

### *Planteamiento del sistema en estudio*

A concentraciones bajas puede precipitarse Zn(II) por formación de una fase condensada de arseniato. Se encuentra la siguiente información <sup>(1)</sup>:

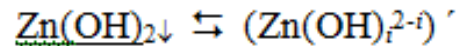
$Zn_3(AsO_4)_2(s)$	$pK_s = 28$	
$Zn(OH)_n^{z-n}$	$\log \beta_n$	$n$
	4.4	1
	14.4	3
	15.5	4
$Zn(OH)_2(s)$	$pK_s = 15.3$	
$H_nAsO_4^{n-3}$	$pK_{a_n}$	$n$
	2.1	3
	6.7	2
	11.2	1

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(1) A. Ringbom  
"Formación de Complejos en Química Analítica"  
Alhambra, 1979.

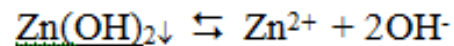
## *Preguntas*

- 1.0 Elaborar el diagrama  $\log S = f(\text{pH})$  para el sistema  $M(\text{OH})_z/M(\text{OH})_n^{z-n}$ .
- 2.0 Escribir el DUZP combinado en función del pH del tipo para  $pC_{Zn} = 5.0$ .
- 3.0 Elaborar el diagrama  $p\text{AsO}_4' = f(\text{pH})_{pZn = 5}$ .
- 4.0 Elaborar el diagrama  $pe = f(\text{pH})_{pZn = 5, p\text{AsO}_4 = 3}$  para el par  $Zn^{2+}/Zn^0$ ,  $E^0 = -0.76V(\text{ENH})$ .
- 5.0 Elaborar la gráfica  $pe = f(\log [AsO_4^{3-}])$  a  $\text{pH} = 7.0$  en el intervalo  $1 < \mu\text{M} < 10$ .

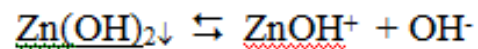


$$S' = 10^{-15.3+28-2pH} [1 + 10^{4.4-14+pH} + 10^{14.4-42+3pH} + 10^{15.5-56+4pH}]$$

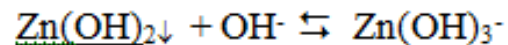

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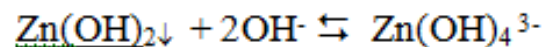
$$(A) \log S' = 12.7 - 2pH$$



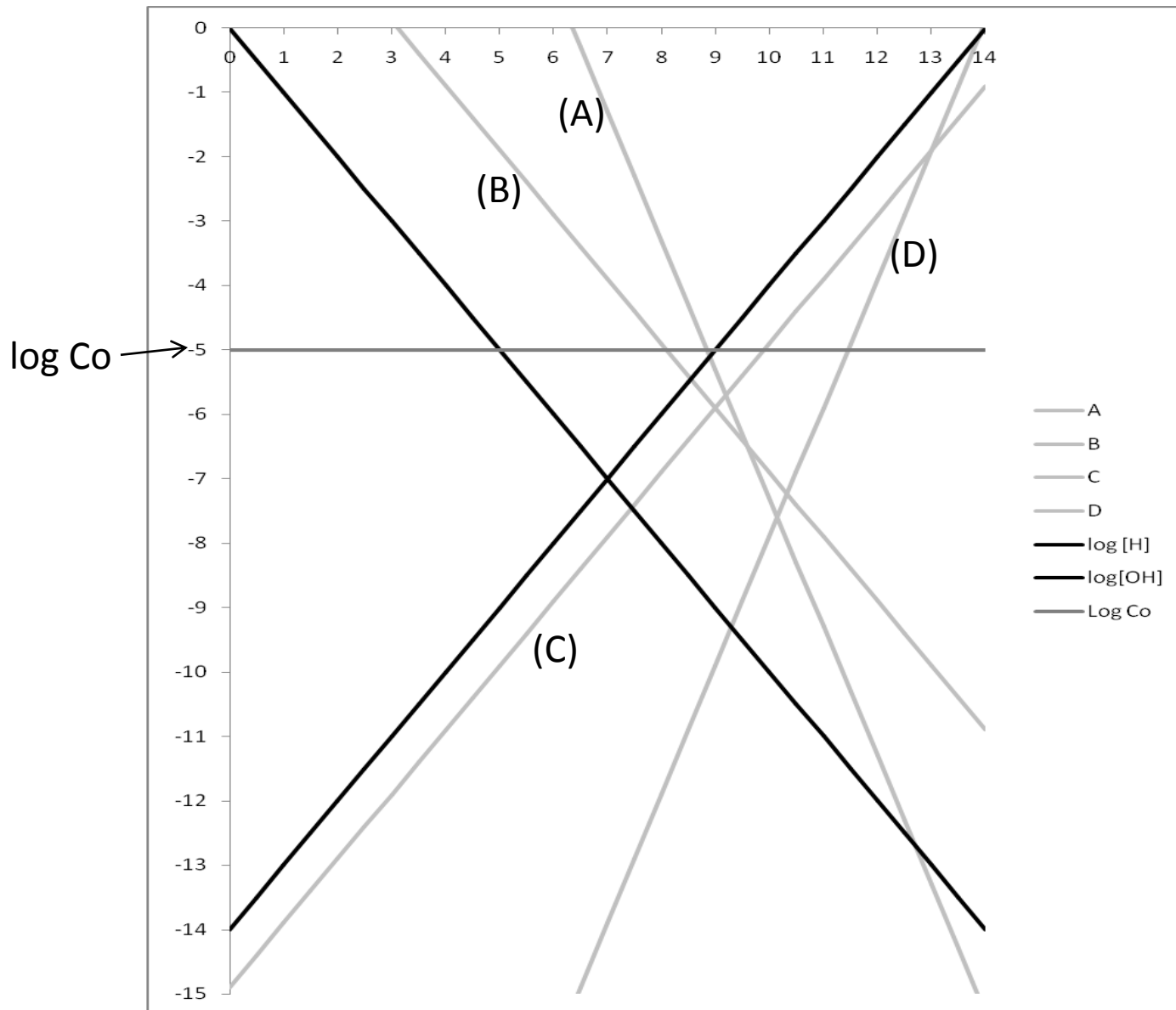
$$(B) \log S' = 3.1 - pH$$

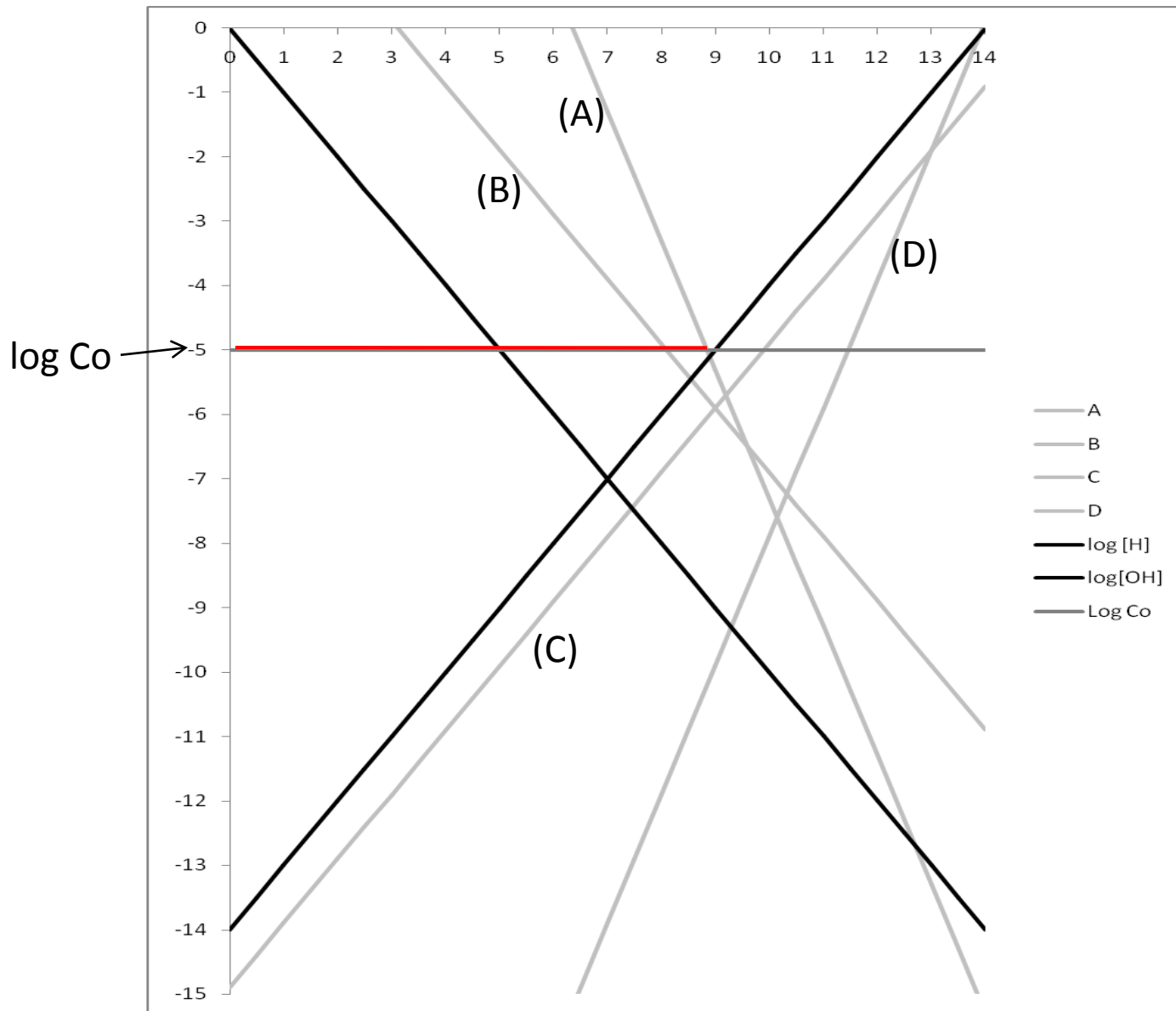


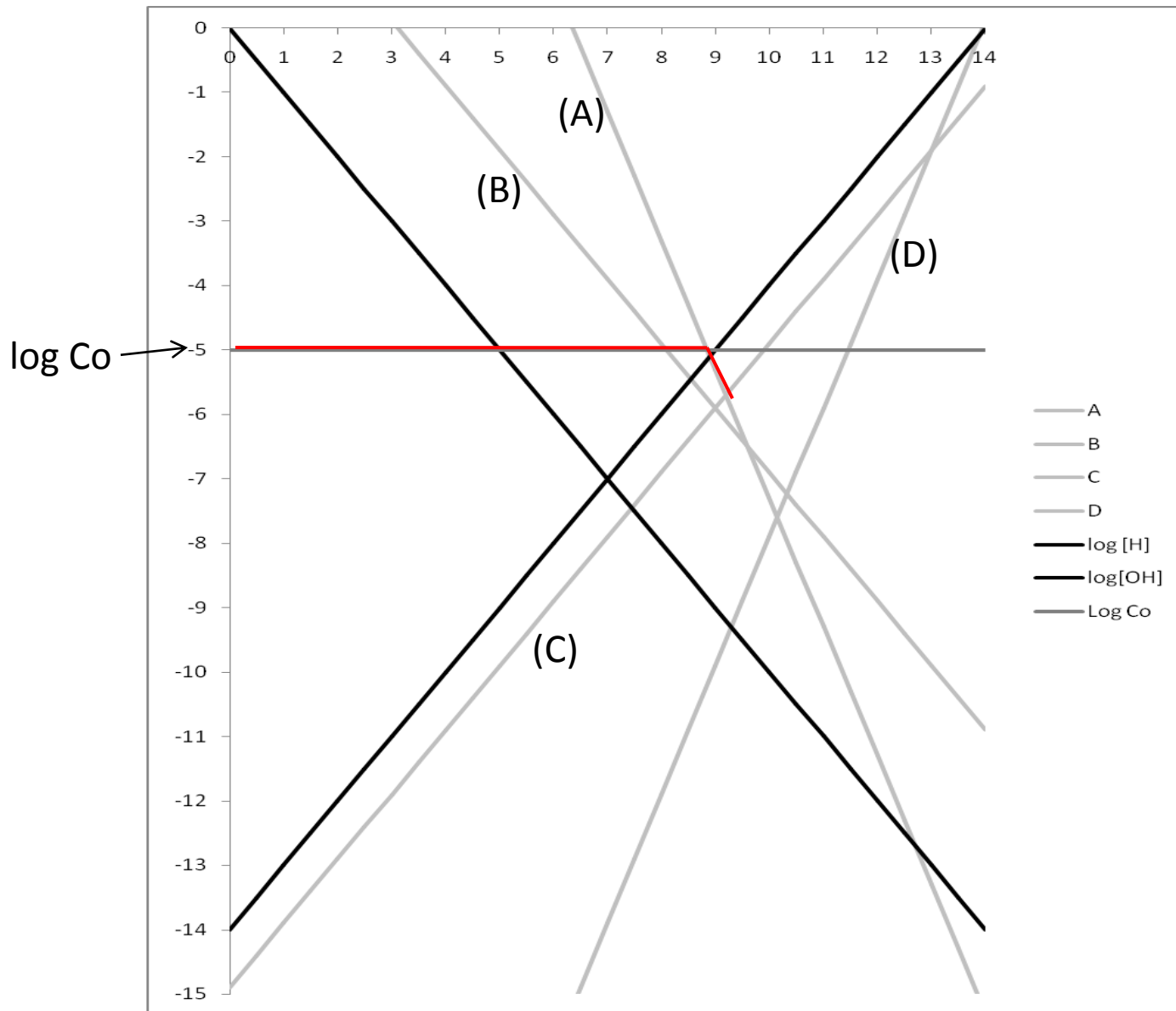
$$(C) \log S' = -14.9 + pH$$

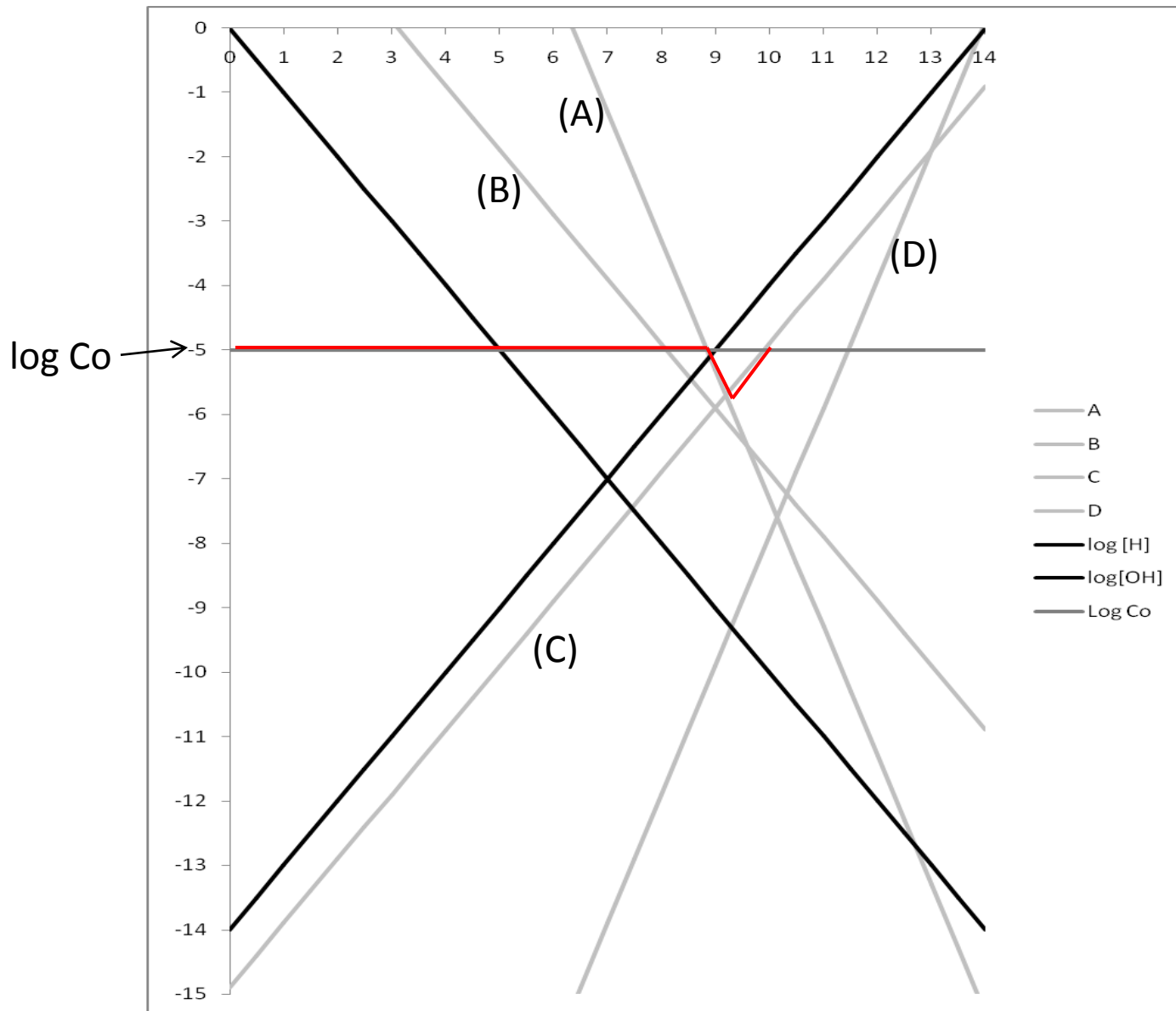


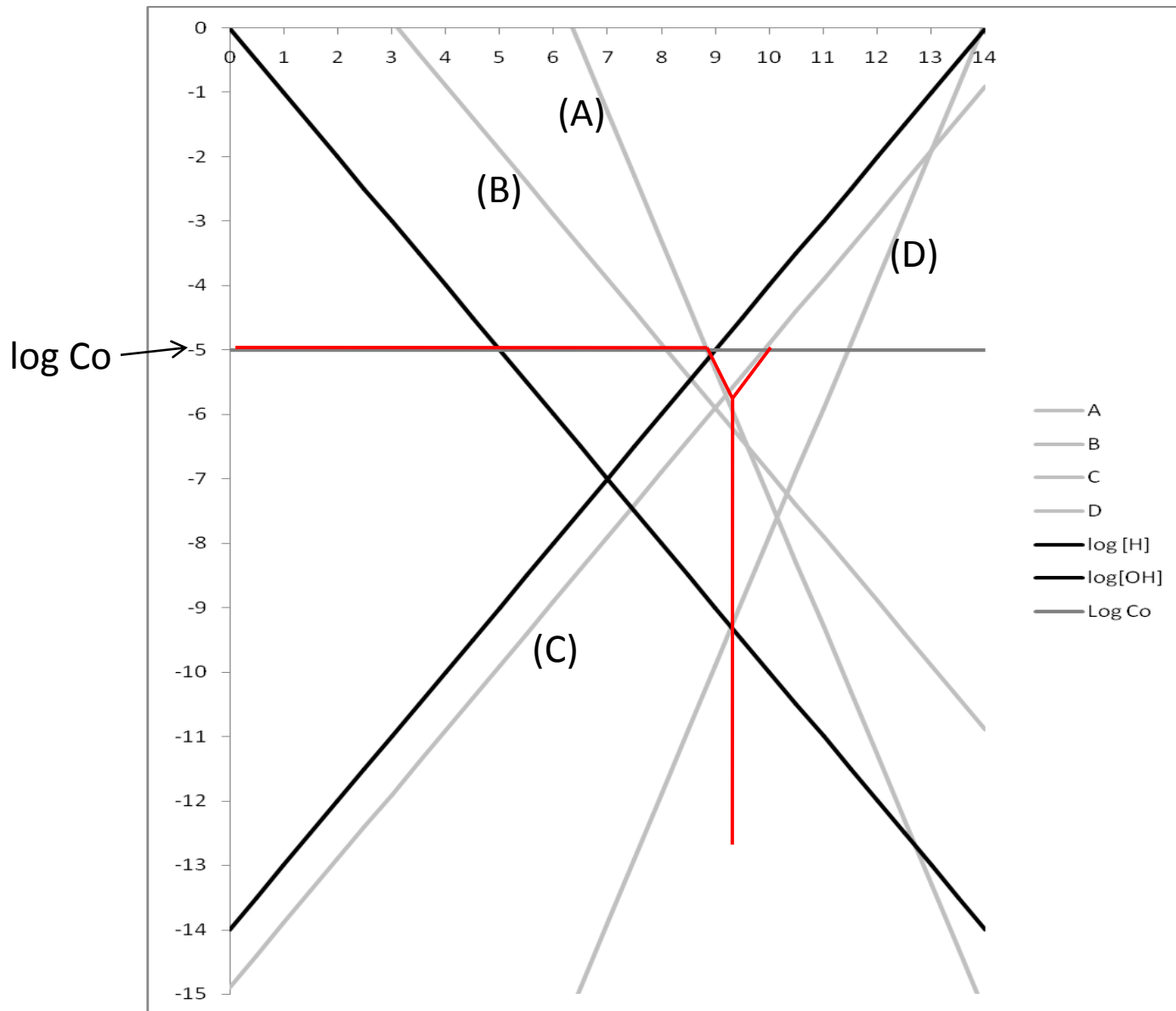
$$(D) \log S' = -27.8 + 2pH$$



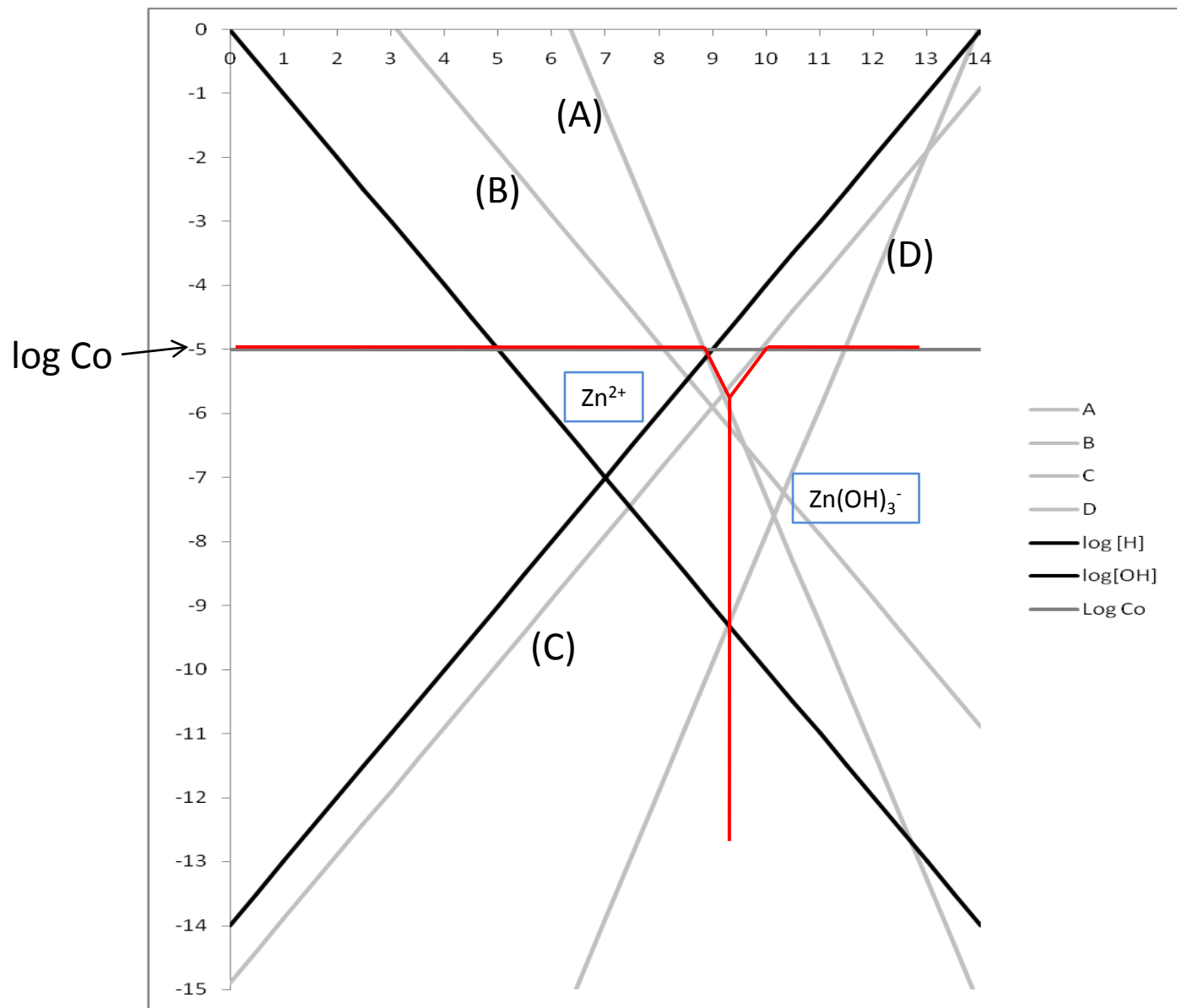


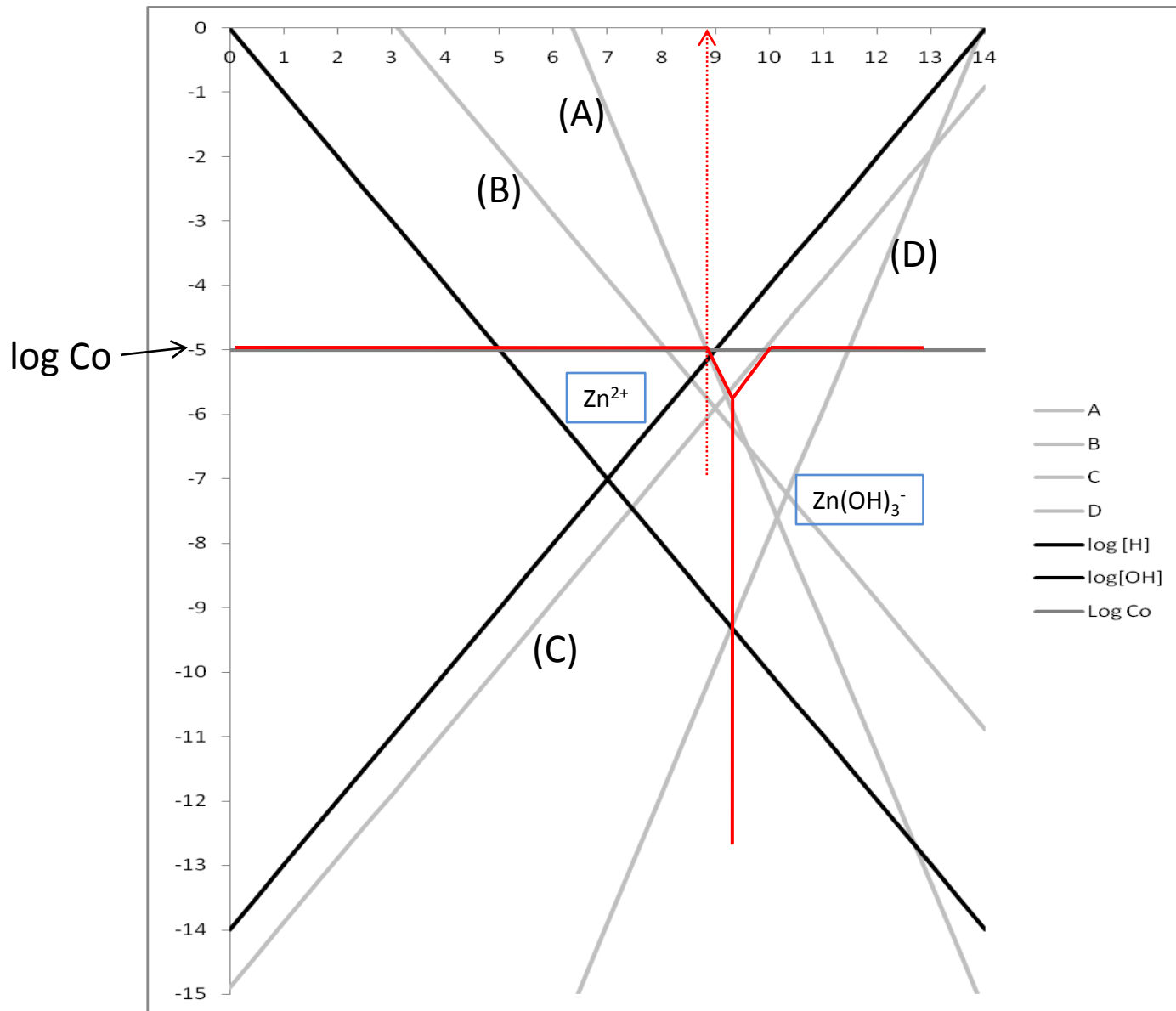


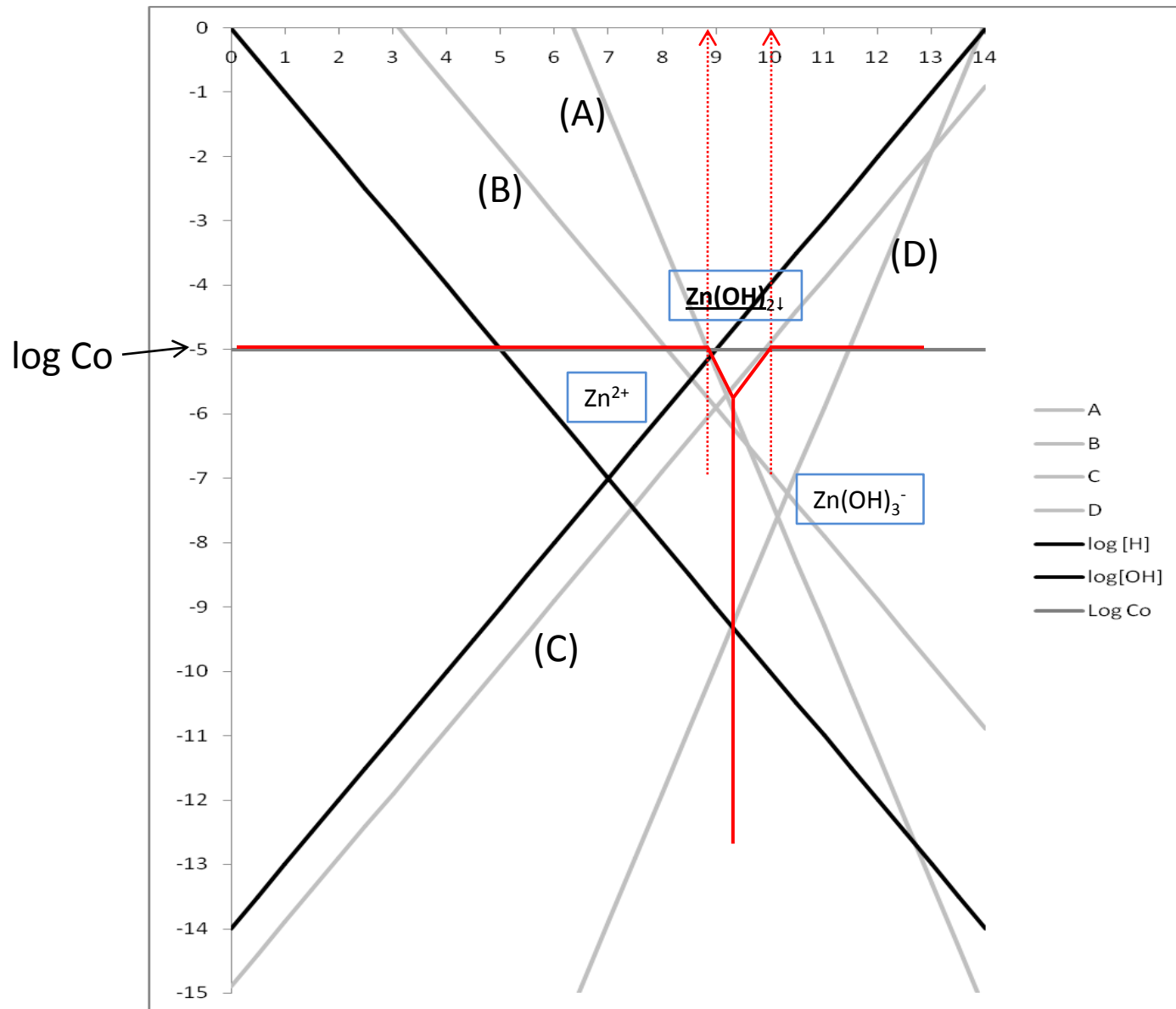




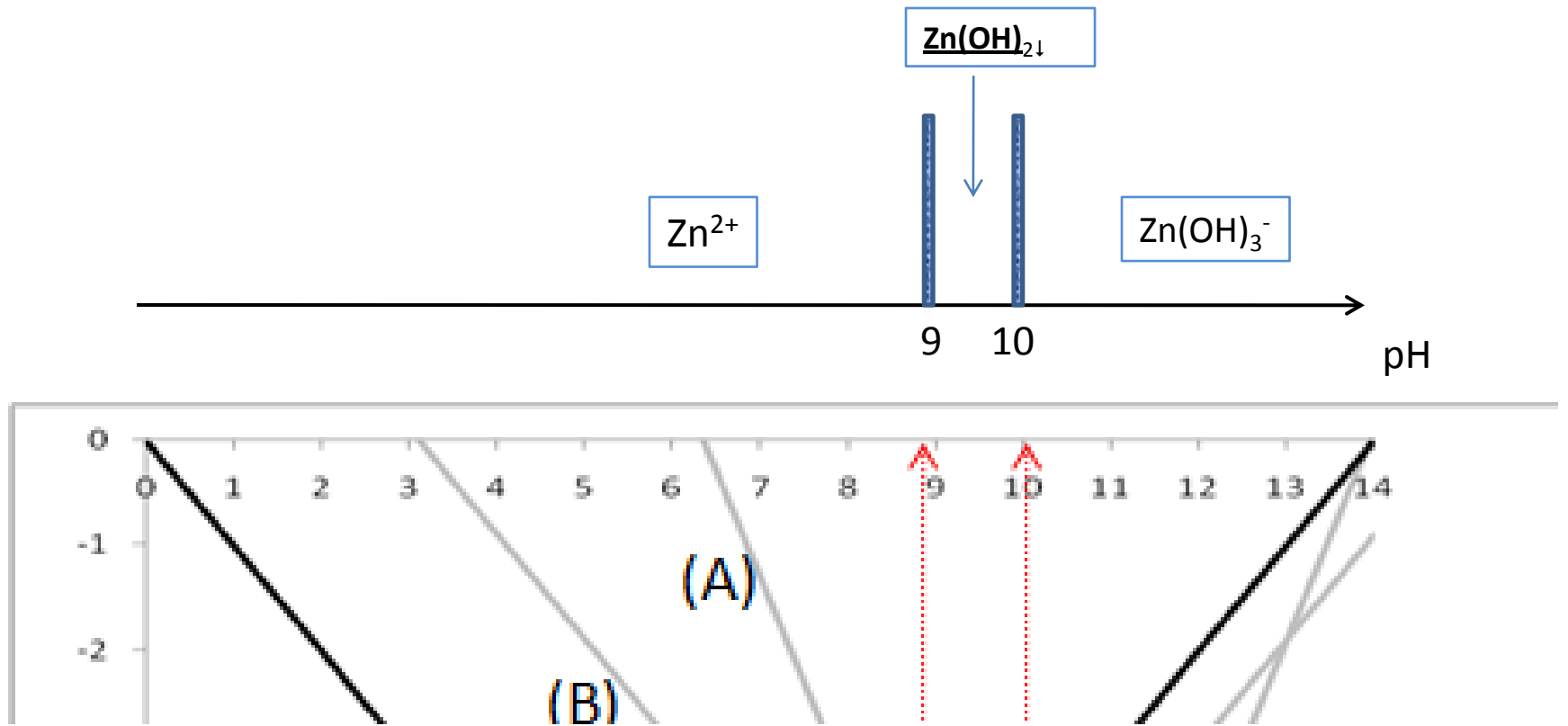




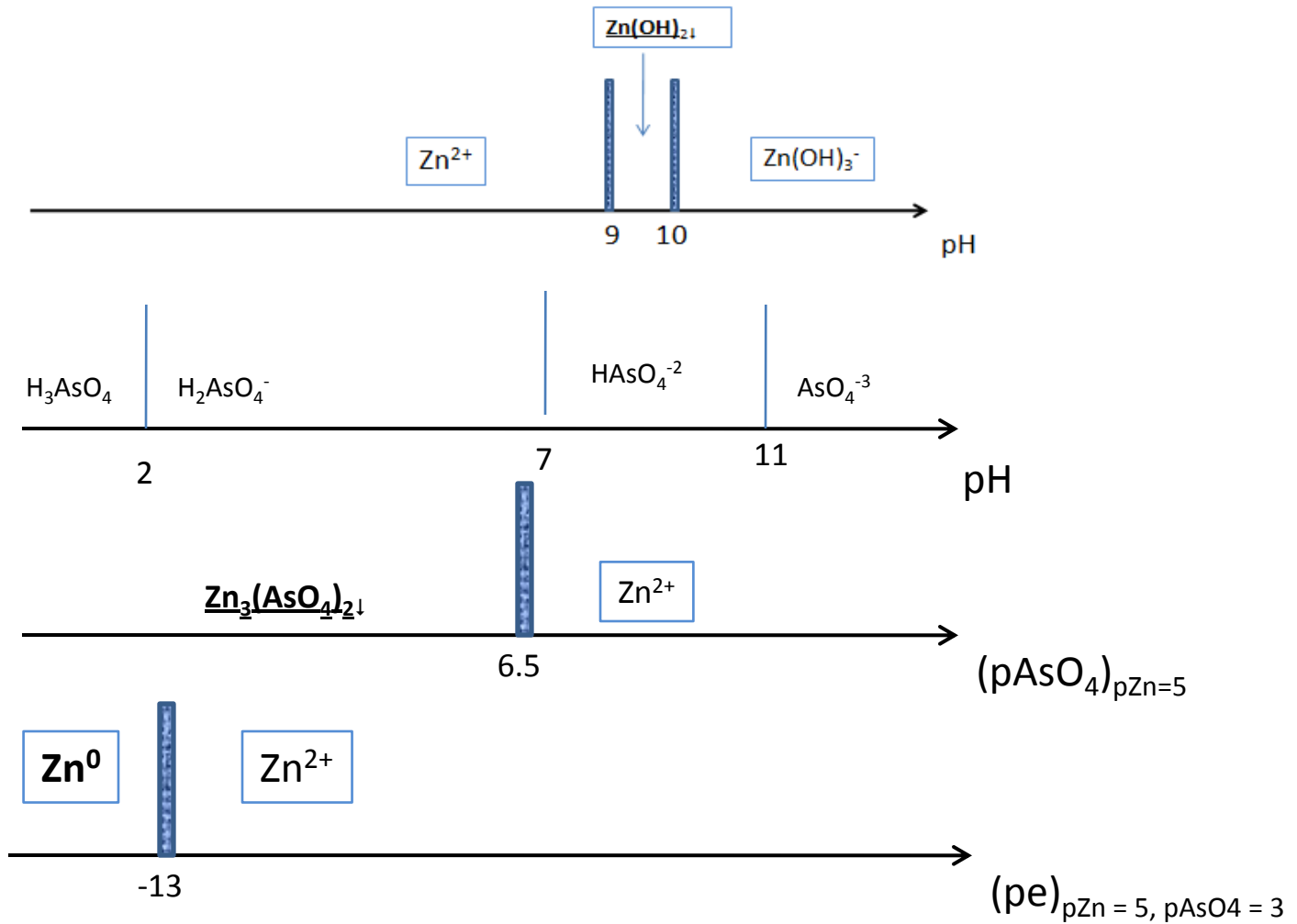




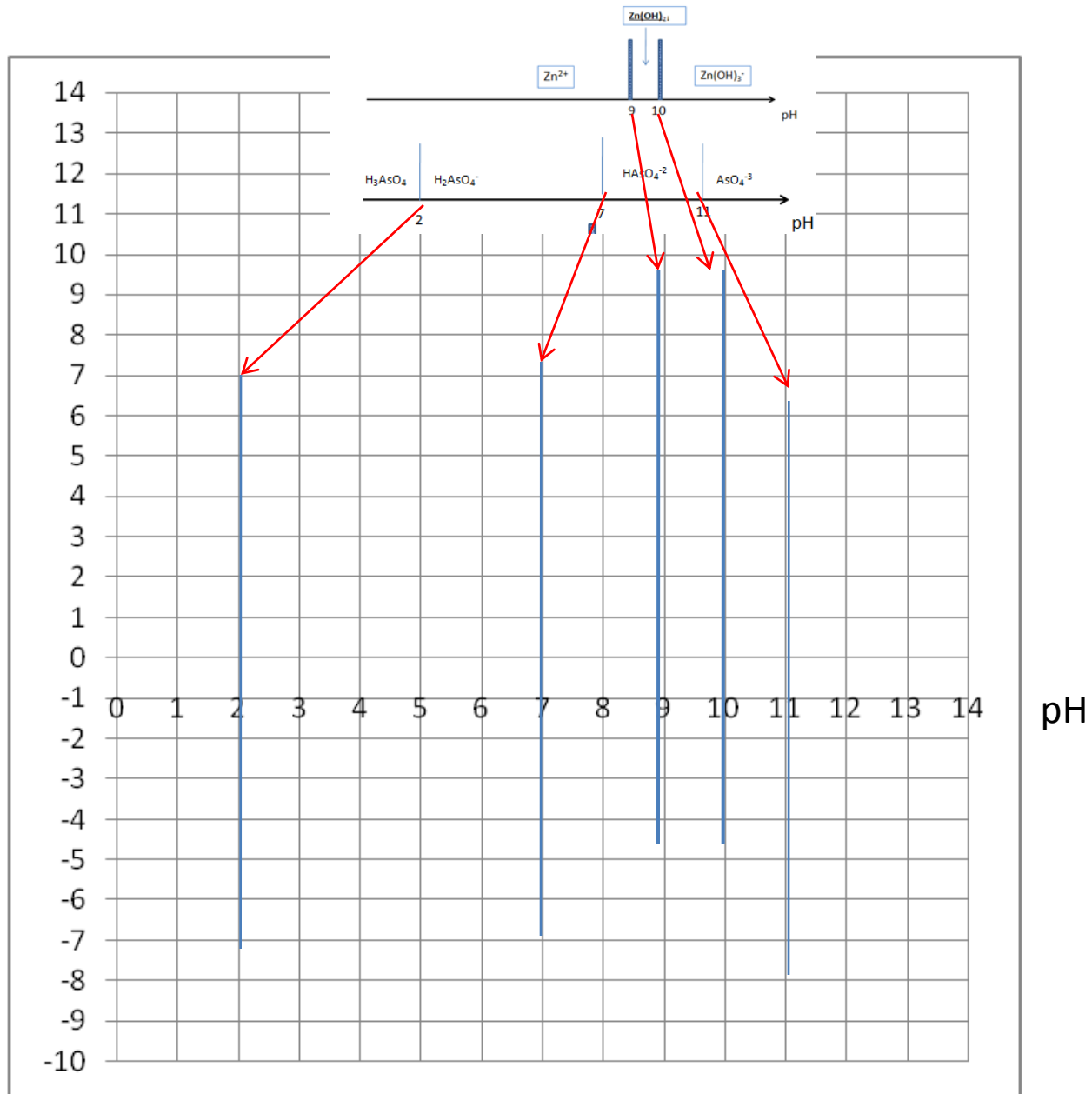
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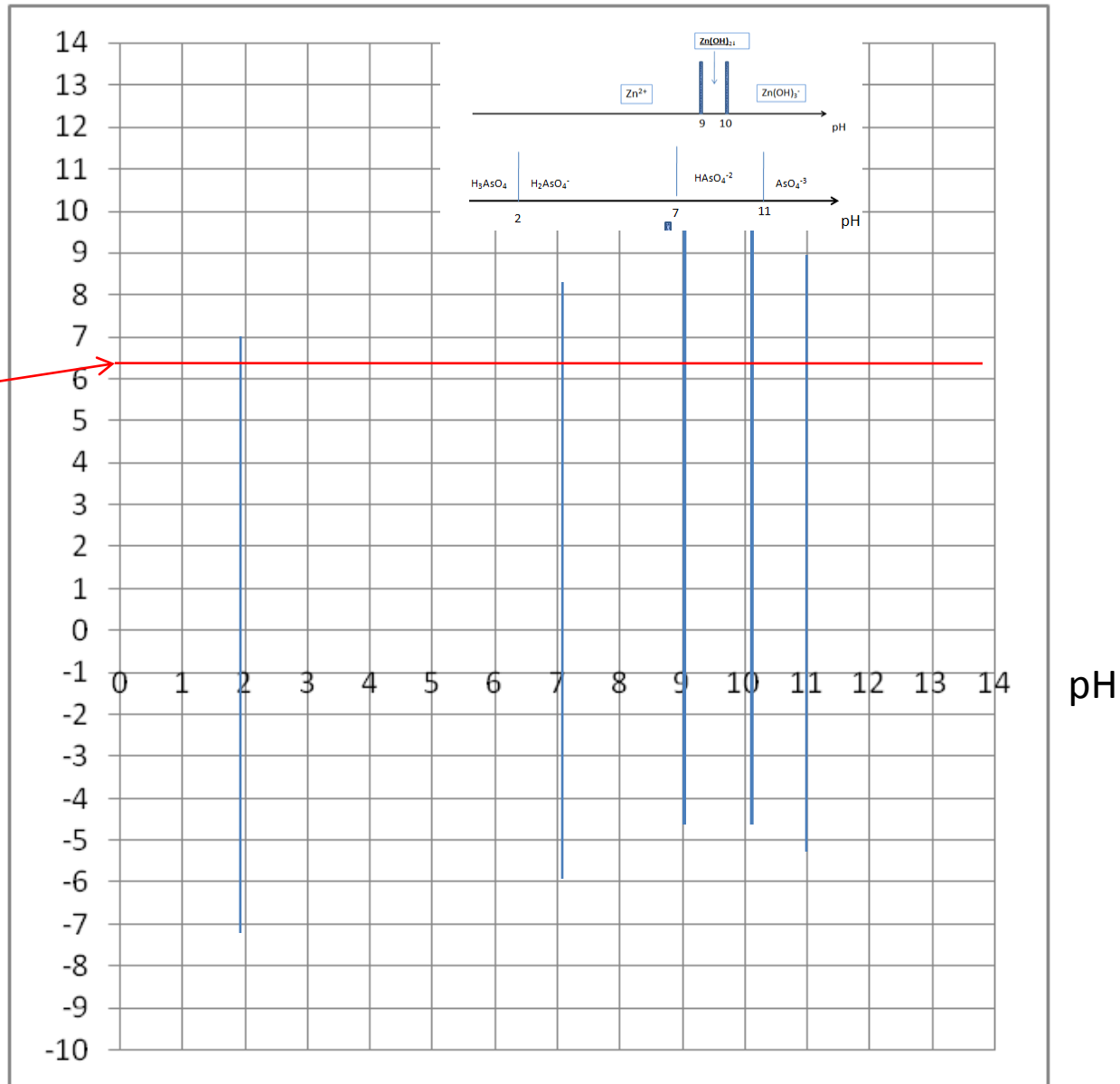
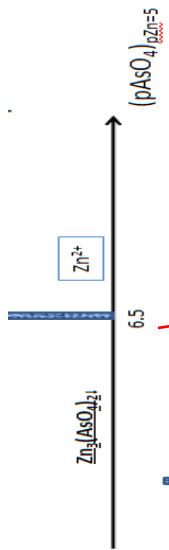
DUPE:



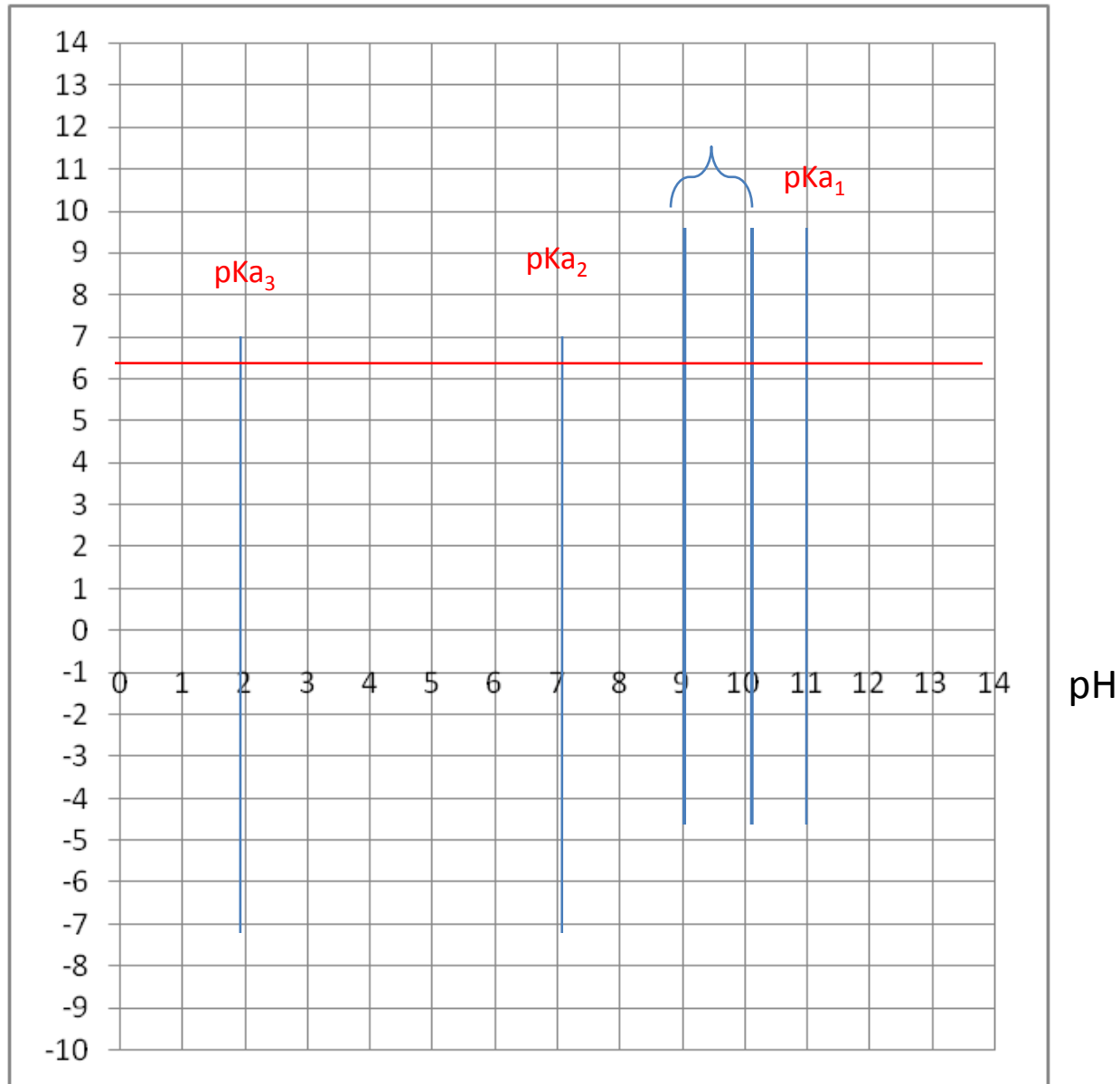
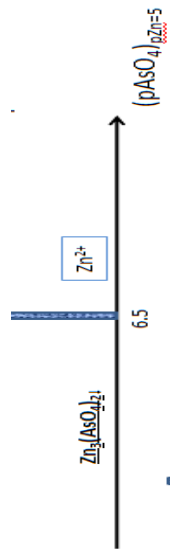
$(pAsO_4)_{pZn=5}$



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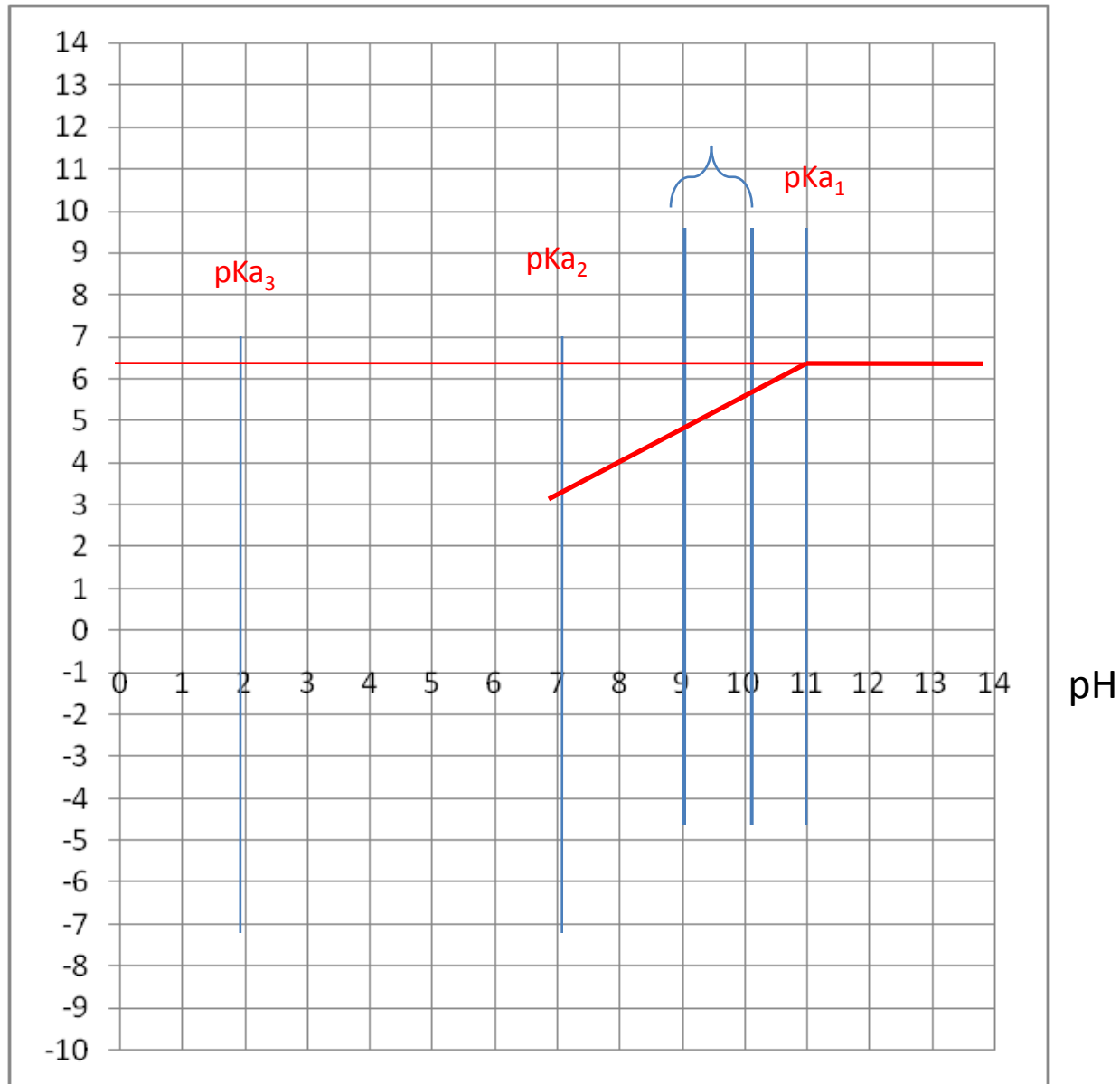
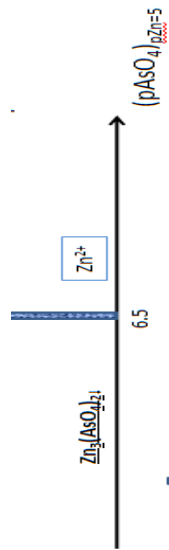


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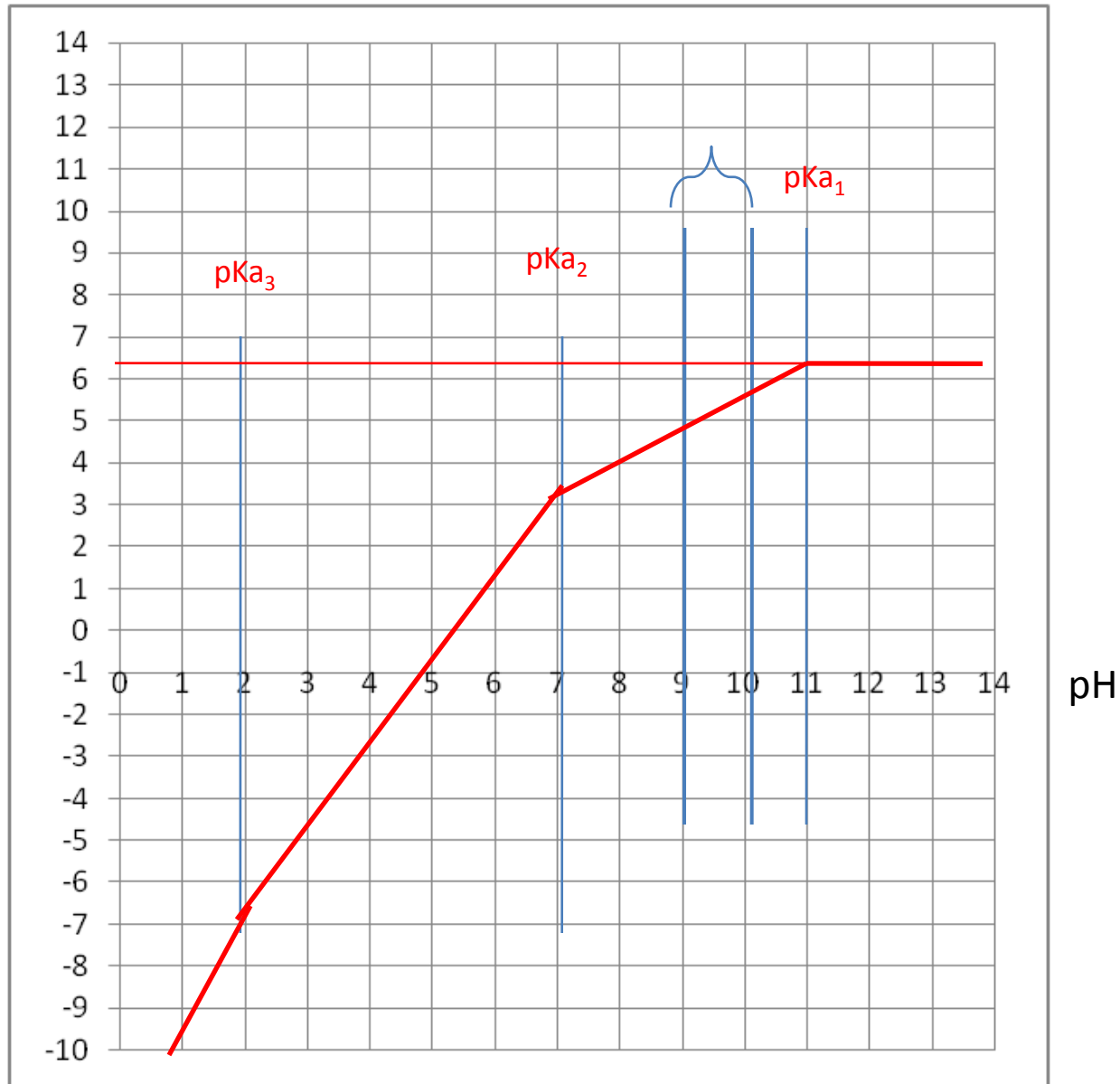
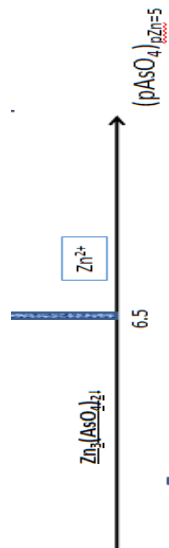




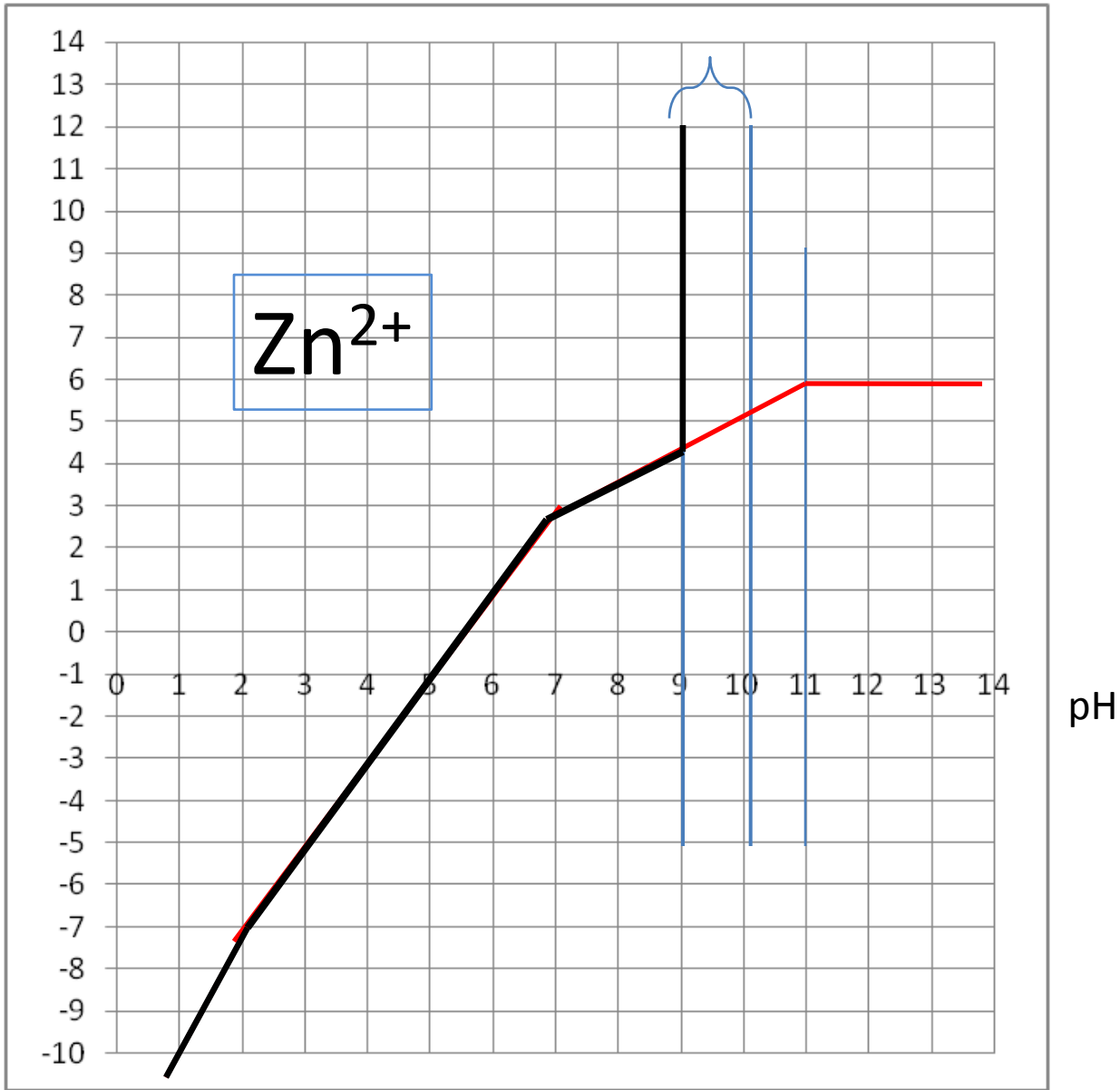
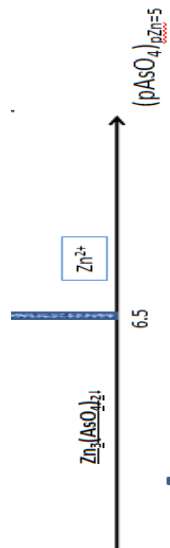
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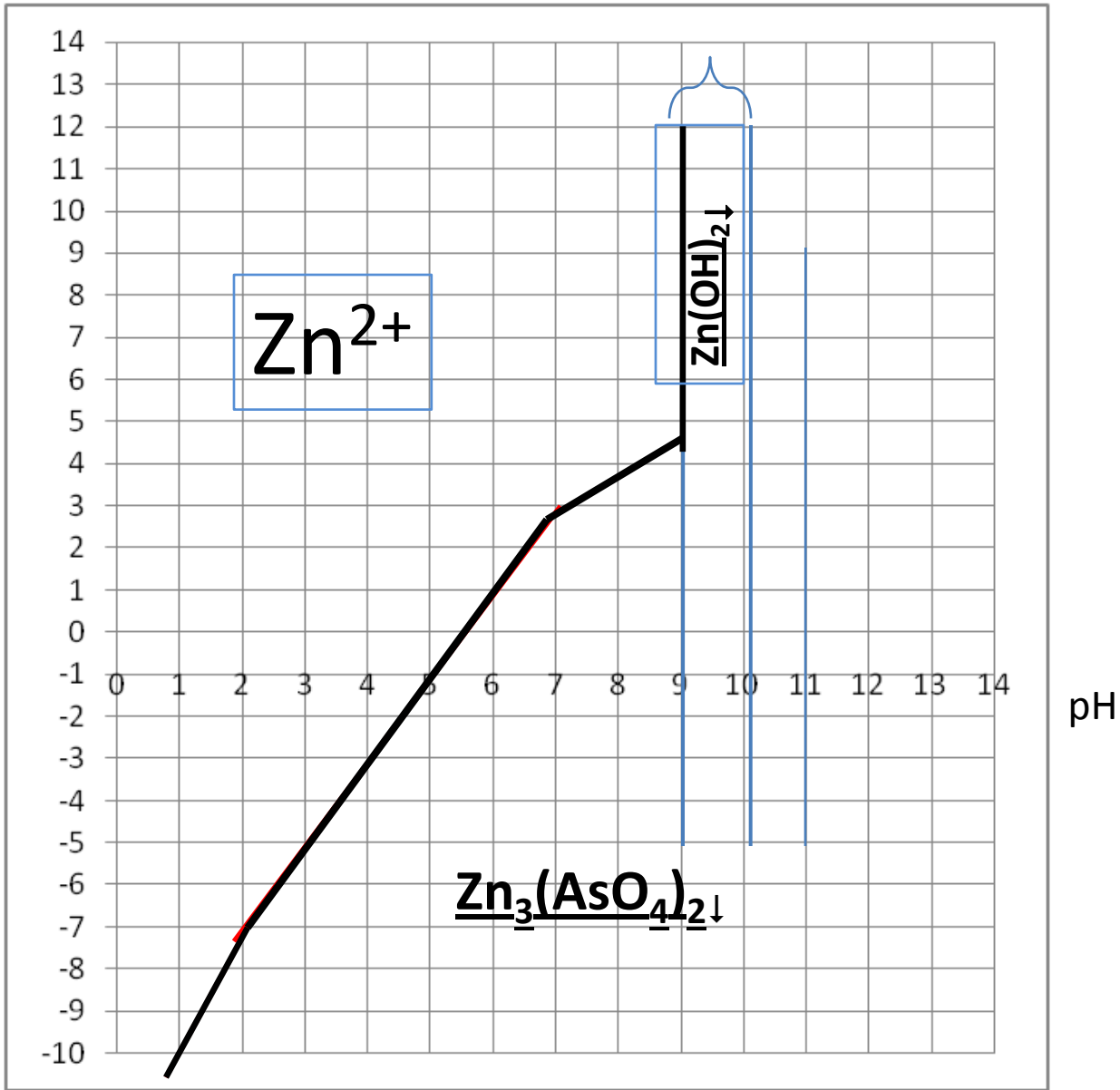
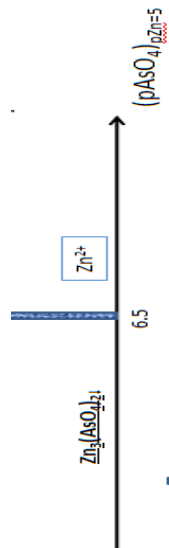
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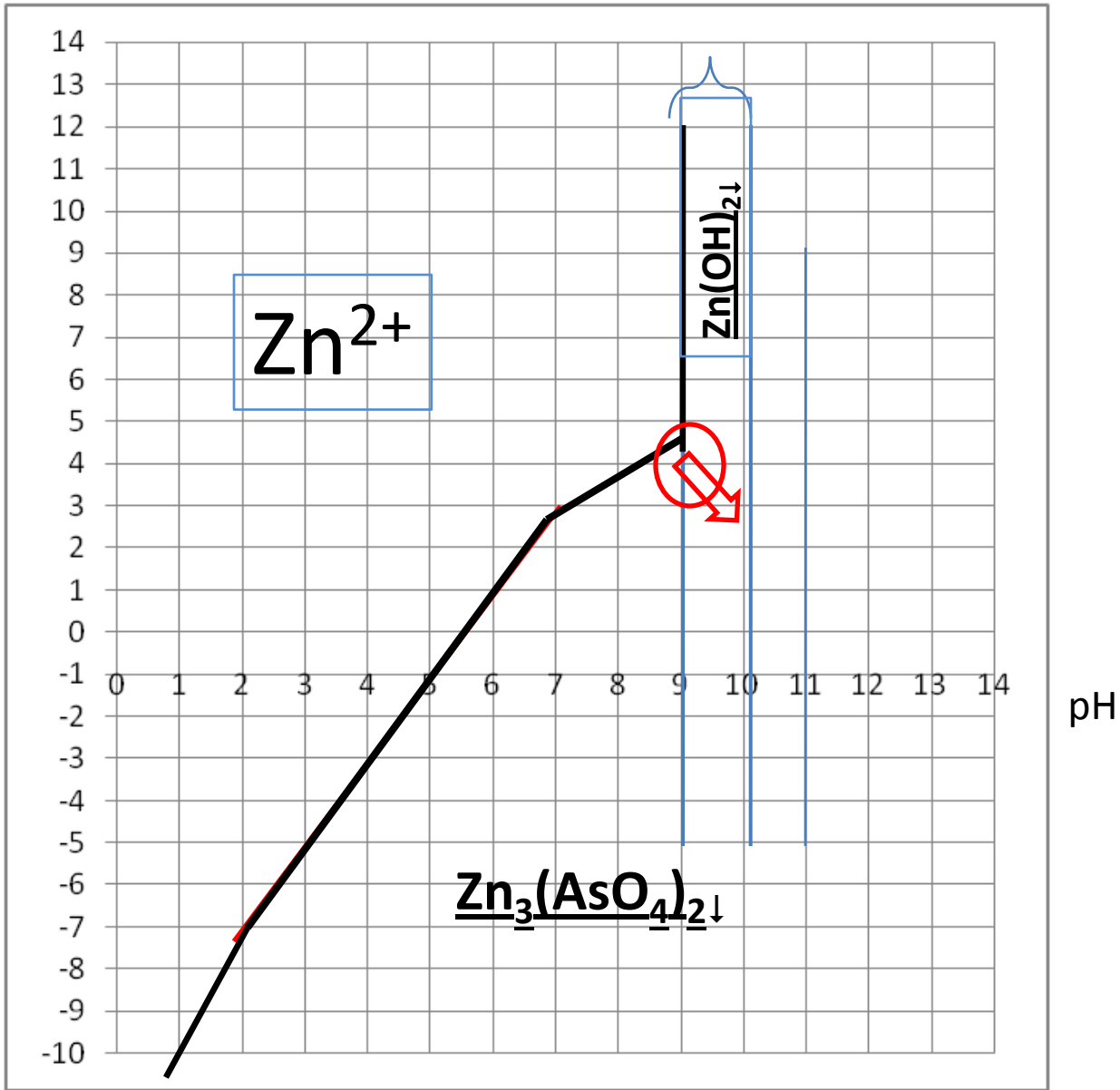
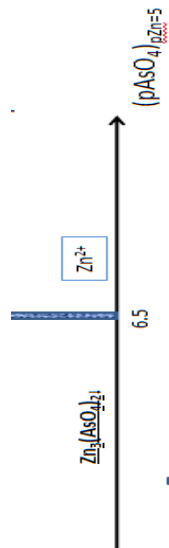
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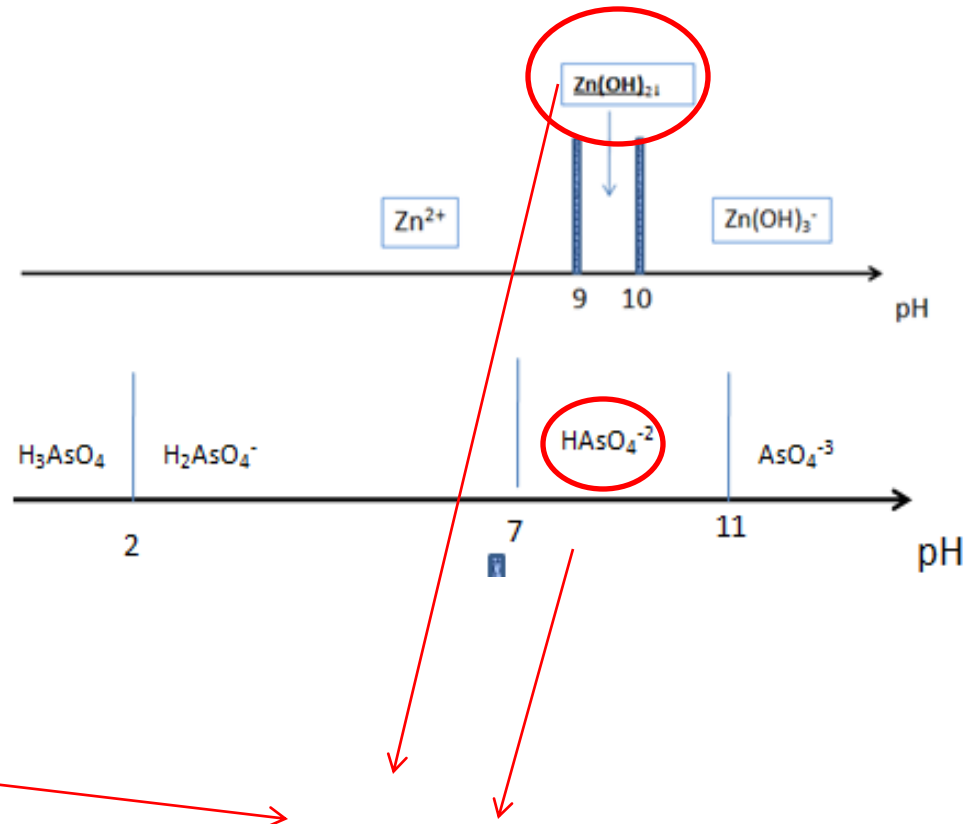
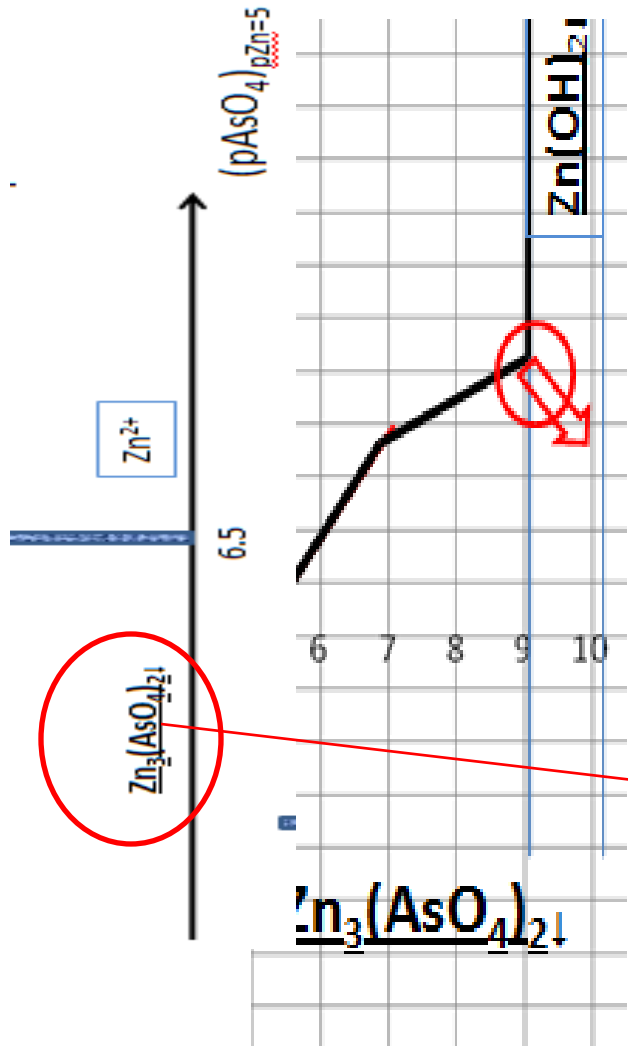


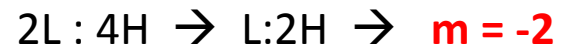
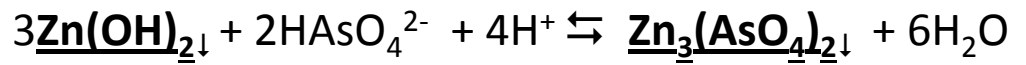
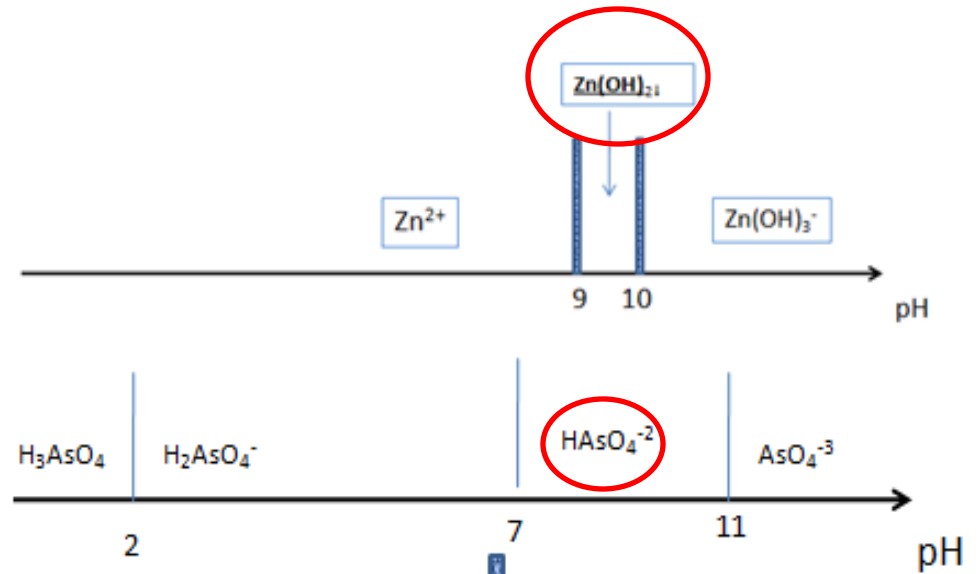
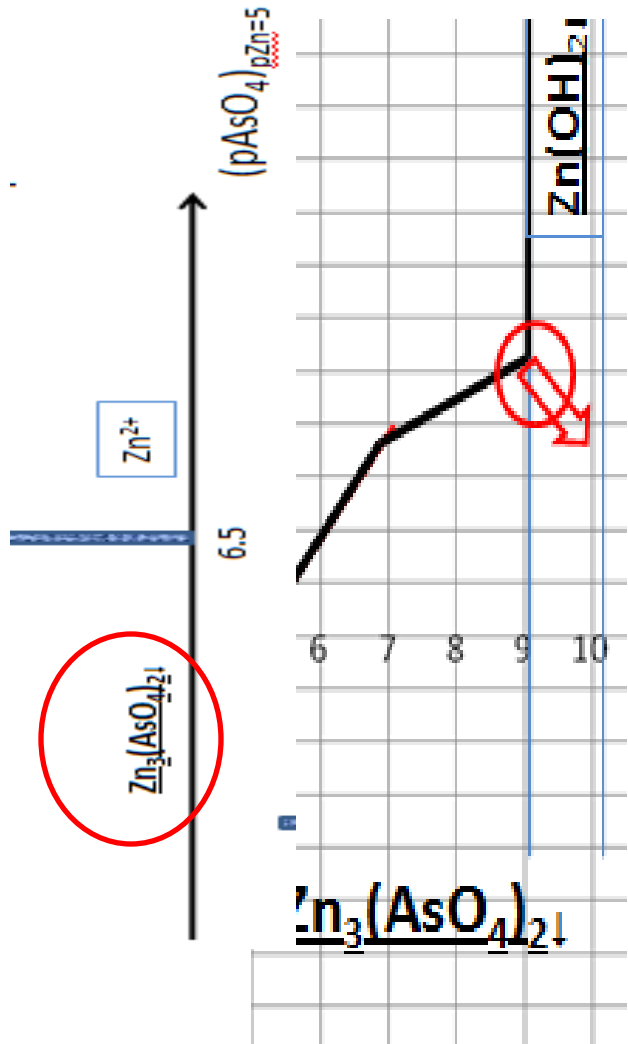
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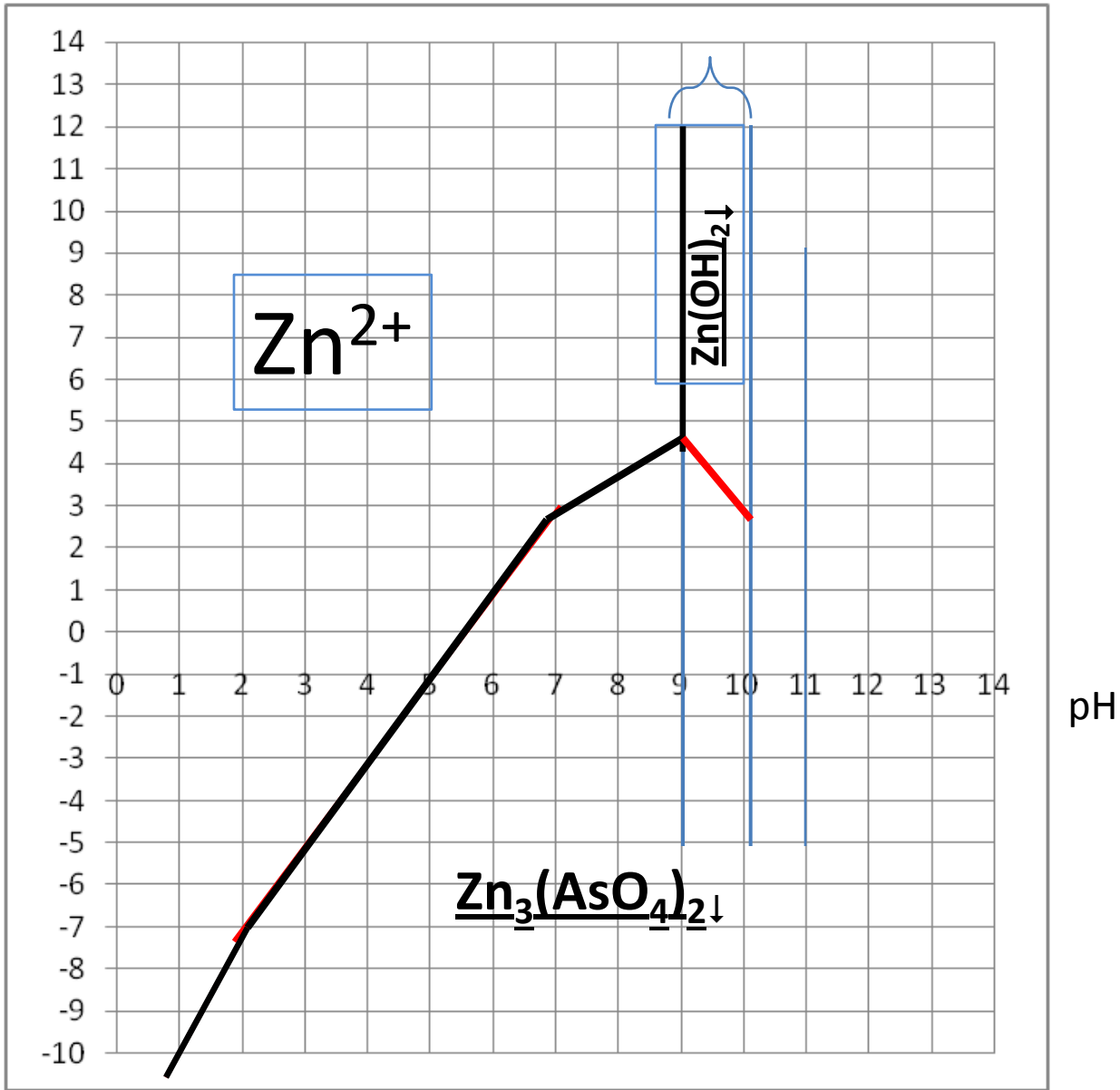
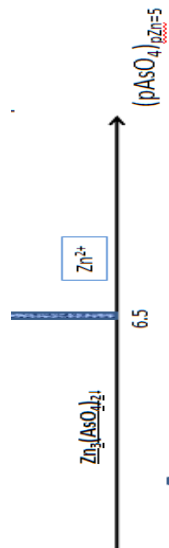
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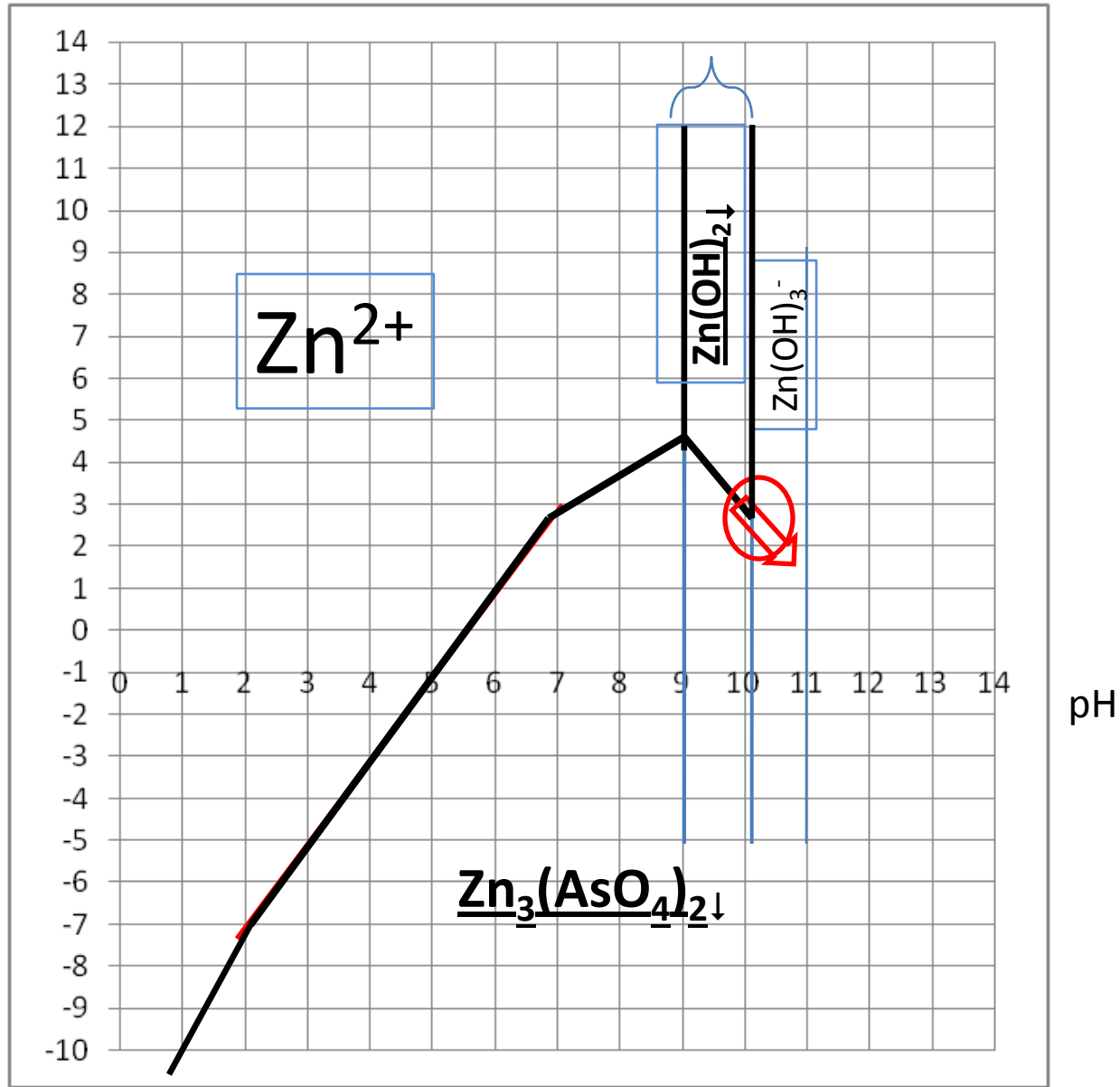
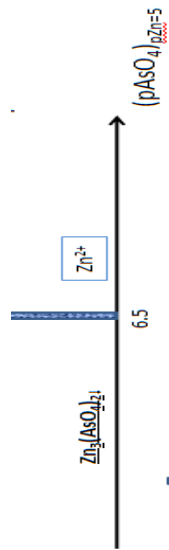


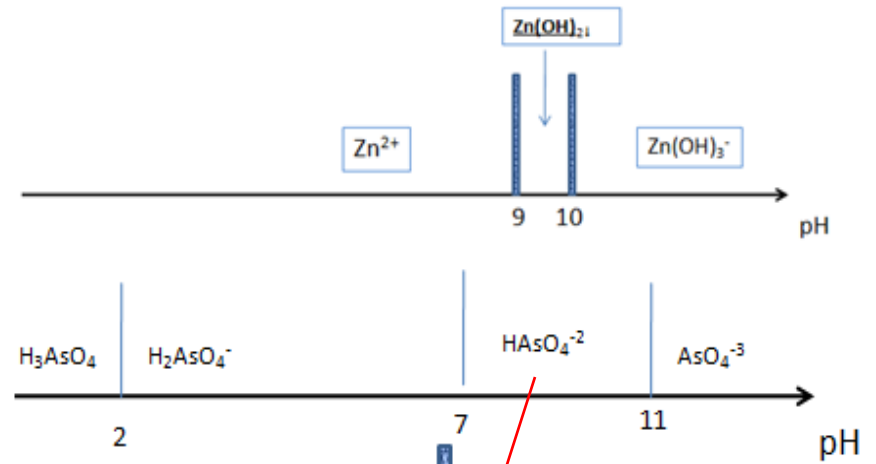
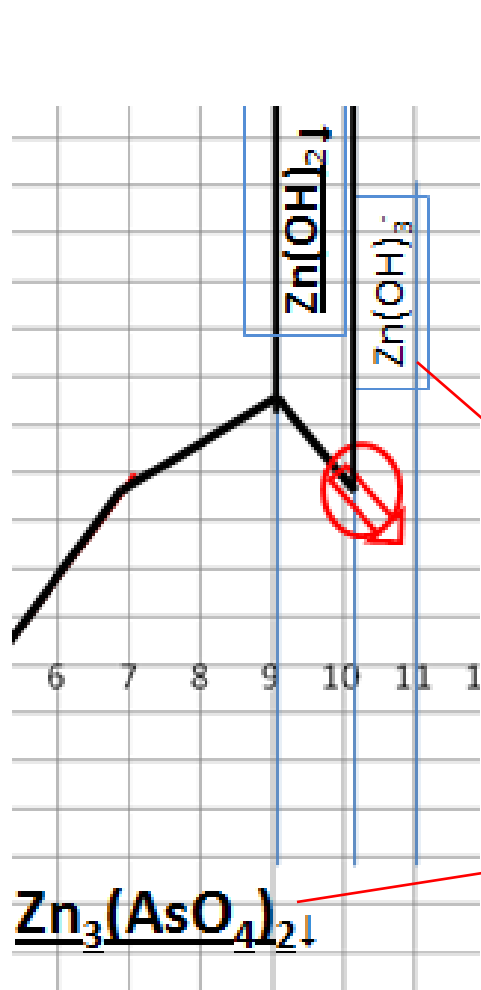
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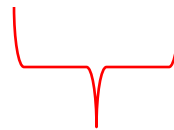
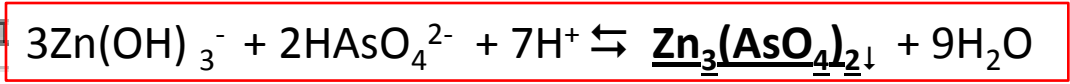
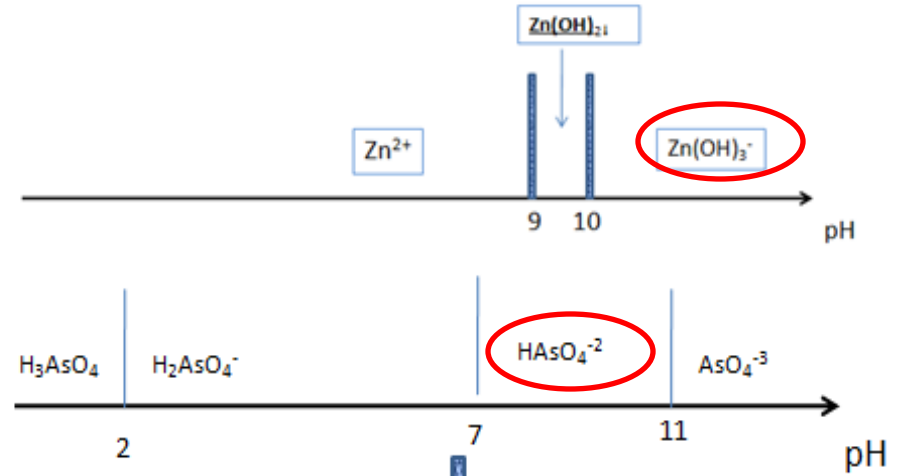
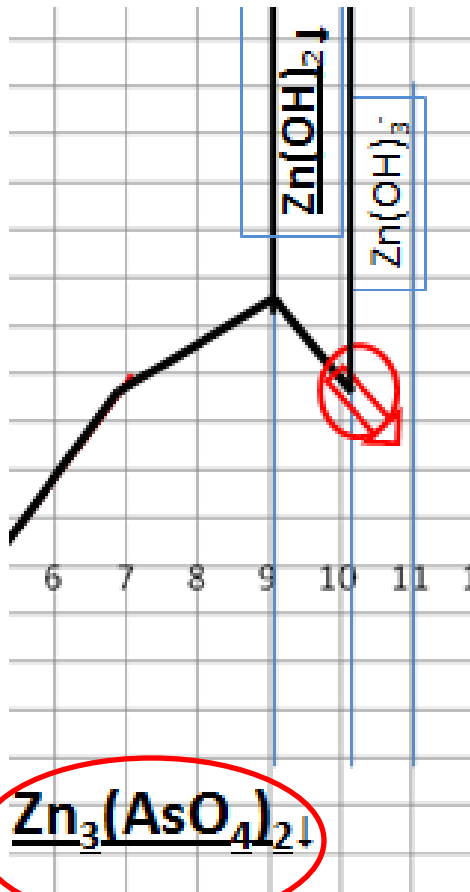




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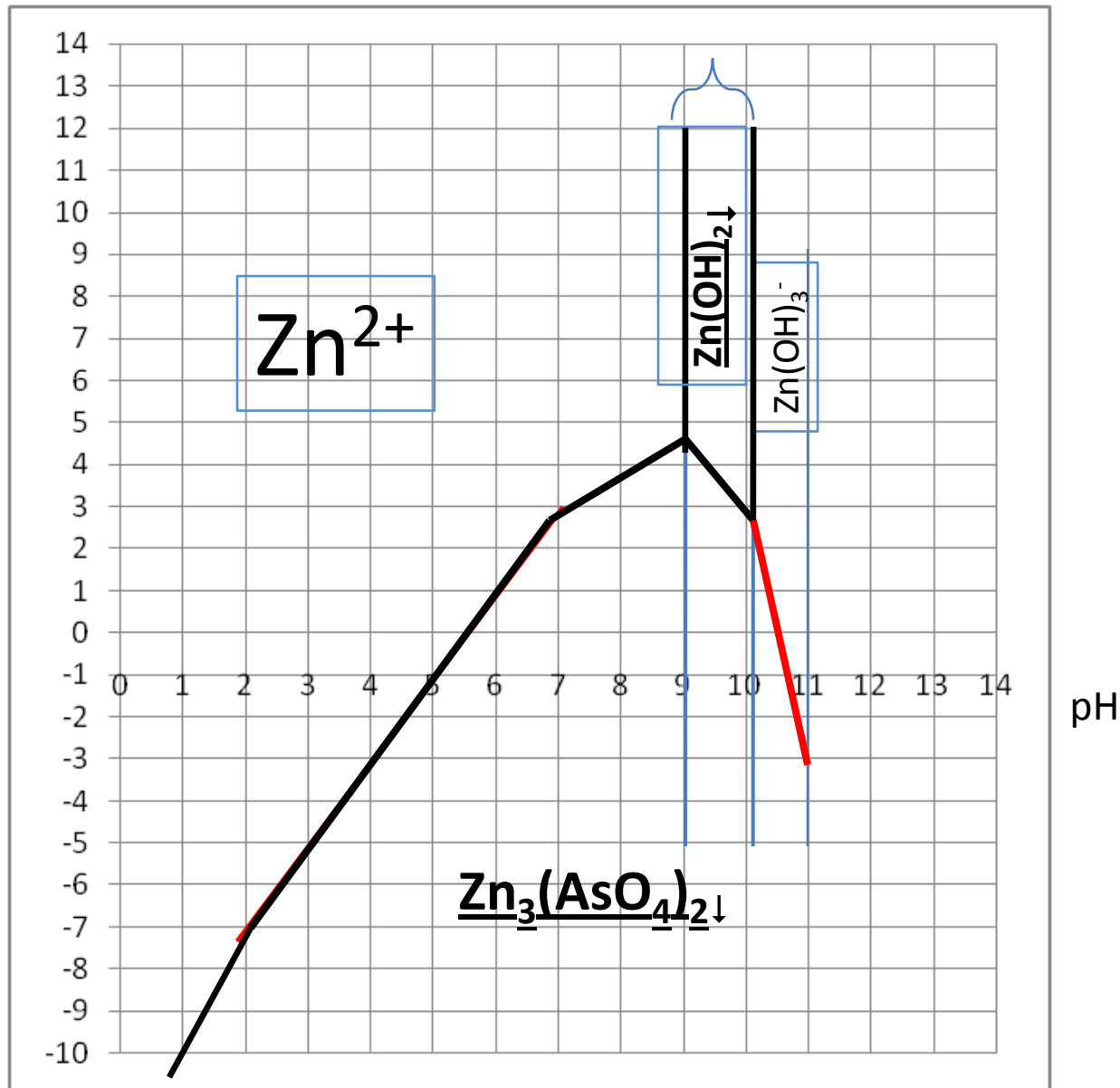
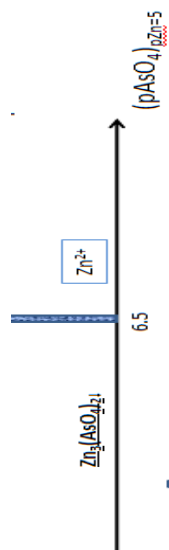




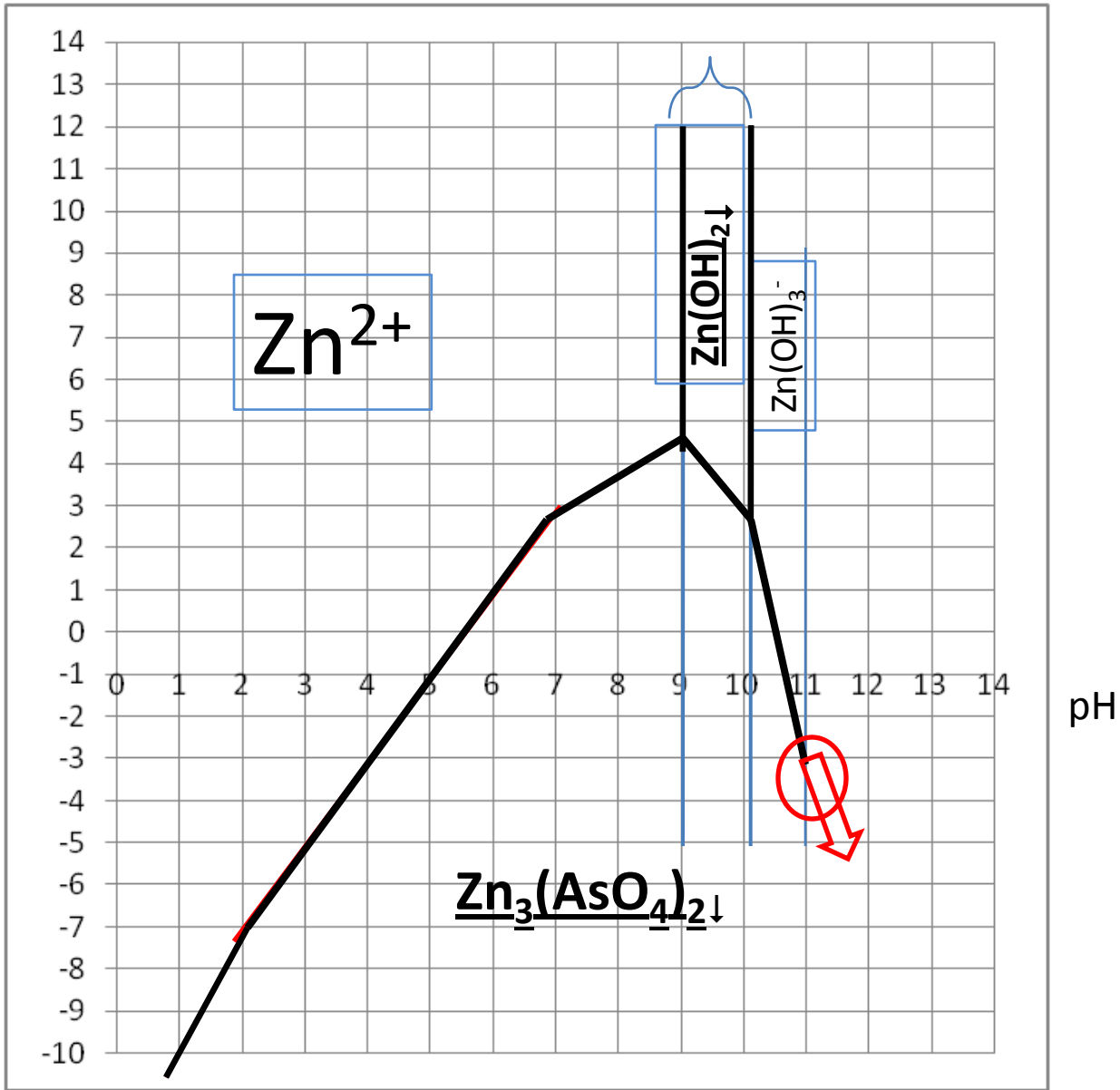
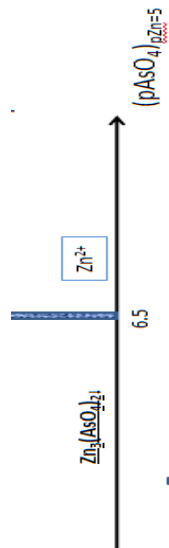


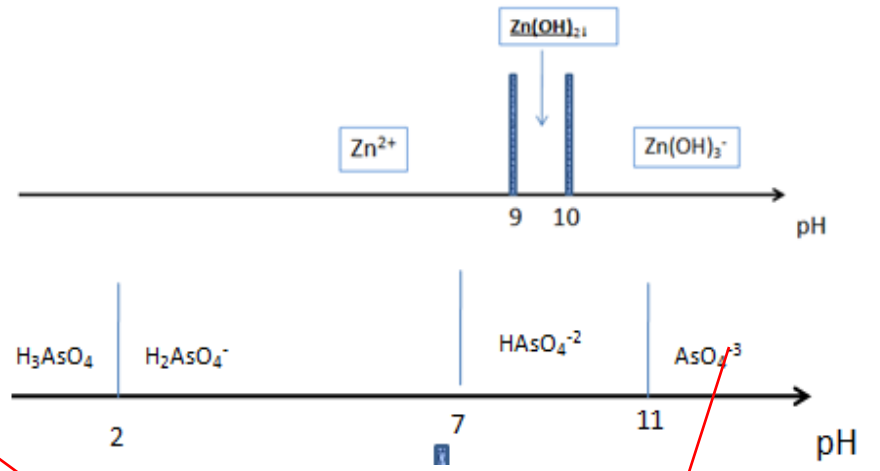
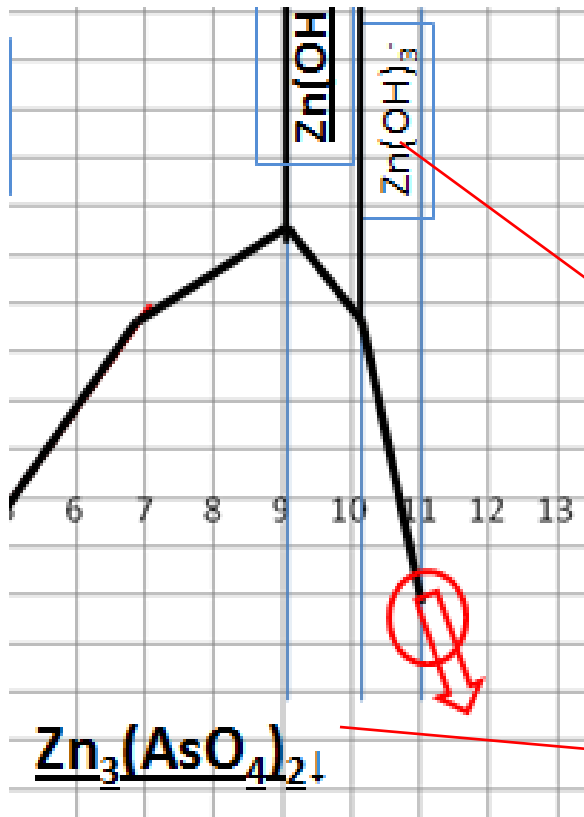
$$2\text{L} : 7\text{H} \rightarrow \text{L}(7/2)\text{H} \rightarrow m = -3.5$$

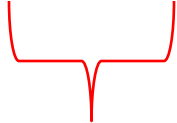
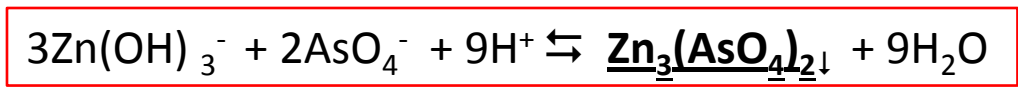
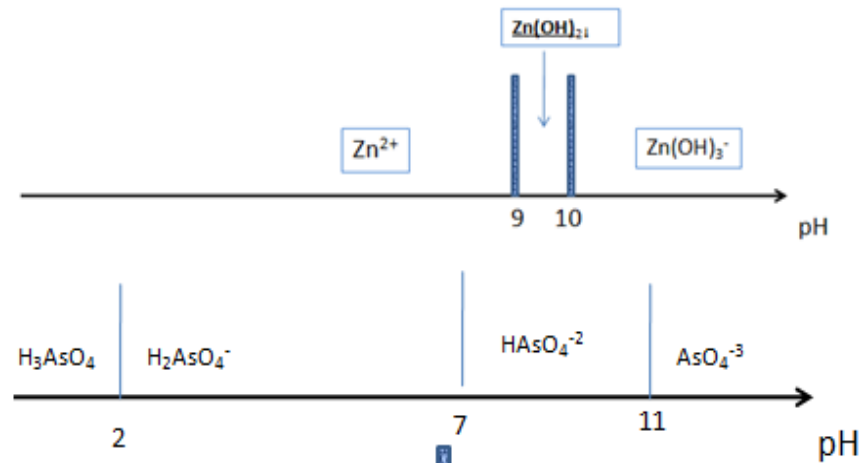
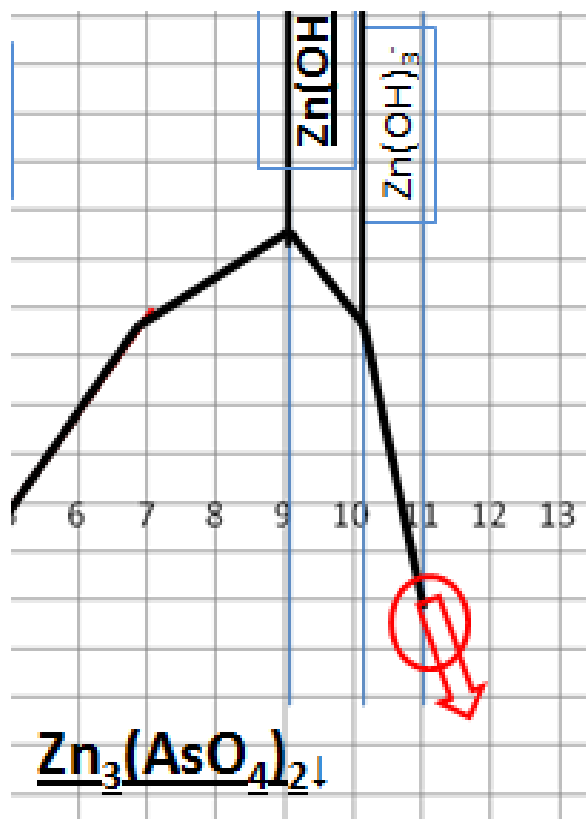
$(pAsO_4)_{pZn=5}$



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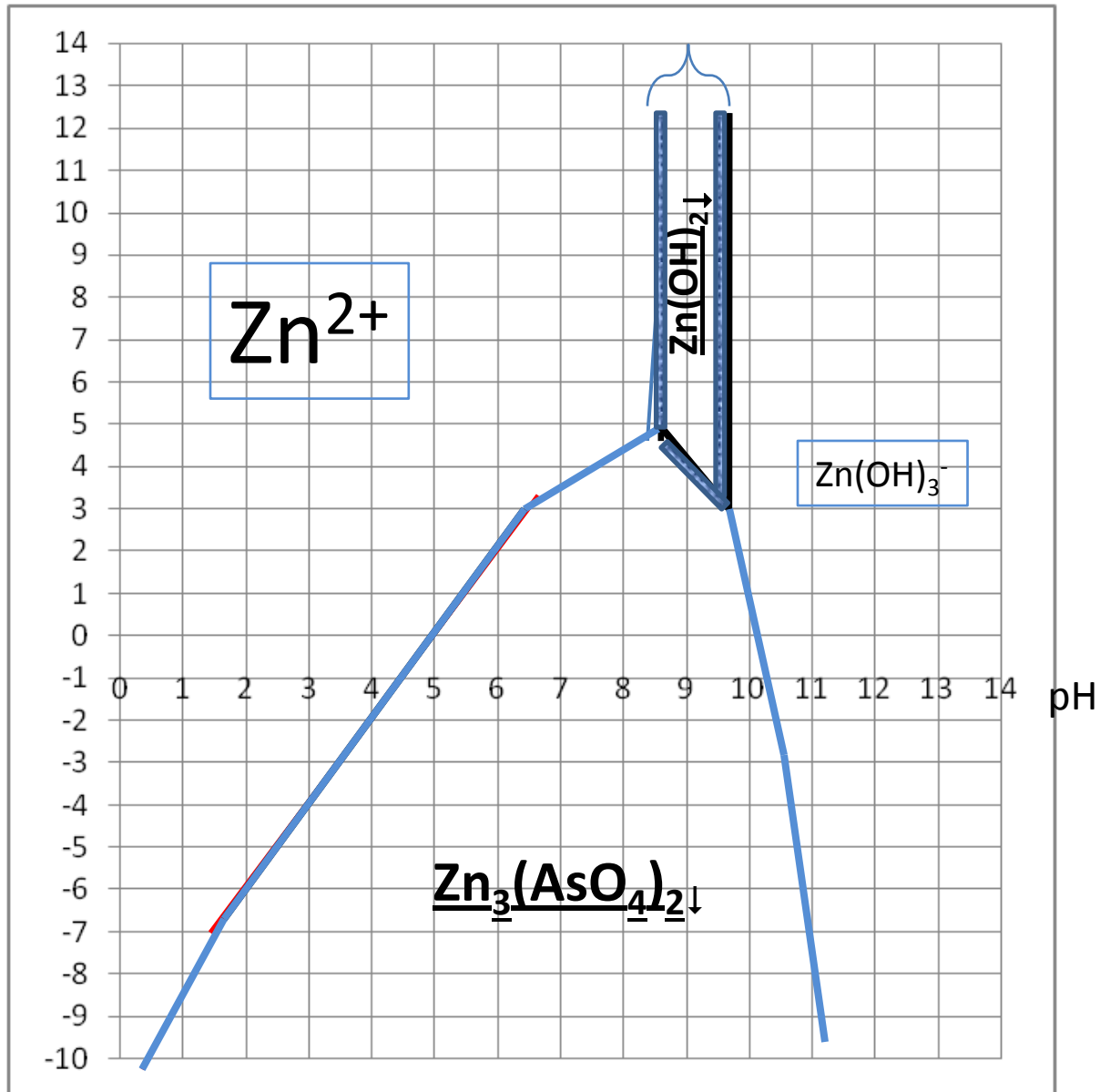






$$2\text{L} : 9\text{H} \rightarrow \text{L}(9/2)\text{H} \rightarrow m = -4.5$$

$(pAsO_4)_{pZn=5}$

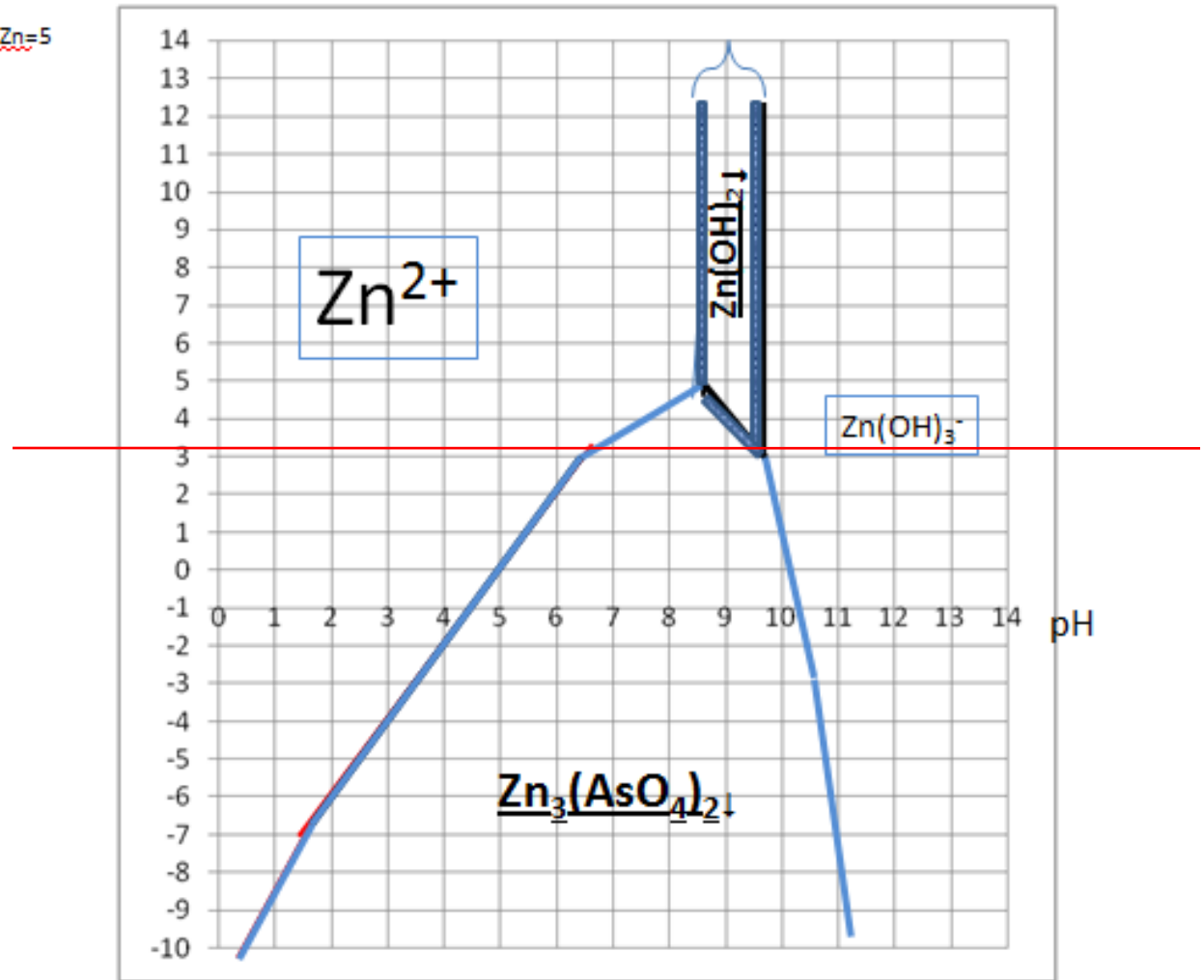




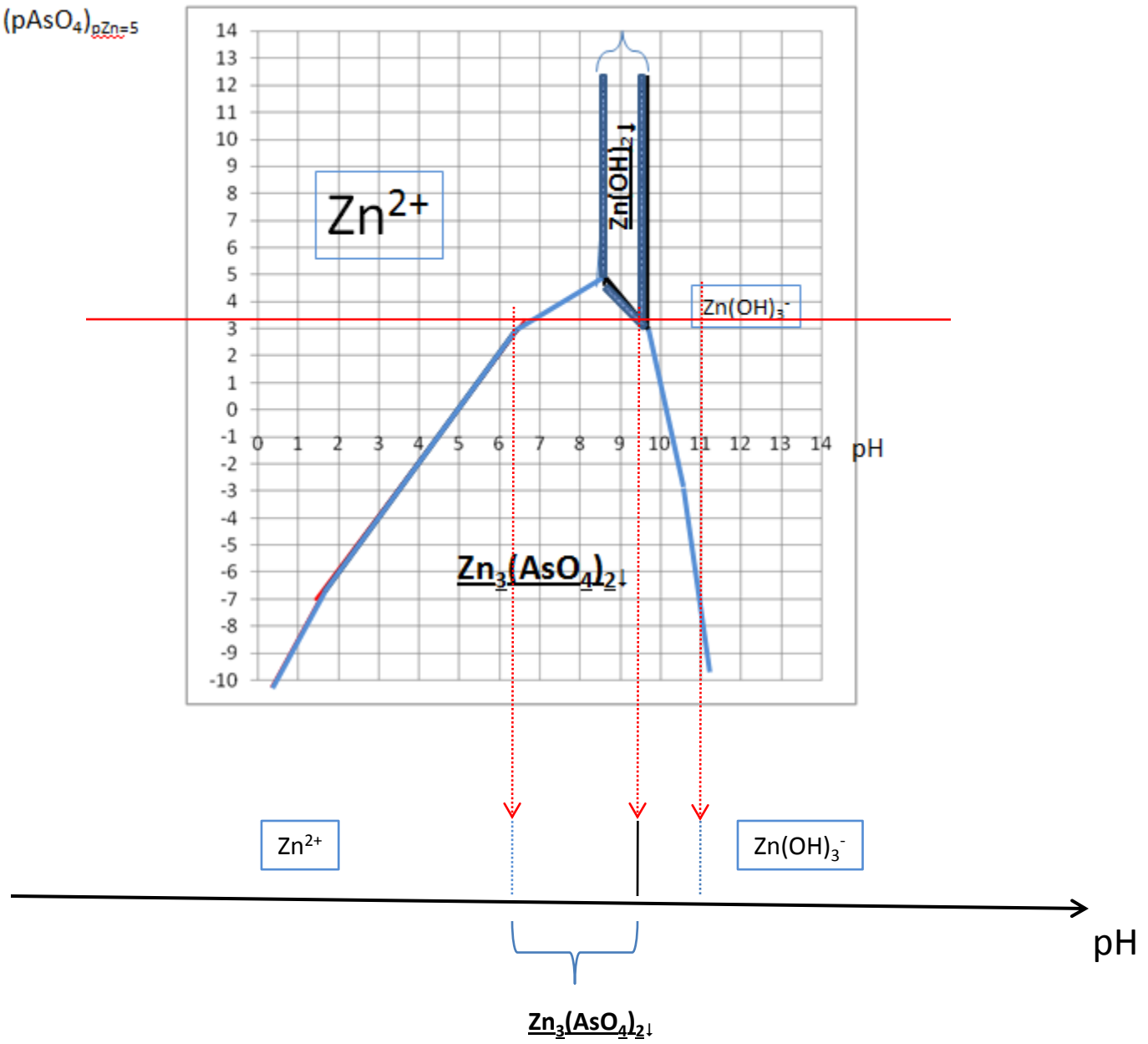
$pe = f(pH)_{pZn=5, pAsO_4=3}$  para el par  $Zn^{2+}/Zn^0$ ,  $E^0 = -0.76V(ENH)$ .

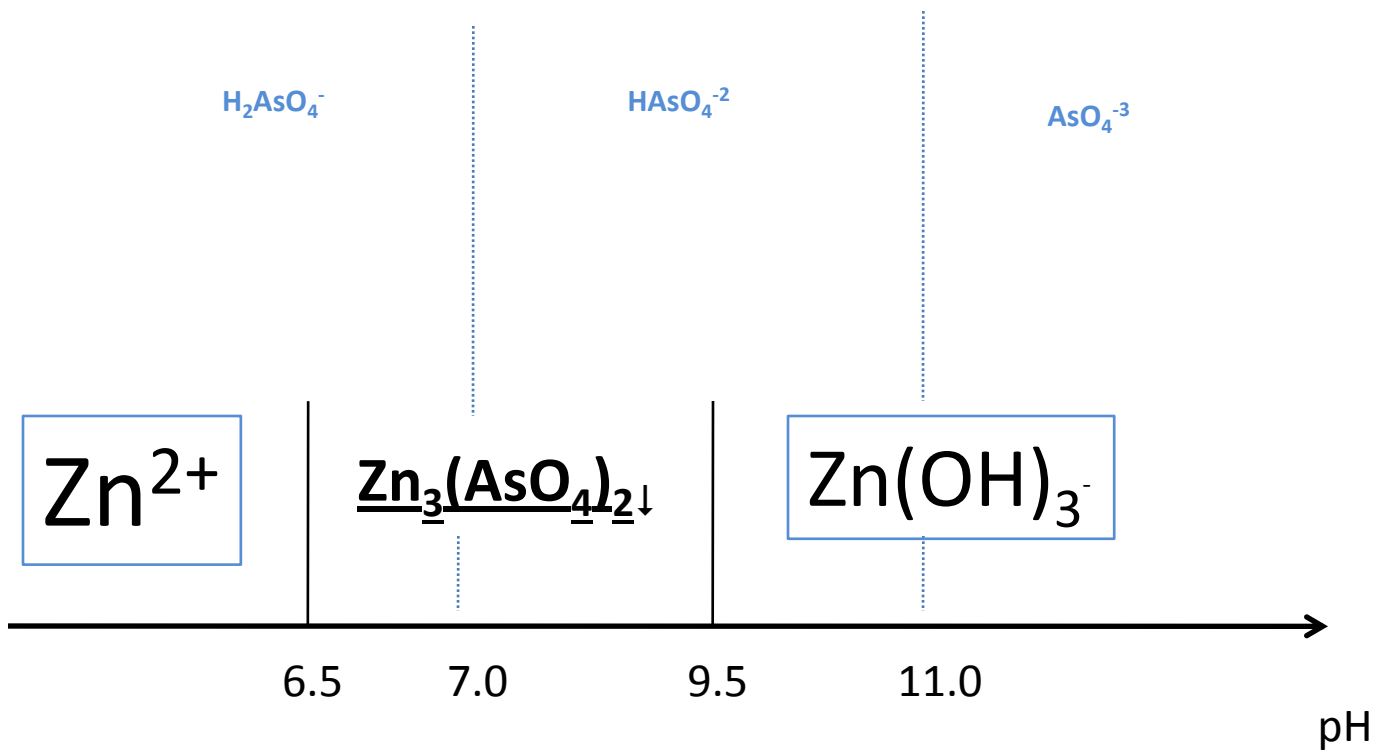


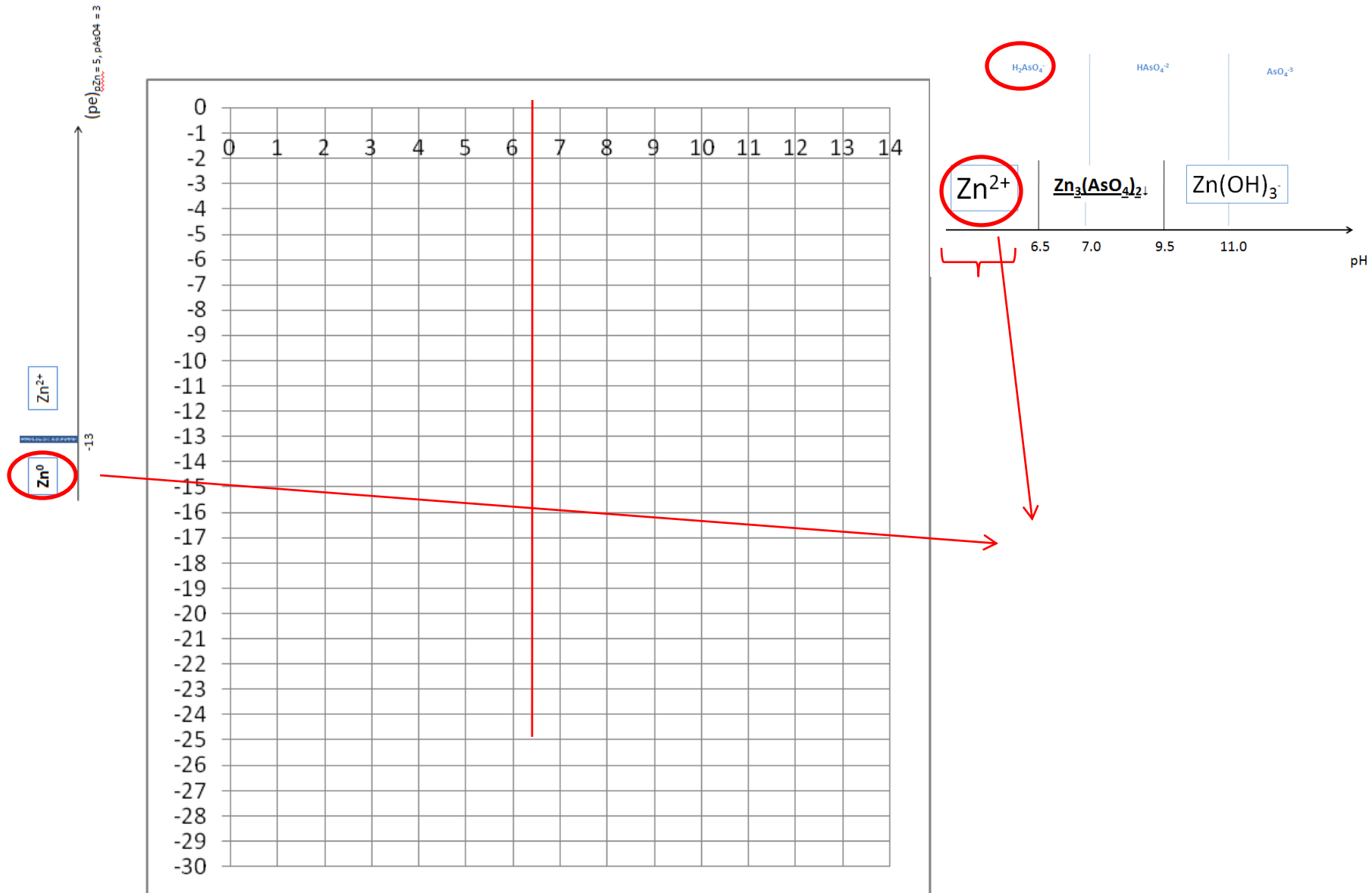
$(pAsO_4)_{pZn=5}$

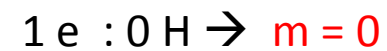
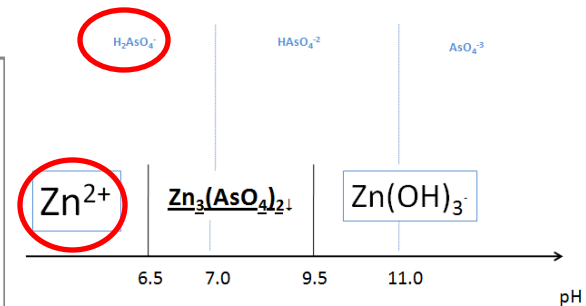
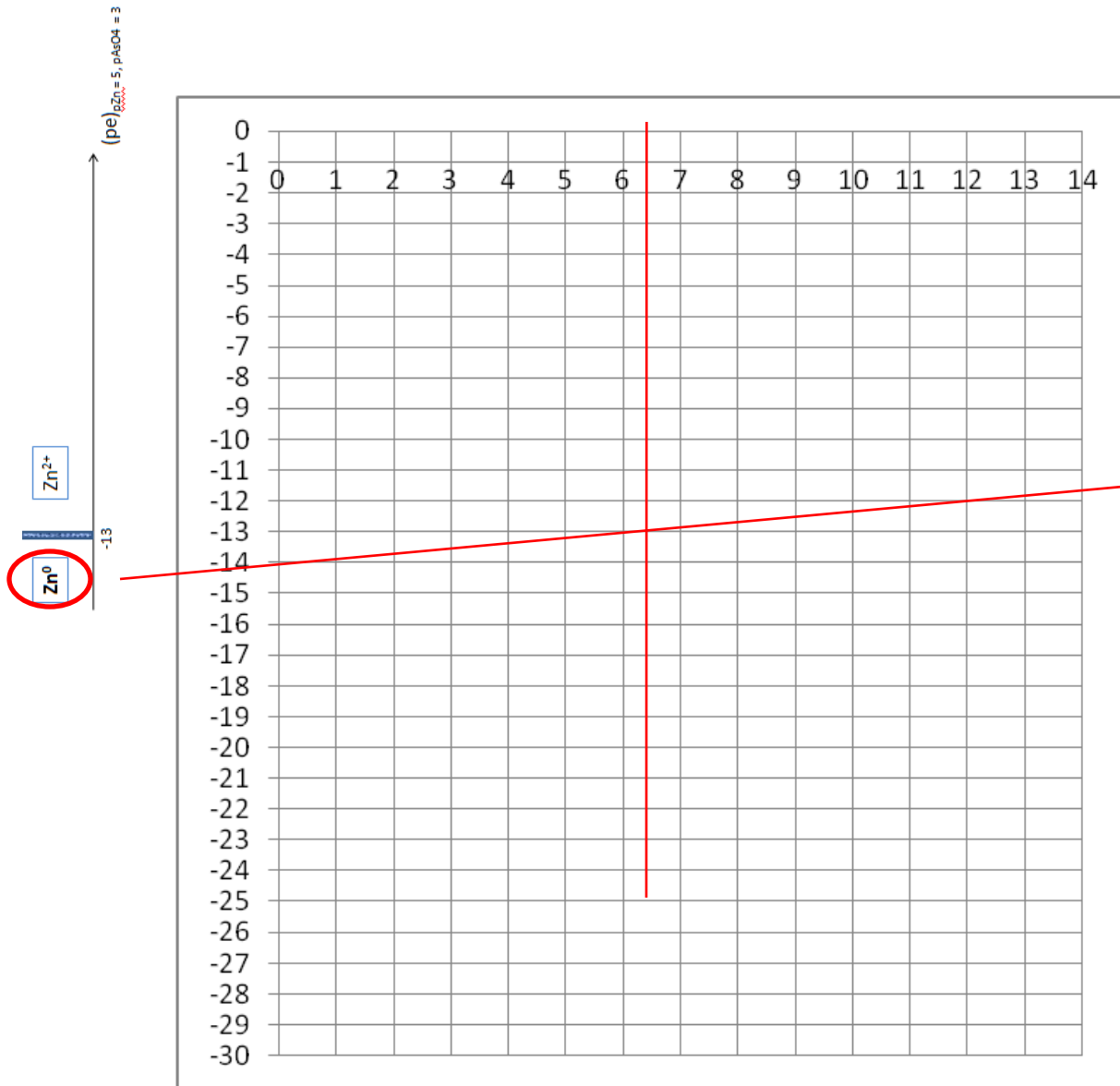


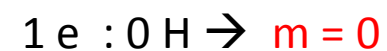
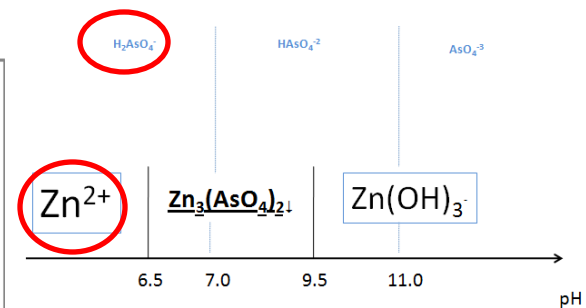
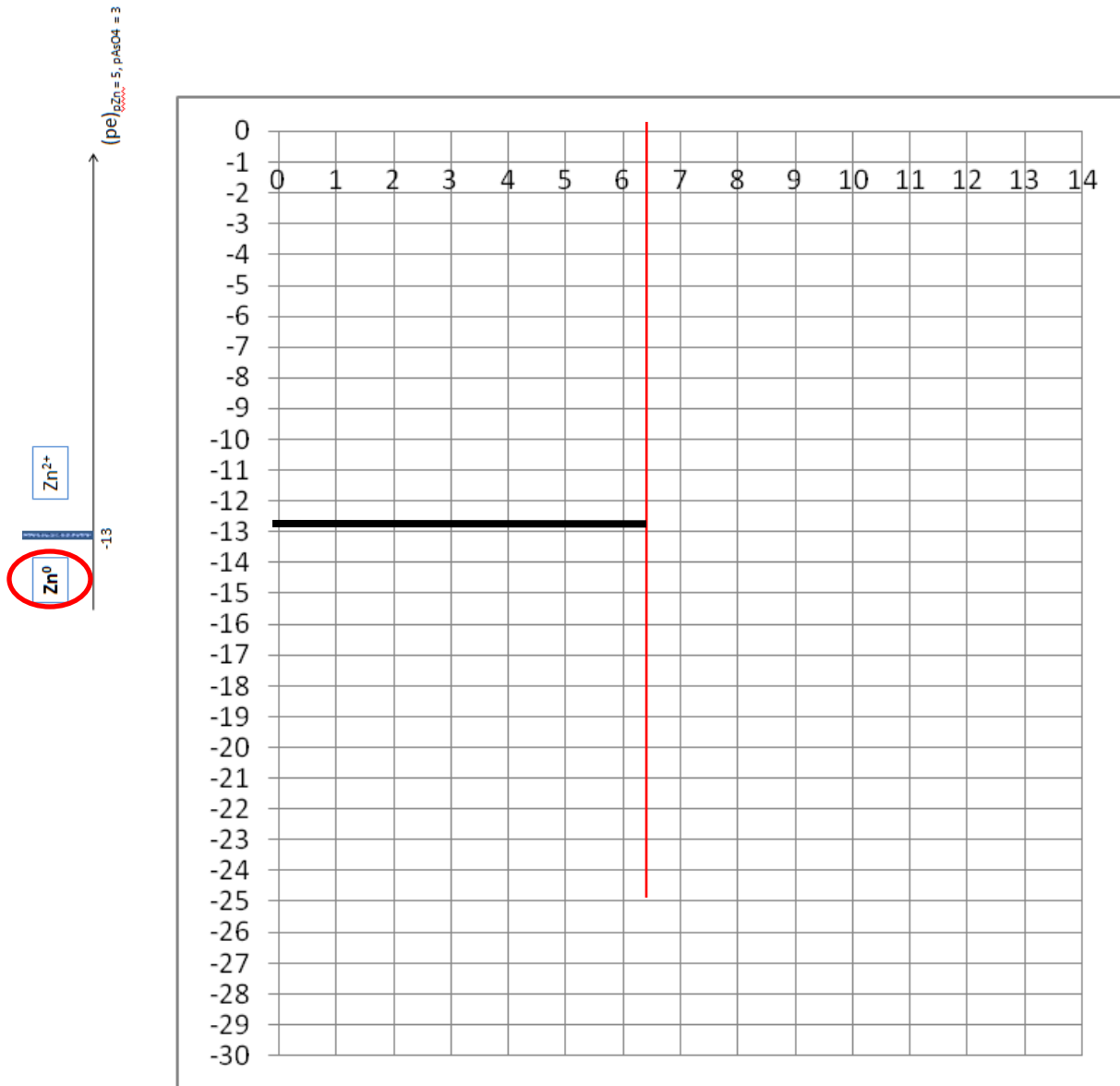
$(pAsO_4)_{pZn=5}$

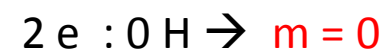
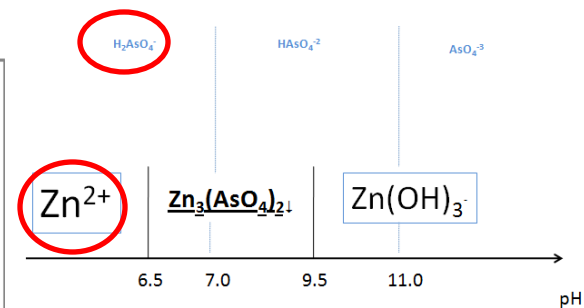
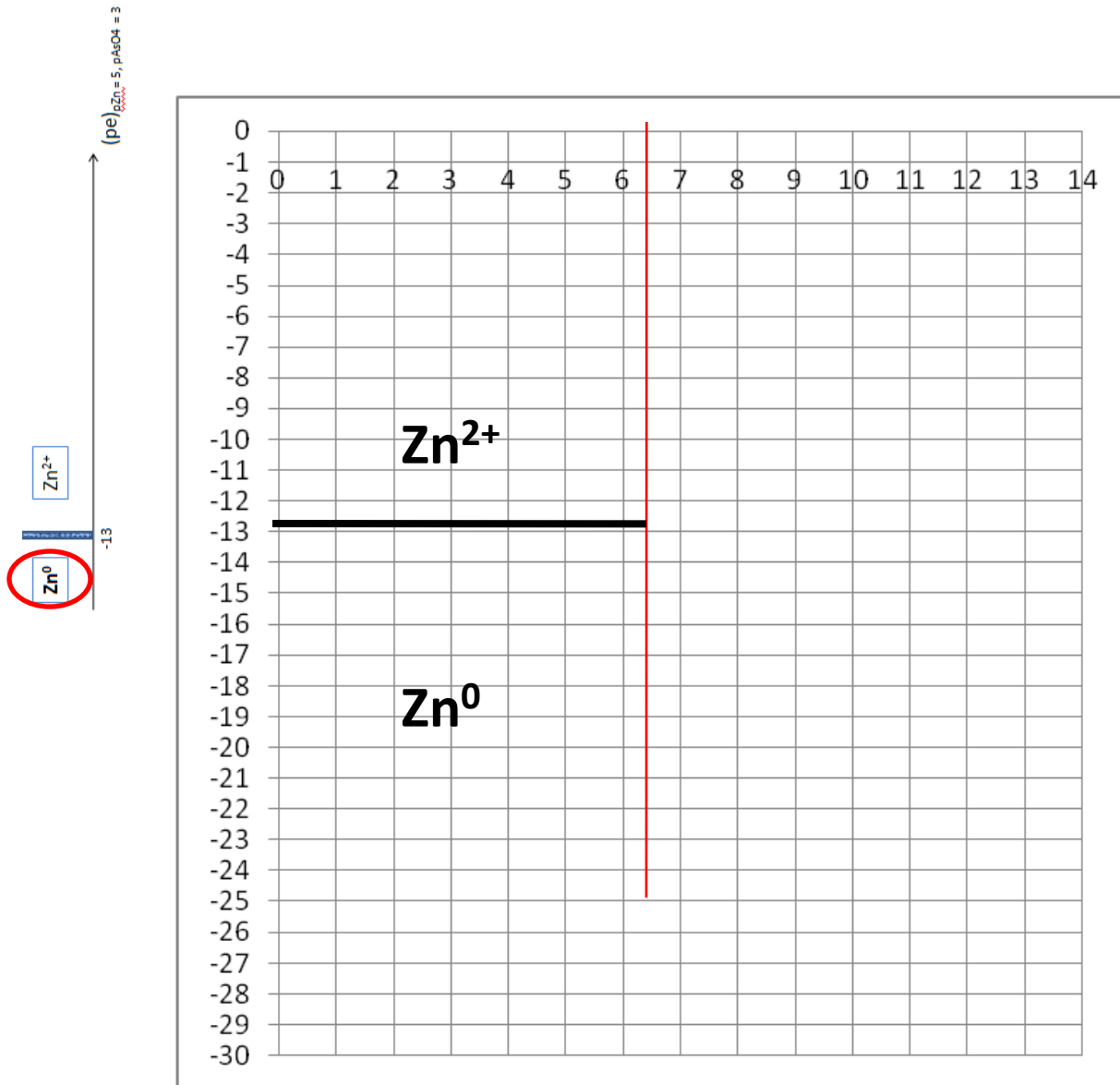


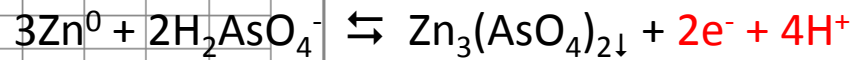
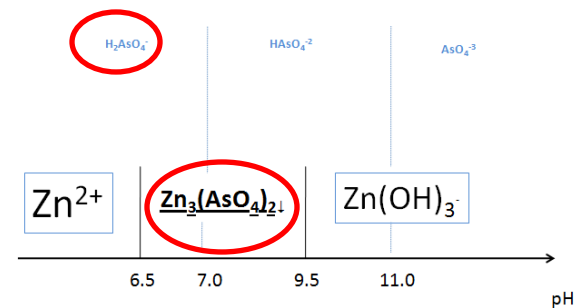
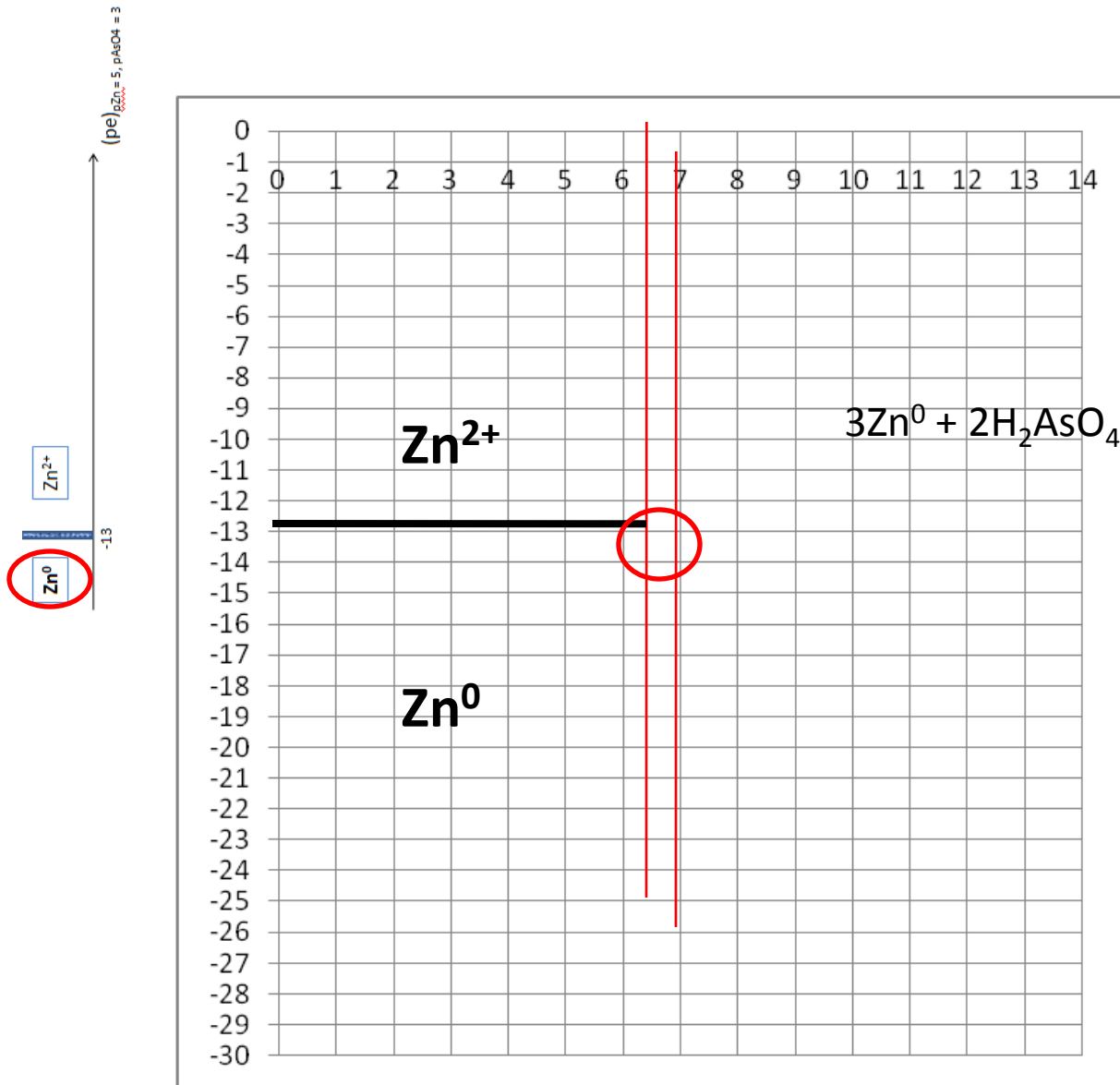






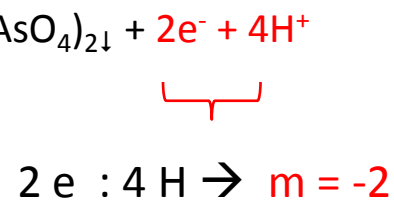
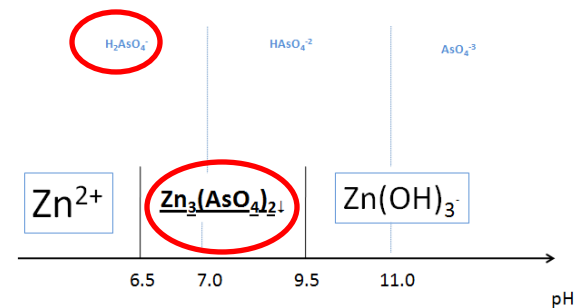
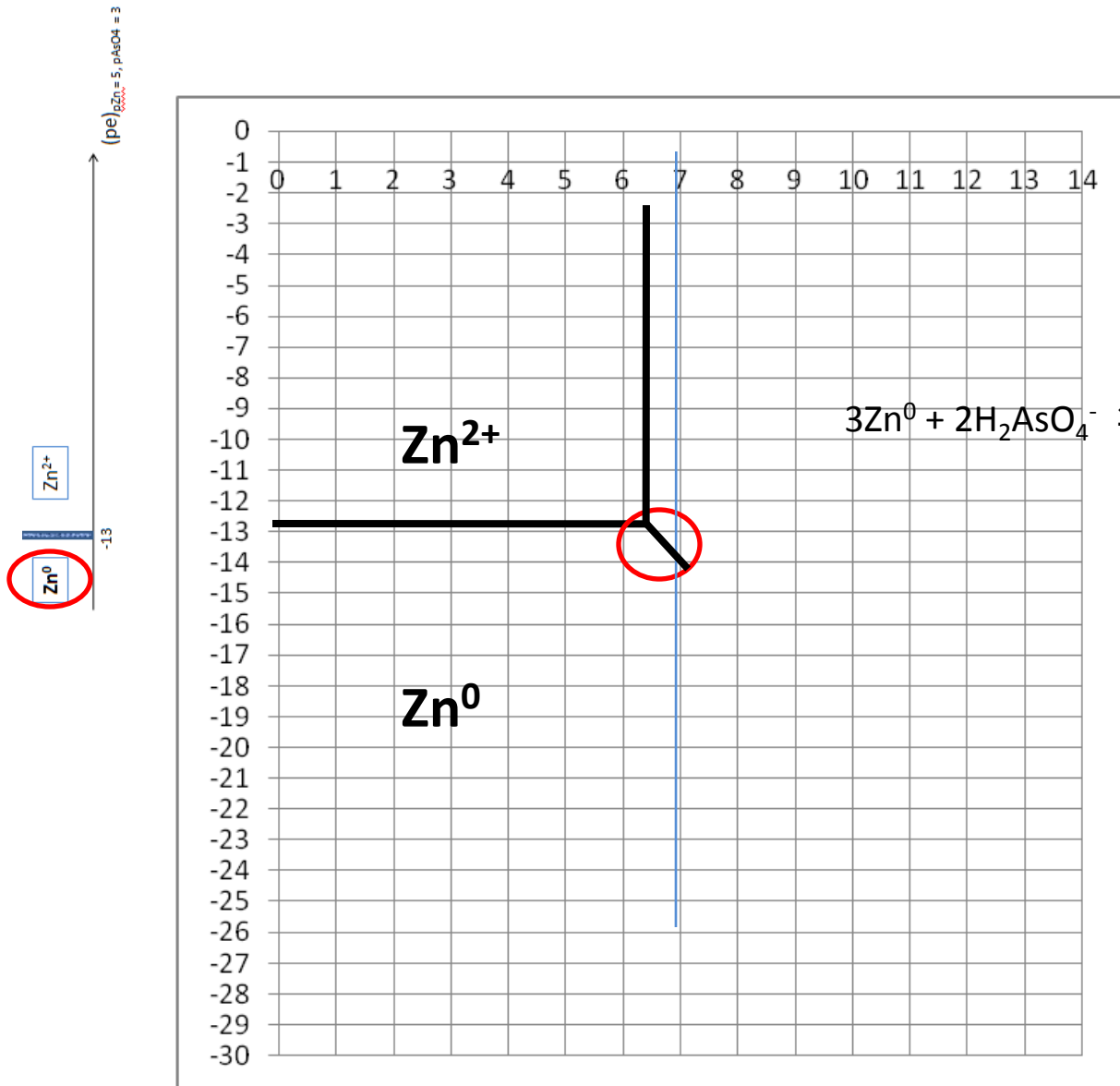


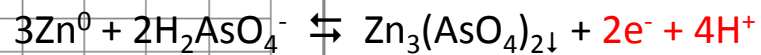
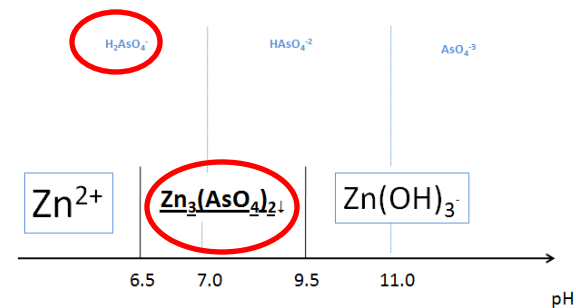
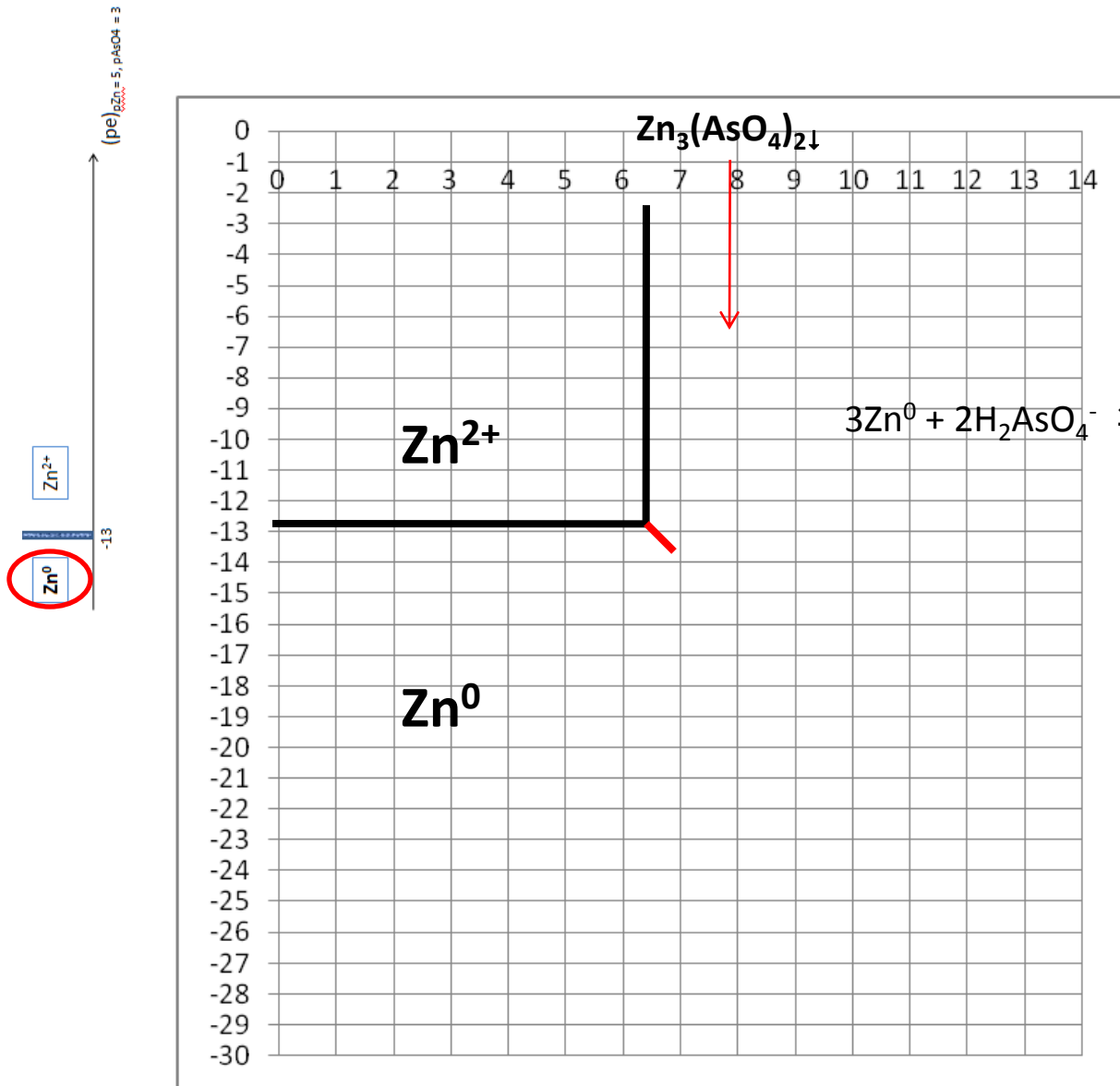




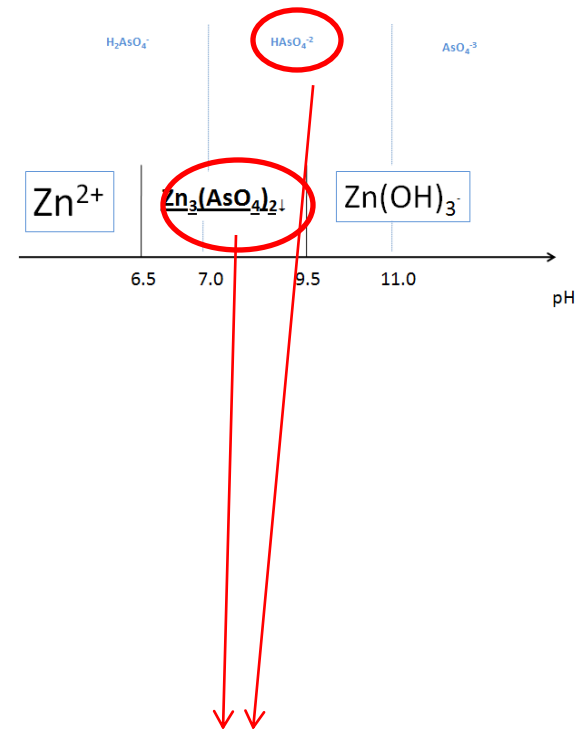
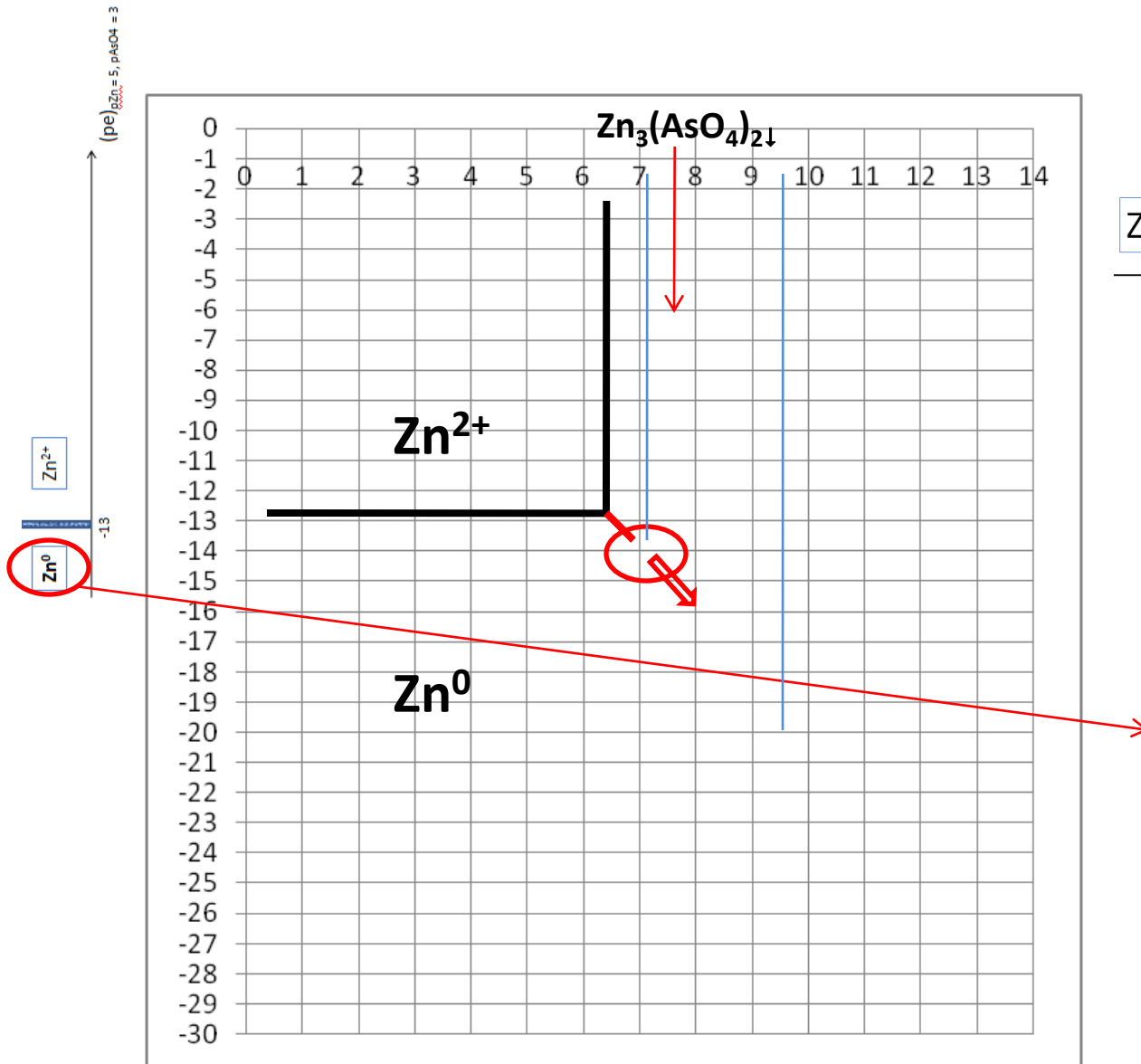
$$2e^- : 4\text{H}^+ \rightarrow m = -2$$

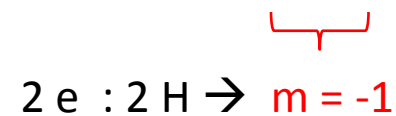
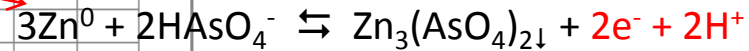
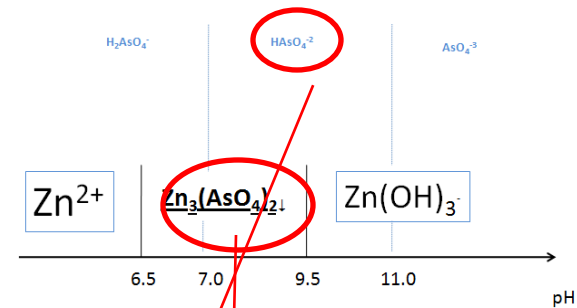
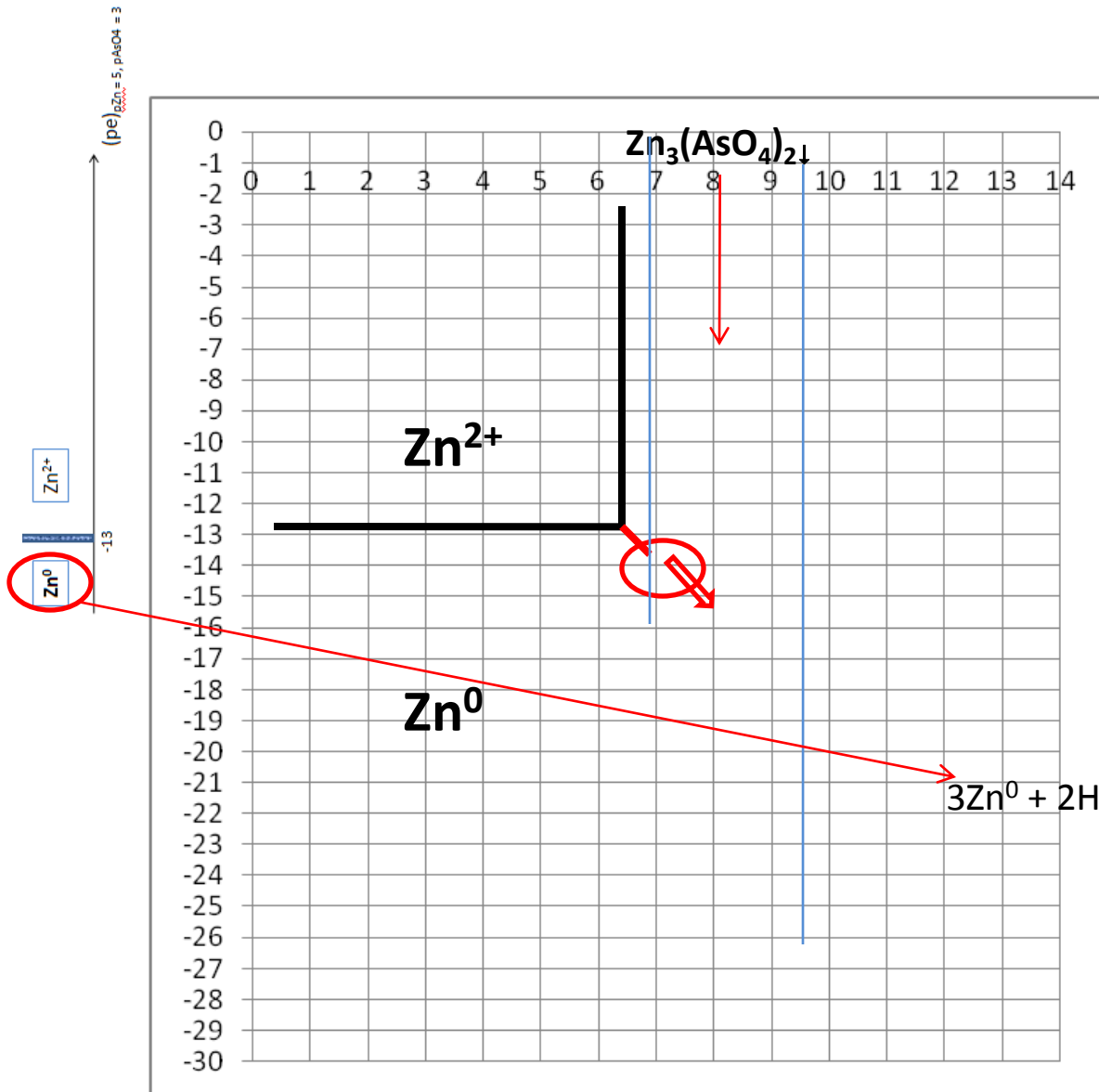


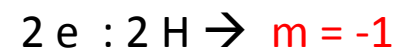
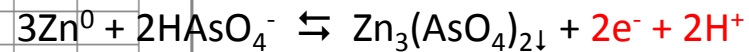
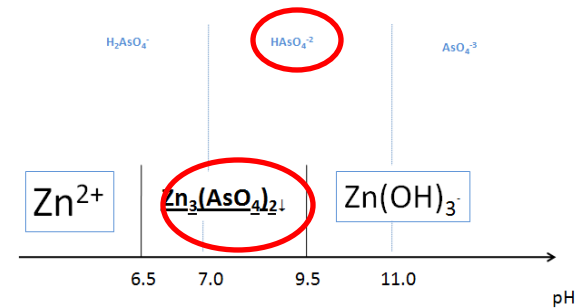
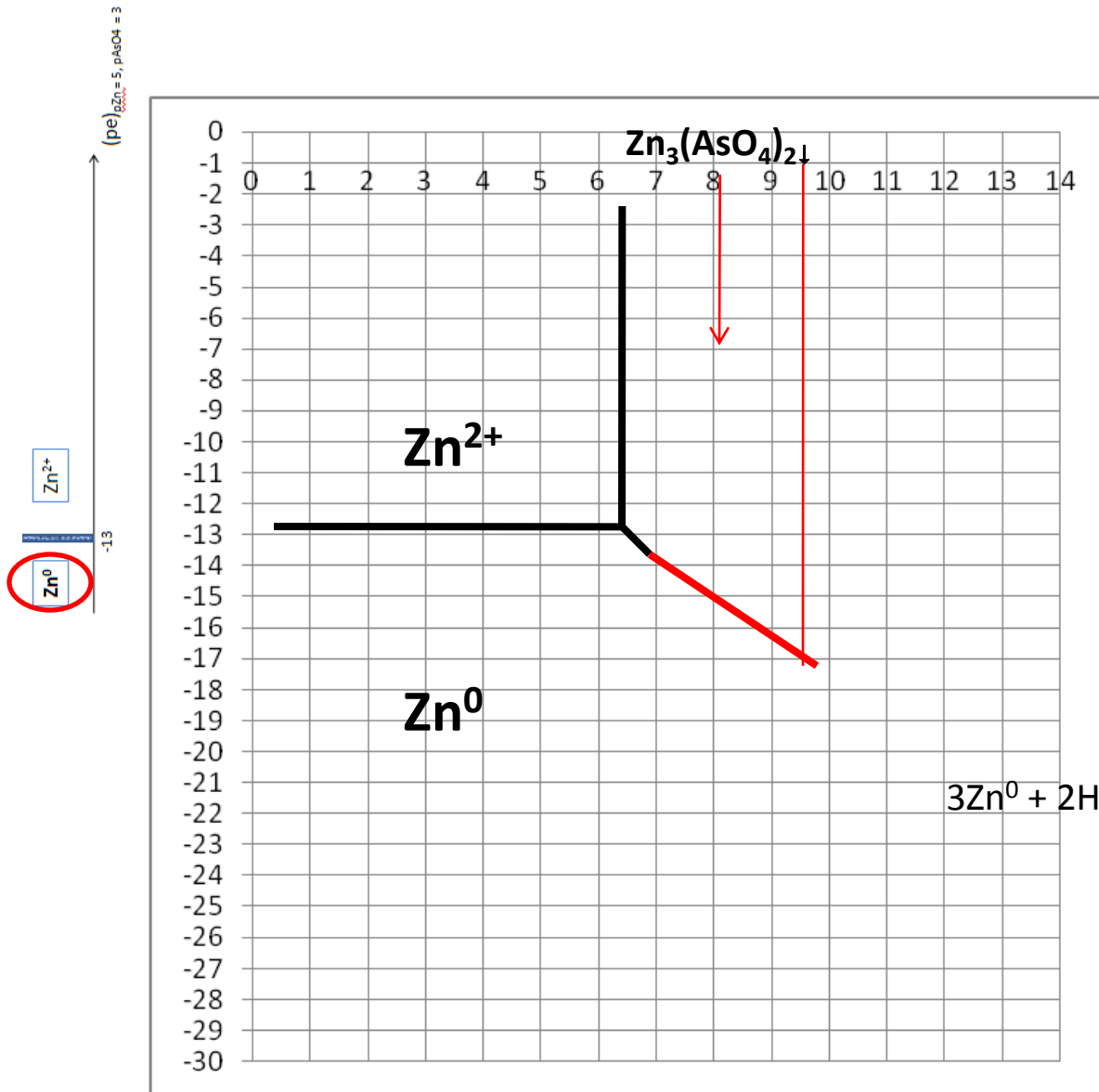


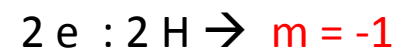
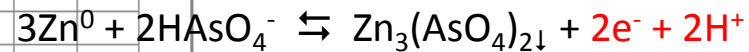
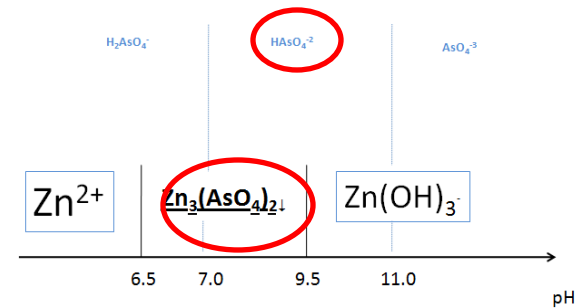
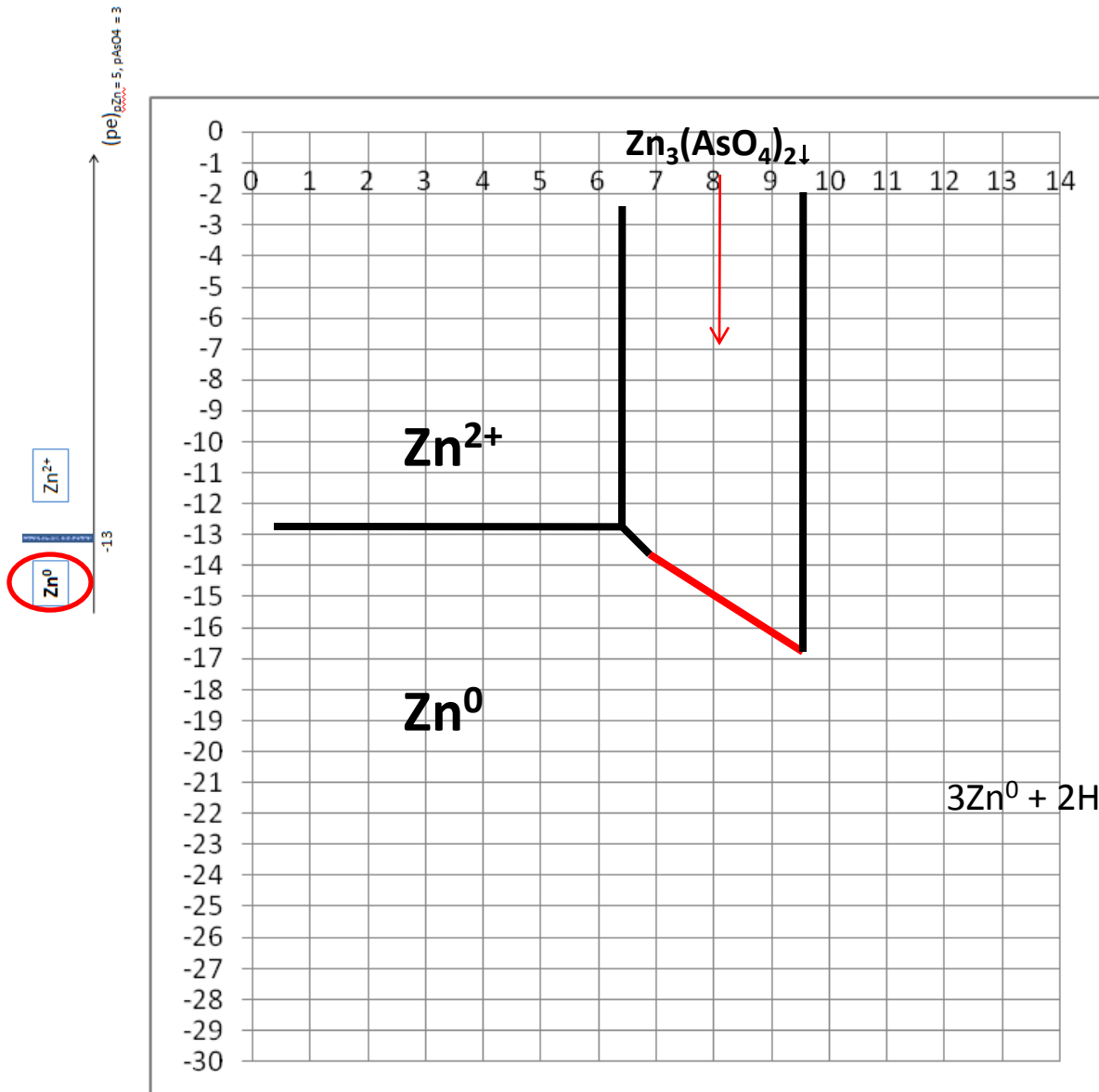


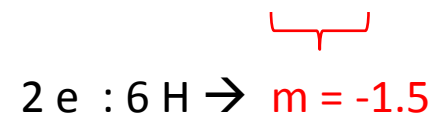
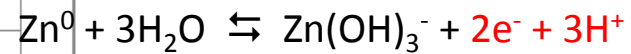
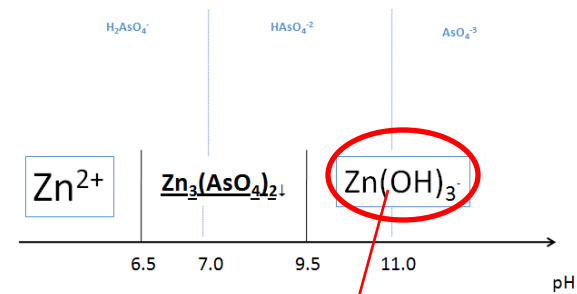
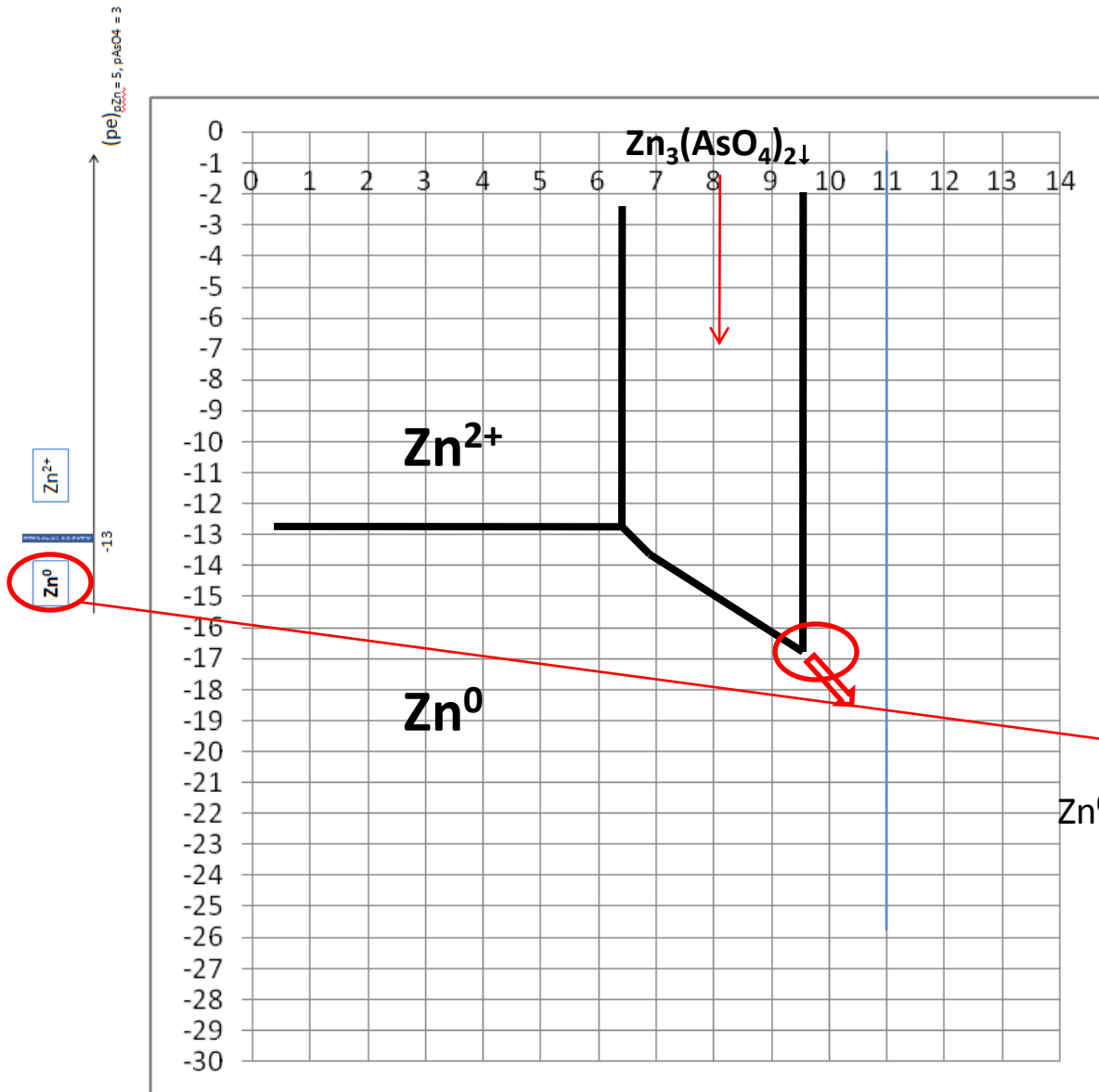
$$2e^- : 4\text{H}^+ \rightarrow m = -2$$

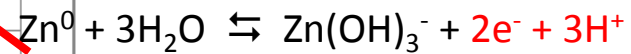
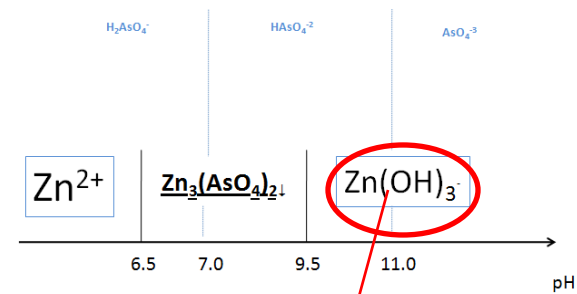
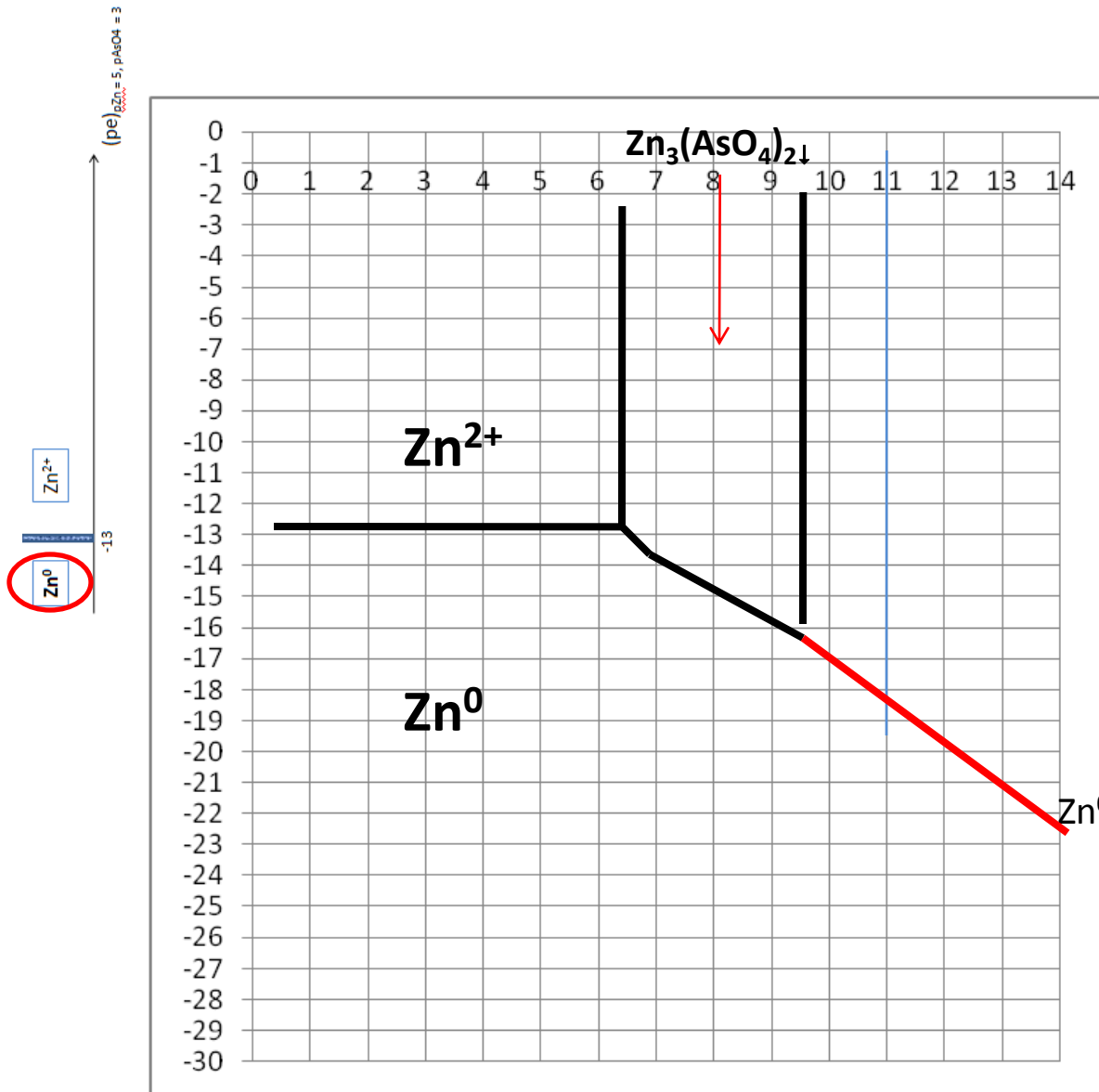






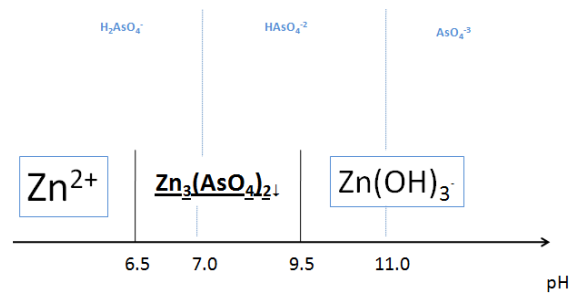
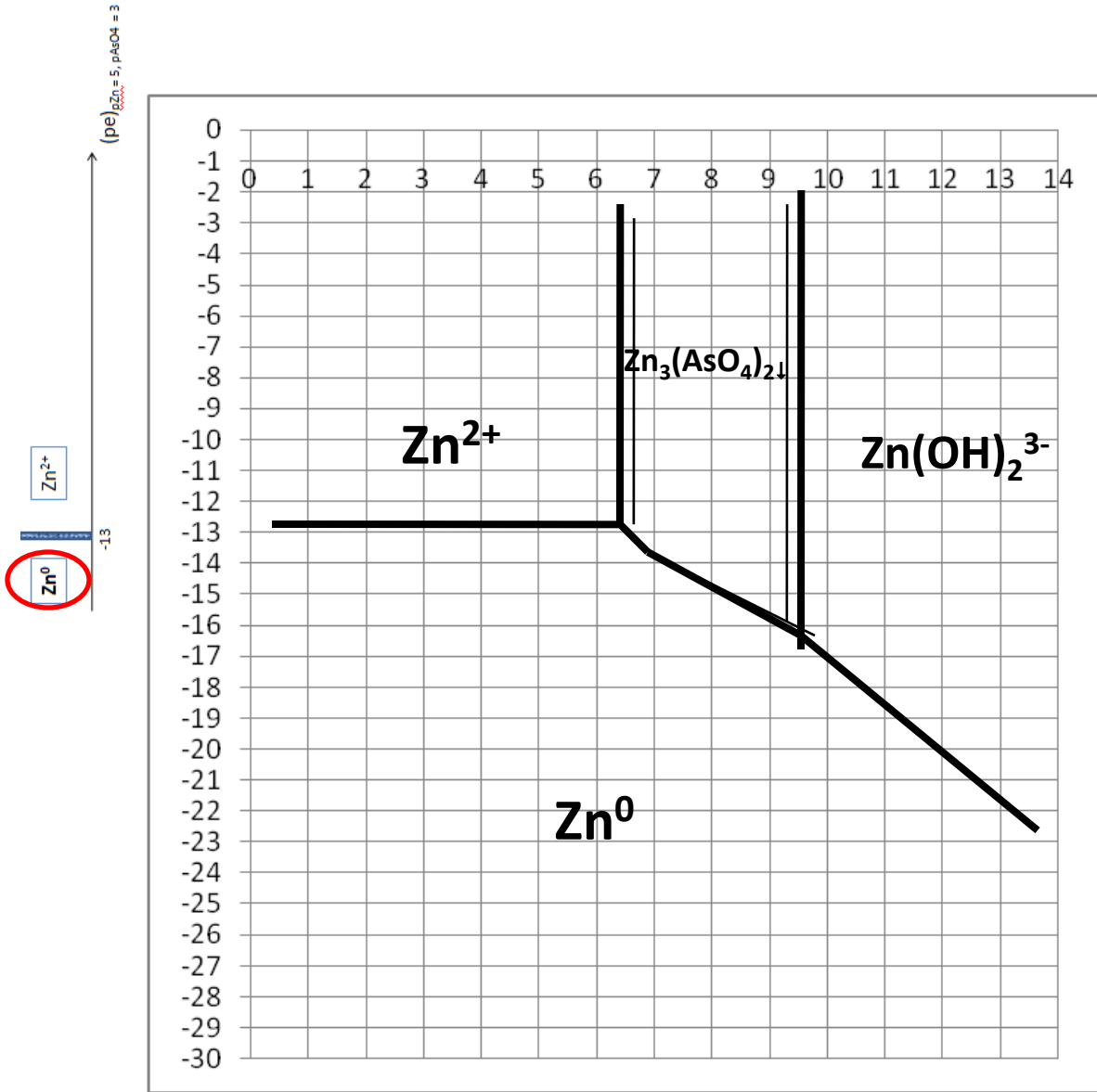






$$2e^- : 6H^+ \rightarrow m = -1.5$$





5.0 Elaborar la gráfica  $pe = f(\log [AsO_4^{3-}])$  a  $pH = 7.0$  en el intervalo  $1 < \mu M < 10$ .

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A  $pH = 7.0$ , se establece el siguiente equilibrio redox:



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$$pe = \left( \frac{pKd - 4pH}{2} \right) - \log[\text{AsO}_4^{3-}]$$

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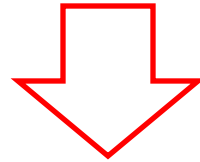
$$2pe = pKd + \log \left[ \frac{[\text{H}^+]^4}{[\text{AsO}_4^{3-}]^2} \right]$$

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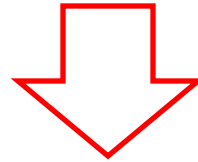
$$pe = \frac{pKd'}{2} - \log[\text{AsO}_4^{3-}]$$

$$pe = \frac{pKd'}{2} - \log[AsO_4^{3-}]'$$



$$K_d = K_r^3 \frac{(K_{a1}K_{a2})^2}{K_s} = \frac{[H^+]^4}{[AsO_4^{3-}]'^2}$$

$$pe = \frac{pK_d'}{2} - \log[AsO_4^{3-}]'$$



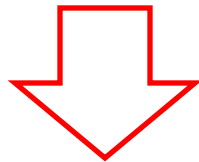
$$K_d = K_r^3 \frac{(K_{a1}K_{a2})^2}{K_s} = \frac{[H^+]^4}{[AsO_4^{3-}]'^2}$$

$$K_d' = \frac{K_d}{[H^+]^4} = 10^{-17}$$



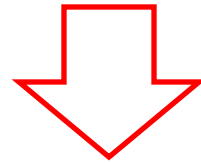
$$pe = \frac{pKd'}{2} - \log[AsO_4^{3-}]'$$

$$pe = 8.5 - \log[AsO_4^{3-}]'$$



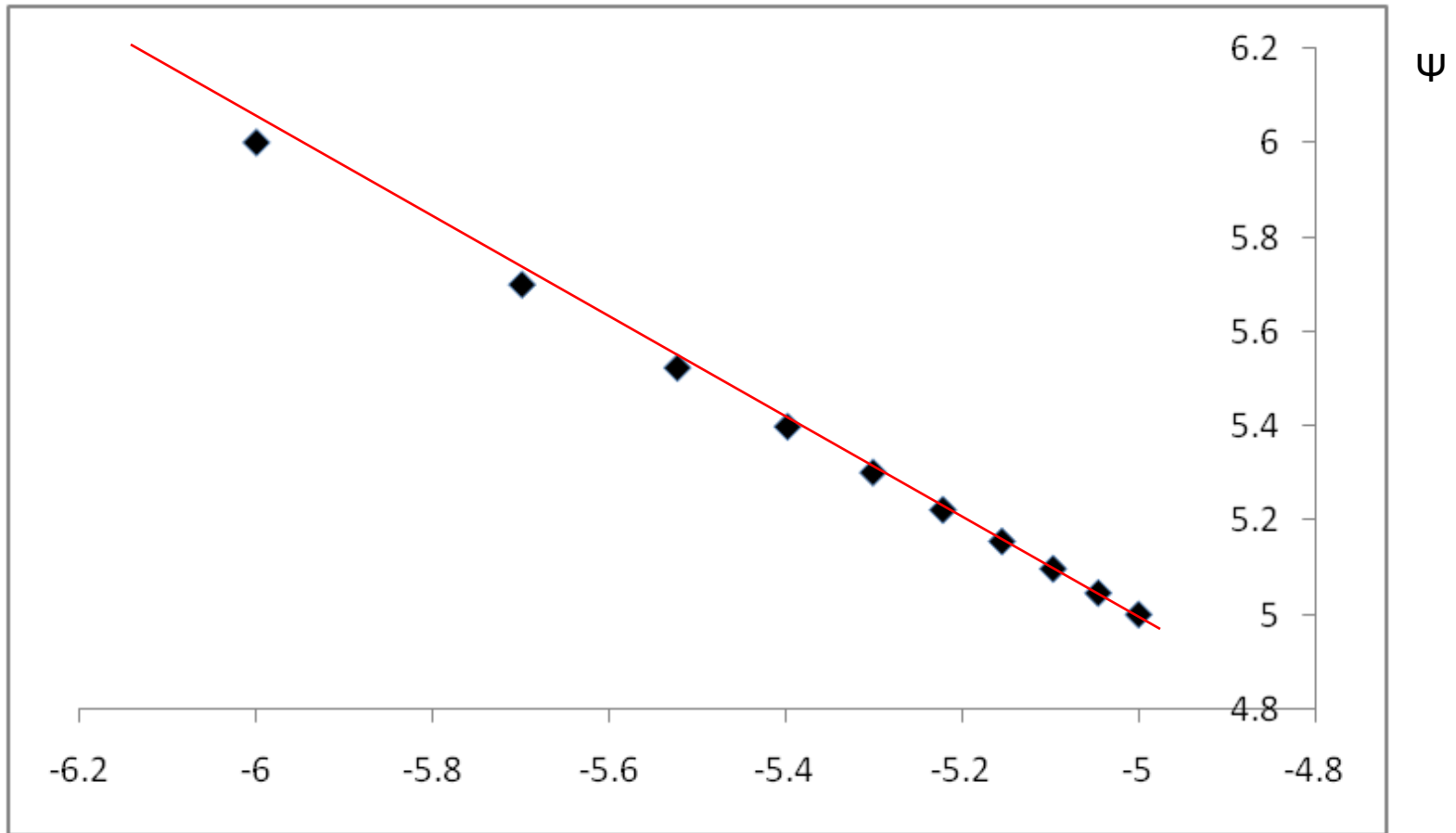
$$\Psi = pe - \frac{pKd'}{2} = -\log[AsO_4^{3-}]'$$

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$$\Psi = pe - \frac{pKd'}{2} = -\log[AsO_4^{3-}]'$$



log (AsO<sub>4</sub><sup>-3</sup>)'