Acid/base titrations 2012

NAME: _____

Indicator	Colour		pH range of indicator
	Acid	Base	
Methyl violet	yellow	violet	0.0–1.6
Methyl orange	red	yellow	3.2–4.4
Litmus	red	blue	5.0–8.0
Bromothymol blue	yellow	blue	6.0–7.6
Phenol red	yellow	red	6.6–8.0
Phenolphthalein	colourless	pink	8.2–10.0
Alizarin yellow	yellow	red	11.1–12.0

1. What is a primary standard? solution
   accurately known concentration ✓

   (2 marks)
   1

2. Distinguish between end point and end point.

   ✓ end point = colour change
   ✓ equivalence point = equimolar amounts, correct stoichiomet amount

   (2 marks)

3. Give three characteristic of a primary standard.

   a. high degree of purity
   Known formula
   Stable
   b. relatively high molar mas ✓✓✓

   a.

   (3 marks)

4. Two students are arguing over part of an experimental procedure.
   a. One claims that the volumetric flask into which the primary standard is to be placed must be dry before use. The other claims that as long as the flask has been thoroughly rinsed with distilled water, it doesn't need to be dry. How would you resolve this argument?

No difference whether dry or not — number of moles of primary standard added is fixed.

(2 marks)

   b. Later, these same two students argue over whether the conical flask into which the aliquot of a solution of known concentration is added needs to be dry. One states that it must be because any water in the flask would alter the concentration of the material dissolved in the aliquot. The other claims that the presence of water won't make a difference to the final titre. Both students are correct so how do you resolve this argument?

No difference because amount added from pipette is known (measured amount already added)

(2 marks)

5. A student trying to determine the amount of ethanoic acid in vinegar titrated the vinegar against a standard sodium hydroxide solution.

$$CH_3COOH + OH^- \text{<===>} CH_3COO^- + H_2O$$

The following method was recorded down in the student's laboratory notebook.

I. The pipette was rinsed with water and then used to transfer 20.00 mL of the standard sodium hydroxide solution to a conical flask. Three drops of methyl orange were added to the flask to produce a yellow coloured solution.

II. The acetic acid was added to the flask from the burette until the colour of the solution changed from yellow to red. The volume on the burette was recorded and the moles of ethanoic acid calculated.

The experimental report then goes on to detail the steps in the calculation of the concentration of the acid from this result.
This student has made several mistakes in this procedure.

a. Identify these mistakes,
b. and the effect each would have on the calculated amount of ethanoic acid in the vinegar solution.

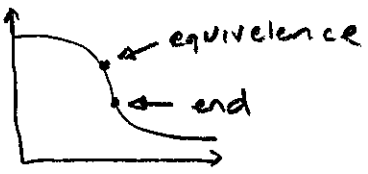
(a) ① rinsing pipette with water, ② use of methyl orange

③ ③ No Record initial Volume Burrette

④ No Pre-Rinse Burrette, ⑤ Record averge

(b) ① NaOH is diluted, add less CH_3COOH so appears more concentraked.

②



equivelence before end point, add more CH_3COOH, so appears weaker (less concentrated)

(6 marks)

6. A student wished to determine the amount of ammonia in a cleaning agent by carrying out the following titration. The diluted ammonia solution was titrated against a standardized HCl solution incorrectly using phenolphthalein as the indicator. The HCl was in the burette.

$$NH_3 + H_3O^+ \text{ <===> } NH_4^+ + H_2O$$

a. What effect does this error have on the calculated concentration of Ammonia?

NH_3 lower ✓

(1mark)

b. Explain your answer to a.

end point before equivalence, ✓ add less HCl ✓

∴ NH_3 appears less concentrated

(2marks)

a. What indicator would be more appropriate to use in the titration? Explain why. Use equations.

Methyl orange, perhaps litmus. ✓

Salt solution produced contains NH_4^+ - acidic ✓

$NH_4^+ + H_2O \rightleftharpoons NH_3 + H_3O^+$ ✓

(2marks)

3

END OF TEST