

**Q1.**

Values of the ionic product of water ( $K_w$ ) at different temperatures are given.

$$K_w = 6.40 \times 10^{-15} \text{ mol}^2 \text{ dm}^{-6} \text{ at } 18^\circ \text{C}$$

$$K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6} \text{ at } 25^\circ \text{C}$$

Which statement is correct?

**A** The concentration of hydroxide ions in water at  $18^\circ \text{C}$  is  $8.00 \times 10^{-8} \text{ mol dm}^{-3}$

☐

**B** The dissociation of water into ions is an exothermic process.

☐

**C** The pH of water is the same at  $25^\circ \text{C}$  and at  $18^\circ \text{C}$

☐

**D** Water becomes less acidic as the temperature is raised.

☐

(Total 1 mark)

**Q2.**

Which species can behave as a Brønsted–Lowry acid in aqueous solution?

**A**  $\text{SO}_4^{2-}$

☐

**B**  $\text{HCO}_3^-$

☐

**C**  $\text{BF}_3$

☐

**D**  $\text{NH}_3$

☐

(Total 1 mark)

**Q3.**

Which change causes the pH of  $10 \text{ cm}^3$  of  $1.0 \text{ mol dm}^{-3}$  NaOH to be halved at  $298 \text{ K}$ ?

$$K_w = 1.0 \times 10^{-14} \text{ at } 298 \text{ K}$$

**A** adding  $10 \text{ cm}^3$  of water

☐

**B** adding  $10 \text{ dm}^3$  of water

☐

**C** adding  $5 \text{ cm}^3$  of  $1.0 \text{ mol dm}^{-3}$  HCl

☐

**D** adding  $10 \text{ cm}^3$  of  $1.0 \text{ mol dm}^{-3}$  HCl

☐

(Total 1 mark)

**Q4.**

A  $0.100 \text{ mol dm}^{-3}$  solution of a weak acid has  $\text{pH} = 2.50$

What is the value of  $K_a$  for this acid, in  $\text{mol dm}^{-3}$ ?

**A**  $3.16 \times 10^{-2}$

☐

**B**  $3.16 \times 10^{-3}$

☐

**C**  $1.00 \times 10^{-4}$

☐

**D**  $1.00 \times 10^{-5}$

☐

(Total 1 mark)

**Q5.**

Equal volumes of pairs of solutions are mixed.

Which pair forms a buffer solution?

**A** ammonia and ammonium chloride

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**B** ammonia and methylamine

☐

**C** ethanoic acid and methanoic acid

☐

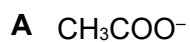
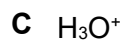
**D** hydrochloric acid and sodium hydroxide

☐

(Total 1 mark)

**Q6.**

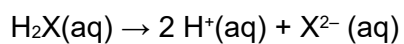
Which can **not** function as a Brønsted-Lowry acid?

☐☐☐☐

(Total 1 mark)

**Q7.**

A strong acid  $\text{H}_2\text{X}$  dissociates in aqueous solution.



What is the pH of a  $0.020 \text{ mol dm}^{-3}$  solution of this acid?

**A** 1.00

☐

**B** 1.40

☐

**C** 1.70

☐

**D** 2.00

☐

(Total 1 mark)

**Q8.**

Equal volumes of two solutions, each with the same concentration, are mixed together at 298 K

Which two solutions, when mixed, form a solution with a  $\text{pH} > 7$ ?

**A**  $\text{HCOOH}$  and  $\text{HCOOK}$

☐

**B**  $\text{KOH}$  and  $\text{CH}_3\text{COOH}$

☐

**C**  $\text{NH}_3$  and  $\text{HCl}$

☐

**D**  $\text{NH}_4\text{Cl}$  and  $\text{KCl}$

☐

(Total 1 mark)