



TAGORE INTERNATIONAL SCHOOL

VASANT VIHAR, NEW DELHI

MID - TERM EXAMINATION (2024-2025)

PHYSICS

CLASS: XI

Raza Iqbal  
X1-D

Date: 27.09.24

No. of Pages: 10

Time: 3 hour

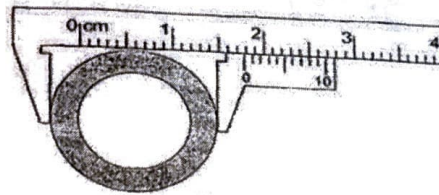
Max Marks: 70

### GENERAL INSTRUCTIONS

- There are 33 questions in all. All questions are compulsory.
- This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
- All the sections are compulsory.
- Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
- There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C and all three questions in Section E. You have to attempt only one of the choices in such questions.
- Use of calculators is not allowed.

### SECTION A

- Q.1 The diagram below shows a pair of Vernier callipers set to measure a metal pipe. Given that the pipe has an internal diameter of 10.2 mm, what is the thickness of the wall of the metal pipe?



- a) 2.8 mm  
b) 3.8 mm  
c) 5.6 mm  
d) 7.6 mm
- (1 mark)
- Q.2 Only 2 forces act on an object. If the object is in equilibrium, which of the following condition(s) is/are required?
- 1) The 2 forces have the same magnitude.
  - 2) The 2 forces are opposite in direction.
  - 3) The 2 forces are in the same direction.
  - 4) The 2 forces are of the same type.

- a) 1 and 2 only
- b) 1 and 3 only
- c) 3 and 4 only
- d) 1,2 and 4 only

(1 mark)

Q.3 The diameter of a cylindrical pencil is measured using a micrometer screw gauge. A student initially takes the zero error reading (Diagram A) of the micrometer followed by the reading of the diameter (Diagram B).

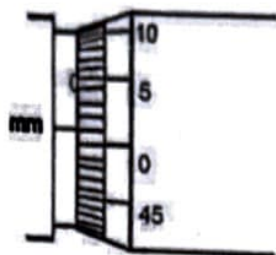


Diagram A

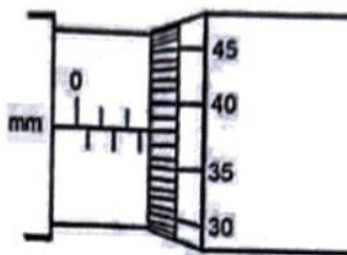


Diagram B

What is the actual diameter of the cylindrical pencil?

- a) 2.37 mm
- b) 2.39 mm
- c) 2.87 mm
- d) 2.89 mm

(1 mark)

Q.4 A particle moves on the x axis. When its acceleration is positive and increasing:

- a) its velocity must be increasing
- b) its velocity must be negative
- c) its velocity must be positive
- d) it must be speeding up

(1 mark)

Q.5 A ball is thrown vertically upwards from P. It reaches the greatest height at Q and then falls back to P where it is caught.



Neglecting air resistance, which of the following statements is CORRECT?

- a) Acceleration at Q is zero.
- b) The time of rise from P to Q is greater than the time of fall from Q to P.
- c) The total displacement of the ball is zero.
- d) The ball experiences a steady decreasing upward force when it rises from P to Q.

(1 mark)



- Q.6 How will the acceleration due to gravity be affected if a heavy object is released from a higher position and its mass is halved?

	Higher Position	Halved its mass
(a)	No change	No change
(b)	No change	Decreases
(c)	Increases	Decreases
(d)	Increases	No change

(1 mark)

- Q.7 A man is standing on a weighing scale inside a lift. The weighing scale reads 500 N when the lift is stationary. Which option describes correctly the reading on the weighing scale when the lift accelerates upwards and when the lift accelerates downwards?

	Lift accelerates upwards	Lift accelerates downwards
(a)	more than 500 N	less than 500 N
(b)	less than 500 N	more than 500 N
(c)	500 N	less than 500 N
(d)	more than 500 N	500 N

(1 mark)

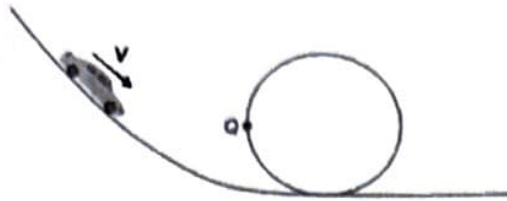
- Q.8 If a 60-Newton tension force acts upward and rightward on Bruno (pet dog) at an angle of 30 degrees, the components of this force along the horizontal and vertical will be



- a) 30N, 52N  
 b) 52N, 30N  
 c) 30N, 30N  
 d) 52N, 52N

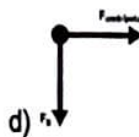
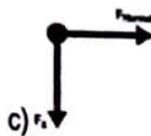
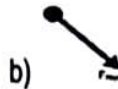
(1 mark)

- Q.9 A toy car sliding down a ramp has a large enough initial speed to make it completely around the loop-the-loop pictured below. Assume the track is frictionless.



Which of the following free body diagrams correctly depicts the toy car at the position Q?

(1 mark)



- Q.10 A toy train consists of three identical compartments X, Y and Z. It is pulled by a constant horizontal force  $F$  applied on Z horizontally. Assuming there is negligible friction, the ratio of tension in string connecting XY and YZ is:

- a) 2:1
- b) 3:2
- c) 1:2
- d) 2:3

(1 mark)

- Q.11 A pulling force of 3.0 N causes a toy car to accelerate on a horizontal surface. The frictional force between the surface and the toy car is 1.0 N. Which of the following statements best describes the subsequent motion of the car when the pulling force is decreased to 1.0 N?

- a) It will continue to accelerate.
- b) It will move with a constant speed.
- c) It will decelerate.
- d) It will stop moving.

(1 mark)

- Q.12 A child jumps onto a trampoline and bounces upwards. On the second jump, he bounces higher. What will most likely remain constant on both jumps?





to make it completely  
less.

- a) his acceleration in the air
- b) his maximum gravitational potential energy
- c) his maximum kinetic energy
- d) his speed on contact with the trampoline

(1 mark)

Q.13 **Assertion: Dimensions of pressure and energy density are same.**  
**Reason: Both have the same units in S. I. System.**

- a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
- b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- c) Assertion is a correct statement but reason is incorrect.
- d) Assertion is an incorrect statement but reason is correct.

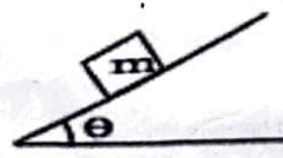
(1 mark)

Q.14 **Assertion: Area under velocity-time graph gives displacement.**  
**Reason: Area under acceleration-time graph gives velocity.**

- a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
- b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- c) Assertion is a correct statement but reason is incorrect.
- d) Assertion is an incorrect statement but reason is correct.

(1 mark)

Q.15 **Assertion: A block is lying stationary as on an inclined plane and coefficient of friction is  $\mu$ . Friction on block is  $\mu mg \cos \theta$ .**  
**Reason: Contact force on block is  $mg$ .**



- a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
- b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- c) Assertion is a correct statement but reason is incorrect.
- d) Assertion is an incorrect statement but reason is correct.

(1 mark)

Q.16 **Assertion: Work done by gravitational force in reaching the same height via two different routes will be the same.**  
**Reason: Gravitational force is conservative in nature.**

- a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
- b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- c) Assertion is a correct statement but reason is incorrect.
- d) Assertion is an incorrect statement but reason is correct.

(1 mark)

## SECTION B

- Q.17 A body is dropped from the ceiling of a transparent cabin falling freely towards the earth. Describe the motion of the body as observed by an observer
- sitting in the cabin (2 marks)
  - standing on the earth. (2 marks)
- Q.18 Distinguish between the dimensions and units of a physical quantity. (2 marks)
- OR**
- Write the dimensional formula for the following:
- Pressure (2 marks)
  - Coefficient of viscosity
- Q.19 A man can swim with a speed of 4.0 km/h in still water. How long does he take to cross a river 1.0 km wide if the river flows steadily at 3.0 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? (2 marks)
- Q.20 A fighter plane flying horizontally at an altitude of 1.5 km with speed 720 km/h passes directly overhead an anti-aircraft gun. At what angle from the vertical should the gun be fired for the shell with muzzle speed  $600 \text{ m s}^{-1}$  to hit the plane? At what minimum altitude should the pilot fly the plane to avoid being hit? (2 marks)
- Q.21 A particle accelerates uniformly for 20 s after starting from rest. If it travels a distance of  $s_1$  in the first 10 s and distance of  $s_2$  in the next 10s. Find the relation between  $s_1$  and  $s_2$ . (2 marks)

## SECTION C

- Q.22 From the top of a multi-storeyed building, 39.2 m tall, a boy projects a stone vertically upwards with an initial velocity of  $9.8 \text{ ms}^{-1}$  such that it finally drops to the ground,
- When will the stone reach the ground?
  - When will it pass through the point of projection?
  - What will be its velocity just before striking the ground? Take  $g = 9.8 \text{ ms}^{-2}$  (3 marks)
- Q.23 Graphically plot the variation of static friction, limiting friction and kinetic friction with the applied force. Mention the physical quantities represented by X-axis and Y-axis respectively. (3 marks)
- Q.24 A stone is thrown from the top of a building upward at an angle of  $30.0^\circ$  to the horizontal and with an initial speed of 20.0 m/s, from the top of a building. If the height of the building is 45.0 m,
- how long is it before the stone hits the ground?
  - With what velocity it hits the ground?
  - How far from the wall does it hit the ground? (3 marks)



Q.25 What is a variable force? Find work done by a variable force graphically. (3 marks)

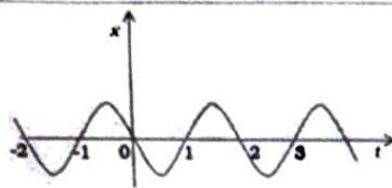
OR

Mathematically show that the work done against gravitational forces are path independent. (3 marks)

Q.26 A simple pendulum of length 1 m has a wooden bob of mass 1 kg. It is struck by a bullet of mass  $10^{-2}$  kg moving with a speed of  $2 \times 10^2$  ms<sup>-1</sup>. The bullet gets embedded into the bob. Obtain the height to which the bob rises before swinging back. (3 marks)

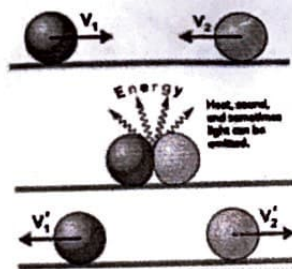
Q.27 Draw the following graphs between distance and time of an object in case of  
i. For a body at rest  
ii. For a body moving with uniform velocity  
iii. For a body moving with constant acceleration. (3 marks)

Q.28 Figure gives the x-t plot of a particle executing one-dimensional simple harmonic motion. Give the signs of position, velocity and acceleration variables of the particle at  $t = 0.3$  s, 1.2 s, -1.2 s. (3 marks)



### SECTION D

Q.29 An elastic collision is a collision in which there is no net loss in kinetic energy in the system as a result of the collision. Both momentum and kinetic energy are conserved quantities in elastic collisions.



- (i) In which motion, momentum changes but K.E does not?  
a) linear motion  
b) straight-line motion  
c) circular motion  
d) parabolic motion

(ii) Two balls moving with the same velocity collides. What is conserved?

- a) Force
- b) kinetic energy
- c) velocity
- d) momentum

(iii) In elastic collision, the relative speed of approach and separation is:

- a) unequal
- b) zero
- c) equal
- d) infinite

(iv) The momentum of two objects moving with the same speed but in opposite directions upon collision

- a) remains the same
- b) increases
- c) decreases
- d) becomes zero

(4 marks)

Q.30 Elastic potential energy is Potential energy stored as a result of the deformation of an elastic object, such as the stretching of a spring. It is equal to the work done to stretch the spring, which depends upon the spring constant  $k$  as well as the distance stretched.



(i) If stretch in spring of force constant  $k$  is doubled, then the ratio of final to initial forces is:

- a) 4:1
- b) 1:4
- c) 2:1
- d) 1:2

(ii) A light body and a heavy body have the same kinetic energy. Which one has greater linear momentum?

- a) light body
- b) both heavy and light body
- c) Low body
- d) heavy body



- (iii) What type of energy is stored in the spring of a watch?
- potential energy
  - Electrical energy
  - mechanical energy
  - kinetic energy

- (iv) When spring is compressed, its potential energy:
- remains the same
  - decrease
  - first increase then decrease
  - increases

(4 marks)

### SECTION E

- Q.31 i) The air bubble formed by an explosion inside water performs oscillations with time period  $T$  which depends on pressure ( $p$ ), density ( $\rho$ ) and on energy due to explosion ( $E$ ). Establish the relation between  $T$ ,  $p$ ,  $E$  and  $\rho$
- ii) The velocity  $v$  of a particle depends upon the time ' $t$ ' according to the equation

$$v = \sqrt{ab} + bt + \frac{c}{d+t}$$

Determine the units of  $a$ ,  $b$ ,  $c$  and  $d$ .

(5 marks)

OR

- The frequency  $f$  of an oscillating drop may depend on the radius  $r$  of the drop, density  $d$  of the liquid, and surface tension  $S$  of the liquid. Establish the expression for the frequency.
- The drag force  $F$  on a sphere is related to the radius of the sphere,  $r$ , the velocity of the sphere,  $v$ , and the coefficient of viscosity of the fluid the drop is falling through,  $\eta$ , by the formula  $F = kr^x\eta^y v^z$  where  $k$  is a dimensionless constant, and  $x$ ,  $y$ , and  $z$  are integers. By considering the units of the equation, work out the values of  $x$ ,  $y$ , and  $z$ .

(5 marks)

- Q.32 (i) Show that for two complementary angles of projection of a projectile thrown with the same velocity, the horizontal ranges are equal.
- (ii) For what angle of projection of a projectile, is the range maximum?
- (iii) For what angle of projection of a projectile, are the horizontal range and maximum height attained by the projectile equal?

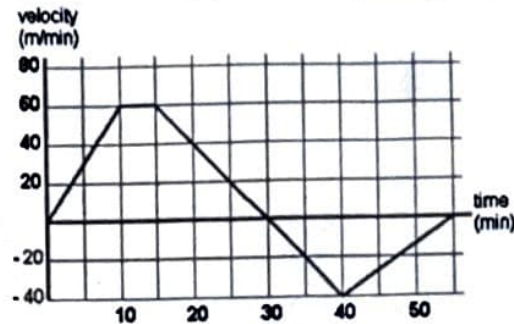
(5 marks)

OR

A gun is designed that can launch a projectile of mass 10 kg at a speed of 200 ms<sup>-1</sup>. The gun is placed close to a straight, horizontal railway line and aligned such that the projectile will land further down the line. A small rail car of mass 200 kg and travelling at a speed of 100 ms<sup>-1</sup> passes the gun just as it is fired. Assuming the gun and the car are at the same level, at what angle upwards must the projectile be fired so that it lands in the rail car?

(5 marks)

- Q.33 For a body having motion described by the given figure.
- (a) Find total distance and displacement covered.
- (b) acceleration at  $t=5, 15$  and  $30$  s
- (c) average acceleration in first 20s (d) draw corresponding acceleration time graph. (5 marks)



OR

For the following scenarios, sketch the motion-time graphs (displacement-time, velocity-time and acceleration-time).

(a) A ball is thrown up in the air and then caught at the same height. Only sketch from the instant the ball leaves the hand to the instant it touches the hand again. Ignore air resistance.

(b) A train travels from New Delhi to Jaipur, stopping only at McDonald's on route. You may assume the journey is in a straight line and it only takes a few minutes of constant acceleration/deceleration to get to its top speed/come to a stop.

(c) A football is dropped from a great height (such that it reaches terminal velocity); it bounces inelastically such that air resistance can be ignored from this point. Sketch the motion from the moment of release until it hits the ground for a second time. (5 marks)

\*\*\*\*\*ALL THE BEST \*\*\*\*\*