DATE Isokos

PURPOSE/OBJET p125.

CUE COLUMN
COLONNE DES INDICATEURS

Physique thermique

NOTES

ex n°1

a) $Q_{perdu} = Q_{gagné}$

b) Température ≠ car chaleurs massiques ≠

ex n°2

a) $m = 0,150\ kg$

$\Delta t = 5,00°C$

$Q = mc\Delta T = 385\ J$

$c = \frac{385}{5 \times 0,150} = 513\ J.kg^{-1}.°C^{-1}$

b) mêmes calculs.

ex n°3

310 g. T = 15°C → cell 20,0 W

$m = 90\ g$.

$c = 420\ J.kg^{-1}.°C^{-1}$

⇒ T = 19°C en 3,0 m

$Q = P \times t = 20,0 \times 3,0 \times 60$

$= 3600\ J$.

$3600 = 0,09 \times 420 \times 4 + 0,310 \times c \times 4$

$3600 = 151,20 + 1,24c$

$c = \frac{3448,80}{1,24} = 2781$

$[c = 2800\ J.kg^{-1}.°C^{-1}]$

SUMMARY/SOMMAIRE

DATE

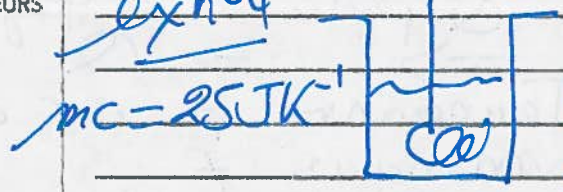
PURPOSE/OBJET

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

← 40 W pendant 4,0 minutes

ex n°4



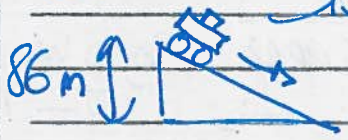
$40 \times 4,0 \times 60 = 0,140 \times c \times 15,8 + 25 \times 15,8$

$9600 - 395 = 2,212 \times c$

$9205 = 2,212 \times c$

$[c = 4161 \text{ J.kg}^{-1}\text{°C}^{-1}]$

ex n°5



$E_p = mgz$

$= 1360 \times 9,8 \times 86$

$= 1\,146\,208 \text{ J}$

$= 1146 \text{ kJ}$

$\Delta T = \frac{1146}{16} = [71 \text{°C}]$

Ex n°6

$c = 480 \text{ J.kg}^{-1}\text{°C}^{-1}$

$m = 45,0 \text{ kg}$

23 kg d'eau

$c_e = 4200 \text{ J.kg}^{-1}.\text{K}^{-1}$

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CUE COLUMN
COLONNE DES INDICATEURS

NOTES

$Q = 45,0 \times 450 \times 1 + 23,0 \times 4200 \times 1$

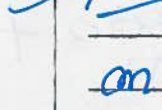
$= 116\,850\ J$

$Q = 117\ kJ$ par 1 degré.

b) $20°C \Rightarrow Q = 117 \times 20 = 2340\ kJ$

$2340 = 450 \times t \Rightarrow t = 5,2\ s.$

ex n°7



150g aluminium.

$Q_{glace} = Q_{eau} + Q_{tasse}$

$= 300 \times 4,2 \times 10 + 900 \times 0,150 \times 10.$

$= 13\,950\ J.$

$Q_{glace} = 2200 \times m \times (+10) + m \times 334\,000 + m \times 4200 \times 10$

$= (22\,000 + 33\,400 + 42\,000)\,m$

$= 398\,000\ m.$

$\Rightarrow m = 0,035\ kg$

$\boxed{m = 35\ g}$

SUMMARY/SOMMAIRE

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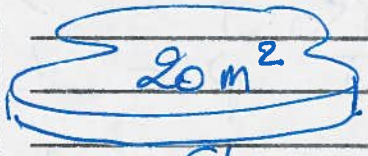
PURPOSE/OBJET

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

exn°8

$t° = -5°C$



Volume $= 20 \times 0{,}06 = 1{,}2\ m^3$

$\rho = 900\ kg/m^3 \Rightarrow m = 900 \times 1{,}2$

$m = 1080\ kg$

$Q = 1080 \times 2200 \times (5) + 1080 \times 334000$

$= 11\,880\,000 + 360\,720\,000$

$= 372\,600\ kJ.$

exn°9

$\Phi = 600\ W.m^{-2}$

a) $t = 0°C$

$V = 0{,}01 \times 1 = 0{,}01\ m^3$

$\rho = 900\ kg.m^{-3}$ $m = 900 \times 0{,}01$

$= 9\ kg.$

$Q = mL = 9 \times 334$

$= 3006\ kJ. = 3 \times 10^6\ J$

$3\ 10^6\ J = 600 \times t$

$\Rightarrow t = \frac{3 \times 10^6}{600} = 5000\ s.$

$t = 1{,}38\ h = 1h\ 22mn.$

b) Le soleil ne chauffe que la surface.

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CUE COLUMN
COLONNE DES INDICATEURS

NOTES

ex n°10

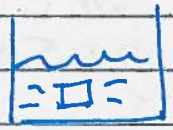
a) $Q_1 = 1 \times 2200 \times 10$
$= 22000\,J = 22\,kJ$.

b) $Q_2 = mL = 334 \times 1 = 334\,kJ$

c) $Q_3 = 1\,kg \times 4200 \times 10$
$= 42000\,J = 42\,kJ$

d) Le changement d'état.

ex n°11



1,0 kg
$T_i = 20°C$
$t_f = 10°C$

$Q_{eau} = -1,0 \times 4200 \times 10$.
$= -42\,kJ$.

$Q_{glace} = mL + m \times 4200 \times 10$.
$= (334 + 42)\,m$
$= 376\,m$

$Q_{eau} = -Q_{glace}$.

$42 = 376\,m \Rightarrow m = 112\,g$

SUMMARY/SOMMAIRE

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CUE COLUMN
COLONNE DES INDICATEURS

NOTES

exn 0/2

100 g de glace à 0°C

50 g de vapeur à 100°C

t_f finale ?

150 g d'eau
30°C

Glace : $Q = mL_f + mc\Delta T$

$= 0,1 \times 334 + 4,2 \times 0,1 \times t_f$

$= 33,4 + 0,42\, t_f$.

Vapeur : $Q_v = mL_v + mc\Delta T$

$= 0,05 \times 2260 + 0,05 \times 4,2 \times (100$

$Q_v = -113 + 0,21(t_f - 100)$

$= -113 - 21 + 0,21\, t_f$

$= -134 + 0,21\, t_f$.

$Q_g + Q_v + Q_e = 0$.

$33,4 + 0,42\, t_f - 134 + 0,21\, t_f + 0,150 \times 4,2 (t_f - 3$

$0,42\, t_f + 0,21\, t_f + 0,63\, t_f + 33,4 - 134 - 18,9 = 0$

$1,26\, t_f - 119,5 = 0$

$t_f = \frac{119,5}{1,26} = 95°C$

SUMMARY/SOMMAIRE

DATE Tsakos

PURPOSE/OBJET p140.

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

(13) # mol $= \frac{28}{2} = 14$ moles

1 mole $= 6,02 \times 10^{23}$ molécules

$\Rightarrow$ il y a $8,428 \times 10^{24}$ molécules

(14) # mol $= \frac{6,0}{4} = 1,5$ moles.

(15) # mol $= \frac{2,0 \times 10^{24}}{6,02 \times 10^{23}} = 3,3$ moles.

(16) # mol Krypton $= \frac{21}{84} = 0,25$ mol

masse de 0,25 mol de Carbone
$= 0,25 \times 12 = 3$ g

[3g de carbone contient autant de molécules que 21g de krypton.

(17) $t_0 = 22°C = 295,15K$
$P_0 = 12,0 \times 10^5$ Pa) Volume constant

$t_1 = 120,0°C = 120 + 273,15 = 393,15$
P_1 ?

$\frac{P_0}{t_0} = \frac{P_1}{t_1} \Rightarrow P_1 = \frac{P_0 \times t_1}{t_0}$

$P_1 = (12 \times 10^5 \times 393,15) / 295,15$

$[P_1 = 16,0 \times 10^5$ Pa]

SUMMARY/SOMMAIRE

DATE Isokos

PURPOSE/OBJET p 140

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

18 $P_0 = 8,2 \times 10^6$ Pa
$V_0 = 2,3 \times 10^{-3}$ m³
$P_1 = 4,5 \times 10^6$ Pa
V_1 ?
T = cste

$P_0 V_0 = P_1 V_1$

$\Rightarrow V_1 = \dfrac{P_0 V_0}{P_1}$

$\Rightarrow V_1 = \dfrac{8,2 \times 10^6 \times 2,3 \times 10^{-3}}{4,5 \times 10^6}$

$[V_1 = 4,2 \times 10^{-3}\ m^3]$

19 12,0 kg hélium.
$V = 5,00 \times 10^{-3}$ m³
$t = 20,0°C = 293,15$ K.

$PV = nRT$

$n = \dfrac{12,0 \times 10^3}{4} = 3,0 \times 10^3$ moles

$P = \dfrac{3,0 \times 10^3 \times 8,31 \times 293,15}{5,00 \times 10^{-3}}$

SUMMARY/SOMMAIRE

DATE Tsokos

PURPOSE/OBJET p140

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

[$p = 1,46 \times 10^9$ Pa].

(20)

$V = 12,0 \times 10^{-3}\ m^3$

$t = 20,0°C = 293,15\ K$

$p = 4,00\ atm = 4,00 \times 101325$

$= 4,05 \times 10^5$ Pa.

$pV = nRT$

$\Rightarrow n = \dfrac{pV}{RT} = \dfrac{4,05 \times 10^5 \times 12,0 \times 10^{-3}}{8,31 \times 293,15}$

$n = 2,0$ moles.

masse $= 2,0 \times$ masse molaire

$= 2,0 \times 44 = 88$ g. de CO_2

(21) $V = 300,0 \times 10^{-6}\ m^{-3}$

$p = 5,00 \times 10^5$ Pa

$t = 27,0°C = 300,15\ K$.

$pV = nRT \Rightarrow n = \dfrac{5,00 \times 10^5 \times 300,0 \times 10}{8,31 \times 300,15}$

$n = 0,06$ moles.

$= 3,62 \times 10^{22}$ moles.

T et V sont constants donc par que la pression diminue de 1/2, il faut que n diminue de 1/2.

SUMMARY/SOMMAIRE

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PURPOSE/OBJET

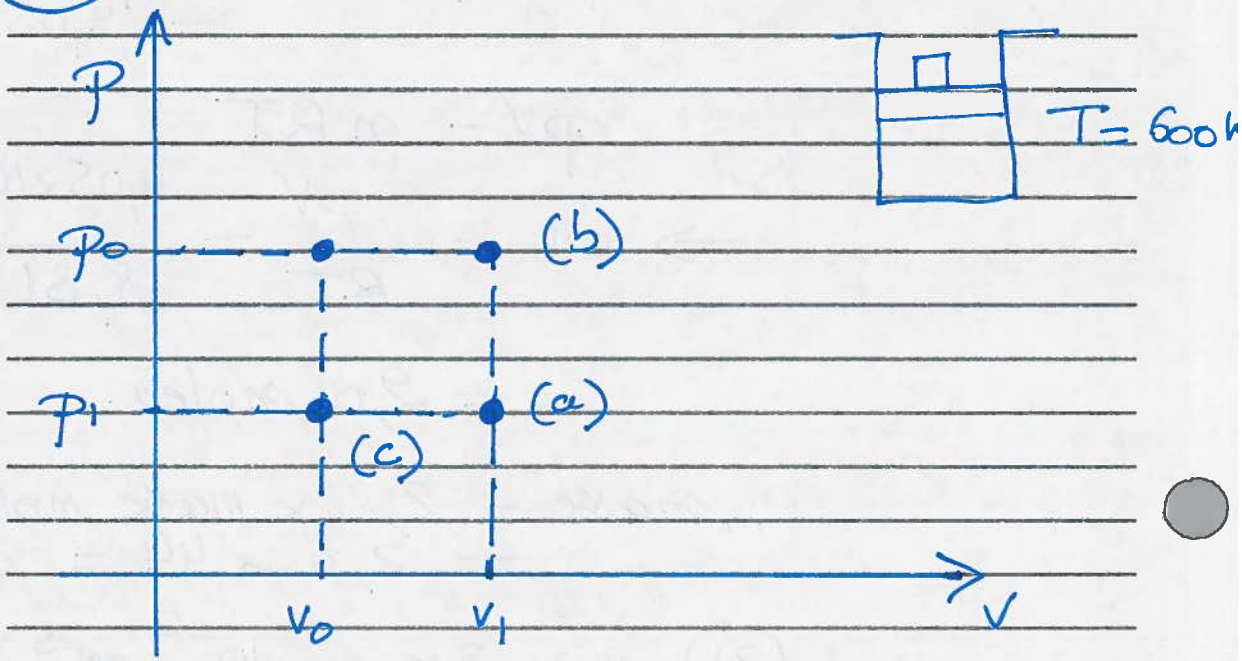
CUE COLUMN
COLONNE DES INDICATEURS

NOTES

$N_{1/2} = 1{,}81 \times 10^{22}$ molécules.

$\Delta t = \frac{1{,}81 \times 10^{22}}{3{,}00 \times 10^{19}} = 603$ secondes $\simeq$ 10 minutes.

(22)



a) $p_0 V_0 = p_1 V_1$ $\quad V_1 = 2V_0$

$p_0 V_0 = p_1 \times 2V_0$

$\Rightarrow p_1 = \frac{p_0}{2}$

b)

$\frac{V_0}{t_0} = \frac{V_2}{t_2}$ $\quad p = cste$

$V_2 = 2 \times V_0$

c) $p = \frac{1}{2} p_0$

$V = cste = V_0$

SUMMARY/SOMMAIRE

DATE Tsokos

PURPOSE/OBJET p 141

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

(23)

$V_1 = 6\ dm^3$ $V_2 = 3 dm^3$

$P_1 = 12\ atm$ $P_2 = 6\ atm$

$T_1 = T$ $T_2 = T$

$PV = nRT \Rightarrow P = \frac{nRT}{V}$

$n = n_1 + n_2 = \frac{P_1V_1}{RT} + \frac{P_2V_2}{RT}$

$n = \frac{P_1V_1 + P_2V_2}{RT} = \frac{6\times12 + 3\times6}{RT} = \frac{90}{RT}$

$V = V_1 + V_2 = 6 + 3 = 9\ dm^3$

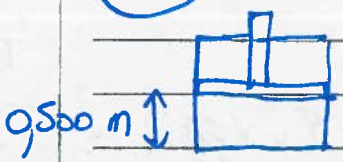
$P = \frac{90}{RT} \times \frac{RT}{9} = \frac{90}{9} = 10\ atm$

(24)

Volume du cylindre $= 9{,}050\ m^3$

masse $= 10{,}0\ kg$

$t = 19{,}0°C = 292{,}15\ K.$



a) $P = \frac{F}{S} = \frac{mg}{S} = \frac{9{,}8\times10{,}0}{0{,}10} = 980$

$S = \frac{V}{0{,}500} = \frac{0{,}050}{0{,}500} = 0{,}1\ m^2$

$[P = 980\ Pa]$

SUMMARY/SOMMAIRE

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CUE COLUMN
COLONNE DES INDICATEURS

NOTES

b) $PV = nRT$

$\Rightarrow n = \frac{PV}{RT} = \frac{980 \times 0{,}050}{8{,}32 \times 292{,}15}$

$n = 0{,}02$ moles

nombre de molecules $= 0{,}02 \times 6{,}02 \times 10^{23}$
$= 1{,}2 \times 10^{22}$ molécul-

c) $\frac{V_1}{V_2} = \frac{T_1}{T_2} \Rightarrow V_2 = V_1 \times \frac{T_2}{T_1}$

$V_2 = 0{,}050 \times \frac{425{,}15}{292{,}15}$

$V_2 = 0{,}073\ m^3$

(25) Masse molaire $= 28\ g.mol^{-1}$

$PV = nRT \Rightarrow V = \frac{2{,}00 \times 8{,}32 \times 273{,}15}{1{,}00 \times 10^5}$

$V = 0{,}455\ m^3$

masse $= 28 \times 2 = 56{,}0\ g$.

(26) $V = 404\ m^3$

$m = 700\ kg$

$T = 17{,}0°C = 290{,}15\ K$

$PV = nRT$

SUMMARY/SOMMAIRE

DATE Tsokos

PURPOSE/OBJET p 141

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

$P = \frac{nRT}{V} = \frac{17500 \times 8{,}32 \times 290{,}15}{404}$

$n = \frac{70{,}0 \times 10^3}{4} = 17500$ moles.

$P = 104569$ Pa $= 1{,}05 \times 10^5$ Pa

(27)

$V = 5{,}0 \times 10^{-4}$ m^3
$T = 300$ K
$P = 150$ kPa

a) $PV = nRT \Rightarrow n = \frac{PV}{RT} = \frac{150 \times 10^3 \times 5}{8{,}32 \times 30}$

$n = 0{,}03$ moles.

b) # molecules $= 0{,}03 \times 6{,}02 \times 10^{23}$
$= 1{,}8 \times 10^{22}$ molécules

c) masse $= 29 \times 0{,}03 = 0{,}87$ g.

(28) a) $V = \frac{nRT}{P} = \frac{1 \times 8{,}32 \times 273}{1{,}0 \times 10^5}$

$V = 22{,}7$ dm^3

b) $\rho = \frac{\text{masse}}{\text{volume}} = \frac{4{,}00}{22{,}7} = 0{,}176$ g.dm

c) $\rho = \frac{\text{masse}}{\text{volume}} = \frac{32}{22{,}7} = 1{,}41$ g.dm^{-3}

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CUE COLUMN
COLONNE DES INDICATEURS

NOTES

(29) $\rho = 1{,}35\ kg.m^{-3}$

$\rho = \frac{masse}{Volume}$ $\quad V_2 = \frac{nRT_2}{P_2} = \frac{nR(2T_1)}{2P_1}$

$\Rightarrow$ [pas de chang^t] $\quad V_2 = \frac{nRT_1}{P_1} = V_1$

(30) $E_C = \frac{3}{2} k_B T = \frac{3}{2} \times 1{,}38 \times 10^{-23} \times 850$

$E_C = 1{,}8 \times 10^{-20}\ J$

$E_C = \frac{1}{2} m c^2 = 1{,}8 \times 10^{-20}$

$c^2 = \frac{2 \times 1{,}8 \times 10^{-20}}{4{,}0 \times 10^{-3}} \times 6{,}02 \times 10^{23}$

$c^2 = 5\,418\,000 \Rightarrow c = 2300\ m.s^{-1}$

(31) $\frac{1}{2} m c^2 = \frac{3}{2} k_B T$

$\frac{1}{2} m c^2 = \frac{3}{2} \frac{R}{N_A} T$

$m c^2 = \frac{3R}{N_A} T$

$\frac{M}{N_A} c^2 = 3 \frac{RT}{N_A}$

$c^2 = \frac{3RT}{M} \Rightarrow c = \sqrt{\frac{3RT}{M}}$

SUMMARY/SOMMAIRE

DATE Tsokos

PURPOSE/OBJET p 141

CUE COLUMN
COLONNE DES INDICATEURS

NOTES

32

a) $E_c = \frac{3}{2} k_B T = \frac{3}{2} \times 1{,}38 \times 10^{-23} \times 300$

$E_c = 6{,}21 \times 10^{-21} J$

b) $M_1 = 4{,}0 \text{ g/mol} \Rightarrow m_1 = \frac{4{,}0}{N_A}$

$M_2 = 32 \text{ g/mol} \Rightarrow m_2 = \frac{32}{N_A}$

$\frac{1}{2} m_1 c_1^2 = \frac{1}{2} m_2 c_2^2 = 6{,}21 \times 10^{-21} J$

$\Rightarrow m_1 c_1^2 = m_2 c_2^2$

$\frac{4{,}0}{N_A} c_1^2 = \frac{32}{N_A} c_2^2$

$\left(\frac{c_1}{c_2}\right)^2 = \frac{32}{4{,}0} = 8{,}0.$

$\frac{c_1}{c_2} = \sqrt{8{,}0} = 2{,}8.$

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