

Source: [KBPhysicsMasterIndex](#)

# 1 | Quantum Mechanics

**What is quantum mechanics?** Quantum => in small/discrete steps

The Quantum of US Currency => \$0.01

## 1.1 | Puzzle of the Blackbody Radiation

("black" => opaque): from solid materials, liquids

The radiation from hot, solid materials looks samey (bright yellow) unlike every gas, however, had a spectral emission (think - neon lights.)

But!

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The light spectrum did depend on temperature, so what happened? Why is everything hot?

**Max Plank** => trying to model incoming light source from rays as basically all absorbed and not bounced back.

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Max Plank's Model 1 in this manner matched well with observations at long wavelengths (red hot). But, it predicted infinite brightness (it will just "keep bouncing") as wavelength => 0, which is wrong. This is the "ultraviolet catastrophe."

So, he made it better.

Max Plank's Model 2 is just Model 1, but an additional assumption that when Energy Transfers from  $e^-$  to EMWave,  $\delta E$  must be some constant \* frequency of light.

So, to synthesize high frequencies, this cop out had the effect of suppressing the infinite growth as  $\delta E$  would grow bigger and bigger to the point where all your energy would not go into the EMWave but to this transferring factor.

Which is like... Kind of a cop out. But it did fit medium frequencies better.

Einstein => Light != "wave"; instead, light are photon particles moving through space.

**Important Knowledges::**

Energy of each photon is equal to the plank constant (h) times the frequency (f).  $E = h * f$ .

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$$\lambda * f = c$$

$$E_{\text{photon}} = h \times f$$

Instead of Hertz, however, the frequency of F could better be represented with  $\omega$ , a unit of  $\frac{\text{radians}}{\text{sec}}$  that is derived as  $2\pi f(\frac{\text{radians}}{\text{s}})$

So to calculate energy with  $\omega$ , simply use  $\bar{h} = \frac{h}{2\pi}$  and so  $E = \bar{h}\omega$

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## 1.2 | Heisenberg Uncertainty

$\Delta E \times \Delta t = \hbar \Rightarrow$  “uncertainty of energy times uncertainty in time is the reduced plank’s constant”