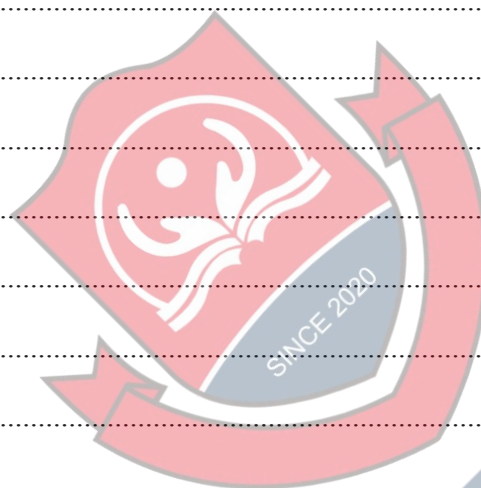


Cambridge International AS & A Level

- 1 A cyclist and bicycle have a total mass of 72 kg. The cyclist rides along a horizontal road against a total resistance force of 28 N.

Find the total work done by the cyclist to increase his speed from 8 m s^{-1} to 16 m s^{-1} while travelling a distance of 100 metres. [3]



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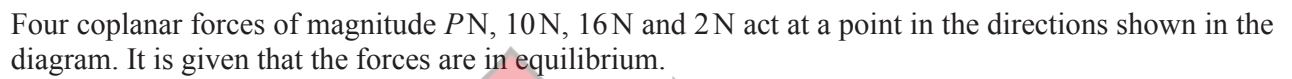
- A particle P moves in a straight line. At time t s after leaving a point O on the line, P has velocity v ms^{-1} , where $v = 44t - 6t^2 - 36$.

- (a) Find the set of values of t for which the acceleration of the particle is positive. [2]

[illegible]

- (b)** Find the two values of t at which P returns to O . [3]

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[6]



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- 4 A car has mass 1400 kg. When the speed of the car is $v \text{ ms}^{-1}$ the magnitude of the resistance to motion is $kv^2 \text{ N}$ where k is a constant.

(a) The car moves at a constant speed of 24 ms^{-1} up a hill inclined at an angle of α to the horizontal where $\sin \alpha = 0.12$. At this speed the magnitude of the resistance to motion is 480 N.

(i) Find the value of k . [1]

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(ii) Find the power of the car's engine. [3]

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(b) The car now moves at a constant speed on a straight level road.

Given that its engine is working at 54 kW, find this speed. [3]

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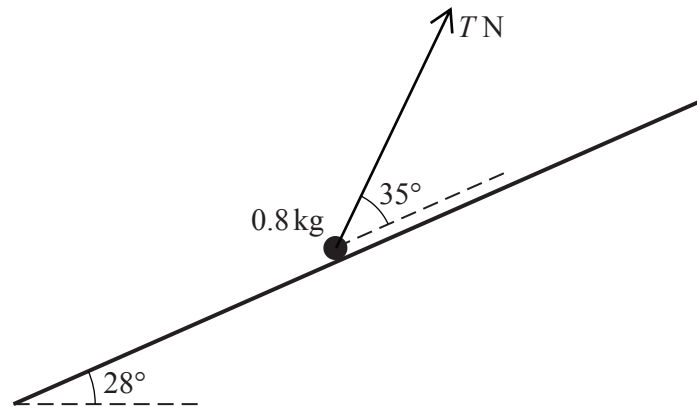
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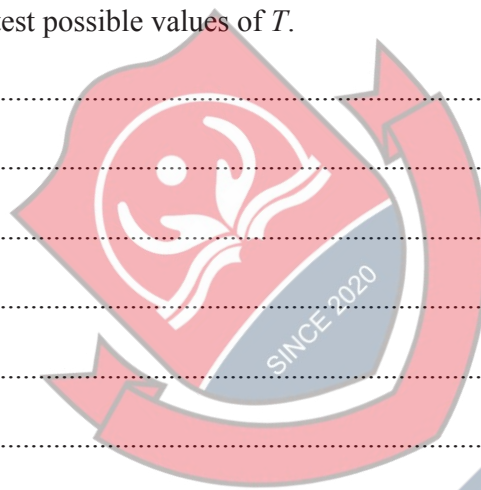
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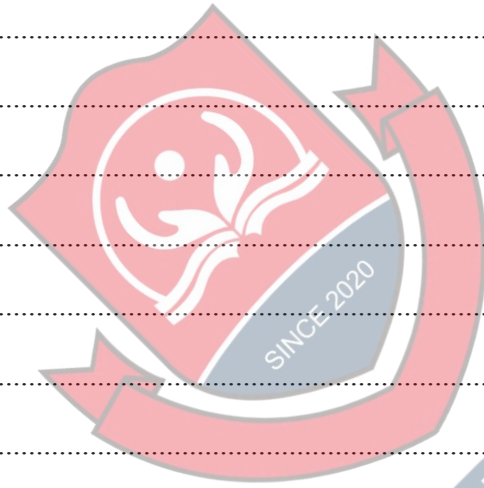
A particle of mass 0.8 kg lies on a rough plane which is inclined at an angle of 28° to the horizontal. The particle is kept in equilibrium by a force of magnitude $T \text{ N}$. This force acts at an angle of 35° above a line of greatest slope of the plane (see diagram). The coefficient of friction between the particle and the plane is 0.2 .

Find the least and greatest possible values of T .

[8]



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- 6 Three particles A , B and C of masses 5 kg, 1 kg and 2 kg respectively lie at rest in that order on a straight smooth horizontal track XYZ . Initially A is at X , B is at Y and C is at Z . Particle A is projected towards B with a speed of 6 ms^{-1} and at the same instant C is projected towards B with a speed of $v \text{ ms}^{-1}$. In the subsequent motion, A collides and coalesces with B to form particle D . Particle D then collides and coalesces with C to form particle E and E moves towards Z .

- (a)** Show that after the second collision the speed of E is $\frac{15-v}{4} \text{ m s}^{-1}$. [3]

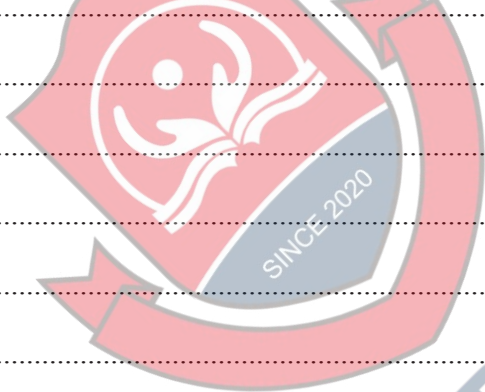


- (b)** The total loss of kinetic energy of the system due to the two collisions is 63 J.

Use the result from **(a)** to show that $v = 3$. [3]

4UaC

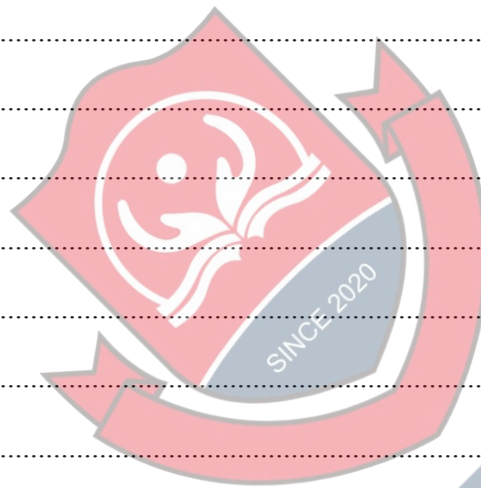
- (i) Find the time between the two collisions.



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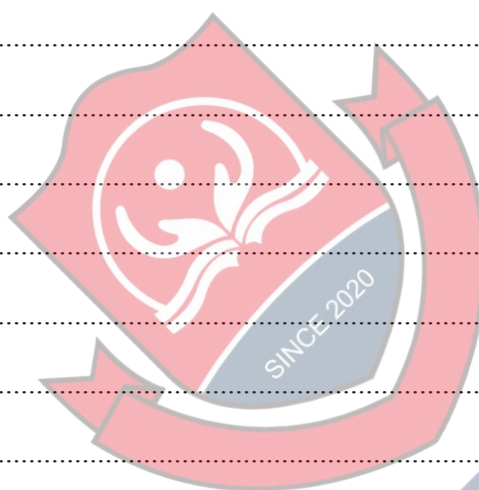
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- (b) Use an energy method to find the speed of the particles at the instant when they are at the same vertical height. [5]



Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.



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