Assessment

The gas we drink - Carbon dioxide in carbonated beverages

Assessment criteria

The assessment of this Task can be based on a number of student assessment tools. Note that formative assessment is more appropriate for practical activities and group work. Summative assessment here concerns mainly the theoretical concepts of: ions, ionic conductivity, electrolytes, electrolysis, ionic bonding, crystals and crystal structure.

The following tables provide criteria for further assessing the students' work. Each of tables 1 to 5 provides criteria for assessing separately each phase. Tables 6 and 7 list the criteria for assessing students' attitudes and interest toward the performed activities (Table 6) , and toward the theoretical concepts and science in general (Table 7). Students can be asked to add their comments for improving the activity. Needless to comment that the proposed student assessment tools are mere suggestions. Teachers can include their own criteria for assessment.

Table 1 – Criteria for collective class assessment of previous student knowledge (**Phase 1):** (i) knowledge of gases and their properties and laws; (ii) knowledge about atmospheric pressure; (iii) knowledge about carbon dioxide and its properties. The execution of the Phase-1 experiments about gases is also evaluated.

Students' knowledge about gases and their properties	The students had satisfactory knowledge	The students had limited knowledge	The students had problematic knowledge	The students had no knowledge
Students' knowledge about atmospheric pressure	The students had satisfactory knowledge	The students had limited knowledge	The students had problematic knowledge	The students had no knowledge
Students' knowledge about carbon dioxide and its properties	The students had satisfactory knowledge	The students had limited knowledge	The students had problematic knowledge	The students had no knowledge
Execution of experiments about gases	Excellent	Adequate	Limited	Poor

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Table 2 – Criteria for assessing planning, execution and explanation of experimental activities of Phase 2.[1]

Explanation of escape of CO_2 from bottled beverage.	Excellent	Adequate	Limited	Poor
Study of effect of temperature on CO_2 solubility in beverage	Excellent	Adequate	Limited	Poor
Planning of experiment for measuring the volume of CO_2 in beverage	Excellent	Adequate	Limited	Poor

Table 3 – Criteria for assessing execution of the experimental activity of Phase 3 **(**measuring the volume of CO_2 in beverage).

Execution of activity for measuring the volume of CO_2 in beverage	Excellent	Adequate	Limited	Poor
Discussion of experimental errors	Excellent	Adequate	Limited	Poor
Answers to questions	Excellent	Adequate	Limited	Poor

[1] Kempa (1986) has considered that the following qualities should be taken into account in schemes for the assessment of practical abilities: (a) recognition and formulation of a problem (NOT APPLICABLE HERE); (b) design and planning of experimental procedures (NOT APPLICABLE); (c) setting-up and execution of experimental work (manipulation); (d) observational and measuring skills (including the recording of data and observations); (e) interpretation and evaluation of experimental data and observations.

Table 4 – Criteria for assessing planning, execution of the experimental activity of Phase 4 (determining gas pressure inside a closed beverage can).

Type (1) of proposed experiment: …….. ……..	Frequency	Proposed planning adequate	Proposed planning with some problems	Proposed planning poor
Type (2) of proposed experiment: …….. ……	Frequency	Proposed planning adequate	Proposed planning with some problems	Proposed planning poor
Type (3) of proposed experiment: …….. ……	Frequency	Proposed planning adequate	Proposed planning with some problems	Proposed planning poor
Execution of experiment	Excellent	Adequate	Limited	Poor

Table 5 – Criteria for assessing in-class discussion during phase 5.

Overall revision and evaluation of module by the students	The students had responded successfully	The students had responded in part	The students had limited involvement	The students were not involved at all
Discussion of experimental errors	Excellent	Adequate	Limited	Poor
Students' explanation of the CO_2 fountain	Excellent	Adequate	Limited	Poor

Table 6– Criteria for assessing students' attitudes and interest toward the performed activities.

In class discussion about the properties of gases (Phase 1)	High	Average	Low
Experiments on properties of gases (Phase 2)	High	Average	Low
Experiments on properties of CO_2. (Phase 2)	High	Average	Low
Planning and execution of experiment on volume of CO_2 in beverage (Phase 3)	High	Average	Low
Planning and execution of experiment on pressure of CO_2 in beverage (Phase 4).	High	Average	Low
Discussion of experimental errors (Phases 3 and 4)	High	Average	Low
Demonstration of CO_2 fountain (Phase 5)	High	Average	Low
End-of-module discussion (Phase 5)	High	Average	Low
In comparison with traditional practical activities the activities were …	Much better	About the same	Worse

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Table 7 – Criteria for assessing students' attitudes and interest toward the theoretical concepts and science in general.

The activities have contributed to increased knowledge and understanding about properties of gases	Yes a lot	Yes a little	No
The activities have contributed to increased knowledge and understanding about atmospheric pressure and gas pressure	Yes a lot	Yes a little	No
The activity has contributed to increased knowledge and understanding of science in general	Yes a lot	Yes a little	No
*Arrange in order of importance/usefulness the following seven studies**	Properties of gases	Properties of CO_2	Volume of CO_2 in beverage
Pressure of CO_2 in beverage	Understanding of carbonated beverages	CO_2 fountain	Experimental errors
*Arrange in order of interest the following seven studies***	Properties of gases	Properties of CO_2	Volume of CO_2 in beverage
Pressure of CO_2 in beverage	Understanding of carbonated beverages	CO_2 fountain	Experimental errors

* From 1 (most important/useful), to 7 (least important/useful).
** From 1 (most interesting), to 7 (least interesting).

Bibliography

Kempa R. (1986). *Assessment in science* (Ch. 5). Cambridge: Cambridge University Press.

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