Webreview - Ch 28 Atomic Physics

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

____ 1. When a wire carries high current causing it to glow, it will emit which type of spectrum?
a. line emission
b. line absorption
c. continuous
d. monochromatic
e. both line and continuous emission

____ 2. When a high voltage is applied to a low-pressure gas causing it to glow, it will emit which type of spectrum?
a. line emission
b. line absorption
c. continuous
d. monochromatic
e. both line and continuous absorption

____ 3. When a cool gas is placed between a glowing wire filament source and a diffraction grating, the resultant spectrum from the grating is which one of the following?
a. line emission
b. line absorption
c. continuous
d. monochromatic
e. both line and continuous emission

____ 4. An alpha particle is:
a. a neutral helium atom.
b. any positively charged nucleus.
c. an x-ray.
d. an electron.
e. none of the above.

____ 5. The Lyman series of hydrogen is made up of those transitions made from higher levels to $n = 1$. If the first line in this series has a wavelength of 122 nm, what is the wavelength of the second line?
a. 49 nm
b. 103 nm
c. 364 nm
d. 486 nm
e. 632 nm

____ 6. The ionization energy for the hydrogen atom is 13.6 eV. What is the energy of a photon that is emitted as a hydrogen atom makes a transition between the $n = 4$ and $n = 2$ states?
a. 0.85 eV
b. 2.55 eV
c. 3.40 eV
d. 6.80 eV
e. 10.2 eV

____ 7. Of the various wavelengths emitted from a hydrogen gas discharge tube, those that are associated with transitions from higher levels down to the $n = 1$ level produce which of the following?
a. infrared
b. visible
c. mixture of infrared and visible
d. ultraviolet
e. x-rays

____ 8. Of the various wavelengths emitted from a hydrogen gas discharge tube, those associated with transitions from higher levels down to the $n = 2$ level produce which of the following?
a. infrared
b. visible
c. mixture of visible and ultraviolet
d. ultraviolet
e. x-rays

____ 9. What is the wavelength of the line in the Paschen series of hydrogen that is comprised of transitions from the $n = 4$ to the $n = 3$ levels? ($R = 1.097 \times 10^7$ m^{-1} and 1 nm = 10^{-9} m)
a. 1 282 nm
b. 1 875 nm
c. 1 923 nm
d. 2 251 nm
e. 3 402 nm

____ 10. The ionization energy of the hydrogen atom is 13.6 eV. What is the energy of a photon emitted corresponding to a transition from the $n = 5$ to $n = 2$ state?
a. 2.9 eV
b. 3.5 eV
c. 4.0 eV
d. 7.9 eV
e. 9.0 eV

____ 11. If the radius of the electron orbit in the $n = 1$ level of the hydrogen atoms is 0.052 9 nm, what is its radius for the $n = 5$ level? (Assume the Bohr model is valid.)
a. 0.106 nm
b. 0.265 nm
c. 0.846 nm
d. 1.32 nm
e. 2.64 nm

____ 12. The Paschen series of hydrogen corresponds to electron transitions from higher levels to $n = 3$. What is the shortest wavelength in that series? ($R = 1.097 \times 10^7$ m^{-1} and 1 nm = 10^{-9} m)
a. 365 nm
b. 820 nm
c. 1 094 nm
d. 313 nm
e. 208 nm

____ 13. The Lyman series of hydrogen corresponds to electron transitions from higher levels to $n = 1$. What is the longest wavelength in that series? ($R = 1.097 \times 10^{7}$ m^{-1} and 1 nm = 10^{-9} m)
a. 91.4 nm
b. 122 nm
c. 273 nm
d. 456 nm
e. 831 nm

____ 14. The ionization energy of the hydrogen atom is 13.6 eV. What is the wavelength of a photon having this much energy? ($h = 6.63 \times 10^{-34}$ J·s, $c = 3.00 \times 10^{8}$ m/s, 1 eV = 1.6×10^{-19} J, and 1 nm = 10^{-9} m)
a. 91.4 nm
b. 136 nm
c. 273 nm
d. 360 nm
e. 480 nm

____ 15. The four visible colors emitted by hydrogen atoms are produced by electrons:
a. that start in the ground state.
b. that end up in the ground state.
c. that start in the level with $n = 2$.
d. that end up in the level with $n = 2$.
e. that end up in the level with $n = 4$.

____ 16. The visible lines from hydrogen are all members of the:
a. Lyman series.
b. Balmer series.
c. Paschen series.
d. Brackett series.
e. Pfund series.

____ 17. The emission of a line from the Balmer series is followed almost immediately by the emission of a line from the Lyman series. This will be true for:
a. only the first line of the Balmer series and the first line of the Lyman series.
b. all the lines of the Balmer series followed by only the first line of the Lyman series.
c. only the first line of the Balmer series followed by any of the lines of the Lyman series.
d. all the lines of the Balmer series followed by any of the lines of the Lyman series
e. None of the above choices is valid.

____ 18. In the Bohr model of the atom, the orbits where electrons move fastest:
a. have the lowest energy.
b. have the highest energy.
c. have the biggest radius.
d. have the greatest angular momentum.
e. have the lowest eccentricity.

____ 19. When an electron moves from the $n = 1$ to the $n = 2$ orbit:
a. both the radius and the angular momentum double.
b. both the radius and the angular momentum increase by a factor of 4.
c. the radius doubles and the angular momentum increases by a factor of 4.
d. radius increases by a factor of 4 and the angular momentum doubles.
e. radius increases by a factor of 4 and the angular momentum is conserved.

____ 20. A hydrogen atom in the ground state absorbs a 12.75 eV photon. To what level is the electron promoted? (The ionization energy of hydrogen is 13.6 eV.)
a. $n = 2$
b. $n = 3$
c. $n = 4$
d. $n = 5$
e. $n = 6$

____ 21. A photon is emitted from a hydrogen atom that undergoes a transition from $n = 3$ to $n = 2$. Calculate the energy and wavelength of the photon. (The ionization energy of hydrogen is 13.6 eV, and $h = 6.63 \times 10^{-34}$ J·s, $c = 3.00 \times 10^{8}$ m/s, 1 eV = 1.60×10^{-19} J, and 1 nm = 10^{-9} m)
a. 1.89 eV, 658 nm
b. 2.21 eV, 563 nm
c. 1.89 eV, 460 nm
d. 3.19 eV, 658 nm
e. 2.21 eV, 460 nm

____ 22. The speed of the electron in the Bohr theory of hydrogen is:
a. proportional to n.
b. proportional to n^2.
c. inversely proportional to n.
d. inversely proportional to n^2.
e. the same for all n.

____ 23. Which of the following transitions in hydrogen from an initial state (n_i) to a final state (n_f) results in the most energy emitted?
a. $n_i = 80$, $n_f = 2$
b. $n_i = 3$, $n_f = 95$
c. $n_i = 2$, $n_f = 1$
d. $n_i = 1$, $n_f = 3$
e. $n_i = 1$, $n_f = 2$

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Answer Section

MULTIPLE CHOICE

1. C
2. A
3. B
4. E
5. B
6. B
7. D
8. C
9. B
10. A
11. D
12. B
13. B
14. A
15. D
16. B
17. B
18. A
19. D
20. C
21. A
22. C
23. C