Separating mixtures worksheet grade 7 pdf

Chapter 2 weeks overview Mixtures was first introduced in Gr. 6, so students should be already familiar with these concepts. Students would also have looked at some of the natural methods of separating different types of mixtures (including hand sorting, sifting, filtration), and this year we will explore some additional methods in more detail (including distillation and chromatography). 2.1 Mixtures (1 hour) Tasks Skill recommendation activity: Types of mixtures Classification and classification, communication, group discussions Suggested 2.2 Methods of physical separation (4 hours) Tasks Skills Activity Recommendation: Thinking about hand sorting Classification and classification, comparison Suggested Activity: Thinking about sifting and filtering Classification and classification, comparison Suggested Activity: Thinking about magnetic separation Classification and classification, comparison Suggested Activity: Comparison Suggested Activity : What if we want to keep both water and salt? Demonstration of CAPS Distillation Suggested Activity: How can we separate two liquids with different boiling points? Distillation Demonstration Using Liebig Condenser Optional, Extension Research: Is Black Ink Really Black? Separation of ink by chromatography, hypothesis, investigation, observation, recording information, comparison, interpretation of information, CAPS suggested Activity: Separation of a complex mixture Design and explanation, research design, sorting and sorting, comparison, writing, CAPS suggested 2.3 Sorting and recycling materials (1 hour) Tasks Skills Recommendation Activity: What happens when we throw things away? Communication, group discussions, writing, identifying problems and issues, asking questions Suggested Activity: Career Research Work Discussion, Communication Optional How can we explain the term mixture? What types of materials can be mixed? What methods can be used to separate a mixture into its original components? What factors are important when choosing a method for separating a mixture into its components? What materials can be recycled? Who is responsible for the disposal of waste? What are the negative consequences of poor waste management? suspension mixture opaque solution clear In the first section of this chapter, students will learn how to detect mixtures. One of the central ideas in this section is that the ingredients in a mixture are not chemically united. They still exist as separate compounds that have not reacted to each other in any way. For this reason, mixtures can be separated by natural methods. Natural methods cannot be used to separate chemically joined elements. To make this section more you could provide small samples from each of the blends discussed and ask students to draw them, paying particular attention to any characteristics that a particular mixture may have. When faced with a solution (water and sugar, for example) you may notice that there are no visible characteristics to draw. This will help in their minds that solutions are mixtures where substances are so closely mixed (literally at the level of individual particles) that we can no longer distinguish separate substances. What does it mean to mix something up? You can imitate an explanation (which means you have to explain without saying a word!) get your students to act on the word mix. Students can make stirring moves with their hands. This exercise may seem trivial, but their attention will immediately focus (and their learning enhanced) if they engage in this way. Using gestures that require students to move their bodies has been shown to enhance learning, even at university level! Is it possible to mix the water? Discuss it with your class. Some students may say no, you need two or more things mixed together to have a mix. Other students may reply that it is possible to mix hot water with cold water. Point out that the end result would only be water, and not really a mixture of hot and cold water; once mixed, the water will have the same temperature throughout. A substance in itself cannot be a mixture. A mixture consists of two or more different substances. A mixture may contain solids, liquids and/or gases. The components of a mixture do not come together chemically. it's just mixed. That means we don't have to use chemical reactions to separate them. Mixtures can be separated using natural methods alone and this is the theme of this chapter: how to separate mixtures. There are many different kinds of mixtures. Before we know how to separate them, it's worth looking at all the different kinds of mixtures for a while. It is a review of the types of mixtures one can get, which has been done in Gr. 6 Material and Materials. If you feel that your students have already understood this, you can spend it for a while, simply looking at the various images provided and asking the students what kind of mixes they are. emulsion abundant concentrated alloy pigment Can you think of an example of a mixture of a solid and a solid? Soil is an example of a mixture of solids. What are the substances found in the soil? The soil may contain clay, sand and small pebbles. The soil can also contain pieces of plant matter. Clay and dust particles are very small and sand particles are larger. The pebbles are even bigger. Soil is a mixture of different ingredients. What happens when clay or sand is mixed with water? Could you see through a mixture of clay and water? The mixture of clay or sand with water is muddy. The small clay suspended in water. This type of mixture is called suspension. The suspends are opaque. this means they are blurry and we can't see through them very well. What happens when sugar is mixed with water? Does the mixture get muddy? I don't know. The sugar dissolves in water and the mixture is called a solution. The solutions are clear; That means we can see through them. Please note that some that we expect to be solutions end up being inhibitions. A good example is table salt and water that could end up looking cloudy due to starch (free flow factor). In this case, it would be better to use pure sea salt. (You could also use this apparent paradox as the basis of an expansion activity on what impressions allow us to deduy in some cases.) Can you see the difference between an opaque suspension of sand and clay in the water (on the left) and a clear sugar solution in the water on the right? Have you ever seen smoke from a fire? What's the smoke made of? You think it's a mixture? Tobacco is actually made of tiny solid pieces of soot and ash and dust mixed with air (which is gas) and water vapour (also gas). This makes tobacco a mixture of one or more solids and gases. The black smoke from a burning building. Universal_Fire_Smoke.jpg Milk is not a single substance, but actually a mixture of two liquids! One liquid ingredient in milk is water, and the other is oil. The reason milk is opaque is that tiny droplets of oil hover in the water. Can you remember what a mixture is called when a solid is suspended in liquid? We use milk as an example of suspension, however, milk is actually more complicated, since it also contains solvents. It is a great example of a mixture that has both the solution and the suspension components (emulsion). Flour or maizena mixed with water also makes a good suspension that is installed after some time. This is also a good opportunity to review the terms soluble, solvent and solution, i.e. soluble (for example sugar) is the substance that dissolves in the solvent (for example water) to form a solution (for example sugar water). When some liquids float in liquid, we call the emulsion mixture. Like floats, emulsions tend to be opaque. A clear, transparent solution on the left and an opaque emulsion on the right are all liquid-liquid mixture emulsions? (One way to identify an emulsion is that it is opaque). Are all liquid-liquid mixtures opaque? Can you think of a liquid-liquid mixture that is not an emulsion? Discuss this with your class and give an answer below. First, no, not all liquid-liquid mixtures are opaque. Second, most solutions that students will be able to think of are essentially solid-liquid blends at the fundamental level. It is good enough for students at this level to offer examples of liquid-liquid mixtures, such as a mixture of apple juice and water. A better example solution is vinegar, which is a mixture of ethanolic acid (acid) - a liquid at room temperature - and water. This example could be a logical inclusion, since it will serve as a timely introduction to household acids that will appear prominently in the next chapter (Acids and Bases). If students are given a vinegar sample to design, it would be better to provide a sample of white vinegar, since it contains less Theme. Once again they will be faced with the realization that the solution has no visible characteristics. Another opportunity to see that solutions are mixtures where substances are so closely mixed that we can no longer distinguish separate substances. A mixture of vinegar and water is clear, and this is an indication that the mixture is a solution. Solutions are special types of mixtures in which particles are so well mixed that they are not separated from each other. We can no longer distinguish separate substances - everything looks the same when we look to the naked eye. The particle model of matter will only be examined in detail in Gr. 8, but the following types of visual representations can help to understand abstract concepts. You can draw these in the table in different colors. The students were exposed to similar images in Gr. 6. However, it is not critical at this stage and you do not need to go into details. The solutions look glassy/translucent, and solid molecules cannot be seen. Substances cannot be separated by filtration (discussed below in this chapter). Particles in solution. Notice that blue particles are more or less evenly distributed among whites. Particles in suspension or emulsion. Notice that blue particles are present in small clusters or clusters between whites. In a suspension, one of the particles of the substance is always concentrated together. Sometimes one can even see little pellets of oil (in the case of an emulsion) or small pieces of solid (in the case of a suspension) suspended in the liquid. We learned in Gr. 6 Matter and Materials that the gas particles are far from each other. This means that gases can be mixed very easily, because it is easy for their particles to move between them. The air we breathe is not just a gas, but actually a mixture of gases! Do you know what the two most abundant ingredients are? Nitrogen gas and oxygen gas. Students can say oxygen and carbon dioxide? nitrogen is actually the main component of air (approximately 80%) carbon dioxide is present in a much smaller amount; remember that we discussed boiling in the previous chapter (Material Properties); what happens to a liquid when it boils; the liquid is converted into gas; can you see the water vapour in the image below of a boiling kettle? Show it with your finger; discuss this with your teacher and classmates, and when you have agreed to an answer, draw an arrow on the image to indicate the water vapor; one suggestion is to make a demonstration of this in class if you can take a kettle and plug it in to show students the colorless steam in the kettle spout; students may point to the cloud in front of the kettle. they are not actually water vapour, which would be invisible to the human eye. The cloud is formed when the water vapor cools enough to condense into micro-droplets visible to the human eye. We'll just see the water. Water. begins to condense. When water particles condense, they become liquid water again. This means that particles begin to cling to tiny micro-droplets, which grow into larger droplets when they come together. The small cloud in front of the kettle is actually a cloud of micro-droplets of liquid water suspended in the air. This is an example of a liquid floating in a gas. The following image shows where the arrow should be designed: Can we see most gases? Why do you think that? Most gases are colorless and can't be seen. We can't see individual particles as they're too small. However, some gases (such as chlorine and fluoride) can be seen because they are coloured. Clouds and fog or fog are all examples of tiny droplets of water hovering in the air. One artist, Berndnaut Smilde, uses a fog machine to make small clouds inside a room that lasts only a few seconds. A wonderful example of science as art! We have learned that mixtures can be made from substances in the same state or in different states. The following activity will help us apply our new knowledge about mixtures to more examples. INSTRUCTIONS: Look at the list of mixtures. Discuss in your group, or with your partner, what each mixture consists of. Determine the type of substances (solid, liquid or gaseous) mixed in each of the examples in the list. Write the name of each example in the appropriate block in the diagram. Mixtures: air smoke hair oil (oil and water emulsion) clear fruit juice (e.g. apple juice) cloudy apple juice salty water alloys, such as brass (used for coins) and stainless steel (used for rust resistant metal objects) plastic foam (such as material used to make mattresses and pillows) air freshener spray (aerosol type) paint dust cloud soil For example, the sugar dissolved in water will go to the middle block of the bottom row, to show that it is a solid (sugar) mixed with a liquid (water). Gas mixtures: Air-liquid gas mixtures: spray deodorant and air freshener Gas-solid mixtures: smoke, dust cloud and plastic foam Liquid-liquid mixtures: Clear fruit juice, Hair oil Solid-liquid mixtures: Salty water, color (emulsion/suspension of solid pigment particles in water or oil), cloudy apple juice (tiny pieces of pulp are solid and suspended in juice) Solid solid mixtures with solid mixtures: Mixtures have many uses: maybe we mix ingredients to bake a cake, or mix metals to make a really strong alloy. A cake is a mixture of ingredients, including eggs and milk. Many things around us happen naturally as mixtures: salt sea water, moist air, soil, fertilizer, rocks (mineral mixture) to name a few. Many mixtures are artificial, for example; Coca-Cola, paint, salad dressing and so on. You can ask your students why we use color. The paint is used to cover walls and other surfaces. Sometimes we want to protect these surfaces from water or wind (for example, when we paint paint exterior wall or roof) and sometimes we just want to make them look attractive (for example when we paint an interior wall, or when we create a beautiful artwork). The water or oil in the paint helps us spread the pigments more evenly over the surface we want to cover and binds the pigments tightly, so that the color forms a protective layer. The mixtures are very useful. However, sometimes we have to separate the mixtures into their ingredients. Remember that the substances in a mixture have not been chemically combined. They have not been converted into new substances, but they are still the same substances as before - they have just been physically combined. That is why we can use natural methods to separate them again. Now that we know about the different types of mixtures that are possible, we will learn about some ways of separating them. As an introduction to this you can ask students why they think we would like to separate the mixtures. For example, imagine that our drinking water comes from a well on the ground and is muddy. Muddy water is not good for drinking. We would like to separate the water from the solid material (sand or clay) before using it! As soon as we split up, we'd hold the water to drink and throw away the sand. Ask students if they can think of a way to separate water from sand? Students can suggest filtration (filtering) as a method for separating sand and water. sieve filtration magnetic grain residue Suppose you were given a basket of apples and oranges. How would you be classified? You'd pick all the oranges by hand. The same method may not be suitable for all mixtures. You probably won't consider sugar and sand grains by hand. I don't know. Sugar and sand grains are too small to be sorted by hand, and look very much the same. It would not be practical to classify them that way. Let's look at some of the most commonly used methods of physical separation. How will you separate the mixture of pellets in the following image into the different colors? The most practical method would probably be to manually sort them into different colors. A mixture of different colored beads. Sometimes people create machines to perform tasks for them, like this Skittles sorting machine. The video on the Skittles sorting machine is just for entertainment, but could be used to introduce discussions about fun explorations and hobbies that challenge us as an initial block to innovation and useful applications of technology. Would hand sorting also be a practical way to sort out the mixture of rice and lentil beans in the picture below? A mixture of rice and Yes, as long as there aren't too many of them to sort. Hand sorting would be a practical way to sort pebbles from a large pile of sand; Well, I guess not. It's going to take too long! In addition to what we discussed in the chapter, consider at least three other examples of mixtures that could be sorted by hand. Answer that depends on the student. Student. may include: Sorting thorns from wool Sorting lego blocks in different sizes or colors Sorting stones from a packet of dried lenses or beans Sort mail Sort fruit or eggs according to size or quality When hand sorting a good method for separating ingredients into a mixture? When the particles in the mixture are relatively large and when there are not too many of them to sort. Can you think of a practical way to classify stones or pebbles from the sand? You think picking up the pebbles by hand would work? It's probably not a good idea to hand kind as it will take too long. How would you separate the pebbles from the sand in this pile? When we have large amounts of materials to sort and the different particles have different sizes, we can sieve the mixture. The smaller particles will fall through the openings in the sieve, while the larger particles remain behind. When the particles in a mixture are too small to be caught by a sieve and when the components of the mixture are in different situations, we can separate them by filtration using a filter. The students did an exercise in Chapter 6 of Matter and Materials in Gr. 6 for the purification of muddy water. The chapter entitled Processes for water purification required students to design, build and evaluate their own filter. You can show off the process again to refresh their memories. To adjust a filter (as shown below), place a folded piece of filtered paper in a hopper and place the hopper in a bottle. Then pour a mixture of muddy water into the filter and let the students notice that the clean water passes through the filter, while the mud/sand/clay remains behind. Muddy water is poured through a funnel lined with filter paper to remove small sand and clay particles. What kind of mixture is muddy water in glass an example? It's a mixture of solid and liquid, it's a suspension. You can get students to highlight the suspension, the filtration and the residue in this diagram. The clear liquid that has passed through the filter paper is called thefiltrate and the particles that have been left behind in the filter paper are called the residue Have you ever noticed how, when people have to work in dusty or smoky environments, wear dust masks or smoke masks? Why do you think it's necessary? Inhalation of dust or smoke is harmful to our lungs. Masks help clean the air before entering the respiratory tract. A firefighter wears a mask to filter out the smoke. The diagram below shows how a Gas. Layers of very thin filters trap harmful substances and particles of dust or smoke, so that only fresh air is left. A smoke mask consists of layers of filter that clean dirty air before it is inhaled into the body. In addition to what we discussed in the chapter, think of at least three other mixtures that could be sifted, and write them in the space below. Answer that depends on the student. Proposals can be Sifting the flour to remove the lumps, barks and other large pieces Throwing tea through a sieve to catch tea leaves (this is a raw way of filtering) Rinsing sand or soil from spinach leaves before we cook them Filtering leaves from a pool (we call it filtering, but what we really do is sift the leaves out of the water) When it sifts a good method for separating the ingredients in a mixture? When the ingredients of the mixture have different sizes and there are many of them to sort. Today most people use tea bags to make tea, but there was a time when people made tea from the leaves and then poured the tea through a sieve into the cup. Why do you think they did this? Tea leaves and pieces have been collected in the sieve after throwing tea into the cup. To remove the tea leaves from the tea before drinking it. Sometimes the particles we want to remove from a mixture are so small that they will easily pass through a sieve (think of the example of muddy water before). Can you think of a way to get over this? Students may realize that they need to make the openings in the sieve smaller if they want to catch smaller particles. In addition to what we discussed in the chapter, consider at least three other blends that could be filtered, and list them below. Answer that depends on the student. Suggestions may include: Filtering coffee beans through a coffee filter or plunger The vacuum cleaner has a filter to trap dust particles inside the machine and lease clean air. This is the way it removes dust particles from carpet and furniture. Air conditioners contain filters to filter the dust before the air from the outside enters a building. When is filtering a good method for separating ingredients into a mixture? When the particles in the mixture are very small, and in different situations. Can you remember the activity from gr. 6 when Tom used magnetism to separate different kinds of metals in his uncle's mantra? The magnetic properties of metals allowed them to separate in this way. You could prove how, or let the students try, to separate a mixture of sand and iron files using a magnet. It could help to place the magnet in a small plastic bag so the iron files are attracted to the magnet, but don't stick to it. The diagram below shows how magnetic separation can be used to separate a mixture of components. In the example, the mineral ore containing two compounds (one magnetic, and the other non-magnetic) The ore seeds are fed into a rotating zone. The cylinder at the end of the belt is magnetic. This means that all magnetic grains in the ore will stick to the belt when it goes around the cylinder, while the non-magnetic seeds will fall from the end. Once the magnetic granules move over the magnetic cylinder, they will also fall down. In the diagram above, what color are non-magnetic granules and in which container do they fall? Add this label to the diagram. What color color magnetic granules and in which container do they fall? The non-magnetic granules are yellow-orange and fall into the container on the left. the magnetic granules are gray-brown and fall into the container on the right. The diagram should be noted as follows: In addition to what we discussed in the chapter, can you think of two other mixtures that could be magnetically separated? Write them down in the space provided. Answer that depends on the student. Suggestions may include: Removal of iron files (magnetic) from sand or sugar (non-magnetic). Separation of aluminium containers (non-magnetic) from metal containers (magnetic). When is magnetic separation suitable for separating components into a mixture? When the components of the mixture have different magnetic properties, in other words when one or more components of the mixture are magnetic and the others are non-magnetic. How can we separate the ingredients into one solution? Let's find out. distillation of evaporation condensation still chromatography soluble soluble chromatogram Substances in a solution are mixed at the level of the individual particles. In a solution of sugar and water, sugar particles and water particles mix so well that we could not distinguish them with the naked eye. You may think that mixtures that are so well blended are impossible to separate! But as we'll see soon, that's not true. In ancient civilizations, wheat and straw were separated by a process called winnowing. It will throw the mixture into the air and the wind will blow away the lightest straw, but not the heavier grain. Demonstrate this in a lesson by dissolving a little salt in the water in front of the class at the beginning of the lesson. Make sure they take into account the clear solution. Then pour a little into a shallow aluminum pan, like the ones used for baking. Place this out in a sunny spot for the duration of the lesson and let the water evaporate. The evaporation rate will depend on how hot and humid it is on the day you do this. At the end of the lesson, collect the pan and show the dried salt left behind, just like in a salt pan. You may have to leave it out until the end of the day, depending on how hot it is. Do you know where most of the salt we use in South Africa comes from? South Africa gets salt from inland salt pans, coastal salt pans and seawater. A salt pan is a shallow barrier in the soil where seawater evaporates to leave a layer of dry salt. An aerial view of salt pans. Salt_pans.jpg salted pans in India. A man is busy collecting dried salt to be packed and sold. When seawater is allowed to stand in pans, the water is heated by sunlight and slowly converted into water vapour through evaporation. Once the water evaporates completely, the solid salt is left behind. Do you think this is a good method for separating salt from water? Do you think it could work for a sugar and water solution? If you have time to do this in class, you can this practically. Get the students to taste the seawater before boiling and then get them to taste the condensed water afterwards. This way they will realize that only the water has evaporated and the salt has remained back in the kettle. You could put the ice in a small plastic bag to make sure the ice doesn't slip off the plate, but the plate is still cold enough for water vapour to condense. Keeping the ice in a plastic bag will also ensure that melting ice does not drip into the condensed water collection glass. You can also use a glass or a glass of salt solution over a bunsen burner and use a cold piece of glass or mirror to condense the water and collect it in another glass. QUESTIONS: Do you think separation with evaporation would be a good method to separate a salt water solution if you want to keep both salt and water? Why do you say that? Evaporation alone is not a good method of separation if you want to keep both salt and water. Once the water evaporates, it's gone. Can you think of a way to modify the method so that the evaporated water is not lost? Perhaps the diagram below will help you formulate a plan. Write an explanation below. In the image, the salt water solution is heated in a kettle and a metal plate (with a little ice inside to keep its outer surface cold) is kept in the water vapor that escapes from the kettle spout. Water vapor cools when it touches the cold metal plate and condenses. Then run off the plate and into the collection glass. Leave the salt behind in the kettle as soon as all the water evaporates. But you still have the water in the glass. What's going on in the kettle? Can you tell what change in the situation is happening inside the kettle? What's the name of the procedure? Liquid water changes into water vapour. The process is evaporation. What change of status occurs on the cold surface of the metal plate? What's the name of the procedure? (Hint: the change of state from gas to liquid was covered in the previous chapter, under physical properties of materials.) Water vapour changes to liquid water. The process is called condensation. Does salt evaporate with water? How would you know? Not. You can try that the water is salty before evaporation, rather than salty after condensation. If you boil the water until all this evaporates, you can see the form of salt crystals. What can you say about the purity of the water after it evaporates and condenses? It doesn't taste salty after evaporation/condensation so we assume it's clean, but it may have other things in it that we can't taste. Some things we can't identify or taste, for example, if we used seawater. The water through evaporation can be concentrated on a cold surface. The cold metal plate will do the job, but it would be difficult to recover all the condensed water because it would drip from the surface of the plate in many different places. Scientists Scientists Solution to this problem: use a special technique to separate mixtures like these without losing any of the ingredients. The technique is called distillation. If you have the equipment to set up this distillation process, then you can prove it in class. Otherwise there are alternative materials and equipment that you can use. For example, if you don't have a Liebig condenser, you can use a piece of copper pipe. Here are two links that explain how to build your own distillation equipment: and . Another suggestion is to get students to also do research to see how to make their own distillation device, especially looking at materials that are easy and cheaper to come by. You don't have to have laboratory equipment to demonstrate a lot of scientific experiments - a lot can just be done by thinking about the materials you use in everyday life and making a plan! This also makes science more accessible to all. Distillation is the separation of one substance from another by evaporation followed by condensation. The device used in this technique is called stationary. Experimental installation for distillation Suppose we want to separate water and salt in seawater. Place the seawater in the round bottle to the left of the image (in the distillation bottle). Then we will boil the sea water to produce water vapour or steam. Salt will not evaporate with water, because only water evaporates. The water vapor rises through the top of the bottle and passes into the Liebig condenser. Two Liebig condensers used in the distillation process Liebig_condensers-two_2.jpg liebig condenser consists of a glass tube inside a larger glass tube. The condenser is designed in such a way that cold water can flow through the space between the pipes. This cools the surface of the inner tube. The water vapour condenses on this cold surface and flow into the receiving bottle. Since the salt has not evaporated, it remains back in the distillation bottle. A video describing how a solar still can desalination (take salt out of) water. The solar still video is short, but provides an interesting topic for discussions: applications of separation methods; inventions; pros and cons; you could even discuss open source projects and share information. The Italian inventor of Eliodomestico solar is still designed with developing countries in mind. It is relatively cheap, easy to assemble, and does not require electricity. It is described as an eco-distillery that operates with solar All you need to do is pour 5 liters of salt or unclean water, tighten the lid and leave it out in the sun. By the end of the day it can provide bacteria-free, salt-free water that is suitable for consumption. It is also an open source project which means that anyone Use the design and reproduce, modify or upgrade, but do not sell it for profit. Distillation is also the best way to separate two liquids that have different boiling points, such as water and ethanol for example. Let's take a look. This is an optional activity, or else it could be done as work for the home. It's an extension of what students would have learned about the use of distillation. QUESTIONS: Can you remember the temperature at which the water boils? Write it down. What's the name of this temperature? The boiling point of the water. Ethanol boils at a temperature below the boiling point of the water, i.e. at 78°C. Suppose you mix some water and some ethanol. The mixture is at room temperature to begin with. Now suppose you start heating the mixture. Which temperature will reach first: 78°C or 100°C? What do you think will happen when the mixture reaches a temperature of 78°C? Do you think ethanol's going to start boiling? Students might be reminded that ethanol is still ethanol, it hasn't changed during the mixing process, so surely it will start boiling at 78 °C. Will the water boil at the same time? Not. The water starts to boil only at 100°C. As long as the temperature is below 100°C, the water will not boil. These questions are identical to those raised in the original activity. They were included in the initial activity to serve as an introduction to the concept of distillation. We can use the same distillation method we used to separate the seawater, to separate the two liquids. The principle is exactly the same, except that we will distill the mixture more than once. Here's how it works: The mixture of the two liquids is placed in the distillation bottle and heated to the lowest boiling point. In the case of an ethanol/water mixture, this temperature would be the boiling point of ethanol, i.e. 78°C. All liquid with this boiling point will evaporate, condense into the Liebig condenser and pass into the receiving bottle. The liquid with the highest boiling point will remain in the distillation bottle. Suppose it contains a third substance that we want to separate. How would you do that? Replace the receiving bottle with a clean one and heat the distillation bottle again, but this time at the boiling point of the second liquid. The second liquid will evaporate, condense into the cooler and flow into the clean receiving bottle, leaving the final component of the mixture in the distillation bottle. Crude oil is divided into several components by distillation. The components evaporate, starting with lighter fuel (which has the lowest boiling point), then jet fuel, then oil, then car oil, until only tar is left. We call on the components fractions, and process, fractional distillation. Learn more about the distillation of crude oil in this video The video on the distillation of crude oil may be a little too advanced, but it summarizes the process of fractional distillation quite well and mentions mentions examples of products produced in the real world. Note that the video repeatedly mentions hydrocarbons. You can put students at ease and tell them that it's not important for them to know what that means yet. The periodic table is only examined in Chapter 4, but you could help students decipher that crude oil contains many hydrogen particles and carbon particles together in different combinations (proportions). Each of the fractions collected eventually contain a kind of hydrocarbon combination. There's another separation technique to explore. Have you noticed how ink on paper will sometimes run when it gets wet? Can you see how the ink on this sign has run after being wet, probably from the rain? Most inks are a mixture of different pigments, mixed to give them just the right color. A pigment is a chemical that gives color to materials. When a mixture contains colorful compounds, it is often possible to separate the different components using a separation method called chromatography. Let's take a look at this next one. Chromatography comes from the Greek words color (meaning color) and graph (meaning to write). Chromatography is a method for separating colored substances into individual pigments. We'll investigate it in the next investigation. AIM: Separate pigment ingredients with ink using different liquids. This is a fun activity that can be done quickly. If the class is divided into small groups and each group gets a different black marker to experiment with, the chromatograms can stick to the wall then for everyone to see and compare. By searching for saucy chromatograms, students can tell which group had the same brand of index, or which markers are filled with the same ink. If the ink from a particular pointer is not separated into a liquid, try using another liquid in the glass. You could even build a story around the investigation: Stage a murder mystery in which the killer can be identified by his(s) black pen. Use three or four black or blue pens of different brands and create the unique chromatograms associated with each brand. Inks may look the same when used for writing, but they will behave differently when broken down by chromatography. What do you suggest the answer to our research question? That's your case. Answer that depends on the student. One hypothesis could be 'Black ink consists of different colored pigments. MATERIALS AND PACKAGES: absorbent paper cut into width of approximately 3 cm and length 12 cm Laboratory Equipment Whatman the No. Alternatively, you can use coffee filters, watercolors or napkin strips. Even the usual copy paper works, but slower and often this makes the colors individually better. For softer papers you may need longer strips of paper and taller containers, since the liquid is up the paper much faster. clear drinking glass or glass assorted black pens and indicators tap water pencil clip or clothes peg filter paper eyedropper variety of liquid solvents (ammonia, surgical spirits, methylated spirits, and nail polish remover) A solvent is a substance that dissolves a soluble, resulting in a solution. A solvent is usually a liquid, but it can also be a solid or a gas. Possible risks: Ammonia is a dissolved gas and a weak base. It is not likely to cause burns, but ammonia fumes can irritate the mucous membranes of your nose. Surgical spirits and methanol contain alcohol. Nail polish remover contains acetone. Alcohol and acetone are flammable and should be kept away from heat and flames. You must not inhale the vapours of these solvents. Safe laboratory practice is extremely important. Take some time to discuss risks, precautions and safety with students. Discuss the fact that scientists often have to handle hazardous substances and/or equipment to be able to make observations. When working with ammonia, be careful to work in a smoke hood or in a well ventilated area. Leave the door and windows open so that the fumes do not linger. Similarly, substances containing alcohol should be used in a well-ventilated, but also flammable, so avoid using them in the presence of open flames. It is always advisable to wear latex/nitril gloves (available from pharmacies) to prevent the absorption of dangerous substances through your skin. Wear goggles to protect your eyes from harmful chemicals. Always have clean water nearby to rinse your eyes or wash your hands if the chemicals dive or leak. Careful laboratory practice will not only ensure your own safety, but will also set a good example for students. METHOD: To make a tape chromatogram Use a black pen or pointer to draw a line along one end of the paper strip, 2 cm from the end. Pour tap water into the glass at a depth of about 1 cm. Wrap the unmarked end of the strip of paper around the pencil and secure it in place with a paper clip. Before placing it on the glass, adjust the strip of paper so that the height of the inked line is about 1 cm above the surface of the liquid by holding it on the outside of the container. Lower the strip on the glass and place the pencil on top of the glass, as shown in the diagram. The end of the strip must be in the water, but the ink line must be above the surface of the water. Allow the liquid to be absorbed into the paper, which rises through the line When migratory pigments approach the top of the strip, near the connector, remove the paper strip and leave it to dry on a flat, non-porous surface. Make a similar tape chromatogram for each of the black pens you've collected. Compare the chromatograms. Is it the same or is it different? When you're done comparing your chromatography with those of the rest of the class, you can either paste your chromatogram into the space below, space, draw a picture of it in space. You can also use a clothes peg to keep the strip in place when drying. To make a circular chromatogram Put a large round piece of filter paper on a smooth non-absorbent surface, such as the surface of your office, for example. Use one of the colored pens to make a 0.5 to 1 cm ink point in the center of the disc. Place the paper tray flat over the top of a glass. Place a drop of water in the center of the ink point. Add another drop of water every minute or so to make the chromatogram spread to the edges of the paper tray. Repeat the experiment with one of the other solvents (ammonia, alcohol or nail polish removal). NOTES: Do the two chromatograms look the same or different? If they look different, and you've used the same pen, why do you think they are? What pigments could you notice? Draw images from your chromatographs in the space below. CONCLUSION: What can you conclude about the pigments that make up black ink? Students should note that black ink actually consists of a number of different pigments. A closer look at how this works: In paper chromatography, the liquid is dragged through the paper fibers. But, why are the pigments in the ink divided into bands of different colors? The pigments in the ink are transferred along by the liquid, but because they are different compounds, they get carried up at different speeds. This causes them to appear as bands of different colors in the chromatogram. Look at the chromatogram image below. An example of tape TLC_black_ink.jpg which color pigment moves the paper up at the fastest speed? Why do you say that? The yellow pigment moves faster because it has travelled the longest distance. Which color pigment moves up the paper at the slowest speed? The green pigment moves the slowest because it has traveled the shortest distance. Why are different pigments transported at different speeds? Pigments migrate at different speeds due to differences in their properties: large pigment particles tend to move more slowly. In addition, particles that dissolve well in the liquid will tend to remain in the liquid and be transferred to the top quickly, while particles that are well connected to the paper will tend to move more slowly. Is black really black? (video) schools also use combo plates for various practical tasks in materials and materials. This is encouraged and activities in these workbooks can be slightly customized to work with any equipment and device at your disposal at your school. Also, if students find the flowchart very complicated at this stage, you can alternatively get them to write down the steps they would follow to separate all the materials in the mix and and have chosen each method of separation. Imagine that you are part of a team of scientists working together in a laboratory. Your team has received an important job. You have been given a glass containing a mixture of substances to separate. The mixture contains the following ingredients: iron sand filings salt water ethanol Your job is to design a process for separating the mixture into its individual components. How would you do that? Your process should be summarized as a flowchart. Before you start, imagine what the mixture would look like. Draw a picture of the clear container and different contents in the mix in space. This can be a difficult task for students to complete, but it is very important for students to be able to visualize the mixture before they start planning the experiment. If they don't, the ideas will remain abstract and students may find it difficult to properly redirect the various separation steps. You could guide them by asking the following questions. Alternatively, you could prepare the mixture to test it before designing it: What does the container look like? Draw it on your page. What liquids are in the container? (Ethanol and water). Now draw the container with a mixture of ethanol and water in it. Will you be able to see ethanol and water when mixed? (No, it will look like liquid in the container.) Now add the sand. Would they mix with the water or sink to the bottom? (Most of it will sink to the bottom.) Now add the iron files. Would they mix with the water or sink to the bottom? (It will sink to the bottom.) Now add the salt. Will the salt sink at the bottom or dissolve in water? (It will dissolve in water.) Could we see if it had dissolved in water? (No.) To help you plan your process, here are some guiding questions and a template for your flowchart: What is the physical condition (solid, liquid or gas) of each of the ingredients in the mixture? Fill these on the table. Component (substance) Status (solid liquid or gas) Dissolved or insoluble; Component (substance) Status (solid liquid or gas) Dissolved or insoluble; Solid insoluble Sand solid undis dissolved Solid ethanol liquid dissolved (in solution with water and salt) Water liquid dissolved (in solution with ethanol and salt) Name solids that will not dissolve in the mixture. These are the insoluble solids. The sand and iron records are insoluble. Name the dissolved solids in the mixture. Salt is the only dissolved solid. What would be the best method for separating insoluble solids from liquids in the mixture? Write the name of this method in the numbered block 1 of the flowchart below. Students should write INFILTRATION in block 1. Write the names of insoluble solids block 2 of the flowchart. Students should write SAND and IRON FILES in Block 2. What remains after insoluble insoluble have been removed from the mixture? Write the names of these compounds in block 3. Students must write SALT, ETHANOL and WATER in block 3. How could we separate the insoluble solids? (Tip: look at the flowchart for some ideas.) Write the name of this procedure in block 4. Students should write MAGNETIC DISCOUNT in block 4. Write the names of two insoluble solids in blocks 6 and 7. Students should write IRON FILES in block 6 and SAND in block 7. How could we separate the liquids from the dissolved solid? We could evaporate them, but then they'll be lost. What other option is available if we want to separate the components into a solution? Write the name of this procedure in block 5. Students will have to write THE DISTILLATION in block 5. Which liquid will be distilled first? (Hint: which liquid has the lowest boiling point?) Write the name of this liquid in block 8. Students should write ETHANOL in block 8. What is left in the solution when the first liquid is removed? Write the names of these items in block 9. Students must write WATER and SALT in block 9. How can we separate the liquid from the dissolved solid? (Tip: this process is the same as the one in block 7.) Write the process name in block 10. Students will have to write the STATEMENT in block 10. Write the names of the last two items in blocks 11 and 12. Students should write WATER in block 11 and SALT in block 12. The complete flowchart should read as follows: So far, we have discussed materials, their properties, how to mix them and how to separate them if they are mixed. The last part of this chapter deals with waste and what we can do to reduce its impact on the environment. Over time, some of our things get old and break and we have to throw them away. When buying food or other items, the packaging used to wrap these items is also discarded. But what does it mean away? Does that mean this waste just disappears? Where do you think our garbage goes when we throw it away? Allow the students to discuss this for a while. Some may know that garbage eventually ends up in a dump somewhere, and this is a good starting point for the next activity that will require students to think about the effects of dumping. Have you ever heard of the Great Pacific Garbage Can? Millions of tons of plastic waste end up in the ocean and stay there. INSTRUCTIONS: Work in groups from 3 to 4. In your group, spend 5 minutes discussing the posters and what you think they mean. QUESTIONS: There is no far away and There is no planet B refers to the same theme, namely that what we fly remains part of our environment. We'll have to think about for the reintegration of our waste, making it part of the environment in ways that will not harm the environment; reuse, recycling and repositioning of waste and materials in creative and innovative ways. There is no planet B is also a game about words that refers to the well-known meaning of the Plan Plan which may come back if the original plan fails (Plan A). Write a paragraph to explain the messages on the posters. What do you think they mean? Do you think it's possible to stop throwing things away altogether? Many things can be reused or recycled. Many of the waste that is not recyclable can be converted into fertilizer for the garden. Students may have interesting opinions on this issue, and we hope it will make them think about creative ways of reusing and reusing waste. Can you suggest ways to reduce the amount of trash thrown into your home? Answer that depends on the student. Students should produce proposals focusing on reuse, recycling and repositioning. An optional additional activity for this department is to get students to evaluate how poor waste management techniques affect the environment. For this activity, students must use materials that would normally go to the trash can in your home (cereal boxes, cardboard boxes, plastic wrappers, etc.) to make a poster that will raise awareness of the environmental problem that concerns them most. The poster should also contain suggestions for solving the problem. Here are some ideas, but you only need to choose one: Cigarette butts can start veld fires. Broken glass bottles can light fires. Discarded plastics trap animals. Discarded plastic pollutes rivers and other natural habitats. Waste poses health risks and diseases spread. Land is wasted when used for dumping or landfilling (landfills). Materials and other resources are wasted when they could have been recycled. Once students have created their posters, you can stick them around the classroom and they can also make a brief report back in class. It is also possible to do this activity as a group. In some suburbs, recycling is actively encouraged and special transparent recycling bags are provided for this purpose. Do you have recycling in your community? Is recyclable waste collected from your home or should you leave it in a container or warehouse? Did you know that some people even make money selling recyclable waste they collect? Do you know which materials from household waste can be recycled? What are the four main categories? Ask your students about this question before proceeding to the next section where this will be discussed. The answers are: paper and cardboard metal glass (canned and boxes) plastic Elements to be disposed of carefully and not dumped in regular garbage, include batteries, and fluorescent lamps. Have you seen colorful bins similar to those around your school or in shopping areas? It's for recycling. If you ever need to dispose of items such as batteries and fluorescent lamps containing harmful substances, be sure to use the correct recycling bin. Here's an additional, optional activity, which you could get students to do as homework. Activity: Other things we throw away in this short short we will think of creative ways of dealing with household waste that are not included in the 4 categories mentioned above. For each item in the table, some recycling ideas have been given. Can you think of other ideas to add to the table? Discuss it in a group and write them on the table. Data recycling ideas Garden waste and other organic waste such as vegetable peels and spoiled food. These elements can be converted into fertilizer. Cooked food, spoiled meat or fish and bones should preferably be buried because they can attract flies and other pests. In this way they can decompose underground and provide nutrients to growing plants in the garden. Old clothing and other textiles; old shoes. Clothes, shoes, curtains, and blankets that are still good enough to be used can be donated to shelters for the homeless. Clothes that are very worn can be converted into fabrics for washing the car or windows. Old jerseys can be s tailored to blankets or other items. Old and expired medicine Medicine that is old or expired should never be reused. You should drop off at your nearest clinic or pharmacy, where they have methods for destroying it. Invite a chemist/scientist: Do you know someone who is a chemist or chemical engineer? Maybe you live near a university? If you do, you could invite a chemist to come to your school and talk to your class about the work that chemists do. Alternatively, you could visit the chemist at their workplace and ask them to show you around. Can you get students to prepare a few questions in advance? For example, you could ask them about their work, their training and what they think are the qualities required if someone wanted to become a chemist. Just remember to make an appointment first! This activity could be turned into a small group project and trainees could be asked to draw up a brief report on the information they have collected. Do you know what chemists do? Let's discover the possibilities of chemistry! Chemists study various chemical elements and compounds, their properties and how they react to each other. We'll find out about the evidence and the compounds in the next chapter. Chemists are also responsible for the development of new materials with specific properties. such as new medicines; innovative materials for buildings and other constructions; materials that could be used to produce fuels from renewable sources and much more. If you are studying chemistry after you finish school, you can work as a researcher, laboratory technician, science teacher and many other important and stimulating Work! Be curious and discover the possibilities! Science can help us solve problems in the world around us. This is not for evaluation purposes and aims to get students to start thinking about the possibilities for their future. Emphasis should be placed on discovering the possibilities that science, mathematics of technology and engineering give us, not only in job opportunities, but also in their use to solve solving in the world. INSTRUCTIONS: Below is a list of different careers that everyone uses chemistry in some way. Take a look through the list and then select one that you will find most interesting. Do an internet search to find out the career includes. Write a brief description of this career. Find out what level of chemistry you'll need for this career. There are many other careers besides those listed here that use chemistry in some way, so if you know something else that isn't mentioned here and you're interested, follow your curiosity and discover the possibilities! Some careers related to chemistry: Chemical education/teaching Chemistry researcher Environmental chemistry Industry Oil Extraction and Petroleum Pharmaceuticals industry and discovery of drugs Space Exploration Waste Management Your descriptions of the career you are interested in: A mixture consists of two or more components that have different physical properties. The components of a mixture do not come together chemically. do not change their chemical identities and retain their physical properties. When we want to separate a mixture, we can use the differences in the physical properties of the components of the mixture to separate the ingredients from each other. Hand sorting is an appropriate separation method for a mixture that contains a relatively small number of large objects. Sifting is an appropriate method of separation when the pieces to be separated are of a different size. Filtration is a good method for separating an insoluble solid from a liquid. Components with different magnetic properties can be separated using magnetic separation. Evaporation is an appropriate separation method for removing a liquid from a solid. Distillation is an appropriate method for separating two liquids with different boiling points. Chromatography is a good method for separating colored pigments from each other. Waste disposal should be managed in a responsible manner so that the negative effects on the environment are as small as possible. Metals, plastics, paper and glass can be recycled. Organic waste can be converted into fertilizer. Responsible waste disposal is the responsibility of everyone, but it is usually done by local authorities, who have waste sorting and recycling systems. Poor waste management leads to negative consequences for humans, animals and the environment. Some of them are: pollution of soil, water resources and the environment; health risks and the spread of the disease; obstruction of sewers and sewerage systems; wasted land when used for disposal or burial of waste landfill); and materials and other resources wasted when they could have been recycled. Concept map We looked at the natural methods to separate the mixtures and these are presented on the concept map. Give an example of the types of blends that you could separate using three of these methods. What negative effects does human waste have on the environment? Fill these in the concept map. Teacher's Edition Two important words words does not exist from the following paragraph. The missing words are chemical and natural. Rewrite the sentences and fill in the missing words in the paragraph by placing each one in the correct position: The ingredients in a mixture have not been changed _____ . They still have the same qualities they had before they were involved. This is why mixtures can be separated by _____ methods. [1 mark] The components of a mixture have not undergone chemical changes. They still have the same qualities they had before they were involved. This is why mixtures can be separated by natural methods. In the diagram below, the iron and sulfur files are mixed. Write a short paragraph (2 sentences) to explain how the mixture can be separated using magnetic separation. [2 points] The student's response should contain the following elements: The iron files are attracted to the magnet, but the sulfur is not. If the magnet is kept in the mixture the iron files will cling to the magnet, but the sulfur will be left behind in the bowl. A vacuum cleaner creates a suspension of dust in the air as it sucks up dust on the floor. Fresh air comes out of the vacuum cleaner. How does the vacuum cleaner separate dust from air? [2 degrees] The vacuum cleaner has a thin filter on it that traps dust particles. The fresh air is able to pass through the filter, but the dust is left behind. Some more modern vacuum cleaners also filter air through water that cleans the air even further. Some very fine dust particles may be able to pass through the thin filter, but if the air passes through the water, then even very fine particles are trapped. Write a short paragraph (3 sentences) to explain how salt is produced from seawater. [3 points] The student's response should contain the following elements: Seawater is allowed to stand in shallow pans. Sunlight heats the water and evaporates. The solid salt is left behind, which can be dried and put in packages to be sold. Select the correct word to fill in the sentence from the following list: colors; colors? boiling points, flavors. Write the word below. Suppose we want to separate two liquids using distillation as a separation method. This will only be possible if the two liquids have different... [1 mark] The following diagram shows a tape chromatogram made from a spot of black ink. The strip on the left shows the chromatogram at the beginning of the experiment, the strip in the middle shows the chromatogram halfway through the experiment, and the strip on the right shows the chromatogram at the end of the experiment. How many different pigments is made up of black ink? Explain your answer to me. [1 signal] Three different colors mean that there are (at least) three different pigments in the ink. Which dye goes up the paper at the fastest speed? Arrange pigments in turn of increasing speed of movement. [2 degrees] The blue pigment moves faster. Arranged in order to increase speed (from slower to faster traffic yellow, then pink, then blue. The following table contains a list of mixtures. In the right column, next to each mixture, write the best method for separating the mixture into its components. [8 points] Method of separation of mixture Salt and water Sand and iron filings Sand and water Color pigments in ink Stones and sand Ethanol and water Oranges and apples Sugar and iron filings Method of separation Salt and water Distillation or evaporation Sand and Iron Filings Magnetic Separation Sand and Water Filtration Coloring Substances in Ink Chromatography Stones and Sand Siaving Ethanol and Water Distillation Oranges and Apples Hand Classification Sugar and Iron Archives Magnetic Separation Name of 4 categories of materials can be recycled. [4 degrees] Glass, metal, plastic, paper. Write a sentence to say how you reject each of the following non-recyclable materials: vegetable peels; old running shoes? expired medicines. [3 degrees] Vegetable peels can be buried in the garden or turned into fertilizer. Old running shoes can be donated to someone who needs them, or to a shelter. The expired medicine must be transferred to the pharmacy. TOTAL: 27 points