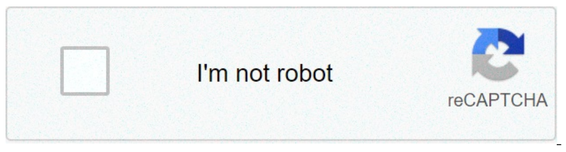

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Uv light and visible light

Most of the charts that help you choose the right model uv filter, are based on the models themselves. I'll go the other way and start with the kind of pond you have as well as your specific situation, and then help you choose a model from there. The following chart will help you to find out which size UV light to choose. While this chart isn't very exact, the main goals are to point out how the size of the UV light changes in relation to the amount of sunlight, fish and plants in the pond, and to roughly determine whether you need a 'clarifier' or a 'sterilizer'. Start by looking for the category in which your pond lies. (You will need to know your pond volume for this.) In order to determine the gallons in your pond, use this easy calculation: Length (ft) x Width (ft) x Average Depth (ft) = Cubic Feet Cubic Feet x 7.5 = Gallons Pond UV Filter Rough Chart Pond UV Light Chart This shows you that, if your pond falls in the left category, you need a less potent UV light than if your pond is in the category to the right. If it is in the left category, you're looking to use a UV light as a 'clarifier'. This will improve water clarity resulting in a natural looking pond. While if your pond falls in the category on the right, you need to look for a 'sterilizer'. You could also choose a sterilizer if your pond is in the first column, but you would do that if your mind was set on having really crystal clear water and bacterial control. Don't get too hooked on the actual strength or wattage that is shown. The table only gives a very rough estimation. (It also gets less accurate the more you reach the end of the 2nd column.) Example An example of a pond in the second column would be a well-stocked koi pond, with few plants. In general, koi ponds will require uv units two to four times larger than well planted fish ponds. To keep such ponds algae-free, even on the hottest of days, a unit is required that is graded as a sterilizer. A unit specified as a sterilizer also comes with recommendations for the right pump to combine it with. The right pump A pump is "right", when its flow rate (the amount of gallons per hour it pumps) supports a high enough "turnover rate" of the pond. If the turnover rate is not high enough, a uv light will not be able to keep up with the reproduction rate of the algae on the hottest days. This is especially true if you're using a unit as a sterilizer. The turnover rate needs to be higher so that more water is treated in a shorter time. This makes treating the pond more efficient. For a unit that only needs to serve as a clarifier, the standard is not as high, so a pump with a slower turnover rate is enough. Recommended turnover rates for sterilizers are (depending on the manufacturer) roughly between 1 and 1.5 times per hour. Recommended turnover rates for clarifiers are about 0.5 times per hour (or once every 2 hours). The thing to remember here however, is that the turnover rate of a pump is determined by the flow rate of the pump, combined with the total volume of the pond. (Example: if your pond is 500 gallons, and your pump pumps 250 gph (gallons per hour), then the turnover rate is 0.5 times per hour About the flow rate Every pump has a flow rate. This is the amount of water that is being pumped through the UV light. It is expressed as "gallons per hour" (gph). If you want maximum efficiency of your UV light, the pump cannot exceed the "maximum flow rate" specified by the UV light. Do not think that you can improve performance by using a larger pump. If water goes through too fast the algae are not effected by the UV. The slower it flows through the UV light, the more effective it is. This is especially true with sterilizers, where a very slow flow is needed. The maximum flow rate of a UV light is determined by the UV power (watts) and the size of the water chamber. So the manufacturer provides the info here. Also, do not use a pump that is not nearly powerful enough. A pump that is too small just reduces the turnover rate and might thus not be as efficient. It is important that you choose a pump that as closely as possible matches the UV light manufacturer's recommendations, otherwise your UV unit might end up not doing what it's supposed to be doing. So, how many watts do I need for my pond? (And what pump to combine it with?) The actual size (amount of wattage) is determined by the manufacturer and the actual specifications on the models themselves. It's very hard to give a general amount of W for a given size of pond. This is because there's so much difference between the models of the different manufacturers. As a help, what follows are the recommendations of a few manufacturers: Manufacturers recommendations: As a clarifier: Manufacturer Max size of pond Wattage max flow rate of pump (in gallons per hour) Model TetraPond 660 gal 5 W 330 gph UVC-5 1800 gal 9 W 900 gph UVC-9 4400 gal 18 W 2200 gph UVC-18 8800 gal 36 W 4400 gph UVC-36 PondMaster 1500 gal 10 W 700 gph 02910 10-Watt 3000 gal 20 W 1800 gph (discontinued) 6000 gal 40 W 2400 gph 02940 40-Watt Hagen Laguna 1000 gal 14 Watt 500 gph 1000-2000 gal 28 W 500-1000 gph 2000-5000 gal 55 W 1300 gph Aqua UV 1500 gal 8 W 1000 gph 2000 gal 15 W 1800 gph 4000 gal 25 W 2000 gph 6000 gal 40 W 3000 gph 6500 gal 57 W 3250 gph As a sterilizer: Size of pond Wattage max flow rate of pump (in gallons per hour) TetraPond Not specified PondMaster 500 gal 10 W 250 gph 02910 10-Watt 1000 gal 20 W 700 gph (20 W model discontinued) 2000 gal 40 W 1200 gph 02940 40-Watt Hagen Laguna Not specified Aqua Uv 5 to 200 gal 8 Watt 642 gph 200 to 500 gal 15 W 700 gph 500-1200 gal 25 W 1200 gph 1200 to 2000 gal 40 W 2900 gph 1500 – 3000 gal 57 W 3200 gph Always oversize One rule of thumb: when doubting between 2 different wattages, always go for the stronger model. I personally tend to oversize all my systems (pumps, filters, etc..) because I've noticed that it doesn't take long before I have more fish in my pond than I intended, or before I want to make my pond bigger. It can be addictive. So when having to choose between a smaller and a larger size UV light, I suggest you go for the bigger system. There are no negative effects of having an oversized uv light for your pond. How do you know if the bulb is faulty? Should you see the UV light? Broken bulb? Sometimes, after ordering, the quartz sleeve and/or the UV lamp may have been broken or damaged during the transport. So, how do you know if the bulb is faulty? The uv lamp will emit a blue light when it is working. Even though UV light is invisible itself, part of the spectrum of these lamps is visible in the form of blue light. In daylight this might be hard to see, so it's a good idea to check in the evening or at night. If you can't see a light, then that means your lamp is faulty. Either the bulb is broken or the ballast is bad. If this a newly purchased lamp, you should be entitled to get a replacement. Contact the vendor in such a case. Use gloves to handle the bulb & quartz sleeve Do not touch Try not to touch the UV lamp or quartz sleeve. If you do, compounds from your skin can decrease the UV transmission once the lamp is lit. Always wear gloves when handling UV lamps and quartz sleeves to prevent premature failure and ensure optimum efficiency. If you did happen to touch the quartz, remove any marks using a clean cloth or tissue Range of spectroscopic analysisThis article needs additional citations for verification. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.Find sources: "Ultraviolet–visible spectroscopy" – news · newspapers · books · scholar · JSTOR (April 2018) (Learn how and when to remove this template message) Beckman DU640 UV/Vis spectrophotometer Ultraviolet–visible spectroscopy or ultraviolet–visible spectrophotometry (UV–Vis or UV/Vis) refers to absorption spectroscopy or reflectance spectroscopy in part of the ultraviolet and the full, adjacent visible regions of the electromagnetic spectrum. This means it uses light in the visible and adjacent ranges. The absorption or reflectance in the visible range directly affects the perceived color of the chemicals involved. In this region of the spectrum, atoms and molecules undergo electronic transitions. Absorption spectroscopy is complementary to fluorescence spectroscopy, in that fluorescence deals with transitions of electrons from the excited state to the ground state, while absorption measures transitions from the ground state to the excited state.[1] Principle of ultraviolet–visible absorption Molecules containing bonding and non-bonding electrons (n-electrons) can absorb energy in the form of ultraviolet or visible light to excite these electrons to higher anti-bonding molecular orbitals.[2] The more easily excited the electrons (i.e. lower energy gap between the HOMO and the LUMO), the longer the wavelength of light it can absorb. There are four possible types of transitions (π–π*, n–π*, σ–σ*, and n–σ*), and they can be ordered as follows :σ–σ* > n–σ* > π–π* > n–π*.[citation needed] Applications An example of a UV/Vis readout UV/Vis spectroscopy is routinely used in analytical chemistry for the quantitative determination of different analytes, such as transition metal ions, highly conjugated organic compounds, and biological macromolecules. Spectroscopic analysis is commonly carried out in solutions but solids and gases may also be studied. Solutions of transition metal ions can be colored (i.e., absorb visible light) because d electrons within the metal atoms can be excited from one electronic state to another. The color of metal ion solutions is strongly affected by the presence of other species, such as certain anions or ligands. For instance, the colour of a dilute solution of copper sulfate is a very light blue; adding ammonia intensifies the colour and changes the wavelength of maximum absorption (λmax). Organic compounds, especially those with a high degree of conjugation, also absorb light in the UV or visible regions of the electromagnetic spectrum. The solvents for these determinations are often water for water-soluble compounds, or ethanol for organic-soluble compounds. (Organic solvents may have significant UV absorption; not all solvents are suitable for use in UV spectroscopy. Ethanol absorbs very weakly at most wavelengths.) Solvent polarity and pH can affect the absorption spectrum of an organic compound. Tyrosine, for example, increases in absorption maxima and molar extinction coefficient when pH increases from 6 to 13 or when solvent polarity decreases. While charge transfer complexes also give rise to colours, the colours are often too intense to be used for quantitative measurement. The Beer–Lambert law states that the absorbance of a solution is directly proportional to the concentration of the absorbing species in the solution and the path length.[3] Thus, for a fixed path length, UV/Vis spectroscopy can be used to determine the concentration of the absorber in a solution. It is necessary to know how quickly the absorbance changes with concentration. This can be taken from references (tables of molar extinction coefficients), or more accurately, determined from a calibration curve. A UV/Vis spectrophotometer may be used as a detector for HPLC. The presence of an analyte gives a response assumed to be proportional to the concentration. For accurate results, the instrument's response to the analyte in the unknown should be compared with the response to a standard; this is very similar to the use of calibration curves. The response (e.g., peak height) for a particular concentration is known as the response factor. The wavelengths of absorption peaks can be correlated with the types of bonds in a given molecule and are valuable in determining the functional groups within a molecule. The Woodward–Fieser rules, for instance, are a set of empirical observations used to predict λmax, the wavelength of the most intense UV/Vis absorption, for conjugated organic compounds such as dienes and ketones. The spectrum alone is not, however, a specific test for any given sample. The nature of the solvent, the pH of the solution, temperature, high electrolyte concentrations, and the presence of interfering substances can influence the absorption spectrum. Experimental variations such as the slit width (effective bandwidth) of the spectrophotometer will also alter the spectrum. To apply UV/Vis spectroscopy to analysis, these variables must be controlled or accounted for in order to identify the substances present.[4] The method is most often used in a quantitative way to determine concentrations of an absorbing species in solution, using the Beer–Lambert law: $A = \log 10 \left(I 0 / I \right) = \varepsilon c L$ {\displaystyle A=\log _{10}(I_{0}/I)=\varepsilon cL} , where A is the measured absorbance (in Absorbance Units (AU)), I 0 {\displaystyle I_{0}} is the intensity of the incident light at a given wavelength, I {\displaystyle I} is the transmitted intensity, L the path length through the sample, and c the concentration of the absorbing species. For each species and wavelength, ε is a constant known as the molar absorptivity or extinction coefficient. This constant is a fundamental molecular property in a given solvent, at a particular temperature and pressure, and has units of 1 / M ∗ c m {\displaystyle 1/M*cm} . The absorbance and extinction ε are sometimes defined in terms of the natural logarithm instead of the base-10 logarithm. The Beer–Lambert Law is useful for characterizing many compounds but does not hold as a universal relationship for the concentration and absorption of all substances. A 2nd order polynomial relationship between absorption and concentration is sometimes encountered for very large, complex molecules such as organic dyes (Xylenol Orange or Neutral Red, for example).[citation needed] UV–Vis spectroscopy is also used in the semiconductor industry to measure the thickness and optical properties of thin films on a wafer. UV–Vis spectrometers are used to measure the reflectance of light, and can be analyzed via the Forouhi–Bloomer dispersion equations to determine the Index of Refraction (n) and the Extinction Coefficient (k) of a given film across the measured spectral range.[citation needed] Practical considerations The Beer–Lambert law has implicit assumptions that must be met experimentally for it to apply; otherwise there is a possibility of deviations from the law.[5] For instance, the chemical makeup and physical environment of the sample can alter its extinction coefficient. The chemical and physical conditions of a test sample therefore must match reference measurements for conclusions to be valid. Worldwide, pharmacopoeias such as the American (USP) and European (Ph. Eur.) pharmacopeias demand that spectrophotometers perform according to strict regulatory requirements encompassing factors such as stray light[6] and wavelength accuracy.[7] Spectral bandwidth It is important to have a monochromatic source of radiation for the light incident on the sample cell.[5] Monochromaticity is measured as the width of the "triangle" formed by the intensity spike, at one half of the peak intensity. A given spectrometer has a spectral bandwidth that characterizes how monochromatic the incident light is.[clarification needed] If this bandwidth is comparable to (or more than) the width of the absorption line, then the measured extinction coefficient will be mistaken. In reference measurements, the instrument bandwidth (bandwidth of the incident light) is kept below the width of the spectral lines. When a test material is being measured, the bandwidth of the incident light should also be sufficiently narrow. Reducing the spectral bandwidth reduces the energy passed to the detector and will, therefore, require a longer measurement time to achieve the same signal to noise ratio. Wavelength error In liquids, the extinction coefficient usually changes slowly with wavelength. A peak of the absorbance curve (a wavelength where the absorbance reaches a maximum) is where the rate of change in absorbance with wavelength is smallest.[5] Measurements are usually made at a peak to minimize errors produced by errors in wavelength in the instrument, that is errors due to having a different extinction coefficient than assumed. Stray light See also: Stray light Another important factor is the purity of the light used. The most important factor affecting this is the stray light level of the monochromator.[5] The detector used is broadband; it responds to all the light that reaches it. If a significant amount of the light passed through the sample contains wavelengths that have much lower extinction coefficients than the nominal one, the instrument will report an incorrectly low absorbance. Any instrument will reach a point where an increase in sample concentration will not result in an increase in the reported absorbance, because the detector is simply responding to the stray light. In practice the concentration of the sample or the optical path length must be adjusted to place the unknown absorbance within a range that is valid for the instrument. Sometimes an empirical calibration function is developed, using known concentrations of the sample, to allow measurements into the region where the instrument is becoming non-linear. As a rough guide, an instrument with a single monochromator would typically have a stray light level corresponding to about 3 Absorbance Units (AU), which would make measurements above about 2 AU problematic. A more complex instrument with a double monochromator would have a stray light level corresponding to about 6 AU, which would therefore allow measuring a much wider absorbance range. Deviations from the Beer–Lambert law At sufficiently high concentrations, the absorption bands will saturate and show absorption flattening. The absorption peak appears to flatten because close to 100% of the light is already being absorbed. The concentration at which this occurs depends on the particular compound being measured. One test that can be used to test for this effect is to vary the path length of the measurement. In the Beer–Lambert law, varying concentration and path length has an equivalent effect—diluting a solution by a factor of 10 has the same effect as shortening the path length by a factor of 10. If cells of different path lengths are available, testing if this relationship holds true is one way to judge if absorption flattening is occurring. Solutions that are not homogeneous can show deviations from the Beer–Lambert law because of the phenomenon of absorption flattening. This can happen, for instance, where the absorbing substance is located within suspended particles.[8][9] The deviations will be most noticeable under conditions of low concentration and high absorbance. The last reference describes a way to correct for this deviation. Some solutions, like copper(II)chloride in water, change visually at a certain concentration because of changed conditions around the coloured ion (the divalent copper ion). For copper(II)chloride it means a shift from blue to green,[10] which would mean that monochromatic measurements would deviate from the Beer–Lambert law. Measurement uncertainty sources The above factors contribute to the measurement uncertainty of the results obtained with UV/Vis spectrophotometry. If UV/Vis spectrophotometry is used in quantitative chemical analysis then the results are additionally affected by uncertainty sources arising from the nature of the compounds and/or solutions that are measured. These include spectral interferences caused by absorption band overlap, fading of the color of the absorbing species (caused by decomposition or reaction) and possible composition mismatch between the sample and the calibration solution.[11] Ultraviolet–visible spectrophotometer See also: Spectrophotometry The instrument used in ultraviolet–visible spectroscopy is called a UV/Vis spectrophotometer. It measures the intensity of light after passing through a sample (I {\displaystyle I}), and compares it to the intensity of light before it passes through the sample (I o {\displaystyle I_{o}}). The ratio I / I o {\displaystyle I/I_{o}} is called the transmittance, and is usually expressed as a percentage (%T). The absorbance, A {\displaystyle A} , is based on the transmittance: $A = - \log \left(\% T / 100 \% \right)$ {\displaystyle A=-\log(\%T/100\%)} The UV–visible spectrophotometer can also be configured to measure reflectance. In this case, the spectrophotometer measures the intensity of light reflected from a sample (I {\displaystyle I}), and compares it to the intensity of light reflected from a reference material (I o {\displaystyle I_{o}}) (such as a white tile). The ratio I / I o {\displaystyle I/I_{o}} is called the reflectance, and is usually expressed as a percentage (%R). The basic parts of a spectrophotometer are a light source, a holder for the sample, a diffraction grating in a monochromator or a prism to separate the different wavelengths of light, and a detector. The radiation source is often a Tungsten filament (300–2500 nm), a deuterium arc lamp, which is continuous over the ultraviolet region (190–400 nm), Xenon arc lamp, which is continuous from 160 to 2,000 nm; or more recently, light emitting diodes (LED)[1] for the visible wavelengths. The detector is typically a photomultiplier tube, a photodiode, a photodiode array or a charge-coupled device (CCD). Single photodiode detectors and photomultiplier tubes are used with scanning monochromators, which filter the light so that only light of a single wavelength reaches the detector at one time. The scanning monochromator moves the diffraction grating to "step-through" each wavelength so that its intensity may be measured as a function of wavelength. Fixed monochromators are used with CCDs and photodiode arrays. As both of these devices consist of many detectors grouped into one or two dimensional arrays, they are able to collect light of different wavelengths on different pixels or groups of pixels simultaneously. Simplified schematic of a double beam UV–visible spectrophotometer A spectrophotometer can be either single beam or double beam. In a single beam instrument (such as the Spectronic 20), all of the light passes through the sample cell. I o {\displaystyle I_{o}} must be measured by removing the sample. This was the earliest design and is still in common use in both teaching and industrial labs. In a double-beam instrument, the light is split into two beams before it reaches the sample. One beam is used as the reference; the other beam passes through the sample. The reference beam intensity is taken as 100% Transmission (or 0 Absorbance), and the measurement displayed is the ratio of the two beam intensities. Some double-beam instruments have two detectors (photodiodes), and the sample and reference beam are measured at the same time. In other instruments, the two beams pass through a beam chopper, which blocks one beam at a time. The detector alternates between measuring the sample beam and the reference beam in synchronism with the chopper. There may also be one or more dark intervals in the chopper cycle. In this case, the measured beam intensities may be corrected by subtracting the intensity measured in the dark interval before the ratio is taken. In a single-beam instrument, the cuvette containing only a solvent has to be measured first. Mettler Toledo developed a single beam array spectrophotometer that allows fast and accurate measurements over the UV/VIS range. The light source consists of a Xenon flash lamp for the ultraviolet (UV) as well as for the visible (VIS) and near-infrared wavelength regions covering a spectral range from 190 up to 1100 nm. The lamp flashes are focused on a glass fiber which drives the beam of light onto a cuvette containing the sample solution. The beam passes through the sample and specific wavelengths are absorbed by the sample components. The remaining light is collected after the cuvette by a glass fiber and driven into a spectrograph. The spectrograph consists of a diffraction grating that separates the light into the different wavelengths, and a CCD sensor to record the data, respectively. The whole spectrum is thus simultaneously measured, allowing for fast recording.[12] Samples for UV/Vis spectrophotometry are most often liquids, although the absorbance of gases and even of solids can also be measured. Samples are typically placed in a transparent cell, known as a cuvette. Cuvettes are typically rectangular in shape, commonly with an internal width of 1 cm. (This width becomes the path length, L {\displaystyle L} , in the Beer–Lambert law.) Test tubes can also be used as cuvettes in some instruments. The type of sample container used must allow radiation to pass over the spectral region of interest. The most widely applicable cuvettes are made of high quality fused silica or quartz glass because these are transparent throughout the UV, visible and near infrared regions. Glass and plastic cuvettes are also common, although glass and most plastics absorb in the UV, which limits their usefulness to visible wavelengths.[1] Specialized instruments have also been made. These include attaching spectrophotometers to telescopes to measure the spectra of astronomical features. UV–visible microspectrophotometers consist of a UV–visible microscope integrated with a UV–visible spectrophotometer. A complete spectrum of the absorption at all wavelengths of interest can often be produced directly by a more sophisticated spectrophotometer. In simpler instruments the absorption is determined one wavelength at a time and then compiled into a spectrum by the operator. By removing the concentration dependence, the extinction coefficient (ε) can be determined as a function of wavelength. Microspectrophotometry UV–visible spectroscopy of microscopic samples is done by integrating an optical microscope with UV–visible optics, white light sources, a monochromator, and a sensitive detector such as a charge-coupled device (CCD) or photomultiplier tube (PMT). As only a single optical path is available, these are single beam instruments. Modern instruments are capable of measuring UV–visible spectra in both reflectance and transmission of micron-scale sampling areas. The advantages of using such instruments is that they are able to measure microscopic samples but are also able to measure the spectra of larger samples with high spatial resolution. As such, they are used in the forensic laboratory to analyze the dyes and pigments in individual textile fibers,[13] microscopic paint chips [14] and the color of glass fragments. They are also used in materials science and biological research and for determining the energy content of coal and petroleum source rock by measuring the vitrinite reflectance. Microspectrophotometers are used in the semiconductor and micro-optics industries for monitoring the thickness of thin films after they have been deposited. In the semiconductor industry, they are used because the critical dimensions of circuitry is microscopic. A typical test of a semiconductor wafer would entail the acquisition of spectra from many points on a patterned or unpatterned wafer. The thickness of the deposited films may be calculated from the interference pattern of the spectra. In addition, ultraviolet–visible spectrophotometry can be used to determine the thickness, along with the refractive index and extinction coefficient of thin films as described in Refractive index and extinction coefficient of thin film materials. A map of the film thickness across the entire wafer can then be generated and used for quality control purposes.[15] Additional applications UV/Vis can be applied to determine the kinetics or rate constant of a chemical reaction. The reaction, occurring in solution, must present color or brightness shifts from reactants to products in order to use UV/Vis for this application.[2] For example, the molecule mercury dithizonate is a yellow-orange color in diluted solution (1*10^-5 M), and turns blue when subjected with particular wavelengths of visible light (and UV) via a conformational change, but this reaction is reversible back into the yellow "ground state".[16] Using optical fibers as a transmission element of spectrum of burning gases it is possible to determine a chemical composition of a fuel, temperature of gases, and air-fuel ratio.[17] The rate constant of a particular reaction can be determined by measuring the UV/Vis absorbance spectrum at specific time intervals. Using mercury dithizonate again as an example, one can shine light on the sample to turn the solution blue, then run a UV/Vis test every 10 seconds (variable) to see the levels of absorbed and reflected wavelengths change over time in accordance with the solution turning back to yellow from the excited blue energy state. From these measurements, the concentration of the two species can be calculated.[18] The mercury dithizonate reaction from one conformation to another is first order and would have the integral first order rate law : ln[A](time t)=−kt+ln[A](initial). Therefore, graphing the natural log (ln) of the concentration [A] versus time will graph a line with slope -k, or negative the rate constant. Different rate orders have different integrated rate laws depending on the mechanism of the reaction. An equilibrium constant can also be calculated with UV/Vis spectroscopy. After determining optimal wavelengths for all species involved in equilibria, a reaction can be run to equilibrium, and the concentration of species determined from spectroscopy at various known wavelengths. The equilibrium constant can be calculated as K(eq) = [Products] / [Reactants]. See also Isosbestic point important in kinetics measurements. A wavelength where absorption does not change as the reaction proceeds. Ultraviolet–visible spectroscopy of stereoisomers Infrared spectroscopy and Raman spectroscopy are other common spectroscopic techniques, usually used to obtain information about the structure of compounds or to identify compounds. Both are forms of vibrational spectroscopy. 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difference between uv light and visible light. below are the application of infrared visible light and uv light. why does benzene react with uv light and not visible light. why is uv light visible. what is the difference between visible light and ultraviolet light

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