Test 2

Number of school:…… Number of teacher:….. Number of group:…….. Number of student: ..…..

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

Thank you for completing this test according to the best of your knowledge, because you help our work. Please, write your answers only on this sheet of paper and do not use any other piece of paper.

AQ

1. a) What **gas** develops when magnesium and hydrochloric acid react?..........................**....**

1. b) Does lead (Pb) deposit from the aqueous solution of a lead compound, if zinc is placed in it? **Explain your answer** using the reactivity line of metals (see below).

AR

K Ca Mg Al Zn Fe Co Ni Sn Pb H Cu Ag Au

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

2. a) The aqueous solution of copper(II) sulphate is blue. How could you decide looking at a very dilute and a very concentrated copper(II) sulphate solution which one is the more concentrated? **Explain your answer!**

AS

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

2. b) There is 6% vinegar and 20% vinegar in two identical looking plastic bottles. The labels have fallen off from both bottles. You have to decide by doing an experiment, in which of the bottles is the more concentrated vinegar. (Smelling does not give a satisfactory answer and you must not taste the vinegar.) The following materials and equipment are available: 2 empty glasses (you can only use both of them once), 2 spoons, 4 droppers (with a scale on them showing the volume), aqueous solution of an alkaline caustic drain cleaner, red cabbage juice. (The vinegar is acidic and the red cabbage juice indicates the changes of pH by the change of colour.)

What materials would you put into one of the glasses and what into the other glass?...............................

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

AT

In what order would you put the materials into one of the glasses and into the other glass?

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

AU

How much would you put of the different materials into one of the glasses and how much into the

AV

other glass? …………….………………………………………………………………………………………………………….

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What different experiences would you expect in the case of the two glasses?

AW

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

Based on your experiences, how could you decide which plastic bottle contains the more concentrated

vinegar?…………………………………………………………………………………………………..…………………………

AX

3. a) A piece of eggshell and a piece of limestone were both held in flame and then they were put separately into water containing phenolphthalein. Why did the indicator show that both solutions are

alkaline? ……………………………………………………………………….………………………………………………….

AY

3. b) Write down the equation of the calcination.

AZ

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

4. The labels of two washing powders („**X**” és „**Y**”) show that they contain the following ingredients:

* „**X**” washing powder: *5-15% anionic surfactants, <5% nonionic surfactants, polycarboxilates, zeolits, enzymes, fragrance materials.*
* „**Y**” washing powder: *sulphate: more than 30%, phosphate and carbonate: 15-30%, anionic surfactants, chloride, silicate: 5-15%, polymers, anionic surfactants below 5%. It contains enzymes. It only contains active ingredients that are biologically easily degradable.*

Which would you buy, the „**X**” or the „**Y**” washing powder? (Assuming their price is the same.) Based on what you learnt about the water softeners, explain **why you did not use the other** washing powder!

BA

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

5. 5 cm3 of **fatty** milk is shaken with 2 cm3 petrol in a test tube. 5 cm3 of **skimmed** milk is

also shaken with 2 cm3 petrol in another test tube. Then we take 3 identical size drops of liquid from the upper layers of the content of both test tubes (from the solutions in petrol) and drop them on a piece of filter paper. In the case of the fatty milk or in the case of the skimmed milk is a bigger patch left on the paper after the evaporation of petrol? **Why?**

BB

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

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

BC

6. a) What is the formula of the magnesium chloride?………………………………………………..…....

b) Which of the materials listed below should be added to a dish of food that has got too much vinegar in it to improve its flavour? **Why?** *salt,**alcohol, citric acid, sodium bicarbonate, starch, cooking oil*

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

BD

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

7. There are three test tubes. One of them contains silver ions (Ag+), the other aluminium ions (Al3+), the third zinc ions (Zn2+) in colourless aqueous solutions. (There is about 1 cm3 dilute solution in each.)

There are two labelled glass bottles beside them, in one of them there is ammonia (NH3) solution and there is sodium hydroxide (NaOH) solution in the other. The table below shows what we would experience if we added a little (a few drops) or much more (several cm3) ammonia solution or sodium hydroxide solution to the test tubes containing the solutions of the different ions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ion | + little NH3 solution | + much NH3 solution | + little NaOHsolution | + much NaOHsolution |
| Ag+ | brown precipitate | brown precipitate, dissolves | brown precipitate | brown precipitate |
| Al3+ | white precipitate | white precipitate | white precipitate | white precipitate, dissolves |
| Zn2+ | white precipitate | white precipitate, dissolves | white precipitate | white precipitate, dissolves |

a)How many test tubes’ content should be examined **as a minimum** to be able to decide in the cases of all the three test tubes which ions’ solution is in them? **Why?**..........................................

BE

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

b) The NH3 solution or the NaOH solution could be used to determine which ion is in which test tube?

BF

**Why?**......................................................................................................................................

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

c) How should be added the reagent you have chosen?

BG

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

d) What would you experience in the case of the aluminium ions (Al3+) while doing the experiment?

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

BH

Please, give us the following information!

BI

The end-of-semester grade you got in chemistry:

* The larger the number you circle, the more you like chemistry:

BJ

(0: you do not like it at all, 4: you really like it): 0 1 2 3 4

* The bigger the number, the more you consider it is important to test ideas in sciences by experiments (0: not important at all; 4: very important):

BK

0 1 2 3 4

* The bigger 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.”

BL

0 1 2 3 4

* How important was it for you to fill in this test? (0: not important at all; 4: you worked as hard as you could):

BM

0 1 2 3 4

Instructions given to the teachers to mark the students’ answers of the Test 2

Teachers correcting the test can judge whether the particular answer is accepted, since that should be determined by the meaning of the answer.

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

Columns ‘AQ’-‘BH’ contain marks for students’ answers.

Columns ‘BI’ contains the student’s end-of-semester grade in chemistry.

Columns ‘BJ’-‘BM’ contain students’ attitude responses.

Column ‘AQ’ (task 1.a)

Hydrogen or H2 or H or Mg + 2HCl = MgCl2 + H2.

Marks: 1

In any other case. Marks: 0

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

Column ‘AR’ (task 1.b)

Alternative answer I.: Yes, because the zinc is more reactive (than the lead).

Alternative answer II.: Yes, because the zinc can reduce the lead.

Alternative answer III.: Yes, because the zinc can replace the lead in its compounds.

Alternative answer IV.: Yes, because the zinc is on the left (or in front) of the lead in the reactivity line.

Marks: 1

In any other case. Marks: 0

1 item: application (DCK task)

Column ‘AS’ (task 2.a)

The deeper blue the solution is the more concentrated it is, since the deeper blue the solution is, the more blue solute is in it. Marks: 1

In any other case. Marks: 0

1 item: understanding (DCK task)

Column ‘AT’ (task 2.b, question 1)

Alternative answer I.: Vinegar, red cabbage juice and aqueous solution of the caustic drain cleaner in both glasses.

Alternative answer II.: Vinegar and red cabbage juice in both glasses.

Alternative answer III.: Red cabbage juice and aqueous solution of the caustic drain cleaner in both glasses. *(Note: This answer is only acceptable, if the student wants to add the two types of vinegar to the content of the glasses later.)*

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘AU’ (task 2.b, question 2)

Alternative answer I.: 1. vinegar 2. red cabbage juice (or 1. red cabbage juice 2. vinegar) 3. aqueous solution of the caustic drain cleaner.

Alternative answer II.: 1. aqueous solution of the caustic drain cleaner 2. red cabbage juice (or 1. red cabbage juice 2. aqueous solution of the caustic drain cleaner) 3. vinegar.

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘AV’ (task 2.b, question 3)

Alternative answer I.: The same amount of the two types of vinegar in the two glasses and the same amount of red cabbage indicator into both glasses. The aqueous solution of the caustic drain cleaner should be added drop by drop to both solutions until the colour of one of the liquids changes.

Alternative answer II.: The same amount of the two types of vinegar in the two glasses and the same amount of red cabbage indicator into both glasses. The aqueous solution of the caustic drain cleaner should be added drop by drop to both solutions until the colours of both liquids change in the same way.

Alternative answer III.: The same amount of the aqueous solution of the caustic drain cleaner and the same amount of red cabbage indicator into the two glasses. The two types of vinegar should be added drop by drop to the content of the two glasses until the colours of one of the liquids change.

Alternative answer IV.: The same amount of the aqueous solution of the caustic drain cleaner and the same amount of red cabbage indicator into the two glasses. The two types of vinegar should be added drop by drop to the content of the two glasses until the colours of both liquids change in the same way.

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘AW’ (task 2.b, question 4)

Alternative answer I.: Less (or more) aqueous solution of the caustic drain cleaner should be added to the content of one glass than to the other until the colour of one of the liquids changes.

Alternative answer II.: Less (or more) aqueous solution of the caustic drain cleaner should be added to the content of one glass than to the other until the colours of both liquids change in the same way.

Alternative answer III.: Less (or more) aqueous solution of one type of vinegar should be added to the content of one glass than of the other type of vinegar to the content of the other glass until the colour of one of the liquids changes.

Alternative answer IV.: Less (or more) aqueous solution of one type of vinegar should be added to the content of one glass than of the other type of vinegar to the content of the other glass until the colours of both liquids change in the same way.

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘AX’ (task 2.b, question 5)

Alternative answer I.: The more concentrated acid is in that glass, in which the colour of the liquid has not changed until the colour of the liquid changed in the other glass, if the same number of drops were added of the aqueous solution of the caustic drain cleaner to the content of both glasses.

Alternative answer II.: The more concentrated acid is in that glass, in which more drops had to be added of the aqueous solution of the caustic drain cleaner until the same change of colour.

Alternative answer III.: The more concentrated acid is the one, which changes the colour of the same amount of aqueous solution of the caustic drain cleaner first, if the same number of drops of vinegar are added to the content of both glasses.

Alternative answer IV.: The more concentrated acid is the one, of which less number of drops changes the colour of the same amount of aqueous solution of the caustic drain cleaner in the same way.

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘AY’ (task 3.a)

Alkaline (calcium hydroxide) solution was formed in both cases.

Marks: 1

In any other case. Marks: 0

1 item: understanding (DCK task)

Column ‘AZ’ (task 3.b)

CaCO3 = CaO + CO2

Marks: 1

In any other case. Marks: 0

1 item: recall (DCK task)

Column ‘BA’ (task 4)

Alternative answer I.: I would choose the washing powder “X”, because there is no phosphate in it (since that causes environmental pollution).

Alternative answer II.: I would choose the washing powder “Y”, because there is phosphate in it that is a water softener.

Marks: 1

In any other case. Marks: 0

1 item: application (DCK task)

Column ‘BB’ (task 5)

The fatty milk, because it contains more fat (in the same volume than the skimmed milk). Marks: 1

In any other case. Marks: 0

1 item: understanding (DCK task)

Column ‘BC’ (task 6.a)

MgCl2Marks: 1

In any other case. Marks: 0

1 item: recall (DCK task)

Column ‘BD’ (task 6.b)

Alternative answer I.: Sodium bicarbonate should be added, because that reacts with the vinegar.

Alternative answer II.: Sodium bicarbonate should be added, because the vinegar develops carbon dioxide of the sodium bicarbonate.

Alternative answer III.: Sodium bicarbonate should be added, because an alkaline solution reacts with an acidic solution.

Alternative answer IV.: Sodium bicarbonate should be added, because that is used when there is too much acid in the stomach.

Marks: 1

In any other case. Marks: 0

1 item: application (DCK task)

Column ‘BE’ (task 7.a)

Alternative answer I.: 2, because then those 2 ions could be excluded in the case of the third test tube.

Alternative answer II.: 2, because then the content of the third test tube could be concluded.

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘BF’ (task 7.b)

Alternative answer I.: With the ammonia solution, because then the experiences would be different in the cases of the three test tubes.

Alternative answer II.: With the ammonia solution, because the experiences would be different in the case of aluminium ion and zinc ion containing solutions too.

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘BG’ (task 7.c)

Alternative answer I.: First only a little and then a lot (of the ammonia solution).

Alternative answer II.: Drop by drop (or in small quantities (of the ammonia solution).

Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘BH’ (task 7.d)

White precipitate would form that would not be dissolved in the excess of ammonia solution. Marks: 1

In any other case. Marks: 0

1 item: higher order cognitive skills (EDS task)

Column ‘BI’

The student’s end-of-semester grade in chemistry.

Column ‘BJ’

Insert the number circled by the student.

Column ‘BK’

Insert the number circled by the student.

Column ‘BL’

Insert the number circled by the student.

Column ‘BM’

Insert the number circled by the student.

END OF EVALUATION OF THE TEST 2