Analysis of brick cleaner

Purpose

To find the percentage, by mass, of hydrogen chloride (present as hydrochloric acid) in brick cleaner.

Materials

- 15 mL brick cleaner
- 100 mL of 0.100 M standard sodium carbonate solution
- 250 mL deionised water
- methyl orange indicator
- phenolphthalein indicator
- 250 mL volumetric flask
- 4 × 100 mL conical flasks
- small funnel
- 10 mL measuring cylinder
- 20 mL pipette
- pipette filler
- dropping pipette
- burette and stand
- white tile
- electronic balance
- safety glasses

Safety

- *Wear safety glasses and a laboratory coat for this experiment.*
- *Brick cleaner contains a high concentration of hydrochloric acid. It can cause severe skin burns and must be handled with care. Mop up spills immediately, washing them away with copious amounts of water.*
- *Methyl orange may cause irritation to the skin and eyes. Avoid contact.*

Procedure

1. Note the hydrogen chloride content of the brick cleaner as specified by the manufacturer.
2. Weigh the 250.0 mL volumetric flask. Record the result.
3. Use a 10 mL measuring cylinder (or a burette set up in the fume hood) to accurately pour 10.0 mL of concentrated brick cleaner into the 250.0mL volumetric flask, avoiding spillages.
4. Reweigh the volumetric flask and its contents. Record the result.
5. Half fill the volumetric flask with deionised water. Stopper the flask and turn it upside down *carefully* several times to mix the solution thoroughly. (THIS IS ALL COMPLETED IN FUME HOOD).
6. Fill the volumetric flask to the mark with more deionised water. Stopper and mix the solution thoroughly.
7. Use a 20 mL pipette to place 20.00 mL aliquots of standard sodium carbonate solution into four 100 mL conical flasks.
8. Add two to three drops of indicator to each conical flask. Set one flask aside to act as a control in colour matching.
9. Rinse the burette and fill with diluted solution of brick cleaner (using small funnel) and record the initial level of the solution in the burette to <u>two decimal places</u>.
10. Titrate the sodium carbonate solution until the end point is reached. Record the final burette reading and calculate the volume of the titre.
11. Repeat the titration until three concordant titres are achieved.

Theory

Brick cleaner contains concentrated hydrochloric acid as the active ingredient. The acid reacts with the basic components of concrete and so enables concrete to be removed from brickwork. To analyse brick cleaner, a sample is diluted (since the original acid is highly concentrated) and titrated against a standard solution of a base, sodium carbonate.

Results.

Mass of empty 250 mL flask volumetric flask (g) _____

Mass of empty volumetric flask and brick cleaner contents (g) _____

Burette reading	Trial 1	Trial 2	Trial 3	Trial 4
Start (mL)				
Finish (mL)				
Total added (mL)				

Average titre (mL) _____

Calculations

i. Write a balanced chemical equation for the reaction between Na_2CO_3 and HCl. Include states. _____

ii. Calculate the amount, in mol, of Na_2CO_3 present in each conical flask.

iii. Calculate the amount, in mol, of HCl present in the average titre.

iv. Calculate the amount, in mol, of HCl present in the volumetric flask

v. Calculate the mass of HCl present in the volumetric flask.

vi. Calculate the concentration of HCl in the sample in % w/w.

vii. Calculate the concentration of HCl in the sample in:
- %w/v

- mol/L

Questions

1. **State 2 possible sources of error, based on the procedure used, other than human mistakes that could be responsible for significant uncertainty in the final result for the percentage composition.**

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2. **Give two examples of human error (mistakes)**

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3. **Apparatus should be cleaned and rinsed before use. What would you use to rinse the:**
   a) **burette** _____
   b) **conical flask before use?** _____

4. **The volumetric flask was washed and rinsed with pure water. Some of this water remained in the flask when it was weighed in step 2. Explain what effect this would have on the final calculated percentage by mass.**

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5. **Give two reasons why a diluted solution of the brick cleaner was prepared in steps 2 -6 for later use in the titrations.**

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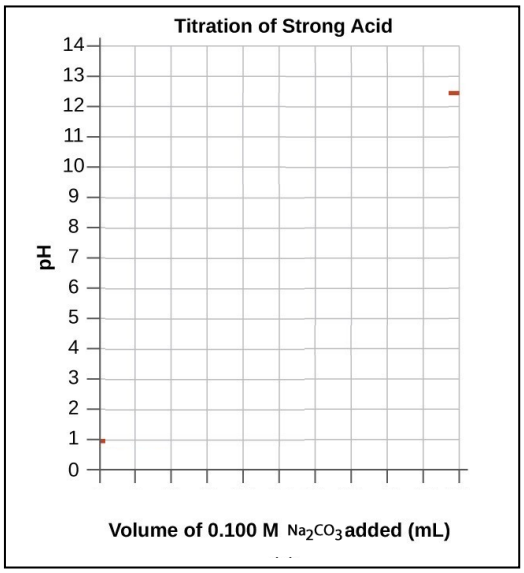
6. **Methyl orange was the chosen indicator. It changes colour at pH = 3.1 to 4.5 but determining the correct colour is difficult. Phenolphthalein indicator has a very distinct colour change from pink in basic solution to clear in acidic solution. The colour change occurs at pH = 8 to 10.**

   a. **Draw a pH curve for the reaction between Na_2CO_3 and HCl in the space provided on the right.**



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b. **Is phenolphthalein a suitable indicator for this titration? Justify your answer with reference to the pH curve drawn as the answer to question a. above and give the appropriate colour change.**

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7. **Differentiate between the terms 'equivalence point' and 'end point' in a volumetric analysis using your experiment to illustrate the difference.**

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8. **Na_2CO_3 is described as a "primary standard" while the Na_2CO_3 solution used in the experiment is said to be a "standard solution"?**
   a. **Explain what these two terms means to clearly show the difference between them?**

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   b. **What three characteristics should a compound have to be considered as a primary standard.**

Solutions use second hand data.