InkPhysics

ANSWER BOOK

# Circular motion

Periodic motion · Year 13

AQA 3.6.1.1 · CIE 12.1, 12.2 · OCR A 5.2.1, 5.2.2

10 questions · 30 marks

NAVY EDITION


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## SECTION A · Warm-up

**A1** Velocity is a vector, so although the speed is constant the direction of motion is continually changing. A changing velocity means the object is accelerating (towards the centre of the circle). [2]

**A2** $\omega = 2\pi f = 2\pi \times 5.0 = 31.4$ rad s$^{-1}$. [2]

**A3** $\omega = v/r = 10/2.0 = 5.0$ rad s$^{-1}$. [2]

## SECTION B · Standard

**B1** (a) $a = v^2/r = 8.0^2/4.0 = 16$ m s$^{-2}$. (b) $F = ma = 0.50 \times 16 = 8.0$ N. [3]

**B2** $F = mv^2/r = (1000 \times 15^2)/50 = 4500$ N. [3]

**B3** (a) $\omega = 2\pi f = 12.57$ rad s$^{-1}$. (b) $v = \omega r = 3.77$ m s$^{-1}$. (c) $a = \omega^2 r = 47.4$ m s$^{-2}$. [4]

**B4** $T = mv^2/r = (0.20 \times 4.0^2)/0.80 = 4.0$ N. [3]

## SECTION C · Stretch

**C1** (a) $\omega = 2\pi/T = 2\pi/0.40 = 15.71$ rad s$^{-1}$. (b) $a = \omega^2 r = 123.4$ m s$^{-2}$. (c) $F = ma = 0.10 \times 123.4 \approx 12.3$ N. [4]

**C2** At the maximum, $T = mv^2/r$, so $v = \sqrt{(Tr/m)} = \sqrt{(50 \times 1.0/0.25)} = 14.1$ m s$^{-1}$. [4]

**C3** The centripetal force acts towards the centre of the circle. If it is removed, no force acts (ignoring others), so by Newton's first law the object travels in a straight line, along the tangent to the circle at the point of release. [3]