

CONTOH SOAL
TEKANAN OSMOTIK (π) LARUTAN ELEKTROLIT
KURSIGURU.COM

1. Jelaskan perbedaan larutan berdasarkan tekanan osmotiknya!
2. Tentukan tekanan osmotik yang tiap literinya mengandung 20 gram NaCl pada suhu 25° C.
3. Berapakah tekanan osmotik larutan 0,1 M satu larutan elektronik biner pada suhu 25° C yang mempunyai $\alpha = 0,72$ adalah?
4. Sebanyak 6 gram CaCl₂ ($M_r = 111 \text{ gr mol}^{-1}$) dilarutkan dalam air hingga volumenya 350 ml pada suhu 50° C. Berapakah tekanan osmotiknya?
5. Berapa gram NH₄NO₃ 0,1 M harus dilarutkan untuk membuat larutan agar isotonis dengan larutan urea, CO(NH₂)₂ sebanyak 250 mL?
6. Senyawa garam BaCl₂ ($M_r = 208 \text{ gr mol}^{-1}$) sebanyak 40 gram dilarutkan dalam air hingga volumenya 5 liter. Tentukan tekanan osmotik larutan tersebut pada suhu 27° C.
7. Senyawa HCl sebanyak 4 gram dilarutkan dalam air hingga 1 liter. Jika tekanan osmotik larutan sebesar 1,23 atm pada suhu 27° C dan $R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$. Berapakah Massa molekul Relatif Senyawa tersebut?
8. Tekanan osmotik darah manusia pada 37° C adalah 7,7 atm. Berapakah gram NaCl harus dilarutkan dalam 1 liter larutan sehingga pada 37° C isotonik dengan darah manusia? ($M_r \text{ NaCl} = 58,5 \text{ gr mol}^{-1}$).
9. Larutan 0,1 molar suatu asam lemah yang tekanan osmotiknya adalah 2,88 atm pada suhu 27° C ($R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$). Jika asam itu hanya terionisasi 10%, hitunglah jumlah ion dari asam tersebut.
10. Sebanyak 82 gram suatu zat elektrolit kuat jumlah kefision kation dan anionnya yaitu 2 dilarutkan dalam air hingga volume 1 Liter dan mempunyai tekanan osmotik sebesar 9,84 atmosfer pada suhu 27° C. Jika tetapan $R = 0,082 \text{ L atm/mol K}$, berapakah M_r senyawa tersebut?
11. Jika tekanan osmotik dari 500 mL larutan NaOH pada suhu 30° C sebesar 1,95 atm, tentukan massa senyawa NaOH tersebut ($M_r = 40$).
12. Tekanan osmotik larutan Ba(OH)₂ 6,7 atm pada suhu 25° C. Berapakah konsentrasi Ba(OH)₂ yang diperlukan?
13. Berapakah derajat ionisasi dari larutan HBr 0,2 M dengan tekanan osmotiknya adalah 9,15 atm pada suhu 25° C?
14. Tekanan osmotik 4,14 atm senyawa H₂SO₄. Jika $R = 0,082 \text{ L atm mol}^{-1} \text{K}^{-1}$ pada suhu 25° C, tentukan massanya?
15. Berapa suhu yang diperlukan untuk membuat 500 mL larutan HNO₃ dengan tekanan osmotik 1,24 atm dan kemolarannya adalah 0,025 mol L⁻¹ ($M_r = 63$)?

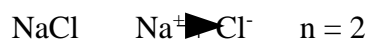
Kunci Jawaban

- Berdasarkan tekanan osmotiknya larutan dapat dibedakan :
 - Larutan isotonis merupakan dua buah atau lebih larutan yang mempunyai tekanan osmotik yang sama
 - Larutan hipertonis adalah larutan yang mempunyai tekanan osmotik lebih tinggi daripada larutan-larutan lain.
 - Larutan hipotonis adalah larutan yang mempunyai tekanan osmotik lebih rendah daripada larutan-larutan lain.

- Dik: massa = 20 gr
 $T = 25^{\circ} C + 273^{\circ} K = 298^{\circ} K$
 $R = 0,082 \text{ L atm mol}^{-1} K^{-1}$
 $M_r \text{ NaCl} = 58,5 \text{ gr mol}^{-1}$
 $Mol \text{ NaCl} = \frac{20 \text{ gr}}{58,5} = 0,34 \text{ mol}$

Dit: π?

Penyelesaian:



$$\alpha = 1$$

$$\pi = M \cdot R \cdot T \cdot i$$

$$\pi = 0,34 \text{ mol} \cdot 0,082 \text{ L atm mol}^{-1} K^{-1} \cdot 298^{\circ} K \cdot (1 + (n-1)\alpha)$$
$$\pi = 8,3 \cdot (1 + (2-1)1)$$

$$\pi = 8,3 \cdot 2$$

$$\pi = \mathbf{16,6 \text{ atm}}$$

- Dik: $M = 0,1 \text{ mol L}^{-1}$
 $R = 0,082 \text{ L atm mol}^{-1} K^{-1}$
 $T = 25^{\circ} C + 273^{\circ} K = 298^{\circ} K$
 $\alpha = 0,72$

Dit: π ...?

Penyelesaian:

$$\pi = M \cdot R \cdot T \cdot i$$

$$\pi = 0,1 \text{ mol L}^{-1} \cdot 0,082 \text{ L atm mol}^{-1} K^{-1} \cdot 298^{\circ} K \cdot (1 + (n-1)\alpha)$$

$$\pi = 0,1 \text{ mol L}^{-1} \cdot 0,082 \text{ L atm mol}^{-1} K^{-1} \cdot 298^{\circ} K \cdot (1 + (2-1)0,72)$$

$$\pi = 2,44 \cdot 1,72$$

$$\pi = \mathbf{4,197 \text{ atm}}$$

- Dik: massa = 6 gram
 $M_r = 111 \text{ gr mol}^{-1}$
 $V = 350 \text{ mL} = 0,35 \text{ L}$

$$T = 50^{\circ} \text{C} + 273^{\circ} \text{K} = 323^{\circ} \text{K}$$

$$R = 0,082 \text{ L atm mol}^{-1} \text{K}^{-1}$$

$$\text{Mol CaCl}_2 = \frac{\text{gr}}{\text{Mr}} = \frac{6111}{122} = 0,05 \text{ mol}$$

Dit: π?

Penyelesaian:



$$\alpha = 1$$

$$\pi = M \cdot R \cdot T \cdot i$$

$$\pi = nV R \cdot T \cdot (1 + (n-1)\alpha)$$

$$\pi = 0,05 \text{ mol} \cdot 0,35 \text{ L} \cdot 0,082 \text{ L atm mol}^{-1} \text{K}^{-1} \cdot 323^{\circ} \text{K} \cdot (1 + (2-$$

$$1)1) \pi = (0,14 \text{ mol L}^{-1}) (0,08 \text{ L atm mol}^{-1} \text{K}^{-1} \cdot 2) (323^{\circ} \text{K}) (2)$$

$$\pi = 7,42 \text{ atm}$$

4. Dik: larutan 1 NH_4NO_3 (isotonik)

larutan 2 $\text{CO}(\text{NH}_2)_2$



$$V = 250 \text{ mL} = 0,25 \text{ L}$$

$$n = 2$$

$$\alpha = 1$$

$$M = 0,1 \text{ mol L}^{-1}$$

Dit: massa NH_4NO_3?

Penyelesaian:

$$\pi_1 \text{ (isotonis)} = \pi_2$$

$$M_1 R \cdot T \cdot (1 + (n-1)\alpha) = M_2 R \cdot T$$

$$M_1 R \cdot T \cdot (1 + (2-1)1) = M_2 R \cdot T$$

$$0,1 \text{ mol L}^{-1} (2) = nV$$

$$0,2 \text{ mol L}^{-1} = n \cdot 0,25 \text{ L}$$

$$n = 0,25 \text{ L} (0,2 \text{ mol L}^{-1})$$

$$n = 0,05 \text{ mol}$$

$$\text{massa NH}_4\text{NO}_3 = n \times \text{Mr}$$

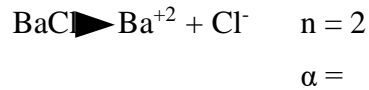
$$= 0,05 \text{ mol} \times 80 \text{ gr mol}^{-1}$$

$$\text{massa NH}_4\text{NO}_3 = 4 \text{ gram}$$

5. Dik : $M_r \text{ BaCl}_2 = 208 \text{ gr mol}^{-1}$
 Massa $\text{BaCl}_2 = 40 \text{ gr}$
 $R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$
 $V = 5 \text{ L}$
 $T = 27^\circ \text{ C} + 273^\circ \text{ K} = 300^\circ \text{ K}$

Dit : $\pi \dots ?$

Penyelesaian:



$$m = \frac{g}{M_r} = \frac{40 \text{ gr}}{208 \text{ gr mol}^{-1}} = 0,2 \text{ mol}$$

$$M = nV = 0,2 \text{ mol} / 5 \text{ L} = 0,04 \text{ mol L}^{-1}$$

$$\pi = M \cdot R \cdot T \cdot (1 + (n-1)\alpha)$$

$$\pi = 0,04 \text{ mol L}^{-1} \cdot 0,082 \text{ L atm mol}^{-1}\text{K}^{-1} \cdot 300^\circ \text{ K} \cdot (1 + (2-1)1)$$

$$\pi = 0,98 (2)$$

$$\pi = \mathbf{1,98 \text{ atm}}$$

6. Dik: massa $\text{HCl} = 4 \text{ gr}$
 $V = 1 \text{ L}$
 $\pi = 1,23 \text{ atm}$
 $T = 27^\circ \text{ C} + 273^\circ \text{ K} = 300^\circ \text{ K}$
 $R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$

Dit: $M_r \dots ?$

Penyelesaian:

$$\pi = M \cdot R \cdot T \cdot (1 + (n-1)\alpha)$$

$$M = \frac{\pi \cdot R \cdot T}{(1 + (n-1)\alpha)}$$

$$M = \frac{1,23 \text{ atm} \cdot 0,082 \text{ L atm mol}^{-1}\text{K}^{-1} \cdot 300 \text{ K}}{(1 + (2-1)1)}$$

$$M = 1,23 \text{ atm} / 49,2 \text{ L atm mol}^{-1}$$

$$M = 0,025 \text{ mol L}^{-1}$$

$$M = nV$$

$$n = M \times V$$

$$n = 0,025 \text{ L mol}^{-1} \times 1 \text{ L}$$

$$n = 0,025 \text{ mol}$$

$$n = \frac{g}{M_r}$$

$$M_r = \frac{g}{n} = \frac{4 \text{ gr}}{0,025 \text{ mol}} = \mathbf{160 \text{ gr mol}^{-1}}$$

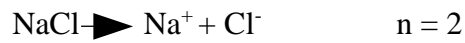
7. Dik : $T = 37^\circ \text{ C} + 273^\circ \text{ K} = 310^\circ \text{ K}$
 $\pi = 7,7 \text{ atm}$
 $V = 1 \text{ L}$

$$M_r \text{ NaCl} = 58,5 \text{ gr mol}^{-1}$$

$$R = 0,082 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

Dit : massa NaCl...?

Penyelesaian:



$$\alpha = 1$$

$$\pi = M \times R \times T (1 + (n-1)\alpha)$$

$$7,7 \text{ atm} = M \times 0,082 \text{ L atm mol}^{-1} \text{ K}^{-1} \times 310^\circ \text{ K} \times (1 + (2-1)1)$$

$$7,7 \text{ atm} = M \times 50,84 \text{ L atm mol}^{-1}$$

$$M = 7,7 \text{ atm} / 50,84 \text{ L atm mol}^{-1}$$

$$M = 0,15 \text{ mol L}^{-1}$$

$$M = n/V$$

$$n = M \times V$$

$$n = 0,15 \text{ mol L}^{-1} \times 1 \text{ L}$$

$$n = 0,15 \text{ mol}$$

$$n = \text{gr} / M_r$$

$$\text{gr} = n \times M_r$$

$$\text{gr} = 0,15 \text{ mol} \times 58,5 \text{ gr mol}^{-1}$$

$$\text{gr} = \mathbf{8,8 \text{ gram}}$$

8. Dik : $\pi = 2,88 \text{ atm}$

$$M = 0,1 \text{ mol L}^{-1}$$

$$R = 0,082 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

$$T = 27^\circ \text{ C} + 273^\circ \text{ K} = 300^\circ \text{ K}$$

Dit : jumlah ion (n)...?

Penyelesaian:

$$\pi = M \cdot R \cdot T (1 + (n-1)\alpha)$$

$$2,88 = 0,1 \text{ mol L}^{-1} \times 0,082 \text{ L atm mol}^{-1} \text{ K}^{-1} \times 300^\circ \text{ K} \times (1 + (n-1)0,1)$$

$$(1 + (n-1)0,1) = 1,2$$

$$\mathbf{n = 3}$$

Jadi, jumlah ionnya adalah 3.

9. Dik : n (koefisien) = 2

$$\text{Massa} = 82 \text{ gram}$$

$$V = 1 \text{ L}$$

$$\pi = 9,84 \text{ atm}$$

$$T = 27^\circ \text{ C} + 273^\circ \text{ K} = 300^\circ \text{ K}$$

$$R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$$

Dit : Mr...?

Penyelesaian:

$$\pi = M \cdot R \cdot T (1 + (n-1)\alpha)$$

$$M = \pi R \cdot T (1 + (n-1)\alpha)$$

$$M = 9,84 \text{ atm} \cdot 0,082 \text{ L atm mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times (1 + (n-1)\alpha)$$

$$M = 9,84 \text{ atm} \cdot 0,082 \text{ L atm mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times (1 + (2-1)1)$$

$$M = 9,84 \text{ atm} \cdot 49,2 \text{ L atm mol}^{-1}$$

$$M = 0,2 \text{ mol L}^{-1}$$

$$M = nV$$

$$n = 0,2 \text{ mol L}^{-1} \times 1 \text{ L}$$

$$n = 0,2 \text{ mol}$$

$$n = \frac{\text{gr}}{\text{Mr}}$$

$$\text{Mr} = \frac{\text{gr}}{n} = \frac{82 \text{ gr}}{0,2 \text{ mol}} = \mathbf{410 \text{ gr mol}^{-1}}$$

10. Dik : $\pi = 1,9 \text{ atm}$

$$V = 500 \text{ mL} = 0,5 \text{ L}$$

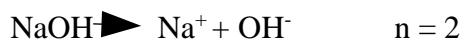
$$T = 30^\circ \text{ C} + 273^\circ \text{ K} = 303^\circ \text{ K}$$

$$R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$$

$$\text{Mr NaOH} = 40 \text{ gr mol}^{-1}$$

Dit : massa NaOH...?

Penyelesaian:



$$\alpha = 1$$

$$\pi = M \times R \times T (1 + (n-1)\alpha)$$

$$1,9 \text{ atm} = M \times 0,082 \text{ L atm mol}^{-1} \text{K}^{-1} \times 303^\circ \text{ K} \times (1 + (2-1)1)$$

$$1,9 \text{ atm} = M \times 49,7 \text{ L atm mol}^{-1}$$

$$M = \frac{1,9 \text{ atm}}{49,7 \text{ L atm mol}^{-1}}$$

$$M = 0,039 \text{ mol L}^{-1}$$

$$M = nV$$

$$n = M \times V$$

$$n = 0,039 \text{ mol L}^{-1} \times 0,5 \text{ L}$$

$$n = 0,0196 \text{ mol}$$

$$n = \frac{\text{gr}}{\text{Mr}}$$

$$\text{gr} = n \times \text{Mr}$$

$$\text{gr} = 0,0196 \text{ mol} \times 40 \text{ gr mol}^{-1}$$

$$\mathbf{\text{gr} = 0,784 \text{ gram}}$$

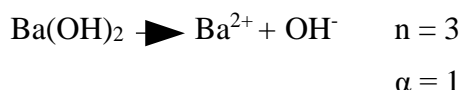
11. Dik : $\pi = 6,7 \text{ atm}$

$$R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$$

$$T = 25^\circ \text{C} + 273^\circ\text{K} = 298^\circ \text{K}$$

Dit : M.....?

Penyelesaian:



$$\pi = M \times R \times T (1 + (n-1)\alpha)$$

$$M = \pi R \times T (1 + (n-1)\alpha)$$

$$M = 6,7 \text{ atm} \times 0,082 \text{ L atm mol}^{-1}\text{K}^{-1} \times 298 \text{ o K} \times 3$$

$$M = 6,7 \text{ atm} \times 73,3 \text{ atm mol L}^{-1}$$

$$M = \mathbf{0,09 \text{ mol L}^{-1}}$$

12. Dik : $M = 0,2 \text{ mol L}^{-1}$

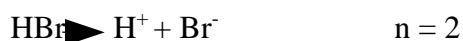
$$T = 25^\circ \text{C} + 273^\circ\text{K} = 298^\circ \text{K}$$

$$\pi = 9,15 \text{ atm}$$

$$R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$$

Dit : α?

Penyelesaian:



$$\pi = M \times R \times T (1 + (n-1)\alpha)$$

$$9,15 \text{ atm} = 0,2 \text{ mol L}^{-1} \times 0,082 \text{ L atm mol}^{-1} \text{K}^{-1} \times 298^\circ \text{K} \times (1 + (2-1)\alpha)$$

$$9,15 \text{ atm} = 4,89 \text{ atm} (1 + (2-1)\alpha)$$

$$4,89 \text{ atm} (1 + (2-1)\alpha) = 9,15 \text{ atm}$$

$$(1 + (2-1)\alpha) = 9,15 \text{ atm} \times 4,89$$

$$\text{atm } 1 + \alpha = 1,87$$

$$\alpha = 1,87 - 1 = \mathbf{0,87}$$

13. Dik : $\pi = 4,14 \text{ atm}$

$$V = 500 \text{ mL} = 0,5 \text{ L}$$

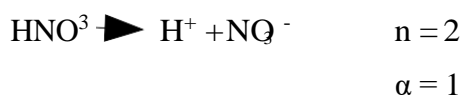
$$T = 25^\circ \text{C} + 273^\circ \text{K} = 298^\circ \text{K}$$

$$R = 0,082 \text{ L atm mol}^{-1}\text{K}^{-1}$$

$$\text{Mr HNO}_3 = 63 \text{ gr mol}^{-1}$$

Dit : massa HNO_3 ...?

Penyelesaian:



$$\pi = M \times R \times T (1 + (n-1)\alpha)$$

$$4,14 \text{ atm} = M \times 0,082 \text{ L atm mol}^{-1} \text{K}^{-1} \times 298^\circ \text{K} \times (1 + (2-1)1)$$

$$4,14 \text{ atm} = M \times 48,87 \text{ L atm mol}^{-1}$$

$$M = 4,14 \text{ atm} \times 48,87 \text{ L atm mol}^{-1}$$

1

$$M = 0,0847 \text{ mol L}^{-1}$$

$$M = nV$$

$$n = M \times V$$

$$n = 0,0847 \text{ mol L}^{-1} \times 0,5 \text{ L}$$

$$n = 0,0424 \text{ mol}$$

$$n = \frac{\text{gr}}{M_r}$$

$$\text{gr} = n \times M_r$$

$$\text{gr} = 0,0424 \text{ mol} \times 63 \text{ gr mol}^{-1}$$

$$\text{gr} = \mathbf{2,67 \text{ gram}}$$

15. Dik : $\pi = 1,24 \text{ atm}$

$$V = 500 \text{ mL} = 0,5 \text{ L}$$

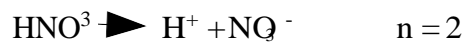
$$M = 0,0254 \text{ mol L}^{-1}$$

$$R = 0,082 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

$$M_r \text{ HNO}_3 = 63 \text{ gr mol}^{-1}$$

Dit : massa HNO_3 ...?

Penyelesaian:



$$\alpha = 1$$

$$\pi = M \times R \times T (1 + (n-1)\alpha)$$

$$1,24 \text{ atm} = 0,0254 \text{ mol L}^{-1} \times 0,082 \text{ L atm mol}^{-1} \text{ K}^{-1} \times T \times (1 + (2-1)1)$$

$$1,24 \text{ atm} = M \times 48,87 \text{ L atm mol}^{-1}$$

$$T = 1,24 \text{ atm} \times 0,0042 \text{ atm K}^{-1} = \mathbf{295^\circ \text{ K}}$$