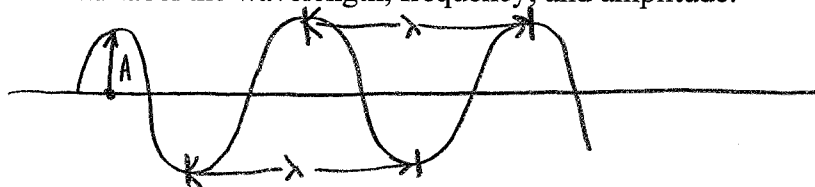


Key

Chapter 7 – Quantum Theory

These are questions you should be able to answer as we discuss quantum theory.

1. Draw a wave and label the wavelength, frequency, and amplitude.



2. Write the equation that is used to represent the relationship between wavelength and frequency. Label all variables and constants.

$$c = \lambda \nu$$

c = speed of light

λ = wavelength ν = frequency

3. What type of relationship exists between wavelength and frequency?

Inversely proportional

4. Organize the electromagnetic spectrum from longest to shortest wavelength.

radio microwave infrared visible ultraviolet x-ray
gamma

5. How are the colors of visible light organized?

visible spectrum \rightarrow R O Y G B I V

low E

high E

6. What was the outcome of Planck's Black Body Problem?

$$E = h\nu$$

light can act as a particle

light is emitted in discrete quanta

7. What was the "problem" that scientists found with the photoelectric effect?

The energy of electrons emitted was independent of the intensity of the light

8. What was the outcome of Einstein's work on the photoelectric effect?

Light can act as particle and a wave

(wave-particle duality)

9. What is a photon?

massless particle of light/energy

10. What causes the "lines" in an atomic emission spectrum?

Energy/color of the line corresponds to the amount of energy lost when an electron moves from a higher to lower energy level.



11. What is the calculation that allows you to determine the change in energy as an electron moves to different energy levels?

$$\Delta E = R_H \left(\frac{1}{n_i^2} - \frac{1}{n_f^2} \right)$$

12. What did Louis deBroglie say about matter?

all matter has an associated wavelength.

13. What does the Heisenberg Uncertainty Principle say? Why did it matter?

It says that it is impossible to determine position & velocity of an electron. It meant an electron could not

14. What does the Schrodinger wave equation indicate?

Probability location of where electron is located around nucleus.

15. What does the principal quantum number (n) indicate?

Distance of electron from the nucleus.

16. What does the angular momentum quantum number (l) indicate?

Shape of the orbital

17. Relate the angular momentum quantum number to the principal quantum number.

$$l = 0 \text{ to } n-1$$

18. What does the magnetic quantum number (m_l) indicate?

orientation/position of orbital

19. Relate the magnetic quantum number to the angular momentum quantum number.

$$m_l = -l \text{ to } +l$$

20. What are the two values of the spin quantum number (m_s)?

$$+\frac{1}{2} \text{ , } -\frac{1}{2}$$

21. What does the Pauli Exclusion Principle state?

No 2 electrons can have the same 4 quantum numbers

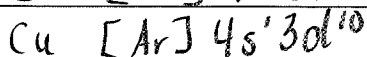
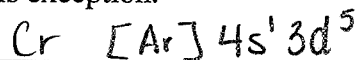
22. What is the aufbau principle?

Electrons fill lowest to highest energy levels ("building up")

23. What is Hund's Rule?

electrons fill equal energy orbitals halfway with same spin before pairing.

24. What is full-shell and half-shell stability? Give an example of an element that follows this exception.



elements that are more stable

with full or half-full d-shells

25. Which elements have full outer shells of electrons?

as opposed to following Aufbau.

Noble gases

26. What is the difference between paramagnetic and diamagnetic?

↳ unpaired e^- ↘ all e^- paired

27. What does "shielding" mean?

Inner electrons block outer electrons from feeling pull of positive nucleus, increasing their energy.

