

Paper Reference(s)

Time: 1 hour 30 minutes

PEARSON

2.



(a) Show that the centre of mass of $OABCD$ is $\frac{2}{9}a$ from O . (4)

(b) Find the value of k . (4)

Question 2 continued

[illegible]

Turn over

3. A particle P of mass 0.75 kg is moving with velocity $4\mathbf{i} \text{ m s}^{-1}$ when it receives an impulse $(6\mathbf{i} + 6\mathbf{j}) \text{ N s}$. The angle between the velocity of P before the impulse and the velocity of P after the impulse is θ° .

(a) the value of θ ,

(b) the kinetic energy gained by P as a result of the impulse.

(3)

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[illegible]

4. A ladder AB , of weight W and length $2l$, has one end A resting on rough horizontal ground. The other end B rests against a rough vertical wall. The coefficient of friction between the ladder and the wall is $\frac{1}{3}$. The coefficient of friction between the ladder and the ground is μ . Friction is limiting at both A and B . The ladder is at an angle θ to the ground, where $\tan \theta = \frac{5}{3}$. The ladder is modelled as a uniform rod which lies in a vertical plane perpendicular to the wall.

Find the value of μ .

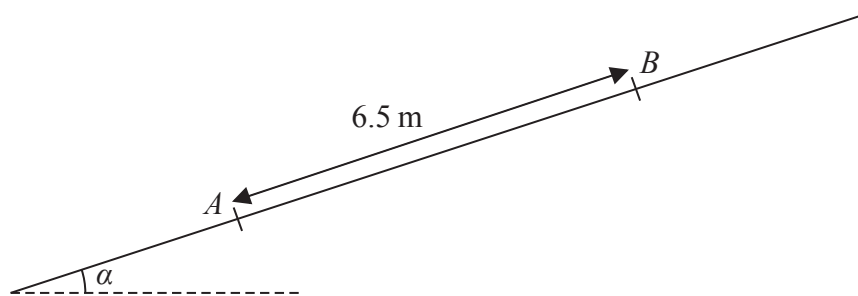
(9)



[illegible]

Turn over

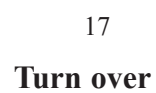
5.



A particle P of mass 10 kg is projected from a point A up a line of greatest slope AB of a fixed rough plane. The plane is inclined at angle α to the horizontal, where $\tan \alpha = \frac{5}{12}$ and $AB = 6.5$ m, as shown in Figure 2. The coefficient of friction between P and the plane is μ . The work done against friction as P moves from A to B is 245 J.

- The particle is projected from A with speed 11.5 m s^{-1} . By using the work-energy principle,

Question 5 continued

[illegible]

[illegible]

7.



(a) Find the value of u and the value of θ .

(7)

(b) Find the time taken for the particle to move from A to B .

(2)

(c) Find the distance OC .

(3)

[illegible]

This image shows a full page of blank, lined paper. It features approximately 28 horizontal blue or grey lines spaced evenly apart, typical of standard notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings present.



8. Three identical particles P , Q and R , each of mass m , lie in a straight line on a smooth horizontal plane with Q between P and R . Particles P and Q are projected directly towards each other with speeds $4u$ and $2u$ respectively, and at the same time particle R is projected along the line away from Q with speed $3u$. The coefficient of restitution between each pair of particles is e . After the collision between P and Q there is a collision between Q and R .

- It is given that $e = \frac{3}{4}$

- (b) Show that there will not be a further collision between P and Q . (6)

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Question 8 continued

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