### Question: A titration was carried out by adding hydrobromic acid, HBr, to 20.0 mL of aqueous methylamine, CH₃NH₂, solution. 

The equation for the reaction is: CH₃NH₂ + HBr → CH₃NH₃⁺ + Br⁻  

Kₐ(CH₃NH₃⁺) = 2.29 × 10⁻¹¹  

Kₜₐₜₜ = 1.00 × 10⁻¹⁴  

The aqueous methylamine, CH₃NH₂, solution has a pH of 11.8 before any HBr is added. Show by calculation that the concentration of this solution is 0.0912 mol L⁻¹.

### Answer

1. Determine if starting solution is acid or base (will it accept or donate H⁺) – strong or weak
   
   CH₃NH₂ is a weak base  
   pH = 11.8  
   Kₐ(CH₃NH₃⁺) = 2.29 × 10⁻¹¹

2. Calculate [H₃O⁺]  
   [H₃O⁺] = 10⁻pH  
   [H₃O⁺] = 10⁻¹¹.8  
   [H₃O⁺] = 1.58 × 10⁻¹² mol L⁻¹

3. Write out Kₐ expression  
   Kₐ = [base][H₃O⁺]  
   [conj acid]  
   Kₐ = [CH₃NH₃⁺][H₃O⁺]  
   [CH₃NH₂⁺]

   And  
   Kₐ = [CH₃NH₃⁺][H₃O⁺]  
   [OH⁻]

4. Rearrange to calculate [CH₃NH₂]  
   [CH₃NH₂] = Kₐ × Kₜₐₜₜ  
   [H₃O⁺]²

   Assumptions: [base] = [H₃O⁺]  
   [OH⁻] = Kₜₐₜₜ / [H₃O⁺]  

   [CH₃NH₂] = 2.29 × 10⁻¹¹ × 1.00 × 10⁻¹⁴  
   (1.58 × 10⁻¹² mol L⁻¹)²

   3sgf and units  
   [CH₃NH₂] = 0.0912 mol L⁻¹

**Note:** The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.