# Gravimetric Analysis of Rock Salt

## Marking Key

### Observations (2 marks)

½ mark of each mass

### Processing of Results (1 mark each x 7) (7 marks)

1. mass (impure rock salt) = mass(impure rock salt + container) – mass(container)

2. mass(AgCl) = mass(precipitate + filter paper) – mass(filter paper)

3. NaCl (aq) + AgNO3 (aq) 🡪 NaNO3 (aq) + AgCl (s)

4. n(AgCl) = m/M = ??? / 143.35

5. n(NaCl) = 1/1 x n(AgCl)

6. m(NaCl) = n x M = ??? x 58.44

7. %(purity- NaCl) = m(NaCl) / m(impure rock salt) x 100

**Conclusion (3 marks)**

Accuracy 65% ± 5% 65% ± 3% 65% ± 2%

(1 mark) (2 marks) (3 marks)

**Errors (3 marks)**

1. Describe two **major** sources of experimental error within this investigation

(not human error) (2)

A systematic error is an error that is constant or drifting slightly and is due to a consistent mistake made during the analysis. Typical systematic errors in titration analyses include:

* Incorrect calculation formulas
* Sample size errors e.g. due to a constant weighing error
* Incorrect titrant concentration
* Too high titration speed for the chemical reaction

A random error is a component of the overall error that varies in an unpredictable fashion. It is usually difficult to identify these errors. Typical sources of random errors include:

* Poor sample handling
* Inadequate equipment e.g. too low balance resolution, wrong grade of

glassware etc.

* Incorrect method parameters e.g. too large increments, insufficient

waiting time between increments.

* Bubbles in burette tubes
* ineffective rinsing between samples
* Lack of operator training
* Inadequate environmental conditions e.g. temperature and humidity

fluctuations

2. Describe a possible improvement that could be made to this

experimental to address an error in question 1. (1)

Needs to address one of the identified errors from Q1

## Questions: (18 marks)

1. (a) NaHCO3 (s) + HCl (aq) 🡪 NaCl (aq) + H2O (l) + CO2 (g) (1)

(b) m(CO2) = (1.454 + 10.086) – 10.989

= 11.540 – 10.989

= 0.551 g (1)

(c) n(CO2) = m / M = 0.551 / 44.01 = 0.0125 mol

n(NaHCO3) = n(CO2) = 0.0125 mol

m(NaHCO3) = n x M = 0.0125 x 84.008 = 1.05 g (3)

(d) %(NaHCO3) = [m(NaHCO3) x 100] / m(impure)

= [1.05 x 100] / 1.454

= 72.3% (1)

2. (a) n(BaSO4) = m / M = 0.566 / 233.37 = 2.43 x 10-3 mol (1)

(b) n(SO42-) = n(BaSO4) = 2.43 x 10-3 mol

m(SO42-) = n x M = 2.42 x 10-3 x 96.07 = 0.233 g (2)

(c) %(SO42-) = [m(SO42-) x 100] / m(fertiliser)

= [0.233 x 100] / 2.50

= 9.32 % (1)

(d) The calculated percentage of sulphate ions would be larger. (1)

If the precipitate was not washed then the dry precipitate may

contain traces of a chlorine salt and this would give us a final mass

of pure sample that is too large. (1)

## 3. (a) M(CaC2O4.H2O) = 40.01 + 2x12.01 + 5x16.99 + 2x1.008 = 146.116 g mol-1

## n(CaC2O4.H2O) = m / M = 0.523 / 146.116 = 3.58 x 10-3 mol

(b) n(CaCl2) = n(CaC2O4.H2O) = 3.58 x 10-3 mol

(c) n(CaCO3) = n(CaCl2) = 3.58 x 10-3 mol

m(CaCO3) = n x M = 3.58 x 10-3 x 100.09 = 0.358 g

%(CaCO3) = [m(CaCO3) x 100] / m(egg shell)

## = [0.358 x 100] / 0.412

= 86.96 % (1 mark each step = 6)

## Technical Support Sheet

**Eye protection Corrosive Flammable**

Eye protection 6M nitric acid acetone

must be worn 0.5M silver nitrate

|  |  |  |
| --- | --- | --- |
| **Requirements** | **Per group** | Checklist |
| weighing bottle containing rock salt sample | 1 |  |
| rock salt (0.26g NaCl and 0.14g NaNO3) | 0.4g |  |
| 250 mL beaker | 1 |  |
| stirring rod | 1 |  |
| 100 mL measuring cylinder | 1 |  |
| 10 mL measuring cylinder | 3 |  |
| filter paper | 2 |  |
| funnel | 1 |  |
| balance | 1 |  |
| Watch glass | 1 |  |
| Conical flask 250 mL | 2 |  |
| 6M nitric acid | 1 mL |  |
| 0.5M silver nitrate solution | 10 mL |  |
| acetone | 20 mL |  |