Torque:

net torque: $\Sigma \tau = F * r$ → radius
↳ force

Static Equilibrium ⟹ $\Sigma F_x = 0$, $\Sigma F_y = 0$, $\Sigma \tau = 0$

↳ The net external force is 0, and the external torque on it about any axis is 0 — True

Counter-Clockwise : + , ↺
Clockwise : − , ↻

The Center of mass ✓

↳ the point within an object that moves as if all of the object's mass where located there — True

The acceleration of the center of mass point depends on the shape of the object — Not True
(we don't depend on shapes)

about Center of mass

Fluids:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

area: $\frac{\pi}{4} d^2$ or πr^2

$\text{pressure} = \rho g h$ $\rho_{water} = 1000$

$P_{atm} = 1 \text{ atm}$ — at sealevel

$\Delta P = \rho g \Delta h$

$$\text{Specific Gravity} = \frac{\rho_{object}}{\rho_{water}} = \frac{\rho_{object}}{\rho_{water}}$$

at constant volume

$P_{gauge} > P_{atm}$ → + value

$P_{gauge} < P_{atm}$ → − value

chapter 31 : Nuclear

Energy of decay, Source of Activity $(E) \rightarrow eV \rightarrow J$

$* 1.6 \times 10^{-19}$ J

Energy per time, Rate of Energy $(E_s) = E * A * abs\% * D_f = \frac{Area \text{ "body"}}{4\pi r^2}$

r: distance from Source

abs% , D_f: If not given assume 1

Total Energy, Deposited Energy, Energy after certain time

$(E_t) = E_s * t$ or $= E * N$

N: number of nucli / number of proton / number of electron

Dose $= \frac{E_t}{mass}$ (J/Kg) → Gy "Gray"

Gy → SI unit

Dose effective / Dose equivalent = Dose * QF / RBE — if not given then assume 1

Note: if Dose Gy → effective Dose SV

Gy → RAD: * 100 ; RAD → Gy: ÷ 100 ; SV → REM: * 100 ; REM → SV: ÷ 100

if Dose RAD → effective Dose REM

Dose rate $= \frac{Dose}{time} = \frac{E_s}{m}$ Gy/s

Effective Dose Equivalent α, β, γ

→ Dose effective (1) = Dose effective (2)

→ Dose * QF (1) = Dose * QF (2)

Ci → Bq $* 3.7 \times 10^{10}$ μ : $* 10^{-6}$ m : $* 10^{-3}$

↓ dec/s M : $* 10^{6}$

To convert from year → sec

$* 365 \times 24 \times 60 \times 60$

chapter 30 : Structure of prop. of nuclear

to convert from amu → Kg

$* 1.67 \times 10^{-24}$ Kg

mass number ← A (big no.), P + N

$^{A}W_{Z}$ → atomic number = no. of protons (Small no.)

Nuclear Radius → $R = r_0 A^{\frac{1}{3}}$

r_0 → 1.2 fermi → 1.2×10^{-15} m

Isotopes : Same proton no.
different neutron no
Same chemical prop.

Isobars : Same mass no. "A"
different proton no.

Isotones : Same neutron no.
different "A"
different "P"

Penetration & shielding

* alpha particles has least penetrating power
↳ largest & slowest emission
* Beta particles more penetrating than alpha particle → Beta > alpha
* gamma particle is the most penetrating
↳ gamma > Beta > alpha

Half-life & rate of decay

Half-life → $t_{1/2}$

Radioactive decay law

$N(t) = N_0 e^{-\lambda t}$

$-\lambda$ → $\lambda = \frac{0.693}{t_{1/2}}$

λ → decay constant $\left(\frac{1}{time} \rightarrow \frac{1}{s} \text{ or } s^{-1}\right)$

$N(t) = N_0 \left(\frac{1}{2}\right)^n$ → $n = \frac{t}{t_{1/2}}$

Activity → decay / sec

$A(t) = A_0 e^{-\lambda t}$ → $-\lambda = \frac{-0.693}{t_{1/2}}$

$A(t) = \lambda N(t)$, $A_0 = \lambda N_0$

When $t_{1/2}$ ↑ $A(t)$ ↓ → more safe

When $t_{1/2}$ ↓ $A(t)$ ↑ → more danger
activity is higher
more radioactive

The half-life of a radioactive nucleus is: the time it takes for half of the substance to decay

chapter 23: The law of Refraction

① Refraction angle " Snell's law "

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$n = \frac{c}{v}$

n: Index of refraction
c: velocity of light
v: velocity of vaccum

$v = \lambda f$ → frequency
↳ wavelength

Rule: $\frac{n_1}{n_2} = \frac{\sin\theta_2}{\sin\theta_1} = \frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1}$

$\sin\theta_c = \frac{n_{small}}{n_{big}}$ (n_{small} → n_1, n_{big} → n_2) → $\theta_c = \sin^{-1}\left(\frac{n_{small}}{n_{big}}\right)$

$n_{air} = 1$ $n_{water} = 1.33$

Lense Equation: $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$

magnification: $m = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$

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