

This print-out should have 14 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

Which of the following statement(s) is/are true?

- I) Classical mechanics accurately predicted the behavior of blackbody radiators.
- II) The failure of classical mechanics to predict the behavior of blackbody radiators is called the ultraviolet catastrophe.
- III) A minimum frequency of light is required to eject an electron from a metal surface.
- IV) The emission spectra of gases are continuous rather than discrete.

- 1. II, III, and IV
- 2. I and III
- 3. II and III
- 4. III and IV
- 5. I, II and IV

002 10.0 points

What is the correct electronic configuration for a ground-state Gold atom (Au)?

- 1. [Rn] $6s^1 4f^{14} 5d^{10}$
- 2. [Xe] $6s^2 4f^{14} 5d^9$
- 3. [Rn] $6s^2 4f^{14} 5d^9$
- 4. [Rn] $6s^1 5d^{10}$
- 5. [Xe] $6s^1 4f^{14} 5d^{10}$
- 6. [Xe] $6s^1 5d^{10}$

003 10.0 points

What is the correct electronic configuration for a ground-state Antimony(V) ion (Sb^{5+})?

- 1. [Kr] $5s^0 3f^{14} 4d^{10}$

2. [Kr] $5s^1 4d^{10}$

3. [Kr] $5s^0 4d^{10}$

4. [Kr] $5s^2 4d^{10}$

5. [Kr] $5s^2 4d^8$

004 10.0 points

Rank the following from least to greatest ionization energy: silicon (Si), phosphorous (P), sulfur (S).

- 1. $P < S < \text{Si}$
- 2. $\text{Si} < P < S$
- 3. $\text{Si} < S < P$
- 4. $S < \text{Si} < P$
- 5. $P < \text{Si} < S$
- 6. $S < P < \text{Si}$

005 10.0 points

Rank the following species in terms of decreasing atomic radius: Chlorine (Cl), Thallium (Tl), Arsenic (As), Tin (Sn), Lead (Pb)

- 1. $\text{Cl} > \text{As} > \text{Pb} > \text{Sn} > \text{Tl}$
- 2. $\text{Tl} > \text{Pb} > \text{Sn} > \text{As} > \text{Cl}$
- 3. $\text{Cl} > \text{As} > \text{Sn} > \text{Tl} > \text{Pb}$
- 4. $\text{Cl} > \text{As} > \text{Sn} > \text{Pb} > \text{Tl}$
- 5. $\text{Tl} > \text{Sn} > \text{Pb} > \text{As} > \text{Cl}$
- 6. Not enough information

006 10.0 points

Which of the following sets of quantum numbers are **valid**, i.e. don't violate any boundary conditions?

I) $n = 3, \ell = 2, m_\ell = -2, m_s = +\frac{1}{2}$

- II) $n = 9, \ell = 5, m_\ell = 6, m_s = +\frac{1}{2}$ **5. 2**
- III) $n = 2, \ell = 1, m_\ell = 0, m_s = +1$ **6. 10**
- IV) $n = 2, \ell = 0, m_\ell = 0, m_s = +\frac{1}{2}$ **7. 14**
1. I only **8. 0**
2. I, III, IV **9. 16**
3. II only **10. 4**
4. III only
5. II, III
6. I, II, IV
7. IV only
8. I, IV

007 10.0 points

What is the shortest-wavelength line in the emission spectrum of the hydrogen atom?

1. 100 nm
2. 122 nm
3. 1.00 nm
4. 182 nm
5. 91.2 nm

008 10.0 points

How many electrons can possess this set of quantum numbers: principal quantum number $n = 4$, magnetic quantum number $m_\ell = 0$?

1. 6
2. 8
3. 12
4. 18

009 10.0 points

Which of the following *valence-shell configurations*

- | | $4s$ | $4p$ | |
|------|----------------------|------------------------------|------|
| I) | $\uparrow\downarrow$ | $\uparrow \downarrow _$ | |
| II) | $\uparrow\downarrow$ | $\uparrow \uparrow _$ | $_$ |
| III) | $\uparrow\downarrow$ | $\uparrow\downarrow _$ | $_$ |
| IV) | \uparrow | $\uparrow \uparrow \uparrow$ | $_$ |

could describe a neutral atom in its ground state?

1. I only
2. None of the configurations
3. II only
4. IV only
5. III only
6. More than one of the configurations

010 10.0 points

Fill in the blanks: chlorine is one of the most well-known elements in the halogen _____. It belongs to _____17 which makes it a _____ element. Its valence electrons belong to the $n = 3$ _____, and it has a nearly-filled $3p$ _____, making it very reactive. Cl^- is a very stable anion because it is isoelectronic to a _____.

1. family, group, main group, shell, subshell,

noble gas

2. group, column, non-metal, shell, orbital, metal

3. row, group, main group, shell, orbital, noble gas

4. series, family, reactive, row, subshell, noble gas

5. family, column, common, row, shell, anion

011 10.0 points

When dealing with electrons in atoms and molecules, the electrons that are not considered as valence electrons (can, cannot) effectively shield the nucleus and thereby (decrease, increase) the effective nuclear charge.

1. cannot; increase
2. can; increase
3. cannot; decrease
4. The non-valence electrons do nothing.
5. can; decrease

012 10.0 points

Given the elements Cl, Ge, and K and the values 418, 1255, and 784 kJ/mol of possible first ionization energies, match the atoms with their first ionization energies.

1. Cl: 1255 kJ/mol; Ge: 784 kJ/mol; and K: 418 kJ/mol
2. Cl: 784 kJ/mol; Ge: 1255 kJ/mol; and K: 418 kJ/mol
3. Cl: 418 kJ/mol, Ge: 1255 kJ/mol; and K: 784 kJ/mol
4. Cl: 1255 kJ/mol; Ge: 418 kJ/mol; and K: 784 kJ/mol

5. Cl: 418 kJ/mol; Ge: 784 kJ/mol; and K: 1255 kJ/mol

013 10.0 points

Which of the following concepts best describes the reason that atoms are larger and electron energies are weaker as you go down the periodic table?

1. increased proton density
2. Aufbau Principle
3. electronegativity
4. shielding
5. stable filled shells

014 10.0 points

Which of the following atoms would have the smallest size (atomic radius)?

1. S
2. N
3. Li
4. O
5. B