

First Terminal Examination 2014-2015

Physics

Class-XI

Time : 3 Hours

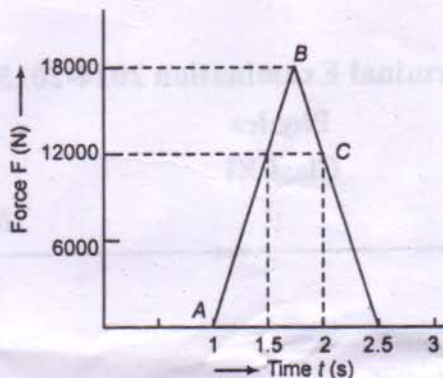
Maximum Marks : 70

Instructions :

- (i) All questions are compulsory.
 - (ii) Questions 1 to 5 carry 1 mark each.
 - (iii) Questions 6 to 10 carry 2 marks each.
 - (iv) Questions 11 to 22 carry 3 marks each.
 - (v) Questions 23 carries 4 marks.
 - (vi) Questions 24 to 26 carry 5 marks each.
- Use logarithms wherever necessary.

1. Which of the following length measurements is the most accurate and why?
 - (i) 500.0 cm
 - (ii) 0.0005 cm
 - (iii) 5.00 cm
2. What is the origin of centripetal force of the earth to go around the sun?
3. Is a bus moving along a circular track an inertial frame of reference? Give reason.
4. What is the work done by the nucleus in keeping the electron in their orbits? Why?
5. Is moment of inertia a scalar or a vector quantity?
6. Subtract 4.0×10^4 from 3.9×10^5 and give your answers with due consideration for significant figures.
7. Two trains 120 m and 80 m in length are running in opposite directions with velocities 42 km/h and 30 km/h. In what time do they completely cross each other?

8.



The figure above shows force time graph for a base ball struck by a bat. Determine the

- (i) impulse delivered to the ball. (ii) force exerted on the ball.
 (iii) the maximum force on the ball.
9. (i) What is the gravitational unit of work? Express it in joule.
 (ii) What is the CGS unit of work.
10. The moment of inertia of a uniform circular disc about a tangent of the disc in its own plane is given by $\frac{5}{4} MR^2$. Find its *M.I* about an axis through its centre and perpendicular to the axis.
11. A gas bubble from an explosion under water, oscillates with a perido T proportional to pressure p the static pressure, d the density of water and E the total energy of the explosion. Find the formula for T .
12. Find the components of $A = 2\hat{i} + 3\hat{j}$ along the direction of $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$.
13. A cyclist is riding with a speed of 27 km/h. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at a constant rate of 0.5 m/s. What is the magnitude and direction of the acceleration of the cyclist on the circular turn?
14. A man can swim with a speed of 4 km/h in still water. How long does he take to cross a river 1 km wide. If the river flows steadily at 3 km/h and he makes his strokes normal to the river current? How far down the river does he go when he reaches the other bank.
15. The displacement (in m) of a particle moving along the X -axis is given by $x = 18t + 5t^2$. Calculate (i) the instantaneous velocity at $t = 2$ s.
 (ii) average velocity between $t = 2$ s and $t = 3$ s
 (iii) instantaneous acceleration.

16. A horizontal force of 500 N pulls two masses 10 kg and 20 kg (lying on a frictionless table) connected by a light string. What is the tension in the string? Does the answer depend on which mass-end the pull is applied?
17. Show that Newton's second law of motion is the real law of motion and the other two laws can be derived from it.
18. What do you mean by banking of roads and why are roads banked? Discuss the motion of a vehicle on a banked road arrive at an expression for the maximum speed of a car can possess to execute a curved path. The coefficient of friction is μ of the road.
19. (i) What is impulse? Is it a scalar or a vector quantity? Show that impulse is the rate of change of momentum of a body.
(ii) Why does a cricketer lower his hands to catch a speedy ball?
20. What is a conservative force? Show that gravitational force is a conservative force.
21. Two inclined tracks one gradual and the other steep meet at O from where two stones are allowed to slide down from rest, one on each track. Will the stones reach the bottom at the same time? Will they reach there with equal speeds? Explain with a diagram.
22. What is centre of mass of a system of particles? Is it the same as centre of gravity? Prove that the centre of mass of 2 particles divides the line joining the particles in the inverse ratio of their masses.
In a two particle system of unequal masses where will the centre of mass be located near the heavier or the lighter particle?
23. During his visit to his aunt's village during vacations, Raja one day saw his aunt drawing water from a well with great difficulty. She dropped the bucket in the well unable to lift it. Raja helped her in taking it out.
After that in consultation with his uncle, he got a pulley system installed for drawing water from the well.
(i) What were the values Raja exhibited by doing this?
(ii) Why do you think a pulley was essential for drawing water?
(iii) What category of devices the pulley come under?
24. What is an elastic collision?
(i) Discuss elastic collision in one dimension in the case of two bodies colliding obliquely.
(ii) A bullet of mass 0.012 kg and horizontal speed of 70 m/s strikes a block of wood of mass 0.4 kg and instantly comes to rest with respect to the block. The block is

suspended from the ceiling by means of thin wires. Calculate the height to which the block rises.

OR

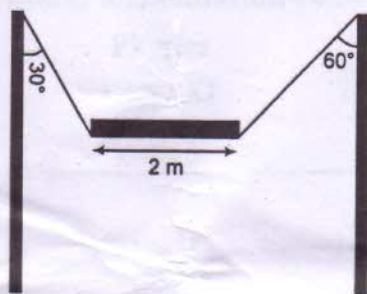
A bob of mass m suspended by a light string of length L . It is imparted a horizontal velocity v_0 at the lowest point A such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack on reaching the topmost point C . Obtain the expression for

- (i) v_0 ,
 - (ii) speeds at the topmost point C and another point B midway between A and C .
 - (iii) ratio of kinetic energies at B and C .
- (b) A ball is dropped from rest at a height of 12 m. If it loses 25% of its kinetic energy on striking the ground, what is the height which it bounces? How do you account for the loss in K.E.?
25. (a) Derive the relation between moment of a force and angular momentum. Hence arrive at the principle of conservation of angular momentum.
- (b) Two discs of moment of inertia I_1 and I_2 about their respective axes (normal to the disc and passing through the centre) and rotating with angular speeds ω_1 and ω_2 are brought in contact face to face with their axes coincident.
- (i) What is the angular speed of the 2 disc system?
 - (ii) Show that the kinetic energy of the combined system is less than the sum of the kinetic energies of the 2 discs. How do you account for the loss in energy? Take $\omega_1 \neq \omega_2$.

OR

- (a) Derive the expression for the position for the centre of mass of a 2 particle system of masses m_1 and m_2 .
- (b) A non-uniform bar of weight W is suspended at rest by two strings of negligible weight as in the figure below. the angles made by the strings with the vertical are 30° and 60° respectively. The bar is 2 m long. Calculate the location of the centre of gravity of the rod.

26.



- (a) Derive the equation for the trajectory of a projectile and the formula for the velocity at any point in the path of the projectile.
- (b) From the top of a tower 40 m high a ball is projected upwards. At what distance from the foot of the tower does the ball strike the ground and with what velocity?

OR

- (a) Derive the equations of motion

$$v = u + at$$

$$v^2 = u^2 + 2as.$$

- (b) The speed of a motor launch with respect to still water is 7 m/s and the speed of stream is $u = 3\text{ m/s}$. When the launch began travelling upstream a float was dropped from it. The launch travelled 4.2 km upstream turned about and caught up with the float. How long is it before the launch reaches the float?