



Lesson Plan

HEUREKA COLOURFUL CHEMISTRY

School and teacher information

"Emil Racovita" High School, Galatzi, Romania
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Pedagogical background

Grade: 10th (Age 15-17 years)

Subject: Chemistry

Lesson theme: Acid-base indicators

Lesson goal: to make the acid-base indicators type known to students, their importance in establishing the nature of the environment

Lesson type: laboratory workshop

Operational objectives: they follow to make obvious the type of knowing, understanding, application and evaluation of the students knowledge, for example:

- to define acid-base indicators
- to classify acid-base indicators
- to perform a series of experiments and to indicate the the reaction environment using acid-base indicators
- to know the importance of those substances

Learning methods used:

- conversation
- experimentation
- independent observation
- explaining
- controlled or independent discovery
- brainstorming

Tools:

- chemical substances,
- laboratory utensils,
- working Record,
- XPLORA Knoppix DVD (Heureka colourful chemistry)

Lesson time schedule:

1. Organizational moment: 2 minutes
 - a) writing down the absent students in the class register
 - b) establishing the right atmosphere for didactical activity

2. Knowledge verification: 10 minutes

- a) verifying the homework given to students
- b) verifying the knowledge from previous lessons with the theme “Acids and bases”, through questions:
 - What are acids?
 - What is their main characteristic?
 - How do they colour acid-bases indicators learned in previous classes: litmus and phenolphthalein?
- c) The same questions are asked for bases
- d) What is the name of the reaction between acids and bases? What substances are obtained following this reaction?
- e) Gives examples of substances used at home that you know that have acid or basic character.
 - Yoghurt , orange or lemon juice taste sour. What are proprieties do you think they have?

3. New knowledge learning : 30 minutes

4. This phase starts with the announcement of the new lesson title “Acid-base indicators” which will be written on the blackboard.

Topic background

An indicator is a substance with organic molecule which changes colour depending on the pH, because of some structural modifications that take place, the pH of which the indicator colour changes is the turning pH.

In a field of pH there will coexist species of both acid character and basic character in comparable concentrations in fact it's about a turning interval (the field of turning of the indicator). On this field, the colour will be given by the mix between acid and basic species.

Not to influence the pH of the studied substance, the indicator quantity used will have to be very small.

The main acid-base indicators:

Indicator	Changing colour	Turning field
Picric acid	Incolour-yellow	0,1-0,8
Methyl yellow	Red-yellow	2,9-4
Orange methyl	Red-yellow	3,1-4,4
Litmus	Red-blue	4,5-8,3
Brometamol blue	Yellow-blue	6-7,6
Phenolphthalein	Incolour-red	8,3-10

Acid-base indicators are both used for determining the pH of a solution (indicator pH paper , which is imbued with an indicator mix), and for titrate acid-base reactions to make evident the pH at the moment of equivalence.

Moving on to practical activity, the teacher is telling students that they need to do a series of experiments in the order written in the paper (Heureka colourful chemistry), to

observe carefully the colour modifications, and to point out the environment character , to establish conclusions and to fill in the missing spaces in the paper .

Workflow

The experiments will be done on groups of three students, and the filling in the records will be done individually.

1. Comparison between some acids concentration

- Introduce in the first test tube 1-2 ml of $\text{CH}_3\text{-COOH}$ over it put 1-2 drops of litmus solution. In acid environment the litmus is coloured in
- Repeat the operation above using the H_3PO_4 solution and then the H_2SO_4 . Compare the colour intensity from the 3 test-tubes.
- The most intense colouration is obtained in the test tube.....
- The most weak colouration is obtained in the test tube.....



Figure 1: Comparison between some acids concentration

2. Comparison between some bases concentration

- Introduce in the first test tube 1 ml of AlCl_3 solution over it put 3-4 drops of NaOH solution, to prepare Al(OH)_3 . Put 1-2 drops of phenolphthalein. In basic environment phenolphthalein is coloured in.....
- Introduce in the second test tube 1ml Mg(OH)_2 solution over it put 1-2 drops of phenolphthalein.
- Repeat the previous experiment, using the NaOH solution. The most intense colouration is obtained in the test tube which contains, and the weakest one is obtained in test tube



Figure 2: Comparison between some bases concentration

3. The colouration of other indicators in the laboratory: picric acid , Congo red , orange methyl.

- a) Using the bottles with indicators on the table and 1ml solution of H_2SO_4 or $NaOH$ identify the colouration of the acid-base indicators.



Figure 3: The colouration of other indicators in the laboratory

4. The quality study of the pH of some solutions of salt.

- a) Introduce in 3 test tubes 1ml of $NaCl$, KCl , Na_2SO_4 solution in each, over it put 1-2 drops of Congo red.



Figure 4: The quality study of the pH of some solutions of salt

b) Introduce in 3 test tubes NH_4NO_3 , NH_4Cl , FeSO_4 solutions, and put 1-2 drops of orange methyl (picric acid)

c) Introduce in 3 test tubes NaHCO_3 , $\text{CH}_3\text{-COONa}$, Na_2CO_3 solutions and put 1-2 drops of phenolphthalein.

d) Introduce in 3 test tubes $\text{CH}_3\text{COONH}_4$, $(\text{NH}_4)_2\text{CO}_3$ and NH_4HCO_3 over it put 1-2 drops of Congo red.

4. Write down the observations in the laboratory record.

Final discussion: 5 minutes

A dialogue is carried out with students regarding the way they worked, what they observed, and the conclusion that they established.

Explanation of Homework: 3 minutes. It is recommended to fill in the papers with required observations.