

Mood Rings – Teacher Notes

By: Louise Lopes

Introduction:

Behold the beauty of gems that change colours! Mood rings are said to change colour depending on the mood of the person who is wearing it. Students will be asked to investigate this claim by seeing if they can change the colour of a mood ring (without having to change their mood!) Students will pose their own question, to which they must answer by planning and conducting their own experiment. Students choose how they will collect and analyse data, and they will evaluate the reliability of their results.

As this investigation is an open inquiry, students from all grades will benefit from practising their science inquiry skills. There are many possibilities that students could test for, meaning that each lab group could essentially perform a unique experiment. Presenting the results at the end of the practical will give students the opportunity to share information that will help them when explaining how mood rings work.

The science behind mood rings is fascinating. Year 7-8 students will benefit from thinking about whether a physical or a chemical change is taking place. They will also learn how separating temperature from other variables (such as increased heart-rate) is difficult as heat energy is a common by-product of energy transfers. Year 9-10 students will benefit from learning how the molecular structure of the mood ring determines its colour, as well as the wave properties of light as it bounces off a coloured surface.

Question:

Students are given the general aim to change the colour of a mood ring. Students will have to choose a likely factor that they can then test for.

Class Discussion: Conduct a brainstorming session with students about the various factors that could cause a colour change in a mood ring. Students can think about different qualities of human skin that could potentially change throughout the day. Examples of things that students may answer are temperature, heart-rate, skin pH, salt concentration on the skin (from sweat), light exposure or small electrical currents.

From this discussion students can choose what they would like to test for. Each lab group could choose a different factor to test and then present their findings to the class. By doing this, students will learn more about mood rings by seeing what things can or cannot change their colour.



If students already suspect that temperature is the likely cause, or they have found this out through a secondary source, then teachers may direct students to make a colour chart. Students will have to identify which temperature corresponds with which colour.

Once students have chosen the factor that they would like to test, teachers may assist them in outlining their variables. The chosen factor will be their independent variable, while the mood ring colour is the dependent variable. Please note that looking at the ring at various angles can show different colours, therefore it may be necessary to specify that the colour which is to be recorded is the colour which is visible when looking directly at the ring from above. Controlled variables will be more difficult. This is because many of the factors listed above will also cause a temperature change.

It is unlikely that temperature change will be able to be controlled when testing things like heart rate or electrical current. This will serve an important lesson about experimental design during the Problem-Solving stage.

Plan:

Lab groups will need to devise a plan in order to test their chosen independent variable. They have been instructed to provide a materials list. Teachers may offer guidance by suggesting various tools which could be used to record results. Below are examples:

Independent Variables	Materials
temperature	<ul style="list-style-type: none"> • beaker • thermometer • bunsen burner (use on low setting in order to increase temperature of water slowly) • tripod • pipe-cleaner and pencil (attach to ring to safely suspend in water) • ice water (An optional way to begin the experiment is to suspend the mood ring in ice cold water. The mood ring will turn to black). <p>Please note that there is no reason to raise the temperature of water to more than 40°C.</p>
heart-rate	<ul style="list-style-type: none"> • stop-watch (to count the pulse) • heart-rate monitor (optional)
skin pH	<ul style="list-style-type: none"> • beaker • baking soda • vinegar • pH paper
salt concentration	<ul style="list-style-type: none"> • beaker • salt
light exposure	<ul style="list-style-type: none"> • access to inside and outside environments • lamp and various light bulbs (optional)
electrical currents	<ul style="list-style-type: none"> • 1.5 volt battery (do not use a stronger battery and do not leave the mood ring on the circuit for longer than 2 minutes continuously) • alligator clips/wires/switch • multimeter

Teachers can encourage students to think of ways to make their experiment more reliable by reminding them that if a person was to read their method, they should be able to repeat it so that similar results are obtained. For example, if students are testing salt concentrations, they should plan to weigh the salt before mixing it into the water so that the impact of approximate salt concentration values is known.






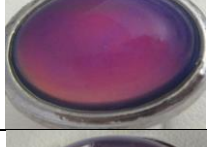

Conduct:

Once lab groups have planned out their experiment and they have their materials, they can then conduct their tests and record their results. A comprehensive results table is critical for students to keep track of their data. If possible, allow students to take photos of their mood rings after each test, as this will make it much easier to observe colour changes over time. These images can be incorporated in their results table.

Teachers may encourage students to record qualitative results by recording their observations. Various items that students may include are the time taken for the colour change to occur, whether

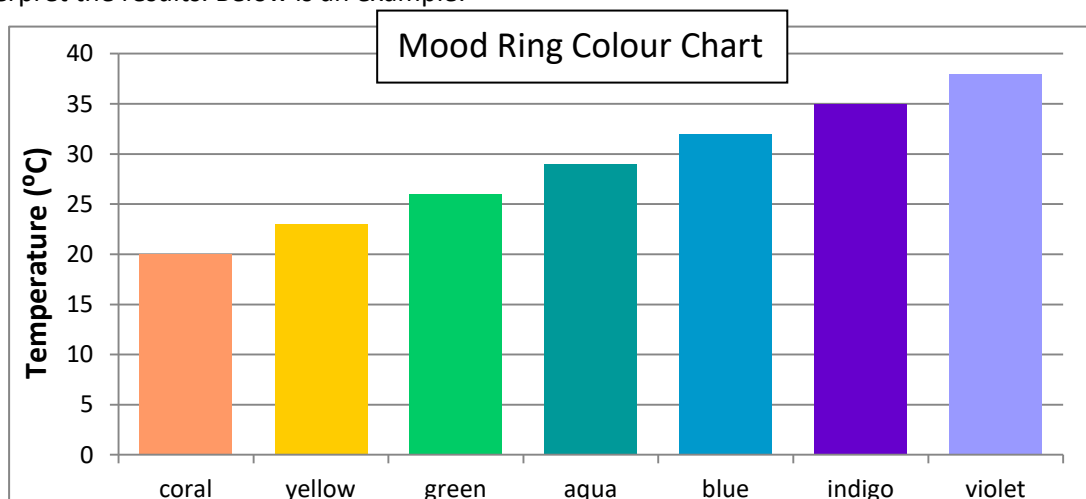
multiple colours were seen at the same time, whether there were any issues preventing students from taking accurate measurements, etc.

Below is an example of a results table that could be used for making a colour chart based on temperature:

Temperature (°C)	Colour (Photo)	Observations
20		
23		
26		
29		
32		
35		
38		

Analyse:

Students have been instructed to represent their data graphically in order to present to the class. Students may use excel in order to create a bar graph, with each bar representing the colour of the mood ring. Students can then sort the data in order to make it easier for their class mates to interpret the results. Below is an example:



Problem-Solves:

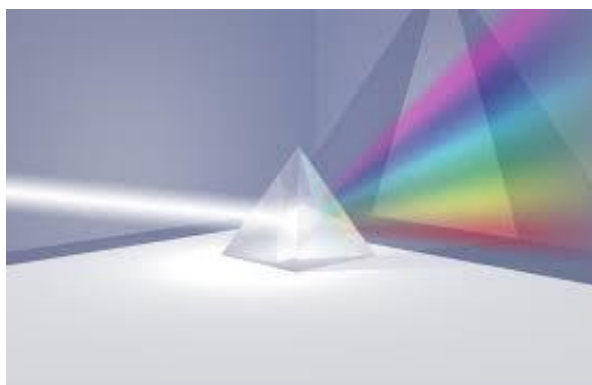
Evaluate: Students are required to evaluate their experiment. Discuss with students whether their method could be improved on. Advise students to reference any issues with setting up the equipment or accurately recording results to justify their reasoning. Could their experiment be repeated by another group? If resources and time were less limited, what would they have done differently? Were there any variables that they wanted to control for but couldn't? All these details will be important when each lab group presents their findings to the rest of the class.

Assess: Students are asked to compare and contrast their results with those of the rest of the class. By assessing the results of all groups, students should get a better idea of how mood rings work. Students should be able to recognise that the strongest causal link was found with the lab group that was testing for the effect of temperature. There should be some changes seen in the lab groups who tested for heart rate and passing electrical current because heat is produced as these things increase. The groups that test for pH or salt concentrations should find no causal link, although if the temperature of the solution changes over time (approaching room temperature), this will also have an effect.

Discuss with students the difficulty of controlling for confounding factors, such as removing the effect of raised body temperature when heart rate is increased. Confounding factors are a common issue in scientific research, especially in population studies (humans are complex!). Scientific papers will try to use mathematical calculations in order to lessen the impact of confounding factors. Discuss with students how this affects the reliability of an experiment.

Apply: In this section, students will tie in what they have learnt through practical work with scientific theory, as teachers provide context for this investigation. Students may already know that temperature is the biggest factor in changing the colour of a mood ring, however can they answer whether this change is physical or chemical? This can be difficult to answer because dramatic colour changes are usually a sign that a chemical change has occurred, however the composition of the mood ring does not change and under the right conditions, the same state (colour) can be achieved again. This interesting property of mood rings is due to special liquid crystals that are thermochromic, meaning they change colour in response to changes in temperature.

The molecules in thermochromic liquid crystals twist in response to different temperatures. This twisting changes the structure, but not the composition of the molecule. This twisting property allows the crystals to display all the colours of the rainbow and be able to be used over and over again. The colour is dependent on the direction and amount of twisting. This is because the molecular structure changes cause light to refract and reflect differently. Something similar occurs when white light is passed through a prism.



Additionally, teachers may elaborate on how heat energy is often produced as a by-product of energy transfers. When we talk about increasing a person's heart rate, we are also talking about increasing the metabolism of the person. The metabolism refers to the rate at which a person is burning energy. When the energy of food is transferred into a cell, heat is generated from the chemical reaction. Electrical currents also produce heat as a by-product. This is due to electrical resistance. The conducting medium will resist the motion of electrons, which leads to the kinetic energy of atoms being transformed into thermal energy.

Therefore, the question that students should be asking is not whether mood rings can tell you your mood. The question should be: does your body change its temperature depending on your mood? This can occur in some cases, but is definitely not reliable. Temperature changes are dependent on metabolism, which can run faster or slower for many different reasons such as time of last meal, exercise or illness.

Conclusion:

In this section students will be able to answer their initial question, making a short statement about what their overall findings were.

Discuss with students if they were successful in answering their question. How many groups were able to show that their hypothesis was correct? What do students think of the claim that mood rings can read your mood?



References:

Chart Images and Mood Rings Obtained from:

<https://www.bestmoodrings.com/shop/classic-oval-mood-ring>

Image 2 – Luis carlos123, https://commons.wikimedia.org/wiki/Category:Prisms#/media/File:Luz_optica.jpg
CC Attribution-ShareAlike 4.0 International: <https://creativecommons.org/licenses/by-sa/4.0/>

Image 3 - <https://www.flickr.com/photos/perspx/4910076070/in/photolist-8tTqxY-axD3Vo-r2FGg-8MyPdB-XVp7yD-gt8EKc-7eSa5o-9ku3nc-afeRz2-7nKajH-YVV78a-afeQDi-WEDJv1-zKwMDN-WfC6HR-SK6vzy-bcNip4-oHgDd-8jYvHF-8kvuq8-66Lmxt-7rUGed-dCb2M-67gdLh-cXnx2Y-8i1oJ-PARI-66zUFF-WEDCYj-6JsHNI-74wJ9F-5dDyek-6nt5x5-aWvsBr-XWVpsB-WEDKEf-5kNgr8-XWVqhx-HNG4M1-7n17VC-3tHTfP-55B3Mo-nefW97-c4ALXm-XWVZ2B-MvWCp-5kNgy6-3D2vUa-6LBSGK-XWVoqM>

CC Attribution-NonCommercial 2.0 Generic: <https://creativecommons.org/licenses/by-nc/2.0/>