grandissement

1,2 : $\frac{1}{\overline{OA'}} - \frac{1}{\overline{OA}} = \frac{1}{f'}$, $\gamma = \frac{\overline{OA'}}{\overline{OA}} = \frac{\overline{A'B'}}{\overline{AB}}$

$\left(\overline{F'A'} \times \overline{FA} = -f'^2 \right.$, $\left. \gamma = \frac{\overline{F'A'}}{-f'} = \frac{f'}{\overline{FA}} \right)$

6 $\ddot{X} + \frac{\omega_0}{Q}\dot{X} + \omega_0^2 X$ | regime $(Q > \frac{1}{2})$ pseudo-periodique
$(Q < \frac{1}{2})$ aperiodique
$(Q = \frac{1}{2})$ critique

9 $P(\vec{f}) = \vec{f} \cdot \vec{v}$, $W_{AB}(\vec{f}) = \int_A^B \vec{f} \cdot d\vec{OM}$

$\Delta E_c = \sum W_{AB}(\vec{f})$, $\Delta E_m = \sum W_{AB}(\vec{f_{NC}})$

force conservative : Travail ne depend pas chemin suivi

10 Force Lorentz $R = \frac{mv}{|q|B}$

12 extensive / intensive proportinell / indep q^{T} de matiere
masse Temperature

$P = \frac{1}{3} \frac{N}{V} m u^2$, $u = \sqrt{\frac{1}{N} \sum v_i^2}$

$dU = C_v dT$, monoatomique gaz parfait : $U_m(T) = \frac{3}{2} RT$
1ere loi Joule

13 $W_f = -\int_{V_i}^{V_F} P_{ext} dV$ $\left(= \int_{V_i}^{V_F} P dV \text{ lorsque reversible lent} \right)$

$\frac{\delta Q}{\delta t} = \phi$, $\phi R_{TH} = \Delta T$

1er principe : $\Delta U = W + Q$,

$H = U + PV$ $dH = C_p dT$
2eme loi Joule

Année 1

$$\gamma = \frac{C_{pm}}{C_{Vm}}$$

$C_{pm} = C_{Vm} + R$, $\Rightarrow C_{Vm} = \frac{R}{\gamma - 1}$ $C_{pm} = \frac{\gamma R}{\gamma - 1}$

14 $\underline{U} = \underline{Z} \cdot \underline{i}$, $\underline{Z_R} = R$ $\underline{Z_L} = j\omega L$ $Z_c = \frac{1}{j\omega C}$

Pire: Tension:

$\varphi(\omega_0) = \frac{-\pi}{2}$, $\omega_r = \omega_0 \sqrt{1 - \frac{1}{2Q^2}}$ ω_r lorsque U maximal

$\Delta\omega$: $\frac{U_{max}}{\sqrt{2}}$

Pire intensité (résonance en)

$\varphi(\omega_0) = 0$ ω_0 lorsque U maximal $\Delta\omega$: $\frac{I_{max}}{\sqrt{2}}$

$Q = \frac{\omega_0}{\Delta\omega}$

15 $\underline{H} = \frac{\underline{U_s}}{\underline{U_e}}$ $G = |\underline{H}|$ $\Phi = \arg(\underline{H})$

ordre d'un filtre (degré du dénom de $\underline{H}$)

$G_{DB} = 20\log(|\underline{H}|)$ / $G(\omega_c) = \frac{G_{max}}{2}$ $G_{DB}(\omega_c) = G_{DB\,max} - 3$

Passe-bande : $\Delta\omega = \frac{\omega_0}{Q}$

16 $\vec{L}_O(M/R) = \vec{OM} \wedge m\vec{v}$ $J \cdot \Delta$

$\vec{M}_O(\vec{\beta}) = \vec{OM} \wedge \vec{\beta}$ $J.$

TMC: $\frac{d\vec{L_o}}{dT} = \Sigma \vec{M_o}(\vec{\beta})$

17 $\frac{dL_o}{dT} = 0$ / $\vec{OM} \wedge m\vec{v} = cte$: plan et $r^2\dot{\theta}$ cte

$\frac{dA}{dT} = \frac{1}{2} r^2 \dot{\theta}$

états... , 3 Lois de Kepler

18 $L_\Delta = J_\Delta \cdot \omega$ $J_\Delta = \Sigma m_i r_i^2$

$E_c = \frac{1}{2} m v^2$ $E_c = \frac{1}{2} J_\Delta \omega^2$ $(E_c = \Sigma \frac{1}{2} m_i v_i^2$

$P_{ext} = M_\Delta^{ext} \omega = \Gamma \omega$

$W_{AB}^{ext} = \int_{T_A}^{T_B} P^{ext} dT = \int_{\theta_A}^{\theta_B} M_\Delta^{ext} d\theta$

$J \cdot K^{-1}$

19 $\Delta S = S_{ech} + S_{cree}$ $S_{ech} = \sum \frac{Q_i}{T_i}$

Loi de Laplace : $\begin{cases} - \gamma \text{ cte} \\ - \text{système fermé} \end{cases}$ - isentropique

- echange seulement Travail force pression

$PV^{\gamma} = cte$

20 Pression de vapeur saturante $P_{SAT}(T)$

point Triple , point critique

$x_G = \frac{LM}{LG}$ $\Delta s_{\ell_1 \to \ell_2} = \frac{\Delta_{\ell_1 \to \ell_2} h}{T}$ (massique)

21 $e = \left| \frac{\text{utile}}{\text{cout}} \right|$

22 $\vec{m} = I\vec{S}$, $\vec{m} = NI\vec{S}$ $\overrightarrow{B_{int}} = \mu_0 \frac{N}{\ell} i \vec{u_z}$

Force de Laplace $d\vec{F} = I\, d\vec{\ell} \wedge \overrightarrow{B_{ext}}$

$\vec{F} = i\, \overrightarrow{MN} \wedge \overrightarrow{B_{ext}}$

$\vec{\Gamma} = \vec{m} \wedge \overrightarrow{B_{ext}}$

23 Loi de modération de Lenz

$\Phi = \vec{B} \cdot \vec{S}$ $T \cdot m^{-2}$ $\Phi = N\vec{B} \cdot \vec{S}$

Loi de Faraday : $e_{ind} = -\frac{d\Phi}{dt}$

$\Phi_P = L i = \iint \overrightarrow{B_P} \cdot \vec{dS}$

$e_P = -L \frac{di}{dt}$

$\Phi_{1 \to 2} = M i_1$ $\Phi_{2 \to 1} = M i_2$