12 Chemistry Acid-Base Revision

1. In which one of the following reactions is the hydrogen carbonate (bicarbonate) ion acting as an acid?

   a) $HCO_3^- + H_3O^+ \rightarrow CO_2 + 2H_2O$
   b) $HCO_3^- + H_2O \rightarrow H_2CO_3 + OH^-$
   c) $HCO_3^- + HSO_4^- \rightarrow H_2CO_3 + SO_4^{2-}$
   d) $HCO_3^- + PO_4^{3-} \rightarrow CO_3^{2-} + HPO_4^{2-}$
   e) $HCO_3^- + CH_3COOH \rightarrow H_2O + CO_2 + CH_3COO^-$

2. The reaction: $HClO_4 + CH_3COO^- \rightarrow CH_3COOH + ClO_4^-$ occurs because:

   a) CH_3COOH is a stronger acid than $HClO_4$
   b) $HClO_4$ is a stronger acid than CH_3COOH
   c) CH_3COOH is a weaker acid than CH_3COO^-
   d) $HClO_4$ is a weaker acid than CH_3COOH
   e) The statement in the question is false as the reaction does not occur in the direction shown.

3. An unknown solid acid is to be analysed by the usual method of addition of a weighed amount to a conical flask and titration.
   Which of sentences a) to e) would you expect to find in the detailed instructions for the exercise?

   a) Dry the conical flask thoroughly before commencing work.
   b) Read the burette to the nearest 0.1 mL.
   c) Add a few drops of phenolphthalein to the conical flask.
   d) As the alkali is pure, standard acid is not needed.
   e) The burette should be filled exactly to the zero mark.

4. The hydrochloric acid concentration in the gastric juice of a patient with an ulcer is 0.09M. What volume of medicine which contains 0.3 mole of aluminium hydroxide in suspension per litre must the patient take each day to neutralise the 2 litres of gastric juice produced each day?

   a) 200 mL
   b) 300 mL
   c) 600 mL
   d) 3333 mL
   e) 5000 mL

5. The oxide of phosphorus P_4O_{10} is said to be an acidic oxide. Why is this?

   a) Because it reacts with H^+ and not OH^-
   b) Because it reacts with OH^- and not H^+
   c) Because it is formed by burning phosphorus in air
   d) Because it cannot be formed by burning phosphorus in air
   e) Because the only basic oxides are those of the group I and group II elements: all other oxides are acidic

6. Sodium carbonate is the most common alkali in chemical industry.
It is basic because

a) the carbonate ion is hydrolysed by water forming bicarbonate ion.
b) the sodium ion is always associated with bases because it occurs in sodium hydroxide.
c) it contains sodium hydroxide as an impurity.
d) the ionisation constant of carbonic acid is smaller than that of water.
e) it has a low solubility product.

7. Which of the following equations represents a reaction in which water acts as an acid?

a) $CH_3COOH + H_2O \rightarrow CH_3CO_2^- + H_3O^+$
b) $NH_3 + H_2O \rightarrow NH_4^+ + OH^-$
c) $Zn^{2+} + 4H_2O \rightarrow Zn(H_2O)_4^{2+}$
d) $NaOH(s) \rightarrow Na^+(aq) + OH^-(aq)$
e) None of these

8. Which of the following statements is FALSE?

a) The pH of a solution of a strong acid is less than the pH of an equimolar solution of a weak acid.
b) The pH of a solution of a strong base is more than the pH of an equimolar solution of a weak base.
c) Weak acids and weak bases do not react with each other.
d) It is possible for water to act either as an acid or as a base.
e) When an acid and a base react the products consist of a new acid and a new base.

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ANSWERS

1. d
2. b
3. c
4. a
5. b
6. a
7. b
8. c