

Pure 2 Applied Chapter 7: Dynamics and Friction Exam Questions (Total Marks 66)

Q1.

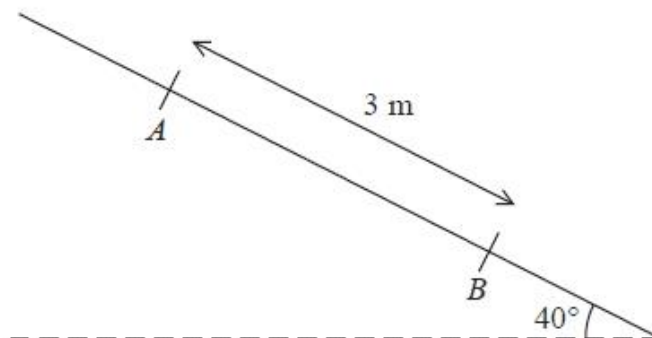


Figure 2

A rough plane is inclined at 40° to the horizontal. Two points A and B are 3 metres apart and lie on a line of greatest slope of the inclined plane, with A above B, as shown in Figure 2. A particle P of mass m kg is held at rest on the plane at A. The coefficient of friction between P and the plane is $\frac{1}{2}$. The particle is released.

(a) Find the acceleration of P down the plane.

(5)

(b) Find the speed of P at B.

(2)

(Total 7 marks)

Q2.

Unless otherwise indicated, whenever a numerical value of g is required, take $g = 9.8 \text{ m s}^{-2}$ and give your answer to either 2 significant figures or 3 significant figures.

A rough plane is inclined to the horizontal at an angle α , where $\tan \alpha = \frac{3}{4}$.

A particle of mass m is placed on the plane and then projected up a line of greatest slope of the plane.

The coefficient of friction between the particle and the plane is μ .

The particle moves up the plane with a constant deceleration of $\frac{4}{5}g$.

(a) Find the value of μ .

(6)

The particle comes to rest at the point A on the plane.

(b) Determine whether the particle will remain at A , carefully justifying your answer.

(2)

(Total for question = 8 marks)

Q3.

A small brick of mass 0.5 kg is placed on a rough plane which is inclined to the horizontal at an angle θ , where $\tan\theta = \frac{4}{3}$, and released from rest. The coefficient of friction between the brick and the plane is $\frac{1}{3}$.

Find the acceleration of the brick.

(9)

(Total 9 marks)

Q4.

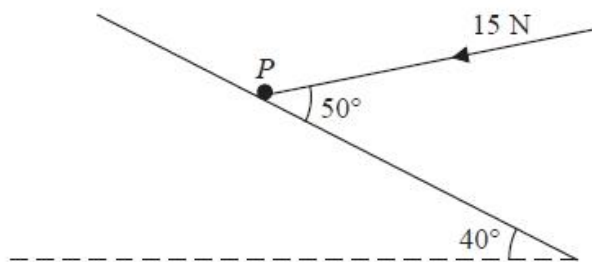


Figure 4

A particle P of mass 2.7 kg lies on a rough plane inclined at 40° to the horizontal. The particle is held in equilibrium by a force of magnitude 15 N acting at an angle of 50° to the plane, as shown in Figure 4. The force acts in a vertical plane containing a line of greatest slope of the plane. The particle is in equilibrium and is on the point of sliding down the plane.

Find

(a) the magnitude of the normal reaction of the plane on P ,

(4)

(b) the coefficient of friction between P and the plane.

(5)

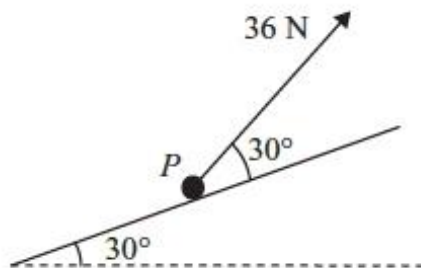
The force of magnitude 15 N is removed.

(c) Determine whether P moves, justifying your answer.

(4)

(Total 13 marks)

Q5.



A particle P of mass 4 kg is moving up a fixed rough plane at a constant speed of 16 m s^{-1} under the action of a force of magnitude 36 N . The plane is inclined at 30° to the horizontal. The force acts in the vertical plane containing the line of greatest slope of the plane through P , and acts at 30° to the inclined plane, as shown above. The coefficient of friction between P and the plane is μ . Find

(a) the magnitude of the normal reaction between P and the plane,

(4)

(b) the value of μ

(5)

The force of magnitude 36 N is removed.

(c) Find the distance that P travels between the instant when the force is removed and the instant when it comes to rest.

(5)

(Total 14 marks)

Q6.

A particle of mass 0.8 kg is held at rest on a rough plane. The plane is inclined at 30° to the horizontal. The particle is released from rest and slides down a line of greatest slope of the plane. The particle moves 2.7 m during the first 3 seconds of its motion. Find

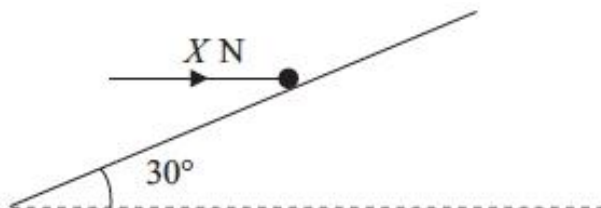
(a) the acceleration of the particle,

(3)

(b) the coefficient of friction between the particle and the plane.

(5)

The particle is now held on the same rough plane by a horizontal force of magnitude $X \text{ newtons}$, acting in a plane containing a line of greatest slope of the plane, as shown below. The particle is in equilibrium and on the point of moving up the plane.



(c) Find the value of X .

(7)

(Total 15 marks)