



Hong Kong Diploma of Secondary Education Examination

Combined Science (Chemistry part)

School-based Assessment Sample Tasks

Teachers may use the sample tasks for non-profit making educational and research purposes with proper acknowledgement.

Chemistry School-based Assessment
Practical Related Tasks

Volumetric analysis

Teacher Notes

NSS Chemistry Curriculum Link: Topic IV Acids and Bases

Time Required: 40 minutes

Students are expected to have acquired the knowledge of topic IV and have some experience in handling apparatuses such as pipette, burette, and volumetric flask before carrying out the school-based assessment.

This experiment involves two tasks:

1. Dilution of sodium carbonate solution
2. Titration of diluted sodium carbonate solution with a standard solution of hydrochloric acid

Students should perform the experiment individually. In order to facilitate large class size, both the side benches and the teacher bench may have to be used. Teachers may distribute the experimental worksheet to students beforehand for reducing the stress of the students during practical assessment. In order to test students' knowledge of detecting the end point of a titration, an unfamiliar indicator, bromothymol blue, is used. Students have to decide the colour change at the end point.

The assessment is mainly based on the written worksheet. Nevertheless, the teacher can walk around to observe student performance and to give some advice. The teacher can take note whether

- (1) there is a filter funnel on top of the burette when the titration is carried out;
- (2) there is a white tile beneath the conical flask when the titration is carried out;
- (3) there is air space between the tap and the tip of the burette; and
- (4) the students perform the experiment safely.

Chemistry School-based Assessment
Practical Related Tasks

Volumetric analysis

Assessment Criteria

Marks	Remarks
10 - 9	<ul style="list-style-type: none">• There are at least four titration readings (including the trial).• The titration readings are recorded in 2 decimal places.• The titration results are accurate (i.e. within $\pm 0.05 \text{ cm}^3$) and the standard deviation of the titres is small (i.e. within $\pm 0.05 \text{ cm}^3$).• Colour changes are accurately recorded.• Calculations are accurate and concise.
8 - 6	<ul style="list-style-type: none">• There are at least three titration readings (including the trial).• The titration readings are recorded in 1 decimal place.• The titration results are reasonably accurate (i.e. within $\pm 0.15 \text{ cm}^3$) and the standard deviation of the titres is reasonably small (i.e. within $\pm 0.15 \text{ cm}^3$).• Colour changes are accurately recorded.• Calculations are accurate and concise.
5 - 3	<ul style="list-style-type: none">• There are at least two titration readings (including the trial).• The titration readings are recorded.• The titration results are barely accurate (i.e. within $\pm 0.25 \text{ cm}^3$) and the standard deviation of the titres is reasonable (i.e. within $\pm 0.25 \text{ cm}^3$).• Colour changes are accurately recorded.• Calculations are appropriate.
2 - 1	<ul style="list-style-type: none">• There is at least one titration reading (including the trial).• The titration readings are recorded.• Colour changes are recorded.• Calculations are shown.

Chemistry School-based Assessment
Practical Related Tasks

Volumetric analysis

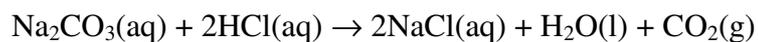
Student Handout

Carry out volumetric analysis using the 0.2 M hydrochloric acid, sodium carbonate solution labelled as 'solution A', and an acid base indicator provided. Determine the concentration of solution A.

Method

1. Dilute 25.00 cm³ of solution A to 250.0 cm³ with deionized water.
2. Transfer 10.00 cm³ of the diluted solution A to a conical flask and titrate it with 0.2 M hydrochloric acid using the indicator provided.

Relevant equation



Titration results

Trial titration

	Final burette reading / cm ³			
	Initial burette reading / cm ³			
	Volume of titrant / cm ³			

Mean titre = _____ cm³

Colour change of indicator: from _____ to _____

Calculations

Concentration of A =

Chemistry School-based Assessment
Practical Related Tasks

Experiment
(Assessment based on a quiz)

Teacher Notes

NSS Chemistry Curriculum Link: Topic IV Acids and Bases
Time Required: 80 minutes (For the practical session)

This is a simple experiment requiring students to prepare an insoluble salt. The students can be assessed through their performance in the pre-experimental quiz.

The teacher should be able to assess the students based on their pre-experimental quiz. The quiz is for consolidating the knowledge required for the experiment.

In a smaller class, the teacher can also choose to assess students' practical skills. In order to alert the students in performing the experiments with care, it can be mentioned clearly to them that marks may have to be adjusted if any unsafe practice is noted. Moreover, the tidiness of the bench during / after experiment can also be used as one of the criteria in assessing the practical performance.

For the experiment, besides wearing a pair of safety spectacles, the students should be reminded to wash their hands thoroughly before leaving the laboratory owing to the toxic nature of barium compounds. In order to determine the dry weight, the students have to keep the solid in an oven before measuring the weight.

Chemistry School-based Assessment
Practical Related Tasks

Experiment
(Assessment based on a quiz)

Assessment Criteria

Marks Distribution (Total: 10 marks)	Remarks
3	<ul style="list-style-type: none">• Understanding of the underlying chemical principle of the experiment is demonstrated.
2	<ul style="list-style-type: none">• Understanding of the experimental procedures is demonstrated.
4	<ul style="list-style-type: none">• Accurate calculations are shown.
1	<ul style="list-style-type: none">• Scientific and critical mind is demonstrated.

Chemistry School-based Assessment
Practical Related Tasks

Experiment
(Assessment based on a quiz)

Pre-experimental quiz

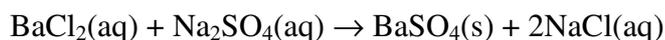
1. Write an ionic equation for the reaction involved in the preparation of barium sulphate in this experiment. (1 mark)
2. Can copper(II) chloride be prepared by mixing copper(II) nitrate solution and sodium chloride solution? Explain your answer. (2 marks)
3. What is the purpose of washing the residue with deionized water? (1 mark)
4. Suggest a salt that cannot be dried by using oven. (1 mark)
5. Calculate the no. of moles of barium ions in 10.0 cm^3 of 0.2 M barium chloride solution. (1 mark)
6. Calculate the no. of moles of sulphate ions in 10.0 cm^3 0.2 M sodium sulphate solution. (1 mark)
7. Calculate the theoretical mass of barium sulphate that should be obtained. (2 marks)
8. Suggest ONE possible source of error for the experiment. (1 mark)

Student Handout

Preparation of an insoluble salt – barium sulphate

For preparing an insoluble salt, one method is to mix two soluble reagents each containing the respective cation and anion. When the ions of the insoluble salt combine, the precipitate of the salt forms. Such a reaction is called precipitation.

In preparing barium sulphate, barium chloride solution can be mixed with sodium sulphate solution.



The precipitate formed is then filtered and washed with deionized water. Finally, the precipitate can be dried in an oven or in a desiccator.

Chemical reagents and apparatus

- 0.2 M barium chloride solution
- 0.2 M sodium sulphate solution
- Measuring cylinder
- Boiling tube
- Test tube rack
- Filter paper and funnel
- Spatula
- Oven
- Electronic balance

Precaution

1. Handle all chemical reagents with care.
2. Barium ions are toxic. Wash the hands thoroughly before leaving the laboratory.
3. All chemical wastes have to be placed into designated bottles for subsequent treatment.

Procedure

1. Mix 10.0 cm³ of 0.2 M barium chloride solution and 10.0 cm³ 0.2 M sodium sulphate solution in a boiling tube.
2. Weigh a piece of filter paper.
3. Filter the mixture by using the pre-weighed filter paper in a filter funnel.
4. Wash the residue with deionized water.
5. Place the residue together with the filter paper into an oven.
6. After 20 minutes, weigh the residue together with the filter paper.

Chemistry School-based Assessment
Practical Related Tasks

Experiment
(Assessment based on a worksheet)

Teacher Notes

NSS Chemistry Curriculum Link: Topic IV Acids and Bases
Time Required: 80 minutes (For the practical session)

This is a simple experiment requiring the students to prepare an insoluble salt. The students can be assessed through their performance in the experimental worksheet.

The teacher should be able to assess the students based on their written worksheets. For the written worksheet, the teacher should consider whether the students are given adequate time to complete and to hand in within lesson time. However, by asking the students in completing the worksheet within lesson time can prevent them from copying from each other.

In a smaller class, the teacher can also choose to assess students' practical skills. In order to alert the students in performing the experiments with care, it can be mentioned clearly to them that marks may have to be adjusted if any unsafe practice is noted. Moreover, the tidiness of the bench during / after experiment can also be used as one of the criteria in assessing the practical performance.

For the experiment, besides wearing a pair of safety spectacles, the students should be reminded to wash their hands thoroughly before leaving the laboratory owing to the toxic nature of barium compounds. In order to determine the dry weight, the students have to weigh the solid placed in oven before measuring the weight.

Chemistry School-based Assessment
Practical Related Tasks

Experiment
(Assessment based on a worksheet)

Assessment Criteria

Marks Distribution (Total: 10 marks)	Remarks
1	<ul style="list-style-type: none">Understanding of the objective of the experiment is demonstrated.
1	<ul style="list-style-type: none">Observation is accurately described.
2	<ul style="list-style-type: none">Understanding of the experimental procedures is demonstrated.
2	<ul style="list-style-type: none">Accurate and precise data and numerical results are recorded.
3	<ul style="list-style-type: none">Accurate calculations are shown.
1	<ul style="list-style-type: none">Scientific and critical mind is demonstrated.

Chemistry School-based Assessment
Practical Related Tasks

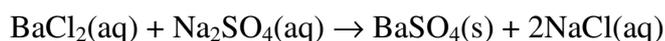
Experiment
(Assessment based on a worksheet)

Student Handout

Preparation of an insoluble salt – barium sulphate

For preparing an insoluble salt, one method is to mix two soluble reagents each containing the respective cation and anion. When the ions of the insoluble salt combine, the precipitate of the salt forms. Such a reaction is called precipitation.

In preparing barium sulphate, barium chloride solution can be mixed with sodium sulphate solution.



The precipitate formed is then filtered and washed with deionized water. Finally, the precipitate can be dried in an oven or in a desiccator.

Chemical reagents and apparatus

- 0.2 M barium chloride solution
- 0.2 M sodium sulphate solution
- Measuring cylinder
- Boiling tube
- Test tube rack
- Filter paper and funnel
- Spatula
- Oven
- Electronic balance

Precaution

1. Handle all chemical reagents with care.
2. Barium ions are toxic. Wash the hands thoroughly before leaving the laboratory.
3. All chemical wastes have to be placed into designated bottles for subsequent treatment.

Procedure

1. Mix 10.0 cm^3 of 0.2 M barium chloride solution and 10.0 cm^3 0.2 M sodium sulphate solution in a boiling tube.
2. Weigh a piece of filter paper.
3. Filter the mixture by using the pre-weighed filter paper in a filter funnel.
4. Wash the residue with deionized water.
5. Place the residue together with the filter paper into an oven.
6. After 20 minutes, weigh the residue together with the filter paper.

Post-experimental Worksheet

1. What is the objective of the experiment? (1 mark)
2. What do you observe when you mix barium chloride solution with sodium sulphate solution? (1 mark)
3. What is the purpose of washing the residue with deionized water? (1 mark)
4. Suggest a salt that cannot be dried by using oven. (1 mark)
5. Record your results (2 marks)

Mass of filter paper = _____ g
Mass of filter paper + barium sulphate = _____ g
Mass of barium sulphate = _____ g
6. Calculate the theoretical mass of barium sulphate that should be obtained. (2 marks)
7. What is the percentage yield of barium sulphate by mass? (1 mark)
8. Suggest ONE possible source of error for the experiment. (1 mark)

Chemistry School-based Assessment
Practical Related Tasks

Experiment
(Assessment based on a report)

Teacher Notes

NSS Chemistry Curriculum Link: Topic IV Acids and Bases
Time Required: 80 minutes (For the practical session)

This is a simple experiment requiring the students to prepare an insoluble salt. The students can be assessed through their performance in the experimental report.

The teacher should be able to assess the students based on their reports. For the reports, it can be in form of a full report or the teacher may consider requiring the students to write a short one without reporting the procedures, etc. As students are required to write experimental reports, the time for doing so should be long and the task could probably not be finished during lesson time. In this regard, the teacher may consider to collect the data sheet copy before letting students leave the laboratory for preventing them from any potential misconduct such as plagiarism.

In a smaller class, the teacher can also choose to assess students' practical skills. In order to alert the students in performing the experiments with care, it can be mentioned clearly to them that marks may have to be adjusted if any unsafe practice is noted. Moreover, the tidiness of the bench during / after experiment can also be used as one of the criteria in assessing the practical performance.

For the experiment, besides wearing a pair of safety spectacles, the students should be reminded to wash their hands thoroughly before leaving the laboratory owing to the toxic nature of barium compounds. In order to determine the dry weight, the students have to weigh the solid placed in oven before measuring the weight.

Chemistry School-based Assessment
Practical Related Tasks

Experiment
(Assessment based on a report)

Assessment Criteria

Marks	Remarks
10-9	<ul style="list-style-type: none">• Demonstration of manipulative skills including filtration and weighing substances with considerable dexterity, taking into account of all necessary safety precautions (such as washing hands before leaving laboratory and wear safety spectacles).• Carrying out experimental work independently with confidence.• Making all of the required observations with due regard to accuracy and detail, and/or taking most measurements with a precision within that of the apparatus as reflected from the number of decimal places recorded in the data.• Making interpretation of the information obtained from an experiment successfully without assistance as reflected from its calculation in percentage yield.• Writing the objective and observations in a clear and concise way.• Writing a logical, coherent and systematic scientific report.
8-6	<ul style="list-style-type: none">• Demonstration of a range of manipulative skills including filtration and weighing substances with considerable with dexterity, taking into account of most of the safety precautions(such as washing hands before leaving laboratory and wear safety spectacles).• Carrying out experimental work with occasional guidance.• Making most of the required observations in a methodical and organised way and/or taking many measurements with a precision within that of the apparatus. The recording is mostly complete.• Knowing the objective and writing the observations correctly.• Writing a scientific report with the relevant sections containing appropriate contents.
5-3	<ul style="list-style-type: none">• Demonstration of a range of manipulative skills including filtration and weighing substances with moderate dexterity, and showing some regard for safety.• Carrying out experimental work with some guidance.• Making the required observations with some accuracy, and/or taking some measurements with a precision within that of the apparatus. The recording is mostly complete.• Knowing the objective and writing the observations.• Writing a scientific report with the relevant sections containing appropriate contents at times.
2-1	<ul style="list-style-type: none">• Demonstration of an ability to use the common apparatus in the laboratory with some dexterity, and showing little regard for safety.• Carrying out experimental work with considerable guidance.• Making the required observations and/or taking some measurements.• Recording some observations.• Attempting to write a report.

Chemistry School-based Assessment
Practical Related Tasks

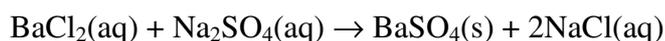
Experiment
(Assessment based on a report)

Student Handout

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6. After 20 minutes, weigh the residue together with the filter paper.

Post-experimental Report

Write a detailed report for this experiment. The report should contain the following sections:

- (1) Objective
- (2) Theory
- (3) Chemical reagents and apparatus
- (4) Precautions
- (5) Procedures (in passive voice)
- (6) Results (including observations and calculations, etc.)
- (7) Discussion (including possible error and suggestions for further improvement, etc.)