A Level H2 Physics Tutorial 6 : Motion in a Circle

Syllabus :
(a) express angular displacement in radians .

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1. (i) Define radian. What is 1 radian in degrees?

(ii) Derive the radian measure for 90°, 180° and 360° in terms of fractions of π.

(iii) A table is rotated by 180°. What is its angular displacement in radians?

(b) show an understanding of and use the concept of angular velocity to solve problems

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2. (a) Write down the formulae relating angular velocity ω, angle θ in radians, and time t.

(b) A merry-go-round spins at 20 revolutions per minute. Calculate its angular velocity.

(c) recall and use $v = r\omega$ to solve problems

(d) describe qualitatively motion in a curved path due to a perpendicular force, and understand the centripetal acceleration in the case of uniform motion in a circle

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3 (i) A ball moving at 3 m/s on a flat, frictionless ground experiences a resultant force of 10 N. The force is in a horizontal direction and perpendicular to the direction of the ball. What is the shape of its path of motion?

(ii) The mass of the ball is 0.1 kg. How long does it take the ball to return to its starting position?

(e) recall and use centripetal acceleration $a = r\omega^2$, and $a = v^2/r$ to solve problems

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4. A child ties a stone to a rope and swings it in a horizontal circle over his head. The stone moves with a radius of 1 m, at 1 round every half a second.

(i) What is the angular velocity of the stone?

(ii) What is its centripetal acceleration?

(iii) What is its speed?

(f) recall and use centripetal force $F = mr\omega^2$, and $F = mv^2/r$ to solve problems.

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5. The stone in the above question has a mass of 100 g. Find the centripetal force on the stone.