

First Terminal Examination 2015 - 2016  
Class - XI  
Subject - Physics

Max. Marks : 70

Time : 3 Hours

General Instructions :

- (a) All questions are compulsory.
- (b) There are 26 questions in total.
- (c) Questions 1 to 5 carry 1 mark each.
- (d) Questions 6 to 10 carry 2 marks each.
- (e) Questions 11 to 22 carry 3 marks each.
- (f) Question 23 carries 4 marks (Value based question).
- (g) Questions 24 to 26 carry 5 marks each.
- (h) Use of calculators is not permitted. However you may use log tables wherever required.

1. Two balls of different masses (one lighter than the other) are thrown vertically upwards with the same speed. Which one will pass through the point of projection in their downward direction with the greater speed? Give reason.

2. A soda-water bottle is falling freely. Will the bubbles of the gas rise in the water of the bottle? Justify.

3. A body of mass 'm' is moving in a circle of radius 'r' with a constant speed 'v'. The force on the body is  $\frac{mv^2}{r}$  and is directed towards the centre. What is the work done by this force in moving the body over half the circumference of the circle?

Can an instrument be called precise without being accurate? Can it be accurate without being precise?

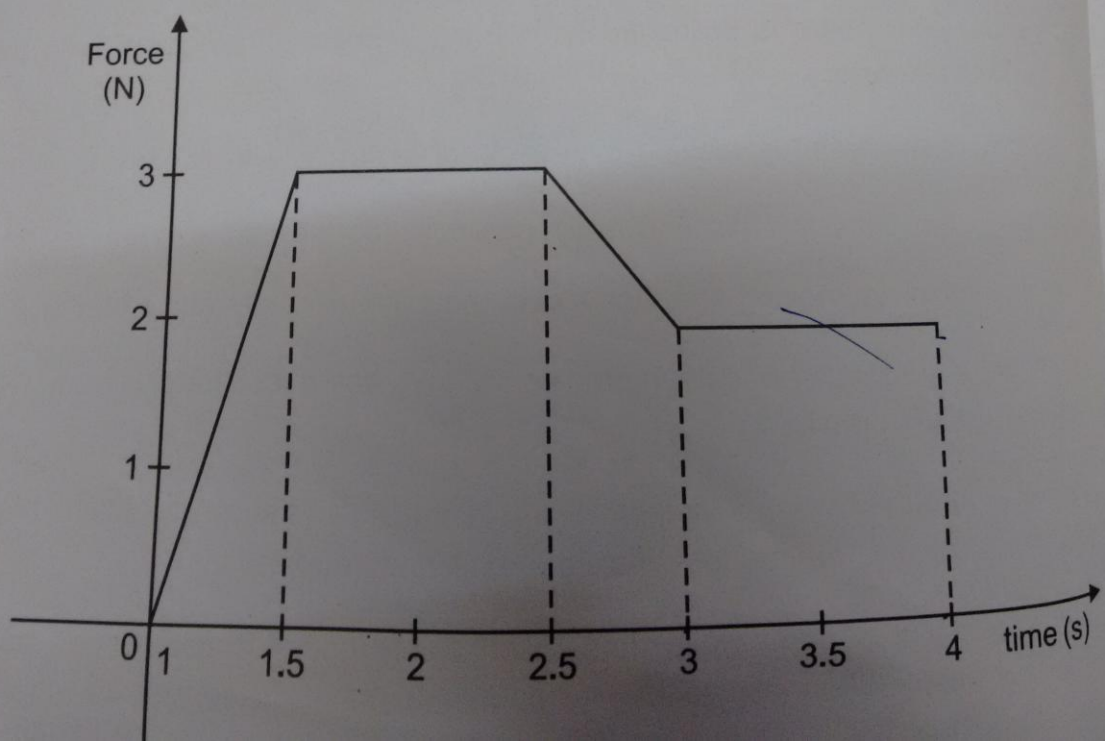
A ball is dropped from a height 'h' on to the floor. If the coefficient of restitution is 'e', calculate the height to which the ball first rebounds.

The velocity of a body which has fallen freely under gravity varies as  $g^p h^q$ , where g is the acceleration due to gravity at the place and h is the height through which the body has fallen. Determine the values of p and q.

7. Define unit vector. If the vectors  $\vec{A}$  and  $\vec{B}$  are given by  $\vec{A} = 3\hat{i} + 4\hat{j}$  and  $\vec{B} = 7\hat{i} + 24\hat{j}$ , find a vector having the same magnitude as  $\vec{B}$  and parallel to  $\vec{A}$ . 12.
8. When a ball is thrown upward, its momentum first decreases and then increases. Is the law of conservation of momentum violated in this process? Explain.

OR

- Determine the maximum acceleration of the train in which a box lying on its floor will remain stationary, given that the co-efficient of static friction between the box and the train's floor is 0.15. Take  $g = 10 \text{ m/s}^2$ . 13.
- Draw the graph of spring force  $F_s$  and displacement  $x$ . From the graph, find an expression for the P.E. of an elastic stretched spring.
- Prove that the centre of mass of two particles system divides the line joining the particles in the inverse ratio of their masses.
- (a) Define Impulse - Momentum theorem.
- (b) The initial speed of a body of mass 2 kg is 5 m/s. A force acts for 4 sec in the direction of motion of the body. In the given Force - Time graph, calculate the impulse of the force and final speed of the body. 1.



12. Give reason to explain the following :

- (a) A stone when thrown on a glass window smashes the window pane to pieces, but a bullet from the gun passes through making a clean hole.
- (b) If a ball is thrown up in a moving train, it comes back to person's hand.
- (c) The passengers are thrown outwards when a car in which they are travelling suddenly takes a circular turn ?

13. In successive measurements, the readings of the time period of oscillation of a simple pendulum were found to be 2.63 s, 2.56 s, 2.42 s, 2.71 s and 2.80 s in an experiment. Calculate :

- (a) Mean value of the period of oscillation
- (b) Absolute error in each measurement
- (c) Mean absolute error
- (d) Relative error
- (e) Percentage error

14. (a) Derive the equation  $S = ut + \frac{1}{2}at^2$  by calculus method.

(b) A balloon is ascending at the rate of 9.8 m/s at a height of 39.2 m above the ground when a food packet is dropped from the balloon. After how much time does it reach the ground ?

OR

(a) A force of  $(7\hat{i} + 6\hat{k})$  Newton makes a body move on a rough plane with a velocity of  $(3\hat{j} + 4\hat{k})$  m/s. Calculate the power in watt.

(b) Determine the angles which the vector  $\vec{A} = 5\hat{i} + 5\hat{k}$ , make with x, y and z-axes.

A body covers 12 m in 2<sup>nd</sup> second and 20 m in 4<sup>th</sup> second. How much distance will it cover in 4 seconds after the fifth second ?

A boatman can row with a speed of 10 km/hr in still water. If the river flows steadily at 5 km/hr in which direction should the boatman row in order to reach a point on the other bank directly opposite to the point from where he started ? The width of the river is 2 km. (Draw a relevant vector diagram)

17. If the units of force, energy and velocity are 20 N, 200 J and 5 m/s, find the units of length, mass and time.

18. On a two lane road, car A is travelling with a speed of 36 km/hr. Two cars B and C approach car A in opposite directions with a speed of 54 km/hr each. At a certain instant, when the distance AB is equal to AC, both being 1 km, B decides to overtake A before C crosses A. What minimum acceleration of car B is required so that they meet the car A simultaneously?

19. A bird is sitting on the floor of a closed glass cage and the cage is in the hand of a girl. Will the girl experience any change in the weight of the cage when the bird :

- (a) starts flying in the cage with a constant velocity?
- (b) flies upward with acceleration?
- (c) flies downward with acceleration?

20. Answer the following :

- (a) A lorry and a car moving with the same kinetic energy are brought to rest by the application of brakes which provide equal retarding force. Which one of them will come to rest in a shorter distance?
- (b) A truck and a car are moving with the same kinetic energy on a straight road. Their engines are simultaneously switched off. Which one will stop at a lesser distance?

From a uniform circular disc of diameter  $D$ , a circular disc of diameter  $\frac{D}{6}$  and having its centre at a distance of  $\frac{D}{4}$  from the centre of the disc is scooped out. Determine the centre of mass of the remaining portion.

Write down the relation between K.E. and momentum. If the linear momentum of a body increases by 20%, what will be the percentage increase in the K.E. of the body?

Ankur was driving the car and his driver was sitting by his side. Seeing a child on the road ahead, Ankur had to apply the brakes suddenly. Unmindfully, the driver was not wearing seat belt and as a result his head smashed against the dashboard. The

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injur  
disc  
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An  
(a)  
(b)  
(c)  
24.

collision was so hard that the driver's head started bleeding and he became unconscious. Ankur took the driver to the city hospital. The doctor advised the MRI scan to rule out head injury. MRI was done. Fortunately there was no internal head injury. After medical treatment, the driver regained his consciousness and was discharged from the hospital. Ankur paid the hospital bill. While returning, the driver admitted his mistake of not wearing the seat belt. He requested that he may be excused for the lapse on his part and assured to be careful in future.

Answer the following questions :

- (a) In your opinion, what values are reflected in the action taken by Ankur ?
- (b) Comment on the role of driver as a person.
- (c) Explain in brief, why the driver fell forward, when Ankur applied the brakes suddenly.

24. (a) Show that for a projectile, the angle between the velocity and the x-axis as a

function of time is given by  $\theta = \tan^{-1} \left\{ \frac{(u_y - gt)}{u_x} \right\}$

(b) Show that the projection angle  $\theta$  for a projectile launched from the origin is given

by  $\theta = \tan^{-1} \left\{ \frac{4h_m}{R} \right\}$ , where the symbols have their usual meanings.

(c) Show that there are two angles of projection possible for same horizontal range.

OR

(a) Show that a given gun will shoot three times as high when elevated at an angle of  $60^\circ$  as when fired at angle of  $30^\circ$  but will carry the same distance on a horizontal plane.

(b) A cyclist is riding with a speed of 27 km/hr. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at the constant rate  $0.5 \text{ m/s}^2$ . What is the magnitude and direction of the net acceleration of the cyclist on the circular turn ?

a) What is perfectly inelastic collision ? Show that kinetic energy is invariably lost in such a collision.

) A railway carriage of mass 9000 kg moving with a speed of 36 km/hr collides with a stationary carriage of the same mass. After the collision, the carriages

*(Handwritten notes and scribbles)*

get coupled and move together. What is their common speed after collision?  
What type of collision is this? Give reason.

OR

A body of mass 0.3 kg is taken up an inclined plane to length 10 m and height 5 m and then allowed to slide down to the bottom again. The coefficient of friction between the body and the plane is 0.15. What is the :

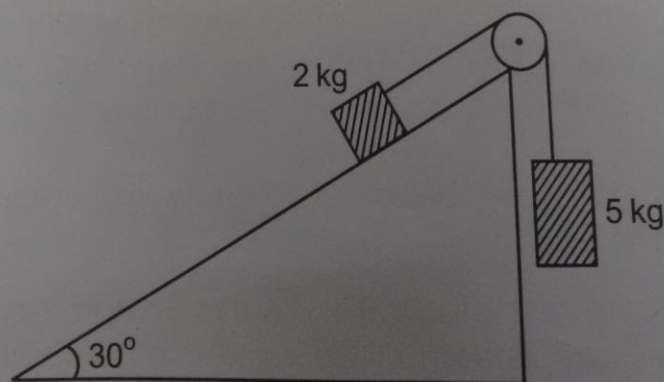
- (a) work done by the gravitational force over the round trip?
- (b) work done by the applied force over the upward journey?
- (c) work done by the frictional force over the round trip?
- (d) kinetic energy of the body at the end of the trip?

How is the answer to (d) related to the first three answers?

- (a) A body tied to one end of a string is made to revolve in a vertical circle. Derive the expression for the velocity of the body and tension in the string at any point. Hence find the tension at the bottom when tension at the top is taken zero (minimum).
- (b) A weightless thread can bear tension up to 3.7 kg wt. A stone of mass 500 g is tied to it and revolves in a circular path of radius 4 m in vertical plane. If  $g = 10 \text{ m/s}^2$ , then what will be the maximum angular velocity of the stone?

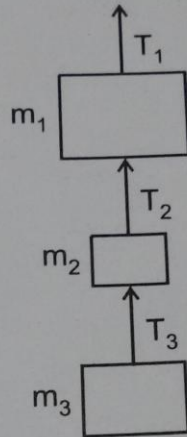
OR

- (a) Two blocks of mass 2 kg and 5 kg are connected by an ideal string passing over a pulley. The block of 2 kg is free to slide on a surface inclined at an angle of  $30^\circ$  with the horizontal whereas 5 kg block hangs freely. Find the acceleration of the system and the tension in the string. Given  $\mu = 0.30$ .



(b) The masses  $m_1$ ,  $m_2$  and  $m_3$  of the three bodies are 5, 2 and 3 kg respectively. Calculate the values of tensions  $T_1$ ,  $T_2$  and  $T_3$  when :

- (i) whole system is moving upward with acceleration of  $2 \text{ m/s}^2$ .
- (ii) system is at rest.



- 30 -