MAR THOMA RESIDENTIAL SCHOOL,TIRUVALLA
SECOND TERMINAL EXAMINATION -2018

STD XI **PHYSICS** MARK:70
TIME:3h

SECTION A(1 MARK)

Question 1

A. Choose the correct answer from the following: (5)

i) A ball of mass m is projected with a velocity u at angle of 60^0 with the horizontal. The velocity at the highest point of the trajectory is

a) u b) u/2 c) 0 d) $\sqrt{3}u/2$

ii) The coefficient of restitution for a perfectly elastic collision is

a) 1 b) 0 c) ½ d) -1

iii) The angle between $\hat{i}x\hat{j}$ and $\hat{i}$ is

a) 0 b)45^0 c) 60^0 d) 90^0

iv) For an adiabatic change of a perfect gas the relation between the pressure and volume.

a) PV^{γ}=constant b) $P^{\gamma}V$ =constant c) PV =constant d) $PV^{\gamma-1}$=constant

v) If a gas has *n* degrees of freedom, ratio of specific heats of a gas is

a) $(1+n)/2$ c) $1+1/n$

b) $1+n/2$ d) $1+2/n$

B. Answer the following (7)

i) A horse has to apply more force to start a cart than to keep it moving. Why?

ii) A light body and a heavy body has equal kinetic energy. Which one will have greater momentum?

iii) Why does an athlete run before taking a long jump?

iv) State the law of equipartition of energy?

v) An ideal gas is compressed at a constant temperature will its internal energy increase or decrease .Why?

vi)Give the dimensions of Boltzmann constant.

vii) What is the relationship between temperature and average kinetic energy of a molecule?

SECTION B (2 MARKS)

Question 2

i) State parallelogram law of vector addition. (2)

ii) Find the cross product of the vectors $\vec{A} = 3\hat{i}+5\hat{j}+2\hat{k}$ and $\vec{B} = 2\hat{i}-4\hat{j}+3\hat{k}$.

Question 3

Two objects are projected with velocities 20m/s and 10m/s at angles 30^0 and 45^0 respectively. Find the ratio of their ranges. (2)

Question 4

a) i) State impulse momentum theorem. (2)

ii) A cricket ball of mass 150g moving with a velocity of 15m/s is brought to rest by a player in 0.05s. Calculate the impulse imparted by the player.

OR

b)A 70kg man standing on a weighing machine in a lift. What will be the reading of the machine, when the lift is (i) moving upwards with a uniform velocity of 5m/s
(ii) moving upwards with an acceleration of $2m/s^2$. ($g=10m/s^2$)

Question 5

An elastic spring of force constant k is continously stretched to a maximum elongation of x_0. i) Draw the force –extension graph. (2)

ii) what do the following represent?

a) area enclosed by the graph b) slope of the graph.

Question 6

"Friction is a necessary evil" . Comment on this. (2)

Question 7

I) Define angle of response. (2)

ii) Obtain the relation between angle of response and coefficient of static friction.

Question 8

State Newton's law of cooling and write its mathematical expression. (2)

Question 9

Obtain Mayer's relation with the help of first law of thermodynamics . (2)

Question 10

i)Can a Carnot engine be realized in practice. Explain?

ii)Write the expression for efficiency of a Carnot engine? (2)

Question 11

a) Determine the values of C_p, C_v, γ using the law of equipartition of energy for i) monoatomic gas ii)polyatomic gas .

OR

b) i)State the first law of thermodynamics .

ii)Name the physical quantity that remains conserved in this law? (2)

Question 12

Which is greater: specific heat of gas at constant pressure or specific heat of gas at constant volume. Give reason? (2)

SECTION C (3 MARKS).

Question 13 (3)

i) Define angular velocity.

ii) Derive the relation connecting angular velocity and linear velocity.

Question 14 (3)

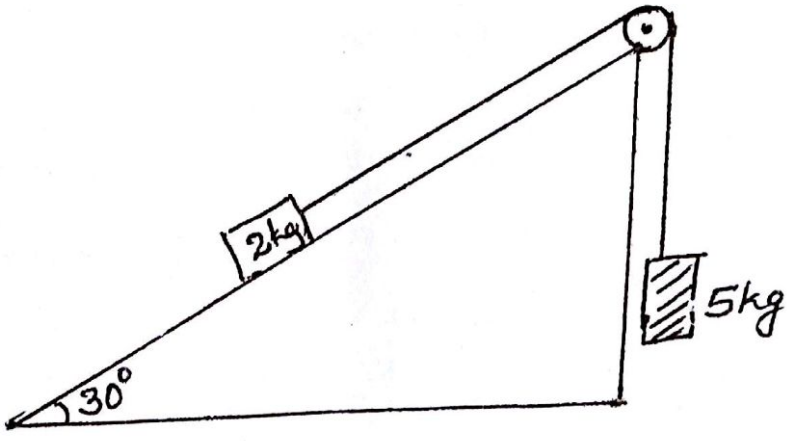
i) State the real law of motion.

ii) State and prove the law of conservation of linear momentum using Newton"s third law of motion.

OR

i) State the laws of static friction.

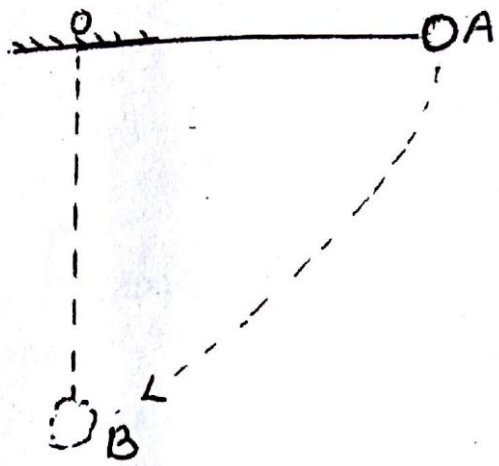
ii) Two blocks of masses 2kg and 5kg are connected by means of an inextensible string passing over a pulley as shown in the figure. Calculate the acceleration of the system and tension in the string. ($g = 9.8 m/s^2$)



Question 15 (3)

i) State and prove work- energy theorem.

ii) The bob of a simple pendulum is held in the horizontal position A as shown in the figure. Calculate the speed of the bob at the lowest position B when released. The length of the pendulum is 0.5m and it is assumed that there is no loss of energy.



Question 16 (3)

i)What is Carnot's engine?

ii) Derive a neat P-V diagram showing cycle of operation of it ?

iii) List the four stages of operation in proper order and explain each ?

Question 17 (3)

i)State Wien's displacement law?

ii)The surface temperature of a hot body is 1227 °C. Find the wavelength at which t radiates maximum energy .Given Wien's constant = 0..2982cmk.

Question 18 (3)

a)i)What is a heat engine?

ii)Explain its working principle ? Write the equation for the efficiency of heat engine

iii)A Carnot engine has the same efficiency I)between 100 K and 500K II) between T K and 900K .Calculate the temperature T K of the sink?

OR

b)i)What is meant by coefficient of linear expansion, superficial expansion and cubical expansion?

ii)Derive the relationship between them?

Question 19 (3)

Derive an expression for the pressure exerted by an ideal gas on the basis of kinetic theory?

SECTION D (5 MARKS)

Question 20 (5marks)

a) (i) Distinguish between elastic and inelastic collision.

ii) Prove that the relative velocity of approach and the relative velocity of separation are equal and opposite in a head on elastic collision. Hence obtain the expressions for velocities after collision.

iii) If the linear momentum of a body is doubled , by what percentage will its kinetic energy change?

OR

b) i) What do you mean by banking of roads?

ii) Derive an expression for maximum possible speed of a vehicle on a banked road.

iii) A body of mass0.1kg is being rotated in a circular path of diameter 1.0m on a frictionless horizontal plane by means of a string. It performs 10 revolutions in 3.14s. Calculate the centripetal force acting on the body.

Question 21 (5 marks)

a) i) Show thay the mechanical energy is conserved during free fall of a body.

ii) Draw the graph showing the variation of kinetic energy and potential energy of an oscillating pendulum.

iii) The potential energy of a certain spring when stretched through 10cm is 5J. Calculate the amount of work must be done to stretch it through an additional distance of 10cm.

OR

b)i)Why do solids expand on heating?

ii)State any four assumptions on which the kinetic theory of gas?

iii)A quantity of air at 27° C and atmospheric pressure is suddenly compressed to half its original volume. Find the final i) pressure and ii) temperature. Given $\sqrt{}$ of air=1.42 .

Question 22 (5 marks)

a) i)Distinguish between isochoric and isobaric process?

ii)Derive an expression for work done in an adiabatic process?

iii) A gas is suddenly compressed to one-fourth of its original volume. Calculate the rise in temperature being 27°C and γ=1.5

OR

b)i)Derive Boyle's law and Charles law on the basis of kinetic theory of gases?

ii)Derive Specific heat of water and specific heat of solids on the basis of law of equipartition of energy?

iii)The velocities of 10 particles in m/s are 0,2,3,4,4,4,5,5,6,9. Calculate their 1)average speed and 2) r.m.s. speed.