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Final Exam
Wednesday, May 12
Here 11:00 - 2:00
Bring book, calculator, notes.

1) Uncertainty/significant figures
2.) 1D motion
3.) 2D motion/vectors
4.) Newtons Laws
5.) Friction / Circular motion
6.) Universal Gravitation
7.) Work & Kinetic Energy
8.) Potential Energy
9.) Momentum Collisions
10.)11) Rotational motion
12.)13.) Fluids
14.) Simple harmonic motion
15.) waves
16.) sound
17.)18.) Gases
19.) Thermodynamics

An object of mass $\underbrace{5.00}_{3}$ kg has speed $0.\underbrace{15}_{2}$ m/s. What is its kinetic energy?

$K = \frac{1}{2} m v^2$ ← 2 sig figs ($\underbrace{1.4}_{2}$ kg m/s)

$m = 5.00$ kg

$v = 0.15$ m/s

answer has as many sig. figs. as the least # of sig. figs. in your inputs

"$\underbrace{5.00}_{3}$ kg" means $\underbrace{5.00}_{3}$ kg ± error where error ~ 0.01 kg

$0.\underbrace{15}_{2}$ m/s = $\underbrace{1.5}_{2} \times 10^{-1}$ m/s   error ~ 0.01 m/s

③

$\vec{\omega} = \frac{d\vec{\theta}}{dt}$

$\vec{\alpha} = \frac{d\vec{\omega}}{dt}$

$\vec{\tau} = \vec{r} \times \vec{F}$

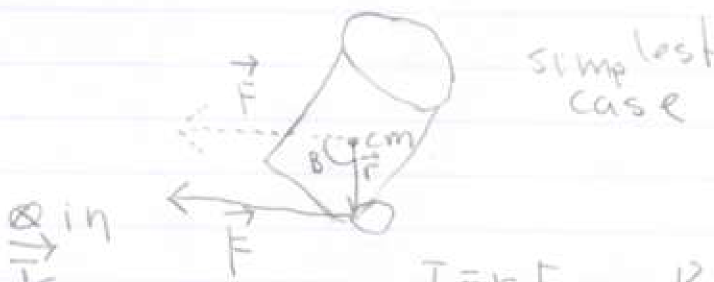
$\vec{L} = I\vec{\omega}$ ← simplest case

analogs

$\vec{r}$	$\vec{\theta}$	angular displacement
$\vec{v}$	$\vec{\omega}$	angular velocity
$\vec{a}$	$\vec{\alpha}$	angular acceleration
$\vec{p}$	$\vec{L}$	angular momentum
$\vec{F}$	$\vec{\tau}$	torque
m	I	momentum of inertia

$\vec{F} = \frac{d\vec{p}}{dt}$	$\vec{\tau} = \frac{d\vec{L}}{dt}$
$\vec{p} = m\vec{v}$	$\vec{L} = I\vec{\omega}$

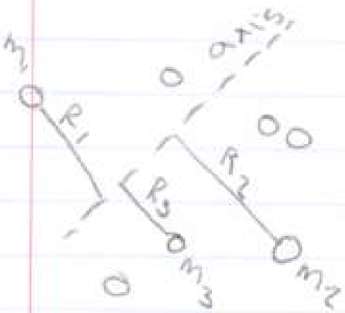
$\vec{\tau} = \vec{r} \times \vec{F}$



$\tau = rF\sin\beta$

$\vec{\tau} \perp \vec{r}$; $\vec{\tau} \perp \vec{F}$

$I = \sum m_i R_i^2$



$K = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$

(2)

$a = 1.0 \times 10^1$ (2)
$b = 1.00 \times 10^2$ (3)

$ab = 1.0 \times 10^3$
$a+b = 1.10 \times 10^3$

~1 ~1 ~1
absolute errors

$ab = 1.0 \times 10^3$

~10% ~1% ~10%
relative error

Rotational Motion

simplest case:

Object spinning about an axis of symmetry

Right-hand rule: direction $\vec{\omega}$

$\omega = |\vec{\omega}| =$ angular speed $= \frac{2\pi}{T}$

magnitude of $\vec{\omega}$

T = time elapsed in one rotation

$\vec{\phi}$ = Angular displacement

$\vec{\omega} = \frac{d\vec{\phi}}{dt}$

e.g. 30° counterclockwise about that axis

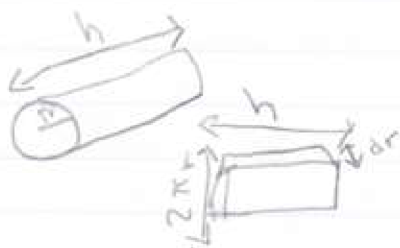
5 rad = 5

$I_{shell} \simeq M_{shell} R_{shell}^2$

$I = \int_0^R r^2 \, dm$

For a shell $dm = \rho 2\pi r h \, dr$

$\int_0^R \rho 2\pi r h \, dr \; r^2$



$\frac{1}{2} M R^2$

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Fluids

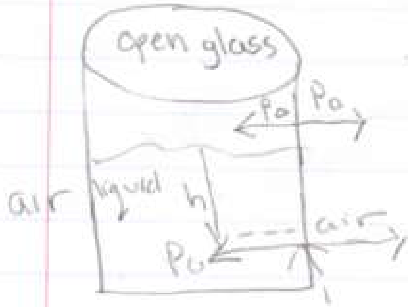
Pressure = $\frac{\text{Force}}{\text{area}}$

$P = \frac{F}{A}$

$[P] = \left[\frac{F}{A}\right] = \left[\frac{E}{V}\right]$

$PV = nRT = \frac{2}{3} E_{int}$ (monoatomic ideal gasses)

5



$P_0 = 1 \text{ atm} = 1.013 \times 10^5 \ P_a$

$1 \text{ Pascal} = \frac{1 N}{1 m^2}$

$P_0 + \rho g h$

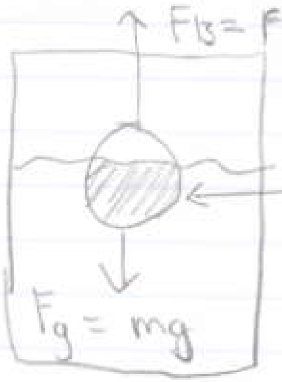
ρ = density of liquid

h = depth below surface of liquid

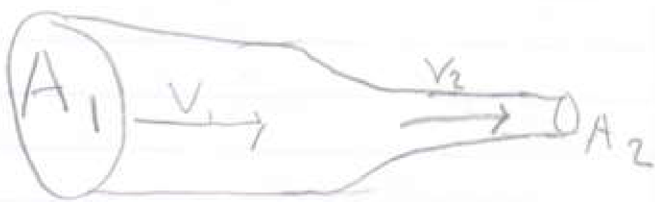
net pressure = $\rho g h$

Force buancy = weight of liquid displaced

$\vec{F_B} = \rho_{liquid}\, g\, V_{displaced}$

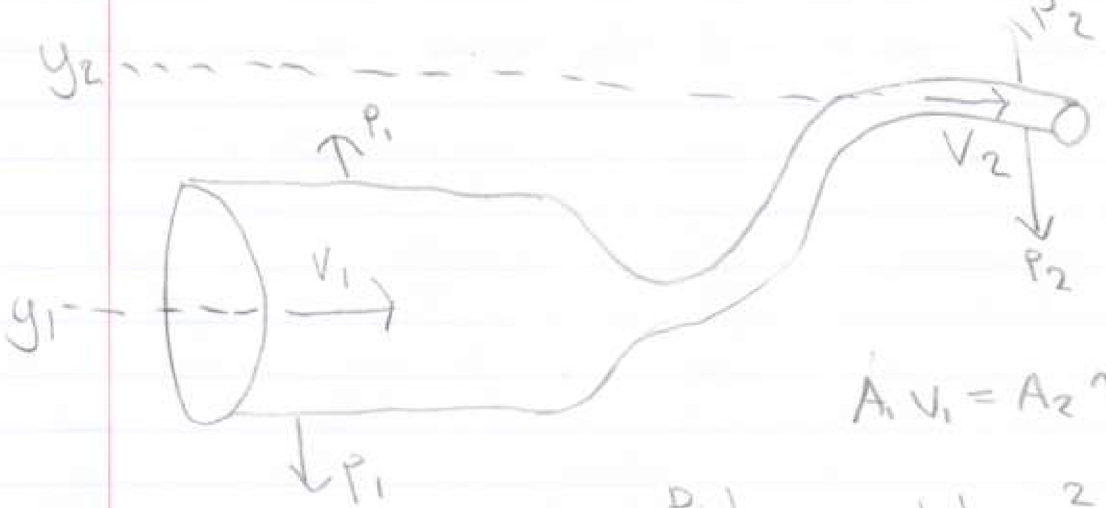


volume displaced



$A_1 V_1 = A_2 V_2$

(6)



$A_1 V_1 = A_2 V_2$ Equation of continuity

$P_1 + \rho g y + \frac{1}{2}\rho v_1^2$

ρ = density of liquid

$P_2 + \rho g y_2 + \frac{1}{2}\rho v_2^2$