide and rebound with the same speed. What is the impulse imparted to each ball due to the other?
8. A child sits stationary at one end of a long trolley moving uniformly with speed ' v ' on a smooth horizontal floor. If the child gets up and runs about on the trolley in any manner, what is the effect on the speed of the centre of mass of the (trolley+ child) system? Explain.
9. Define coefficient of viscosity and give its S.I unit.
10. (a) State parallel axes theorem of moment of inertia of an object.
(b) The moment of inertia of a circular disc about an axis passing through its centre and normal to the plane of the disc is 8 kg m^2 . What will be the moment of inertia of the same disc about an axis passing along its diameter?

OR

Prove that the rate of change of angular momentum of a particle is equal to the torque acting on it

11. (a) State the laws of static friction
(b) Determine the maximum acceleration of a train in which a box lying on its floor will remain stationary. Coefficient of static friction between the box and the train's floor is 0.15 .
12. Derive an expression for the elastic potential energy of a wire under stress.
13. A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 minutes. If the tank is 40m above the ground and the efficiency of the pump is 30% , how much electric power is consumed by the pump?

14. State and prove the law of conservation of linear momentum using Newton's third law of motion.

15. 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 the angular momentum of the cylinder about its axis?

OR

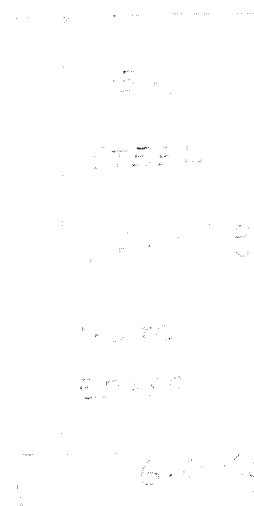
(a) A child stands at the centre of a turn table with his two arms out stretched . The turn table is set rotating with an angular speed of 40 rpm. How much is the angular speed of revolution of the child if he folds his hands back and there by reduces his moment of inertia to 2/5 times the initial value?

(b). Show that the child's new kinetic energy of rotation is more than the initial kinetic energy of rotation.

16. What do you mean by gravitational potential energy of a body? Derive an expression for it, when a body of mass 'm' is situated at a distance 'r' from the centre of the earth of mass 'M'.

17. Two wires of diameter 0.25 cm, one made of steel and the other made of brass are loaded as shown in the figure. The unloaded length of steel wire is 1.5 m and that of brass wire is 1.0m. Compute the elongations of the steel and the brass wires.

$$Y_S = 2 \times 10^{11} \text{ Pa}$$
$$Y_B = 0.91 \times 10^{11} \text{ Pa}$$



18. Define escape velocity. Prove that the velocity of escape of a body from the earth's surface is $\sqrt{2}$ times the velocity for a circular orbit just above the earth's surface.
19. State law of conservation of angular momentum. Explain two applications.
20. A stone is dropped from a height 'h'. Prove that the total mechanical energy at any point in its path is 'mgh'.
21. Define torque. Derive the relation between torque and moment of inertia.
22. The edge of an aluminium cube is 10 cm long. One face of the cube is firmly fixed to a vertical wall. A mass of 100 kg is then attached to the opposite face of the cube. The shear modulus of aluminium is 25GPa. What is the vertical deflection of this face?
23. Sanjay found that the road to his home is very pathetic. Most of the time accidents occur on the road. He took this as an issue and discussed with his friends and parents. They planned to reconstruct the road with the help of their society, by raising the outer edge of the road a little above the inner edge. With a great effort they were able to do it and thus accidents were reduced.
- (a) What according to you, are the moral values displayed by Sanjay and his friends to solve the above problem?
- (b) A train runs along an unbanked circular track of radius 30m at a speed of 54km/h. The mass of the train is 10^6 kg. What provides the centripetal force required for this purpose- the engine or the rails? What is the angle of banking required to prevent wearing out of the rail?
24. (a) State the principle on which hydraulic lift work and explain its working.
- (b) In a car lift, compressed air exerts a force F_1 on a small piston having a radius of 5cm. Its pressure is transmitted to a second piston of radius 10.0 cm. If the mass of the car to be lifted is 1350 kg, calculate F_1 . What is the pressure necessary to accomplish this task?

OR

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- (a) State Stokes' law. Derive an expression for the terminal velocity ' v ' of a sphere of radius ' r ', density ' ρ ' falling vertically through a viscous fluid of density ' σ ' and coefficient of viscosity ' η '.
- (b) The terminal velocity of a copper ball of radius 2mm falling through a tank of oil at 20°C is 6.5 cm s⁻¹. Compute the viscosity of the oil at 20°C. Density of oil is $1.5 \times 10^3 \text{ kg m}^{-3}$. Density of copper is $8.9 \times 10^3 \text{ kg m}^{-3}$.

25. (a) Distinguish between elastic and inelastic collision.
- (b) Deduce an expression for the velocity of two bodies of masses m_1 and m_2 after collision if their velocities in a straight line before collision is ' u_1 ' and ' u_2 '.

OR

- (a) An elastic spring of spring constant ' k ' is stretched by an amount ' x '. Show that its potential energy is $\frac{1}{2} kx^2$.
- (b) The bob of a pendulum is released from a horizontal position. If the length of the pendulum is 2.5 m, what is the speed with which the bob arrives at the lowermost point, given that it dissipated 7% of initial energy against air resistance?

26. (a) Derive an expression for variation in acceleration due to gravity with depth. What is its value at the centre of earth?
- (b) Assuming the earth to be sphere of uniform mass density, how much would a body weigh half way down to the centre of the earth, if it weighed 250N on the surface.

OR

- (a) What is meant by acceleration due to gravity? Derive an expression for variation in acceleration due to gravity with height?
- (b) A body weighs 64N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to one-third of the radius of the earth?
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