NAME:……………………………………………………..…Index No:………………… ……..

Candidate’s Signature…………………………….

Date…………………………………

**CHEMISTRY**

**233/3**

**CHEMISTRY PRACTICAL**

**TIME: 21/4**

**233/3**

**Chemistry**

**Paper 3**

**(PRACTICAL)**

**July - August 2017**

**JULY/AUGUST EXAMINATION**

**FORM FOUR EVALUATION TEST**

**CHEMISTRY PAPER 3**

**INSTRUCTIONS**

* Answer all the questions in the spaces provided in the question paper.
* You are not allowed to start working with the apparatus for the first 15 minutes of the 21/4 hours allowed for this paper.
* All working must be clearly shown where necessary.
* Mathematical table and silent calculator.

|  |  |  |
| --- | --- | --- |
| **Questions** | **Max score** | **Score** |
| 1 | 17 |  |
| 2 | 7 |  |
| 3 | 16 |  |
| Total  | 40 |  |

1. You are provided with:
2. 0.5g of a metal carbonate, X2CO3 labeled solid A
3. Sulphuric (VI) acid solution B
4. Solution C, 1.0M sodium hydroxide

You are required to determine the value of x in the metal carbonate x2 CO3

**PROCEDURE 1**

Fill the burette with sulphuric (VI) acid, solution B. pipette 25.0cm3 of solution C and place into a conical flask. Add 3 drops of phenolphthalein indicator. Titrate solution C against solution B. Repeat the experiments two more times and record your results in table 1 below. (3mks)

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution B used (cm3) |  |  |  |

1. Work out the average volume of solution B used. (1mk)
2. Calculate the number of moles of solution C used. (1mk)
3. Find the number of moles of solution B used. (1mk)
4. Calculate the molarity of the sulphuric (VI)acid solution B. (1mk)

**PROCEDURE II**

Using a measuring cylinder, measure 100cm 3 of the solution B into 250 cm3 beaker. Add all of the 0.5g of solid A into the beaker and swirl the mixture. Wait until the reaction stops. Label this as solution D. rinse the burette and fill it with solution D. pipette 25 cm3 of solution C into a conical flask. Add 3 drops of phenolphthalein indicator. Titrate solution C against solution D.

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution B used (cm3) |  |  |  |

1. Calculate the average volume of solution D used. (1mk)
2. Calculate the number of moles of solution D used. (1mk)
3. Work out the number of moles of sulphuric (IV) acid in 100 cm3 of solution D. (1mk)
4. Determine the number of moles of sulphuric (IV) acid the reacted with 0.5g of the metal carbonate X2CO3 (1mk)
5. Work out the value of x in X2CO3 (1mk)

(C=12,O=16)

1. You are provided with 0.5g of zinc power labeled solid Z and 0.2M copper (II) sulphate solution labeled as solution K. You are required to determine the amount of heat evolved when 1 mole of copper (II) ions is displaced.

**PROCEDURE**

* Put 25.0cm3 of 0.2M copper (II) sulphate solution into a plastic cup. Using a thermometer measuren the temperature of the solution.
* Transfer all the 0.5g zinc power into the 0.2 copper (II) sulphate solution and stir, record the highest temperature reached by the solution.
1. Record your result in the table below and answer the questions that follow

Table 3

|  |  |
| --- | --- |
| Initial temperature of copper(II) sulphate (0C) | T1 |
| Final temperature of the mixture (0C) | T2= |
| Change in temperature (0C) | $$∆3=$$ |

1. Write an ionic equation for the reaction between zinc and copper (II) sulphate solution (1mk)
2. Calculate the number of moles of copper (II) sulphate used in the reaction. (1mk)
3. Calculate the amount of heat evolved in the reaction above. (Specific heat capacity of the solution = 4.2kjkg-1k-1, density of solution = 1 gcm-3) (1 mark)
4. Hence calculate the amount of heat evolved when 1 mole of copper (II) ions is displaced in the raction. (1 mark)
5. a) You are provided with solid P. Carry out the following tests and write your observations and inferences in the spaces provided
6. Place a half spatula endful of solid P in a dry test tube and heat strongly. Test the gases provided. (2 marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

1. Place a half spatula of solid P in a boiling tube and add 10cm3 of distilled water. Shake the boiling tube well and filter the mixture. Keep the residue for part (b). Divide the filtrate into four portions. (2 marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

1. To the first portion, add sodium hydroxide solution drop wise until in excess. (2 marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

1. To the second portion, add 5 drops of hydrogen peroxide and then add ammonia solution drop wise until in excess. (2 marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

1. To the third portion, add a few drops of lead (II) nitrate solution. (2 marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

1. To the forth portion add a few drops of acidified barium nitrate solution. (1 mark)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

b) Put the residue in a test tube and add nitric (V) acid until the solid dissolves. Divide the solution into two portions. (1 ½ marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

1. To the first portion, add sodium hydroxide solution drop wise until in excess. (2 marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

1. To the second portion, add ammonia solution drop wise until in excess. ( 1 ½ marks)

|  |  |
| --- | --- |
| Observation | Inferences  |
|  |  |

**CHEMISTRY PRACTICAL**

**FORM FOUR EVALUATION EXAMINATION**

**MARKING SCHEME**

**Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading cm 3 | 12.5 | 25.0 | 37.5 |
| Initial burette reading cm 3  | 0.0 | 12.5 | 25.0 |
| Volume of solution N used | 12.5 | 12.5 | 12.5 |

The mark are to be distributed as follows.

1. Complete table …………………………………………………………………………………………………………………………………(1mk)
2. Complete table with 3 titration’s done a ward………………………………………………………………………(1mk)
3. Incomplete table with 2 titration’s done award…………………………………………………………………….(½mk)
4. Incomplete table with 1 titration done a ward ……………………………………………………………………….(0mk)

Penalize

* Wrong arithmetic
* Inverted table
* Burette reading above 50 unless explained
* Unrealistic titre value i.e values in number in hundreds or below 1.0cm3

Penalize ½ mark for each to a maximum of ½ mark once.

1. Use of decimals…………………………………………………………………………………………………………………………………(1mk)
2. Accept only 1 or 2 decimal places used contently otherwise penalize FULLY and award 0 mark
3. If the two decimal places are used the 2nd decimal place be either “ 0” or “5” otherwise penalize fully.
4. Accuracy ……………………………………………………………………………………………………………………………………………….(1mk)

Compare the candidates titre value with the teachers value. (1mk)

Conditions

1. If at least one of the titre value is within + 0.1 cm3 of the teachers value award ………………(1mk)
2. If no value is within + 0.1 of the teachers value but at least one is within + 0.2 of teachers value award ……(1½mk)

Conditions

1. If 3 consistent titration are done and averaged award …………………………………………………………….(1mk)
2. If 3 titrations done and ONLY two consistent and averaged award …………………………….……………(1mk)
3. If only two titrations’ done are consistently averaged award ………………………………………………..(1mk)
4. If three titres are possible but only two are averaged award ………………………………………………………(0mk)
5. If 3 inconsistent titres are averaged award………………………………………………………………………………… (0mk)
6. If only 1 titration is done award …………………………………………………………………………………………………..(0mk)
7. Final answer………………………………………………………………………………………………………………………………………………(1mk)

Compare the candidate’s correct average titre with the teachers value.

1. If within + 0.1 of the teacher value award ……………………………………………………………………………………..(1mk)
2. If not within + 0.1 of the teachers value but within + 0.2 award ……………………………………………………(½mk)
3. If beyond + 0.2 of the teacher’s value award …………………………………………………………………………………(0mk)

**CALCULATIONS**

1. (ii) 1000cm3 of C =1 mole

½

In 25cm3 of C =

|  |
| --- |
| $$\frac{25x1}{1000}$$ |
|  |

= 0.025 moles ½

(iii) Mole ratio NaOH:H2SO4

2:1

No of moles of solution B Used = $\frac{0.025}{2}$ ½

 = 0.0125 moles ½

iv) $ \frac{1000x 0125}{average titre}$

 = answer ½

v) $\frac{100xAnswer (iv)}{100}$ ½

 = Answer ½

**CONDITIONS**

1. Penalize ½ mk in answer if wrong units are given otherwise ignore when units are omitted.
2. Penalize ½ mk for wrong transfer of average titre in (iv) above otherwise penalize FULLY for a strange figure
3. Answer (iii) above should be at least to 4 decimal places unless it works out exactly to less than 4 decimal places otherwise penalize ½ mk on the answer.

Table 2

Conditions to apply as in table 1

**CALCULATIONS**

ii) No. of moles of NaOH used = $\frac{25X1}{1000}$

 = 0.025 moles ½

Mole ratio Na OH: H2SO4

 2 : 1 ½

No. of moles of solution D used = $\frac{0.025}{2}$ ½

 =0.0125 moles ½

iii) No of moles H2SO4 in 1000cm3 of the solution =$\frac{100X0.0125}{average titre }$ ½

 = Answer ½

iv) No of moles of H2SO4 that =Answer (iv)- Answer b (iii) of reacted Na2 CO3 with 0.5g

 Answer ½

v) Moles ratio X2CO3: H2SO4

 1 : 1 ½

No. of moles of X2 CO3 in 0.5g = Answer (iv)above ½ X2 C0

0.5g of X2CO3 = answer (iv) above

 X

 = 1 Mole

Relative formular mass of X2C03 = $\frac{1x0.5}{Answer }$ ½

 = Answer ½

vi) 1 Moles of X2CO3 = answer (v)above

 X = $\frac{Answer \left(v\right)-60}{2}$ ½

 = Answer ½

**CONDITIONS**

1

1. The average titre in (iii) should be transferred intact otherwise penalize fully.
2. Answer a (iv) and answer b (iii) in (iv) above should be transferred intact otherwise penalize FULLY
3. Penalize fully for any working beyond the expected answer.

2. Temperature of CuSO4 solution T1 = 24.00C …………………………………………………………………………...(1mk)

 Highest temperature of mixture T2 = 30.00C……………………………………………………………………………………………………………………….(1mk)

 Change of temperature T2=T1=60C…………………………………………………………………………………………..(1mk)

 Accuracy of reading …………………………………………………………………………………………………………………(1mk)

ii) Cu2+ (aq) + Zn(s) Zn2+ (aq) + Cu (s)………………………………….………………………………………………..(1mk)

iii) Volume of copper (II) sulphate solution = 25.00cm3

 Molarity of CuSO4 = 0.2M

Moles of copper (II) sulphate used = $\frac{25x0.2}{1000}$ ½mk

 = 0.005 ½ mk

 Total =1mk

1. Heat evolved =$\frac{25}{1000}x4.2 x6 ½ mk$

 = 0.63KJ $½ MK$ or 630J

 V) 0.005 mole 63OJ

 1 mole $\frac{630X1}{0.005}$ ½mk

 = 12600J/ Mol or 12.6KJ/Mol ½ mk

 Total = 1mk

3. a) i)

|  |  |
| --- | --- |
| Observation  | Inferences  |
| Colourless liquid formed on the cooler part of the test tube. Blue litmus turns red | Hydrated salt Acidic gas produced.  |
| ii) |
| Observation  | Inferences  |
| Pale green filtrate White residue  | Fe2+ presentCu2+, Fe2+, Fe3+ absent |
| iii) |
| Observation  | Inferences  |
| Green precipitate insoluble in excess | Fe2+ present |
| iv) |
| Observation  | Inferences  |
| Pale green solution turns brown Brown precipitate in excess | Fe2+ present Fe3+ absent Fe2+ oxidized to Fe 3+ |
| v) |
| Observation  | inferences |
| White precipitate formed  | SO42-, SO32- ,Cl-,CO32- presents  |
| vi)  |
| Observation | inferences |
| White precipitate formed | SO42- present |
| B)  |
| Observation | Inferences |
| Efferscence with evolution of odourless gas that turns blue litmus red. | C032- present |
| ii) |
| Observation  | Inferences |
| White precipitate soluble in excess | Al3+, Zn 2+ ,Pb2+ present |
| iii)  |
| Observations | Inference |
| White precipitate soluble in excess | Zn 2+ present |

**CHEMISTRY PRACTICAL**

**FORM FOUR EVALUATION EXAMINATION**

**MARKING SCHEME**

**Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading cm 3 | 12.5 | 25.0 | 37.5 |
| Initial burette reading cm 3  | 0.0 | 12.5 | 25.0 |
| Volume of solution N used | 12.5 | 12.5 | 12.5 |

The mark are to be distributed as follows.

1. Complete table …………………………………………………………………………………………………………………………………(1mk)
2. Complete table with 3 titration’s done a ward………………………………………………………………………(1mk)
3. Incomplete table with 2 titration’s done award…………………………………………………………………….(½mk)
4. Incomplete table with 1 titration done a ward ……………………………………………………………………….(0mk)

Penalize

* Wrong arithmetic
* Inverted table
* Burette reading above 50 unless explained
* Unrealistic titre value i.e values in number in hundreds or below 1.0cm3

Penalize ½ mark for each to a maximum of ½ mark once.

1. Use of decimals…………………………………………………………………………………………………………………………………(1mk)
2. Accept only 1 or 2 decimal places used contently otherwise penalize FULLY and award 0 mark
3. If the two decimal places are used the 2nd decimal place be either “ 0” or “5” otherwise penalize fully.
4. Accuracy ……………………………………………………………………………………………………………………………………………….(1mk)

Compare the candidates titre value with the teachers value. (1mk)

Conditions

1. If at least one of the titre value is within + 0.1 cm3 of the teachers value award ………………(1mk)
2. If no value is within + 0.1 of the teachers value but at least one is within + 0.2 of teachers value award ……(1½mk)

Conditions

1. If 3 consistent titration are done and averaged award …………………………………………………………….(1mk)
2. If 3 titrations done and ONLY two consistent and averaged award …………………………….……………(1mk)
3. If only two titrations’ done are consistently averaged award ………………………………………………..(1mk)
4. If three titres are possible but only two are averaged award ………………………………………………………(0mk)
5. If 3 inconsistent titres are averaged award………………………………………………………………………………… (0mk)
6. If only 1 titration is done award …………………………………………………………………………………………………..(0mk)
7. Final answer………………………………………………………………………………………………………………………………………………(1mk)

Compare the candidate’s correct average titre with the teachers value.

1. If within + 0.1 of the teacher value award ……………………………………………………………………………………..(1mk)
2. If not within + 0.1 of the teachers value but within + 0.2 award ……………………………………………………(½mk)
3. If beyond + 0.2 of the teacher’s value award …………………………………………………………………………………(0mk)

**CALCULATIONS**

1. (ii) 1000cm3 of C =1 mole

½

In 25cm3 of C =

|  |
| --- |
| $$\frac{25x1}{1000}$$ |
|  |

= 0.025 moles ½

(iii) Mole ratio NaOH:H2SO4

2:1

No of moles of solution B Used = $\frac{0.025}{2}$ ½

 = 0.0125 moles ½

iv) $ \frac{1000x 0125}{average titre}$

 = answer ½

v) $\frac{100xAnswer (iv)}{100}$ ½

 = Answer ½

**CONDITIONS**

1. Penalize ½ mk in answer if wrong units are given otherwise ignore when units are omitted.
2. Penalize ½ mk for wrong transfer of average titre in (iv) above otherwise penalize FULLY for a strange figure
3. Answer (iii) above should be at least to 4 decimal places unless it works out exactly to less than 4 decimal places otherwise penalize ½ mk on the answer.

Table 2

Conditions to apply as in table 1

**CALCULATIONS**

ii) No. of moles of NaOH used = $\frac{25X1}{1000}$

 = 0.025 moles ½

Mole ratio Na OH: H2SO4

 2 : 1 ½

No. of moles of solution D used = $\frac{0.025}{2}$ ½

 =0.0125 moles ½

iii) No of moles H2SO4 in 1000cm3 of the solution =$\frac{100X0.0125}{average titre }$ ½

 = Answer ½

iv) No of moles of H2SO4 that =Answer (iv)- Answer b (iii) of reacted Na2 CO3 with 0.5g

 Answer ½

v) Moles ratio X2CO3: H2SO4

 1 : 1 ½

No. of moles of X2 CO3 in 0.5g = Answer (iv)above ½ X2 C0

0.5g of X2CO3 = answer (iv) above

 X

 = 1 Mole

Relative formular mass of X2C03 = $\frac{1x0.5}{Answer }$ ½

 = Answer ½

vi) 1 Moles of X2CO3 = answer (v)above

 X = $\frac{Answer \left(v\right)-60}{2}$ ½

 = Answer ½

**CONDITIONS**

1

1. The average titre in (iii) should be transferred intact otherwise penalize fully.
2. Answer a (iv) and answer b (iii) in (iv) above should be transferred intact otherwise penalize FULLY
3. Penalize fully for any working beyond the expected answer.

2. Temperature of CuSO4 solution T1 = 24.00C …………………………………………………………………………...(1mk)

 Highest temperature of mixture T2 = 30.00C……………………………………………………………………………………………………………………….(1mk)

 Change of temperature T2=T1=60C…………………………………………………………………………………………..(1mk)

 Accuracy of reading …………………………………………………………………………………………………………………(1mk)

ii) Cu2+ (aq) + Zn(s) Zn2+ (aq) + Cu (s)………………………………….………………………………………………..(1mk)

iii) Volume of copper (II) sulphate solution = 25.00cm3

 Molarity of CuSO4 = 0.2M

Moles of copper (II) sulphate used = $\frac{25x0.2}{1000}$ ½mk

 = 0.005 ½ mk

 Total =1mk

1. Heat evolved =$\frac{25}{1000}x4.2 x6 ½ mk$

 = 0.63KJ $½ MK$ or 630J

 V) 0.005 mole 63OJ

 1 mole $\frac{630X1}{0.005}$ ½mk

 = 12600J/ Mol or 12.6KJ/Mol ½ mk

 Total = 1mk

3. a) i)

|  |  |
| --- | --- |
| Observation  | Inferences  |
| Colourless liquid formed on the cooler part of the test tube. Blue litmus turns red | Hydrated salt Acidic gas produced.  |
| ii) |
| Observation  | Inferences  |
| Pale green filtrate White residue  | Fe2+ presentCu2+, Fe2+, Fe3+ absent |
| iii) |
| Observation  | Inferences  |
| Green precipitate insoluble in excess | Fe2+ present |
| iv) |
| Observation  | Inferences  |
| Pale green solution turns brown Brown precipitate in excess | Fe2+ present Fe3+ absent Fe2+ oxidized to Fe 3+ |
| v) |
| Observation  | inferences |
| White precipitate formed  | SO42-, SO32- ,Cl-,CO32- presents  |
| vi)  |
| Observation | inferences |
| White precipitate formed | SO42- present |
| B)  |
| Observation | Inferences |
| Efferscence with evolution of odourless gas that turns blue litmus red. | C032- present |
| ii) |
| Observation  | Inferences |
| White precipitate soluble in excess | Al3+, Zn 2+ ,Pb2+ present |
| iii)  |
| Observations | Inference |
| White precipitate soluble in excess | Zn 2+ present |

**JULY AUGUST EXAM 2017**

**CONFIDENTIAL**

**CHEMISTRY PRACTICAL**

**In addition to ordinary apparatus in a chemistry laboratory each candidates will require**

* solid A (0.5g accurately weighed)
* solution B
* solution C
* Burette
* Pipette
* Three conical flasks
* 100ml measuring cylinder.
* 250 ml beaker
* Means of labeling
* Metallic spatula

Thermometer (-10-1100c)

* Plastic cup, 250ml
* Six test tubes
* One boiling tubes.
* 60 cm3of 0.2M copper (II) sulphate labeled solution K
* Filter paper.
* Filter funnel.
* Retort stand
* white tile
* 0.5g of zinc powder, labeled solid Z
* Blue and red litmus paper
* 10ml measuring cylinder.

**Access to the following**

* Phenolphthalein indicator
* Distilled
* Source of heat
* 2M sodium Hydroxide supplied with a dropper
* 20 Volume Hydrogen Peroxide supplied with a dropper.
* 2M Ammonia solution supplied with a dropper
* 1M Barium Nitrate (Acidified) solution supplied with a dropper.
* 1M lead (II) Nitrate supplied with a dropper
* 1M Nitric (V) acid supplied with a dropper

**Note**

Solid A, is Na2CO3

Solution B, 1M Sulphuric (IV) acid.

Solution C, Sodium Hydroxide 1M

Solution P, is Iron (II) Sulphate and zinc carbonate in the ration 1:1