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| **Cornell Notes**  **Topic: LIGHT**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **Essential Question:**  **Questions/Main Ideas:** | **Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**Block:** \_\_\_\_\_\_\_\_  **Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **Notes:** |
| **Light the Astronomer’s Tool**  **Properties of Light**  **It is because of the special nature of electric and magnetic fields that allow light to travel without a medium, like sound waves require.**  **Photons are really just packets of energy that move through space, delivering that energy to whatever they interact with.**  **Light and Color**  **Visible Light Spectrum** |  |
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| **Frequency** |  |
| **Electromagnetic Spectrum**  **Infrared**  **Ultraviolet**  **X-rays**  **Gamma Rays**  **Energy Carried by EM**  **Different Wavelength Different Science**  **Matter and Heat**  **Kelvin Scale**  **Wien’s Law**  **Radiation and Temperature**  **Ideal Blackbodies**  **An ideal blackbody absorbs all incident radiation, and emits a characteristic spectrum that is partly described using Wien's Law.  The wavelength of peak emission shifts toward higher energies (shorter wavelengths, higher frequencies) as the body gains thermal energy (heats up.)**  **The Chemical Elements**  **The nucleus composed of protons and neutrons is still at the center of the atom, but ina  more modern model, the electrons are found in "orbitals," cloud-like structures describing the probability of an electgron existing at a given location.  Just for a sense of scale - if the nucleus of an atom were the size of a sesame seed, the nearest electron would be 250 meters away!**  **Orbitals can be imagined as being like the stories in a tall building.  Each floor represents a discrete "level" in the building, and one cannot (or at least should not) try to exist halfway between floors.  Electron orbitals represent discrete "levels" in the energy of an atom, and electrons cannot exist anywhere but at these levels.**  **If an electron moves from a lower orbital to an upper one, it must gain energy through some mechanism (perhaps collision, or absorption.)  The electron loses that energy when it moves to a lower orbital.**  **Conservation of Energy**  **For an electron to move to a higher orbital, the atom must absorb energy exactly equal to the energy difference between the electron's current orbital and the destination orbital.  Photons of too much or too little energy pass through the atom unabsorbed.**  **Spectroscopy**  **An electron transition signifies the absorption or emission of a photon as the atom excites or de-excites.  By collecting photons from an unidentified gas, we can use either an absorption or emission spectrum to determine its makeup.**  **Types of Spectroscopy**  **Helium Emission**  **Continuous and Absorption Spectrum**  **Astronomical Spectrum**  **Emission spectra are characterized by a series of bright lines on a dark background, or as a series of peaks on a histogram of brightness vs wavelength.  In much the same way, an absorption spectrum is characerised by dark lines on a continuous spectrum, or as strong dips or gaps in a histogram of brightness vs. wavelength.    For either type of spectra, the bright and dark lines are at exactly the same wavelengths for a given element.**  **Absorption in the Atmosphere**  **In some ways, our atmosphere acts like a filter, blocking oight of particular wavelength ranges from reaching the ground.  There are parts of the electromagnetic spectrum that are strongly absorbed by our atmosphere, and other parts where the atmosphere is relatively transparent.  Light in the gamma ray and x ray part of the spectrum is completely blocked, as are parts of the UV and infrared wavelength ranges.  Visible light, radio waves, and some UV and infrared pass through the atmosphere to the surface.  Wavelength ranges where light passes through are called "atmospheric windows."**  **Doppler Shift of Sound**  **With sound waves, the wavelengths are compressed if the sound emitter is approaching the observer, resulting in a higher pitch to the sound.  Likewise, if the emitter is moving away from the observer, the pitch is lower as the wavelengths are stretched out.**  **Doppler Shift of Light**  **The Doppler shift can be observed in light waves as well as sound waves.  As the emitter moves away from the observer, the light waves are shifted down toward the red (or longer wavelength) end of the spectrum.  If the emitter is approaching, the light is shifted to shorter wavelengths.  For both sound and light, there must be some sort of motion toward or away from the observer (radial motion) for the Doppler shift to occur.**  **Red Shift and Blue Shift**  **The Doppler shift is used to detect speeders by law enforcement officers.  As the wavelength of the reflected wave is determined by the (alleged) speeder's velocity, a wave that is shifted by too large an amount indicates speeding and a possible ticket.** |  |
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