SKILLS CHECK

QUESTION 1

A block of mass 200 kg is pulled along a rough horizonal surface by a rope inclined at an angle of 30° to the horizontal. The coefficient of friction between the box and the surface is 0.3. If the box is accelerating at 2.2 ms^{-2}, find the tension in the rope.

QUESTION 2

A ball is thrown vertically upwards from a point 1.8 m above a horizontal surface with velocity 4.9 ms^{-1}. Calculate the height of the first bounce if it will reach 70% of the maximum height reached previously.

QUESTION 3

Two particles of mass 0.4 kg and m kg are connected by a light inextensible string which hang vertically over a smooth fixed peg. The system is released from rest and the 0.4 kg mass moves upwards with a tension in the string of 5N. Find the value of m.

QUESTION 4

A uniform metal bar of mass 40 kg and length 4 m rests on supports at A and B. A is 1 m from one end of the bar and B is 2.25 m from A. Find the magnitude of the reaction forces acting on the bar at points A and B.

QUESTION 5

An object travelling with velocity $(3i - 2j)\ ms^{-1}$ underwent an acceleration of $(i + 2j)ms^{-2}$ for a period of 4 seconds. Calculate the magnitude of the displacement during this period.

SKILLS CHECK

QUESTION 1

A particle is projected from ground level with speed U at and angle of θ° to the horizontal. Show that the maximum height reached by the particle is $\frac{U^2 sin^2\theta}{2g}$

QUESTION 2

A horizonal force of 80N is applied to a sledge of mass 30 kg resting on the snow. The sledge accelerates at 2.2 ms^{-2}. Find the force of the friction acting on the sledge.

QUESTION 3

A parked car begins to move with constant acceleration, reaching the a tunnel 45 seconds later. The car continues to accelerate at the same rate and takes a further 30 seconds to pass through the tunnel which is 600 m long. How far away from the entrance to the tunnel was the car parked?

QUESTION 4

A particle moves in a straight line beginning at the origin when t = 0. It's velocity at time t seconds is given by $v = 6 + 24t^2 – 3t^3$. Find the range of values for t for which the particle is accelerating (not decelerating)

QUESTION 5

A uniform rod AB of length 8 m and weight 50N hangs in equilibrium in a horizontal position supported by vertical strings at A and B. A mass of weight 40 N rests on the rod at point X which is 2.5 m from A. Calculate the tensions in the strings.

SKILLS CHECK

QUESTION 1

A body falls from rest from the top of a tower. During the last second of it motion it falls $\frac{5}{16}$ of the total distance travelled. Find the height of the tower

QUESTION 2

A block of mass 10kg is at rest on a rough plane inclined at an angle θ to the horizontal. The coefficient of friction between the block and the plane is ¼ . Given that the block is on the point of slipping find θ

QUESTION 3

A block of mass 5kg rests on a horizontal table. It is connected by a light inextensible string passing over a smooth pulley at the edge of the table to a 6kg body hanging freely. If the friction force acting on the block is 10N, calculate the acceleration of the block.

QUESTION 4

A uniform rod AB of length 10m and weight 40N hangs in equilibrium in a horizontal position supported by vertical strings at A and B. A mass of weight 20 N rests on the rod at X such at the tension in the string at A is 20% higher than the tension at B. How far is X from B?

QUESTION 5

A particle moves so that its position vector at time t (seconds) is given by $\mathbf{r} = (2t^2 - 3t)\mathbf{i} + (t^3 - 2t)\mathbf{j}$. Calculate the magnitude of the acceleration when t = 4

SKILLS CHECK

QUESTION 1

A particle moves in a horizontal plane with position at time t given by **r** = 5t + 3sin t + 4cos t m. Find the maximum velocity of the particle

QUESTION 2

At t = 0 a particle P is at position vector (2i – 5j)m relative to a fixed origin 0, moving with a constant velocity of (i + 3j) ms^{-1}. Calculate the distance of P from the origin when t = 5.

QUESTION 3

A car accelerates from rest at a uniform rate of 4 ms^{-2} for 5 seconds. It then travels at a constant velocity for 10 seconds before slowing to rest at a constant rate of 1.5 ms^{-2}. Calculate the total distance travelled.

QUESTION 4

A ball is projected with a speed of 10ms^{-1} at an angle of 40° to the horizontal from a point 1.6 m above the ground. The ball hits a wall 4m away. Calculate the height above the ground at which the ball hits the wall.

QUESTION 5

A block of mass 6 kg rests on a rough horizonal surface. A pulling force of 25 N is applied to the block at an angle of 30° to the horizontal. If the block is on the point of moving find the coefficient of friction between the block and the surface.

SKILLS CHECK

QUESTION 1

A block of mass 6 kg rests in limiting equilibrium on a rough plane inclined at an angle of 22° to the horizontal. Find the magnitude of the friction force acting on the block and the coefficient of friction between the block and the plane.

QUESTION 2

A ball is hit from horizontal ground with velocity $(8\mathbf{i} + 24\mathbf{j})$ m s^{-1} where the unit vectors **i** and **j** are horizontal and vertically upwards respectively. Find the range of the ball when it hits the ground.

QUESTION 3

A stone of mass 0.2kg is released from rest on the surface of the water in a well. It takes 3 seconds to reach the bottom of the well. Given that the water exerts a constant resistance of 1.5N, find the depth of the well.

QUESTION 4

A particle has velocity $v = (3 - 2t)i + (2t - 1)j$ ms^{-1} where i and j are unit vectors pointing East and North respectively. When t = 0 the particle has position vector 4i from the fixed origin 0. Calculate the distance of the particle from the origin when the particle is travelling due south.

QUESTION 5

Two forces A (3i + 2j)N and B(4i – 3j)N act on a mass of 400g. Calculate the magnitude of the acceleration of the particle

SKILLS CHECK

QUESTION 1

A block of mass 2 kg moving at a rate of $10m^{-1}$ on a smooth horizontal surface goes onto a rough surface and is brought to a rest in a distance of 25m. Calculate the coefficient of friction between the block and the rough surface.

QUESTION 2

A particle has velocity $v = (2t – 5)i + (2\sin t - 3\cos t)j$ ms^{-1} where i and j are unit vectors pointing East and North respectively. Calculate the magnitude of the maximum velocity of the particle.

QUESTION 3

A uniform rod AB of length 10m and mass 40kg has loads of mass 50kg and 60 kg placed at A and B respectively. Find the distance from A at which a support should be placed so that the rod is in equilibrium when it is horizontal

QUESTION 4

A small gate is 1m wide. It is held shut by a block at the end of the gate opposite the hinge. A perpendicular force of 60 N is applied a distance of 80 cm from the hinge but the block is keeping it shup. Find the frictional force active through the block.

QUESTION 5

A particle of mass 3 kg is projected with velocity 4 ms^{-1} up a slope of a plane inclined at 18° to the horizontal. Assuming the plane is smooth, calculate the time for the particle to return to the base of the slope.

SKILLS CHECK

QUESTION 1

Two children sit on a seesaw formed from a uniform rod of length 3.5m balanced in the middle. One child of mass 35 kg sits on one end of the seesaw. The other child has a mass of 42kg. How far from the other child should the heavier child sit to ensure that the seesaw is balanced?

QUESTION 2

A block of mass m lies on a flat rough surface. One end of the surface is lifted to create an inclined plane. When the angle reaches 40° the block begins to move. Calculate the coefficient of friction between the block and the rough surface.

QUESTION 3

A stone is thrown upwards from a height of 1.7m with speed 1.5 ms^{-1} at an angle of 40° to the horizontal. The stone moves freely under gravity before hitting the ground. Calculate the speed of the ball when it hits the ground.

QUESTION 4

A block of mass 5 kg rests on a smooth plane inclined at 30° to the horizontal. It is connected by a light inextensible string passing over a smooth pulley at the top of the slope to a mass of 3kg. Find the acceleration of the system.

QUESTION 5

A particle of mass 8 kg is acted on by the three forces $F_1 = (2i + 6j – k)$ N, $F_2 = (i – 2j + 4k)$ N and $F_3 = (i – j + 2k)$ N. If the particle starts from rest at position O and is at position A after 4 seconds, calculate the distance OA.