Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 2 (Mechanics)

Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.
The gravitational field strength on the Moon is about 1/6 of the gravitational field strength on the Earth.

(a) On the Moon, an astronaut dropped a golf ball. He later wrote "When I dropped the ball, it took about three seconds to land."

Show that the astronaut would need to be over 7 m tall for the ball to take 3 s to land.

(2)

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(b) The astronaut hit the ball with a golf club. He wrote "The ball, which would have gone thirty to forty yards on the Earth, went over two hundred yards. The ball stayed up in the black sky for almost thirty seconds."

Assume an initial velocity of 18 m s^{-1} at 34° to the horizontal.

(i) Show that the astronaut's suggested time of flight of 30 s is over twice the actual value.

(3)

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(ii) Show that the value given for the initial velocity leads to a value for the horizontal distance travelled by the ball in agreement with his stated value.

200 yards = 183 m

(3)

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*(c) A projectile would have a greater range on the Moon than the Earth because of the lower gravitational field strength and because of the lack of an atmosphere.

Explain how each of these factors would increase the range of the projectile.

(3)

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(Total for Question = 11 marks)

Q2.
The 'Stealth' roller coaster at the Thorpe Park theme park is advertised as reaching 135 km hour^{-1} from rest in 2.3 seconds.

Most roller coasters are driven slowly up to the top of a slope at the start of the ride. However the carriages on 'Stealth' are initially accelerated horizontally from rest at ground level by a hydraulic launch system, before rising to the top of the first slope.

(a) (i) Calculate the average acceleration of the carriages.

135 km hour^{-1} = 37.5 m s^{-1}

(2)

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Average acceleration = ...

(ii) Calculate the minimum average power which must be developed by the launch system.

mass of carriages and passengers = 10 000 kg

(3)

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Minimum average power = ...

(iii) Suggest why the power in (ii) is a minimum value.

(1)

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*(b) The force required to launch 'Stealth' is not always the same. The ride is monitored and the data from preceding launches is used to calculate the required force.

If the mass of the passengers for a particular ride is significantly more than for preceding launches, this can lead to 'rollback'. This is when the carriages do not quite reach the top of the first slope and return backwards to the start.

Explain why 'rollback' would occur in this situation.

(3)

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(c) Suggest why roller coasters may have a greater acceleration when the lubricating oil between the moving parts has had time to warm up.

(2)

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(Total for Question = 11 marks)