

Name of the Student: _____

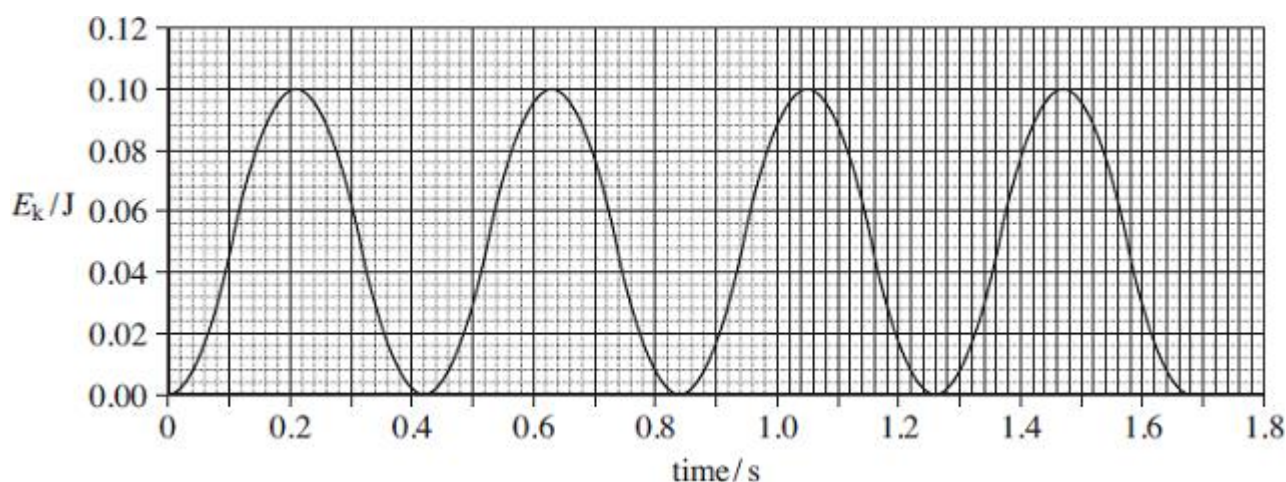
Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

- (a) **Figure 1** shows how the kinetic energy, E_k , of an oscillating mass varies with time when it moves with simple harmonic motion.

Figure 1



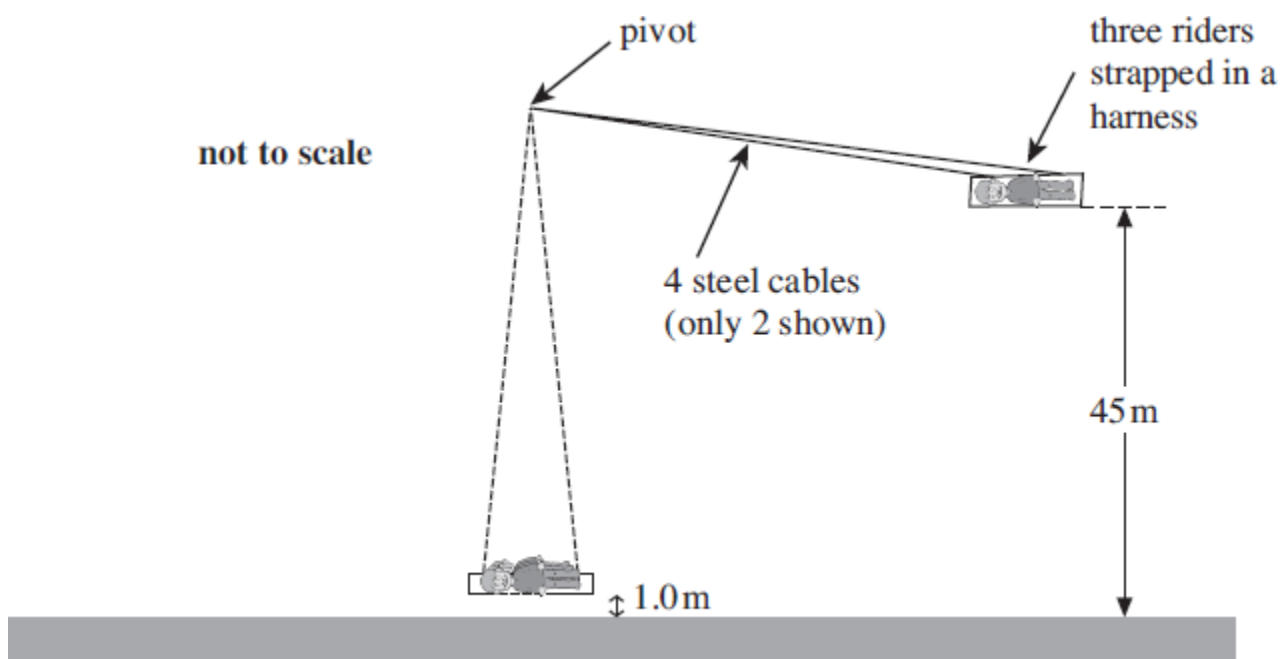
- (i) Determine the frequency of the oscillations of the mass.

frequency of oscillation _____ Hz
(2)

- (ii) Sketch, on **Figure 1**, a graph showing how the potential energy of the mass varies with time during the first second.
(2)

- (b) **Figure 2** shows a ride called a 'jungle swing'.

Figure 2



The harness in which three riders are strapped is supported by 4 steel cables. An advert for the ride states that the riders will be released from a height of 45 m above the ground and will then swing with a period of 14.0 s. It states that they will be 1.0 m above the ground at the lowest point and that they will travel at speeds of 'up to 120 km per hour'.

- (i) Treating the ride as a simple pendulum, show that the distance between the pivot and the centre of mass of the riders is about 49 m.

(2)

- (ii) The riders and their harness have a total mass of 280 kg. Calculate the tension in each cable at the lowest point of the ride, assuming that the riders pass through this point at a speed of 120 km h^{-1} . Assume that the cables have negligible mass and are vertical at this point in the ride.

tension in each cable _____ N

- (iii) Show that the maximum speed stated in the advert is an exaggerated claim.
Assume that the riders are released from rest and neglect any effects of air resistance.

(4)

- (iv) The riders lose 50% of the energy of the oscillation during each half oscillation. After one swing, the speed of the riders as they pass the lowest point is 20 m s^{-1} .

Calculate the speed of the riders when they pass the lowest point, travelling in the same direction after two further complete oscillations.

speed of riders _____ ms^{-1}

(3)

(Total 17 marks)