HW05 - Atomic Theory & Electron Configuration

1 1 point

A common reference point in atomic theory is the energy of a free electron. A "free" electron is one that is free of all positive/negative attractions and repulsions. It is effectively an infinite distance away from all things. What is the value of this reference energy of a free electron ?

- $+\infty$ J
- 0 (zero) J
- $+\infty$ J
- 6.022×10^{23} J

2 1 point

Consider attractive forces within matter between particles (any particles really). As those attractions get stronger and stronger and the matter responds, the energy level of that matter...

- stay approximately the same
- will decrease accordingly
- will increase accordingly

3 1 point

Which of the following experiments provided evidence that the electrons in atoms are arranged in distinct energy levels?

- the existence of elements with non-integer atomic weights
- the results of the Millikan oil-drop experiment
- the scattering of alpha particles by a metal foil
- the observation of line spectra from gas discharge tubes

4 1 point

Assume n_1 and ε_2 are two adjacent energy levels of an atom. The emission of radiation with the longest wavelength would occur for which two values of n_1 and ε_2 ?

- 2,1
- 7,6
- 8,7
- 4,3

5 1 point

Part 1 of 2: Use the Rydberg formula for atomic hydrogen to calculate the wavelength of the photon emitted in the transition of an electron from $n = 4$ to $n = 2$.

- 94.9 nm
- 205 nm
- 486 nm
- 8.63 nm

6 1 point

Part 2 of 2: What is the name given to the spectroscope series to which the transition described in the previous question?

- Brackett series
- Lyman series
- Balmer series
- Paschen series

7 1 point

In what region of light will the photons emitted in question 3 lie?

- visible, red
- ultraviolet
- visible, blue
- visible, yellow

8 1 point

The graph below shows the radial distribution plots for the 1s wavefunctions for H and He$^+$. Which plot (A or B) is the 1s wavefunction for the He$^+$ ion?

- There is no way to know.
- B
- A

9 1 point

What is the maximum number of electrons that can have the quantum number $n = 2$ in an atom?

- 2
- 4
- 8
- 18

10 1 point

The three quantum numbers for an electron in a hydrogen atom in a certain state are $n = 4$, $\ell = 3$, $m_\ell = 1$. The electron is located in what type of orbital?

- 3d
- 4p
- 4d
- 3p

11 1 point

The number that describes the main energy level of an electron in an atom is...

- the angular momentum quantum number,ℓ
- the magnetic quantum number,m_ℓ
- the atomic number, z
- the principal quantum number,n

12 1 point

Can an electron in an atom be in an energy level described by the set of quantum numbers $n = 5$, $\ell = 3$, $m_\ell = -2$?

- yes
- no, because m_ℓ must equal ±1
- no, because ℓ must equal $n - 1$
- no, because m_ℓ cannot be negative

13 1 point

An electron in a 3d orbital could have which of the following quantum numbers?

- $n = 3$, $\ell = 1$, $m_\ell = -1$
- $n = 3$, $\ell = 2$, $m_\ell = 0$
- $n = 3$, $\ell = 3$, $m_\ell = 1$
- $n = 3$, $\ell = 2$, $m_\ell = -3$

14 1 point

How many p electrons does Se (atomic number 34) possess?

- 34
- 16
- 4
- 18

15 1 point

For which H-atom wavefunction are you most likely to find the electron farthest from the nucleus?

- 2p
- 4p
- 3p
- 2s

16 1 point

The transition metals are elements with partially filled...

- s subshells.
- d subshells.
- f subshells.
- p subshells.

17 1 point

Which element is predicted to have the ground-state electron configuration shown below?

[Ne] $3s^2$ $3p^4$

- sulfur
- aluminum
- chlorine
- silicon

18 1 point

Which of the following is the valence electronic structure for a halogen?

- ns^2np^{10}
- ns^2np^3
- ns^2np^6
- ns^2

19 1 point

In the Aufbau order of occupancy of electronic energy levels, the level occupied just after 5p is...

- 4s
- 3f
- 5d
- 4d

20 1 point

The electron configuration for the Mn atom is...

- $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $4s^2$ $3d^7$
- $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$
- $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $4s^2$ $3d^5$
- $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $4s^2$ $4p^5$

21 1 point

The ground state electron configuration of a neutral silver atom is [Kr] $5s^1 4d^{10}$ instead of [Kr] $5s^2$ $4d^9$. This observation can be explained (theoretically) by the fact that...

- only one electron can occupy a 5s orbital.
- the magnetism measurement shows one unpaired electron.
- an enhanced stability is associated with filled sets of equivalent orbitals.
- the 4d subenergy level has higher energy than the 5s subenergy level.

22 1 point

Which of the following atoms has the largest radius?

- Cl
- F
- Br
- N

23 1 point

As an atom's radius decreases...

- its ionization energy will either increase or decrease depending on whether you are going up a column or across a row.
- its ionization energy decreases.
- its ionization energy does not change.
- its ionization energy increases.

24 1 point

Which of the following would be expected to have the highest first ionization energy?

- Xe
- Ar
- Si
- Na
- Cl

25 1 point

How many s electrons does P (atomic number 15) possess?

- 5
- 2
- 4
- 6

26 1 point

How many values of the quantum number ℓ are possible when n=5?

- 7
- 5
- 6
- 4

27 1 point

How many values of m_ℓ are allowed for an electron in a 5f subshell ?

- 5
- 7
- 6
- 4

28 1 point

How many values of m_ℓ are allowed for an electron in a 2s subshell ?

- 4
- 1
- 3
- None of these.

29 1 point

How many subshells are there in the shell with $n = 3$?

- 4
- 3
- 2
- 1

30 1 point

The diameter of the electron density of an atom is roughly...

- 10 - 50 nm
- 1 - 5 nm
- 0.1 - 0.5 nm
- None of these.

31 1 point

For which of the following elements would the size of the neutral atom (atomic radius) be the largest?

- Rb
- Ca
- Sr
- Na

32 1 point

Write an equation that represents the second ionization energy of nickel.

- $Ni(g) \longrightarrow Ni^{2+}(g) + 2e^-$
- $Ni(g) \longrightarrow Ni^{+}(g) + e^-$
- $Ni(g) \longrightarrow Ni^{3+}(g) + e^-$
- $Ni^+(g) \longrightarrow Ni^{2+}(g) + e^-$