8cm are respectively 13π and 12π cm/sec.

(30) A point moving in a straight line with S.H.M has velocities v_1 & v_2 when its distances from the centre are x_1 & x_2. Show that the period of motion is $2\pi\sqrt{\frac{x_1^2 - x_2^2}{v_2^2 - v_1^2}}$

(31) A particle is attached to the middle point of a uniform elastic string which is stretched b/w two points A & B and then liberated, show that the motion is S.H.M and find the period of motion. What is the amplitude?

(32) Prove that the work done against the tension in stretching a light elastic string is equal to the product of its extension and the mean of the initial and final tension.

(33) A mass m hangs from a fixed point by means of an elastic string and is given a vertical displacement. If n is the no. of oscillation per second in the ensuring S.H.M and l is the equilibrium length of the string. Show that the natural length of the string is $l - \frac{g}{4\pi^2 n^2}$.

(34) A body of mass m is placed on a horizontal plane which is moving with constant acceleration f. To find the pressure of mass m on the plane if
(i) the acceleration is in the upward direction.
(ii) the acceleration is in the downward direction.

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(iii) what happens if the downward acceleration of the plane more than the acceleration due to gravity.

(35) Two particles of masses m_1 & m_2 are connected by a light inextensible string, m_2 is placed on the smooth horizontal table. The string passes over a light pulley at the edges of the table and m_1 is hanging freely. Find the motion, tension in the string and pressure on the pulley.

(36) A mass of 10kg falls freely a distance of 10m from rest and is then brought to rest after penetrating through 1m in sand. Find the average force exerted by the sand on it.

(37) Two scale pans each of mass 4kg are connected by a light string passing over a pulley. Show that how to divide a mass of 10kg in two pans, so as to produce an acceleration of $\frac{g}{9}$.

(38) Prove that the shortest time from rest to rest in which a steady load P tons can lift a wt. W ton and through a vertical distance h ft. is $\sqrt{\frac{2hP}{g(P-W)}}$ seconds.

(39) If the string of an Atwood's machine can bears a strain of only $\frac{1}{4}$ of the sum of two weights. show that the least possible acceleration is $\frac{g}{\sqrt{2}}$.

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(40) Find the uniform force that will move 1 kg mass from rest through 1 meter in 1 second.

(41) A body whose true weight is 13 kg. wt. appeared to weigh 12 kg. wt. when weighed by means of spring balance in a moving lift. What was acceleration of the lift at the time of weighing.

(42) A mass of 3 kg descending vertically draws up a mass of 2 kg by means of light string passing over a smooth pulley. At the end of 5 seconds string breaks. Find how much higher the 2 kg mass will go?

(43) An aeroplane which together with its load weights M kg, is falling with an acceleration of f ft/sec^2 such that $(f < g)$. Show that if the part of the load equal to $\frac{2Mf}{f+g}$ kg be thrown out, the aeroplane will be begin to rise with an acceleration of f m/sec^2

(44) Masses of 4 kg & 2 kg are connected by a thread passing over a light pulley. Find the distance travelled by particle in 6 second.

(45) A body of mass 25 gms is acted upon by a constant force. It acquires a velocity of 2 cm/sec. in 5 sec. from rest. Find how large is the force acting?

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(46) A force of 150 N acts on a body of mass 15 kg. for 5 minutes and then ceases. What is the force required to bring the body to rest in 2 minutes?

(47) A balloon of mass m is rising with an acceleration f. Prove that the fraction of weight of the balloon that must be detached in order to double its acceleration is $\frac{mf}{2f+g}$, assuming the upthrust of the air remains the same.

(48) Define Newton's first law of motion.

(49) A train whose mass is 20 tons moves at the rate of 60 m.p.h. After steam is shut off, it is brought to rest by breaks in 500 yds. Find the retarding force assuming it to be uniform.

(50) A mass of 5 kg is suspended from a spring balance in a balloon ascending vertically upwards with a uniform acceleration. If the retarding of the spring balance is 6 kg, find the acceleration of the balloon.

(51) Prove that in any displacement of a particle, the change in the K.E is equal to the work done by the impressed force acting on the particle.

(52) An engine of horse-power H, draws a train of mass M tons up an incline of I in n against a resistance of m lbs wt. per ton. Show that maximum speed of the train is $\frac{550Hn}{M(2240+mn)}$ ft./sec.

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(52) A car of mass 900kg has an engine with power out 42kW. If it can achive a speed of 120 km/h along the level, find:

(i) Resistance of motion.

(ii) If maximum power and the resistance remain the same, what would be the maximum speed of the car could achieve up an incline of 1 in 40 along the slope?

(53) A rifle bullet losses $\frac{1}{25}$th of its velocity in passing through a plank. Find how many such uniform planks' it would pass throug before coming to rest assuming the thickness of planks to be uniform.

(54) A locomotive engine draws a load of m lbs. up an incline of α to the horizon, the co-efficient of friction being μ. If starting from rest & moving with uniform accelerration it acquires a velocity v in t seconds, show that average H.P. at which the engine has worked is $\frac{mv}{1100}\left[\frac{v}{gt} + \mu\cos\alpha + \sin\alpha\right]$.

Q55 A particle is projected with a velocity of 14m/sec at an angle of elevation 60°. Find the time of flight and the range of horizontal plane.

Q56 A heavy particle strolls down a smooth cycloid starting from rest at the cusp. the axis being verticle and vertex downcoords. Prove that magnitud

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