

91392



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## Level 3 Chemistry, 2015

### 91392 Demonstrate understanding of equilibrium principles in aqueous systems

2.00 p.m. Wednesday 11 November 2015

Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of equilibrium principles in aqueous systems.	Demonstrate in-depth understanding of equilibrium principles in aqueous systems.	Demonstrate comprehensive understanding of equilibrium principles in aqueous systems.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

A periodic table is provided on the Resource Sheet L3-CHEMR.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

TOTAL

ASSESSOR'S USE ONLY





**QUESTION TWO**

Sufficient calcium carbonate,  $\text{CaCO}_3(s)$ , is dissolved in water to make a saturated solution.

- (a) (i) Write the equation for the equilibrium occurring in a saturated solution of  $\text{CaCO}_3$ .

- (ii) Write the expression for  $K_s(\text{CaCO}_3)$ .

- (iii) Calculate the solubility product of  $\text{CaCO}_3$ ,  $K_s(\text{CaCO}_3)$ .

The solubility of  $\text{CaCO}_3$  is  $5.74 \times 10^{-5} \text{ mol L}^{-1}$ .

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- (b) Some marine animals use calcium carbonate to form their shells. Increased acidification of the oceans poses a problem for the survival of these marine animals.

Explain why the solubility of  $\text{CaCO}_3$  is higher in an acidic solution.

Use an equation to support your explanation.

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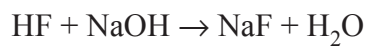
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### QUESTION THREE

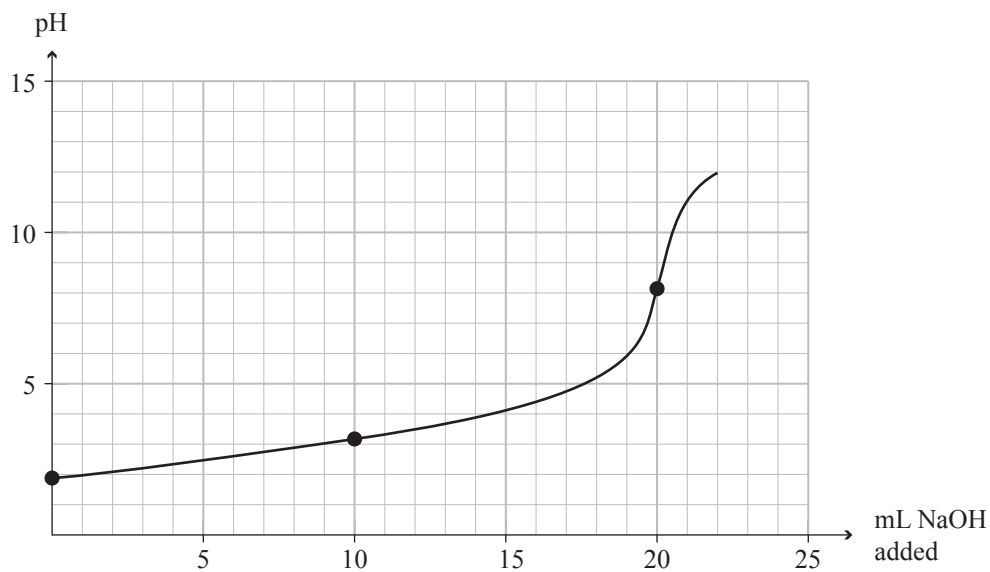
20.0 mL of 0.258 mol L<sup>-1</sup> hydrofluoric acid, HF, solution is titrated with a sodium hydroxide, NaOH, solution.

The equation for the reaction is:



$$\text{p}K_{\text{a}}(\text{HF}) = 3.17$$

The titration curve is given below:



- (a) (i) Identify the species in solution at the equivalence point.

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- (ii) Explain why the pH at the equivalence point is greater than 7.

Include an equation in your answer.

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