

# [Hard water in chemistry](https://assignbuster.com/hard-water-in-chemistry/)

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(A) Experiment   
Name: Titration   
Required items:   
A beaker   
A burette   
Phenolphthalein   
HCL solution   
calcium hydroxide solution   
Procedure   
20 ml of a solution of HCl is to be placed in a beaker.   
Add a couple of drops, 3 to be precise of phenolphthalein to the beaker. It is to be noted that phenolphthalein has a pink colouring in bases but a transparent/ clear colour in acids.   
Fill a burette with calcium hydroxide.   
Calcium hydroxide is slowly added drop by drop to the acid, HCL until the solutions starts turning pink. This shows that the acid is being neutralised, that is, a neutral pH of 7 is being achieved.   
The reading of the burette is recorded. That is the amount of Calcium hydroxide required to neutralise 20ml of 0. 05M HCL   
All the steps are to be repeater at least three times to achieve a more accurate reading. The more number of times the experiment is performed the more the accurate the reading.   
(B) Laboratory sheet   
Readings   
Volume of HCL   
Volume of calcium hydroxide   
1   
20   
48   
2   
20   
53   
3   
20   
51   
4   
20   
52   
5   
20   
52   
6   
20   
49   
7   
20   
50   
8   
20   
51   
9   
20   
50   
10   
20   
48   
11   
20   
52   
12   
20   
53   
13   
20   
48   
14   
20   
48   
15   
20   
51   
average   
20   
50. 4   
(C ) How to calculate the concentration of calcium hydroxide   
If 50. 4 ml (average) of unknown Ca (OH)2 neutralized 25. 0ml of 0. 05M HCl.   
How to determine the concentration of Ca (OH)2   
Firstly, write the chemical equation of the reaction   
Ca(OH)2(aq)+ HCl(aq)------CaCl2+H2O   
Secondly, balance the equation   
Ca(OH)2(aq)+2HCl(aq)------CaCl2+2H2O   
Thirdly, extract information that is relevant from the experiment performed   
Ca(OH)2 V = 50mL (average reading) M = ?   
HCl V = 20. 0 mL, M = 0. 05 M   
Fourthly, convert millilitres to litres   
Ca(OH)2 V = 0. 05 L , M = ?   
HCl V = 0. 020 L, M = 0. 05 M   
Fifthly, Calculate moles HCL   
n(HCL) = M x V = 0. 05 moles/L x 0. 020L = 1 x 10-3 moles   
sixthly, From the balanced chemical equation find the molar ratio   
Ca(OH)2: HCl = 1: 2   
Seventhly, find the number of moles of Ca(OH)2 that were titrated.   
Ca(OH)2: HCl is 1: 2,   
so number of moles Ca(OH)2 = n(HCl)/2 = 0. 0005 moles at neutralization.   
Lastly, Calculate the concentration of Ca(OH)2:   
M = n ÷ V n = 0. 0005 mol, V = 0. 05L   
Molarity Ca(OH)2 = 0. 0005 moles ÷ 0. 0504 L = 0. 00992 moles/L or 0. 0992 M   
Describe the preparation of 100mL phosphate buffer at pH 7. 4, starting from H3PO4 solution (1M) and KH2PO4 (FW 136 g/mol).   
Preparation   
Buffer strength of 1M at 7. 4 pH is achieved by mixing 3. 12 grams of monosodium phosphate monohydrate and 20. 74 g of disodium phosphate hepta hydrate to 100 ml water.   
Calculation   
Below is the initial ionization   
H3PO4 --------> H+ + H2PO4-   
K1 =   
Calculations of relative amounts are obtained through their normalization. Molarities are found through the following equation.   
H3PO4 + H2PO4- (monosodium phosphate monohydrate)   
PO43- + HPO42- (disodium phosphate hepta hydrate)   
The pKs that were used are as follows   
2. 15   
6. 87   
12. 32.   
By using the pH and all the above pKs of phosphoric acid, the ratios of each of the phosphoric pairs are calculated. By using their molecular weights along with the buffer strength the required amount of each is calculated.   
What is the pH of a solution resulting from mixing 100 mL 0. 5M NaOH with 500 mL 0. 3M HCl?   
HCl + NaOH --> H2O + NaCl   
If HCl is mixed with NaOH it neutralises at a ratio of 1: 1 . Hence, find mmol mixed of each to check which one is more   
HCl = 0. 3 x 0. 5 = 0. 15 mmol   
NaOH = 0. 5 x 0. 1 = 0. 05 mmol   
HCL excess = 0. 15 – 0. 05 = 0. 1 mmol   
Total volume of solution= 0. 6 L   
Number on M of Hcl= 0. 1/0. 6= 0. 167   
pH = -log[H3O+] = -log[HCl]   
hence   
pH = -log(0. 167) = 0. 77 really acidic   
SHORT ESSAY ON HARDWATER   
Introduction   
Water with quite a high content of mineral is known as hard water. We sometime do experience soap solutions forming a white scum rather than lather, this is due to the water being high in mineral content. This occurs mainly due to 2+ ions change the properties of the soap and performs a white scum. Hence one may define hardness as the capacity of water that doesn’t allow the formation of the any lather of the soap.   
Hard water is also responsible for the formation of deposits that effect plumbing. The clog formation may include many compounds but the main reason that causes its formation is hard water.   
Hardness is expressed in terms of calcium carbonate.   
Soft water is usually contains 75 milligrams per litter (mg/l)   
Hard water above 150 mg/l   
76-150 mg/l is considered as moderately hard   
Origin   
C02 and water reacts with each other carbonic acid. Carbonic acid usually exists as a bicarbonate ion at a normal environmental pH.  (figure 1) . Extensive limestone deposits have been built up over the years by microorganism by taking up of this carbonic acid. Groundwater acquires calcium and bicarbonate ions and hence becomes " hard". If the bicarbonate ions are a lot then they may form a precipitate like that in pipes. (Figure 2)   
Temporary hardness   
Temporary hardness is referred to such water that can lose its hardness by simply boiling it. Boiling water gives rise to the following reaction   
2 HCO3– → CO32– + CO2   
CO32– reacts with Calcium or Magnesium ions. This leads to the formation of a precipitate. This precipitate is actually calcium and magnesium carbonates which are insoluble in nature.   
Permanent hardness   
Water that doesn’t lose it hardness by boiling is known to be permanently hard. This is mainly due to the presence of chloride or sulphate, that is, it contains anions.   
Traditional water softening   
Traditional water softening is usually carried out through a process that is known as ion exchange. Ion exchange refers to the process in which chloride and sodium ions exchange places. These ions are fixed comparatively loosely to something called a zeolite. Zeolite may be understood referring to figure 3 in the appendix,   
Alternative methods   
Although they is quite some proof that electromagnetic devices may be useful in preventing the formation of scale but due to lack of testing and scientific proof one may not be able to give an assuredly claim it.   
As softening of water is of high importance many companies and organisations have claimed to come up with really good and effective solutions and have also claimed to be chemical free. In actual most of them are just claiming economic advantage by selling their product or process without actually carrying on an in depth research and coming out with an effective solution.   
Health Concerns and issue   
Some researchers believe that hard water may lead to potential cardiac risk but there is no such evidence to actually prove this aspect. Hard water has not so far been termed as unhealthy but it has always been emphasized that soft water is more preferable to drink.   
Negative aspect   
They are as such no health concerns but they surely are a few negative aspects of hard water. Some are as follows:   
A grey staining may occur when clothes are washed   
A scum may appear on water after using soap. This also reduces the lathering of soap as mentioned above.   
Due to hard water, you may seem a formation of scale on heating elements along with heating boilers (usually the electric ones). You may also experience a white precipitate (scale) formation in kettles and all things used to boil water in.   
Hard water may also lead to the reduction of water supply in houses especially hot water due the formation of scale.   
Conclusion   
Although hard water doesn’t have much health concerns its negative aspects are of great concern and an effort should be made for the softening of water which is not only effective but also cheap along with having no unhealthy impact.   
APPENDIX   
Figure 1   
Figure 2   
Figure 3   
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