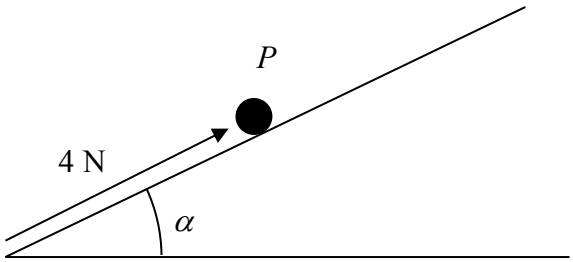
Forces & Friction - Edexcel Past Exam Questions

1. **Figure 2**



A particle P of mass 0.5 kg is on a rough plane inclined at an angle α to the horizontal, where $\tan \alpha = \frac{3}{4}$. The particle is held at rest on the plane by the action of a force of magnitude 4 N acting up the plane in a direction parallel to a line of greatest slope of the plane, as shown in Figure 2. The particle is on the point of slipping up the plane.

(*a*) Find the coefficient of friction between P and the plane. **(7)**

The force of magnitude 4 N is removed.

(*b*) Find the acceleration of P down the plane. **(4)**

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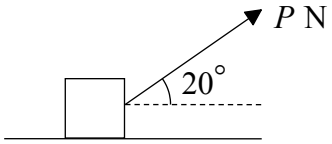
2. **Figure 3**



A box of mass 30 kg is being pulled along rough horizontal ground at a constant speed using a rope. The rope makes an angle of 20° with the ground, as shown in Figure 3. The coefficient of friction between the box and the ground is 0.4. The box is modelled as a particle and the rope as a light, inextensible string. The tension in the rope is P newtons.

(*a*) Find the value of P. **(8)**

The tension in the rope is now increased to 150 N.

(*b*) Find the acceleration of the box. **(6)**

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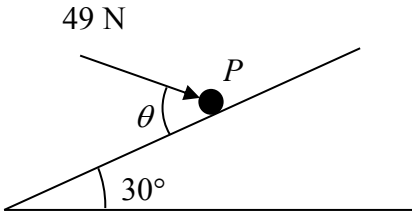
3.



A particle P of mass 6 kg lies on the surface of a smooth plane. The plane is inclined at an angle of 30° to the horizontal. The particle is held in equilibrium by a force of magnitude 49 N, acting at an angle θ to the plane, as shown in Figure 1. The force acts in a vertical plane through a line of greatest slope of the plane.

(*a*) Show that $\cos\theta = \frac{3}{5}$. **(3)**

(*b*) Find the normal reaction between P and the plane. **(4)**

The direction of the force of magnitude 49 N is now changed. It is now applied horizontally to P so that P moves up the plane. The force again acts in a vertical plane through a line of greatest slope of the plane.

(*c*) Find the initial acceleration of P. **(4)**

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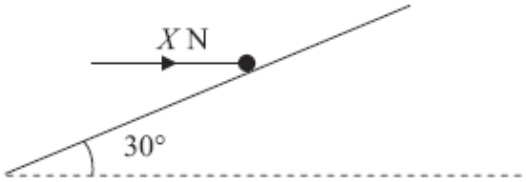
4. A particle of mass 0.8 kg is held at rest on a rough plane. The plane is inclined at 30° to the horizontal. The particle is released from rest and slides down a line of greatest slope of the plane. The particle moves 2.7 m during the first 3 seconds of its motion. Find

(*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 newtons, acting in a plane containing a line of greatest slope of the plane, as shown in Figure 3. The particle is in equilibrium and on the point of moving up the plane.



(c) Find the value of X. **(7)**

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