Angry Bases

It’s a chemistry simulation that tests concepts with using simple tools to make hard concepts enjoyable and easy to learn.

Mapped to

10th - Acids, Bases and Salts

7th - Acids, Bases and Salts

It will test knowledge of

* Identification of Acids, Bases and Salts - 7th
* Action of indicators - 7th
* Definitions of acids, bases and salts - 10th
* Classification of acids, bases and salts - 10th

Description

There will be a scene similar to angry birds. But here on slingshot, instead of angry birds we will have base (default setting). On the other side there will be a beaker/pond full of acid (default settings). The pH value of the pond will be shown and action of this pond over litmus paper can be known by using various tools (in default blue litmus paper). Now the task is to make the pond neutral by throwing bases to the pond. After being neutral, when more bases is added to the pond, it will turn into basic. Now acid can be loaded on slingshot and will be fired to the pond to make it neutral.

At every stage, the pH value and action of litmus paper can be known. Also the net concentration of hydronium ion (H3O+) & hydroxyl ion (OH-) is compared.

Snapshots

Following are an indicative snapshot of how the simulations can look.

Snap 1:



In this stage (Default stage):

* A strong base is loaded to the slingshot and is fired to the beaker containing strong acid (HN).
* Default pH scale is shown as 2, showing the acidic nature of solution.
* After a base is fired, acid will be neutralised and pH scale will shift accordingly towards right.
* Three tools are available to play with the simulation.
* Blue litmus when dipped in solution will turn red.
* Red litmus will remain unchanged.
* An electrical circuit connected with bulb is shown. Bulb will glow brightly when dipped in solution, showing the electrical conduction of solution.
* nSBases & nSAcids on left shows the no. of strong bases and strong acids fired respectively from the slingshot.
* nSBases& nSAcids on right shows the no. of strong bases and strong acids that hit the beaker respectively.
* nWBases and nWAcids represents the no. of weak bases and weak acids respectively.
* The ions balance shows the relative difference between the conc. of hydronium & hydroxyl ion.

Snap 2:



In this stage

* The solution has been neutralised and so the pH scale shows 7.
* nBases and nAcids values have changed accordingly.
* The ions balance shows that conc. of H3O+ & OH-, it shows that the solution have been neutralised.

(The mentioned user “interactions” are just for indicative purpose, the UX/UI designer can use their own “interactions”. )

Parameters

* Compound on the slingshot
* pH value
* Reaction
* nSAcids & nSBases on left ; nWAcids & nWBases on left
* nSAcids & nSBases on right ; nWAcids & nWBases on right

Implementation

* The major parameter of this simulation is pH value that is shown on the pH scale.
* At max 5 bases or 5 acids can be fired from the slingshot.
* pH value is determined according to the difference in no. of H3O+ ion & OH- ion present in the solution/pond.
* Here I have shown acids and bases like a circle, but it’s just for indicative purpose. It can be shown as molecules or liquids. [See this](https://phet.colorado.edu/sims/html/acid-base-solutions/latest/acid-base-solutions_en.html) for more ways.
* Different clip art should be used for bulb in which it is attached to an electric circuit with electrodes to be dipped in the solution. It will test the electrical conduction of the solution.

**Calculation of nAcids - nBases in solution:**

nAcids - nBases = (nSAcids + 0.5\*nWAcids) - (nSBases + 0.5\*nWBases)

**Balance Index:**  The whole weighing machine is divided into 5 +ve & 5 -ve sprites.

This index just shows the id of sprite to be used.

**The implementation table**

|  |  |
| --- | --- |
| **nAcids - nBases-**  **in soln** | **Balance**  **Index** |
| 5.0 ; 4.5 | 5 |
| 4.0 ; 3.5 | 4 |
| 3.0 ; 2.5 | 3 |
| 2.0 ; 1.5 | 2 |
| 1.0 ; 0.5 | 1 |
| 0.0 | 0 |
| -0.5 ; -1.0 | -1 |
| -1.5 ; -2.0 | -2 |
| -2.5 ; -3.0 | -3 |
| -3.5 ; -4.0 | -4 |
| -4.5; -5.0 | -5 |
|  |  |

**Value of pH Scale**

* nSAcids - nSBases > 0 , pH = 2
* nSAcids - nSBases = 0 & nWacids - nWBases = 0, pH = 7
* nSAcids - nSBases < 0, pH = 13
* nSAcids = nSBases = 0 , nWAcid - nWBase > 0 , pH = 4
* nSAcids = nSBases = 0 , nWAcid - nWBase < 0 , pH = 10

**Action of litmus paper**

if (nAcids - nBases) > 0

{

* Dragging blue litmus to the solution will turn it red
* Red litmus will remain unchanged

}

else if (nAcids - nBases) = 0

{

* Both the litmus paper will remain unchanged in this condition

}

else for (nAcids - nBases) < 0

{

* Blue litmus will remain unchanged
* Red litmus will turn to blue

}

**Action of Electric bulb**

net nWAcidBase = nWAcid + nWBase

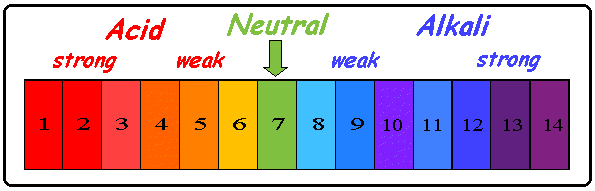
net nSAcidBase = nSAcid + nSBase

There are three stages of electric bulb

|  |  |
| --- | --- |
| **Stage** | **This will be condition when** |
| Bulb lightening very brightly | netSAcidBase > 0 |
| Bulb lightening medium brightly | netWAcidBase > 0 |
| Bulb lightening less brightly | nAcids = nBases = 0 |

**Color of beaker**

Color of beaker will change according to the pH value as shown below:



Test Cases

All test cases are discussed in implementation itself.

References

* [phet Simulation](https://phet.colorado.edu/sims/html/acid-base-solutions/latest/acid-base-solutions_en.html)
* NCERT Science Textbook 7th & 10th

Note

* Before adding any colour or interaction to any science element, kindly consult first  
  For eg. It may be lucrative to color bases and acids with some color but it will send wrong informations about them. So before doing any this kind of changes kindly confirm first from the respective content team member.