MAR THOMA RESIDENTIAL SCHOOL,TIRUVALLA
ANNUAL EXAMINATION -2017-18

STD XI PHYSICS MARK:80
Time: 3hr

SECTION A

Question 1

A. Choose the correct answer from the following. [10]

(i) The respective number of significant figures for the measurements 23.023kg, 0.0003cm and 2.1x10-3 m^3 are

(a) 4.4.2 (b) 5,1,2 (c) 5,1,5 (d) 5,5,2

(ii) Pick out the odd one from the following.

(a) Angular momentum (b) Torque (c) Kinetic energy (d) Linear momentum

(iii) A solid sphere of radius R is rolling with velocity v on a smooth plane. The total kinetic energy o the sphere is

(a) 7/10 mv^2 (b) 3/4mv^2 (c) 1/2mv^2 (d) 1/4mv^2

(iv) Two masses m and M are situated in air and the gravitational force between them is F. The space arpund them is filled with a liquid of relative density 3. The gravitational force will now be

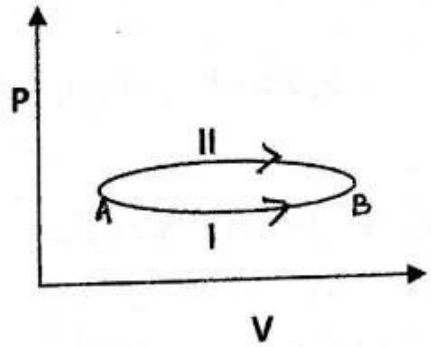
(a) 3F (b) F (c) F/3 (d) F/9

(v) A person is sitting in a lift accelerating upwards. Measured weight of the person will be

(a) less than actual weight (b) equal to actual weight

(c) more than actual weight (d) zero

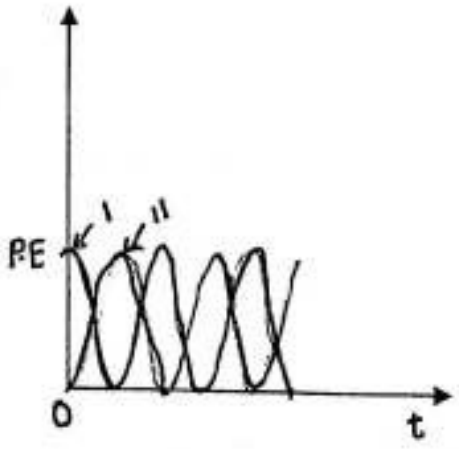
I. A system goes from **A** to **B** (via) two processes **1** and **11** as shown

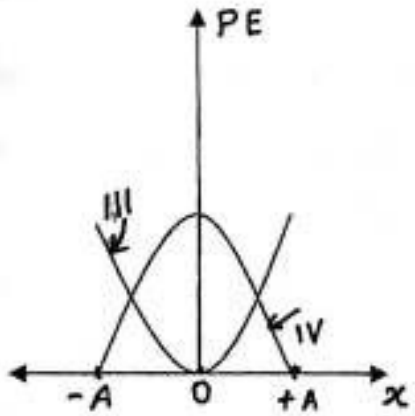


If ΔU_1 and ΔU_2 are the changes in the internal energies in the processes **I** and **ii** respectively. Then

a) $\Delta U_1 = \Delta U_2$ b) $\Delta U_1 > \Delta U_2$ c) $\Delta U_1 < \Delta U_2$ d) relation between ΔU_1 and ΔU_2 cannot be determined.

VII. For a particle executing S.H.M.,the displacement ' **x** ' is given by **x = A cosωt.** Identify the graph which represents the variation of potential energy (PE) as function of time 't' and displacement ' x'





a) I, IV b) II, III c) I, III d) II, IV

VIII. The velocity of sound in air at NTP is 330 m/s. What will be its value when pressure is doubled?
a) 165 m/s b) 660 m/s c) 330 m/s d) 330 √2m/s

IX. The dimensional formula of modulus of rigidity is
a) $ML^{-2}T^{-2}$ b) $ML^{-3}T^{-2}$ c) $ML^{2}T^{-2}$ d) $ML^{-1}T^{-2}$

X. The breaking stress of a wire depends upon
a) length of the wire b) radius of the wire c) Material of the wire d) shape of the cross-section

B. Answer the following questions. [12]

(i) Our earth has a thick atmosphere while moon has no atmosphere. Why?

(ii) Define radius of gyration of a rotating body about an axis.

(iii) The maximum range of a projectile is 2/√3 times the actual range. What is the angle of projection for the actual range?

(iv) A force $\vec{F}= (5\hat{i}+3\hat{j}+2\hat{k})$ N displaces a particle from origin to a point $\vec{r}=(2\hat{i}-\hat{j})$m. Calculate the workdone on the particle.

(v) A wheel of moment of inertia 5kgm^2 is rotaing about its axle with 180 rotaions per minute. Calculate the torque required to stop the wheel in 10 second.

(vi). Why does a rifle give a backward kick while firing a bullet?

(vii).Calculate the efficiency of a Carnot engine working between the temperatures 100 K and 500

(viii).What will be the period of oscillation, if the length of a second's pendulum is halved?

(ix) Draw the acceleration-time graph for a particle executing simple harmonic motion.

(x) Sound can be heard over longer distances on a rainy day. Why?

(xi) A steel wire 0.72m long has a mass of 5×10^{-3} kg. If the wire is under a tension of 60N, what is the speed of transverse waves on the wire?

(xii) State Hooke's law.

SECTION B

Question 2

(i) Give the dimensional formula of 1. Angular momentum and 2. Gravitational potential

(ii) State parallelogram law of vectors. [2]

Question 3

An object is projected with a velocity u at an angle θ with the horizontal. Obtain the expressions for (i) time of flight and (2) maximum height. [2]

Question 4

(i) A car is moving with a speed of 126km/h is brought to a stop within a distance of 200m. Calculate the retardation of the car and the time required to stop it.

OR

(II) The velocity of a train increases uniformly from 18km/h to 126km/h in 4 hour.Calculate the distance travelled by the train in this period. [2]

Question 5

(i) What are geostationary satellites? At what height above the earth they orbit?

(ii) Write the uses of these satellites. [2]

QUESTION 6

(i) Name the rotational analog of mass

(ii) State the factors on which it depends. [2]

QUESTION 7

(I) Define centre of mass of a system of particles.

(ii) Three point masses 1kg, 2kg and 3kg lie at (1,2), (0,-1) and (2,-3) respectively. Calculate the co ordinates of the centre of mass of the system. [2]

Question 8

Two bodies M and N of equal masses are suspended from two separate massless springs of spri constants k_1 and k_2 respectively. If the two bodies oscillate vertically such that their maximum velocities are equal, then find the ratio of the amplitude of M to that of N. [2]

Question 9

Why does the pitch of a note produced by a wooden open end pipe becomes sharper when the temperature rises? [2]

Question 10

Using the law of equipartition of energy, determine the values of C_p and C_v for a non-linear triato gas molecule. [2]

Question 11

What do you understand by the term capillarity ? Write an expression for the rise of liquid in a capillary tube. [2]

Question 12

A faulty thermometer has its fixed points marked as 5^0 and 95^0. Temperature of a body as meas by the faulty thermometer is 59^0. Find the correct temperature of the body on Celsius scale.[2]

OR

A structural steel rod has a radius of 10mm and a length of 1m. A 100 kN force stretches it alor length. Calculate the stress. [2]

SECTION C

QUESTION 13

(I) What is meant by banking of roads?

(ii) With the help of a free body diagram derive an expression for the maximum possible speed vehicle on a banked road. [3]

QUESTION 14

(i) Differentiate between elastic and inelastic collisions. (2 points)

(ii) Derive an expression for the velocities after a head on elastic collision. [3

QUESTION 15

(i) State the law of conservation of angular momentum.

(ii) Prove that $\vec{\tau}=d\vec{L}/dt$.

(ii) A boiled egg and a raw egg are spinning on a table. How will you distinguish them with out touching them?

OR

(i) Give the rotational analog of linear momentum. I it a scalar or vector quantity?

(ii) A circular disc of mass 2kg and radius 0.5m rotating about an axis through its centre and it completes 120 revolutions in one minute. Calculate its (1) moment of inertia and (2) rotationa kinetic energy. [

QUESTION 16

(i) State Kepler's laws of planetary motion.

(ii) Define escape velocity and derive an expression for it.

Question 17

1. State and explain for first law of thermodynamics.
2. Heat equivalent to 50 J is supplied to a thermodynamic system and 10 J work is done on the system. What is the change in internal energy of the system in the process? [3]

Question 18

1. State the law of equipartition of energy.
2. Write an expression for the most probable speed in terms of temperature of the gas.
3. Write an expression for the pressure exerted by an ideal gas, on the basis of kinetic theory. [3]

Question 19

1. What is terminal velocity?
2. An iron ball of radius 0.3cm falls through a column of oil of density $0.94gcm^{-3}$. It is found to attain a terminal velocity of $0.5cms^{-1}$. Determine the viscosity of the oil. Given that the density of iron is $7.8gcm^{-3}$.

OR

1. State Kirchhoff's law of heat radiation.
2. Steam at 100^0C is passed into a copper cylinder 10mm thick and of 200 cm^2 area. Water at 100^0C collects at the rate of $150gmin^{-1}$. Find the temperature of the outer surface, if the conductivity of copper is $0.8cals^{-1}cm^{-1}{}^0C^{-1}$ and the latent heat of steam is 540 $calg^{-1}$. [3]

SECTION D

QUESTION 20

(a) (i) State theorem of parallel axes for the moment of inertia of a body.

(ii) Determine the moment of inertia of a solid sphere about a tangent.

(iii) Derive an expression for the acceleration of a solid cyinder rolling without slipping down an inclined plane. State the condition for rolling without slipping down the plane.

OR

(B) (i) State Newton's universal law of gravitation.

(Ii) Define Gravitational potential of a body at a point in a gravitational field. Derive an expression for it.

(iii) Give the expressions for acceleration due to gravity above and below the surface of earth.

(iv) Find the value of acceleration due to gravity at (i) height (ii) depth equal to half the radius of earth. (g on the surface=$9.8m/s^2$) [5]

a.1. What is the basic condition for the motion of a particle to be simple harmonic?
2. Deduce an expression for the velocity of a particle executing simple harmonic motion.
3. A block is resting on a piston which is moving vertically with simple harmonic motion of period one second. What is the maximum velocity of the piston, when its amplitude is 0.248m?

OR

b) 1.What is doppler effect?
2. Derive an expression for the apparent frequency when both the source and the listener are m in the direction of sound.
3. A train stands at a platform blowing whistle of frequency 400 Hz in still air. What is the frequency of the whistle heard by a man running
i) towards the engine at 10m/s and
ii) away from the engine at 10m/s.(Take Speed of sound in still air =340m/sec] [5

Question 22

a. 1. Derive an expression for the time period of the horizontal oscillations of a massless loaded spring.
2. A spring compressed by 0.2m develops a restoring force of 25N. A body of mass 5kg is placed over it. Find the
i) force constant of the spring.
ii) the period of oscillation, if the body is disturbed.

OR

b. 1. How are stationary waves produced?
2. Derive an expression for the frequency of the first and second mode of vibrations of a closed pipe.
3. Why do we not hear beats due to sound waves produced by the violins in the violin- section of an orchestra? [5