Revision Quiz (Quantitative methods of analysis)

Section A: Multiple-choice

Questions 1 and 2 refer to the analysis of hydrated barium chloride ($BaCl_2 \bullet 2H_2O$) using Mohr's method.

1. What is the indicator used in the Mohr's method?
   A. Starch solution
   B. Methyl orange
   C. Phenolphthalein
   D. Potassium chromate

2. What is the volume of 0.25 M $AgNO_3$ required to titrate with a solution containing 0.568 g of $BaCl_2 \bullet 2H_2O$?
   (Relative atomic masses: H = 1.0, O = 35.5, Cl = 35.5, Ba = 137.3)
   A. 9.30 cm^3
   B. 18.6 cm^3
   C. 27.9 cm^3
   D. 37.2 cm^3

3. Which of the following combinations about the methods used to detect the end point of titration are correct?

	Titration	***Method used***
(1)	HCOOH against NaOH	Using phenolphthalein
(2)	I_2 against $Na_2S_2O_3$	Using starch solution
(3)	$FeSO_4$ against $KMnO_4/H^+$	Measuring the change in pH of the reaction mixture

   A. (1) and (2) only
   B. (1) and (3) only
   C. (2) and (3) only
   D. (1), (2) and (3)

4. 0.05 M of $KMnO_4$ was titrated with 25.0 cm^3 of 0.2 M $FeSO_4$ in the presence of excess acid. What is the volume of $KMnO_4$ required for complete reaction?
   A. 10.0 cm^3
   B. 15.0 cm^3
   C. 20.0 cm^3
   D. 40.0 cm^3

5. 30.0 cm^3 of 0.1 M Na_2SO_3 reduces 0.002 mol of XO_4^-. The oxidization number of *X* decreases from +7 to
   A. +1.
   B. +2.
   C. +3.
   D. +4.

Questions 6 and 7 refer to the following experiment. The molarity of a sodium hydroxide solution is found by titrating with standard hydrochloric acid, using methyl orange as the indicator. 25.0 cm^3 of sodium hydroxide solution required 27.90 cm^3 of 0.050 *M* hydrochloric acid for complete reaction.

6. What is the colour change at the end point of the titration?
   A. From red to orange
   B. From yellow to orange
   C. From pink to colourless
   D. From colourless to very pale pink

7. What is the molarity of sodium hydroxide solution?
   A. 0.005 M
   B. 0.028 M
   C. 0.056 M
   D. 0.112 M

8. Which of the following statements about permanganate index is INCORRECT?
   A. The index shows the amount of potassium permanganate required to react with all oxidizable matters in a water sample.
   B. Potassium permanganate acts as an oxidizing agent.
   C. Back titration is involved when determining the permanganate index.
   D. The larger the permanganate index, the better is the quality of water.

Section B: Structured questions

A student performed a titration to determine the concentration of an acidified potassium permanganate solution. 25.0 cm^3 of 0.05 M sodium oxalate solution was titrated against acidified potassium permanganate solution. It required 24.90 cm^3 of potassium permanganate solution for complete reaction.

(a) Draw a labelled set-up for the titration.

(b) State the colour change at the end point of the titration.

(c) Write the ionic equation for the reaction involved in this titration.

(d) Calculate the concentration of potassium permanganate solution.

(e) The student found that the reaction proceeded slowly at room temperature. He suggested heating up the reaction mixture when performing the titration. However, his teacher did not agree with his suggestion. Explain why.

The End

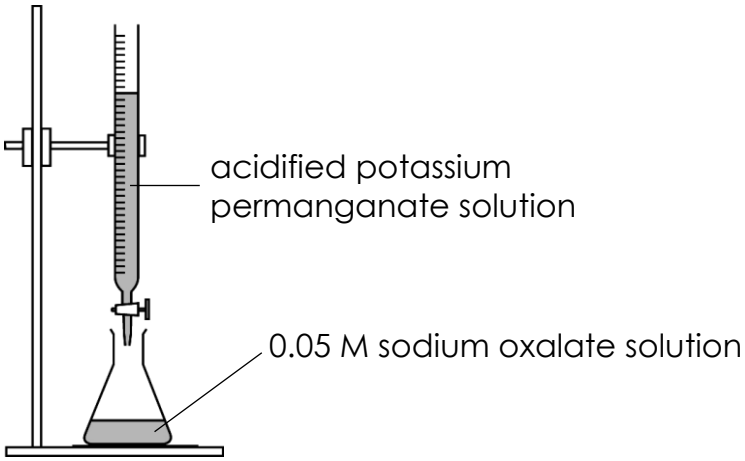
Suggested Answer

Section A:

1.	D	5.	D
2.	B	6.	B
3.	A	7.	C
4.	C	8.	D

Section B:

(a)



(b) The reaction mixture changed from colourless to <u>pale purple</u> (<u>pale pink</u>).

(c) $2MnO_4^-(aq) + 5C_2O_4^{2-}(aq) + 16H^+(aq) \longrightarrow 2Mn^{2+}(aq) + 10CO_2(g) + 8H_2O(l)$

(d) Number of moles of $C_2O_4^{2-}$
= 0.05 x 0.025
= 0.00125

Number of moles of MnO_4^-
= 0.00125 x 2 / 5
= 5.0×10^{-4}

Concentration of MnO_4^-
= 5.0×10^{-4} / 0.0249
= 0.020 M

(e) Oxalate ions decompose at high temperatures.