QUÍMICA

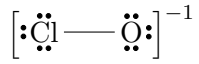
OPCIÓN A - SOLUCIONES

1. a) No; **b)** A; **c)** B; **d)** C y D.

2.

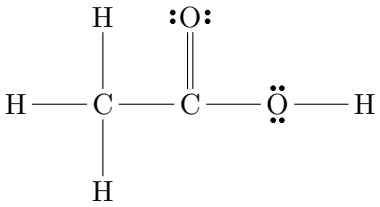
a)

$14\,\mathrm{e^-} \equiv 7\,\text{pares}$



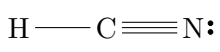
b)

$24\,\mathrm{e^-} \equiv 12\,\text{pares}$



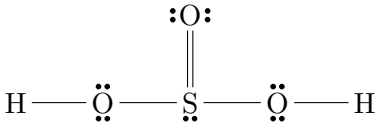
c)

$10\,\mathrm{e^-} \equiv 5\,\text{pares}$



d)

$26\,\mathrm{e^-} \equiv 13\,\text{pares}$



3.

	$CO_2(g)$	+	$H_2(g)$	$\rightleftharpoons$	$CO(g)$	+	$H_2O(g)$
$n(\xi = 0\,\text{mol})/\text{mol}$	$2,00$		$2,00$		0		0
$n(\xi = \xi_{eq})/\text{mol}$	$2,00 - z$		$2,00 - z$		z		z

$$z = 0{,}540\,\text{mol}$$

	$CO_2(g)$	+	$H_2(g)$	$\rightleftharpoons$	$CO(g)$	+	$H_2O(g)$
$n(\xi = \xi_{eq})/\text{mol}$	$1{,}46$		$1{,}46$		$0{,}540$		$0{,}540$

$$n_{\text{tot, eq}} = 1{,}46 + 1{,}46 + 0{,}540 + 0{,}540 = 4{,}00\,\text{mol}$$

	$x_{\mathrm{eq}} = n_{\mathrm{eq}}/n_{\mathrm{tot,\,eq}}$	$p_{\mathrm{eq}}/\mathrm{atm} = x_{\mathrm{eq}} \cdot p_{\mathrm{tot,\,eq}}/\mathrm{atm} = x_{\mathrm{eq}} \cdot 1,00$
$\mathrm{CO_2(g)}$	$\dfrac{1{,}46}{4{,}00} = 0{,}365$	$0{,}365$
$\mathrm{H_2(g)}$	$\dfrac{1{,}46}{4{,}00} = 0{,}365$	$0{,}365$
$\mathrm{CO(g)}$	$\dfrac{0{,}540}{4{,}00} = 0{,}135$	$0{,}135$
$\mathrm{H_2O(g)}$	$\dfrac{0{,}540}{4{,}00} = 0{,}135$	$0{,}135$

$$K_p = \frac{\dfrac{p_{\mathrm{CO(g),\,eq}}}{p^\ominus} \cdot \dfrac{p_{\mathrm{H_2O(g),\,eq}}}{p^\ominus}}{\dfrac{p_{\mathrm{CO_2(g),\,eq}}}{p^\ominus} \cdot \dfrac{p_{\mathrm{H_2(g),\,eq}}}{p^\ominus}} = \frac{0{,}135 \cdot 0{,}135}{0{,}365 \cdot 0{,}365} = 0{,}137$$

Procedimiento alternativo:

$$n_{\mathrm{tot,\,eq}} = 4{,}00\,\mathrm{mol}$$

$$V = \frac{n\,R\,T}{p} = \frac{4{,}00 \times 0{,}0821 \times (550 + 273{,}15)}{1{,}00} = 270{,}32\,\mathrm{L}$$

	$\mathrm{CO_2(g)}$	$+$	$\mathrm{H_2(g)}$	$\rightleftharpoons$	$\mathrm{CO(g)}$	$+$	$\mathrm{H_2O(g)}$
$n(\xi = \xi_{\mathrm{eq}})/\mathrm{mol}$	$1{,}46$		$1{,}46$		$0{,}540$		$0{,}540$
$c(\xi = \xi_{\mathrm{eq}})/(\mathrm{mol\,L^{-1}})$	$\dfrac{1{,}46}{270{,}32}$		$\dfrac{1{,}46}{270{,}32}$		$\dfrac{0{,}540}{270{,}32}$		$\dfrac{0{,}540}{270{,}32}$

$$K_c = \frac{\dfrac{[\mathrm{CO(g)}]}{c^\ominus} \cdot \dfrac{[\mathrm{H_2O(g)}]}{c^\ominus}}{\dfrac{[\mathrm{CO_2(g)}]}{c^\ominus} \cdot \dfrac{[\mathrm{H_2(g)}]}{c^\ominus}} = \frac{[\mathrm{CO(g)}] \cdot [\mathrm{H_2O(g)}]}{[\mathrm{CO_2(g)}] \cdot [\mathrm{H_2(g)}]} = \frac{\dfrac{0{,}540}{270{,}32} \cdot \dfrac{0{,}540}{270{,}32}}{\dfrac{1{,}46}{270{,}32} \cdot \dfrac{1{,}46}{270{,}32}} = 0{,}137$$

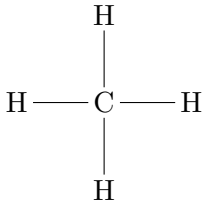
$$K_p = K_c(RT)^{\Delta n} = 0{,}137\,(RT)^0 = 0{,}137$$

4.

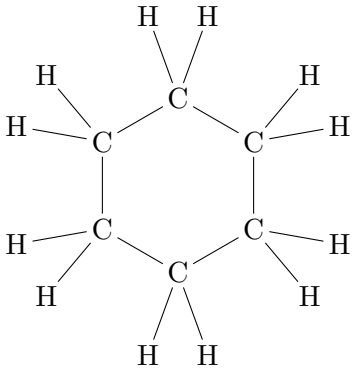
Reducción	Manganeso(VII)	$\rightarrow$	Manganeso(II)
	MnO_4^-	$\rightarrow$	Mn^{2+}
	MnO_4^-	$\rightarrow$	$Mn^{2+} + 4\,H_2O$
	$MnO_4^- + 8\,H^+$	$\rightarrow$	$Mn^{2+} + 4\,H_2O$
R	$MnO_4^- + 8\,H^+ + 5\,e^-$	$\rightarrow$	$Mn^{2+} + 4\,H_2O$
Oxidación	Carbono(III)	$\rightarrow$	Carbono(IV)
	$H_2C_2O_4$	$\rightarrow$	CO_2
	$H_2C_2O_4$	$\rightarrow$	$2\,CO_2$
	$H_2C_2O_4$	$\rightarrow$	$2\,CO_2 + 2\,H^+$
O	$H_2C_2O_4$	$\rightarrow$	$2\,CO_2 + 2\,H^+ + 2\,e^-$
2R	$2\,MnO_4^- + 16\,H^+ + 10\,e^-$	$\rightarrow$	$2\,Mn^{2+} + 8\,H_2O$
5O	$5\,H_2C_2O_4$	$\rightarrow$	$10\,CO_2 + 10\,H^+ + 10\,e^-$
2R+5O	$2\,MnO_4^- + 5\,H_2C_2O_4 + 16\,H^+$	$\rightarrow$	$2\,Mn^{2+} + 8\,H_2O + 10\,CO_2 + 10\,H^+$
(2R+5O)'	$2\,MnO_4^- + 5\,H_2C_2O_4 + 6\,H^+$	$\rightarrow$	$2\,Mn^{2+} + 8\,H_2O + 10\,CO_2$
(2R+5O)"	$2\,MnO_4^-(aq) + 5\,H_2C_2O_4(aq) + 6\,H^+(aq)$	$\rightarrow$	$2\,Mn^{2+}(aq) + 8\,H_2O(l) + 10\,CO_2(g)$

5.

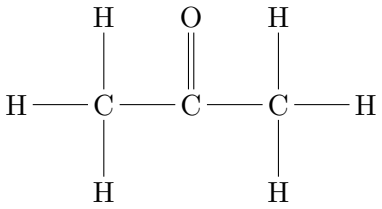
a) CH_4



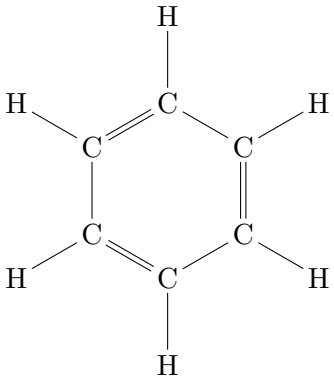
b) C_6H_{12}



c) C_3H_6O



d) C_6H_6



QUÍMICA

OPCIÓN B - SOLUCIONES

1. Ninguno está permitido porque los únicos valores posibles de m_s son $+1/2$ o $-1/2$. Adicionalmente, en el apartado b) no puede ocurrir que $l > n$ y en el apartado d) que $l = n$.

2.

$$M(\mathrm{CH_3COOH}) = 60{,}0520 \cdot 10^{-3}\,\mathrm{kg\,mol^{-1}}$$

$$\rho(\text{disolución}) = 1{,}004\,\mathrm{g\,mL^{-1}} \rightarrow 1\,\mathrm{L}\ \text{disolución} \equiv 1{,}004\,\mathrm{kg}$$

$$1{,}004\,\mathrm{kg}\ \text{disolución} - 0{,}7630\,\mathrm{mol\,CH_3COOH} \times \frac{60{,}0520 \cdot 10^{-3}\,\mathrm{kg\,CH_3COOH}}{1\,\mathrm{mol\,CH_3COOH}} = 958{,}2 \cdot 10^{-3}\,\mathrm{kg\,H_2O}$$

$$b(\mathrm{CH_3COOH}) = \frac{0{,}7630\,\mathrm{mol\,CH_3COOH}}{958{,}2 \cdot 10^{-3}\,\mathrm{kg\,H_2O}} = 0{,}7963\,\mathrm{mol\,kg^{-1}}$$

3.

				$\Delta_\mathrm{r}H^\ominus(298{,}15\,\mathrm{K})/(\mathrm{kJ\,mol^{-1}})$
a	$\mathrm{C_3H_8(g) + 5\,O_2(g)}$	$\rightarrow$	$\mathrm{3\,CO_2(g) + 4\,H_2O(l)}$	$-2220{,}0$
b	$\mathrm{C(s) + O_2(g)}$	$\rightarrow$	$\mathrm{CO_2(g)}$	$-394{,}0$
c	$\mathrm{H_2(g) + 1/2\,O_2(g)}$	$\rightarrow$	$\mathrm{H_2O(l)}$	$-286{,}0$
3b	$\mathrm{3\,C(s) + 3\,O_2(g)}$	$\rightarrow$	$\mathrm{3\,CO_2(g)}$	$3 \times (-394{,}0) = -1182$
-1a	$\mathrm{3\,CO_2(g) + 4\,H_2O(l)}$	$\rightarrow$	$\mathrm{C_3H_8(g) + 5\,O_2(g)}$	$-1 \times (-2220{,}0) = +2220{,}0$
3b-1a	$\mathrm{3\,C(s) + 4\,H_2O(l)}$	$\rightarrow$	$\mathrm{C_3H_8(g) + 2\,O_2(g)}$	$+1038$
4c	$\mathrm{4\,H_2(g) + 2\,O_2(g)}$	$\rightarrow$	$\mathrm{4\,H_2O(l)}$	$4 \times (-286{,}0) = -1144$
3b-1a+4c	$\mathrm{3\,C(s) + 4\,H_2(g)}$	$\rightarrow$	$\mathrm{C_3H_8(g)}$	-106

4.

	$\mathrm{HA(aq)}$	+ $\mathrm{H_2O(l)}$	$\rightleftharpoons$	$\mathrm{A^-(aq)}$	+ $\mathrm{H_3O^+(aq)}$
$c(\xi = 0\,\mathrm{mol})/(\mathrm{mol\,L^{-1}})$	$0{,}0100$			0	0
$c(\xi = \xi_\mathrm{eq})/(\mathrm{mol\,L^{-1}})$	$0{,}0100 - x$			x	x

$$x = 10^{-2{,}95}\,\mathrm{mol\,L^{-1}} = 0{,}00112\,\mathrm{mol\,L^{-1}}$$

$$K_a = \frac{\frac{x}{c^\ominus} \cdot \frac{x}{c^\ominus}}{\frac{0{,}0100 - x}{c^\ominus}} = \frac{0{,}00112^2}{0{,}0100 - 0{,}00112} = 1{,}41 \cdot 10^{-4}$$

5. a) Ésteres; **b)** $\mathrm{CH_3CH_2COOCH_3}$; **c)** amidas; **d)** $\mathrm{CH_3CH_2CO(NH)CH_3}$.