Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Further Mechanics

Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Q1.

A lead ball of mass 0.25 kg is swung round on the end of a string so that the ball moves in a horizontal circle of radius 1.5 m. The ball travels at a constant speed of 8.6 m s^{-1}.

(a) (i) Calculate the angle, in degrees, through which the string turns in 0.40 s.

angle _____ degree

(3)

(ii) Calculate the tension in the string.
You may assume that the string is horizontal.

tension _____ N

(2)

(b) The string will break when the tension exceeds 60 N.
Calculate the number of revolutions that the ball makes in one second when the tension is 60 N.

number of revolutions _____

(2)

(c) Discuss the motion of the ball in terms of the forces that act on it. In your answer you should:

- explain how Newton's three laws of motion apply to its motion in a circle
- explain why, in practice, the string will not be horizontal.

You may wish to draw a diagram to clarify your answer.

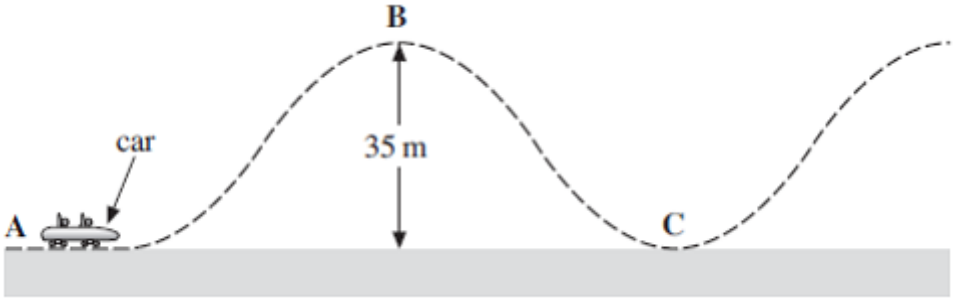
The quality of your written communication will be assessed in your answer.

(6)

(Total 13 marks)

Q2.

The figure below shows a car on a rollercoaster track. The car is initially at rest at **A** and is lifted to the highest point of the track, **B**, 35 m above **A**.



The car with its passengers has a total mass of 550 kg. It takes 25 s to lift the car from **A** to **B**. It then starts off with negligible velocity and moves unpowered along the track.

(a) Calculate the power used in lifting the car and its passengers from **A** to **B**.
Include an appropriate unit in your answer.

power_____unit_____

(3)

(b) The speed reached by the car at **C**, the bottom of the first dip, is 22 ms^{-1}. The length of the track from **B** to the bottom of the first dip **C** is 63 m.

Calculate the average resistive force acting on the car during the descent.

Give your answer to a number of significant figures consistent with the data.

resistive force _____ N

(4)

(c) Explain why the resistive force is unlikely to remain constant as the car descends from **B** to **C**.

(3)

(d) At **C**, a passenger of mass 55 kg experiences an upward reaction force of 2160 N when the speed is 22 ms^{-1}.

Calculate the radius of curvature of the track at **C**. Assume that the track is a circular arc at this point.

radius of curvature of the track _____ m

(3)

(Total 13 marks)