Color Production Methods on <https://physics.info/color/>

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1. Emission

continuous spectra: hot stuff (the sun, fire, incandescent light bulbs)

discrete spectra: excited electrons (lasers, phosphors, fluorescent tubes, LEDs, neon

tubes, sodium & mercury vapor lamps)

luminescence, fluorescence, phosphorescence (reemission)

1. Reflection

opaque bodies (paints, inks, dyes, pigments)

hemoglobin; chlorophyll a is bright blue-green and is twice as common as the olive colored chlorophyll b;

carotenoids are yellow orange (carrots, squash, tomatoes) two kinds of carotenes have nutritional significance; anthocyanins provide the red purple blue color of red grapes, red cabbage, apples, radishes, eggplants; anthoxanthins pale yellow of potatoes, onions, cauliflower;

1. Transmission

transparent bodies (stained glass, photographic filters, tinted sunglasses, red sunsets

1. Scattering

small suspended particles (nitrogen molecules make the sky blue)

foam, froth, clouds, smoke

a colloid is basically a suspension of very small particles in another substance: clouds, smoke, haze; emulsions are suspensions of one liquid in another: mayonnaise, cosmetic creams

milk (fat globules 1-5 μm diameter reduced to <1 μm after homogenization, micelles of milk protein casein 0.1 μm diameter); gels are liquids dispersed in a solid: pudding is water dispersed in starch; sols are solids particles dispersed in a liquid: flour and cornstarch thickened sauces.

1. Dispersion

variations in transmission speed (rainbows, diamonds, flint glass, chromatic aberration

1. Interference - path length differences

(thin films, insect wings & shells, pigeon necks, peacock feathers, mother of pearl, heat stains on metals, spider webs, halos, bubbles, watered silks, mist on glass, photoelastic stress, iridescence, opalescence, pearlescence)