Dynamics and Inclined Planes

If a particle is in motion, $F = F_{max} = \mu R$, and F opposes the direction of motion.

- Draw a force diagram
- Use Newton's 2nd law to resolve parallel and perpendicular to the plane
- Use SUVAT to solve problems if F (and therefore a) are constant

Example *(EdExcel M1 Jan 2010 Q5)*

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.

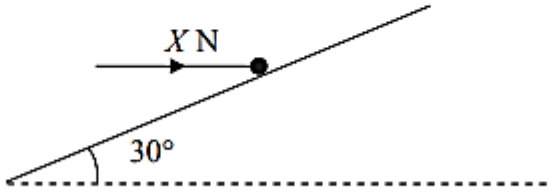

Figure 3

(c) Find the value of X.

(7)

Test Your Understanding *(EdExcel M1 May 2013(R) Q5)*

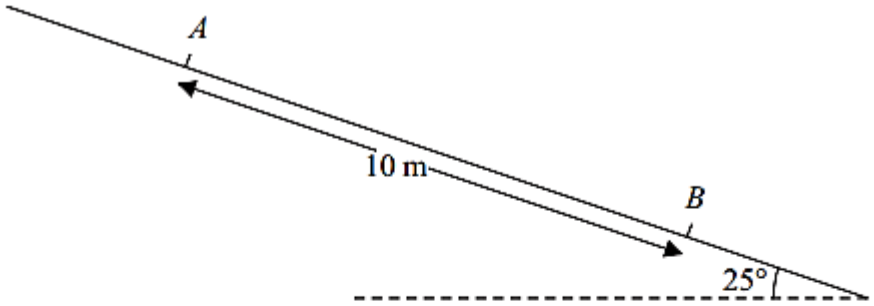

Figure 3

A particle P of mass 0.6 kg slides with constant acceleration down a line of greatest slope of a rough plane, which is inclined at 25° to the horizontal. The particle passes through two points A and B, where $AB = 10$ m, as shown in Figure 3. The speed of P at A is 2 m s^{-1}. The particle P takes 3.5 s to move from A to B. Find

(a) the speed of P at B,

(3)

(b) the acceleration of P,

(2)

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

(5)

Exercise 7E Page 148