A.P. "C" Ch 8 Practice

1. c
2. d
3. e
4. d/A
5. e
6. a
7. d
8. d
9. c
10. d
11. b
12. c
13. b
14. d
15. b
16. c
17. e
18. c
19. a
20. a
21. d
22. d
23. c

24. e

25. e

26. e

27. b

28. e

29. b

30. d

Rotation Answers - Practice Test

① $\omega_2^2 = \cancel{\omega_1^2}^{\,0} + 2\alpha\theta$

$\omega^2 \sim \theta \quad ; \quad \omega = 10\ rev$

to get $(2\omega)^2$ you need $4\times\ 10\ rev$

$= 40\ rev$

$= 30$ more

$\boxed{C}$

#2 $\theta = \cancel{\omega_1 t}^{\,0} + \frac{1}{2}\alpha t^2$

$\alpha = \frac{2\theta}{t^2} = \frac{2(5\,rad)}{(2.8\,s)^2} = 1.276\ rad/s^2$

$\omega_2 = \cancel{\omega_1}^{\,0} + \alpha t = (1.276\,rad/s^2)(2.8\,s)$

$\boxed{3.57\ rad/s}$

$\boxed{D}$

#3 $V = R\omega = (.65\,m)(4\,rev/s)(2\pi\,rad/1\,rev)$

$16.3\ m/s$ tangent to circle

$\boxed{E}$

#4 $\omega = \frac{V}{R} = \frac{9.8m/s}{.519m} = 18.9\ rad/s$

$\boxed{A}$

#5 $\frac{30rev}{1min} \Big/ \frac{1min}{60sec} \Big/ \frac{2\pi\ rad}{1rev} = \pi\ rad/s$

$\boxed{E}$

#6 Linear speed = $R\omega$
Centripetal Acceleration $= R\omega^2$
Tangential Acceleration $= R\alpha$

$\boxed{A}$

#7 - has centripetal Acceleration
- changes direction
- centripetal Force
- Force & Δx perpendicular $\Rightarrow$ no work

$\boxed{D}$

#8 - since V = const, no tangential A but centripetal A
- direction always changing - pointed to center
- nonzero
- $A_c = R\omega^2$ - constant ω constan R

$\boxed{D}$

#9 α = constant

- ω changing so V changing
- $A_r = V^2/R$ since V changing A_R changes
- $A_t = R\alpha$ = constant
- ω changes

$\boxed{C}$

#10 $\omega = \frac{d\theta}{dt} = a + 2bt - 4ct^3$

$\alpha = \frac{d\omega}{dt} = 2b - 12ct^2$

$\boxed{D}$

#11 α = slope of ω vs t graph

$= \frac{\omega_2 - \omega_1}{\Delta t} = \frac{80-20}{10\,s} = 6\ rad/s^2$

$\boxed{b}$

#12 - direction always changing

- hand moving in circle $\omega \neq 0$
- constant V = constant $\omega \Rightarrow \alpha = 0$
- $A = R\omega^2 \neq 0$
- $A_t = \alpha \cdot R$ $\alpha \neq 0$ so $A_t \neq 0$

$\boxed{C}$

#13 $F_f = F_c$ $\mu \cancel{m} \cdot g = \cancel{m}\overbrace{R\omega^2}^{A_c}$

$R = \frac{\mu g}{\omega^2} = 1.02m$

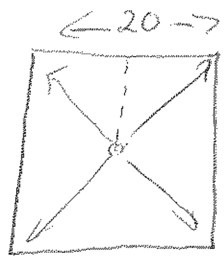
$\boxed{B}$

#14 $\tau = I\alpha \qquad \tau = F \times r$

$$\alpha = \frac{F \times r}{I} = \frac{(160N)(1.5m)}{34\,kg \cdot m^2} = 7.06\ rad/s^2$$

$\boxed{D}$

#15

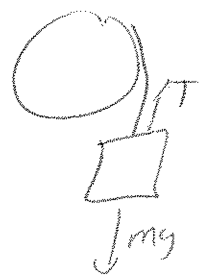


$$r = \sqrt{10^2 + 10^2} = .141\,m$$

$$I = 4(mr^2) = 4(.05kg)(.141m)^2$$
$$= .004\ kg\,m^2$$

$\boxed{B}$

#16



$$\tau = I\alpha$$
$$I = \tfrac{1}{2}MR^2 = \tfrac{1}{2}(50kg)(.125m)^2$$
$$= .391\ kg\,m^2$$

$$Mg - T = M \cdot A$$

$$200 - T = 20 \cdot A = 20R(\alpha)$$
$$T = 200 - 20R\alpha$$
$$T = 200 - 2.5\alpha$$

$$Tr = I\alpha$$
$$(200 - 2.5\alpha).125 = (.391\,kgm^2)\alpha$$
$$200 - 2.5\alpha = 3.128\alpha$$
$$200 = 5.628\alpha$$
$$\alpha = 35.5$$

$\boxed{C}$

#17 F = Gravity = towards center
Velocity is tangential - not in same direction

$\boxed{e}$

#18 $\tau = F \times r = I\alpha$

$\alpha = \frac{F \times r}{I} = \frac{(39.2N)(.8m)}{12\ kgm^2} = 2.61\ rad/s^2$

$\omega_2^2 = \cancel{\omega_1^2}^{\,0} + 2\alpha\theta$

$\omega = \sqrt{2(\alpha)(\frac{D}{R})} = \sqrt{2(2.61 rad/s^2)(\frac{2m}{.8})}$

$= 3.6\ rad/s$

$\boxed{c}$

#19 $KE = \frac{1}{2}mv^2$

$KE_{rot} = \frac{1}{2}I\omega^2$ Disk $I = \frac{1}{2}mR^2$

$KE_{rot} = \frac{1}{4}mv^2$

$KE_{trans} > KE_{rot}$

$\boxed{A}$

#20 $L = m \cdot v \cdot R = (1kg)(2m/s)(.5m)$

$= 1\ kg\,m^2/s$

$\boxed{A}$

#21 Force in $-y$ direction
by right hand rule, τ in $-x$

$\boxed{D}$

#22 a) $A \times B$ in $+y$
b) $B \cdot A$ not yet learned
c) Same as A
d) $B \times A$ in $-y$

$\boxed{D}$

#23 by right hand rule

 $V\downarrow$ into page

$\boxed{C}$

#24 Angular momentum of Disc $-X$ so its
negative w.r.t. pivot Point at origin.
$F =$ down (gravity) so Torque $+y$
$F \times R$ by right hand rule.
Torque changes angular momentum in pos. direction
so a Torque in $+y$ direction affects a
negative angular momentum in opposite direction
so precession in $-y$ direction. ω of precession
will be $-z$ by right hand rule

$\boxed{E}$

#25 $P = \tau \cdot \omega$ - equation 9-27

$$P = F \times V = (F \times R) \times \left(\frac{V}{R}\right) = \tau \cdot \omega$$

$\boxed{E}$

#26 $KE = KE_{Trans} + KE_{rot} = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$

$$I = \frac{1}{2}MR^2 \quad \omega = \frac{V}{R}$$

$$K_{tot} = \frac{1}{2}mv^2 + \frac{1}{4}mv^2 = \frac{3}{4}mv^2$$

$$= \frac{3}{4}(50kg)(4m/s)^2 = 600J$$

$\boxed{E}$

#27 $I = I_{cm} + mh^2$

$$I_{cm} = I - mh^2 = 2.4\,kgm^2 - (10kg)(.2m)^2$$

$$= 2\ kgm^2$$

$\boxed{D}$

#28 Zero Net Torque - conservation of angular momentum

$\boxed{E}$

#29 $\boxed{b}$ - No external Torque to change angular velocity

#30 Originally, L is upward in direction. When she rotates the wheel, L is downward so the $\Delta L = 2L$

$$\uparrow L_1 \qquad \downarrow L_2$$

$$L_2 - L_1 = \downarrow L_1 \downarrow L_2 = 2L$$

Since no <u>external</u> torque, the chair and the woman aequire angular momentum $2L$ so net change is zero.

$\boxed{D}$