FIRST TERMINAL EXAMINATION, 2016
PHYSICS

Time : 3 hrs. **Class XI** **M.M. : 90**

Date – 19.09.2016

General Instructions:

- All questions are compulsory.
- There are 26 questions.
- Question No **1 to 5** carry **1 mark** each.
- Question No **6 to 10** carry **2 marks** each.
- Question No **11 to 22** carry **3 marks** each.
- Question No **23** carries **4 marks**.
- Question No **24 to 26** carry **5 marks** each.

Q.1 Write two pairs of physical quantities, which have same dimensional formula.

Q.2 The displacement time graph for two particles X and Y are straight lines making angles of 30^0 and 60^0 with the time axis. What is the ratio of the velocities of Y and X ?

Q.3 A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards east. What is the direction of $\vec{A}\times\vec{B}$?

Q.4 Calculate the angular speed of flywheel making 420 revolutions per minute.

Q.5 The distance travelled by a moving body is directly proportional to time. Find external force acting on it?

Q.6 The heat dissipated in a resistance can be determined from the relation H = $\frac{I^2Rt}{4.2}$ cal. If the maximum errors in the measurement of current, resistance and time are 2%, 1% and 1% respectively, what would be the maximum error in the dissipated heat?

Q.7 Plot position-time and velocity-time graphs for a freely falling body.

Q.8 For what value of *a* are the vectors $\vec{A} = a\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{B} = 2a\hat{i} + a\hat{j} - 4\hat{k}$ perpendicular to each other?

Q.9 Prove that the maximum horizontal range is four times the maximum height attained by the projectile, when fired at an inclination so as to have maximum horizontal range.

Q.10 Derive relation between linear velocity (ν) and angular velocity (ω).

OR

State laws of limiting friction.

Q.11 Assuming that the critical velocity v_c of a viscous liquid flowing through a capillary tube depends only upon the radius 'r' of the tube, density 'ρ' and the coefficient of viscosity 'η'of the liquid, find the expression for critical velocity.

Q.12 If two resistors of resistances $R_1 = (4 \pm 0.5)\Omega$ and $R_2 = (16 \pm 0.5)\ \Omega$ are connected (i) in series (ii) in parallel then find the percentage error in each case.

Q.13 Derive any two equations of motion using calculus method.

Q.14 A boat covers certain distance between two spots on a river taking 4 hrs going downstream and 6 hrs going upstream. What time the boat will take to cover same distance in still water?

Q.15 State and prove triangle law of vector addition.

Q.16 Find the area of the triangle formed by the tips of the vectors $\vec{a} = \hat{i} - \hat{j} - 3\hat{k}$, $\vec{b} = 4\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$.

Q.17 To a person moving eastwards with a velocity of 48 km/hr, rain appears to fall vertically downwards with a speed of 6.4 km/her. Find the actual speed and direction of the rain. ($\tan 53^0 7' = 1.33$)

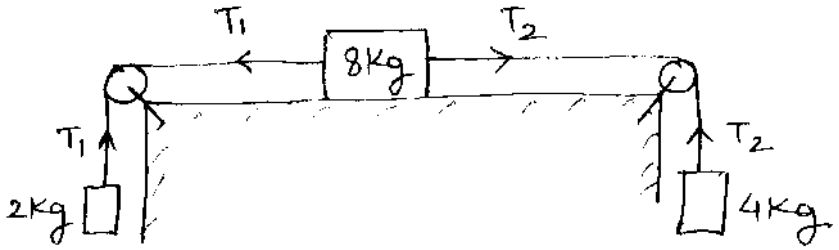
Q.18 A particle is projected horizontally with a speed 'u' from the top of a plane inclined at an angle θ with the horizontal. How far from the point of projection will the particle strike the plane?

Q.19 Define centripetal acceleration. Derive an expression for the centripetal acceleration of a particle moving with uniform speed 'ν' along a circular path of radius 'r'.

Q.20 Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle θ. The coefficient of friction between the wheels and the road is 'μ'.

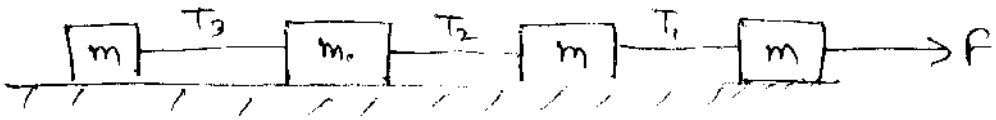
Q.21 Show that Newton's Second Law of motion is the real law of motion.

Q.22 In fig. given below, find the acceleration 'a' of the system and the tension T_1 and T_2 in the strings. Assume that the table and the, pulleys are frictionless and the strings are mass less. Take g = 9.8 m/sec^2.



OR

Four block of the same mass 'm' connected by cords are pulled by a force 'F' on a smooth horizontal surface. Determine the tensions T_1, T_2 and T_3 in the cords.



Q.23 Before 1600 AD, scientists felt that the natural state of matter was the state of rest. Galileo was the first to take a different approach to motion and the natural state of matter. He performed various experiments and concluded that it is not the nature of an object to stop once set in motion, rather, it is its nature to resist changes in its motion.

a) State Galileo's approach to motion in his own words.

b) How was this approach formalized later by Newton?

c) Can you bring in some human trait in this context?

Q.24 A body tied to one end of a string is made to revolve in a vertical circle. Derive the

expression for the velocity of the body and tension in the string at any point. Hence, find

(a) tension at the bottom and the top of the circle.

(b) minimum velocity at the lowest point so that it is just able to loop the loop.

(c) the minimum velocity at the top.

OR

(a) Find an expression for the work done against friction when a body is made to slide up an inclined plane.

(b) Find an expression for the work done against friction when a body is made to slide down an inclined plane.

Q.25 (a) What is a projectile? A projectile is fired with a velocity u making an angle θ with the horizontal. Show that its trajectory is a parabola.

(b) Derive expression for its -

i) time of flight ii) maximum height iii) horizontal range

OR

A projectile is fired horizontally with a velocity 'u' from a point at a height 'h' above the ground. Show that its trajectory is a parabola. Also obtain expressions for its (i) time of flight (ii) horizontal range (iii) velocity at any instant.

Q.26 a) A body of mass 'm' is placed on the floor of a lift. Find its apparent weight when the lift is –

i) moving upwards with uniform acceleration 'a'

ii) moving downwards with uniform acceleration 'a'

iii) at rest or moving with uniform velocity 'ν'

b) Why is it easier to pull a lawn roller than to push it? Explain.

OR

a) A thin circular loop of radius R rotates about its vertical diameter with an angular frequency 'ω'. Show that a small bead on the wire remains at its lower most point for $\mu \leq \sqrt{\frac{g}{R}}$? What is the angle made by the radius vector joining the centre to the bead with the vertical downward direction for $\mu = \sqrt{\frac{2g}{R}}$? Neglect friction.

b) A ball of mass 0.1 kg is suspended by a string 30cm. Keeping the string always tight, the ball describes a horizontal circle of radius 15 cm. Calculate the angular speed.