education

Department:
Education
PROVINCE OF KWAZULU-NATAL

KwaZulu-Natal Department of Basic Education

REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES PRACTICAL TEST TERM 2

GRADE 12

MARKS: 40

TIME: 1 Hour

This question paper consists of 5 pages

Surname: _____

Name : _____

Date: _____

Experiment 2

STANDARDIZATION OF SODIUM HYDROXIDE SOLUTION USING A STANDARD OXALIC ACID SOLUTION

Question 1

The following instruction were given to the learners who were performing the experiment. Complete the table by writing your answer in the last column.

PROCEDURE	QUESTION	ANSWER	Marks
1. Preparation of a 100 ml of a $\pm 0{,}2\ mal.dm^{-3}$	Mention one safety precaution for handling the N_aOH		**1**
1.1. Place a small sheet of folded paper (or filter paper) on the mass meter and tare the mass meter to compensate for the mass of the paper. Measure around 0,8 – 0,9 g N_aOH.			
1.2. Dissolve the N_aOH in $100\ ml$ water in a beaker.	Is N_aOH a strong or weak base? Explain.		**1**
2. **Preparation of standard oxalic acid solution.**	What is standard solution?		**1**
2.1. Calculation the formula mass of oxalic acid, $(COOH)_2.2H_2O$	Calculate the formula mass of oxalic acid, $((COOH)_2.2H_2O$		**2**
2.2. Calculate the mass of oxalic acid need $100\ ml$ of a $0{,}1\ mol.dm^{-3}$ oxalic acid solution.	Calculate the mass of oxalic acid needed to prepare $100\ ml$ of a $0{,}1\ mol.dm^{-3}$ acid solution		**3**
2.3. Measure the mass of oxalic acid calculated above correct to one decimal place.	Name the instrument used to measure the mass of oxalic acid.		**1**
2.4. Carefully pour the measured amount of oxalic acid into a $100\ ml$ volumetric flask.	Is oxalic acid a weak or strong acid?		**1**
2.5. Add water to the volumetric flask until it is half full. Close the flask with the stopper and shake the contents to dissolve the oxalic acid. Continue adding water with the wash bottle. VERY SLOWLY AT THE END, until the bottom of the meniscus of the liquid just line up with the.	What is the meniscus?		**1**
3. Fit the burette into the clamp on the retort stand. Use the funnel to pour the			

sodium hydroxide solution into the burette. Place a beaker under the tap of the burette and open the tap just long enough to expel the air in the bottom tube. Fill the burette to the zero mark.			
4. Pipette 25 ml of the standard oxalic acid solution into the Erlenmeyer flask.			
5. Add 2-3 drops of phenolphthalein to the flask and swirl it gently.	What is the function of the indicator, phenolphthalein in this titration?		**1**
6. Place the flask under the tap of the burette. Place a white tile or else a sheet of white of white paper underneath the flask.	Why is the white paper placed underneath the flask?		**1**
7. Slowly run in the sodium hydroxide from the burette, controlling the tap with you left hand while swirling the flask with your right hand. If some of the base is spilled onto the sides of the flask, use the wash bottle to wash it into the solution.	Why should the flask be swirled?		**1**
8. When you get near the end point, add the solution from the burette drop by drop, until the solution just turns a pale pink and hold this colour for approximately 10-15 seconds.	Describe the end point		**1**
9. Close the tap and record the volume of sodium hydroxide used in the table.			
10. Refill the burette to the zero mark and repeat this procedure two more times so that you have three readings in the table. Take the average of these three reading to determine how much sodium hydroxide is needed to neutralize the acid.			

[15]

Question 2 – Results

After the experiment was conducted the results in the table below were obtained

Titration	Volume of oxalic acid (ml)	Volume of sodium hydroxide
1	25	
2	25	
3	25	
Average	25	

INTERPRETATION OF RESULTS

2.1. Write down a balanced equation for the neutralization reaction.

_____ (3)

2.2. How many moles of base will react with one mole of acid?

_____ (1)

2.3. Calculate the number of moles of oxalic acid in the Erlenmeyer flask.

_____

_____

_____

_____ (3)

2.4. Calculate the number of moles of sodium hydroxide needed to neutralize the acid in Erlenmeyer flask.

_____

_____

_____

_____ (2)

2.5. Calculate the concentration of the sodium hydroxide solution.

_____

_____

_____

_____ (3)

[12]

Question 3 – EVALUTION

3.1. List 3 factors that could give rise to experiment error.

_____

_____

_____

_____

_____

_____ (3)

3.2. What is the reason for doing three repetitions for the titration?

_____ (1)

3.3. During the titration, based spilled onto the sides of the flask can be washed into the solution using the wash bottle. Give a reason why addition of water to the measured volume of acid will not influence the results. _____

_____ (2)

3.4. Give a reason why oxalic acid is classified as a weak acid. _____

_____ (2)

3.5. Define the term neutralization

_____

_____ (2)

3.6. Define the term hydrolysis. _____

_____ (1)

3.7. Explain why phenolphthalein ($pHrange\ from\ 7{,}5 - 10{,}5$) is used in this titration

_____

_____

_____

_____ (2)

GRAND TOTAL: [40]

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TERM 2

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MARKING GUIDELINE

Experiment 2

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Question 1

The following instruction were given to the learners who were performing the experiment. Complete the table by writing your answer in the last column.

PROCEDURE	QUESTION	ANSWER	Marks
1. Preparation of a 100 ml of a $\pm 0{,}2\ mal.dm^{-3}$	Mention one safety precaution for handling the N_aOH	***Wear safety gloves to avoid contact with skin.*** √	1
1.1. Place a small sheet of folded paper (or filter paper) on the mass meter and tare the mass meter to compensate for the mass of the paper. Measure around 0,8 – 0,9 g N_aOH.			
1.2. Dissolve the N_aOH in $100\ ml$ water in a beaker.	Is N_aOH a strong or weak base? Explain.	***Strong*** √	1
2. **Preparation of standard oxalic acid solution.**	What is standard solution?	***Standard solution is a solution of known concentration*** √	1
2.1. Calculation the formula mass of oxalic acid, $(COOH)_2.2H_2O$	Calculate the formula mass of oxalic acid, $((COOH)_2.2H_2O$	$(COOH)_2.2H_2O$ $2(12+32+1)+2(18)=126g.mol^{-1}$	2
2.2. Calculate the mass of oxalic acid need $100\ ml$ of a $0{,}1\ mol.dm^{-3}$ oxalic acid solution.	Calculate the mass of oxalic acid needed to prepare $100\ ml$ of a $0{,}1\ mol.dm^{-3}$ acid solution	$c\ \frac{m}{MV}$ √ $m = cMV$ $m = (0,1)(126)(100X10^{-3})$ √ $m = 1,26\ g$ √	3
2.3. Measure the mass of oxalic acid calculated above correct to one decimal place.	Name the instrument used to measure the mass of oxalic acid.	***Mass meter or double beam balance or triple beam balance*** √	1
2.4. Carefully pour the measured amount of oxalic acid into a $100\ ml$ volumetric flask.	Is oxalic acid a weak or strong acid?	***Weak*** √	1
2.5. Add water to the volumetric flask until it is half full. Close the flask with the stopper and shake the contents to dissolve the oxalic acid. Continue adding water with the wash bottle. VERY SLOWLY AT THE END, until the bottom of the meniscus of the liquid just line up with the.	What is the meniscus?	***Meniscus is a curved upper surface of the liquid*** √	1
3. Fit the burette into the clamp on the retort stand. Use the funnel to pour the			

sodium hydroxide solution into the burette. Place a beaker under the tap of the burette and open the tap just long enough to expel the air in the bottom tube. Fill the burette to the zero mark.			
4. Pipette 25 ml of the standard oxalic acid solution into the Erlenmeyer flask.			
5. Add 2-3 drops of phenolphthalein to the flask and swirl it gently.	What is the function of the indicator, phenolphthalein in this titration?	***To determine the equivalent point when two solutions have reached neutralization*** √	**1**
6. Place the flask under the tap of the burette. Place a white tile or else a sheet of white of white paper underneath the flask.	Why is the white paper placed underneath the flask?	***To improve visibility of any colour change during the titration.*** √	**1**
7. Slowly run in the sodium hydroxide from the burette, controlling the tap with you left hand while swirling the flask with your right hand. If some of the base is spilled onto the sides of the flask, use the wash bottle to wash it into the solution.	Why should the flask be swirled?	***In order to ensure that all reagents mix.***	**1**
8. When you get near the end point, add the solution from the burette drop by drop, until the solution just turns a pale pink and hold this colour for approximately 10-15 seconds.	Describe the end point	***The end point is the point where the indicator changes colour.*** √	**1**
9. Close the tap and record the volume of sodium hydroxide used in the table.			
10. Refill the burette to the zero mark and repeat this procedure two more times so that you have three readings in the table. Take the average of these three reading to determine how much sodium hydroxide is needed to neutralize the acid.			

[15]

Question 2 – Results

After the experiment was conducted the results in the table below were obtained

Titration	Volume of oxalic acid (ml)	Volume of sodium hydroxide
1	25	
2	25	
3	25	
Average	25	

INTERPRETATION OF RESULTS

2.1. Write down a balanced equation for the neutralization reaction.

$(COOH)_2 + 2N_aOH \ \surd \rightarrow (COO)_2Na_2 \ \surd \ +2H_2O \quad \surd \quad bal.$ (3)

2.2. How many moles of base will react with one mole of acid?

2 moles $\surd$ (1)

2.3. Calculate the number of moles of oxalic acid in the Erlenmeyer flask.

$na = cV \quad \surd$

$= (0{,}1)(25X10^{-3}) \ \surd$

$= 2{,}5X10^{-3}\ mol \ \surd$

2.4. Calculate the number of moles of sodium hydroxide needed to neutralize the acid in Erlenmeyer flask.

$\frac{n_a}{n_b} = \frac{1}{2} \quad \surd$

$n_b = 2n_a$

$n_b = 2(25X10^{-3})$

$n_a = 5X10^{-3}mol \ \surd$ (2)

2.5. Calculate the concentration of the sodium hydroxide solution.

$C_b = \frac{n_b}{V}$

$\frac{5X10^{-3} \surd}{23{,}5X10^{-3} \ \surd}$

$0{,}21\ mol.dm^{-3} \ \surd$ (3)

[12]

Question 3 – EVALUTION

3.1. List 3 factors that could give rise to experiment error.

- ***Contamination from dirty glassware.***
- ***Oxalic acid solution becoming lump/ forming precipitate.***
- ***Overshooting the mark.***
- ***Volumetric flask calibrate at a specific temperature (e.g. room temperature)***
- ***(Any three)*** √ √ √ (3)

3.2. What is the reason for doing three repetitions for the titration?

Improve accuracy / fair test √ (1)

3.3. During the titration, based spilled onto the sides of the flask can be washed into the solution using the wash bottle. Give a reason why addition of water to the measured volume of acid will not influence the results.

The addition of water does not affect the mole ration of the acid and the base √√ (2)

3.4. Give a reason why oxalic acid is classified as a weak acid.

It ionizes completely in water to form a high concentration of H_3O^+ ***ions*** √ √ (2)

3.5. Define the term neutralization

Reaction of an acid and a base to form a salt and water √ √ (2)

3.6. Define the term hydrolysis.

Reaction of a salt with water √ (1)

3.7. Explain why phenolphthalein ($pHrange\ from\ 7{,}5 - 10{,}5$) is used in this titration

N_aOH ***is a strong base and oxalic acid is a weak acid*** √ . ***The endpoint will be above 7 And therefore phenolphthalein, which changes colour in a range above 7, will be suitable as indicator*** √ (2)

GRAND TOTAL: [40]