

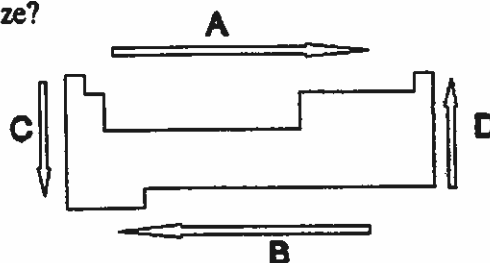
**Project Advance Chemistry 106 Sample Questions
on Material in *General Chemistry*, Brown, LeMay, and Bursten, 6th ed.**

Chapter 7. Periodic Properties of the Elements

1. Which scientist was responsible for showing that the periodic table was arranged most logically by atomic number?
 - (a) Bohr
 - (b) Mendeleev
 - (c) Meyer
 - (d) Moseley
 - (e) Rutherford
2. The 1s subshell is much closer to the nucleus in argon than in helium due to
 - (a) nuclear charge
 - (b) paramagnetism
 - (c) diamagnetism
 - (d) Hund's rule
 - (e) the azimuthal quantum number, l
3. Screening by valence electrons for representative elements is
 - (a) less efficient than that by core electrons.
 - (b) more efficient than that by core electrons.
 - (c) essentially identical to that by core electrons.
 - (d) responsible for a general increase in atomic radius going across a period.
 - (e) *both* more efficient than that by core electrons *and* responsible for a general increase in atomic radius going across a period.
4. Atomic radius for the main-group elements generally increases down a group because
 - (a) the effective nuclear charge increases down a group.
 - (b) the effective nuclear charge decreases down a group.
 - (c) the effective nuclear charge zigzags down a group.
 - (d) the principal quantum number of the valence orbitals increases.
 - (e) *both* the effective nuclear charge increases down a group *and* the principal quantum number of the valence orbitals increases.
5. Which one of the following atoms has the largest radius?
 - (a) oxygen
 - (b) fluorine
 - (c) sulfur
 - (d) chlorine
 - (e) none of these.

6. Which set of arrows corresponds to increasing atomic size?

- (a) A,D (b) C,B
(c) C,B (d) B,D
(e) not enough information to determine answer.

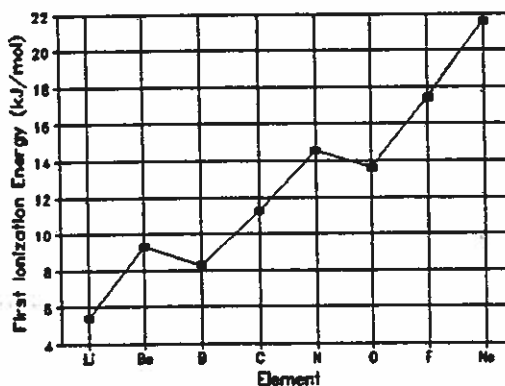


7. At which value n of ionization energy I_n does a graph of I_n plotted as a function of n suddenly get very large for carbon?

- (a) 1 (b) 2
(c) 3 (d) 4
(e) 5

8. The graph of $I_1 = f(\text{element})$ below shows $I_1(\text{Boron}) < I_1(\text{Beryllium})$. The key concept explaining why is

- (a) paramagnetism.
(b) $2p$ electrons penetrate the $1s^2$ core less than do $2s$ electrons.
(c) degeneracy.
(d) repulsion of paired electrons in the p^4 configuration.
(e) effective nuclear charge.



9. 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.

- (a) increase, increase
(b) increase, decrease
(c) decrease, increase
(d) decrease, decrease
(e) remain the same.

10. Which one of the following elements has the largest *first* ionization energy?

- (a) Na
- (b) Al
- (c) Se
- (d) Cl
- (e) Cs

11. Which one of the following elements has the largest *second* ionization energy?

- (a) K
- (b) Rb
- (c) Sr
- (d) Ca
- (e) H

12. Which one of the following elements has the largest *third* ionization energy?

- (a) As
- (b) Sc
- (c) Ti
- (d) Ca

13. The trend for electron affinity going from left to right across a period of main group elements is best described as

- (a) becoming linearly more exothermic.
- (b) becoming linearly less exothermic.
- (c) becoming generally more exothermic, but with considerable interruptions due to electron-configuration effects.
- (d) becoming generally less exothermic, but with considerable interruptions due to electron-configuration effects.
- (e) remaining essentially constant.

14. Which one of the following elements has the largest (most exothermic) electron affinity?

- (a) S
- (b) Cl
- (c) Se
- (d) Br
- (e) Na

15. In general, as one goes across a period from left to right in the periodic table, the atomic radius _____, the exothermicity of the electron affinity _____, and the first ionization energy _____.

- (a) decreases, decreases, increases
- (b) increases, increases, decreases
- (c) increases, increases, increases
- (d) decreases, increases, increases
- (e) decreases, decreases, decreases

16. The expected formula of germanium fluoride is

- (a) GeF_2
- (b) Ge_2F
- (c) Ge_4F
- (d) GeF_4
- (e) GeF_7

17. Which one of the following is a transition metal?

- (a) V
- (b) Rb
- (c) Al
- (d) Be
- (e) Te

18. Which one of the following is a metalloid?

- (a) Ge
- (b) S
- (c) Br
- (d) Pb
- (e) Cs

19. Which one of the following is most metallic?

- (a) Na
- (b) Mg
- (c) Al
- (d) K
- (e) At

20. In the following list, the element with the *highest* melting point is

- (a) Ca
- (b) K
- (c) Sc
- (d) Na
- (e) H

21. All of the following are ionic compounds except

- (a) K_2O
- (b) Na_2SO_4
- (c) SiO_2
- (d) Li_3N
- (e) CsCl

22. Which one of these oxides is most basic?

- (a) K_2O
- (b) Al_2O_3
- (c) CO_2
- (d) MgO
- (e) SO_3

23. Which one of the following metal oxides has both acidic and basic properties?

- (a) Na_2O
- (b) Al_2O_3
- (c) CaO
- (d) MgO
- (e) RaO

24. Which of the following oxides is most acidic?

- (a) CO_2
- (b) SiO_2
- (c) Al_2O_3
- (d) SO_2
- (e) Rb_2O

25. Which of the following traits characterizes the alkali metals?

- (a) very high melting point
- (b) existence as diatomic molecules
- (c) common formation of dianions
- (d) the lowest I_1 values of the elements in each period
- (e) the smallest atom in each period

26. Which one of the following substances is *always* produced when an active metal reacts with water?

- (a) H_2O
- (b) H_2
- (c) CO_2
- (d) NaOH
- (e) O_2

27. Which Group 6A element is most metallic in character?

- (a) oxygen
- (b) sulfur
- (c) selenium
- (d) tellurium
- (e) polonium

28. Which one of the following elements has an allotropic form that is produced in the upper atmosphere by lightning?

- (a) nitrogen
- (b) hydrogen
- (c) oxygen
- (d) sulfur
- (e) chlorine

29. Which element is expected to be chemically *most* similar to phosphorus?

- (a) S (b) As
(c) Se (d) Sb
(e) Si

30. Which of the following statements is correct?

- (a) Na is an alkali earth metal.
(b) Ti is a representative element.
(c) Sn is a transition element.
(d) Ba is an alkali metal.
(e) Br is a halogen.

31. The most probable arrangement of the *valence* electrons in the ground state electronic configurations of several Lanthanide (inner transition) elements are shown below. Which two of these elements would be expected to have the most stable +2 oxidation states. [Hint: For the cations of the Lanthanide elements the 4*f* orbitals are of lower energy than the 6*s* orbital.]

Lanthanum	La:	$6s^25d^1$
Cerium	Ce:	$6s^24f^2$
Praesodymium	Pr:	$6s^24f^3$
Europium	Eu:	$6s^24f^7$
Gadolinium	Gd:	$6s^24f^75d^1$
Dysprosium	Dy:	$6s^24f^{10}$
Erbium	Er:	$6s^24f^{12}$
Thulium	Tm:	$6s^24f^{13}$
Ytterbium	Yb:	$6s^24f^{14}$
Lutetium	Lu:	$6s^24f^{14}5d^1$

- (a) La and Lu
(b) Ce and Tm
(c) Pr and Er
(d) Eu and Yb
(e) Gd and Dy