**Test 0 and associated teacher’s notes**

[**MTA-ELTE Research Group on Inquiry-Based Chemistry Education**](https://mta.hu/kozoktatas-fejlesztesi-kutatasi-program/scientific-foundations-of-education-research-program-of-the-hungarian-academy-of-sciences-111618)

[**Research Programme for Public Education Development of the Hungarian Academy of Sciences**](https://mta.hu/kozoktatas-fejlesztesi-kutatasi-program/research-programme-for-public-education-development-of-the-hungarian-academy-of-sciences-111934)

*Note: More detailed instructions are available in Hungarian in the teacher’s guides, under the titles ‘*[T0 teszt és javítási útmutatója](https://ttomc.elte.hu/rails/active_storage/blobs/eyJfcmFpbHMiOnsibWVzc2FnZSI6IkJBaHBBa3NNIiwiZXhwIjpudWxsLCJwdXIiOiJibG9iX2lkIn19--32510915cae616a1da253bb1c5861d41330837bd/T0_teszt_2022_07_23_UTMUTATO_HONLAPRA.docx?disposition=attachment)’ *at* [*https://ttomc.elte.hu/publications/92*](https://ttomc.elte.hu/publications/92)

Test 0 (September, 2021)

Number of school:…(A) Number of teacher:…(B) Number of group:…(C) Number of student: …(D)

Gender of student (underlined): boy/girl (E)

The aim of our research is to make the teaching of chemistry as interesting and effective as possible.

Thank you for completing this test to the best of your ability. This will help our work considerably. Write your answers on this sheet of paper. Please do not use any other paper.

1. a) Do you know the name of the component of air that fuels combustion?

F

If you do, write it here on the dotted line. .......................................................................

1. b) Which gas do you think is the one that is more in the exhaled air than the air you

G

breathe in? ………………………………………………………………………………………………………………………

2. Steve, Liz and Lesley were pleased with the snowman they built. However, the **sun has come out and the children are worried their snowman will quickly melt**. Steve wants to put a black coat on the snowman to protect it from the sun. Liz says it would be better to put a white coat on the snowman because it reflects the sunlight. Lesley, on the other hand, says that the snowman doesn't need any coat because he is always warm in his coat. The children think that by replacing the snowman with an ice cube and the coats with large enough pieces of cloth, they could **experiment** to see which method would **best** protect their snowman from melting. **Help them design the experiment** with your answers below!

H

a)How many ice cubes do they need for the experiment?....................................................

b) How many pieces of cloth are needed for the experiment and what should they look like?

…………………………………………………………………………………………………………………………………….……

I

c) Where should the children put the ice cubes?.............................................................................

J

…………………………………………………………………………………………………………………………………………...

d)How should the children place each piece of cloth in the case of each ice cube?

K

…………………………………………………………………………………………………………………………………………..

L

e)What do the children need to observe to decide which of them was right?

……………………………………………………………………………………………………………………………………………………………

f) Put a (**+**) sign in front of the statement(s) in the list below that are important and a (**-**) sign in front of the statement(s) that are not important (You can write a different sign after a clear strike-through if you change your mind.)

M

The ice cubes must be the same size.

N

The ice cubes must be taken out at the same time, from the same freezer.

The ice cubes should be placed directly next to each other.

O

The pieces of cloth must be of the same type and thickness.

P

3. a) What is the visible sign of boiling in a liquid while it is heated?

Q

………………………………………………………………………………………………………………………………………..…

3. b) In one dish, we boil 1 litre of water and in the other dish 2 litres of water. In which case is more heat required if the initial temperatures are the same? **How many times** more heat is needed?

R

…………………………………………………………………………………………………………………………………………..

4. a) Do you think there is any **substance** among the particles of pure oxygen gas?

S

…………………………………………………………………………………………………………………………………………

4. b) The drawing illustrates an experiment when an uninflated baloon and an inflated balloon are placed in the two pans of the scale. The balloons have the same mass. Use dots (**∙**) to show where air particles are in the diagram wherever there is air.

EMPTY BALLOON

INFLATED BALLOON

**Draw the points (∙) representing the air particles** on each part of the framed figure where there is air. The points should be denser where there are more particles in a given volume.

T

4. c) **Which property of gases** would you attribute to the fact that you have drawn the dots denser on

one part of the gas? ………......................................................................................................

U

5. a) Write the following statement correctly! "*Sugar melts in tea*."

V

…………………………………………………………………………………………………………………………………..………

5. b) Drawing **A** shows the beginning of distillation of a solution. Particles of the solvent are shown by empty circles and the solid solute particles by black disks. Complete drawing **B** to show **where the particles of solvent and solute are** when the distillation is stopped after a while. (The number of circles and disks can be less than the number of circles and disks on the left drawing.)

W

HEATING

COOLING

* Please also answer the following questions!

X

* Write your end of year grade in 6th grade science in the box:
* The higher the number you circle, the more you preferred the subject called ‘science’.

(0: you did not like it at all, 5: you really liked it):

Y

1 2 3 4 5

* The higher the number, the more you consider it important to test ideas in sciences by experiments (0: not important at all; 5: very important)

Z

1 2 3 4 5

* The higher the number, the more you agree with the following statement:

“I prefer the step-by-step experiments to the ones that I have to design.”

AA

1 2 3 4 5

Instructions given to the teachers to mark the students’ answers of the Test 0

Please complete the columns of the Excel spreadsheet with the marks obtained following the instructions below. A student’s marks should be written in the appropriate row of the Excel spreadsheet.

Columns A-E contain information about the student’s identity and gender.

Columns F-W contain marks for students’ answers.

Columns X contains the student’s science mark in the previous year.

Columns Y-AA contain students’ attitude responses.

Columns AB contains information whether the student’s mother has got a degree in higher education.

Abbreviations:

* DCK: disciplinary content knowledge;
* EDS: experimental design task

Column ‘A’:

Number of school (i.e. the number given for this in column 1 of the table on the penultimate page of the teacher’s guide).

Column ‘B’:

Number of teacher (i.e. the number given for this in column 2 of the table on the penultimate page of the teacher’s guide).

Column ‘C’:

Number of group (class) (i.e. the number given for this in column 3 of the table on the penultimate page of the teacher’s guide).

Column ‘D’:

Number of student: The number of student in the alphabetic list of names of the group (class) in the beginning of Grade 7.

Column ‘E’:

1: If the gender in the answer concerning the student’s gender is a boy.

2: If the gender in the answer concerning the student’s gender is a girl.

Column ‘F’ (task 1.a)

If the word “oxygen” appears in the answer. Marks: 1

In any other case. Marks: 0

1 item: recall (DCK task)

Column ‘G’ (task 1.b)

If the expression “carbon dioxide” appears in the answer. Marks: 1

In any other case. Marks: 0

1 item: recall (DCK task)

Column ‘H’ (task 2.a)

If the number three appears in the answer. Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘I’ (task 2.b)

If (the number two and) one black + one white appears in the answer. Marks: 1

In any other case. Marks: 0.

1 item: higher order cognitive skills (EDS task)

Column ‘J’ (task 2.c)

If “on the sun” / “on the heat” or any synonymous expression appears in the answer (see examples in the teacher’s guide). Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘K’ (task 2.d)

If a correct method when one of the ice cubes is covered by the black cloth and the other by the white appears in the answer (see examples in the teacher’s guide). Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘L’ (task 2.e)

If “which ice cube melts last” or any synonymous expression appears in the answer (see examples in the teacher’s guide). Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘M’ (task 2.f)

If the student put a “+” sign in front of the following sentence: “The ice cubes must be the same size.” Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘N’ (task 2.f)

If the student put a “+” sign in front of the following sentence: “The ice cubes must be taken out at the same time, from the same freezer.” Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘O’ (task 2.f)

If the student put a “-” sign in front of the following sentence: “The ice cubes should be placed directly next to each other.” Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘P’ (task 2.f)

If the student put a “+” sign in front of the following sentence: “The pieces of cloth must be of the same type and thickness.” Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘Q’ (task 3.a)

If the word “bubble” or a synonym appears in the answer. Marks: 1

In any other case. Marks: 0

1 item: recall (disciplinary content knowledge task: DCK task)

Column ‘R’ (task 3.b)

If the expression “2 litres” and the word “double” also appear in the answer. Marks: 1

In any other case. Marks: 0

1 item: understanding (DCK task)

Column ‘S’ (task 4.a)

If the word “nothing” or “vacuum” or any synonymous expression appears in the answer. Marks: 1

In any other case. Marks: 0

1 item: understanding (DCK task)

Column ‘T’ (task 4.b)

If the points are on the drawing where there is air and the points are denser inside the balloon. Marks: 1

In any other case. Marks: 0

1 item: application (DCK task)

Column ‘U’ (task 4.c)

If the answer proves that the student understands and can apply the following correlation: There are more particles in a unit of volume inside the (blown up) balloon than in the unit of volume of the air around and/or the pressure is higher inside the (blown up) balloon than in the air around it. Marks: 1

In any other case. Marks: 0

1 item: application (DCK task)

Column ‘V’ (task 5.a)

If “the sugar dissolves in the tea” or any synonymous expression appears in the answer (see examples in the teacher’s guide). Marks: 1

In any other case. Marks: 0

1 item: understanding (DCK task)

Column ‘W’ (task 5.b)

If the right hand side drawing shows that only the particles of solvent are in the right hand side vessel and the particles of solute are not. Marks: 1

In any other case. Marks: 0

1 item: application (DCK task)

Column ‘X’

The student’s grade in science in the end of the 6th grade.

Column ‘Y’

The answer given by the student to the question how much he/she liked the subject “science”. (Insert the number circled by the student.)

Column ‘Z’

The answer given by the student to the question how important he/she thinks it is in science to test ideas by experiments. (Insert the number circled by the student.)

Columns ‘AA’

The answer given by the student to the question: “The higher the number, the more you agree with the following statement: »I prefer the step-by-step experiments to the ones that I have to design.«” (Insert the number circled by the student.)

Column ‘AB’

Enter the highest level of education of the student's mother/guardian/carer underlined on the paper consent form, coded as follows:

* primary school: 1
* secondary school: 2
* university/college: 3.

END OF EVALUATION OF THE TEST 0