

Applications of Dynamic Friction

Question Paper 6

Level	A Level
Subject	Maths
Exam Board	AQA
Module	Mechanics 1
Topic	Newton's Laws of motion
Sub Topic	Applications of dynamic friction
Booklet	Question Paper - 6

Time Allowed: 50 minutes

Score: /41

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

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A box, of mass 20 kg, is initially at rest on a rough horizontal surface. A horizontal force of magnitude P newtons is applied to the box. The coefficient of friction between the box and the surface is 0.3.

- (a) State the magnitude of the normal reaction force acting on the box. (1)
- (b) Find the magnitude of the friction force that acts on the box if:
- (i) $P = 80$;
- (ii) $P = 40$. (3)
- (c) Find the value of P when the box is accelerating at 0.8 m s^{-2} . (3)
- (d) When the box reaches a speed of 6 m s^{-1} , the horizontal force P is removed. Find the distance that the box travels after the force P is removed. (5)
- (Total 12 marks)**

Q2. A particle of mass 60 kg is on a rough surface inclined at an angle of 40° to the horizontal.

- (a) Find the magnitude of the normal reaction force acting on the particle. (2)
- (b) If the particle remains at rest, find the minimum value of the coefficient of friction between the particle and the slope. (4)
- (c) If the coefficient of friction between the particle and the slope is 0.2, the particle slides down the slope. Find the acceleration of the particle in this case. (5)
- (Total 11 marks)**

Q3. A block of wood has mass 4 kg. It is placed on a rough horizontal surface and is pulled by a horizontal string. The coefficient of friction between the block and the surface is 0.4.

- (a) Draw a diagram to show the forces acting on the block. (1)
- (b) Calculate the magnitude of the normal reaction force acting on the block. (1)
- (c) If the acceleration of the block is 2 m s^{-2} , find the tension in the string. (3)
- (d) If the tension in the string is 20 N, find the acceleration of the block. (2)
- (Total 7 marks)**

Q4. A block, of mass 5 kg, is held at rest on a rough plane, which is inclined at 30° to the horizontal. The block is released and slides down the plane. The coefficient of friction between the block and the plane is 0.2.

- (a) Draw a diagram to show the forces acting on the block as it slides. (1)
- (b) Show that the magnitude of the friction force acting on the block is approximately 8.5 N. (3)
- (c) Find the acceleration of the block. (4)
- (d) Find the speed of the block when it has travelled 1.2 metres down the slope. (3)
- (Total 11 marks)**

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