7.



Figure 4

A rough straight ramp is fixed at an angle α to horizontal ground, where $\tan\alpha = \frac{5}{12}$

The point A is at the bottom of the ramp and the point B is at the top of the ramp. Points A and B are on a line of greatest slope of the ramp, with $AB = 5\,\text{m}$, as shown in the sketch in Figure 4.

A particle of mass $0.5\,\text{kg}$ is projected up the ramp from A, along the line AB, with speed $U\,\text{m s}^{-1}$. At the instant when it reaches B, the speed of the particle is $26\,\text{m s}^{-1}$

The coefficient of friction between the particle and the ramp is $\frac{1}{3}$

(a) Find the work done against friction as the particle moves from A to B.

(3)

(b) Use the work–energy principle to find the value of U.

(4)

After leaving the ramp at B, the particle moves freely under gravity.

The particle is above the level of B for T seconds.

(c) Find the value of T.

(3)

The particle hits the ground for the first time at the point C.

(d) Find the distance AC.

(6)

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TOTAL FOR PAPER IS 75 MARKS

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