LESSON 1 - The ultraviolet catastrophe and Planck's formula

Part 1 – Revision: e.m. waves

Match the following terms with their definition: (*do this part on Spark, so you can check immediately your answers).*

1. Electromagnetic wave	A. The range of wavelengths or frequencies over which electromagnetic radiation extends.
2. Wavelength	B. The total number of vibrations or oscillations per unit time.
3. Frequency	C. The power per unit area delivered by a wave.
4. Electromagnetic spectrum	D. The distance between successive crests of a wave.
5. Intensity (of a wave)	E. A wave propagated by the periodic variation of intensities of electric and magnetic fields.

Part 2 – Video watching: ultraviolet catastrophe and Planck's formula

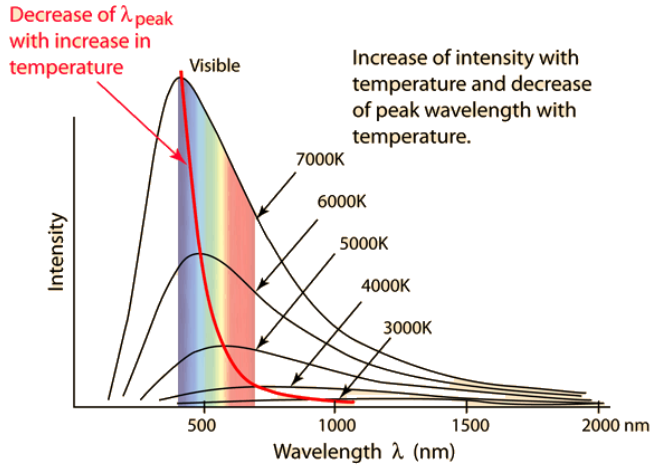
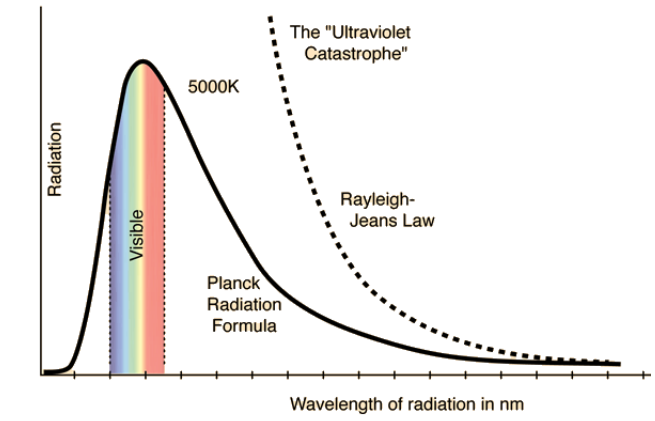
Watch the video "Quantization of Energy Part 1: Blackbody Radiation and the Ultraviolet Catastrophe" and complete the following sentences. *The video is also on Spark; we will check your answers in our next video lesson.*

1. A blackbody emits e.m.radiations of all _____
2. The light _____ by the sun matches the _____ _____ for 5778K. Most of the light that we receive from the sun is in the _____ spectrum.
3. The blackbody spectrum depends only on _____
4. The wavelength that is emitted with _____ intensity shifts left as temperature increases. This maximum will move into the visible spectrum at around _____ K and above. This is why very hot objects appear to _____, like a hot _____, light _____ filament or the _____ and other stars.
5. According to classical theory, shorter wavelengths were not predicted to _____ in intensity.
6. Classical models don't match _____, otherwise every time you use the oven you would get blasted with _____
7. Max _____ solved the problem introducing a concept called _____
8. Planck proposed that the _____ _____ of the atoms must be quantized, meaning that they can only possess specific _____ values.
9. Planck's expression for blackbody radiation is $\boldsymbol{E = nhf}$, where *n* can be any _____, *h* is called the Planck's _____ ($\boldsymbol{h = 6.626 \cdot 10^{-34}\ J \cdot s}$) and *f* is the _____ of radiation.

10. Energy appears to be _____ to macroscopic beings, such as humans, but it is quantized on the _____ of the scale (not observable).

Part 3 – Describe pictures and formulas

In the following table, you can find pictures and formulas rdlated to two important laws. They are not explicitly named in the video, but professor Dave talks about them anyway. Try to describe them: *do this on Spark, so I can eventually check if your answers are right. We will correct them anyway during our next video lesson.*

	***Wien's displacement law:*** $\lambda_{peak} \cdot T = constant$
	***Rayleigh-Jeans law:*** $I \propto \frac{T}{\lambda^4}$

Part 4 – Key points

Watch again the video and rearrange in the right order the <u>key points</u> of the lesson: *do this part on Spark, so you can immediately check your answers.*

- Planck's quantization of energy
- Definition of a blackbody
- Ultraviolet catastrophe and Rayleigh-Jeans formula: classical Physics is not able to explain blackbody radiation
- Description of blackbody radiation and Wien's displacement law