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| Session leaders:Contact number:Date:  |
| Session theme:  | Chemistry |
| Session objectives: | * Know that solutions can be acidic, alkaline or neutral
* Describe that some natural chemicals, such as red cabbage water, may be used as indicators to determine whether solutions are acidic or alkaline
* Describe a real life example of when people may want to determine if a solution is acidic or alkaline
* Explain that a polymer is a long strand of molecules which behaves in the same way as freshly cooked spaghetti – the molecules slide past each other, the substance acts like a liquid
* Describe that borax can be added to join together the long chains of polymers in PVA glue to create a bouncy ball. Also that cornflour can be added to help the molecules stick together so the ball retains its shape.
* Explain that the elasticity of the ball is its ability to retain its shape and this is due to the polymers
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| Careers links: | Chemist in a laboratory, always want to test new substances and chemicals to make medicines, toothpastes, shampoo, make-up. Lifeguards need to test the pH of swimming pools. Engineers on big manufacturing plants also need to test solutions for the pH level.Polymers are used to create all kinds of materials for everyday life and research scientists continually create new substances and test their different properties like elasticity. |
| Starter questions:  | Activity 1* Does anyone know what an acid or alkali is? – *it is a solution that has a pH that is not neutral (like water). Some very strong acids and alkalis can irritate (or burn) our skin, so we can’t touch them*
* Can you think of any acids or alkalis you know of in your house? – *hint with cleaning products, and then what about food? Don’t give away all of the answers!*
* How do we keep swimming pools clean? – *add chlorine, but too much of this will sting our skin, so we need to be able to tell how much of it is in the pool. Lifeguards measure the pH of pool water to test the levels of acidity in the pool.*

Activity 2* What is spaghetti like when it is first cooked? – *the strands are almost like a liquid because they slip and slide over each other*
* What about if you leave the cooked spaghetti for a while? – *the strands start to stick to each other and the pasta becomes a bit rubbery. Eventually, the spaghetti strands really do stick together, and you are left with a solid block which is bouncy.*
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| **Activities**  | **Notes**  | **Materials** |
| *Activity 1 (25 minutes)* *Title:* Acid or alkali?*Aims:* The children will investigate 5 different solutions to determine which are acidic, alkaline and neutral. They will learn that by adding certain natural chemicals called indicators (the red cabbage solution) to various solutions, we can change some of their colours, and that the new colours will depend on what the pH is (whether the solution is acidic or alkaline).*Context:* All solutions are acidic, alkaline or neutral and it is really important to be able to determine what an unknown solution might be before you touch it. For example, in real factories there will be times when a pipe will be leaking and need to be fixed. The people in the factory need to find out whether the liquid escaping from the pipe will be harmful to them without touching it. In this activity, there has been a delivery of some common household goods, but due to an accident we can no longer read the labels and can’t work out what some of the items are. A sample has been taken of each item and these are labelled 1 – 5.*Description:* The children should work in small groups to perform this activity. Each group should have a container with some dilute red cabbage solution, containers labelled 1 – 5 with each of the solutions, droppers (or pipettes) and some coffee filter paper (soaked in the red cabbage solution and left to dry previously). The children should also be provided with a table to record their results and this is attached at the end of this document. To begin with, ask the children to try and guess what some of the numbered solutions are – teach the way to smell in chemistry and note the colour. The children can then carry out this activity in two ways, first they can use the droppers to add each numbered solution to separate sheets of the coffee filter paper. They can record what colour this changes to. Next, they can use a clean dropper to add the red cabbage solution to each of the numbered containers, observe and record the colour change.*Reflective questions:* Why did adding the red cabbage solution change the colour of some of the solutions? (acts as an indicator for acids and alkalis) Are there any common links between the different acids and alkalis? (Try to get the children to realise that many alkaline solutions are used for cleaning because they are good at removing dirt and grease and many acidic solutions are food and drink items) Our stomachs contain acid, and sometimes this builds up and when we get heartburn. What do you think happens if we then drink some milk of magnesia (an alkali)?  |  This activity should be fairly straightforward provided that the red cabbage solution is correctly diluted. This solution is prepared by covering a red cabbage in boiling water and leaving it to sit for a while. The red cabbage should then be removed from the solution and this should be diluted. This will be completed by the leaders the night before and tested for the correct dilution level. All of the acids and alkalis chosen should be safe to handle but may cause slight irritation to eyes and skin. The children should use any PPE that is available (e.g. gloves, goggles) but if this is not possible then it should be discussed with the children that they would need this in a real laboratory. Small quantities of each solution should be used to help avoid major spillages. It would be best to carry out this activity either in trays or on top of newspaper to deal with spillages.If there are a limited number of droppers, these will need to be cleaned before being used in different solutions.There is a good chance of contamination between the acids and alkalis in this activity. This will lead to an interesting talking point and can link to stomach acid and milk of magnesia. | Diluted red cabbage solution (to be made the night before – will be made by the leaders and tested)Household acids – white wine vinegar, lemon juiceHousehold alkalis – bicarbonate of soda solution, milk of magnesiaHousehold neutral solution – waterCoffee filter paper soaked in red cabbage solution and dried (again prepared by the leaders the night before)Each group will need 6 containers (beakers, jugs, clean paint pots, or ask the children to bring in some things – e.g. clean yoghurt pots, jars?) – five of these should be labelled 1 – 5 and filled as:1. Vinegar
2. Lemon Juice
3. Water
4. Bicarbonate of soda solution
5. Milk of magnesia

The last container should be filled with the red cabbage solution.It would also be ideal if each group could have 6 droppers, otherwise will need to share between groups or rinse between uses.Newspaper or something similar to do experiment onTable at the end of this plan to record results |
| *Activity 2 (25 minutes)**Title:* Cornflour Bouncy Balls*Aims:* The children will create their own bouncy balls using borax to join together the long polymer chains in PVA glue. They will observe that adding the borax and cornflour will change the liquid PVA glue into a solid, elastic structure.*Context:* A large variety of objects and materials are made from polymer chains: clothes (nylon), pens, toothbrushes… To further develop more sustainable and cheaper products, researchers have to test the properties of new substances they create. In this activity, we will test the elasticity of bouncy balls made from PVA glue, borax and cornflour.*Description:* The leaders should first create a borax solution for the class by adding the powder to some warm water and stirring well. Each child should have a beaker and fill this with 15cm3 of PVA glue. They should then add 2 spatulas of cornflour and 1 spatula of dry borax powder. Add some food colouring (optional). Then add a drop (0.5cm3 of the borax solution). Stir this mixture well. When it starts to become sticky, scoop it out of the beaker and roll into a ball. Take the balls outside to test how well they bounce!*Reflective questions:* What did the borax do to the polymer chains in the PVA glue? (joined them together, think spaghetti) What property allows the balls to retain their shape when they bounce? (elasticity) | The main difficulty with this experiment will be trying to measure out the ingredients. To try and resolve any issues: if the ball is too brittle, there is too much borax whereas if the ball is too soft and not elastic, need to add more borax.The borax solution should be prepared by one of the leaders to reduce the use of beakers. The solution should be 1 spatula of borax to 10cm3 of warm water, so this may be scaled up as appropriate.If any PPE is available this may be worn but is not necessary for this experiment. The food colouring is optional but will make the bouncy balls look more exciting to the children. | PVA glueBorax powderCornflourFood colouring (optional)Warm waterBeakersSpatulasStirrers/spoonsDroppers |
| Summary: We learned that solutions are acidic, alkaline or neutral and this can be tested by using indicators such as red cabbage solution. Measuring the pH of solutions is something that lifeguards will do every day as well as people who work in manufacturing plants for example. Chemists will also analyse the pH of any solution they make. We also learned that polymers are long chains of molecules that behave like long strands of spaghetti. When these chains of polymers are joined together, they form solid structures which can be elastic. Borax is able to join together the chains in PVA glue to create a bouncy ball. A lot of the items we use every day are made with polymers and research scientists often study their properties. |  |  |

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| **Sample** | **Contents** | **Colour before** | **Colour on filter paper** | **Colour after adding red cabbage** | **Acid / Alkali / Neutral?** |
| **1** |  |  |  |  |  |
| **2** |  |  |  |  |  |
| **3** |  |  |  |  |  |
| **4** |  |  |  |  |  |
| **5** |  |  |  |  |  |