Chap 4 CQ (13-16), EP (21, 28, 30)

(13) In uniform circular motion:
Speed — constant
instantaneous vel. - not constant (direc.)
tang. velocity - constant
radial accel. - constant
tange. accel — constant (0)

(14) $\vec{\omega}_1 = \vec{\omega}_2 = \vec{\omega}_3$ every point on
a) wheel has the same ω

b) $v_3 > v_1 = v_2$
↳ larger radius — equal radius
($v_T = r\omega$)

(15) Recall CCW = +
CW = -

(a) ω & α (+)

b) ω (-)
α (+)

c) ω (+)
α (-)

d) ω (-), α (-)

(16) ω = zero - not in motion
α = (-) since
ω is increasing from zero
to CW motion

(21) Find area in first 4s.
$(2 \times 10) + (\tfrac{1}{2} \times 20) = 60\,rad$
$60\,rad / 2\pi\,rad = 9.5\,rev.$

(28) $r = 1.5 \times 10^{11}\,m$
$\theta = 2\pi\,rad$
$t = 365\,days = 31,536,000\,sec$

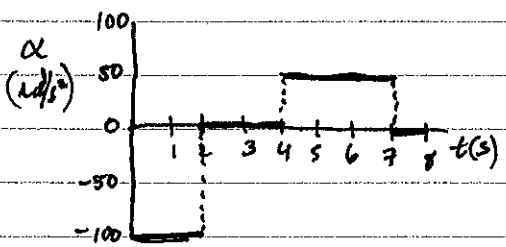
a) $v_T = r\omega$
$v_T = (1.5E11\,m)\left(\frac{2\pi}{31,536,000\,s}\right)$
$v_T = 30,000\,m/s$

b) $\theta/t = \omega = 2\pi/31,536,000 = 2 \times 10^{-7}\,rad/s$

c) $a_c = \frac{v_T^2}{r} = r\omega^2 = (1.5E11)\left(\frac{2\pi}{31,536,000}\right)^2$

$a_c = 6.0 \times 10^{-3}\,m/s^2$

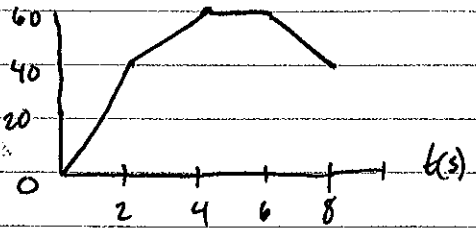
(30) $-200\,rad/s / 2s = -100\,rad/s^2$
$150\,rad/s / 3s = 50\,rad/s^2$



EP

Chap 4 (22-25, 27, 29)

(22)



$\omega = d\theta/dt$

(23) 45 rpm

$45 \frac{\text{rot.}}{\text{min}} \times \frac{2\pi \text{ rad}}{\text{rot.}} \times \frac{1 \text{ min}}{60 \text{ sec}} =$

a) 4.7 rad/s

b) Period $= \frac{60 \text{ s}}{45} =$ 1.3 sec $= T$

(24) $\Delta = r\theta$

5000 mi = 4000 mi (θ)

a) $\theta = 1.25$ rad $= 72°$

b) $\omega = \frac{\Delta\theta}{t} = \frac{1.25 \text{ rad}}{(9 \times 3600)} =$

$\omega = 3.9 \times 10^{-5}$ rad/s

(25) $\omega = \frac{2\pi \text{ rad}}{(24)(3600)}$

$v_T = r\omega$

$v_T = (6400 \times 10^3 \text{ m})\left(\frac{2\pi}{(24)(3600)}\right)$

$v_T = 465.42$ m/s

$v_T = (6400E3 + 300)\left(\frac{2\pi}{(24)(3600)}\right)$

$v_T = 465.44$ m/s

$\pm$ 0.02 m/s

(27) $a_c = v^2/r$

$98 \text{ m/s}^2 = \frac{v^2}{12 \text{ m}}$

$v = 34$ m/s

(29) 60 cm = d

30 cm = .30 m = r

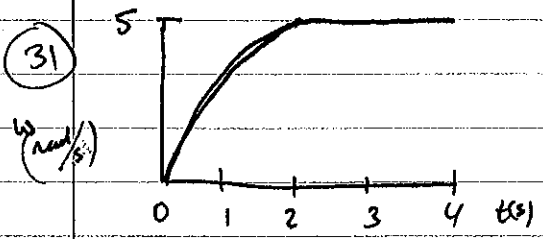
$3 \text{ rev/s} = \frac{2\pi \times 3 \text{ rad}}{\text{s}} = 6\pi \frac{\text{rad}}{\text{s}} = \omega$

$v_T = r\omega = (.30)(6\pi) = 5.7$ m/s

$a_c = r\omega^2 = (.30)(6\pi)^2 = 107 \text{ m/s}^2$

Chap 4 EP (31-33, 35-38)

(31)



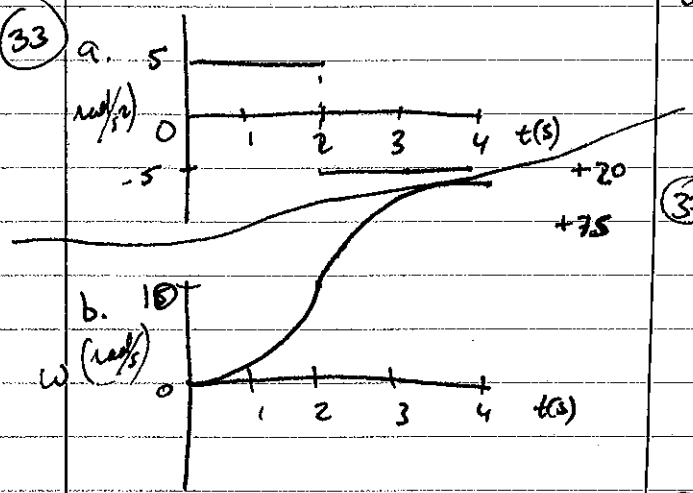
(32) Area

$(2 \times 20 \times \frac{1}{2}) + (2 \times 20)$

$20 + 40 = 60 \text{ rad} = 9.5 \text{ rev}$

2π

(33)



(35) $r = 2.5\text{m}$

$T = 4.0\text{s}$

$\omega_0 = \frac{2\pi}{4}$

$\omega_f = 0$

$t = 20\text{s}$

a) $v_t = \frac{2\pi r}{4} = 3.9 \text{ m/s}$

b) $\omega_{AVE} = \frac{\frac{2\pi}{4} + 0}{2}$

$= .785398 \text{ rad} \times \frac{20\text{s}}{15.708 \text{ rad}} = 2.5 \text{ rev}$

(36) $r = .015\text{m}$

$\omega_0 = 2500 \frac{\text{rot.}}{\text{min}} = 261.8 \text{ rad/s}$

$\omega_f = 0$

$t = 1.5\text{s}$

a) $a_t = r\alpha = r\left(\frac{261.8}{1.5}\right) = 2.6 \text{ m/s}^2$

b) $\omega_{AVE} = 1250 \frac{\text{rot}}{\text{min}} = \frac{1250 \text{ rot}}{60 \text{ sec}} \times 1.5 \text{ sec}$

$\approx 31 \text{ rot.}$

(37) $\omega_0 = 0$

$\omega_f = 1800 \frac{\text{rot}}{\text{min}} \times \frac{2\pi}{60} = 188.5$

$t = 4.0\text{s}$

$\alpha = ? \quad 188.5/4 = 47 \text{ rad/s}^2$

(38) $\omega_0 = 50 \frac{\text{rot}}{\text{min}} \times 2\pi/60 = 5.236 \text{ rad/s}$

$\alpha = 0.50 \text{ rad/s}^2 \qquad \Delta\omega = (10)(.5) = 5$

$t = 10\text{s}$

a) $\omega_f = ? \quad 10.236 \text{ rad/s} = 98 \text{ rpm}$

b) $\omega_{AVE} = \frac{97.7465 + 50}{2} = 73.87 \text{ rpm} \times 1/6 \text{ min}$

$= 12.3 \text{ rot.}$