Calculating K+ Concentration in Solution

https://gemini.google.com/app/0537adcf5d509a54

Response: Here is the step-by-step solution to the problem:

1. Molar Mass of KBr

$$\text{Molar mass of KBr} = 39 + 80 = 119 \text{ g mol}^{-1}$$

2. Moles of K^+ Ions

$$\text{Moles of KBr} = \frac{0.0119 \text{ g}}{119 \text{ g mol}^{-1}} = 1.0 \times 10^{-4} \text{ mol}$$

Since 1 mol of KBr dissociates into 1 mol of K^+:

$$\text{Moles of } \mathrm{K}^+ = 1.0 \times 10^{-4} \text{ mol}$$

3. Concentration of K^+ in mol dm^{-3}

The volume of the solution is $500.0 \text{ cm}^3 = 0.500 \text{ dm}^3$.

$$\text{Concentration} = \frac{\text{moles}}{\text{volume in dm}^3} = \frac{1.0 \times 10^{-4} \text{ mol}}{0.500 \text{ dm}^3} = \mathbf{2.0 \times 10^{-4}} \text{ mol dm}^{-3}$$

4. Concentration of K^+ in ppm (mg kg^{-1})

- **Mass of K^+ ions:**

$$\text{Mass of } \mathrm{K}^+ = 1.0 \times 10^{-4} \text{ mol} \times 39 \text{ g mol}^{-1} = 3.9 \times 10^{-3} \text{ g} = 3.9 \text{ mg}$$

- **Mass of the solution:**

$$\text{Mass of solution} = \text{Density} \times \text{Volume} = 1.00 \text{ kg dm}^{-3} \times 0.500 \text{ dm}^3 = 0.500 \text{ kg}$$

- **Concentration in ppm:**

$$\text{ppm} = \frac{\text{Mass of } \mathrm{K}^+ \text{ (mg)}}{\text{Mass of solution (kg)}} = \frac{3.9 \text{ mg}}{0.500 \text{ kg}} = \mathbf{7.8} \text{ mg kg}^{-1}$$

Conclusion

- mol dm^{-3}: 2.0×10^{-4}
- ppm (mg kg^{-1}): 7.8

Correct Option: (5)
