Chapter 5 Chemical Periodicity

Class:_____ **Number:**_____ **Name:**_____

( ) 1. Accordingly to the periodic law the properties of elements repeat at regular intervals when the elements are arranged in order of

(a) their increasing atomic mass. **(b) their increasing number of neutrons in the nucleus.**
(c) their increasing atomic size. **(d) their increasing number of isotopes.**
(e) their increasing number of protons in the nucleus.

( ) 2. Which electrons have the greatest influence on the properties of elements?

(a) those electrons in *s* orbitals **(b) those electrons in *d* orbitals**
(c) core electrons **(d) the outermost electrons** **(e) none of these**

( ) 3.Of the following, which element does **not** match its designation?

(a) $_{38}$Sr representative metal **(b) $_{49}$In representative nonmetal**
(c) $_{14}$Si metalloid **(d)$_{42}$Mo *d*-transition metal** **(e) $_{90}$Th *f*-transition metal**

( ) 4.Which of the following is **not** a representative element?

(a) Cl **(b) Sr** **(c) Co** **(d) K** **(e) N**

( )5. What would be the outer electron configuration of group VIA (O, S, Se, . . .)?

(a) ns^2np^6 **(b) ns^2np^2** **(c) ns^2np^4** **(d) np^6** **(e) ns^0np^6**

( )6. Which of the following statements is **false**?

(a) The effective nuclear charge experienced by an electron in an outer shell is less than than the actual nuclear charge.
(b) Within a family (vertical group in the periodic table) of representative elements atomic radii increase from top to bottom.
(c) Electrons in inner shells screen, or shield, electrons in outer shells from the full effect of the nuclear charge.
(d) The atomic radii of representative elements decrease from left to right across a period (horizontal row in the periodic table).
(e) Transition elements have larger atomic radii than the preceding IA and IIA elements in the same period because transition elements have electrons in their *d* orbitals.

( )7. Which element has the **largest** atomic radius?

(a) Al **(b) Si** **(c) P** **(d) S** **(e) Cl**

( )8. Arrange the following elements in order of **increasing** atomic radii.

(a) Na < Mg < Cl < K < Cs **(b) Cl < Mg < Na < K < Cs**
(c) Cs < K < Cl < Mg < Na **(d) Cl < Mg < Cs < K < Na** **(e) Cl < Mg < Na < Cs < K**

( )9. As we move across the periodic table from left to right, atoms become smaller due to

(a) increasing effective nuclear charge. **(b) shell size increases.**
(b) the *p* orbitals being filled. **(d)electron-electron repulsions.** **(e) none of these.**

( )10. The first ionization energy of sulfur is less than that of phosphorus. A reasonable explanation for this fact involves

(a) the stability of the half-filled subshell in atomic sulfur.
(b) pairing of two electrons in one 3*p* orbital in sulfur atoms.
(c) the smaller size of sulfur atoms relative to phosphorus atoms.

(d) the ease with which phosphorus attains a noble gas electronic configuration.

(e) the higher electronegativity of sulfur relative to phosphorus.

( )11. Which element has the **lowest** first ionization energy?

(a) Be **(b) B** **(c) C** **(d) N** **(e) O**

( )12. Arrange the following elements in order of **decreasing** first ionization energy.

(a) F > O > N > C > Be **(b) Be > C > O > N > F** **(c) F > N > O > C > Be**

(d) O > F > N > Be > C **(e) Be > C > N > O > F**

( )13. Arrange the following elements in order of **increasing** values of electron affinity, i.e., from most negative to least negative.

(a) Cl < S < Se < Rb < Te < Cs **(b) Cl > Te > Se > S > Rb > Cs**

(c) Cl > Se > S > Te > Rb > Cs **(d) Cl < S < Se < Te < Cs < Rb**

(e) Cl < S < Se < Te < Rb < Cs

( )14. Which of the following statements about ionization energy and electron affinity is **true**?

(a) Elements with very high ionization energies usually have very negative electron affinities.

(b) IE_1 and EA are equal in value but with the sign reversed.

(c) It is very easy to measure both IE and EA values.

(d) Elements with low IE, as well as very negative EA, tend to form cations easily.

(e) All of the above statements are true.

( )15. Which one of the following pairs contains isoelectronic species?

(a) Na, Na^+ **(b) S, Se** **(c) S^{2-}, Se^{2-}** **(d) F_2, Cl_2** **(e) Na^+, O^{2-}**

( )16. Which ion has the **largest** radius?

(a) Li^+ **(b) Na^+** **(c) Be^{2+}** **(d) Mg^{2+}** **(e) Al^{3+}**

( )17. Which ion or atom has the **largest** radius?

(a) S **(b) S^{2-}** **(c) Se** **(d) Se^{2-}** **(e) Br**

( )18. Arrange the following set of ions in order of **increasing** ionic radii.

(a) $Ca^{2+} < K^+ < P^{3-} < S^{2-} < Cl^-$ **(b) $Ca^{2+} < K^+ < Cl^- < S^{2-} < P^{3-}$** **(c) $K^+ < Cl^- < Ca^{2+} < S^{2-} < P^{3-}$**

(d) $Cl^- < S^{2-} < P^{3-} < Ca^{2+} < K^+$ **(e) $P^{3-} < S^{2-} < Cl^- < K^+ < Ca^{2+}$**

( )19. Which element has the **lowest** electronegativity?

(a) K **(b) Ca** **(c) Ga** **(d) Ge** **(e) As**

( )20. Arrange the following elements in order of **increasing** electronegativities.

(a) Mg < Ra < P < Al < Cl **(b) Ra < Mg < Al < P < Cl** **(c) Mg < Ra < P < Cl <Al**

(d) Al < P < Cl < Mg < Ra **(e) Al < P < Cl < Ra < Mg**

( )21. Which pair of elements below would be **least likely** to form an ionic bond between them?

(a) Na and S **(b) C and N** **(c) Al and F** **(d) Mg and Br** **(e) Cs and O**

( )22. Determine the oxidation number of the underlined element in $\underline{S}O_3^{2-}$.

(a) +2 **(b) –2** **(c) +3** **(d) +4** **(e) –3**

( )23. Determine the oxidation number of the underlined element in $H\underline{B}C_2$.

(a) +6 **(b) +7** **(c) +3** **(d) +4** **(e) +5**

( )24. What are the oxidation numbers (oxidation states) of the elements in $K_2Cr_2O_7$?

(a) K = +1, Cr = +7, O = –2 **(b) K = +1, Cr = +12, O = –2** **(c) K = +1, Cr = +6, O = –2**

(d) K = +1, Cr = +8, O = –2 **(e) K = +2, Cr = +6, O = –2**

( )25. Which one of the following (pure) compounds of hydrogen is ionic?

(a) HF (b) HCl (c) NaH (d) H_2O (e) H_2Se

( )26. Which of the following responses lists only the molecular hydrides?

I. LiH II. B_2H_6 III. GeH_4 IV. HCl V. BaH_2

(a) I (b) I, V (c) II, III (d) II, III, IV (e) I, II, V

( )27. Which of the following is **incorrectly** classified?

(a) KH – ionic hydride (b) CH_4 – ionic hydride (c) HI – molecular hydride

(d) CsH – ionic hydride (e) H_2S – molecular hydride

( )28. Which one of the following hydrides is basic?

(a) H_2Te (b) B_2H_6 (c) CaH_2 (d) HI (e) CH_4

( )29. Which of the following statements about oxygen is **false**?

(a) The most common form of oxygen is a diatomic molecule.

(b) Ozone is an allotrope of oxygen. (c)Oxygen forms basic metal oxides.

(d) Oxygen forms binary compounds with nonmetals called acid anhydrides.

(e) Oxygen always forms -2 ions with metals.

( )30. Which one of the following will **not** react with oxygen to form a peroxide?

(a) Be (b) Ca (c) Sr (d) Ba (e) all form peroxides

( )31. Which one of the following compounds is a superoxide?

(a) Na_2O_2 (b) SrO (c) KO_2 (d) Li_2O (e) Cl_2O_7

( )32. Which one of the following does **not** represent correctly the major product formed by the reaction of an alkali metal with oxygen at ordinary temperatures and pressures?

(a) Li_2O_2 (b) Na_2O_2 (c) KO_2 (d) RbO_2 (e) CsO_2

( )33. Which response includes all the oxides below that are ionic and none that are molecular?

I. Na_2O II. MgO III. As_2O_5 IV. SO_3

(a) II and IV (b) I, II, and III (c) I and II (d) III and IV (e) II and III

( )34. Which of the following oxides does **not** give an acidic solution when dissolved in water?

(a) SO_2 (b) CO_2 (c) N_2O_5 (d) P_4O_{10} (e) Na_2O

( )35. Arrange the following in order of increasing acidic character (most acidic at the right).

(a) $Al_2O_3 < Na_2O < N_2O_5$ (b) $N_2O_5 < Al_2O_3 < Na_2O$ (c) $Al_2O_3 < N_2O_5 < Na_2O$

(d) $Na_2O < Al_2O_3 < N_2O_5$ (e) $Na_2O < N_2O_5 < Al_2O_3$

( )36. The brownish color of photochemical smog is due to _____.

(a) CO (b) NO_2 (c) NO (d) SO_2 (e) SO_3

( )37. The two acids that are major contributors to "acid rain" are _____.

(a) H_2CO_3 and HNO_3 (b) H_2SO_4 and H_3PO_4 (c) H_2CO_3 and H_2SO_4

(d) H_2SO_4 and HNO_3 (e) H_3PO_4 and HNO_3