



HALF YEARLY EXAMINATION

SUBJECT: PHYSICS

CLASS: XI

DATE OF EXAMINATION: 14/09/2017

General Instructions:

1. This Question Paper contains four printed pages.
2. All questions are compulsory.
3. 15 minutes time has been allotted to read this question paper. The Question Paper will be distributed at 8:15am. From 8:15am to 8:30am students will read the Question paper only and will not write any answer on the answer book during this period.
4. The question paper consists of 26 questions divided into five sections A, B, C, D and E. Section A comprises of 5 questions of 1 mark each, Section B comprises of 5 questions of 2 marks each, Section C comprises of 12 questions of 3 marks each, Section D comprises of 1 question of 4 marks and Section E comprises of 3 questions of 5 marks each.

DURATION OF EXAMINATION: 15 minutes (Reading Time) + 3 hours (Writing Time)

MAXIMUM MARKS: 70

PART A

- Q1. Name any two fundamental forces of nature. 1
- Q2. If $A = i - 3j + 2k$ and $B = 4i + 2j + 2k$, then find $A \times B$. 1
- Q3. State the number of significant digits in the following: 1
- (i) 5100 kg - 4
- (ii) 100.05 km
- Q4. Why does a cricket player lower his hands while catching a ball? 1
- Q5. A force $7\hat{i} + 6\hat{k}$ 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. 1

PART B

- Q6. With the help of technique of integral calculus, show that for an object moving with constant acceleration along a straight line, 2

$$s = ut + [at^2]/2$$

- Q7. A man of mass m is standing on the floor of a lift. Find his apparent weight when the lift is moving: 2
- Downwards with uniform acceleration a
 - Falling freely
- (Give appropriate equations/relations to support your answer)

- Q8. The kinetic energy of a body decreases by 19%. What is the percentage decrease in its linear momentum? 2

- Q9. If Earth has a mass 9 times and radius twice that of a planet Mars, calculate the minimum velocity required by a rocket to pull out of gravitational force of Mars. Take the escape velocity on the surface of the Earth to be 11.2 km/s. 2
- 3.752

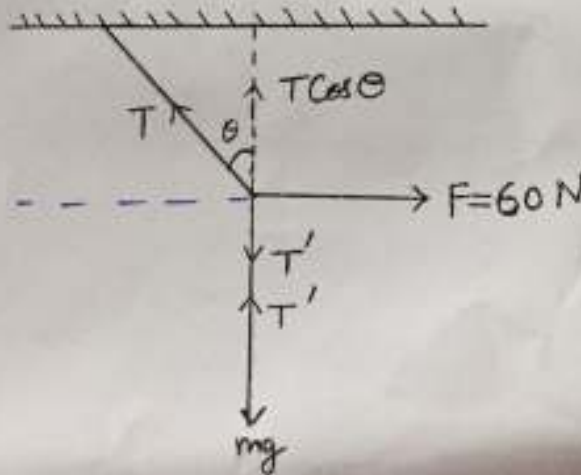
- Q10. Calculate the moment of inertia of the Earth about its diameter, taking it to be a sphere of 10^{25} kg and diameter 12800 km. 2
- M.O.I of sphere along diameter = ...*

PART C

- Q11. The velocity ' v ' of water waves depends on the wavelength ' λ ', density of water ' ρ ' and the acceleration due to gravity ' g '. Deduce by the method of dimensions the relationship between these quantities. 3

- Q12. A food packet is released from a helicopter which is rising steadily at 2 m/s. After two seconds, 3
- What is the velocity of the packet? -12.6
 - How far is it below the helicopter? (Take $g = 9.8 \text{ m/s}^2$) 19.6
- $\frac{v^2}{2g}$
 $-g$

- Q13. A mass of 10 kg is suspended vertically by a rope of length 2 m from a ceiling. A force of 60 N is applied at the middle point of the rope in the horizontal direction as shown in figure below. Calculate the angle the rope makes with the vertical. (Neglect mass of rope and take $g = 10 \text{ m/s}^2$) 3



- Q14. Two forces whose magnitudes are in the ratio 3:5 give a resultant of 35 N. If the angle of inclination be 60 degrees, then calculate the magnitude of each force. 3
- $(5) 25$

Q15.
0.37

The length, breadth and height of a rectangular wooden block were measured to be:

$$l = 12.13 \pm 0.02 \text{ cm}$$

$$b = 8.16 \pm 0.01 \text{ cm}$$

$$h = 3.46 \pm 0.01 \text{ cm}$$

Determine the percentage error in the volume of the block.

Q16.

A 16 kg block moving on a frictionless horizontal surface with a velocity of 5 m/s compresses an ideal spring and comes to rest. If the force constant of the spring be 100 N/m, then how much is the spring compressed?

Q17.

A body of mass m is made to slide down an inclined plane with an applied force ' P '. Calculate the expression for work done against friction by the body.

Q18.

What is coefficient of restitution? What is its physical significance?

Q19.

(i) Using Newton's laws of gravitation, prove Kepler's third law of planetary motion for circular orbits.

(ii) The radius of the Earth's orbit is 1.5×10^8 km and that of Mars is 2.5×10^{11} m. In how many years, will the Mars complete its one revolution? (Assume circular orbits in both cases).

Q20.

A solid cylinder rolls down an inclined plane. Its mass is 10 kg and radius 0.1 m. If the height of the inclined plane is 4 m, what is its rotational K.E. when it reaches the foot of the plane?

Q21.

Find the potential energy of a system of four particles, each of mass m , placed at the vertices of a square of side l . Also obtain the potential at the centre of the square.

Q22.

Derive an expression for the moment of inertia of a disc about an axis through the centre and perpendicular to its plane.

OR

A wheel is rotating at a rate of 1000 rpm and its kinetic energy of rotation is 10^6 J. Determine the moment of inertia of the wheel about its axis of rotation.

PART D

Q23.

Hriday was standing on National highway when he saw an open car moving on the road with a speed of 100 km/h. A man sitting in the car fired a bullet from the gun in the opposite direction towards a police vehicle chasing it. He recorded the incident with his phone and later helped police catch the culprits with the evidence.

(i) What two qualities were shown by Hriday?

(ii) If the speed of the bullet is 250 km/h relative to the car, then what is the speed of the bullet with respect to Hriday (observer on ground)?

PART E

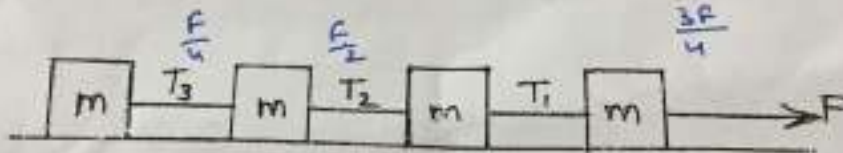
- Q24. (i) A projectile is fired with a velocity u making an angle θ with the horizontal. Show that its trajectory is a parabola.
 (ii) Derive an expression for the time of flight.
 (iii) A boy stands at 39.2 m from a building and throws a ball which just passes through a window 19.6 m above the ground. Calculate the velocity of projection of the ball.

OR 18.1

- (i) A projectile is fired horizontally with a velocity u . Show that its trajectory is a parabola.
 (ii) Derive an expression for time of flight.
 A body is projected horizontally from the top of a cliff with a velocity of 9.8 m/s. What time elapses before horizontal and vertical velocities become equal?
- Q25. (i) Calculate the angle through which a cyclist bends from the vertical when he crosses a circular path of 34.3 m in circumference in $\sqrt{22}$ s. (Take $g = 9.8 \text{ m/s}^2$) 5
 (ii) Define angle of friction. How is it related to coefficient of static friction? 45°

OR

- (i) Four blocks of the same mass m connected by cords are pulled by a force F on a smooth horizontal surface, as shown in figure below. Determine the tensions T_1 , T_2 and T_3 in the cords.



- (ii) A 30 g bullet leaves a rifle with a velocity of 300 m/s and the rifle recoils with a velocity 0.6 m/s. Find the mass of the rifle. 3kg

- Q26. Prove that in an elastic one dimensional collision between two bodies, the relative velocity of approach before collision is equal to the relative velocity of separation after the collision. Hence derive expressions for the velocity of the two bodies in terms of their initial velocities before collision.

OR

Discuss elastic collision in two dimensions and write relevant equations as applicable. What are the conditions of

- (i) Glancing collision
 (ii) Head-on collision

