Acids and bases chart worksheet

Learning the purpose In this lesson we compare acids, foundations and neutral solutions. We will also discuss how acidity is measured and how it can be adjusted. Study the results By the end of this lesson you will be able to: Identify acids, foundations and neutral solutions, in terms of hydrogen ions and hydroxide. Compare the properties and use of acids and bases. Describe how pH is a measure of acidity or alkalinity of the solution, and explain how it can be regulated. Describe the use of pH indicators to distinguish between acids, bases and neutral solutions. When discussing acids and bases, the terms strong, weak, concentrated and diluted are made. Click the image to view the sheet for this lesson and the Year 9 Chemistry Workbook (PDF and printed version) The introduction of the substance can be classified as an acid, base or neutral substance. They vary in relative concentrations of hydrogen and hydroxide ions. pH is a measure of how acidic or alkaline (basic) substance is. It ranges from 0 (very acidic) to 14 (very alkaline), with 7 being neutral. Acids and bases are widespread in nature and have different scientific and common applications. (Image: wmedien, Adobe Stock) Acids are substances that produce hydrogen ions (H) in a solution. For example, when hydrogen chloride gas dissolves in water, it ionises hydrogen and chloride ions, as shown in the following equation: Acids are found not only in laboratories, but also in nature. For example, acids are found in many foods, including oranges, tomatoes, grapes and milk. Acids are also found in our bodies, and acids are the cause of sting ants bites. Acids have many applications inside and outside the laboratory. For example, acids are used in food preservation, car batteries and many industrial chemical processes to produce substances including plastics, paints and fertilizers. For example, think about the taste of lemons or vinegar. Chemical acid names usually end in acid. Examples of acids commonly used in the laboratory include: ▸ hydrochloric acid (HCl). Examples of acids found in nature and food include: ▸ citric acid (oranges, lemons, limes). ▸ tartare acid (grapes, bananas). ▸ lactic acid (yogurt, sour cream). ▸ (ants bites, stinging nettles). Acids are found in many foods, including citrus fruits, vinegar and yogurt. (Images: USDA, Commons; evitaochel, Pixabay; pxhere) Bases are substances that produce hydroxide ions (OH-). For example, when sodium hydroxide dissolves in water, it splits to form sodium ions and hydroxide ions, as shown in the following equation: NaOH → Na' and OH- Bases, which are soluble in water, are called alkaline solutions and the solutions they form are called alkaline solutions. Their soapy, slimy texture makes common components of cleaning products and building materials. For example, the bases are found in a variety of substances, including baking soda, soap, soap, bleach, cement and glass. For example, think about the taste of celery, cabbage or tonic water. The chemical names of bases usually end with hydroxide, oxide, carbonate or hydrogen carbonate. Examples of common bases used in and out of laboratories include: ▸ caustic soda (sodium hydroxide - NaOH). ▸, limestone, marble (calcium carbonate - $CaCO_3$). ▸ baking soda (sodium bicarbonate - $NaHCO_3$). ▸ Magnesia (magnesium oxide - Mgo). Widely used bases include baking soda, caustic soda and limestone. (Images: Max Pixel; Skatebicker, Commons; Ferdous, Wikimedia Commons) Strong and weak acids and bases of acids and bases vary in strength. Differences in force are associated with the proportion of ions formed. When a strong acid or base dissolves in water, all molecules form ions. Hydrofluoric acid is a strong acid. When hydrogen fluoride (HF) dissolves in water, it completely forms hydrogen ions (H) and chloride ions (Cl-). Potassium hydroxide is a strong base. When potassium hydroxide (KOH) dissolves in water, it is completely dispersed to form potassium ions (ants) and hydroxide ions (OH-). When a weak acid or base dissolves in water, only a small fraction of the molecules form ions. Acetic acid is a weak acid. When acetic acid (CH_3COOH) dissolves in water, only about 1% of the molecules are dispersed to form hydrogen ions (H) and acetate ions (CH_3COO-). When ammonia (NH_3) dissolves in water, about 1% of molecules react with water to form ammonium ions (NH_4) and hydroxide ions (OH-). Weak bases do not contain hydroxide ions, but form ions of hydroxy as when a small fraction of the molecules react with water. Ammonia forms ammonium hydroxide at the following reaction: NH_3 and H_2O → NH_4 Weak acids are partially ionized in water. Concentrated and diluted acid and the base of concentrated acid or base is a solution formed from a large number of molecules. Diluted acid or base is a solution formed from a small number of molecules. Note that definitions concentrated and diluted differ from definitions strong and weak. Therefore, the solution can be: in ▸ concentrated strong acid or base. ▸ dilute with strong acid or base. ▸ concentrated weak acid or base. ▸ dilute with weak acid or base. Concentrated acids are formed from a large number of molecules. Diluted acids are formed from a small number of molecules. The corrosive properties of acids and bases of strong acids and strong bases are corrosive, which means that they react easily with other substances. For example, acids can corrode metals, and alkaline are powerful cleaning products that can destroy fat, oils and fats. Strong acids and bases can cause severe burns if they come into contact with living tissues such as the skin or eyes. protective clothing, including aprons and goggles, should always be worn when handling these materials. Even at low concentrations, strong acids and as irritants, as they can cause inflammation and redness of the eyes, skin and throat. Strong acids and bases can cause severe burns, so protective gear should always be worn when handling them. (Images: Dr Stordhorn, Commons; Blasius, Commons; David Dixon, RAF) PH scale is a measure of how acidic or alkaline decisions are. It is usually presented as a numerical scale from 0 to 14. Solution with pH less than 7 is acidic. Solution with pH more than 7 alkaline. The solution with pH is 7 neutral - neither sour nor basic (e.g. clean water or saline). The farther from 7 pH, the more acidic or alkaline the solution is. For example, a solution with pH 6 is mildly acidic, while a solution with pH 2 is strongly acidic. Similarly, the solution with pH 8 is weakly alkaline, while the solution with pH 12 is strongly alkaline. The pH scale is a logarithic scale, not a linear scale. There is a tenfold increase/decrease in acidity between pH units. For example, pH 5 is ten times more acidic than pH 6 and pH 9 is ten times more alkaline than pH 8. The pH scale is a measure of how acidic or alkaline the substance is. Concentration of hydrogen ions and hydroxide All water solutions (solutions in water) contain hydrogen and hydroxid ions. The solution's rocket is a measure of the relative concentrations of hydrogen ions and hydroxide. In acidic solutions, the concentration of hydrogen ions exceeds the concentration of hydroxide ions. In alkaline solutions, the concentration of hydroxide ions exceeds the concentration of hydrogen ions. In neutral solutions, the concentrations of hydrogen ions and hydroxide are equal. Since pH is directly related to the concentration of hydrogen and hydroxide, the pH of acids and bases depends on two factors: the strength of the acid or the base - the degree to which the molecules form the ions in the solution. Concentration of acid or base - how much acid or base was added during the formation of the solution. The pH scale reflects the relative concentrations of hydrogen ions and hydroxide. PH pH indicators are substances that change color depending on the pH of the solution. An example of a pH indicator is a litmus test. The litmus paper comes in two colors - red and blue. When the litmus paper is placed in a solution, it either changes color or remains the same color, depending on whether the solution is acidic, alkaline or neutral. Red litmus paper will sow if placed in an alkaline solution, but will remain red if placed in a sour or neutral solution. The blue litmus test paper will turn red if placed in a sour solution, but will remain blue if placed in an alkaline or neutral solution. Two pieces of litmus test paper - one red and one blue - are needed to distinguish between acidic, alkaline and neutral solutions (see table below). Two Litmus paper - one red and one blue - are necessary to distinguish acidic, alkaline and neutral solutions. (Image: Kanesskong, Wikimedia Commons) There are a number of liquid pH indicators that are also used in laboratories. When 2-3 drops of the indicator are added to a small sample of the solution, they lead to a change in the color of the solution depending on its pH. Examples of the different pH indicators and color changes they cause are shown in the table below. PH indicators change color depending on the pH of the solution. The universal indicator, which is actually a mixture of different indicators, produces a range of colors, depending on the pH of the solution. This makes it particularly useful as it can distinguish between strong and weak acids and bases. The universal indicator also comes with a color chart that can be used to determine the approximate pH value of the solution. The universal pH indicator gives a range of colors to approximate the pH value. There are many natural pH indicators that can be extracted from some fruits, vegetables and garden plants. These include curry powder, red cabbage, tomatoes, onions, blueberries and grapes. Red cabbage extract added to solutions across the pH spectrum. (Image: V. Belkhir, Wikimedia Commons) pH meters are electronic scientific instruments that can directly measure the concentration of hydrogen ions solutions to give an accurate pH value. pH counters give the most accurate measurement of the pH of the solution. (Image: Sergey Golyshev, Commons) Regulation of pH solutions can be adjusted by adding acids or bases to them. If the acid is added to the solution, an increase in the concentration of hydrogen ions will reduce the pH of the solution. If the base is added to the solution, an increase in the concentration of hydroxide ions will increase the pH of the solution. Neutralization occurs when the pH of an acidic or alkaline solution is regulated to 7, adding a base or acid accordingly to create a neutral solution with an equal amount of hydrogen ions and hydroxide. Neutralization occurs when the mixing of acids and bases leads to an equal amount of hydrogen ions and hydroxide. Living organisms are very sensitive to pH. Therefore, careful monitoring and regulation of pH is necessary in many situations. For example, swimming pools should regularly monitor pH to make sure they are safe for swimming. If the pH is outside the optimum range of 7.2-7.6, the water in the pool can cause skin and eye irritation. If pH needs to be increased, soda ash (sodium carbonate) is used; Muriatic acid (salt acid) is used to reduce pH. Soil, drinking water, natural waterways and aquariums are other examples where regular pH monitoring is important. Soil pH testing kits make it easy for farmers and gardeners to check the pH of their soil. (Image: CSIRO Short acids are substances that produce hydrogen ions (H). Bases are substances that produce ions (O-). Soluble bases are called alkaline and the solutions they form are called alkaline solutions. The acid taste is sour, while the grounds taste bitter. Common laboratory acids include salt acid (HCl), sulphuric acid (H_2SO_4) and nitric acid (HNO_3). Common laboratory bases include potassium hydroxide (KOH), magnesium oxide (MgO), calcium carbonate ($CaCO_3$) and sodium hydrogen carbonate ($NaHCO_3$). Strong acid or base is completely ionized in the solution. Weak acid or bases are only partially ionized in the solution. Concentrated acid or base is a solution formed from a large number of molecules. Diluted acid or base is a solution formed from a small number of molecules. The pH scale is a measure of how acidic or alkaline a solution is based on the relative concentrations of hydrogen ions and hydroxide. This is a numerical scale from 0 to 14. Acids have a pH of less than 7, and a higher proportion of hydrogen ions than hydroxide ions. The bases have a pH greater than 7, and a higher proportion of hydroxide ions than hydrogen ions. Neutral solutions have a pH equal to 7, and an equal share of hydrogen ions and hydroxide. The farther from the 7 pH of the solution, the greater the difference between the concentration of hydrogen ions and hydroxide, and the more acidic or alkaline solution. The solution's rn can be increased by adding a base. The rn of the solution can be reduced by adding acid. The equal amount of hydrogen and hydroxide ions in the solution leads to neutralization. PH indicators are substances that change color depending on the pH of the solution. The red litmus test paper turns blue if placed in an alkaline solution, but remains red if placed in a sour or neutral solution. Blue litmus paper turns red if placed in a sour solution, but remains blue if placed in an alkaline or neutral solution. The universal indicator produces a wide range of colors, depending on the pH of the solution. It can distinguish between strong and weak acids and bases, and be used to determine the approximate pH value of the solution. pN counters can electronically measure the pH value of the solution. Click images to view the sheet for this lesson and the year 9 Chemistry Workbook (PDF and printed version) version)