VP390 Review 3

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1. What kind of experiment disproved the Thomsons model of the atom? The Rutherfords model that correctly reproduced the experimental data assumed that
   Some α particles will be scattered after hitting an atom. It assumes that the positive charge gathers together at the center of atom

2. According to Bohrs model of the hydrogen atom, the electron moves in a circular orbit such that the magnitude of its angular momentum is
   n$\hbar$

3. According to Bohrs model of the hydrogen atom, the electron moving in a circular orbit with $L_z = n\hbar$ emits electromagnetic radiation.
   False

4. State the postulates of Bohrs model of the hydrogen atom
   The orbits with different energy level is discrete. When the state or the orbits of one electron change, the atom will radiate electromagnetic wave.

5. According to Bohrs model, when is the hydrogen atom able to emit or absorb electromagnetic radiation? What is its frequency equal to?
   When the electron changes its orbit. $\nu = \frac{Z^2(E_2-E_1)}{h}$

6. The energy levels of the hydrogen atom are $E_n = \cdots E_0$, where $E_0 = 13.6\text{eV}$
   $E_n = \frac{E_0}{(n+1)^2}$

7. In quantum mechanics, the state of a system with the lowest energy is called the $\cdots$ state
   ground state

8. The radius of the first Bohr orbit in the hydrogen atom is of the order of
   10^{-11}

9. State the correspondence principle
   When the quantum is large, the result is just like classical result

10. What was the idea of the Frank-Hertz experiment and what did it confirm?
    Hit atom with electron with increasing energy. The atom only radiate when the electron's energy is above certain value. The multiple times of the value will cause multiple radiation.

11. In the original Frank-Hertz experiment with the gas tube filled with mercury atoms, dips in the current were observed for the values of the accelerating potential differing by ca. 4.9 V. Does it mean that energy levels in the mercury atom are equally spaced?
    No, it just cause twice radiation

12. In the original Frank-Hertz experiment with the tube filled with mercury atoms, dips in the current were observed for the values of the accelerating potential differing by ca. 4.9 V. How would you interpret the second dip that is observed at ca. 9.8 V?
    Two same radiation was caused

13. The ideal blackbody is modeled as a cavity that $\cdots$ absorbs incident radiation
    completely

14. What is the UV catastrophe?
    When λ is small, $u(\lambda) \to \infty$

15. State the Stefan-Boltzman law and Wien law. Explain all symbols in the formulas
    $\frac{P}{A} = \sigma T^4, \lambda_m T =$**const**

16. The average energy per resonant mode of electromagnetic field in the cavity modeling the ideal black body is $\cdots$ in the classicalal approach and $\cdots$ in Plancks model.
    $kT, \frac{h\nu}{e^{h\nu/kT}-1}$

17. Where does quantum mechanics appear in the Plancks model of blackbody radiation?
    Energy of electromagnetic radiation is quantized

18. How do waves with small wavelengths contribute to energy radiated from a unit volume of the ideal blackbody?
    When wavelength is very small, energy approaches 0, otherwise it follows the classical result, which decreases with larger wavelength

19. Write down the photoelectric effect equation. Explains all symbols
    $h\nu = \phi + K_{max}$

20. Assuming that the magnitude of the electrons charge is known, how can we use the data from a photoelectric effect measurement to find the value of the Plancks constant?
    Draw the relation between ν and K_{max}, the slope is $\frac{h}{e}$

21. In the model of Compton scattering, light is treated as $\cdots$ scattered off resting $\cdots$
    Particles, electrons

22. What does the Youngs double-slit experiment illustrate?
    Light has the property of waves to cause inference