Technical Education, Vocational and Entrepreneurship Training Authority (TEVETA)

DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY

YEAR II

Chemistry Techniques II

Record of Practical Assessment

Learner`s Name:____

Learner`s NRC no.:______________________________________

Learner`s TEVETA No.:__________________________________

Assessment Period:______________________________________

PREFACE

The Technical Education, Vocational and Entrepreneurship Training Authority (TEVETA) is an institution created under the Technical Education, Vocational and Entrepreneurship Training Act Number13 of 1998, as amended by the Technical Education, Vocational and Entrepreneurship Training (Amendment) Act Number 11 of 2005.

The Act among other things provides that TEVETA shall:

(a) regulate and conduct national examinations and assessments relating to technical education, vocational and entrepreneurship training;

(b) charge and collect fees in respect of examinations, assessments and other services provided by the Authority;

(c) award certificates to persons who succeed in examinations and assessments undertaken under this Act

(d) do all such things connected with or incidental to the functions of the Authority under this Act.

Through this mandate, the Assessment and Qualifications Division of TEVETA has developed Practical Assessment Tool Kits to enable learners achieve the competences that are congruent with the demand of the workplace tasks. These tool kits in part are also intended to ensure that similar conditions under which all students in TEVET are assessed and examined apply wherever the course is undertaken in Zambia.

The Trainers shall work with theLearnersto collect evidence of competence, using the benchmarks provided by the unit standards.During the year, the Learners shall be required to undertake a series of practical assessment tasks. It is the sum of all these assessments tasks that deems a Learner to be competent (or not).

This approach to assessment is not a one-off event but one that giveslearners many opportunities to demonstrate skill and allow for the capturing and recording of these demonstrations.

For the Learner to be deemed competent, they must demonstrate competency in every aspect of the practical tasks being undertaken. It must however be understood by the Trainer that Competency does not mean expert. It means that the candidate has attained sufficient skill and knowledge to perform the activity or service to a degree and quality that is acceptable to the industry and the customer in a time within which a competent person at the level could reasonably be expected to perform the task.

While this will be undertaken at institutional level, it is therefore envisaged that the Assessment principles of VALIDITY, RELIABILITY, FAIRENESS and FLEXIBILITY shall at all times be adhered to.

Pre-Assessment

Assessment process explained to the employee (✓ if Yes).	☐
Any appeal relating to the outcome of the assessment or the way in which the assessment was conducted shall be made through the company's *fair treatment policy* as explained to the employee (✓ if Yes).	☐

Employee/Trainee	**Assessor**	
Employee/Trainee name: ________________________ (Print) Employee/Trainee comments:	Assessor name: ________________________ (Print) Assessor comments:	
I fully understand the assessment and appeals process.	Theory assessment sighted and checked as satisfactory.	☐
Signature: ____________________ Date: ____________________	Signature: ____________________ Date: ____________________	

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Observation Checklist

1 PERFORM AN EXPERIMENT ON PREPARATION OF A SINGLE SALT	Satisfactory			Not Satisfactory		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: ☐ Heat source ☐ Evaporating dish ☐ Desiccator ☐ Reagent sample ☐ Beaker	☐	☐	☐	☐	☐	☐
b. Set up the apparatus correctly. This may include: ☐ Getting and assembling the required equipment and materials for the experiment	☐	☐	☐	☐	☐	☐
c. Run the experiment correctly. This may include: ☐ Putting some solution of the salt into evaporating dish ☐ Putting the evaporating dish on a source of heat ☐ Heating slowly and gently ☐ Removing the evaporating dish from heat source when crystals start forming ☐ Cooling the sample ☐ Drying it in the desiccators.	☐	☐	☐	☐	☐	☐
d. Interpret the results correctly. This may include: ☐ Identifying the salt by appropriate means ☐ Storing it in a well labeled container	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: Trainee:

2 PERFORMING AN EXPERIMENT ON PREPARATION OF GAS	**Satisfactory**			**Not Satisfactory**		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: ☐ Clamp stand ☐ Flat bottomed flask ☐ Rubber bung with two holes ☐ Marble chips, (Calcium carbonate) ☐ 0.5 M hydrochloric acid ☐ Lime water ☐ Thistle funnel ☐ Glass delivery tube ☐ Gas jars	☐	☐	☐	☐	☐	☐
b. Set up the apparatus correctly. This may include: ☐ Getting and assembling the required materials and apparatus	☐	☐	☐	☐	☐	☐
c. Run the experiment correctly. This may include: ☐ Clamping the flat bottomed flask ☐ Putting marble chips into a flat bottomed flask ☐ Fixing a rubber bung with two holes, one to receive the thistle funnel and the other the glass delivery tube ☐ Directing the glass delivery tube into a bottomed of a gas jar ☐ Pouring the dilute hydrochloric acid into the bottomed flask thistle funnel and ensuring that the tip of the thistle funnel is dipped into the acid ☐ Collecting the gas in many gas jars by upward displacement of air ☐ Testing the gas so prepared	☐	☐	☐	☐	☐	☐
d. Interpret the results. This may include: ☐ Identifying the gas so produced by appropriate methods	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: Trainee:

3 PERFORMING AN EXPERIMENT ON PURIFYING SOLUTIONS BY FRACTIONAL DISTLLATION	Satisfactory			Not Satisfactory		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: ☐ Fractionating column ☐ Condenser ☐ Source of running water ☐ Rubber tubes ☐ Sample for separating ☐ small beakers ☐ Glass laboratory thermometer	☐	☐	☐	☐	☐	☐
b. Set up the apparatus correctly. This may include: ☐ Arranging the apparatus required for fractional distillation and the materials in order	☐	☐	☐	☐	☐	☐
c. Run the experiment correctly. This may include: ☐ Pouring the mixture into the round bottomed flask ☐ Putting the thermometer condensing system and collecting vessel in place ☐ Heating the round bottomed flask and collect the components in the mixture as they come out of the condenser ☐ Collecting the separate liquids ☐ Testing the liquids separated using boiling points	☐	☐	☐	☐	☐	☐
d. Interpret results correctly. This may include: ☐ Identifying the liquids correctly	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: ____________ Trainee: ____________

4 PERFOMING AN EXPERIMENT ON GRAVITMETRIC ANALYSIS OF SOLUBLE CHLORIDE	Satisfactory			Not Satisfactory		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: ☐ Precipitating reagent silver nitrate solution ☐ Unknown chloride sample (free-flowing powder) ☐ Three porcelain filter crucibles ☐ Permanent marker ☐ Oven (100 – 110℃) ☐ Beaker ☐ Watch glass ☐ Desiccator ☐ Electronic balance ☐ Water ☐ dilute mineral acid/ base ☐ Concentrated ammonia ☐ Concentrated nitric acid ☐ Concentrated hydrochloric acid ☐ Vacuum flask ☐ Crucible holder ☐ Rubber hose ☐ wash bottle ☐ Glass rod ☐ Rubber policeman ☐ 0.01M nitric acid ☐ Fume hood	☐	☐	☐	☐	☐	☐

ii. Set up the apparatus correctly. This may includes: - Clean and dry three porcelain filter crucibles Make sure crucibles are marked so they can be distinguished from one another. Use a permanent marker. - Dry crucibles in the oven at 100-110 °C for one hour or overnight. The crucibles should be put in a labeled beaker and covered with a watch glass when in the oven. - Cool the crucibles in a desiccator for 20 minutes and weigh. - Repeat Steps 2 and 3, this time oven-drying for only 20 minutes. - Repeat this procedure until the mass of each crucible agrees to within 0.3 mg between weighings. ***Note: Cleaning Procedure for Porcelain Filter Crucibles*** - Scraping any large amount of gray or purplish precipitate in the crucible into the waste container for ***Solid AgCl***. - Thoroughly wash the inside and outside of the crucible with a test tube brush and a small amount of soapy water. ***Soak off and remove all paper or tape labels***. - If there is a gray or white residue in the crucible, add about 100 mL of water to a filter flask to dilute the rinse acid or base when it comes through. Mounting the filter crucible in the filter flask, add 1-2 mL of concentrated NH_3, let it sit for a few of minutes, then apply a gentle vacuum to pull the resulting solution through the fritted bottom. Follow by rinsing with large amounts of distilled water from a wash bottle. You may need to repeat this procedure 2 or 3 more times. **NOTE:** **Always break the vacuum first before you turn off the aspirator water.**	☐	☐	☐	☐	☐	☐

- If a dark stain remains, empty the contents of the filter flask in the appropriate waste container and add a few mL of conc. HNO_3 to the crucible. Let it sit for a few minutes, apply a gentle vacuum as before, and rinse the crucible thoroughly with distilled water. - If there is a reddish stain in the crucible, empty it and add a few drops of conc.HCl. This should remove it nicely. Proceed as with HNO_3 above. If the crucible does not filter rapidly (1-2 drops per second) after this cleaning, repeat the entire procedure. If it still does not drain rapidly under vacuum, consult with your lecturer. - After you are completely done. Rinse the vacuum flask and crucible holder thoroughly with distilled water. Turn on the vacuum and squirt some distilled water down the rubber hose. Place the vacuum flask, crucible holder, and rubber hose back in their proper drawers. ***Hazardous Waste Note***: The NH_3 waste (basic) container is housed in a separate hood from the HNO_3 and the HCl waste (acidic) containers. **Preparation of the Chloride Unknown Samples** - Drying the sample in an oven at 110 °C for 1-2 hours or overnight. - Weighing out ***accurately***, by difference, three portions of the dried sample of about 0.5 to 0.7 g each to within +0.1 mg. **NOTE: *NEVER* transfer chemicals *inside* the balance.** - Dissolving each portion in a clean, separate, labeled 400-mL beaker, using 150 mL of distilled water to which about 1 mL of concentrated nitric acid has been added. - Placing a watch glass cover on each beaker.	☐	☐	☐	☐	☐	☐

c. Run the experiment correctly. This may include: **Precipitation of Chloride with Silver Ion** ☐ Heating the chloride solutions to gentle simmering on a hotplate and keep each one hot until the AgCl is fully precipitated. **Precipitate the chloride from one unknown solution at a time**. ☐ 2. Going to the hood containing the stock silver nitrate solution and carefully **pour about 80mL of the solution into a 100-mL graduated cylinder**. [Each unknown will require about 50-70 mL to precipitate the Cl^- completely. ☐ DO NOT FILL ANY CONTAINER LARGER THAN 100 mL with the stock silver nitrate solution. **Owing to severewastage of very expensive silver nitrate in the past, any student caught filling alarger container with the stock solution will be penalized severely**. ☐ Stirring constantly **with a glass stirring rod** (do NOT use a magnetic stirrer and stir bar), add the silver nitrate from the graduated cylinder in approximately 5 mL increments to your first unknown solution until the precipitation of the silver chloride is complete. To check for complete precipitation, silver nitrate must be added in small quantities and vigorously stirred. Allow the precipitate to settle a bit and add some more silver nitrate solution (no stirring yet). If the solution becomes cloudy, keep adding. If the solution remains clear, then add a total of about 5% more silver nitrate solution than you have added to that point. ☐ Placing the beaker (covered) in the laboratory cabinet for at least one hour to “digest” before filtering. This minimizes exposure of the AgCl to light and consequent decomposition. ☐ Repeating this precipitation and digestion for your other unknown solutions, one at a time. If you have used a graduated cylinder to monitor the volume of silver nitrate solution used for your first unknown solution, then you can then estimate about how much you need to add to the remaining samples. Simply ratio the volume to be used based on the masses of the two unknown samples that you weighed out.	☐	☐	☐	☐	☐	☐

Filtration and Final Weighing This procedure should be done separately for each sample in turn. ☐ After the solution has digested for a *minimum of 1 hour*, filter the supernatant liquid through a labeled, weighed filter crucible with suction, keeping most of the precipitate in the beaker. *NOTE: Always break the suction on the flask before turning off the waterflow on the aspirator.* ☐ Testing the filtrate in the suction flask for complete precipitation by again adding a few drops of silver nitrate solution. If your filtrate remains clear, dispose of the filtrate in the appropriate waste container. ☐ Wash the precipitate with three 25-mL portions of 0.01 M nitric acid (2 drops of concentrated HNO3 per 100 mL of water) using your washing bottle. [A standard-sized washing bottle will hold about 500 mL.] The washings are poured through the filter crucible and the precipitate is left in the beaker. If any of the precipitate has dried on the sides of the beaker or the glass stirring rod, scrape them down with a rubber policeman and rinse with small amounts of the wash solution during this process to ensure that 100% of the precipitate will be filtered off into the filter crucible. ☐ Stirring the bulk of the precipitate up in a small volume of 0.01 M HNO3 and quantitatively transfer the precipitate to the crucible. ☐ After filtering, placing the crucibles in a large beaker covered with a watch glass and dry at 120-140 °C for 2 hours. You can leave the crucibles overnight, if you return the next day and put them in your desiccator. ☐ Cooling in a desiccator and weigh. ☐ Return them to the oven for 20 minutes. Then cooling in the desiccator for 20 minutes and reweigh. Repeating this step until the mass of a crucible with the precipitate agrees to within 0.4 mg.	☐	☐	☐	☐	☐	☐
d. Interpret the results correctly. This may include: ☐ working out the gravimetric factor from $\frac{mCl}{mAgCl} = \frac{35.453 gmol^{-1} Cl}{143.321 gmol^{-1} AgCl} = 0.247368\ Cl/AgCl$ where m is the mass in grams ☐ The mass of chlorine in the sample is $mCl = mAgClxgraavimetricfactor$ ☐ Percentage of $Cl = \left(\frac{mCl}{mAgCl}\right) x100\%$	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: Trainee:

5 PERFORMING AN EXPERIMENT TO DETERMINE THE MELTING POINT OF A SUBSTANCE CORRECTLY		Satisfactory		Not Satisfactory		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: - Finely ground sample - Capillary tube - Heating block - Platinum resistance thermometer - OptiMelt	☐	☐	☐	☐	☐	☐
b. Set up the apparatus correctly. This may include: - Arrange the materials and apparatus for use	☐	☐	☐	☐	☐	☐

c. Run the experiment correctly. This may include: ☐ Putting the finely ground dry powder of the sample into the thin glass capillary tube closed at one end to 2 to 3 mm ☐ Tightly packing the sample to improve the measurement ☐ Maintaining a fixed level in the fill is also a very important requirement. ☐ Wiping the outside surface of capillary tubes with a clean cloth before inserting them into the heating stand. ☐ Dusting the glass window of the heating block reducing overall visibility of the melt ☐ Making sure OptiMelt is plugged in and set to a start temperature below the expected MP of the sample(s) before placing any capillaries into the sample slots. ☐ A thin glass capillary tube containing a compact column of the substance to be determined is introduced into a heated stand (liquid bath or metal block) in close proximity to a high accuracy thermometer. ☐ The temperature in the heating block is ramped at a user-programmable fixed rate until the sample in the tube transitions into the liquid state. ☐ Inserting a platinum resistance thermometer into one of the slots on the stand ☐ Switching on the heating block ☐ Observing at the glass window until the sample melts completely ☐ Switch off the instrument when melting takes place and note down the temperature	☐	☐	☐	☐	☐	☐
d. Interpreting the results correctly. This may include: ☐ Noting down the melting point ☐ Comparing the melting to the standard values of melting points and hence determine the substance under investigation	☐	☐	☐	☐	☐	☐
v. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: ____________________ Trainee: ____________

6 PERFORM AN EXPERIMENT ON USE OF SPECTROPHOTOMETER IN THE PREPARATION OF A STANDARD CURVE AND FINDING THE CONCENTRATION OF UNKNOWN	**Satisfactory**			**Not Satisfactory**		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: ☐ Spectrophotometer ☐ Standard solution, 20mmol/L protein ☐ Test tubes (7) ☐ Test tube rack (1) ☐ Distilled water ☐ Cuvette ☐ Biuret reagent ☐ 10 ml graduated glass pipettes (2) ☐ Pasteur pipette ☐ Safety goggles ☐ Latex gloves ☐ Unknown Xmmol/L	☐	☐	☐	☐	☐	☐
b. Set up the apparatus correctly. This may include: ☐ Labelling the test tubes, Blank, unknown X, 4mmol/L, 8mmol/L, 12mmol/L,16mmol/L, 20mmol/L, ☐ Putting the test tubes in the test tube rack	☐	☐	☐	☐	☐	☐

c. Run the experiment correctly. This may include: □ Using the dilution equation $M_1V_1 = M_2V_2$ prepare serially diluted solutions with following concentrations:0 mmol/L, 4mmol/L, 8mmol/L,12mmol/L,16mmol/L, and 20mmol/L ➢ Pipetting 10 ml of distilled water into the test tube labelled Blank and putting it back into the test tube rack. ➢ Pipetting 2 ml of 20mmol/L into a test labelled 4mmol/L and then pipetting 8 ml of distilled into the same test tube. Mixing thoroughly and putting it back into the test tube rack. ➢ Pipetting 4ml of 20mmol/L into a test labelled 8 mmol/L and then pipetting 6 ml of distilled into the same test tube. Mixing thoroughly and putting it back into the test tube rack. ➢ Pipetting 6 ml of 20 mmol/L into a test labelled 12mmol/L and then pipetting 4 ml of distilled into the same test tube. Mixing thoroughly and putting it back into the test tube rack. ➢ Pipetting 8 ml of 20 mmol/L into a test labelled 16mmol/L and then pipetting 2 ml of distilled into the same test tube. Mixing thoroughly and putting it back into the test tube rack. ➢ Pipetting 10 ml of 20 mmol/L into a test labelled 20mmol/L and then pipetting 0 ml of distilled into the same test tube. Mixing thoroughly and putting it back into the test tube rack. ➢ Do not ad water to the unknown X ➢ Adding 2-3 drops of biuret reagent to all the test tubes □ Incubating at room temperature for 10 minutes. □ Noting down the colours development □ Switching on the spectrophotometer and calibrate it at 540nm □ Measuring the absorbancies of the solutions and record them in a table	□	□	□	□	□	□
d. Interpret the results correctly. This may include: □ Plotting the graph of absorbance versus concentration □ Finding the concentration of the unknown by Beer's law or by interpolation	□	□	□	□	□	□

e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: Trainee:

7 PERFORM AN EXPERIMENT TO IDENTIFY DIFFERENT TYPES OF ORGANIC COMPOUNDS	Satisfactory			Not Satisfactory		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: ☐ Unknown samples include the following functional groups: ➢ Unsaturated hydrocarbon, ➢ Alcohol ➢ Ketone ➢ Aldehyde ➢ Carboxylic ➢ Phenol ➢ Amine ☐ Testing reagents or tests include: ➢ Bromine water ➢ Tollen’s reagent, ➢ Mineral acid ➢ Sodium bicarbonate ➢ Rimini’s test ➢ Simons test ➢ 2,4DNP test ➢ Schiff’s test ➢ Ceric nitrate test ➢ Chromic acid test ➢ Lucas test ➢ Litmus test ➢ Acetyl chloride test ☐ Clean test tubes ☐ Test tube racks ☐ Stickers ☐ Permanent marker ☐ Safety goggles ☐ Latex gloves	☐	☐	☐	☐	☐	☐
b. Set up apparatus correctly. This may include: ☐ Wearing safety goggles ☐ Wearing latex gloves ☐ Labeling test tubes ☐ Putting the test tubes into the test tube racks	☐	☐	☐	☐	☐	☐

c. Run the experiment correctly. This may include: ☐ Putting samples of equal amounts into clean dry test tubes standing in test tube rack ☐ Adding test reagent at a time to all samples ☐ Noting down colour changes ☐ Clean the test tubes so as to receive fresh amounts of samples ☐ Repeat the procedures in bullets 1, 2, 3 and 4 for other test reagents or tests	☐	☐	☐	☐	☐	☐
d. Interpret the results correctly. This may include: ☐ Identifying the samples with the corresponding colours produced	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided. **Note: some reagents are corrosive and should worked with caution**	☐	☐	☐	☐	☐	☐

Assessor comments:

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Signed: Assessor: __________________ Trainee: ____________

<table>
<tr><th>8 PERFORM AN EXPERIMENT TO IDENTIFY DIFFERENT TYPES OF CATIONS</th><th colspan="3">Satisfactory</th><th colspan="3">Not Satisfactory</th></tr>
<tr><td colspan="7">During observation of work activities, the candidate demonstrated that they can:</td></tr>
<tr><td>a. Identify the apparatus correctly. This may include:
☐ Unknown sample of salt solutions the following cations:
➢ Cr^{3+}
➢ Mn^{2+}
➢ Fe^{3+}
➢ Fe^{2+}
➢ Co^{2+}
➢ Ni^{2+}
☐ Testing reagents include:
➢ Sodium hydroxide solution
➢ Hydrogen peroxide solution
➢ Dilute sulphuric acid
➢ Potassium iodate KIO_4 (white solid)
➢ Hexaferric potassium cyanide ($K_3Fe(CN)_6$ solution
➢ NH_4SCN solution
➢ Tarttric acid solution
➢ Dimethylglyomine
➢ Aqueous ammonia
☐ Heat source
☐ Pasteur pipette
☐ Test tubes
☐ Stickers
☐ Marker for labeling
☐ 2ml Pasteur pipette
☐ Latex gloves
☐ Safety goggles</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>b. Set up the apparatus correctly. This may include:
☐ Wearing latex gloves
☐ Wearing safety goggles
☐ Labeling test tubes according to the number of cations
☐ Pipette equal amount of salt solution in each test tube
Note: The reagent should be added at a time to all the test tubes</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr>
</table>

c. Run the experiment correctly. This may include: **Cr^{3+} ion test** ☐ Adding an excess of NaOH solution and some H_2O_2. Heat the resulting mixture. Filter the solution and observe the color of the filtrate. If it is yellow, you have CrO_4^{2-} ion in filtrate **Mn^{2+} ion test** ☐ Put 1 droplet of unknown (NO more than 1!!!) solution into a test tube and dilute it with some H_2SO_4. Add KIO_4 (white solid) and warm gently. The appearance of characteristic purple color shows the presence of Mn. Very sensitive reaction. MnO_4^- **Fe^{3+} ion test** ☐ To a drop of unknown solution, adding several drops of NH_4SCN. Bloody red color appears if Fe(III) is present. $Fe(SCN)_3$ **Fe^{2+} ion test** ☐ To a drop of unknown , adding several drops of $K_3Fe(CN)_6$. The deep blue color is the indication of Fe^{2+}. $K_3[Fe(CN)_6]_2$ **Co^{2+} ion test** ☐ To a drop of unknown solution, adding several drops of NH_4SCN in acetone or butanol. The bright blue color is the indication of Co^{2+}. $Co(NCS)_4^{2-}$ **Ni^{2+} ion test** ☐ To several drops of unknown, adding some tartric acid dimethylglyoxime solution, and then slowly add aqueous ammonia. Drops of ammonia solution must go by the wall of the test tube. A pink color of nickel glyoximate appears. nickel glyoximate	☐	☐	☐	☐	☐	☐
d. Interpret the results correctly. This may include: ☐ Noting down the colours produced ☐ Identifying the metal ions	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: Trainee:

9 PERFORM AN EXPERIMENT TO IDENTIFY DIFFERENT TYPES OF ANIONS	Satisfactory			Not Satisfactory		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus needed correctly. This may include: ☐ Sample solutions of the following anions ➢ OH^- ➢ Cl^- ➢ Br^- ➢ I^- ➢ SO_4^{2-} ➢ S^{2-} ➢ CO_3^{2-} ➢ CrO_4^2 ➢ NO_3^- ➢ SO_3^{2-} ☐ Testing reagents include: ➢ Barium nitrate solution ➢ barium chloride solution ➢ Silver nitrate solution ➢ Lead ethanoate solution ➢ Nitric acid solution ➢ Potassium dichromate (VI) paper ➢ Lead ethanoate ➢ Concentrated sulphuric acid ➢ Aluminium foil (Devardas ' Alloy) ➢ Litmus paper or universal indicator ➢ Lime water ☐ Test tubes ☐ Test tube racks ☐ Heat source ☐ Pasteur pipette ☐ Stickers ☐ dilute hydrochloric acid ☐ Marker for labeling ☐ 2ml Pasteur pipette ☐ Latex gloves ☐ Safety goggles	☐	☐	☐	☐	☐	☐

b. Set up the apparatus correctly. This may include: - Wearing latex gloves - Wearing safety goggles - Labeling test tubes according to the number of anions - Pipette equal amount of sample solution in each test tube **Note: The reagent should be added at a time to all the test tubes**	☐	☐	☐	☐	☐	☐

c. Run the experiment correctly. This may include:
Carbonate ion test CO_3^{2-}
- Adding dilute strong acid of the suspected solid of carbonate.
    ➢ If gas is given off, test with lime water. White precipitate forms if carbon dioxide is produced.
- Heating the solid strongly and testing the gas given off with lime water.
    ➢ If white precipitate form then carbon dioxide is present
Sulphate(VI) ion test SO_4^{2-}
- To a solution of suspected sulphate add dilute hydrochloric acid and a few drops of barium chloride or nitrate solution
    ➢ A white precipitate of barium sulphate is the test for sulphate ion
Sulphite(IV) ion test SO_3^{2-}
- Add dilute hydrochloric acid to the suspected sulphite
    ➢ A chocking sulphur dioxide gas is formed is a test for sulphite
- Test any gas evolved with fresh potassium dichromate (VI) paper
    ➢ The dichromate paper turns from orange to green confirmatory test for sulphite
- Adding barium chloride or barium nitrate solution
    ➢ A white precipitate of barium sulphite which dissolves in excess hydrochloric acid to five off a clear colourless solution
Sulphide ion test S^{2-}
- If soluble sulphide, add a few drops of lead II) ethanoate solution(VI)
    ➢ Black precipitate of lead sulphide is formed
- If sulphide is solid, add dilute hydrochloric acid and test smelly gas with damp lead ethanoate paper
Rotten egg smell of hydrogen sulphide and the gas turns lead (II) ethanoate paper black
Chloride ion test Cl^-
- If a soluble chloride, add dilute nitric acid and silver nitrate solution .The silver nitrate is acidified with dilute nitric acid to prevent the precipitation of other non–halide silver salts
    ➢ A white precipitate of silver chloride soluble in dilute ammonia is formed
- If insoluble salt, add concentrated
	☐	☐	☐	☐	☐	☐

Bromide ion test $\mathbf{Br^-}$

- If bromide is soluble, add dilute nitric acid and silver nitrate The silver nitrate is acidified with dilute nitric acid to prevent the precipitation of other non–halide silver salts,
    - Cream precipitate of silver bromide forms only soluble in concentrated ammonia
- If insoluble salt, add concentrated sulphuric acid, warm gently if necessary
    - Orange vapour of bromine and pungent fumes sulphur dioxide form
- Adding lead (II) nitrate solution
    - A white precipitate of lead (II) bromide is formed

Iodide ion test $\mathbf{I^-}$

- If iodide is soluble, add dilute nitric acid and silver nitrate solution. The silver nitrate is acidified with dilute nitric acid to prevent the precipitation of other non–halide silver salts
    - Yellow precipitate of silver iodide insoluble in concentrated ammonia
- If insoluble salt, can heat with concentrated sulphuric acid
    - Yellow precipitate of lead (II) iodide

Nitrate (V) ion test $\mathbf{NO_3^-}$

- Boil the suspected nitrate with sodium hydroxide solution and fine aluminium powder (Devarda's Alloy) or aluminium foil
    - The fumes contain ammonia, which turns red litmus blue
- Add iron(ii) sulphate solution and then conc. sulphuric acid (the '**brown ring'**test
    - Where the liquids meet a brown ring forms
- Strongly heating nitrates of M^{2+} salts

Nasty brown gas (beware!) of nitrogen(IV) oxide (nitrogen dioxide) **Hydroxide ion test** $\mathbf{OH^-}$

- Litmus or universal indicator or pH meter
    - It turns litmus blue, variety of colours universal indicator dark green – violet for weak – strong.
- Add a little of ammonium salt
    - If strongly alkaline ammonia should be released

Chromate(VI) ion test $\mathbf{CrO_4^{2-}}$

- Add dilute sulphuric acid.
    - The yellow solution turns orange as the dichromate(VI) ion

d. Interpret the results correctly. This may include: ☐ Noting down the colours produced ☐ Identifying the anions **Note: care should be take when handling chemicals**	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

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Signed: Assessor: ____________________ Trainee: ______________

10 PERFORM AN EXPERIMENT ON ELECTROLYSIS OF WATER	**Satisfactory**			**Not Satisfactory**		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: ☐ Hofmann voltameter ☐ Water ☐ Dilute sulphuric acid ☐ Power source (12V) ☐ Glowing splint ☐ Stirrer	☐	☐	☐	☐	☐	☐
b. Set up the apparatus correctly. This may include: ☐ Putting the Hofmann voltameter on the horizontal bench ☐ Connecting the Hofmann voltameter to the power supply ☐ Opening the taps of the limbs ☐ Adding a few drops of dilute sulphuric acid to the water to improve on its conductivity ☐ Stirring fully ☐ Pouring acidified water into the central limb ☐ Closing the taps when full with acidified water	☐	☐	☐	☐	☐	☐
c. Run the experiment correctly. This may include: ☐ Closing the taps on the voltameter. ☐ Switching the power source on ☐ Letting it to run for some time ☐ Switching off when the water is almost finished in the limb with more gas	☐	☐	☐	☐	☐	☐
d. Interpret the results correctly. This may include: ☐ Identifying the gases; ➢ using either the quantities produced ➢ using a glowing splint placed some 10 cm above tips of the limbs containing the gases • Hydrogen produces a squeak pop sound when a glowing splint is introduced into the container • Oxygen causes the glowing splint to burn brightly	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: Trainee:

11 PERFORM AN EXPERIMENT ON THE ENERGY CHANGES DURING A CHEMICL REACTION	Satisfactory			Not Satisfactory		
During observation of work activities, the candidate demonstrated that they can:						
a. Identify the apparatus correctly. This may include: - Vinegar - Baking soda - Calcium chloride - Water - Thermometer - 4 small plastic cups - 1 measuring cup - Spatula (1 teaspoon or ½ teaspoon)	☐	☐	☐	☐	☐	☐
b. Set up apparatus correctly. This may include: - Arranging the apparatus and materials in readiness for the two processes to be carried out	☐	☐	☐	☐	☐	☐

c. Run experiment correctly. This may include:						
Baking Soda and Vinegar ☐ Pouring about 10 mL of vinegar into a small plastic cup. Then, place a thermometer into the vinegar. Record the initial temperature (T_i) in the table below. ☐ While the thermometer is in the cup, add about ½ teaspoon of baking soda to the cup. ☐ Watching the thermometer for any change in temperature. After it has stopped changing, record the final temperature (T_f) and any other observations you made in the table below. Baking Soda and Calcium Chloride ☐ Making a baking soda solution by dissolving about 2 tablespoons of baking soda in 1 cup of water. Stir until no more baking soda will dissolve. ☐ Placing about 10 mL of baking soda solution in a small plastic cup. Then, place a thermometer into the baking soda solution. Record the initial temperature (T_i) in the table below ☐ While the thermometer is in the cup, add ½ teaspoon of calcium chloride to the cup. ☐ Watching the thermometer for any change in temperature. After it has stopped changing, record the final temperature (T_f) and any other observations you made in the table below	☐	☐	☐	☐	☐	☐

Process	T_i	T_f	Endothermic /Exothermic	Other obs.	ΔH(+/-)
Baking soda + vinegar					
Baking soda solution + Calcium chloride					

d. Interpret the results correctly. This may include: Using the table: Comment on the values of temperatures, observations and the type of the energy changes associated with the two processes	☐	☐	☐	☐	☐	☐
e. Identify the errors that may affect the experiment and how they can be avoided.	☐	☐	☐	☐	☐	☐

Assessor comments:

Signed: Assessor: ____________________ Trainee: _____________

Final Assessment Summary

Practical assessment summary

Note: refer to mapping document if required

		Satisfactory	Not Satisfactory
1.	Preparation of single salt	☐	☐
2.	Preparation of gas	☐	☐
3.	Fractional distillation	☐	☐
4.	Gravimetric analysis of soluble chloride	☐	☐
5.	Melting point determination by capillary tube method	☐	☐
6.	Calibration curve and its use	☐	☐
7.	Identification of organic compounds	☐	☐
8.	Identification of cations	☐	☐
9.	Identification of anions	☐	☐
10.	Electrolysis of water	☐	☐
11.	Energy changes during chemical reactions	☐	☐

Assessor comments:

Signed: Assessor: ____________________ Trainee: _____________

Assessment Outcome

Satisfactory ☐

Not Satisfactory ☐

Employee/Trainee	**Assessor**
Employee/Trainee name: ______________________ (Print)	Assessor name: ______________________ (Print)
Employee/Trainee comments:	**Assessor comments:**
Signature: ______________________ Date: ______________________	Signature: ______________________ Date: ______________________

VALIDATION OF THE ASSESSMENT

NAME:………………………………………….. DATE:………………………………………..

POSITION: **PRINCIPAL/HEAD OF INSTITUTION** SIGNATURE:……………………………..

NAME INSTITUTION:………………………………………….

STAMP: