(a) Colour Changing Gin & Tonic
http://www.molecularrecipes.com/molecular-mixology/color-changing-gin-tonic-blue-ice

Equipment:
Blue Ice
- 2 cups of filtered water
- 8 dashes of b'Lure (£9.99+delivery): http://www.amazon.co.uk/b-Lure-Natural-Flower-Extracts-Butterfly/dp/B00NAIL7QU

Gin & Tonic
- 2 oz Gin
- 4 oz Tonic water
- 1 Tbsp. lime juice
- Lime wedge for garnish

Preparation:
Blue Ice
1) Mix the water and b'Lure
2) Fill the ice cube tray.

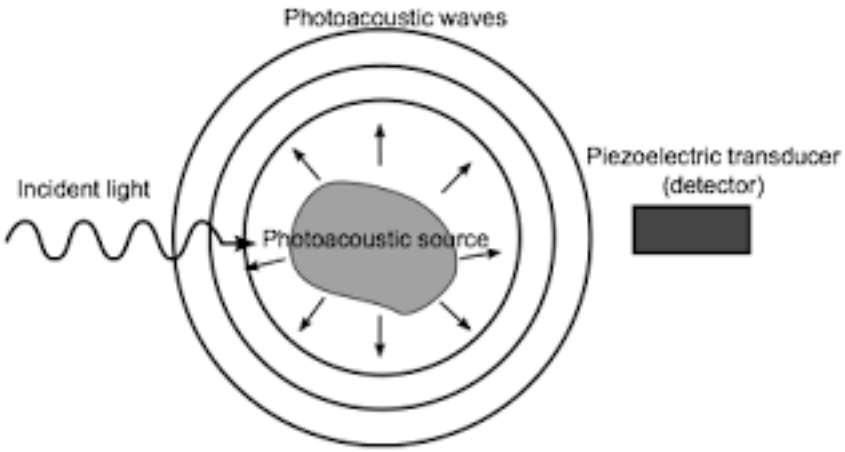
Changing colour Gin & Tonic
1) Fill serving glass with blue ice and garnish with lime wedge.
2) In another vessel stir all ingredients of Gin & Tonic.

At the event:
Fill the glass in front of the guest and watch the ice turn from blue to purple.

The science:
b'Lure is a 100% natural, gluten free, gmo free, chemical free extract from butterfly pea flowers. b'Lure dances from blues to purples and pinks depending on surrounding light and the acidity (pH) of the drink or food it is mixed with. b'Lure with neutral and alkaline mixes (higher pH) is more blue (eg. when used with eggwhites, cream, coconut, herbs & spices, vodka, white rum, water). But b'Lure in more acidic mixes (lower pH) turns purple and pink (eg. when citrus is added).

Link to medical imaging:
We can use contrast agents that are sensitive to changes in the body (such as pH). For example, if we image the contrast agent and look for a colour change it can tell us something specific about how the body is functioning.

(b) The Photoacoustic Effect



(Image from https://bagustris.wordpress.com/2012/01/24/photoacoustic-imaging-and-its-application/)

Equipment:

1) Can
2) Camera flashlight
3) Audio amplifier

Preparation: none

At the event:

1) Carry tray with one or more cans and the flashlight;
2) Invite guests to use the audio amplifier as you flash the light at the coke can;
3) Guests should hear a "ping" as the light is absorbed by the can and generates a sound wave.

The science:

When the light hits the can it is absorbed and causes a small heating effect, which results in a pressure wave. This pressure wave is the sound that we hear.
(NB: if it helps you could mention thermal expansion, but in fact the photoacoustic effect we employ imaging happens over a very short time scale and is isochoric).

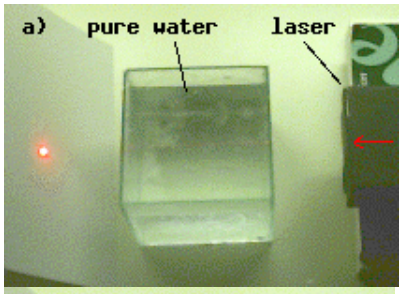
Link to medical imaging:

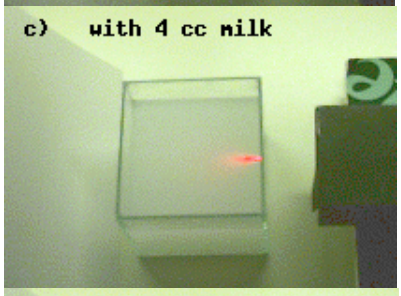
Photoacoustic imaging combines the advantages of optical imaging (high contrast) and ultrasonic imaging (high spatial resolution). This results in various new applications in the field of biology, medicine, industry and material science.

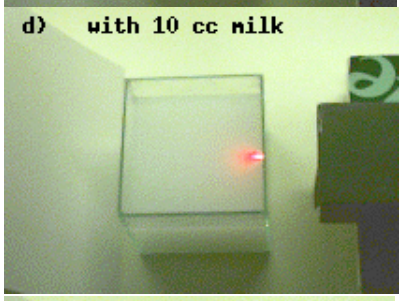
We can also use contrast agents or reporters to produce colour changes and probe specific structures or functions (see demo (a)).

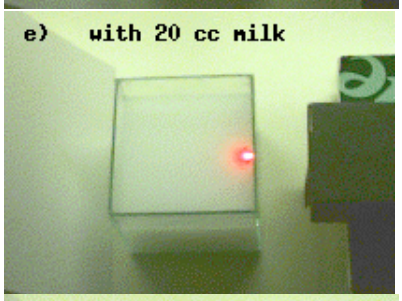
(c) Light scattering in milk

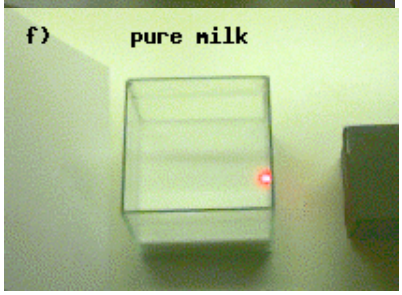
http://omlc.org/classroom/scat_demo/











Equipment:

1) Water
2) Milk
3) Glasses
4) Finger pulse oximeters?

Preparation:

Fill glasses with water.

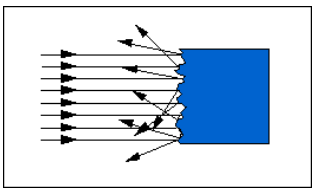
At the event:

5) Place a white sheet of paper behind the glass of water.
6) Shine with the laser pointer through the water (see picture a) below). Depending on how many small air bubbles (or other particles like dust) you have in the water you might see a dim red line where the laser beam goes through the water. The bright spot on the paper is actually just red, the white spot in the picture is caused by overexposure.
7) Add a small amount of milk and stir until mixed. If you hold the laser so that the beam passes just below the surface you should be able to see where the beam goes. We had 600 ml water, and added 1 ml of vitamin D milk (see picture b)). You will probably have less water, so be very careful and start by adding only a few drops! If you add too much milk you will not see the dim spot (see picture b)) on the paper anymore.
8) Add more milk and see how the light pattern changes. In pictures c) to f) you can see how the light beam eventually becomes a glowing ball.

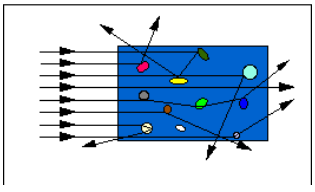
The science:

Scattering of light is important for our daily life. Almost all objects scatter light, which means they reflect light in all directions. If the objects around us reflected light perfectly without scattering they would appear like mirrors.

There are several ways how scattering occurs, for example:



- Random reflection on a rough surface. e.g a “dull” unpolished car or jewellery.



- Reflection (or refraction or diffraction) on impurities in the volume. This is the type of scattering which plays the major role in medical applications. In tissues the light is scattered at cells or their components (demo pulse oximeter??). In milk it is scattered mostly at the tiny fat droplets.

(d) Vanishing Water Balls
http://weirdsciencekids.com/Vanishingwaterballs.html

Equipment:

1) Water pearls (about £5.50):
   http://www.amazon.co.uk/Glam-Decor-Water-Beads%C2%AE-Decoration/dp/B00AHVEEW2
   http://www.amazon.co.uk/Aqua-Crystal-Expanding-Storing-Crystals/dp/B007K6HEJM/
2) Distilled water
3) Glasses

Preparation:

1) On the morning of the event, immerse the water pearls in water and allow to swell (I would be happy to do this seeing as I will already be in London so would not need to transport the equipment on the train).

At the event:

4) Fill glasses with the water containing the pearls, giving the appearance of glasses of water.
5) Invite guests to dip their hands into one of the glasses and scoop up some of the water. Magically the water balls
   will appear as they take their hand out of the water. When they drop the balls back into the water they will vanish again.

The science:

The clear water pearls are super absorbent polymers that can hold up 300 times their original weight in water. Polymers are individual molecules linked together to form long chains of molecules. Anything made of plastic is a form of a polymer. When there is no water in the bowl, you can see objects (like the clear water pearls) inside the bowl perfectly. This occurs because rays of light scatter as they hit the objects in the bowl making them visible. After the clear water pearls absorb and fill with water they become invisible once submerged in water. This happens because the water filled clear pearls have the same index of refraction as the water itself. As you remove the pearls from the water light refracts against the pearls making them visible. As you drop them back in the water, the index of refraction for the pearls becomes the same as the water making them vanish!
Clear Water Pearls go by many names, jelly marbles, clear spheres, water balls, water crystals.

Link to medical imaging:

Refraction of ultrasound as well as EM waves (such as light and x-rays) is important in visualising structures inside the body.