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[1] speed = $\frac{\text{distance}}{\text{time}}$ m/s [2] $\bar{v} = \frac{\text{displacement}}{t}$ m/s

instantaneous → $v = \frac{dx}{dt}$

[3] $\bar{a} = \frac{\Delta v}{\Delta t}$ or (instantaneous) $\frac{dv}{dt} = \frac{d^2x}{dt^2}$ m/s^2

Motion equations with constant acceleration :

[1] $v = v_0 + at$

[2] $v^2 = v_0^2 + 2a\Delta x$

[3] $\Delta x = v_0 t + \frac{1}{2}at^2$

[4] $\bar{v} = \frac{v_0 + v}{2}$

* In free fall we replace (a) by (-g)
* For projection questions
  * $v_x = v_{ox}$
  * $\Delta x = v_{ox} t$
  * $v_y = v_{oy} - gt$
  * $\Delta y = v_{oy} t - \frac{1}{2}gt^2$

Key words : dropped → (free fall questions) $v_o = 0$

(projection questions) → thrown horisantaly $v_{oy} = 0$

→ Greatest height $v_y = 0$

Newton's Law : [1] $\Sigma F = 0$ (project is at rest or it has constant velocity)

[2] $F_{12} = -F_{21}$

Object

Chapter 6

[1] $W = FS\cos\theta$ J (work)

[2] $K.E = \frac{1}{2}mv^2$ J

[3] $U = mgh$ J

[4] $W = \Delta K.E = K.E_f - K.E_i$ J

[5] $W = -\Delta U$ J

[6] $E_f = E_i$ $(U_f + KE_f = U_i + KE_i)$

power → [7] $P = \frac{\Delta W}{\Delta t}$ J

↳ if velocity is constant we can use

$$P = \frac{dw}{dt} = \frac{d(FS)}{dt} = \frac{d((F)X)}{dt} = F\left(\frac{dx}{dt}\right) = FV$$

Chapter 10

[1] $T_C = \frac{5}{9}(T_F - 32)$

[2] $T_F = \frac{9}{5}T_C + 32$

[3] $T_K = T_C + 273.15$

* If we want to convert from F to K we have to convert it to C first then to K
- there's no direct relationship between (F + K)

pressure → [4] $P = \frac{F}{A}$ Pascale (atm, bar, torr, mmHg)

[5] gauge pressure = $P_{\text{inside container}} - P_{\text{outside container}}$

Chapter 12

[1] $\Delta L^{m} = \alpha L \Delta T$ ⇒ (for linear expansion)

[2] $\Delta A^{m^2} = \beta A \Delta T$ ⇒ (for area expansion)

[3] $\Delta V^{m^3} = \gamma V \Delta T$ ⇒ (for volume expansion)

where $\beta = 2\alpha$ / $\gamma = 3\alpha$

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Chapter 13

buoyant force [1] $B = \rho_0 V g$ N

قاعدة ارخميدس [2] $T = \rho V g - \rho_0 V g$ where

apperance Weight → N

ρ = density for metal

for water = 10^3 ← ρ_0 = for fluid

V: volume [3] $Q = \frac{\Delta V}{\Delta t}$ m^3/s اجباري

v: velocity [4] $Q = v A$

continuity equation [5] $Q_1 = Q_2$ → for incompressible fluids

$A_1 v_1 = A_2 v_2$

Bernoulli's equation (fluid should be: incompressible / non viscous flow rate is streamline / velocity is constant)

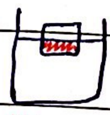
if velocity is constant: $P_a + \rho g y_a = P_b + \rho g y_b$

if velocity isn't constant: $P_a + \rho g y_a + \frac{1}{2} \rho v_a^2 = P_b + \rho g y_b + \frac{1}{2} \rho v_b^2$

[6] $P_b = P_{atmosphere} + \rho g d$

فرق الارتفاع بين النقطة المراد حساب ضغطها ونقطة (atm)

[7] $\frac{\rho}{\rho_0} = \frac{V_s}{V}$ ⇒ for submerged substances



volume submerged

Chapter 14

Flow under applied force

[1] $\vec{F} = \eta A \frac{\Delta v}{\Delta y}$ ← velocity

η ($kg/m.s$ = Pa s)

[2] $\bar{v} = \frac{\Delta P R}{8 \eta L}$ ← viscous fluid

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[3] $Q = A\bar{V}$ → $\pi R^2 \times \frac{\Delta P R^2}{8\eta L}$ → $Q = \frac{\pi R^4 \Delta P}{8\eta L}$

Poiseuille's Law

[4] $P = F\bar{V}$ (power = F × velocity)

P: power

ρ: pressure

$P = \Delta P A \bar{V}$

$= Q$

$P = \Delta P \bar{V} (\pi R^2)$

[5] $R_f = \frac{\Delta P}{Q}$ R_f: flow resistance

$= \frac{\Delta P}{\frac{\pi \Delta P R^4}{8\eta L}}$

$R_f = \frac{8\eta L}{\pi R^4}$

للأرقام الكبيرة (كيلوباسكال بدل باسكال)

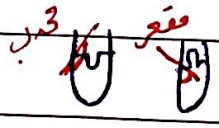
$R_f : (Pa.S/m^3) \xrightarrow{\div 1000} K.Pa.S/m^3$

Chapter 15%

[1] $\gamma = \frac{F}{2L}$

surface tension coefficient

[2] $h = \frac{2\gamma \cos\theta}{\rho g r}$



for height of water in capillarity

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Chapter 16

Coulomb's law ① $\vec{F_e} = K \frac{q_1 q_2}{r^2} \hat{r}$ اتجاه فقط

N

نفسه ق ك = ٩×١٠^٩ $\frac{ش_1 ش_2}{ف^2}$ = $\frac{ش_1 ش_2}{ف^2}$ ...

② $E = \frac{F}{q}$ نفسه ص = $\frac{ق ك}{ش}$

N/coulomb

المجال الغير منتظم ③ $\vec{E} = K \frac{Q}{r^2} \hat{r}$ نفسه ص = ٩×١٠^٩ $\frac{ش}{ف^2}$

④ $V = \frac{U_e}{q}$ (الجهد = طاقة وضع) نفسه ج = $\frac{ط ك}{ش}$

Joule/coulomb = volt

⑤ $V = K \frac{q}{r}$ نفسه ج = ٩×١٠^٩ $\frac{ش}{ف}$

قوانين بالكتاب (سهلين + ممكن يكونوا مهمين مابعرف)

المجال المنتظم ⑥ $\Delta V = E I$ نفسه ج = ف ص

⑦ $V = \frac{4 \pi K Q b}{A}$

Q: شحنة الصفيحة بالمجال المنتظم (غير قانون التوجيهي ن)

Chapter 17

① $I = \frac{\Delta Q}{\Delta t}$ (التيار) نفسه ت = $\frac{ش}{ز}$

ampere (A) → instatinious $\frac{dQ}{dt}$

② $N = \frac{Q}{e}$ → نفسه ن = $\frac{ش}{ص}$

③ $I = enAu$ نفسه ت = ...

$n = \frac{d}{M}$ ← density
M ← molar mass × (1u)

معطى ب (رقم) u   قيمة بالسؤال

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4 $R = \frac{V}{I}$ (Ohm) نفسه $م = \frac{ج}{ت}$

5 $R = \frac{\rho L}{A}$ نفسه $م = \frac{مل}{P}$

$\sigma = \frac{1}{\rho}$

Chapter 23

1 $n = \frac{c}{v}$ c: سرعة الضوء, v: سرعة الموجة

(معامل الانكسار) index of refraction

① دائماً $c > v$

② دائماً $n > 1$

2 $\frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1}$

3 $v = \frac{c}{n} = \lambda f$ (f: التردد)