سنتر فيوتشر

Subject: كيمياء اكلينيكي

Chapter: الثرمو ١٢

Mob: 0112 3333 122

0109 3508 204

Thermo dynamic

Thermo/dynamic Called science of energy

Thermo ← يعني حرارة heat

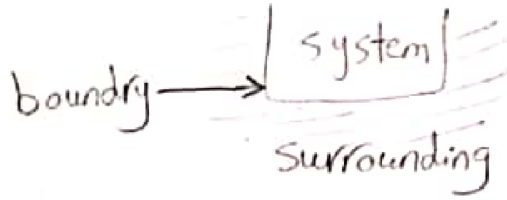
dynamic ← يعني قوة power

System :

النظام

anything chosen for study

اى شيء محط الدراسة يسمى نظام او system



Surrounding :

كل ماهو خارج النظام يسمى الوسط المحيط

region outside the system

Boundry :

الحد الفاصل بين surrounding & system

surface separate between system and surrounding (real or imaginary)

(*) Types of system

① Closed system

نظام مغلق

هو نظام لا يسمح بإنتقال الكتلة ولكن يسمح بإنتقال الحرارة

No mass Can enter or leave the system, but energy Can cross the boundry

mass change X

heat change ✓

② Isolated system

نظام معزول

هو نظام لا يسمح بإنتقال الكتلة ولا الحرارة

No mass Can enter or leave the system and the energy Can't cross the boundry

mass change X

heat change X

ملحوظة

Isolated system is special Case from the closed system

③ open system

نظام مفتوح

هو نظام يسمح بتبادل الكتلة والحرارة

Both mass and energy Can cross the boundry

mass change ✓

heat change ✓

Dimension الأبعاد للتعبير عن الكميات الفيزيائية

① **primary dimension**
أساسية (fundamental)

Ex:- mass الكتلة
length الطول
time الزمن
temp درجة الحرارة

② **secondary dimension**
مشتقة (derived)

Ex:- Volume الحجم
Velocity السرعة
acceleration العجلة

Units الوحدات

	SI system (international system)	English system (united state system)
mass	kg, gm, ---	lbm.
length	m, cm, ---	ft
time	sec	sec

1 lbm = 0.4539 kg

1 ft = 0.3048 m

⊛ Acceleration gravity (g)

SI system

$g = 9.807\ m/s^2$

English system

$g = 32.174\ ft/s^2$

	temperature scale	Thermodynamic scale
SI system	$^\circ C$	$^\circ k$
English system	$^\circ F$	$^\circ R$

thermodynamic scale لحل المسائل في هذا chapter لازم أحول درجات الحرارة إلى

$$T(^\circ c) + 273 = T(^\circ k)$$

$$T(^\circ F) + 460 = T(^\circ R)$$

$$1.8\,T(^\circ c) + 32 = T(^\circ F)$$

$$1.8\,T(^\circ k) = T(^\circ R)$$

Temp difference between two scale is the same

SI system $\Rightarrow$ $\Delta T(^\circ c) = \Delta T(^\circ k)$

English system $\Rightarrow$ $\Delta T(^\circ F) = \Delta T(^\circ R)$

ملحوظة when say The rise in temp or The drop in temp
هستخدم قوانين temp difference

Ex) The temperature of system drop by $27^\circ F$ during Cooling process.
Express this drop in temp $^\circ R$??

$$\Delta T(^\circ F) = 27^\circ F$$

$$\because \Delta T(^\circ F) = \Delta T(^\circ R)$$

$$\therefore \Delta T(^\circ R) = 27^\circ R$$

Ex| During the heating process the temperature of system was 10°C

Express the temp in k, °R, °F ??

Soln

$$T(°k) = T(°c) + 273$$

$$T(°k) = 10 + 273 = 283 \ k$$

$$T(°R) = 1.8 \ T(°k)$$

$$= 1.8 \ (283) = 509.4 \ °R$$

$$T(°F) = 1.8 \ T(°c) + 32$$

$$= 1.8 (10) + 32 = 50 \ °F$$

(*) Force|:: القوة Force = mass X acceleration

$$F = m \cdot a$$

★ وحدات قياس القوة

النيوتن Newton = kg . $\frac{m}{s^2}$ (SI system)

(bound force) $1 \ lb_f = 32.174 \ lb_m \cdot \frac{ft}{s^2}$ (English system)

Newton :: is the force required to accelerate 1 kg of body by rate 1 m/s²

bound force (lb_f) :: is the force required to accelerate body of 32.174 lb_m by rate ft/s²

Ex| what is the force required to accelerate 30 kg of body at a rate of 15 m/s²

Soln → $F = m \cdot a$

$$= 30 \ kg * 15 \ m/s^2$$

$$= 450 \ kg \ m/s^2 = 450 \ Newton$$

⊛ Relation between mass & weight :

الوزن weight ← $\boxed{W = m\,g}$ → acceleration gravity عجلة الجاذبية

m: الكتلة mass

(specific weight) الوزن النوعي

the weight of unit volume of substance

هو وزن وحدة الحجوم من المادة

specific weight الوزن النوعي ← $\boxed{w = \rho \cdot g}$ → acceleration gravity عجلة الجاذبية

ρ: $\frac{\text{الكتلة}}{\text{الحجم}}$ = الكثافة denisty

⊛ Work : الشغل

Work = Force X distance

$$\boxed{W = F \cdot L}$$

وحدات قياس الشغل

SI system ⟹ N.m

English system ⟹ Btu (British thermal unit)

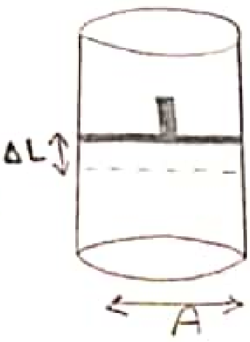
$W = F \cdot L$ but $P = \frac{F}{A}$

$dW = P\,\underbrace{A\,\Delta L}$ $F = PA$

$$\boxed{W = P\,\Delta V}$$

at Const pressure عند ثبوت الضغط

W: Work, P: pressure, ΔV: change in volume



$$\boxed{W = P(V_2 - V_1)}$$

$$\boxed{W = \int_{V_1}^{V_2} P\,dV}$$

at $P \neq$ Const عند تغير الضغط

for ideal gas $\longrightarrow$ $\boxed{PV = nRT}$

- P → pressure الضغط
- V → volume الحجم
- n → no. of moles عدد المولات
- R → general gas Const الثابت العام للغازات
- T → temp درجة الحرارة

$$\therefore P = \frac{nRT}{V}$$

$$W = \int_{V_1}^{V_2} P \cdot dV = \int_{V_1}^{V_2} \frac{nRT}{V} \cdot dV$$

$$W = nRT \int_{V_1}^{V_2} \frac{dV}{V} = nRT \ln [V]_{V_1}^{V_2}$$

$$= nRT [\ln V_2 - \ln V_1]$$

$P \propto \frac{1}{V}$

$$\boxed{W = nRT \ln \frac{V_2}{V_1}} \Longrightarrow \begin{matrix} T = Const \\ V \# Const \end{matrix}$$ عندثبوت temp وتغيير الحجم

$$\boxed{W = nRT \ln \frac{P_1}{P_2}} \Longrightarrow \begin{matrix} T = Const \\ P \# Const \end{matrix}$$ عندثبوت temp وتغيير الضغط

* Units of Work

① $W = P \Delta V$

$= atm . L = L . atm$

$$W = nRT \ln \frac{V_2}{V_1}$$

$$\cancel{mole} \times 0.082 \frac{L.atm}{\cancel{mole\ {}^\circ k}} \times \cancel{{}^\circ k} \ \ln \frac{\cancel{m^3}}{\cancel{m^3}}$$

$= \_\_\_\_ \ L.atm$

$$\boxed{R = 0.082 \frac{L.atm}{mole\ {}^\circ k} = 2 \frac{Calory}{mole\ {}^\circ k}}$$

② $W = nRT \ln \frac{V_2}{V_1}$

$$\cancel{mole} \times 2 \frac{Calory}{\cancel{mole\ {}^\circ k}} \times \cancel{{}^\circ k} \ \ln \frac{\cancel{m^3}}{\cancel{m^3}}$$

$= \_\_\_\_ \ Calory$

③ $\boxed{1 \ Calory = 4.182 \ Joule}$

④ $\boxed{Joule = 10^7 \ erg}$