CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

RESIT/SPECIAL

EXAMINATION FOR THE AWARD OF BACHELOR OF EDUCATION ARTS

MATH 223: MECHANICS

STREAMS: BED (ARTS) **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 03/02/2021 **11.30 A.M. – 1.30 P.M.**

INSTRUCTIONS: All questions are compulsory.

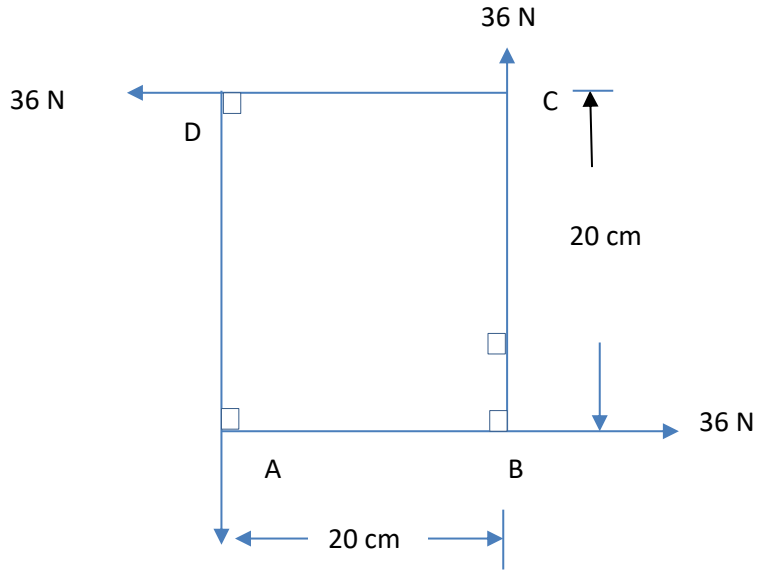
Take g=10N/kg

Question One (30 marks)

a) A partial moving in straight line with a constant acceleration travels 10m in the first second and 15m in the second second. Determine the distance travelled in the third second (5mks)

b) A stone is thrown with an initial velocity of 300m/s at an angle of 60^0 to the horizontal. Find the maximum height that it attains. (3mks)

c) Show that a force of magnitude 36N acting at the vertices of the square ABCD below form a couple and determine the magnitude of the couple if the length of the square is 20cm. (5mks)



d) A smooth wire is bent to form a circular ring of radius r meter. The ring is held in a vertical plane and a small bend of mass 10g is threaded on the wire. The bend is given a small displacement from the lowest position and is then released. If at any instant the radius to the bend is inclined at an angle θ to the vertical, show that $\ddot{\theta} = \frac{-g}{\gamma}\theta$ (5 mks)

e) A particle of mass 0.2kg is moving on a course 032^0 at 25m/s. It's acted upon by a force of 15N for 0.45s, so that the subsequent direction of its motion is 098^0. Find the direction of the force and the final speed of the particle. (5 mks)

f) A block of wood is placed on a horizontal plank. The plank is titled so that the angle of inclination increases to 25^0. At this angle, the block begins to slide down the plank. Determine the coefficient of friction. (5 mks)

g) An object of mass 4kg moves round a circle of radius 6m with a constant speed of 12m/s. Calculate the force towards the centre. (2 mks)

Question Two (20 marks)

a) A simple pendulum of length L suspended from a fixed point is allowed to oscillate about the vertical. When the string is inclined at an angle θ to the vertical line, the speed of the bob is v ms^{-1}. Neglecting air resistance, show that the bob performs simple harmonic motion. (6 mks)

b) A uniform ladder of mass 30kg and length 4m stands on a rough horizontal ground and leans against a smooth vertical wall. The foot of the ladder is 1.2m out from the wall. Determine:

i. The normal contact force of the wall on the ladder. (3 mks)

ii. The normal contact force of the ground on the ladder. (3 mks)

iii. The frictional force of the ground on the ladder. (2 mks)

c) A particle P is projected vertically upwards from a point A with an initial velocity of 40m/s. One second later, another particle Q is projected from the point A with the same vertical velocity. Calculate:

i. The time the particles takes to collide after the projection of Q. (4 mks)

ii. The height from point A of the point of collision (2 mks)

Question Three (20 marks)

a) The fig.1 below shows two bodies A and B of masses 3kg and 5 kg respectively placed on the rough sloping face of a double inclined place. The angles of the sloping sides are 30^0 and 60^0. The coefficient of friction is $1/3$ between A and the left-hand face and $3/5$ between B and the right-hand face

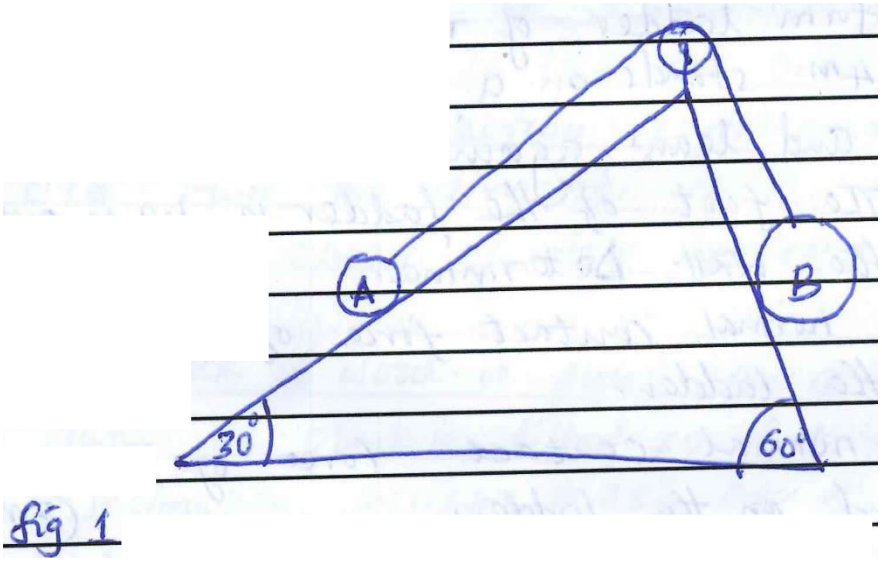


Fig 1

Calculate

i. The acceleration of the system (7 mks)

ii. The tension in the string when the bodies are released from rest. (1 mk)

b) A particle of mass m undergoes an acceleration a when a force F, acts on it such that within a time t, it is displaced through s. given V_o and V are its initial and final velocity, show that:

i. $F = ma$ (4 mks)

ii. $v_o = v - at$ (1 mk)

iii. $v_o = \frac{2s-at^2}{2t}$ (4 mks)

$v_o = \sqrt{v^2 - 2as}$
