

MAR THOMA RESIDENTIAL SCHOOL, THIRUVALLA
SECOND TERMINAL EXAMINATION DEC -2017

STD XI

PHYSICS

MARK:80

TIME:3h

SECTION A (20 marks)

(Answer all questions)

QUESTION 1

A. Choose the correct answer from the following.

- (i) A boy can throw a stone up to a maximum height of 10m. The maximum horizontal distance that the boy can throw the same stone up to will be
(a) $20\sqrt{2}m$ (b) 10m (c) $10\sqrt{2}m$ (d) 20m
- (ii) A man is standing on a weighing machine in a lift. How will the reading of the machine change if the lift is moving upwards with an acceleration.
(a) remain same (b) increase (c) decrease (d) zero
- (iii) The area enclosed by the force-time graph represents
(a) work (b) impulse (c) potential energy (d) power
- (iv) A shell explodes in mid air. Its total
(a) momentum increases (b) momentum decreases
(c) kinetic energy increases (d) kinetic energy decreases
- (v) Which of the following is not a conservative force?
(a) Electrostatic force (b) Magnetic force
(c) Viscous force (d) Elastic force
- VI. The increase in internal energy of a system is equal to the work done on the system. Which process does the system undergo?
a. isochoric b. adiabatic c. isobaric d. isothermal
- VII. The heat of 110J is added to a gaseous system whose internal energy is 40J, then the amount of external work done will be
a. 140J b. 70J c. 40J d. none of these
- VIII. Water falls from a height of 50meters. Assuming that all the energy is used in heating the water, the rise in temperature of water will be
a. $1.17^{\circ}C$ b. $11.7^{\circ}C$ c. $0.117^{\circ}C$ d. $117^{\circ}C$
- IX. A mass 'm' is suspended from a spring. Its frequency of oscillation is f. The spring is cut into two halves and the same mass is suspended from one of the two pieces of the spring. The frequency of oscillation of the mass will be
a. $\sqrt{2} f$ b. $f/2$ c. f d. 2f
- X. A particle starts SHM from the mean position. Its amplitude is 'a' and total energy is 'E'. At one instant its kinetic energy is $3E/4$. Then its displacement is
a. $a/\sqrt{2}$ b. $a/2$ c. $\sqrt{3} a/2$ d. $3/4 a$

B. Answer the following.

- (i) A bullet fired on a window glass makes a clear hole in the glass without cracking it. Give reason.
- (ii) Why does a cyclist lean towards the curve while taking a sharp turn?
- (iii) What are concurrent forces?
- (iv) Two identical objects are projected with equal velocities at angles 30° and 60° with the horizontal. Compare their horizontal ranges.
- (v) Define centripetal force.
- (vi) What do you mean by banking of curves?
- (vii) Define absolute zero of temperature.
- (viii) Eskimos make double wall houses of blocks of ice. Give reason.
- (ix) Draw a graph to show the distribution of energy in the spectrum of a black body.
- (x) Define Kelvin-Planck statement.
- (xi) Why does the amplitude of an oscillating pendulum go on decreasing?
- (xii) On what factors, the efficiency of a Carnot engine depends?

SECTION B (2 Mark)

QUESTION 2

Write the expression for horizontal range of a projectile fired at an angle θ with the horizontal direction. At what angle, the range is maximum?

QUESTION 3

Define angle of repose. How is it related to coefficient of friction?

QUESTION 4

(a) Draw the force-displacement graph of a stretched spring. What does the area enclosed by the graph represent?

OR

(b) A solid of mass 2kg moving with a velocity 10m/s strikes an ideal string and produces a compression of 25m in it. Calculate the force constant of the spring.

QUESTION 5

A stone is tied to a weightless string and revolved in a vertical circle of radius 5m. What are the minimum speeds at the lowest and highest points of the circle so as to complete the loop?
($g=9.8\text{m/s}^2$)

QUESTION 6

Friction is a necessary evil. Comment on it.

(2)

QUESTION 7

If $\vec{A} = 2\hat{i} + 3\hat{j} - 5\hat{k}$ and $\vec{B} = -\hat{i} + 4\hat{j} + a\hat{k}$ are perpendicular, find "a".

(2)

QUESTION 8

Which object will cool faster when kept in open air, the one at 300°C or the one at 100°C . Why?

(2)

QUESTION -9

What conclusions can be drawn from the P- V diagram of a cyclic process?

(2)

QUESTION -10

Draw the displacement-time graph for a body executing

- i) damped vibration and ii) free vibration.

(2)

QUESTION -11

Show that the acceleration of a particle in SHM is proportional to displacement.

(2)

QUESTION -12

- a. The efficiency of a Carnot engine is 0.6. It rejects 20J of heat to the sink. Calculate the work done by the engine.

OR

- b. The time period of oscillation of a spring is 1.57s when a mass of 100g is suspended from its lower end. Calculate

- i) the force constant of the spring.
ii) the kinetic energy of the mass when its displacement is equal to its amplitude.

(2)

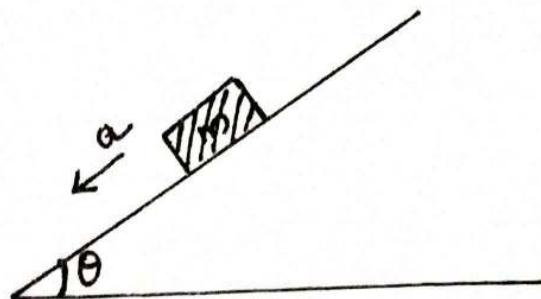
SECTION C (3mark)**QUESTION 13**

State and prove law of conservation of linear momentum.

(3)

QUESTION 14

- (a) A block of mass 'm' is placed on a rough inclined plane. Draw the free body diagram and obtain the expression for acceleration of the block.



OR

(b) A body is in limiting equilibrium on a rough plane, inclined at 30° with the horizontal. When the inclination is increased to 45° , the body slides down with acceleration. Find the acceleration. ($g=9.8\text{m/s}^2$). (3)

QUESTION 15

1. Define angular velocity. State its unit. (3)
2. Obtain the relation between angular velocity and linear velocity. (3)

QUESTION 16

Show that the total mechanical energy is conserved during the free fall of a body. (3)

QUESTION -17

- i) State Wien's displacement law.
- ii) The surface temperature of a hot body is 1227°C . Find the wavelength at which it radiates maximum energy. Given Wien's constant = 0.2898 cmK (3)

Question -18

- i) What is Carnot's engine?
- ii) Draw a neat P-V diagram showing cycle of operations of it.
- iii) List the four stages of operation in proper order. (3)

Question -19

- a) A spring of force constant 1200Nm^{-1} is mounted horizontally on a horizontal table. A mass of 3kg is attached to the free end of the spring, pulled sideways to a distance of 2cm and released.
 - i) What is the frequency of oscillation of the mass?
 - ii) What is the maximum acceleration of the mass?
 - iii) What is the maximum speed of the mass?

OR

- b) i) The acceleration due to gravity on the surface of the moon is 1.7m/s^2 . What is the time period of a simple pendulum on the moon if its time period on the earth is 3.5 s . Take g on earth = 9.8 m/s^2 .
 - ii) What will the time period of the pendulum on the moon if the mass of the bob is doubled? (3)

SECTION D (5marks)

QUESTION 20

- (a) 1. What is meant by collision?
2. Differentiate between elastic and inelastic collision.
3. Prove that in an elastic collision in one dimension, the relative velocity of approach before impact is equal to the relative velocity of separation after impact.

OR

- (b) 1. Differentiate between conservative and non conservative forces.
2. State and prove work- energy theorem.

(5)

QUESTION 21

- a) i. Derive an expression for the kinetic, potential and total energies of a simple harmonic oscillator.
ii. Draw a graph to show the variations of energies of a simple harmonic oscillator with time 't'.

OR

- b) i. Derive an expression for the displacement of particle in SHM.
ii. Draw displacement-time, velocity-time and acceleration-time graphs for a particle executing simple harmonic motion.

(5)

QUESTION -22

- a) i) Define and write an expression for coefficient of performance of a refrigerator.
ii) A refrigerator freezes 5kg of water at 0°C into ice at 0°C in a time interval of 20 minutes. Assume that the room temperature is 20°C . Calculate the minimum power needed to accomplish it.

OR

- b) i) Derive an expression for the work done during the adiabatic expansion of an ideal gas .
ii) State the essential conditions for an adiabatic process to take place.
iii) A gas is suddenly compressed to one fourth of its original volume.

Calculate the rise in temperature, the original temperature being 27°C and (5)

$$\Gamma = 1.5$$