

TOPIC 12 ANSWERS TO EXERCISES

Topic 12 Exercise 1

- acid
 - base
 - both
 - acid
 - both
 - acid
 - both
 - both
 - both
 - both
 - base
 - both
- H₂O
 - HClO₄
 - HSO₄⁻
 - H₃O⁺
- HCO₃⁻ (acid) and CO₃²⁻ (base), H₂O (base) and H₃O⁺ (acid)
 - HCO₃⁻ (base) and CO₂ + H₂O (acid), H₃O⁺ (acid) and H₂O (base)
 - H₂SO₄ (acid) and HSO₄⁻ (base), HNO₃ (base) and NO₂⁺ + H₂O (acid)
 - HSO₄⁻ (acid) and SO₄²⁻ (base), OH⁻ (base) and H₂O (acid)

Topic 12 Exercise 2

- 3.00
 - 11.30
 - 2.60
 - 4.89
 - 1.65
 - 12.60
- 1.0 x 10⁻³ moldm⁻³
 - 6.3 x 10⁻³ moldm⁻³
 - 1.0 x 10⁻³ moldm⁻³
- 2.0 x 10⁻⁵ moldm⁻³
- 76

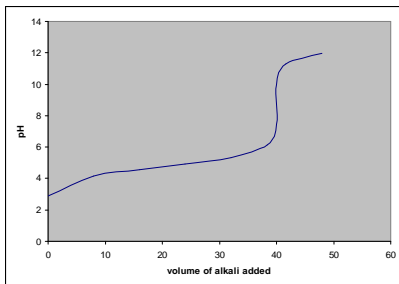
Topic 12 Exercise 3

- resists large pH change on addition of small amounts of acid or alkali
 - 4.60
 - $$\text{CH}_3\text{CH}_2\text{COOH} + \text{OH}^- \rightarrow \text{CH}_3\text{CH}_2\text{COO}^- + \text{H}_2\text{O}$$

$$\text{CH}_3\text{CH}_2\text{COO}^- + \text{H}^+ \rightarrow \text{CH}_3\text{CH}_2\text{COOH}$$
 - 4.84
 - 4.30
 - 12.30
 - the buffer solution restricts the pH change to 0.24 units, but the water changes its pH by 5.30 units (from 7 to 12.3).
- 2.85
 - 3.33 g
 - 4.41
 - 4.77
- 8.65
- salt: acid ratio 1.58:1
- 10.21
 - 10.01
 - 10.54
 - 13.00
 - buffering capacity has been exceeded, so cannot resist change in pH.

Topic 12 Exercise 4

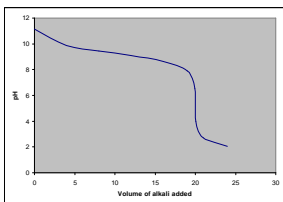
1. a) i) 2.37 ii) 3.27 iii) 3.74 iv) 4.22 v) 11.85
 b)



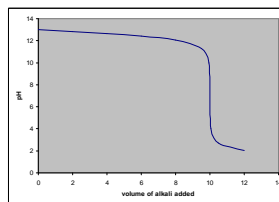
- c) the salt produced is sodium methanoate, and the methanoate ion is basic:
 $\text{HCOO}^- + \text{H}_2\text{O} \rightarrow \text{HCOOH} + \text{OH}^-$

2. a) 1.70 b) 12.30

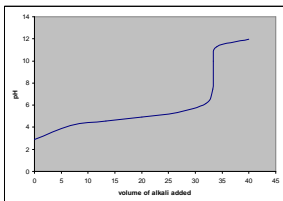
3. a)



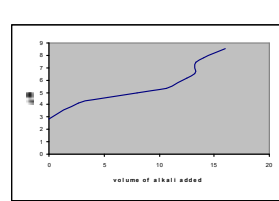
- b)



- c)



- d)



4. a) methyl red, as it will change colour completely within the pH range (4 – 7), over which the equivalence point occurs
 b) both, as they will both change colour completely within the pH range (4 – 10), over which the equivalence point occurs
 c) phenolphthalein, as it will change colour completely within the pH range (7 – 10), over which the equivalence point occurs
 d) neither, as there is no sharp pH change at the equivalence point of this titration, so indicators will not change colour sharply