1) What is the final molal concentration of ethanol if 10 g of 40% (w/w) ethanol (C₂H₆O) solution in water was diluted with 20 mL water?

   a) 0.20 m  
   b) 4.60 m  
   c) 4.35 m  
   d) 0.61 m  
   e) 3.34 m  

   Solution: We have 4 g of ethanol (Mₘ = 46 g/mol), which makes 0.087 moles. This is dissolved in 26 g of water. The molality of this solution is 3.34 m.

2) Calculate the amount of solid anhydrous magnesium chloride that is needed to make 250 mL of solution where Mg⁺⁺ concentration is 0.02 M

   a) 1.19 g  
   b) 0.29 g  
   c) 19.0 g  
   d) 0.48 g  
   e) 0.05 g  

   Solution: The required mass can be found as
   \[ X = M_w [g/mol] \times C [mol/L] \times V [L] = \]
   \[ 95.2 \text{ [g/mol]} \times 0.02 \text{ [mol/L]} \times 0.25 \text{ [L]} = 0.48 \text{ g} \]
3) Which of the following aqueous solutions shows the highest osmotic pressure?

a) 0.004 g NaCl dissolved to make 10 mL of solution
   \[6.8 \cdot 10^{-5} \text{ moles in 10 mL} \Rightarrow 6.8 \text{ mM NaCl, } i = 2; \text{ thus} \]
   \[0.014 \text{ moles/L of ions}\]

b) 0.0095 g urea (NH2-CO-NH2) dissolved to make 20 mL of solution
   \[1.58 \cdot 10^{-4} \text{ moles in 20 mL} \Rightarrow \]
   \[0.008 \text{ moles/L (} i = 1 \text{)}\]

c) 10 g 0.7% (w/w) urea (NH2-CO-NH2) diluted to make 50 mL
   \[0.07 \text{ g, or } 1.2 \cdot 10^{-3} \text{ moles in 50 mL} \Rightarrow \]
   \[0.024 \text{ moles/L}\]

d) 0.015% (w/vol) solution of KCl
   \[0.015 \text{ g in 100 mL is } 0.15 \text{ g/L} \Rightarrow 2 \text{ mM KCl, } i = 2; \]
   \[0.004 \text{ moles/L of ions}\]

e) 200 \mu M solution of oxygen
   \[200 \cdot 10^{-6} \text{ moles/L} = \]
   \[0.0002 \text{ moles/L}\]