Chapter-11: Dual Nature of Radiation and Matter

1. For photoemission to take place, either of the following conditions must be satisfied:

$$E \geq W \;\; or \;\; f \geq f_0 \;\; or \;\; \lambda \leq \lambda_0$$

---

2. Energy of a photon (E)

$$E = \frac{hc}{\lambda} = hf$$

---

3. Effect of intensity of light on photoelectric current
   Intensity ∝ photoelectric current ∝ number of photo electrons emitted per sec

$$\propto \frac{1}{distance^2}$$

---

4. Maximum kinetic energy of emitted electrons

$$K_{max} = eV_0 = \frac{1}{2}mv_{max}{}^2$$

---

5. Einstein's photoelectric equation:
   Work function

$$W = hf_0$$

As per the law of conservation of energy

$$E = W + \frac{1}{2}mv_{max}{}^2 = W + K_{max}$$

$$K_{max} = hf - W$$

---

6. Relation between maximum kinetic energy and frequency

$$K_{max} = h(f - f_0)$$

---

7. Relation between stopping potential and frequency

$$eV_0 = h(f - f_0)$$

---

8. Einstein's mass energy relationship

$$E = mc^2$$

9. De-Broglie's wave equation

$$\lambda = \frac{h}{mc} = \frac{h}{p}$$

10. For material particles like electrons, protons, neutrons wavelength λ

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

11. de-Broglie wavelength of an electron

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}} = \frac{h}{\sqrt{2meV}} = \frac{12.27}{\sqrt{V}}$$

12. de-Broglie wavelength for any charge particle,

$$\lambda = \frac{h}{\sqrt{2mK}} = \frac{h}{\sqrt{2mqV}}$$

13. de-Broglie wavelength for other charged particle (except electron) (λ is in Angstrom)

For proton,

$$\lambda = \frac{0.286}{\sqrt{V}}$$

For deuteron,

$$\lambda = \frac{0.2o2}{\sqrt{V}}$$

For α-particle,

$$\lambda = \frac{0.101}{\sqrt{V}}$$