

**Test Bank for Chemistry The Central Science 13th Edition  
by Brown LeMay Bursten Murphy Woodward Stoltzfus  
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**Chapter 7 Periodic Properties of the Elements**

7.1 Multiple-Choice Questions

- 1) In which set of elements would all members be expected to have very similar chemical properties?
1. A) O, S, Se
  2. B) N, O, F
  3. C) Na, Mg, K
  4. D) S, Se, Si
  5. E) Ne, Na, Mg

**Answer: A**

Diff: 1 Var: 1 Page Ref: Sec. 7.1

GO: G2

2) In which set of elements would all members be expected to have very similar chemical properties?

1. A) P, Se, I
2. B) Cl, Br, Na
3. C) Si, As, Te
4. D) Ne, Na, Mg 5. E) Br, I, At

**Answer: E**

Diff: 1 Var: 1 Page Ref: Sec. 7.1

GO: G2

3) Electrons in the 1s subshell are much closer to the nucleus in Ar than in He due to the larger \_\_\_\_\_ in Ar. 1. A) nuclear charge

2. B) paramagnetism
3. C) diamagnetism
4. D) Hund's rule
5. E) azimuthal quantum number

**Answer: A**

Diff: 1 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

- 4) Screening of the nuclear charge by core electrons in atoms is\_\_\_\_\_.
1. A) less efficient than that by valence electrons
  2. B) more efficient than that by valence electrons
  3. C) essentially identical to that by valence electrons
  4. D) responsible for a general decrease in atomic radius going down a group
  5. E) both essentially identical to that by valence electrons and responsible for a general decrease in atomic radius going down a group

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

- 5) The effective nuclear charge of an atom is primarily affected by\_\_\_\_\_.
1. A) inner electrons
  2. B) outer electrons
  3. C) nuclear charge
  4. D) electron distribution
  5. E) orbital radial probability

**Answer: A**

Diff: 3 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

6) The atomic radius of main-group elements generally increases down a group because\_\_\_\_\_.

1. A) effective nuclear charge increases down a group
2. B) effective nuclear charge decreases down a group
3. C) effective nuclear charge zigzags down a group
4. D) the principal quantum number of the valence orbitals increases
5. E) both effective nuclear charge increases down a group and the principal quantum number of the valence orbitals increases

**Answer: D**

Diff: 2 Var: 1 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

7) Atomic radius generally increases as we move\_\_\_\_\_.

1. A) down a group and from right to left across a period
2. B) up a group and from left to right across a period
3. C) down a group and from left to right across a period
4. D) up a group and from right to left across a period
5. E) down a group; the period position has no effect

**Answer: A**

Diff: 1 Var: 1 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

8) Atomic radius generally decreases as we move\_\_\_\_\_.

1. A) down a group and from right to left across a period
2. B) up a group and from left to right across a period
3. C) down a group and from left to right across a period
4. D) up a group and from right to left across a period
5. E) down a group; the period position has no effect

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

9) Of the following, which gives the correct order for atomic radius for Mg, Na, P, Si and Ar?

1. A)  $\text{Mg} > \text{Na} > \text{P} > \text{Si} > \text{Ar}$
2. B)  $\text{Ar} > \text{Si} > \text{P} > \text{Na} > \text{Mg}$
3. C)  $\text{Si} > \text{P} > \text{Ar} > \text{Na} > \text{Mg}$
4. D)  $\text{Na} > \text{Mg} > \text{Si} > \text{P} > \text{Ar}$
5. E)  $\text{Ar} > \text{P} > \text{Si} > \text{Mg} > \text{Na}$

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

10) Of the following, which gives the correct order for atomic radius for Ca, K, As, Ge and Kr?

1. A)  $\text{Ca} > \text{K} > \text{As} > \text{Ge} > \text{Kr}$
2. B)  $\text{Kr} > \text{Ge} > \text{As} > \text{K} > \text{Ca}$
3. C)  $\text{Ge} > \text{As} > \text{Kr} > \text{K} > \text{Ca}$
4. D)  $\text{K} > \text{Ca} > \text{Ge} > \text{As} > \text{Kr}$
5. E)  $\text{Kr} > \text{As} > \text{Ge} > \text{Ca} > \text{K}$

**Answer: D**

Diff: 1    Var: 1    Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

11) Of the compounds below, \_\_\_\_\_ has the smallest ionic separation.

1. A) KF
2. B)  $\text{K}_2\text{S}$
3. C) RbCl
4. D)  $\text{SrBr}_2$
5. E) RbF

**Answer: A**

Diff: 1    Var: 1    Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

12) Which of the following is an isoelectronic series?

1. A)  $B^{5-}$ ,  $Si^{4-}$ ,  $As^{3-}$ ,  $Te^{2-}$  2. B)  $F^-$ ,  $Cl^-$ ,  $Br^-$ ,  $I^-$  3. C) S, Cl, Ar, K
4. D)  $Si^{2-}$ ,  $P^{2-}$ ,  $S^{2-}$ ,  $Cl^{2-}$
5. E)  $O^{2-}$ ,  $F^-$ , Ne,  $Na^+$

**Answer: E**

Diff: 1 Var: 1 Page Ref: Sec. 7.3

LO: 7.3

GO: G2

13) Which isoelectronic series is correctly arranged in order of increasing radius?

1. A)  $K^+ < Ca^{2+} < Ar < Cl^-$  2. B)  $< Ar < K^+ < Ca^{2+}$
3. C)  $Ca^{2+} < Ar < K^+ < Cl^-$  4. D)  $Ca^{2+} < K^+ < Ar < Cl^-$
5. E)  $Ca^{2+} < K^+ < Cl^- < Ar$

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

14) Of the choices below, which gives the order for first ionization energies?

1. A)  $Cl > S > Al > Ar > Si$
2. B)  $Ar > Cl > S > Si > Al$
3. C)  $Al > Si > S > Cl > Ar$
4. D)  $Cl > S > Al > Si > Ar$
5. E)  $S > Si > Cl > Al > Ar$

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

15) Of the choices below, which gives the order for first ionization energies?

1. A) Kr > Se > Br > Ga > Ge
2. B) Kr > Br > Se > Ge > Ga
3. C) Ga > Br > Ge > Kr > Se
4. D) Ga > Ge > Se > Br > Kr
5. E) Br > Se > Ga > Kr > Ge

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

16) \_\_\_\_\_ have the lowest first ionization energies of the groups listed.

1. A) Alkali metals
2. B) Transition elements
3. C) Halogens
4. D) Alkaline earth metals
5. E) Noble gases

**Answer: A**

Diff: 1 Var: 1 Page Ref: Sec. 7.4



LO: 7.2, 7.3, 7.4, 7.5

GO: G2

17) Which of the following correctly represents the second ionization of aluminum?

1. A)  $\text{Al}^+(\text{g}) + \text{e}^- \rightarrow \text{Al}(\text{g})$
2. B)  $\text{Al}(\text{g}) \rightarrow (\text{g}) + \text{e}^-$  3. C)  $\text{Al}^-(\text{g}) + \text{e}^- \rightarrow \text{Al}^{2-}(\text{g})$
4. D)  $\text{Al}^+(\text{g}) + \text{e}^- \rightarrow \text{Al}^{2+}(\text{g})$
5. E)  $\text{Al}^+(\text{g}) \rightarrow \text{Al}^{2+}(\text{g}) + \text{e}^-$

**Answer: E**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

18) Which of the following correctly represents the third ionization of aluminum?

1. A)  $\text{Al}^{2+}(\text{g}) + \text{e}^- \rightarrow \text{Al}^+(\text{g})$
2. B)  $\text{Al}(\text{g}) \rightarrow \text{Al}^+(\text{g}) + \text{e}^-$  3. C)  $\text{Al}^{2-}(\text{g}) + \text{e}^- \rightarrow \text{Al}^{3-}(\text{g})$
4. D)  $\text{Al}^{2+}(\text{g}) + \text{e}^- \rightarrow \text{Al}^{3+}(\text{g})$
5. E)  $\text{Al}^{2+}(\text{g}) \rightarrow \text{Al}^{3+}(\text{g}) + \text{e}^-$

**Answer: E**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

19) Which of the following correctly represents the second ionization of phosphorus?

1. A)  $P^+(g) + e^- \rightarrow P^{2+}(g)$
2. B)  $P(g) \rightarrow P^+(g) + e^-$  3. C)  $P^-(g) + e^- \rightarrow P^{2-}(g)$
4. D)  $P^+(g) \rightarrow P^{2+}(g) + e^-$
5. E)  $P^+(g) + e^- \rightarrow P(g)$

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

20) Which equation correctly represents the first ionization of calcium?

1. A)  $Ca(g) \rightarrow Ca^+(g) + e^-$
2. B)  $Ca(g) \rightarrow Ca^-(g) + e^-$
3. C)  $Ca(g) + e^- \rightarrow Ca^-(g)$
4. D)  $Ca^-(g) \rightarrow Ca(g) + e^-$  5. E)  $Ca^+(g) + e^- \rightarrow Ca(g)$

**Answer: A**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.4 GO:

G2

21) Which of the following correctly represents the second ionization of calcium?

1. A)  $\text{Ca (g)} \rightarrow \text{Ca}^+ \text{(g)} + \text{e}^-$  2. B)  $\text{Ca}^+ \text{(g)} \rightarrow \text{Ca}^{2+} \text{(g)} + \text{e}^-$  3. C)  $\text{Ca}^-(\text{g}) + \text{e}^- \rightarrow \text{Ca}^{2-} \text{(g)}$
4. D)  $\text{Ca}^+(\text{g}) + \text{e}^- \rightarrow \text{Ca}^{2+} \text{(g)}$
5. E)  $\text{Ca}^+(\text{g}) + \text{e}^- \rightarrow \text{Ca (g)}$

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

22) Which of the following correctly represents the second ionization of copper?

1. A)  $\text{Cu (g)} \rightarrow \text{Cu}^+ \text{(g)} + \text{e}^-$  2. B)  $\text{Cu}^+(\text{g}) \rightarrow \text{Cu}^{2+} \text{(g)} + \text{e}^-$
3. C)  $\text{Cu}^-(\text{g}) + \text{e}^- \rightarrow \text{Cu}^{2-} \text{(g)}$
4. D)  $\text{Cu}^+(\text{g}) + \text{e}^- \rightarrow \text{Cu}^{2+} \text{(g)}$
5. E)  $\text{Cu}^+(\text{g}) + \text{e}^- \rightarrow \text{Cu (g)}$

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

23) Which ion below has the largest radius?

1. A)  $\text{Cl}^-$
2. B)  $\text{K}^+$

3. C) Br<sup>-</sup>
4. D) F<sup>-</sup>
5. E) Na<sup>+</sup>

**Answer: C**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.3

GO: G2

24) Of the following species, \_\_\_\_ has the largest radius.

1. A) Rb<sup>+</sup>
2. B) Sr<sup>2+</sup>
3. C) Br<sup>-</sup>
4. D) Kr
5. E) Ar

**Answer: C**

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.3 GO:

G2

*Consider the following electron configurations to answer the questions that follow:*

(i) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>1</sup>

(ii) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup>

(iii)  $1s^2 2s^2 2p^6 3s^2 3p^1$

(iv)  $1s^2 2s^2 2p^6 3s^2 3p^4$

(v)  $1s^2 2s^2 2p^6 3s^2 3p^5$

25) The electron configuration belonging to the atom with the highest second ionization energy is\_\_\_\_\_.

1. A) (i)
2. B) (ii)
3. C) (iii)
4. D) (iv)
5. E) (v)

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.4

L0: 7.2, 7.3, 7.4, 7.5

GO: G2

26) The electron configuration that belongs to the atom with the lowest second ionization energy is\_\_\_\_\_.

1. A) (i)
2. B) (ii)
3. C) (iii)
4. D) (iv)
5. E) (v)

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

27) The electron configuration of the atom with the most negative electron affinity is\_\_\_\_\_.

1. A) (i)
2. B) (ii)
3. C) (iii)
4. D) (iv)
5. E) (v)

**Answer: E**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

28) The electron configuration of the atom that is expected to have a positive electron affinity is \_\_\_\_\_.

1. A) (i)
2. B) (ii)
3. C) (iii)
4. D) (iv)
5. E) (v)

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

29) Of the following elements,\_\_\_\_\_has the most negative electron affinity.

1. A) S
2. B) Cl
3. C) Se
4. D) Br

5. E) I **Answer:B**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

30) Of the following elements,\_\_\_\_\_has the most negative electron affinity.

1. A) P
2. B) Al
3. C) Si
4. D) Cl
5. E) B

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

31) Of the following elements,\_\_\_\_\_has the most negative electron affinity.

1. A) O
2. B) K
3. C) B
4. D) Na 5. E) S

**Answer: E**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

32) Sodium is much more apt to exist as a cation than is chlorine. This is because \_\_\_\_\_.

1. A) chlorine is a gas and sodium is a solid
2. B) chlorine has a greater electron affinity than sodium does
3. C) chlorine is bigger than sodium
4. D) chlorine has a greater ionization energy than sodium does
5. E) chlorine is more metallic than sodium

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.5

GO: G2

33) Which equation correctly represents the electron affinity of calcium?

1. A)  $\text{Ca (g)} + e^- \rightarrow \text{Ca}^- \text{ (g)}$



2. B)  $\text{Ca (g)} \rightarrow \text{Ca}^+ \text{(g)} + \text{e}^-$
3. C)  $\text{Ca (g)} \rightarrow \text{Ca}^- \text{(g)} + \text{e}^-$  4. D)  $\text{Ca}^-(\text{g}) \rightarrow \text{Ca (g)} + \text{e}^-$
5. E)  $\text{Ca}^+(\text{g}) + \text{e}^- \rightarrow \text{Ca (g)}$

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.5

34) Which of the following correctly represents the electron affinity of bromine?

1. A)  $\text{Br (g)} \rightarrow \text{Br}^+ \text{(g)} + \text{e}^-$
2. B)  $\text{Br (g)} + \text{e}^- \rightarrow \text{Br}^- \text{(g)}$
3. C)  $\text{Br}_2(\text{g}) + \text{e}^- \rightarrow \text{Br}^- \text{(g)}$
4. D)  $\text{Br}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{Br}^- \text{(g)}$
5. E)  $\text{Br}^+(\text{g}) + \text{e}^- \rightarrow \text{Br (g)}$

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.5

GO: G2

35) Which of the following correctly represents the electron affinity of phosphorus?

1. A)  $\text{P (g)} \rightarrow \text{P}^+ \text{(g)} + \text{e}^-$
2. B)  $\text{P (g)} + \text{e}^- \rightarrow \text{P}^- \text{(g)}$
3. C)  $\text{P}_4(\text{g}) + \text{e}^- \rightarrow \text{P}^- \text{(g)}$
4. D)  $\text{P}_4(\text{g}) + 4\text{e}^- \rightarrow 4\text{P}^- \text{(g)}$
5. E)  $\text{P}^+(\text{g}) + \text{e}^- \rightarrow \text{P (g)}$

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.5

GO: G2

36) In the generation of most anions, the energy change (kJ/mol) that\_\_\_\_\_an electron is\_\_\_\_\_.

1. A) removes, positive
2. B) adds, positive
3. C) removes, negative
4. D) adds, negative
5. E) None of the above is correct.

**Answer: D**

Diff: 3 Var: 1 Page Ref: Sec. 7.5

LO: 7.5

37) Of the elements below,\_\_\_\_\_is the most metallic.

1. A) sodium
2. B) barium
3. C) magnesium
4. D) calcium
5. E) cesium

**Answer: E**

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

38) The list that correctly indicates the order of metallic character is\_\_\_\_\_.

1. A)  $B > N > C$
2. B)  $F > Cl > S$
3. C)  $Si > P > S$
4. D)  $P > S > Se$
5. E)  $Na > K > Rb$

**Answer: C**

Diff: 1    Var: 1    Page Ref: Sec. 7.6

LO: 7.6

GO: G2

39) The list that correctly indicates the order of metallic character is\_\_\_\_\_.

1. A)  $Sr > Ca > Mg$
2. B)  $F > Cl > Br$
3. C)  $C > Ge > Si$
4. D)  $Li > Na > K$
5. E)  $O > Se > S$

**Answer: A**

Diff: 1    Var: 1    Page Ref: Sec. 7.6

LO: 7.6

GO: G2

40) Of the elements below, \_\_\_\_\_ has the highest melting point.

1. A) Ca
2. B) K
3. C) Fe
4. D) Na
5. E) Ba

**Answer: C**

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

41) Of the following metals, \_\_\_\_\_ exhibits multiple oxidation states.

1. A) Al
2. B) Rb
3. C) Mg
4. D) Ni 5. E) Cs

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

42) Of the following oxides, \_\_\_\_\_ is the most acidic.

1. A) CaO
2. B) CO<sub>2</sub>
3. C) Al<sub>2</sub>O<sub>3</sub>
4. D) Li<sub>2</sub>O
5. E) Na<sub>2</sub>O

**Answer: B**

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

43) The acidity of carbonated water is due to the\_\_\_\_\_.

1. A) presence of sulfur
2. B) reaction of CO<sub>2</sub> and H<sub>2</sub>O
3. C) addition of acid
4. D) nonmetal oxides
5. E) none of the above

**Answer: B**

Diff: 3 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

44) The element in the periodic table that looks like a metal, is a poor thermal conductor, and acts as an electrical semiconductor is\_\_\_\_\_.

1. A) Sn
2. B) B
3. C) As
4. D) Si
5. E) Ge

**Answer: D**

Diff: 2 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

45) Transition metals within a period differ mainly in the number of \_\_\_\_\_ electrons.

1. A) s
2. B) p
3. C) d
4. D) f
5. E) all of the above

**Answer: C**

Diff: 3 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

46) Which one of the following compounds would produce an acidic solution when dissolved in water?

1. A) Na<sub>2</sub>O
2. B) CaO

3. C) MgO
4. D) CO<sub>2</sub>
5. E) SrO

**Answer: D**

Diff: 1    Var: 1    Page Ref: Sec. 7.6

LO: 7.6

GO: G2

47) Nonmetals can be \_\_\_\_\_ at room temperature.

1. A) solid, liquid, or gas
2. B) solid or liquid
3. C) solid only
4. D) liquid only
5. E) liquid or gas

**Answer: A**

Diff: 1    Var: 1    Page Ref: Sec. 7.6

LO: 7.6

GO: G2

48) Which of the following is not a characteristic of metals?

1. A) acidic oxides
2. B) low ionization energies
3. C) malleability
4. D) ductility

5. E) These are all characteristics of metals.

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

49) When two elements combine to form a compound, the greater the difference in metallic character between the two elements, the greater the likelihood that the compound will be\_\_\_\_\_.

1. A) a gas at room temperature
2. B) a solid at room temperature
3. C) metallic
4. D) nonmetallic
5. E) a liquid at room temperature

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

50) Alkaline earth metals\_\_\_\_\_.

1. A) have the smallest atomic radius in a given period
2. B) form monoanions
3. C) form basic oxides
4. D) exist as triatomic molecules
5. E) form halides with the formula MX

**Answer: C**



Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

51) Between which two elements is the difference in metallic character the greatest?

1. A) Rb and O
2. B) O and I
3. C) Rb and I
4. D) Li and O
5. E) Li and Rb

**Answer: A**

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

52) The oxide of which element below can react with hydrochloric acid?

1. A) sulfur
2. B) selenium
3. C) nitrogen
4. D) sodium
5. E) carbon

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

53) Consider the general valence electron configuration of  $ns^2np^5$  and the following statements:

(i) Elements with this electron configuration are expected to form -1 anions. (ii)

Elements with this electron configuration are expected to have large positive electron affinities.

(iii) Elements with this electron configuration are nonmetals.

(iv) Elements with this electron configuration form acidic oxides.

Which statements are true?

1. A) (i) and (ii)
2. B) (i), (ii), and (iii)
3. C) (ii) and (iii)
4. D) (i), (iii,) and (iv) 5. E) All statements are true.

Answer: D

Diff: 2 Var: 1 Page Ref: Sec. 7.6, 7.7

LO: 7.7

GO: G2

54) Which of the following traits characterizes the alkali metals?

1. A) very high melting point
2. B) existence as diatomic molecules

3. C) formation of dianions
4. D) the lowest first ionization energies in a period
5. E) the smallest atomic radius in a period

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

55) This element is more reactive than lithium and magnesium but less reactive than potassium. This element is\_\_\_\_\_.

1. A) Na
2. B) Rb
3. C) Ca
4. D) Be
5. E) Fr

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

56) Which one of the following is not true about the alkali metals?

1. A) They are low density solids at room temperature.
2. B) They all readily form ions with a +1 charge.
3. C) They all have 2 electrons in their valence shells.
4. D) They are very reactive elements.
5. E) They have the lowest first ionization energies of the elements.

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

57) Consider the following properties of an element:

- (i) It is solid at room temperature.
- (ii) It easily forms an oxide when exposed to air.
- (iii) When it reacts with water, hydrogen gas evolves.
- (iv) It must be stored submerged in oil.

Which element fits the above description the best?

1. A) sulfur
2. B) copper
3. C) mercury
4. D) sodium
5. E) magnesium

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

58) Which of the following generalizations cannot be made with regard to reactions of alkali metals? (The symbol M represents any one of the alkali metals.)

1. A)  $M (s) + O_2 (g) \rightarrow MO_2 (s)$
2. B)  $2M (s) + 2H_2O (l) \rightarrow 2MOH (aq) + H_2 (g)$
3. C)  $2M (s) + H_2 (g) \rightarrow 2MH (s)$
4. D)  $2M (s) + Cl_2 (g) \rightarrow 2MCl (s)$
5. E)  $2M (s) + S (s) \rightarrow M_2S (s)$

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

59) The reaction of alkali metals with oxygen produce\_\_\_\_\_.

1. A) oxides
2. B) peroxides
3. C) superoxides
4. D) all of the above
5. E) none of the above

Answer: D

Diff: 2 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

60) Alkali metals tend to be more reactive than alkaline earth metals because \_\_\_\_\_.

1. A) alkali metals have lower densities
2. B) alkali metals have lower melting points
3. C) alkali metals have greater electron affinities
4. D) alkali metals have lower ionization energies
5. E) Alkali metals are not more reactive than alkaline earth metals.

**Answer: D**

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

61) The alkali metal that is naturally radioactive is\_\_\_\_\_.

1. A) rubidium
2. B) cesium
3. C) lithium
4. D) francium
5. E) sodium

Answer: D

Diff: 2 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

62) Which one of the following beverages originally contained lithium salts?

1. A) Coca-Cola®
2. B) Pepsi-Cola®
3. C) Gatorade®
4. D) Kool-Aid®
5. E) Seven-Up®

Answer: E

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G7

63) The alkali metal that is used to treat manic-depressive illness is\_\_\_\_\_.

1. A) Na
2. B) K
3. C) Li
4. D) Rb
5. E) Cs

Answer: C

Diff: 2 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G7

64) Which alkaline earth metal will not react with liquid water or with steam?

1. A) Be

2. B) Mg
3. C) Ca
4. D) Ba
5. E) They all react with liquid water and with steam.

Answer: A

Diff: 2 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

65) Which element is solid at room temperature?

1. A) Cl<sub>2</sub>
2. B) F<sub>2</sub>
3. C) Br<sub>2</sub>
4. D) I<sub>2</sub>
5. E) H<sub>2</sub>

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

66) \_\_\_\_\_ is a unique element and does not truly belong to any family.

1. A) Nitrogen
2. B) Radium



3. C) Hydrogen
4. D) Uranium
5. E) Helium

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.8

67) Which of the following statements is not true for oxygen?

2. A) The most stable allotrope of oxygen is O<sub>2</sub>.
3. B) The chemical formula of ozone is O<sub>3</sub>.
4. C) Dry air is about 79% oxygen.
5. D) Oxygen forms peroxide and superoxide anions.
6. E) Oxygen is a colorless gas at room temperature.

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

68) Which one of the following elements has an allotrope that is produced in the upper atmosphere by lightning?

1. A) N
2. B) O
3. C) S
4. D) Cl
5. E) He

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

69) In nature, sulfur is most commonly found in\_\_\_\_\_.

1. A) pure elemental sulfur
2. B) sulfur oxides
3. C) metal sulfides
4. D) sulfuric acid
5. E) H<sub>2</sub>S

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.8

70) All of the halogens\_\_\_\_\_.

1. A) exist under ambient conditions as diatomic gases
2. B) tend to form positive ions of several different charges
3. C) tend to form negative ions of several different charges
4. D) exhibit metallic character
5. E) form salts with alkali metals with the formula MX

Answer: E

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

71) The noble gases were, until relatively recently, thought to be entirely unreactive. Experiments in the early 1960s showed that Xe could, in fact, form compounds with fluorine. The formation of compounds consisting of Xe is made possible by\_\_\_\_\_.

1. A) the availability of xenon atoms
2. B) xenon's noble gas electron configuration
3. C) the stability of xenon atoms
4. D) xenon's relatively low ionization energy
5. E) xenon's relatively low electron affinity

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

72) Of the following elements, which have been shown to form compounds?

Helium neon argon krypton xenon

1. A) xenon and argon
2. B) xenon only
3. C) xenon, krypton, and argon
4. D) xenon and krypton
5. E) None of the above can form compounds.

Answer: C

Diff: 2 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

73) In nature, the noble gases exist as\_\_\_\_\_.

1. A) monatomic gaseous atoms



2.

- B) the gaseous fluorides
- 3. C) solids in rocks and in minerals
- 4. D) alkali metal salts
- 5. E) the sulfides

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

74) Hydrogen is unique among the elements because\_\_\_\_\_.

- 1. It is not really a member of any particular group.
- 2. Its electron is not at all shielded from its nucleus.
- 3. It is the lightest element.
- 4. It is the only element to exist at room temperature as a diatomic gas.
- 5. It exhibits some chemical properties similar to those of groups 1A and 7A.
- 6. A) 1, 2, 3, 5
- 7. B) 1, 2, 3, 4, 5
- 8. C) 1, 4, 5
- 9. D) 3, 4 10. E) 2, 3, 4, 5

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.8

3.

LO: 7.8

GO: G2

75) Hydrogen is unique among the elements because\_\_\_\_\_.

1. It has only one valence electron.
2. It is the only element that can emit an atomic spectrum.  
Its electron is not at all shielded from its nucleus.
4. It is the lightest element.
5. It is the only element to exist at room temperature as a diatomic gas.
6. A) 1, 2, 3, 4, 5
7. B) 1, 3, 4
8. C) 1, 2, 3, 4
9. D) 2, 3, 4
- 10.E) 3, 4

Answer: E

Diff: 2    Var: 1    Page Ref: Sec. 7.8

LO: 7.7

GO: G2

76) Ozone is a a(n)\_\_\_\_\_of oxygen.

1. A) isotope
2. B) allotrope

4.

3. C) precursor
4. D) peroxide
5. E) free radical Answer: B

Diff: 3 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

77) Astatine has a(n) \_\_\_\_\_ density and a(n) \_\_\_\_\_ atomic radius compared to iodine.

1. A) greater; greater
2. B) smaller; greater
3. C) smaller; smaller
- D) greater; smaller
5. E) equal; equal

Answer: A

Diff: 4 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

78) Xenon has been shown to form compounds only when it is combined with \_\_\_\_\_.



5.

1. A) something with a tremendous ability to remove electrons from other substances
2. B) another noble gas
3. C) something with a tremendous ability to donate electrons to other substances
4. D) an alkali metal
- E) an alkaline earth

metal Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

## 7.2 Bimodal Questions

1) \_\_\_\_\_ is credited with developing the concept of atomic numbers.

1. A) Dmitri Mendeleev
2. B) Lothar Meyer
3. C) Henry Moseley
4. D) Ernest Rutherford
5. E) Michael Faraday

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.1

GO: G2

6.

2) Elements in the modern version of the periodic table are arranged in order of increasing\_\_\_\_\_.

1. A) oxidation number
2. B) atomic mass
3. C) average atomic mass
4. D) atomic number
5. E) number of isotopes

Answer: D

Diff: 1    Var: 1    Page Ref: Sec. 7.1

GO: G2

3) An electron in a \_\_\_\_\_ subshell experiences the greatest effective nuclear charge in a many-electron atom.

1. A) 3f
2. B) 3p
3. C) 3d
4. D) 3s 5. E) 4s

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

4) A tin atom has 50 electrons. Electrons in the \_\_\_\_\_ subshell experience the lowest effective nuclear charge.

1. A) 1s
2. B) 3p
3. C) 3d
4. D) 5s
5. E) 5p

Answer: E

Diff: 2 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

5) The first ionization energies of the elements \_\_\_\_\_ as you go from left to right across a period of the periodic table, and \_\_\_\_\_ as you go from the bottom to the top of a group in the table.

1. A) increase, increase
2. B) increase, decrease
3. C) decrease, increase
4. D) decrease, decrease
5. E) The first ionization energies of the elements are completely unpredictable.

Answer: A

Diff: 1                      Var: 1      Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

6) In general, as you go across a period in the periodic table from left to right:

(1) the atomic radius \_\_\_\_\_;

(2) the electron affinity becomes \_\_\_\_\_ negative; and

(3) the first ionization energy \_\_\_\_\_.

1. A) decreases, decreasingly, increases
2. B) increases, increasingly, decreases
3. C) increases, increasingly, increases
4. D) decreases, increasingly, increases
5. E) decreases, increasingly, decreases

Answer: D

Diff: 2 Var: 1 Page Ref: Sec. 7.5

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

7) The\_\_\_\_\_have the most negative electron affinities.

1. A) alkaline earth metals
2. B) alkali metals
3. C) halogens
4. D) transition metals
5. E) chalcogens

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.5

LO: 7.5

GO: G2

8) Element M reacts with chlorine to form a compound with the formula  $MCl_2$ . Element M is more reactive than magnesium and has a smaller radius than barium. This element is\_\_\_\_\_.

1. A) Sr
2. B) K
3. C) Na
4. D) Ra 5. E) Be

Answer: A

Diff: 2 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

9) Metals can be\_\_\_\_\_at room temperature.

1. A) liquid only
2. B) solid only
3. C) solid or liquid
4. D) solid, liquid, or gas
5. E) liquid or gas

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

10) Most of the elements on the periodic table are\_\_\_\_\_.

1. A) gases
2. B) nonmetals
3. C) metalloids
4. D) liquids
5. E) metals

Answer: E

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

11) Na reacts with element X to form an ionic compound with the formula  $\text{Na}_3\text{X}$ .  
Ca will react with X to form\_\_\_\_\_.

1. A)  $\text{CaX}_2$
2. B)  $\text{CaX}$
3. C)  $\text{Ca}_2\text{X}_3$
4. D)  $\text{Ca}_3\text{X}_2$
5. E)  $\text{Ca}_3\text{X}$

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

12) Ca reacts with element X to form an ionic compound with the formula CaX. Al will react with X to form\_\_\_\_\_.

1. A) AlX<sub>2</sub>
2. B) AlX
3. C) Al<sub>2</sub>X<sub>3</sub>
4. D) Al<sub>3</sub>X<sub>2</sub>
5. E) Al<sub>3</sub>X

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

13) Oxides of the active metals combine with water to form\_\_\_\_\_.

1. A) metal hydroxides
2. B) metal hydrides
3. C) hydrogen gas
4. D) oxygen gas
5. E) water and a salt

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2



14) Oxides of the active metals combine with acid to form\_\_\_\_\_.

1. A) hydrogen gas
2. B) metal hydrides
3. C) water and a salt
4. D) oxygen gas
5. E) metal hydroxides

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

15) Oxides of most nonmetals combine with water to form\_\_\_\_\_.

1. A) an acid
2. B) a base
3. C) water and a salt
4. D) water
5. E) hydrogen gas

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

16) Oxides of most nonmetals combine with base to form\_\_\_\_\_.

1. A) hydrogen gas
2. B) an acid
3. C) a base
4. D) water
5. E) water and a salt

Answer: E

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

17) An alkaline earth metal forms a compound with oxygen with the formula

\_\_\_\_\_.

(The symbol M represents any one of the alkaline earth metals.)

1. A) MO
2. B) M<sub>2</sub>O
3. C) MO<sub>2</sub>
4. D) M<sub>2</sub>O<sub>2</sub>
5. E) MO<sub>3</sub>

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

18) An alkali metal forms a compound with chlorine with the formula

\_\_\_\_\_. (The symbol M represents any one of the alkali metals.)

1. A)  $M_2Cl_2$
2. B)  $M_2Cl$
3. C)  $MCl_2$  4. D)  $MCl$
5. E)  $MCl_3$

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

19) What is the coefficient of M when the following equation is completed and balanced if M is an alkali metal?



1. A) 1
2. B) 2
3. C) 3
4. D) 4
5. E) 0

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

20) The substance \_\_\_\_\_ is always produced when an active metal reacts with water.

1. A) NaOH
2. B) H<sub>2</sub>O
3. C) CO<sub>2</sub>
4. D) H<sub>2</sub>
5. E) O<sub>2</sub>

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

21) The reaction of potassium metal with elemental hydrogen produces\_\_\_\_\_.

1. A) KH
2. B) KH<sub>2</sub>
3. C) K<sub>2</sub>H
4. D) None of the above; potassium will not react directly with hydrogen.
5. E) KOH

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

22) What is the coefficient of H<sub>2</sub>O when the following equation is completed and balanced?



1. A) 1
2. B) 2
3. C) 3
4. D) 5
5. E) Ba(s) does not react with H<sub>2</sub>O (l).

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

23) The element(s)\_\_\_\_\_could be used to produce a red or crimson color in fireworks.

1. A) Mg or Ba
2. B) Sr
3. C) Ca, Sr, or Li
4. D) Ba 5. E) Na or K

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

24) Element X reacts with chlorine to form a compound with the formula  $\text{XCl}_2$ . The oxide of element X is basic. Element X is\_\_\_\_\_.

1. A) Rb
2. B) Ca
3. C) Al
4. D) P
5. E) H Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

25) The reaction of a metal with a nonmetal produces a(n)\_\_\_\_\_.

1. A) base
2. B) salt
3. C) acid
4. D) oxide
5. E) hydroxide

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

26) Which nonmetal exists as a diatomic solid?

1. A) bromine
2. B) antimony
3. C) phosphorus
4. D) iodine
5. E) boron

Answer: D

Diff: 3 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

27) The most common and stable allotrope of sulfur is\_\_\_\_\_.

1. A) S
2. B) S<sub>2</sub>
3. C) S<sub>4</sub>
4. D) S<sub>8</sub>
5. E) Sulfur does not form allotropes.

Answer: D

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

28) Which group 6A element is a metal?

1. A) tellurium and polonium
2. B) sulfur
3. C) selenium
4. D) tellurium 5. E) polonium

Answer: E

Diff: 2 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

29) The most common sulfur ion has a charge of\_\_\_\_\_.

1. A) 2-
2. B) 1-
3. C) 4+
4. D) 6+
5. E) Sulfur does not form ions.

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

30) The element phosphorus exists in two forms in nature called white phosphorus and red phosphorus. These two forms are examples of\_\_\_\_\_.

1. A) isotopes



2. B) allotropes
3. C) oxidation
4. D) metalloids
5. E) noble gases

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

31) Which periodic table group contains only nonmetals?

1. A) 8A
2. B) 2A
3. C) 6A
4. D) 7A
5. E) 5A

Answer: A

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

32) Which periodic table group contains only metals?

1. A) 8A
2. B) 2A

3. C) 6A
4. D) 7A
5. E) 5A

Answer: B

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

33) Of the hydrogen halides, only \_\_\_\_\_ is a weak acid.

1. A) HCl (aq)
2. B) HBr (aq)
3. C) HF (aq)
4. D) HI (aq)
5. E) They are all weak acids.

Answer: C

Diff: 2 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

34) All the elements in group 8A are gases at room temperature. Of all the groups in the periodic table, only group \_\_\_\_\_ contains examples of elements that are gas, liquid, and solid at room temperature.

1. A) 2A
2. B) 1A
3. C) 7A

4. D) 5A

5. E) 6A

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

35) The only noble gas that does not have the  $ns^2np^6$  valence electron configuration is\_\_\_\_\_.

1. A) radon

2. B) neon

3. C) helium

4. D) krypton

5. E) All noble gases have the  $ns^2np^6$  valence electron configuration.

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

36) The first noble gas to be incorporated into a compound was \_\_\_\_\_.

1. A) Ar

2. B) Kr

3. C) He

4. D) Ne 5. E) Xe

Answer: E

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

37) Of the halogens, which are gases at room temperature and atmospheric pressure?

1. A) fluorine, bromine, and iodine
2. B) fluorine, chlorine, and bromine
3. C) fluorine, chlorine, bromine, and iodine
4. D) fluorine, chlorine, and iodine
5. E) fluorine and chlorine

Answer: E

Diff: 2 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

38)  $2F_2(g) + 2H_2O(l) \rightarrow$  \_\_\_\_\_

1. A)  $2HF(aq) + 2HFO(aq)$
2. B)  $2F^-(aq) + 2H^+(aq) + H_2O_2(aq)$
3. C)  $4HF(aq) + O_2(g)$
4. D)  $2HF_2(aq) + 2OH^-(aq)$
5. E)  $4HF(aq) + 2O_2^-(aq)$

Answer: C

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

39)  $\text{Cl}_2 (\text{g}) + \text{H}_2\text{O} (\text{l}) \rightarrow \underline{\hspace{2cm}}$

1. A)  $\text{HCl} (\text{aq}) + \text{HOCl} (\text{aq})$
2. B)  $2\text{Cl} (\text{aq}) + \text{H}_2\text{O} (\text{l})$
3. C)  $2\text{HCl} (\text{aq}) + \text{O}_2 (\text{g})$
4. D)  $2\text{HCl} (\text{aq}) + \text{O}_2 (\text{g})$
5. E)  $\text{Cl}_2 (\text{aq}) + \text{H}_2\text{O} (\text{l})$

Answer: A

Diff: 2    Var: 1    Page Ref: Sec. 7.8

LO: 7.8

GO: G2

### 7.3 Algorithmic Questions

1) Which element would be expected to have chemical and physical properties closest to those of rubidium?

1. A) Cu
2. B) Fe
3. C) S
4. D) Ca
5. E) K

Answer: E

Diff: 1    Var: 6    Page Ref: Sec. 7.1

GO: G2

2) In which orbital does an electron in a nitrogen atom experience the greatest shielding?

1. A) 3p
2. B) 3s
3. C) 2p
4. D) 2s
5. E) 1s

Answer: C

Diff: 2

Var: 6 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

3) In which orbital does an electron in a copper atom experience the greatest effective nuclear charge?

1. A) 1s
2. B) 4s
3. C) 4p
4. D) 4d
5. E) 3d

Answer: A

Diff: 2 Var: 7 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

4) In which of the following atoms is the 3s orbital closest to the nucleus?

1. A) S
2. B) Po
3. C) Te
4. D) Se
5. E) P

Answer: B

Diff: 1 Var: 5 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

5) \_\_\_\_\_ is isoelectronic with helium.

1. A) H<sup>-</sup>
2. B) H<sup>+</sup>
3. C) H
4. D) B<sup>3-</sup>
5. E) N<sup>3-</sup>

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.3

LO: 7.3

GO: G2

6) \_\_\_\_\_ is isoelectronic with krypton.



1. A)  $\text{Se}^{2-}$
2. B)  $\text{Se}^{3-}$
3. C) Br
4. D)  $\text{Se}^{2+}$
5. E)  $\text{Te}^{2-}$

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.3

LO: 7.3

GO: G2

7) \_\_\_\_\_ is isoelectronic with argon.

1. A)  $\text{Cl}^-$
2. B)  $\text{P}^{4-}$
3. C) Ca
4. D)  $\text{K}^-$
5. E)  $\text{F}^-$

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.3

LO: 7.3

GO: G2

8) \_\_\_\_\_ is isoelectronic with scandium.

1. A)  $\text{Cr}^{3+}$
2. B)  $\text{Mn}^{5+}$
3. C) Mn
4. D)  $\text{Mn}^{4-}$
5. E)  $\text{K}^+$

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.3

LO: 7.3

GO: G2

9) \_\_\_\_\_ is isoelectronic with argon, and \_\_\_\_\_ is isoelectronic with neon.

1. A)  $\text{P}^{3-}$ ,  $\text{N}^{3-}$
2. B)  $\text{P}^{2-}$ ,  $\text{N}^{2-}$
3. C)  $\text{P}^{3+}$ ,  $\text{N}^{3+}$
4. D)  $\text{N}^{3-}$ ,  $\text{P}^{3-}$
5. E) P, N

Answer: A

Diff: 1 Var: 5 Page Ref: Sec. 7.3

LO: 7.3

GO: G2

10) Which one of the following atoms has the largest radius?

1. A) In
2. B) Sn
3. C) Sb
4. D) Te
5. E) I

Answer: A

Diff: 1 Var: 4 Page Ref: Sec. 7.3

LO: 7.3

GO: G2

11) Which one of the following atoms has the largest radius?

1. A) As
2. B) O
3. C) Sn
4. D) Cs 5. E) Ca

Answer: D

Diff: 1 Var: 6 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

12) Which one of the following has the smallest radius?

1. A) Na
2. B) Al
3. C) K
4. D) Ca

Answer: B

Diff: 1 Var: 5 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

13) Which of the following correctly lists the five atoms in order of increasing size (smallest to largest)?

1. A)  $\text{Ge} < \text{Si} < \text{S} < \text{O} < \text{Ne}$
2. B)  $\text{Ne} < \text{O} < \text{S} < \text{Si} < \text{Ge}$
3. C)  $\text{Ne} < \text{S} < \text{O} < \text{Si} < \text{Ge}$
4. D)  $\text{Ne} < \text{Si} < \text{O} < \text{S} < \text{Ge}$
5. E)  $\text{Ne} < \text{Ge} < \text{Si} < \text{S} < \text{O}$

Answer: B

Diff: 1 Var: 3 Page Ref: Sec. 7.3

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

14) The ion with the smallest diameter is \_\_\_\_\_.

1. A) Li<sup>+</sup>
2. B) Na<sup>+</sup> 3. C) K<sup>+</sup>
4. D) Rb<sup>+</sup>
5. E) Cs<sup>+</sup>

Answer: A

Diff: 1 Var: 5 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

15) The ion with the largest diameter is\_\_\_\_\_.

1. A) Po<sup>2-</sup>
2. B) S<sup>2-</sup>
3. C) Se<sup>2-</sup> 4. D) Te<sup>2-</sup>
5. E) O<sup>2-</sup>

Answer: A

Diff: 1 Var: 5 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

16) Of the following atoms, which has the largest first ionization energy?

1. A) K
2. B) Rb

3. C) Sr
4. D) Ca
5. E) Ba

Answer: D

Diff: 1 Var: 6 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

17) Which of the following has the largest second ionization energy?

1. A) Si
2. B) Mg
3. C) Al
4. D) Na 5. E) P

Answer: D

Diff: 2 Var: 4 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

18) Which equation correctly represents the third ionization of aluminum?

1. A)  $\text{Al}^{2+}(\text{g}) \rightarrow \text{Al}^{3+}(\text{g}) + \text{e}^-$
2. B)  $\text{Al}(\text{g}) \rightarrow \text{Al}^+(\text{g}) + \text{e}^-$  3.  
C)  $\text{Al}^{2-}(\text{g}) \rightarrow \text{Al}^{3-}(\text{g}) + \text{e}^-$
4. D)  $\text{Al}^{3+}(\text{g}) + \text{e}^- \rightarrow \text{Al}^{2+}(\text{g})$
5. E)  $\text{Al}^+(\text{g}) \rightarrow \text{Al}^{2+}(\text{g}) + \text{e}^-$

Answer: A

Diff: 1 Var: 3 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

19) Which equation correctly represents the first ionization of phosphorous?

1. A)  $\text{P}(\text{g}) \rightarrow \text{P}^+(\text{g}) + \text{e}^-$  2.
- B)  $\text{P}^+(\text{g}) \rightarrow \text{P}^{2+}(\text{g}) + \text{e}^-$
3. C)  $\text{P}(\text{g}) \rightarrow \text{P}^-(\text{g}) + \text{e}^-$  4.
- D)  $\text{P}^+(\text{g}) + \text{e}^- \rightarrow \text{P}(\text{g})$
5. E)  $\text{P}^{2+}(\text{g}) \rightarrow \text{P}^{3+}(\text{g}) + \text{e}^-$

Answer: A

Diff: 1 Var: 3 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

20) Which equation correctly represents the first ionization of copper?

1. A)  $\text{Cu(g)} \rightarrow \text{Cu}^+(\text{g}) + \text{e}^-$
2. B)  $\text{Cu}^+(\text{g}) \rightarrow \text{Cu}^{2+}(\text{g}) + \text{e}^-$
3. C)  $\text{Cu(g)} \rightarrow \text{Cu}^-(\text{g}) + \text{e}^-$
4. D)  $\text{Cu}^+(\text{g}) + \text{e}^- \rightarrow \text{Cu(g)}$
5. E)  $\text{Cu}^{2+}(\text{g}) \rightarrow \text{Cu}^{3+}(\text{g}) + \text{e}^-$

Answer: A

Diff: 1    Var: 3    Page Ref: Sec. 7.4

LO: 7.4

GO: G2

21) Of the following elements, \_\_\_\_\_ has the most negative electron affinity.

1. A) F
2. B) Cl
3. C) Br
4. D) H
5. E) I

Answer: A

Diff: 1    Var: 5    Page Ref: Sec. 7.5

LO: 7.5

GO: G2

22) Which one of the following is a metalloid?



1. A) Si
2. B) S
3. C) Cl
4. D) In
5. E) Li

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.6

LO: 7.6

GO: G2

23) Which one of the following is a metal?

1. A) Li
2. B) S
3. C) I
4. D) He
5. E) Si

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.6

LO: 7.6

GO: G2

24) Of the elements below, \_\_\_\_\_ is the most metallic.

1. A) Sn

2. B) P
3. C) Br
4. D) Rn 5. E) As

Answer: A

Diff: 1 Var: 5 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

25) Of the elements below, \_\_\_\_\_ is the least metallic.

1. A) Ne
2. B) F
3. C) Cl
4. D) O
5. E) S

Answer: A

Diff: 1 Var: 5 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

26) Of the following metals, \_\_\_\_\_ exhibits multiple oxidation states.

1. A) Ni 2.  
B) K
3. C) Ca
4. D) Al

5. E) Sr

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.6

LO: 7.6

GO: G2

27) Bromine is much more apt to exist as an anion than is potassium.  
This is because

\_\_\_\_\_.

1. A) Bromine has a greater electron affinity than potassium does
2. B) Bromine is bigger than potassium
3. C) Bromine has a greater ionization energy than potassium does
4. D) Bromine is a liquid and potassium is a solid
5. E) Bromine is more metallic than potassium

Answer: A

Diff: 1 Var: 3 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

28) All of the following are ionic compounds except\_\_\_\_\_.

1. A) CH<sub>4</sub>
2. B) K<sub>2</sub>O

3. C)  $\text{Be}(\text{OH})_2$
4. D)  $\text{NiCl}_2$
5. E)  $\text{Sr}_3\text{N}_2$

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

29) Which one of the following compounds produces a basic solution when dissolved in water?

1. A)  $\text{Rb}_2\text{O}$
2. B)  $\text{SO}_2$
3. C)  $\text{OBr}_2$
4. D)  $\text{ZnCl}_2$
5. E)  $\text{N}_2$

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

30) Element M reacts with oxygen to form an oxide with the formula  $\text{MO}$ . When  $\text{MO}$  is dissolved in water, the resulting solution is basic. Element M could be\_\_\_\_\_.

1. A) strontium
2. B) bromine
3. C) selenium

4. D) germanium
5. E) nitrogen

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

31) This element reacts with hydrogen to produce a gas with the formula HX. When dissolved in water, HX forms an acidic solution. X is\_\_\_\_\_.

1. A) chlorine
2. B) calcium
3. C) oxygen
4. D) germanium
5. E) arsenic

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

32) Element M reacts with oxygen to form an oxide with the formula  $M_2O$ . When  $M_2O$  is dissolved in water, the resulting solution is basic. Element M could be \_\_\_\_\_.

1. A) calcium
2. B) bromine

3. C) oxygen
4. D) carbon
5. E) nitrogen

Answer: A

Diff: 1 Var: 50+ Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

#### 7.4 Short Answer Questions

- 1) The degree of interaction between two electrical charges depends on the \_\_\_\_\_ and the \_\_\_\_\_ of the charges and the distance between them.

Answer: signs, magnitude

Diff: 3 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

- 2) As successive electrons are removed from an element, the ionization energy \_\_\_\_\_.

Answer: increases

Diff: 2 Var: 1 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

3) Which noble gas has the highest first ionization energy? Answer: helium

Diff: 2 Var: 1 Page Ref: Sec. 7.4

LO: 7.2, 7.3, 7.4, 7.5

GO: G2

4) When electrons are removed from a lithium atom, they are removed first from which orbital?

Answer: 2s<sup>1</sup>

Diff: 2 Var: 1 Page Ref: Sec. 7.4

LO: 7.3

GO: G2

5) An added electron to the element bromine goes into which orbital?

Answer: 4p

Diff: 2 Var: 1 Page Ref: Sec. 7.5

LO: 7.3

GO: G2

6) Write the balanced reaction between zinc oxide and sulfuric acid. Answer:  $\text{ZnO} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\text{O}$

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

7) What are the elements called that are located between the metals and nonmetals?

Answer: metalloids

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

8) Complete the following:  $\text{P}_4\text{O}_{10} + 6\text{H}_2\text{O} \rightarrow$

Answer:  $4\text{H}_3\text{PO}_4$

Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

9) Which metal is a liquid at room temperature? Answer: Mercury (Hg)



Diff: 1 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

10) [Xe]6s<sup>2</sup> is the electron configuration for

\_\_\_\_\_. Answer: barium

Diff: 2 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

11) [Kr]5s<sup>2</sup> is the electron configuration for\_\_\_\_\_.

Answer: strontium

Diff: 2 Var: 1 Page Ref: Sec. 7.6

LO: 7.6

GO: G2

12) In their compounds, the charges on the alkali metals and the alkaline earth metals are \_\_\_\_\_ and \_\_\_\_\_, respectively.

Answer: 1+, 2+

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

13) Which alkali metals can react with oxygen to form either the peroxide or the superoxide?

Answer: K, Rb, and Cs

Diff: 1 Var: 1 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

14) Write the balanced equation for the reaction of potassium with water. Answer:  $2\text{K (s)} + 2\text{H}_2\text{O (l)} \rightarrow 2\text{KOH (aq)} + \text{H}_2 \text{ (g)}$

Diff: 3 Var: 1 Page Ref: Sec. 7.7

LO: 7.7, 7.8

GO: G2

15) Of the alkaline earth metals, which two elements are the least reactive?

Answer: Be and Mg

Diff: 3 Var: 1 Page Ref: Sec. 7.7

LO: 7.7

GO: G2

16) Write the balanced equation for the reaction of elemental fluorine with liquid water.

Answer:  $2\text{H}_2\text{O} (\text{l}) + 2\text{F}_2 (\text{g}) \rightarrow 4\text{HF} (\text{aq}) + \text{O}_2 (\text{g})$

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

17) Write the balanced equation for the reaction of elemental chlorine with liquid water.

Answer:  $\text{Cl}_2 (\text{g}) + \text{H}_2\text{O} (\text{l}) \rightarrow \text{HCl} (\text{aq}) + \text{HOCl} (\text{aq})$

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

18) List seven nonmetals that exist as diatomic molecules in their elemental forms. Answer: hydrogen, oxygen, nitrogen, fluorine, chlorine, bromine, iodine

Diff: 2 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

19) All of the group VIA elements are solids except \_\_\_\_\_. Answer: oxygen

Diff: 2 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

20) Which noble gas has the lowest first ionization energy? Answer: radon

Diff: 3 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2

### 7.5 True/False Questions

1) The effective nuclear charge acting on an electron is larger than the actual nuclear charge.

Answer: FALSE

Diff: 1 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

2) The effective nuclear charge in an atom is proportional to the number of nuclear protons.

Answer: FALSE

Diff: 3 Var: 1 Page Ref: Sec. 7.2

LO: 7.2

GO: G2

3) The atomic radius of iodine is one-half the distance separating the iodine nuclei.

Answer: TRUE

Diff: 1 Var: 1 Page Ref: Sec. 7.3

LO: 7.3

GO: G2

4) A group of ions all containing the same number of electrons constitutes an isoelectronic series.

Answer: TRUE

Diff: 1 Var: 1 Page Ref: Sec. 7.3

LO: 7.3

GO: G2

5) Elements that readily conduct electricity are elements with low ionization energies.

Answer: TRUE

Diff: 2 Var: 1 Page Ref: Sec. 7.4

LO: 7.4

GO: G2

6) Electron affinity measures how easily an atom gains an electron. Answer: TRUE

Diff: 2 Var: 1 Page Ref: Sec. 7.5

LO: 7.5

GO: G2

7) Xenon can form compounds with fluorine. Answer: TRUE

Diff: 1 Var: 1 Page Ref: Sec. 7.8

LO: 7.8

GO: G2