Dancing Elements

It’s a chemistry brain training game that tests chemistry concepts along with aptitude and analytical ability.

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 some moving chemical elements (In this discussion, when we say “element”, we are not referring to the chemical meaning of elements, instead we mean any entity that appears in the leftmost rectangle - be it ions, atoms, molecules etc) like Na+, Cl-, NH4+, HSO4- etc. Student has to select the pair of elements to form compounds based on some given constraint. These elements and constraints will keep changing with different level. More are the compounds formed, more would be the score.

But one level should not take more than 2 minutes, else it will be boring. So here we will be trying to do something like lumosity and elevate apps. In these apps, games are simple, but tests our analytical and aptitude approach.

Same elements can be present in multiple times. This will test students knowledge of valency.

**Example:** A student will be asked to form as many compounds as possible from a given set of elements with a constraint, say, the compound should be acidic in nature.

Snapshots

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

Snap 1:



In this stage (Initial stage):

* Elements are dancing. (The no. of elements can be randomised between some predefined range, Also same element can be present in multi times.Like Na+ in given condition)
* Instructions are given on right dialog box.

Snap 2:



In this stage (Mid stage)

* When one element is selected, it would increase in font size and would show a change in color ( an “interaction” to show that it is selected ). When it is paired with another element, it would also show the same color. (an “interaction” to show that it is paired with the previous element).
* The score will be increased if the pairing is done correctly (a user “interaction” to show correctness).
* The lower rectangular box shall have all paired elements as compounds.

**Snap 3: Easy stage with hint (Indicator tub)**



The indicator tub makes it easy to recognise the acids and bases by change of color.

When any formed acidic or basic compounds are dragged to ***indicator tub***, it changes its color.

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

Parameters

* Elements
* No. of dancing elements
* No. of cations & anions in the dancing elements
* Constraint

Implementation

The different elements classified on the basis of their nature are:

Cations: Na+, Mg2+, NH4+, H+, Ca2+, K+

Anions: Cl-, CH3COO-, SO42-, CO32-, NO3-, HS-, OH-, O2-

The elements classified on the basis of their valency are:

Valency\_1: Na+, NH4+, H+, K+ ; Cl-, CH3COO-, HS-, NO3-, OH-

Valency\_2: Mg2+, Ca2+ ; SO42-, CO32-, O2-

For our convenience, we define

*base ions* as **either** OH- or O2-

*acid ions* as **either** NH4+ or H+

The solution will be considered valid only when following condition is fulfilled:

1. An anion and cation are joined together.
2. Valency\_1 element will require one element of valency\_1
3. Two Valency\_1 element will be required to form compound with valency\_2 element.
4. Valency\_2 elements will require two elements of valency\_1.
5. Valency\_2 elements will require one element of Valency\_2

**Acidic Compounds -** Those compounds which are formed when any anion ( except base ions) are paired with acid ions.

**Basic Compounds -** Those compounds which are formed when any cation ( except acid ions) are paired with base ions.

**Salts:** Those compounds which are formed when cations and anions mix in appropriate numbers.

**Neutral**: Salts + H2O

**Hint Implementation**

Single ion cannot be dragged to the indicator tub. Only a compound can be dragged to the tub.

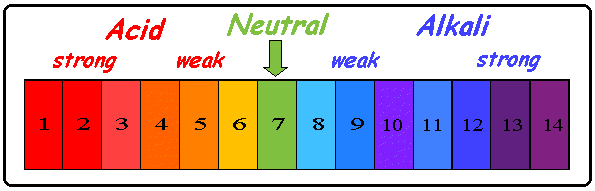
Two indicators will be used:

1. Litmus indicators: Common acid base indicator

* Initially the litmus solution will be purple in color.
* When acidic compound is dragged to the litmus indicator tub.
* Color changes to red
* When basic compound is dragged to the litmus indicator tub
* Color changes to blue
* When a neutral or salt is dragged to the litmus indicator tub
* Color doesn’t change

1. pH indicator: Universal indicator

Follow the following color chart:



**Level 1 - Constraints & its solution** (Mapped to 7th)

1. Compound is sour in taste. (Constraint)  
   Those compounds which are formed when any anion ( except base ions) are paired with acid ions.
2. Compound is corrosive in touch (Constraint)  
   Those compounds which are formed when any anion ( except base ions) are paired with acid ions.
3. Compound is bitter in taste (Constraint)  
   Those compounds which are formed when any cation ( except acid ions) are paired with base ions.
4. Compound is soapy in touch (Constraint)  
   Those compounds which are formed when any cation ( except acid ions) are paired with base ions.
5. Compound will turn blue litmus red (Constraint)

All acidic compounds

1. Compound will turn red litmus blue (Constraint)

All basic compounds

**Level 2 - Constraints & its solution** (Mapped to 10th)

All Level 1 constraints + followings:

1. Compounds should be acidic. (Constraint)  
   Those compounds which are formed when any anion ( except base ions) are paired with acid ions.
2. Compounds should be basic. (Constraint)  
   Those compounds which are formed when any cation ( except acid ions) are paired with base ions.
3. Compound should be a salt (Constraint)  
   Those compounds which are formed when cations and anions mix in appropriate numbers.

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More constraints and solutions can be added very easily if a chemistry engine framework is applied to the simulation.

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Test Cases

All test cases are discussed in constraint and its solution itself.

References

* [Lumosity](https://www.lumosity.com)
* NCERT Science Textbook 7th & 10th