# Acids, bases, salts

All acids are harmful – or are they?

# SAILS inquiry and assessment unit overview

|  |  |
| --- | --- |
| **Name** | Acids, bases, salts |
| **Key content/concepts** | * Acids, bases and salts in everyday life * Chemical properties – how to detect acids and bases * Use of indicators |
| **Level** | * Lower second level |
| **Inquiry skills assessed** | * Planning investigations * Developing hypotheses * Forming coherent arguments * Working collaboratively |
| **Assessment of scientific reasoning and scientific literacy** | * Scientific reasoning (drawing conclusions; observation, classification, making comparisons) * Scientific literacy (everyday applications of acids and bases; explaining phenomena scientifically) |
| **Assessment methods** | * Classroom dialogue * Teacher observation * Peer-assessment * Self-assessment * Worksheets * Student devised materials (pH scale) * Other assessment items (post-activity test) |

Table 1: Teacher rubric for the assessment of developing hypotheses

|  |  |  |  |
| --- | --- | --- | --- |
| **Inquiry skill** | **Level 1** | **Level 2** | **Level 3** |
| **Developing hypotheses** | Student was not able to formulate a hypothesis, not even with the teacher´s help | Student was able to formulate a hypothesis with the teacher´s help | Student was able to formulate a hypothesis without additional help |

|  |
| --- |
| Hypothesis no. \_\_\_  The mistake was:  ......................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................  The final conclusion is: ......................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................  Verified Modified Rejected |

Figure 9: Self-assessment of developing hypotheses

Table 2: Rubric used to evaluate constructed pH scale

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Excellent (4)** | **Good (3)** | **Needs improvement (2)** | **Unacceptable (1)** |
| **The colour of the indicator for each sample is precise** | All measurements are correct/No mistakes at all | Some mistakes/Most measurements are correct | Several mistakes/Some measurements are correct/It can be improved | A lot of mistakes/It needs a lot of work to be improved |
| **Numerical values of pH are precise** | All numerical values are precise/No mistakes at all | Some mistakes/Most numerical values are precise | Several mistakes/Some numerical values are precise/It can be improved | A lot of mistakes/It needs a lot of work to be improved |
| **Each colour is matched with the right numerical value of the pH** | All colours are matched with the right numerical value/No mistakes at all | Some mistakes/Most colours are matched with the right numerical value | Several mistakes/Some colours are matched with the right numerical value/It can be improved | A lot of mistakes/It needs a lot of work to be improved |
| **Numerical calibration of the pH scale is precise** | All numerical values are precise/No mistakes at all | Some mistakes/Most numerical values are precise | Several mistakes/Some numerical values are precise/It can be improved | A lot of mistakes/It needs a lot of work to be improved |
| **Numerical values as well colour values have been placed in the right spots across the scale** | All numerical values and colour values have been placed in the right spots/No mistakes at all | Some mistakes/Most numerical values and colour values have been placed in the right spots | Several mistakes/Some numerical values and colour values have been placed in the right spots/It can be improved | A lot of mistakes/It needs a lot of work to be improved |
| **No sample is missing from the scale** | No sample is missing from the scale/No mistakes at all | Some mistakes/Most samples are present in the scale | Several mistakes/Some samples are present in the scale/It can be improved | A lot of mistakes/It needs a lot of work to be improved |

Table 3: Teacher rubric for the assessment of forming coherent arguments

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Excellent (4)** | **Good (3)** | **Needs Improvements (2)** | **Unacceptable (1)** |
| **Does the answer seem right?** | All points seem right/No mistakes at all | Some mistakes/Most points seem right | Several mistakes/Some points seem right/It can be improved | The answer is unacceptable |
| **Do they use arguments in order to convince you?** | All arguments convinced me/No mistakes at all | Some mistakes/Most arguments convinced me | Several mistakes/Some arguments convinced me/It can be improved | The arguments are unacceptable |
| **Is the argumentation being used complete?** | The argumentation is complete/No mistakes at all | Some mistakes/Most arguments are complete | Several mistakes/Some arguments are complete/It can be improved | The argumentation is unacceptable |

Table 4: Self-assessment card for the assessment of scientific literacy

|  |  |  |  |
| --- | --- | --- | --- |
| **Self-assessment card** | **Very well** | **With deficiencies** | **I can´t do it** |
| **1.** I understand the classification of substances based on the solution of red cabbage extract... |  |  |  |
| **2.** I was able to get information from the internet or encyclopaedia... |  |  |  |
| **3.** I was able to suggest a procedure for preparing the indicator from red cabbage... |  |  |  |
| **4.** I managed to get indicator from red cabbage... |  |  |  |
| **5.** I was able to sort substances as acids or bases based on the values of pH... |  |  |  |
| **6.** I was able to explain the term indicator... |  |  |  |
| **7.** I was able to explain why water and kitchen salt solutions were not acidic or alkaline solutions... |  |  |  |

Table 5: Example of a self-assessment card after learning the topic “Acids”

|  |  |  |  |
| --- | --- | --- | --- |
| **Topic: Acids** | **With significant help from the teacher** | **With the teacher’s help** | **Independently** |
| **1. I can name...**  ...three acids used at home, and  ...three acids used in a laboratory |  |  |  |
| **2. I can explain...**  ...what indicators are |  |  |  |
| **3. I can describe...**  ...what to do after an acid spill |  |  |  |
| **4. I know the principle of...**  ...how to dilute acids with water |  |  |  |
| **5. I can write down...**  ...the chemical formulas of three acids |  |  |  |
| **6. I can determine...**  ...if an unknown solution is acidic or not |  |  |  |

Table 6: Teacher rubric for the assessment of formulation of conclusions

|  |  |  |  |
| --- | --- | --- | --- |
| **Inquiry skill** | **Level 1** | **Level 2** | **Level 3** |
| **Formulation of conclusions (scientific reasoning)** | Student was not able to formulate a conclusion, not even with the teacher´s help | Student was able to formulate conclusion with the teacher´s help | Student was able to formulate a conclusion without additional help |

Table 7: Assessment table for working collaboratively (teamwork)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Use the following scale and mark the option which describes you most:** | **1**  **Almost never** | **2**  **Rarely** | **3**  **Sometimes** | **4**  **Always** |
| **1.** I like to work in a group. |  |  |  |  |
| **2.** I am more comfortable working in a group than working alone. |  |  |  |  |
| **3.** I like working in a group, because I would not manage the work on my own. |  |  |  |  |
| **4.** I can listen to ideas of other members of the group. |  |  |  |  |
| **5.** I can persuade the group about my idea. |  |  |  |  |
| **6.** I learn more during group work. |  |  |  |  |

Table 8: Assessment table for working independently

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Use the following scale and mark the option which describes you most:** | **1**  **Almost never** | **2**  **Rarely** | **3**  **Sometimes** | **4**  **Always** |
| **1.** I like to work individually |  |  |  |  |
| **2.** I learn more during individual work |  |  |  |  |
| **3.** I like my own pace during individual work |  |  |  |  |
| **4.** I prefer individual work, because the group does not accept my opinions. |  |  |  |  |