

Phys.G12-Atomic physics- Test**Multiple Choice**

Identify the choice that best completes the statement or answers the question.

- _____ 1. What is the process in which an electron returns to a lower energy level and emits a photon?
- line absorption
 - spontaneous emission
 - line emission
 - energy transition
- _____ 2. Classical electromagnetic theory predicted that the energy radiated by a blackbody would become infinite as the wavelength became shorter. What was the contradiction between observation and this result called?
- the photoelectric effect
 - the ultraviolet catastrophe
 - the quantum theory
 - the wave-particle duality
- _____ 3. Which of the following is *not* a weakness of the Rutherford model of the atom?
- The atom is mostly empty space.
 - The atom cannot produce spectral lines.
 - The atom radiates energy continuously.
 - The atom is unstable.

Choose the best answer from the options that follow each question.

- _____ 4. What causes the dark lines in the absorption spectrum of an element to occur?
- Photons are emitted when electrons jump from a lower-energy to a higher-energy state.
 - Photons are emitted when electrons jump from a higher-energy to a lower-energy state.
 - Photons are absorbed when electrons jump from a higher-energy to a lower-energy state.
 - Photons are absorbed when electrons jump from a lower-energy to a higher-energy state.
- _____ 5. Light with an energy equal to three times the work function of a given metal causes the metal to eject photoelectrons. What is the ratio of the maximum photoelectron kinetic energy to the work function?
- 1 : 1
 - 4 : 1
 - 2 : 1
 - 3 : 1
- _____ 6. What is the frequency of a photon with an energy of 1.99×10^{-19} J?
($h = 6.63 \times 10^{-34}$ J•s)
- 3.00×10^{14} Hz
 - 4.00×10^{14} Hz
 - 1.00×10^{14} Hz
 - 2.00×10^{14} Hz

Choose the best answer from the options that follow each question.

- _____ 7. Which of the following statements correctly describes an atom's energy levels as they are depicted in an energy-level diagram?
- The energy levels are separated by equal amounts.
 - The energy levels are the same for all elements.
 - The higher energy levels are separated by greater amounts.
 - The higher energy levels are separated by smaller amounts.

- _____ 8. A photon with an energy of 2.86 eV is absorbed by a hydrogen atom. Afterwards, three photons are spontaneously emitted. Which statement correctly describes the emitted photons?
- The emitted photons each have the same wavelengths.
 - Three photons are always emitted when a 2.86 eV photon is absorbed.
 - The photons are produced by a single electron energy-level transition.
 - The sum of the emitted photon energies equals 2.86 eV.
- _____ 9. What were the units of light energy emitted by blackbody radiation originally called?
- electron volts
 - resonators
 - joules
 - quanta

Choose the best answer from the options that follow each question.

- _____ 10. What is the energy of a photon with a frequency of 5.45×10^{14} Hz?
($h = 6.63 \times 10^{-34}$ J•s)
- 1.22×10^{-48} J
 - 3.61×10^{-34} J
 - 3.61×10^{-19} J
 - 3.65×10^{-40} J
- _____ 11. What observation confirmed de Broglie's theory of matter waves?
- the diffraction of electrons
 - the scattering of alpha particles
 - the photoelectric effect
 - the spontaneous emission of photons
- _____ 12. When a high potential difference is applied to a low-pressure gas, what kind of spectrum will the gas emit?
- continuous
 - absorption
 - emission
 - monochromatic
- _____ 13. What is the concentration of positive charge and mass in Rutherford's atomic model called?
- neutron
 - nucleus
 - alpha particle
 - proton
- _____ 14. Which of the following processes is more easily observable for light with a short wavelength?
- radio transmission
 - diffraction
 - interference
 - the photoelectric effect

Choose the best answer from the options that follow each question.

- _____ 15. According to the matter-wave modification to the Bohr model of the atom, what do the orbits of electrons in an atom resemble?
- standing waves
 - traveling waves
 - probability waves
 - longitudinal waves
- _____ 16. What is the momentum of a proton with a de Broglie wavelength of 6.63×10^{-9} m?
($h = 6.63 \times 10^{-34}$ J•s)
- 4.40×10^{-44} kg•m/s
 - 3.33×10^{-34} kg•m/s
 - 3.00×10^{-17} kg•m/s
 - 1.00×10^{-25} kg•m/s

- _____ 17. When a high potential difference is applied to a low-pressure gas, what kind of spectrum will the gas emit?
- monochromatic
 - continuous
 - emission
 - absorption
- _____ 18. What is the process in which an electron returns to a lower energy level and emits a photon?
- spontaneous emission
 - line absorption
 - line emission
 - energy transition
- _____ 19. What would you observe if light from argon gas were passed through a prism?
- a series of discrete bright lines
 - a continuous spectrum
 - a series of dark lines imposed on a continuous spectrum
 - a single bright line
- _____ 20. What does the peak of a probability curve for an electron in an atom indicate?
- that Heisenberg's uncertainty principle is violated
 - the distance from the nucleus at which the electron is most likely to be found
 - that the electron's location can be precisely determined
 - the location where there is zero probability of finding the electron
- _____ 21. Which of the following is *not* a feature of Bohr's model of the atom?
- Electrons emit radiation continuously while orbiting the nucleus.
 - Electrons move in circular orbits about the nucleus.
 - Electron jumps between energy levels account for discrete spectral lines.
 - Only certain electron orbits are allowed.
- _____ 22. What were the units of light energy emitted by blackbody radiation originally called?
- electron volts
 - joules
 - quanta
 - resonators
- _____ 23. What is the speed of a 50 g rock if its de Broglie wavelength is 3.32×10^{-34} m? ($h = 6.63 \times 10^{-34}$ J•s)
- 20 m/s
 - 30 m/s
 - 60 m/s
 - 40 m/s
- _____ 24. A monochromatic light beam with a quantum energy value of 3.0 eV is incident upon a photocell. The work function of the photocell is 1.6 eV. What is the maximum kinetic energy of the ejected electrons?
- 2.4 eV
 - 4.8 eV
 - 1.4 eV
 - 4.6 eV
- _____ 25. What is the concentration of positive charge and mass in Rutherford's atomic model called?
- alpha particle
 - neutron
 - nucleus
 - proton

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