

**Marks**  
**4**

- The ocean contains a variety of forms of  $\text{CO}_3^{2-}$  and  $\text{CO}_2$  with a variety of acid-base and solubility equilibria determining their concentrations. There is concern that increasing levels of  $\text{CO}_2$  will lead to increased dissolution of  $\text{CaCO}_3$  and critically affect the survival of life forms that rely on a carbonaceous skeleton.

Calculate the concentrations of  $\text{Ca}^{2+}$  and  $\text{CO}_3^{2-}$  in a saturated solution of  $\text{CaCO}_3$ . (The  $K_{\text{sp}}$  of  $\text{CaCO}_3$  is  $3.3 \times 10^{-9}$ .)

 $[\text{Ca}^{2+}] =$  $[\text{CO}_3^{2-}] =$ 

Calculate the pH of such a solution. (The  $\text{p}K_{\text{a}}$  of  $\text{HCO}_3^-$  is 10.33).

pH =

**THIS QUESTION CONTINUES ON THE NEXT PAGE**