making fake rocks

ingredients:

- epoxy
- polyester polymer resins
- food colouring
- iridescent cellophane
- glow-in-the-dark powder (strontium aluminate)
- mould release spray
- silicone chocolate moulds
- plastic cups
- dolomite
- white wine vinegar

recipe:

fake gems:

1. mix resin according to packaging instructions
2. pour into a second plastic cup to minimise unmixed resin
3. add a few drops of food colouring, glow in the dark power or iridescent cellophane
4. slowly pour into moulds
5. leave to set for two days

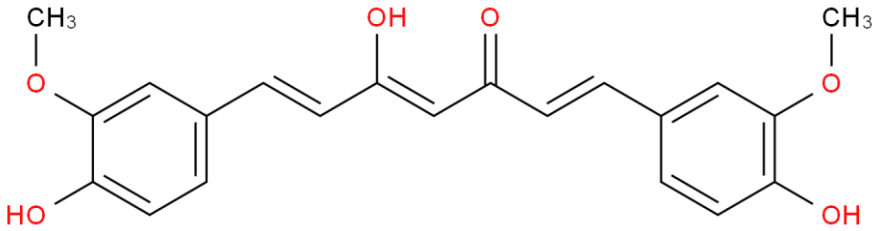
popcorn rocks:

1. place an unwashed sample of crystal growing dolomite in a small glass or plastic bowl.
2. pour distilled white vinegar over the sample until it is nearly submerged. the rock should be just barely sticking above the surface of the vinegar.
3. place the bowl with the rock on a shelf or windowsill where it can remain undisturbed but can be easily observed. the warmer the location, the faster the vinegar will evaporate and the more quickly your aragonite crystals will appear and grow.
4. observe the dolomite every day as the aragonite crystals grow atop the rock. be careful not to touch them at this point as they are very delicate and will drop off.
5. let the bowl sit undisturbed until all the vinegar has evaporated and the rock is completely dry.

turmeric & tonic water fluorescence

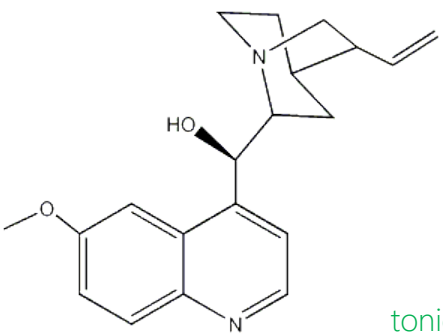
ingredients:

- ethanol
- turmeric
- UV light
- Tonic water



turmeric = curcumin molecules

- turmeric, 'curcumin' is a conjugated molecule (alternating single and double bonds)
- the electrons that form those bonds aren't pinned down in one place, but can move along the whole molecule.
- the electrons have many possible energy states. the lowest energy state ("ground state") is one where the electrons are closest to the nucleus of the atom, and are paired up, with each electron in the pair spinning in the opposite direction.
- at room temperature, the electrons have enough heat energy to bounce around and bump one another between energy levels at random. most of the electrons will be in the lower energy levels at any given time.
- the electrons in the molecule have energy levels of different types. the basic energy levels are the electronic states (the ground state, the excited ground states, and the exited triplet state). but layered on top of these are vibrational and rotational energy states.
- these extra vibrational states allow the electron to absorb photons of different energies that raise the energy of the electron to different levels. since the energy of a photon is related to its wavelength (the color of the light), many slightly different colors of light can be absorbed by the electron to push it into higher energy states.
- once an electron has absorbed a photon and has jumped into a higher energy state, it can lose some of the energy easily by releasing the vibrational energy as heat. the electron then settles into the lowest vibrational energy level at that excited electronic state.



- It is the same process that makes tonic water glow blue
- The quinine molecules in tonic water get excited by UV light

tonic water = quinine molecules

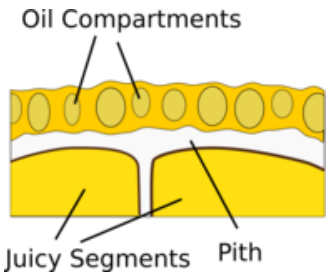
custard powder flame thrower & citrus sparklers

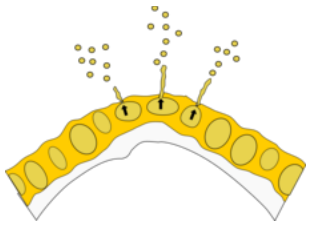
ingredients:

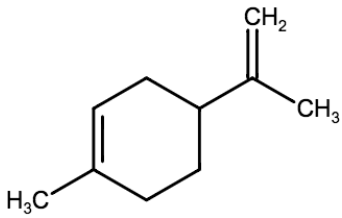
- Custard powder
- Flame (Bunsen burner, candle, lighter)
- Orange peel

Custard Powder:

- A large object like a log has a large amount of fuel inside it but quite a small amount of surface for it to react with oxygen and burn on.
- Every time you chop the log in half you create more surface for it to burn on so it will burn quicker, so small twigs have much more surface and will burn more vigorously.
- Paper has much more surface again so burns very quickly, but the custard powder has a ridiculously large surface area.
- The particles of custard powder are 0.01 mm across, so a gram of custard powder has a surface area of about 600 square metres. so it can burn almost everywhere at once incredibly quickly forming an impressive fireball.
- Interestingly, despite being super fine custard powder alone, even though very fine dust does not readily burn. When the dust is suspended in air, as in the custard bomb experiment, there is ample oxygen nearby so it can form and incredibly quick burning explosive mixture.





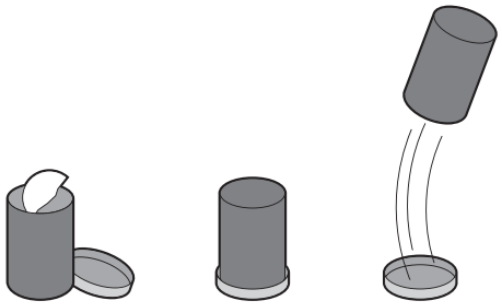


Orange Peel:

1. If you bend a piece of orange peel you often get a spray of orange oily stuff coming out.
2. Direct this spray upwards into the side of a flame.

- Oranges have a peel which includes little compartments full of oily substances. When you bend the peel the outer layer of skin is stretched, and these compartments are flattened. This squashes them until they eventually fail squirting out their contents in the form of a spray.
- The oils which spray out are hydrocarbons - a bit like petrol - and are highly flammable, and you have sprayed them out of the orange, so they are very well mixed with air. This means that the oxygen from the air can get to the oil in many places at the same time, so it burns very quickly in a fireball.
- The oily skin is waterproof, so it is difficult for fungi to get a hold, and the oils are both poisonous and repellent to insects - this is why citronella is such a good mosquito repellent. It just so happens they are also very flammable.

film canister rockets



ingredients:

- Film canister
- Alka seltzer [3($NaHCO_3$) + $C_6H_8O_7$]
- Water (H_2O)

Method:

1. Put half a tablet in the canister
2. Add some water (not much!)
3. Turn upside down- move back!

Reaction:

Alka-Seltzer® is a medical drug that works as a pain reliever and an antacid (antacids help neutralize stomach acidity — e.g., heartburn). The pain reliever used is aspirin and the antacid used is baking soda (sodium bicarbonate, $NaHCO_3$)

In water, alka-seltzer undergo a chemical reaction that produces lots of carbon dioxide (CO_2) bubbles.

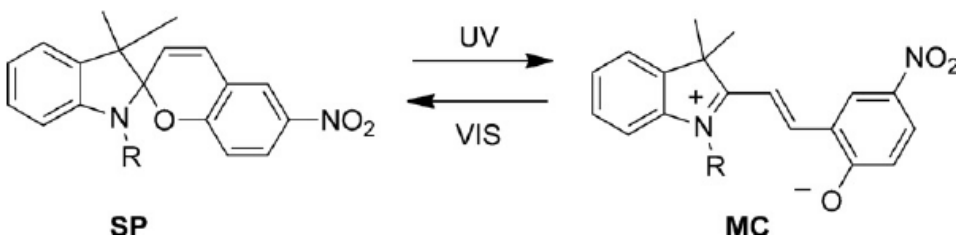
As the tablets dissolve, the sodium bicarbonate ($NaHCO_3$) splits apart to form bicarbonate (HCO_3^-).

This reacts with hydrogen (H^+) from citric acid, another ingredient in the tablets. This chemical reaction forms water and carbon dioxide gas.

$$3HCO_3^- + 3H^+ \rightarrow 3H_2O + 3CO_2$$

photochromic fluid

- This liquid is non-toxic liquid paraffin containing a UV sensitive photochromic dye.
- Indoors it appears as a clear liquid but when exposed to UV light it immediately becomes coloured.
- This colour increases in intensity when exposed to more radiation
- Absorbing UV radiation causes a rearrangement of the bonding between the atoms within a colourless or weakly coloured molecule (photo-isomerisation), creating a structure that is intensely coloured



frixion pens & receipts

frixion pens

- frixion pens use thermo-sensitive ink
- while rubbing, the ink heats up to over 60° and becomes invisible. conversely, the ink reappears at temperatures of under -10°.
- leaving homework near heaters or putting pages through repeated photocopying, can heat the paper sufficiently to make frixion ink invisible.
- our thermo-sensitive ink reappears at around -10°, so if you put your notes in the fridge they reappear!

receipt paper

- receipt paper is a special fine paper that is coated with a chemical that changes colour when exposed to heat.
- when a thermal printer applies heat to thermal paper, molecules in the dye bond with molecules in the developer, producing the printed image.
- most thermal papers produce black images.

egg shell geodes

ingredients:

- egg
- copper sulphate (a salt)
- hot water

recipe:

1. carefully crack open an egg, discard the egg, and keep the shell. clean the egg from the shell. try for a clean break, to create two halves of the shell, or you may wish to just remove the top of the shell, for a more ball-shaped geode.
2. in a separate container, add copper sulphate to 1/4 cup of hot water. the amount of copper sulphate isn't exact. you want to stir copper sulphate into the water until no more will dissolve. more is not better! it should take a few pinches of solid material to make a saturated solution.
3. pour the copper sulphate solution into the dry egg shell
4. place the eggshell in a location where it can remain undisturbed for 2-3 days. you may want to place the eggshell in another container to keep it from falling over.
5. observe your geode each day. crystals should appear by the end of the first day and will be at their best after the second or third day.
6. you can pour out the solution and allow your geode to dry after a couple of days or you can let the solution fully evaporate (week or two).