Unit 1 · Volumetric Analysis

WORKSHEET

Full marks 33

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 33

1 Key words [4]

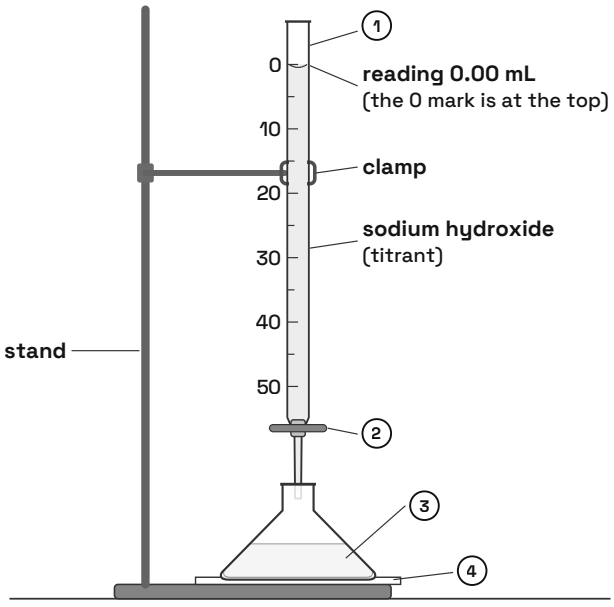
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

analyte	**deliquescent**	**end point**	**equivalence point**	**molality**	**molarity**	**normality**
primary standard	**self-indicator**	**titrant**				

The substance whose amount is being measured in an analysis is the _____. The standard solution run in from the burette in a titration is the _____. The point at which just enough titrant has been added to react with all the analyte is the _____, and the point at which the indicator changes color is the _____. A pure, stable, non-hygroscopic substance whose solution can be made exactly by weighing is a _____. The number of moles of solute in one kilogram of solvent is the _____, and the number of gram equivalents of solute in one liter of solution is the _____. Potassium permanganate needs no other indicator in a titration, because it is a _____.

2 Label the diagram [2]

The diagram shows a titration set up on the bench. Write the names of the parts 1 to 4. Each carries 0.5 mark.



1. _____ 2. _____

3. _____ 4. _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The n-factor of potassium permanganate in a neutral or weakly alkaline medium, where it is reduced to MnO_2, is: [1]

a. 1 **b.** 2

c. 3 **d.** 5

ii. Which of these measures of concentration does not change with temperature? [1]

a. molarity **b.** normality

c. % w/v **d.** molality

iii. What is the equivalent weight of potassium carbonate, K_2CO_3, as a salt? (K = 39, C = 12, O = 16) [1]

a. 138 **b.** 69

c. 46 **d.** 34.5

iv. What volume of 0.20 N sodium hydroxide exactly neutralizes 15 mL of 0.10 M sulphuric acid? [1]

a. 7.5 mL **b.** 15 mL

c. 30 mL **d.** 3.0 mL

v. In an iodometric titration, the iodine set free is titrated with sodium thiosulphate. The indicator used is: [1]

a. phenolphthalein **b.** methyl orange

c. starch **d.** potassium permanganate

4 Short answers [7]

Write short answers to the following questions.

a. Distinguish the end point from the equivalence point of a titration. What is the titration error? [2]

b. Why can't sodium hydroxide be used as a primary standard? How is the exact strength of a sodium hydroxide solution found? [2]

c. Find the equivalent weight of: a. aluminium hydroxide, $Al(OH)_3$, as a base; b. sodium phosphate, Na_3PO_4, as a salt; c. tin(II) chloride, $SnCl_2$, as a reducing agent that becomes $SnCl_4$. (H = 1, O = 16, Na = 23, Al = 27, P = 31, Cl = 35.5, Sn = 119) **[3]**

5 Long answer **[4]**

Write a long answer to the following question.

What is permanganometry? Why is potassium permanganate called a self-indicator? Why is its solution always standardized before use, and why is dilute sulphuric acid, not hydrochloric acid, used with it? Write the balanced ionic equation for its reaction with iron(II) ions.

6 Numerical problems **[8]**

Solve the following problems. Show your working. Take H = 1, C = 12, O = 16, Na = 23, Cl = 35.5, Fe = 56.

a. 2.65 g of anhydrous sodium carbonate is dissolved in water and made up to 250 mL in a volumetric flask. **[4]**

i. Find the normality of the solution.
ii. Find its molarity.
iii. 20.0 mL of this solution is exactly neutralized by 16.0 mL of hydrochloric acid. Find the normality of the acid.
iv. Find the concentration of the acid in g/L.

Answer:

b. 20.0 mL of an iron(II) sulphate solution, acidified with dilute sulphuric acid, needs 15.0 mL of 0.0150 M potassium dichromate to reach the end point. **[4]**

$Cr_2O_7^{2-} + 14\,H^+ + 6\,Fe^{2+} \rightarrow 2\,Cr^{3+} + 6\,Fe^{3+} + 7\,H_2O$

i. Find the moles of dichromate used.

ii. Find the molarity of the iron(II) solution.

iii. Find the mass of iron(II) ions in one liter of it.

iv. Find the normality of the potassium dichromate solution.

Answer: _____

7 Think [3]

Two students titrate the same hydrochloric acid against the same standard sodium hydroxide. Sita rinses her burette with distilled water just before filling it with the alkali. Manish leaves his conical flask wet with distilled water before pipetting the acid into it. Will either student's result for the acid's concentration be wrong? Explain.

8 Activity: Concordant readings (not marked)

In the laboratory, with goggles on, titrate 25.0 mL of dilute hydrochloric acid with a few drops of phenolphthalein against standard sodium hydroxide from a burette. Do one rough titration, then careful ones until two agree. Read the burette at the bottom of the meniscus, to the nearest 0.05 mL.

Titration	Initial reading (mL)	Final reading (mL)	Volume used (mL)
Rough			
1			
2			
3			

Which readings will you average, and what is the acid's normality?