

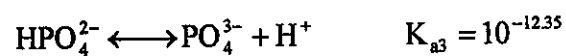
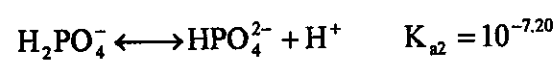
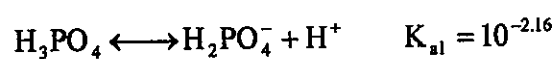
1. Trinitrotoluene (TNT),  $C_7H_5N_3O_6$ , combines explosively with oxygen to produce  $CO_2$ , water, and  $N_2$ . Write a balanced chemical equation for the reaction and calculate the grams of oxygen required for the complete combustion of 100 g of TNT. (10 points)

2. One of the consequences of increased  $CO_2$  in the atmosphere is ocean acidification.

(a) List all chemical reactions leading to this phenomenon and explain in detail how this process proceeds (10 points)

(b) Explain in detail why greenhouse gases such as  $CO_2$  can cause an increase of global temperature (10 points)

3. The deprotonation reactions of phosphoric acid ( $H_3PO_4$ ) can be described by the following equations:



(a) Determine the fraction of  $[HPO_4^{2-}]$  in the total phosphoric acid ( $[H_3PO_4] + [H_2PO_4^-] + [HPO_4^{2-}] + [PO_4^{3-}]$ ) in terms of pH and  $pK_a$  (10 points)

(b) Determine the fraction of  $[HPO_4^{2-}]$  at pH 7.0. (10 points)

4. Please explain the difference between "aerobic respiration" and "anaerobic respiration"? (15 points)

5. Define "coliform groups" and explain why it is important to public health? (15 points)

6. When microbes facing starvation, many physical changes will happen to withstand the stress and to increase chance of survival. Please list possible changes. (20 points)

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