LEARN Physics

STUDENT NUMBER | | | | | | | | | |

PHYSICS
Written examination

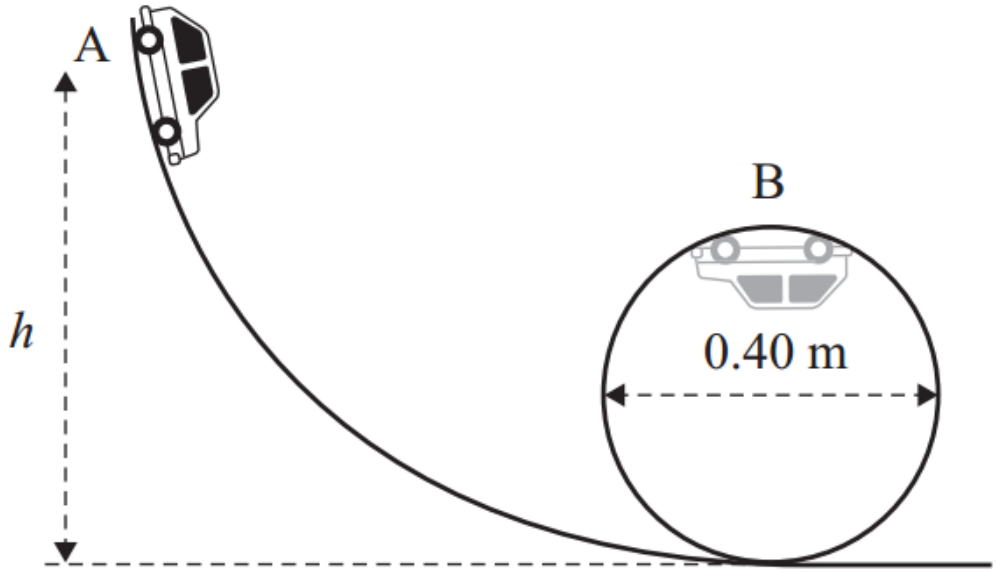
2026 Motion SAC

Unit 3

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Question 1

A 2.5 Kg car moves in a vertical circle as shown on the diagram below. At point B its velocity is 25m/s. Assume the track is frictionless and airresistance can be ignored.



a) Calculate the centripetal force on the car at point B.

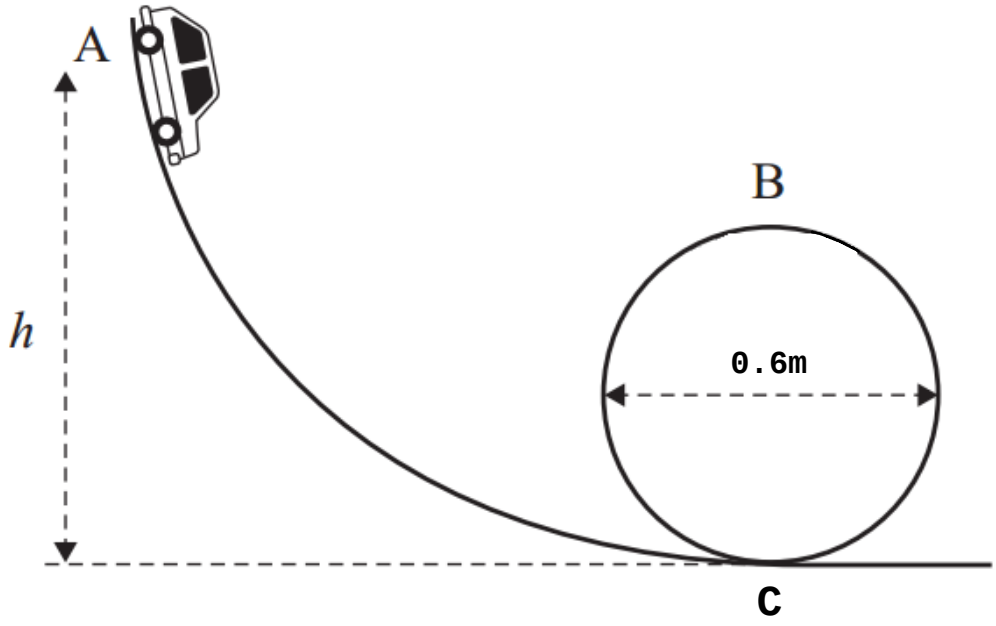
b) Calculate the acceleration that keeps the car moving in a vertical circle.

c) What is the normal reaction on the car at point B and in which direction does it act?

d) What is the minimum speed the car can travel at to avoid falling off the track at point B?

Question 2

A 2.5 Kg car moves in a vertical circle as shown on the diagram below.
Assume the track is frictionless and airresistance can be ignored.
The car starts at rest at point A.



a) If the height h is 3m, what is the velocity of the car at point C?

b) What is the velocity of the car at point B?

c) Calculate the normal reaction on the car at point B.

Question 3

s

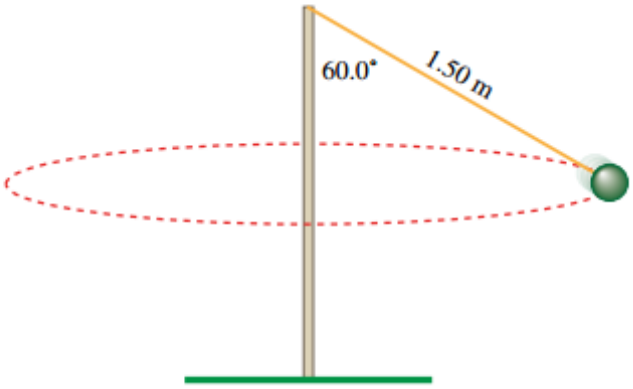
A car moves around a roundabout of 5m radius at a constant speed of 60 Km/h. Assume that there is no slope in the roundabout and that the road is flat.

a) What keeps the car moving around the roundabout?

b) Calculate this force.

Question 4

During a game of Totem Tennis, the ball of mass 150 g is swinging freely in a horizontal circular path. The cord is 1.50 m long and is at an angle of 60.0° to the vertical, as shown in the diagram.



a Calculate the radius of the ball's circular path.

b Draw and identify the forces that are acting on the ball at the instant shown in the diagram.

c Determine the net force that is acting on the ball at this time.

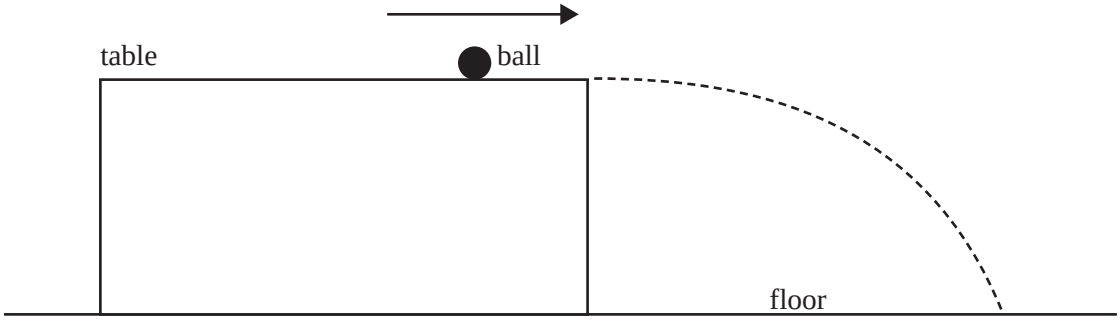
d Calculate the size of the tensile force in the cord.

Question 5

A ball rolls off a table and takes 5 seconds to touch the floor. It leaves the table with an initial horizontal speed of 20m/s. Ignore air resistance in your calculations.

a) How far away from the edge of the table does the ball land?

b) What is the height of the table?

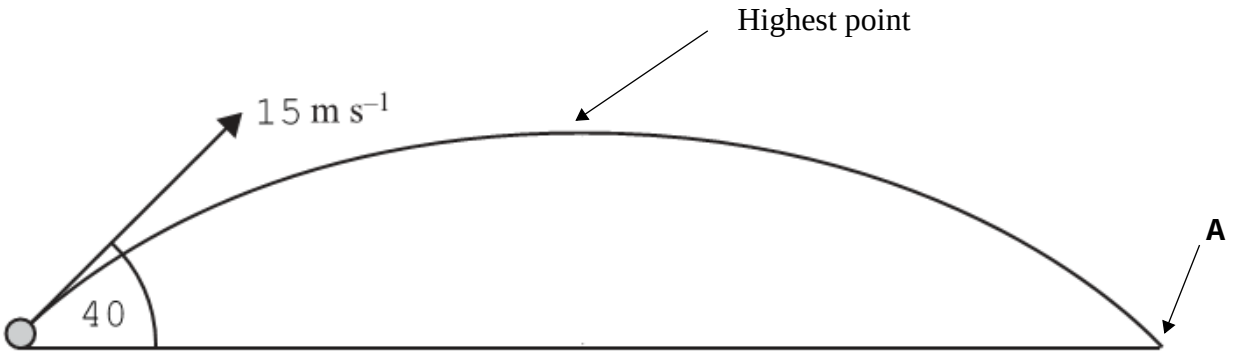


Question 6

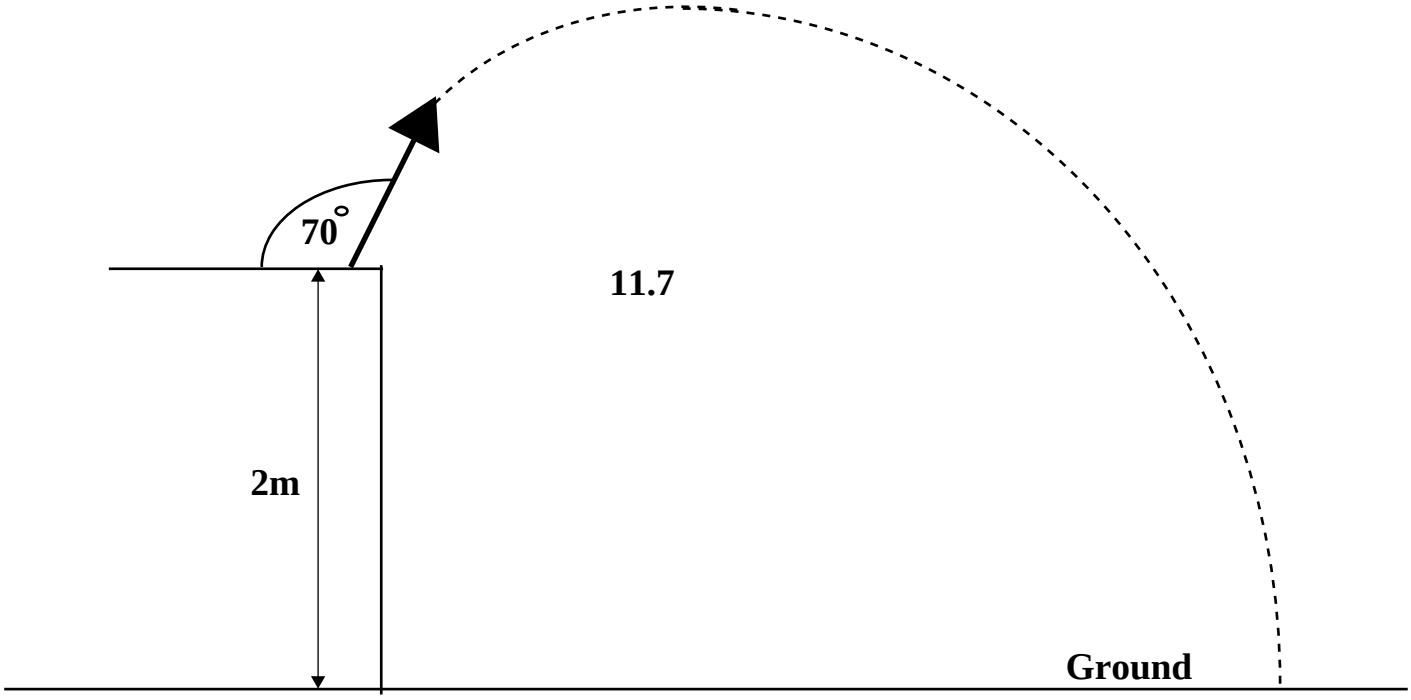
The diagram below shows a projectile that is launched at a speed of 15m/s at an angle of 40 degree from the ground. Ignoring air resistance, calculate the following:

a) How long does the projectile take from launch to reach it's height point?

b) What is the final velocity of the object at point A?



Question 7



A projectile is launched with an initial speed of 10m/s at an angle of 70 degrees as shown.

Calculate

a) Show that the vertical velocity of the object just before it hits the ground is 7.14m/s

b) Calculate the final speed of the object when it hits the ground.

b) Calculate the time it took to hit the ground after it was launched.

Physics formulas

Motion and related energy transformations

velocity; acceleration	$v = \frac{\Delta s}{\Delta t}; \quad a = \frac{\Delta v}{\Delta t}$
equations for constant acceleration	$v = u + at$ $s = ut + \frac{1}{2}at^2$ $s = vt - \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ $s = \frac{1}{2}(v + u)t$
Newton's second law	$\Sigma F = ma$
circular motion	$a = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$
Hooke's law	$F = -k\Delta x$
elastic potential energy	$\frac{1}{2}k(\Delta x)^2$
gravitational potential energy near the surface of Earth	$mg\Delta h$
kinetic energy	$\frac{1}{2}mv^2$