This print-out should have 25 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

ChemPrin3e 01 01
001 10.0 points

What is the correct order of decreasing energy?

1. microwaves, visible light, ultraviolet light, x-rays, γ-rays

2. visible light, ultraviolet light, microwaves, x-rays, γ-rays

3. visible light, microwaves, x-rays, γ-rays, ltraviolet light

4. microwaves, visible light, x-rays, γ-rays, ltraviolet light

5. γ-rays, x-rays, ultraviolet light, visible light, microwaves

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Mlib 50 2001
002 10.0 points

How much energy does a photon with a wavelength equal to 350 nm have?

1. 2.32×10^{-31} J

2. 1.89×10^{-27} J

3. 3.50×10^{-7} J

4. 5.68×10^{-19} J

5. 1.29×10^{-48} J

Blackbody Radiators
003 10.0 points

The observation and characterization of black body radiation was key to the development of our quantum mechanical view of the atom. Which statement below is **correct** regarding blackbody radiation?

1. The emission from a blackbody consists of a series of discrete spectral lines, the colors of which are unique to the type of blackbody used.

2. The peak intensity of the emission curve for a blackbody shifts to shorter wavelengths as the temperature of the blackbody increases.

3. Theoreticians were unable to explain why blackbody radiators emitted so much UV light at room temperature, which became known as the "UV Catastrophe".

4. The emission of radiation from an incandescent lightbulb does not resemble the emission of radiation from a blackbody.

Work function 01
004 10.0 points

We conduct an experiment by shining 500 nm light on potassium metal. This causes electrons to be emitted from the surface via the photoelectric effect. Now we change our source light to 450 nm at the same intensity level. Which of the following is the result from the 450 nm light source compared to the 500 nm source?

1. Fewer electrons would be emitted from the surface.

2. The same number of electrons would be emitted, but they would have a lower velocity

3. No electrons would be emitted from the surface.

4. More electrons would be emitted from the surface.

5. The same number of electrons would be emitted, but they would have a higher velocity

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Mlib 02 0095
005 10.0 points

Which of the following experiments provided evidence that the electrons in atoms are ar-

ranged in distinct energy levels?

1. the existence of elements with noninteger values for atomic weights

2. the scattering of α particles by a metal foil

3. the results of the Millikan oil-drop experiment

4. the deflection of ions in a mass spectrometer

5. the observation of line spectra from gas discharge tubes

LDE Q01 05

006 10.0 points

In the 20th century, quantum mechanics addressed the failures of classical mechanics by introducing the concept of wave-particle duality. Why did classical mechanics able to explain the world just fine up until then?

1. The wave nature of particles does not affect any macroscopic phenomena and is only important at the atomic scale.

2. Macroscopic objects have no wave-like properties

3. Planck's constant is proportional to the size of the object it describes, so that the wavelength of that particle is only significant for small objects.

4. Macroscopic objects can be modeled purely as particles because their wavelength is so small compared to their scale that it can be neglected for most purposes and still give a good description of their behavior.

5. Only at very high velocity, rarely traveled by macroscopic objects, does the wavelength of particles become large enough to influence its behavior.

ChemPrin3e T01 13

007 10.0 points

Calculate the velocity of an oxygen molecule if it has a de Broglie wavelength of 0.0140 nm.

1. 891 m/s

2. 1780 m/s

3. 445 m/s

4. 3×10^8 m/s

5. 8.9 m/s

ChemPrin3e T01 10a

008 10.0 points

You are caught in a radar trap and hope to show that the speed measured by the radar gun is in error due to the uncertainty principle. If you assume that the uncertainty in your position is large, say about 10 m, and that the car has a mass of 2150 kg, what is the uncertainty in the velocity?

1. 1×10^{33} m

2. 4×10^{38} m/s

3. 1×10^{-34} m/s

4. 5.0×10^{-42} m/s

5. 2.5×10^{-39} m/s

Msci 05 1103R

009 10.0 points

An electron in a hydrogen atom could undergo any of the transitions listed below, by emitting light. Which transition would give light of the shortest wavelength?

1. $n = 4$ to $n = 3$

2. $n = 2$ to $n = 1$

3. $n = 3$ to $n = 1$

4. $n = 4$ to $n = 1$

5. $n = 4$ to $n = 2$

Mlib 02 0063alt
010 10.0 points

The following three statements refer to the Bohr theory of the atom.

Z1) An electron can remain in a particular orbit as long as it continually absorbs radiation of a definite frequency.

Z2) The lowest energy orbits are those closest to the nucleus.

Z3) An electron can jump from an inner orbit to an outer orbit by emitting radiation of a definite frequency.

Which response contains all the statements that are consistent with the Bohr theory of the atom and no others?

1. Z3 only

2. Z2 and Z3 only

3. Z1, Z2 and Z3

4. Z2 only

5. Z1 and Z2 only

LDE Schrodinger Theory 002
011 10.0 points

Which of the following statements concerning the Schrödinger equation and its solutions is true?

I) Its solutions are wave functions.

II) It can be used to determine an electron's exact position.

III) Both attractive and repulsive $V(r)$ terms are used when solving the Schrödinger equation for the hydrogen atom.

1. I, II

2. I only

3. I, III

4. I, II, III

5. III only

6. II, III

7. II only

ChemPrin3e T01 24
012 10.0 points

If a particle is confined to a one-dimensional box of length 300 pm, for Ψ_3 the particle is most likely to be found at

1. 100 and 200 pm, respectively.

2. 0 pm.

3. 50, 150, and 250 pm, respectively.

4. 300 pm.

5. 17.3 pm.

Msci 05 1404
013 10.0 points

The size of an atomic orbital is determined by which quantum number?

1. m_ℓ

2. n

3. ℓ

4. m_s

Msci 05 1432
014 10.0 points

Which set of quantum numbers does NOT provide a satisfactory solution to the wave equation?

1. $n = 1$, $\ell = 0$, $m_\ell = 0$

2. $n = 4$, $\ell = 2$, $m_\ell = +2$

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

4. $n = 2$, $\ell = 0$, $m_\ell = -1$

5. $n = 5$, $\ell = 3$, $m_\ell = -3$

Msci 05 1427

015 10.0 points

In an atom, what would be the maximum number of electrons having the quantum numbers $n = 6$ and $\ell = 2$?

1. 6.

2. 5.

3. 72.

4. 10.

5. 8.

LDE Aufbau, Hund, Pauli 002

016 10.0 points

Consider the electron filling diagram

$3p$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow}$ $\underline{\ }$ $\underline{\ }$
$3s$ $\underline{\uparrow}$
$2p$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$
$2s$ $\underline{\uparrow\downarrow}$
$1s$ $\underline{\uparrow\downarrow}$

for a ground state atom. Which of the following does it violate?

I) The Aufbau principle
II) Hund's rule
III) The Pauli exclusion principle

1. I only

2. I, II, III

3. II only

4. III only

5. I, II

6. II, III

7. I, III

LDE Periodic Table 005

017 10.0 points

Fill in the blanks: potassium is one of the most well-known elements in the alkali metal _____. It is in the _____which makes it a _____element. Its single valence electron is in the _____subshell of the _____shell, making it very reactive. It reacts readily with non-metals to form _____.

1. row; d block; main group; $\ell = 1$; $n = 4$; salts

2. family; s block; reactive; $\ell = 0$; $n = 3$; alloys

3. row; d block; non-metal; $\ell = 1$; $n = 3$; alloys

4. family; s block; main group; $\ell = 0$; $n = 4$; salts

5. series; s block; common; $\ell = 2$; $n = 4$; networks

ChemPrin3e T01 42

018 10.0 points

Write the ground-state electron configuration of a europium atom.

1. $[\text{Xe}]\, 4f^9$

2. $[\text{Xe}]\, 4f^2\, 5d^5\, 6s^2$

3. $[\text{Xe}]\, 5d^7\, 6s^2$

4. $[\text{Xe}]\, 4f^5\, 5d^2\, 6s^2$

5. $[\text{Xe}]\, 4f^7\, 6s^2$

Msci 05 1675

019 10.0 points

Which response includes only species that have the electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$, and no other species?

1. Cl^-, K^+, Ar, Mg^{2+}

2. Cl^-, K^+, Ar, P^{3-}

3. Na^+, K^+, Ar

4. Na^+, Ar, P^{3-}

5. Cl^-, Na^+

Msci 05 1660

020 10.0 points

What is the ground state electron configuration for chromium?

1. $1s^2\ 2s^2\ 2p^8\ 3s^2\ 3p^8\ 3d^2$

2. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$

3. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4$

4. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

LDE ENC Calculation 001

021 10.0 points

What is the effective nuclear charge experienced by the $2p$ and $3p$ electrons of an Chlorine atom (Cl), respectively?

1. 17, 7

2. 7, 2

3. 17, 10

4. 11, 7

5. 15, 7

LDE Rank Atomic Radius 001

022 10.0 points

Arrange the following atoms in order of increasing radius: Li, Au, C, Cs.

1. Li < C < Cs < Au

2. Cs < Au < Li < C

3. C < Li < Au < Cs

4. Au < Cs < C < Li

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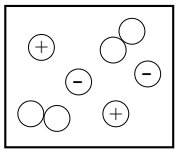
ion sizes 01

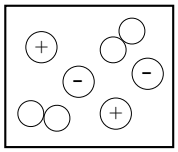
023 10.0 points

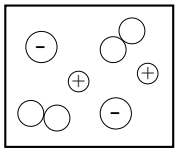
A diatomic molecule decomposes by the following reaction:

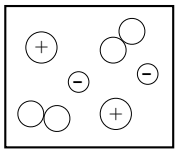
$$X_2 \rightarrow X^+ + X^-$$

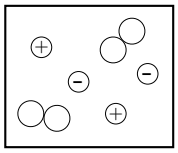
Look carefully at the following pictures. Which one accurately depicts this reaction as it is proceeding?

1. 

2. 

3. 

4. 

5. 

Msci 06 0315

024 10.0 points

Which elements are correctly listed in order of INCREASING ionization energy?

1. O < S < Se

2. O < F < Ne

3. N < P < As

4. N < O < F

5. C < N < O

LDE Rank Electron Affinity 001

025 10.0 points

Rank the following species from least to great-

est electron affinity: F, Ge, S, As, Se.

1. F < Se < S < Ge < As

2. Ge < As < Se < S < F

3. As < Ge < Se < S < F

4. As < Ge < S < Se < F

5. F < S < Se < Ge < As