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) 38Sr  representative metal   (b) 49In  representative nonmetal
   (c) 14Si  metalloid   (d) 42Mo  d-transition metal   (e) 90Th  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^6np^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.
   (c) 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 3p 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 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) S2–, Se2–  (d) F2, Cl2  (e) Na+, O2–

16. Which ion has the **largest** radius?
(a) Li+  (b) Na+  (c) Be2+  (d) Mg2+  (e) Al3+

17. Which ion or atom has the **largest** radius?
(a) S  (b) S2–  (c) Se  (d) Se2–  (e) Br

18. Arrange the following set of ions in order of **increasing** ionic radii.
(a) Ca2+ < K+ < P3– < S2– < Cl–  (b) Ca2+ < K+ < Cl– < S2– < P3–  (c) K+ < Cl– < Ca2+ < S2– < P3–
(d) Cl– < S2– < P3– < Ca2+ < K+  (e) P3– < S2– < Cl– < K+ < Ca2+

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 \( \text{SO}_3^{2–} \).
(a) +2  (b) –2  (c) +3  (d) +4  (e) –3

23. Determine the oxidation number of the underlined element in \( \text{Cr}_2\text{O}_7^{3–} \).
(a) +6  (b) +7  (c) +3  (d) +4  (e) +5

24. What are the oxidation numbers (oxidation states) of the elements in \( \text{K}_2\text{Cr}_2\text{O}_7 \)?
(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) H₂O  (e) H₂Se

26. Which of the following responses lists only the molecular hydrides?
   I. LiH    II. B₂H₆    III. GeH₄    IV. HCl    V. BaH₂
   (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) CH₄ – ionic hydride  (c) HI – molecular hydride
   (d) CsH – ionic hydride  (e) H₂S – molecular hydride

28. Which one of the following hydrides is basic?
   (a) H₂Te  (b) B₂H₆  (c) CaH₂  (d) HI  (e) CH₄

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) Na₂O₂  (b) SrO  (c) KO₂  (d) Li₂O  (e) Cl₂O₇

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) Li₂O₂  (b) Na₂O₂  (c) KO₂  (d) RbO₂  (e) CsO₂

33. Which response includes all the oxides below that are ionic and none that are molecular?
   I. Na₂O    II. MgO    III. As₂O₅    IV. SO₃
   (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) SO₂  (b) CO₂  (c) N₂O₅  (d) P₄O₁₀  (e) Na₂O

35. Arrange the following in order of increasing acidic character (most acidic at the right).
   (a) Al₂O₃ < Na₂O < N₂O₅  (b) N₂O₅ < Al₂O₃ < Na₂O  (c) Al₂O₃ < N₂O₅ < Na₂O
   (d) Na₂O < Al₂O₃ < N₂O₅  (e) Na₂O < N₂O₅ < Al₂O₃

36. The brownish color of photochemical smog is due to ________.
   (a) CO  (b) NO₂  (c) NO  (d) SO₂  (e) SO₃

37. The two acids that are major contributors to "acid rain" are ________.
   (a) H₂CO₃ and HNO₃  (b) H₂SO₄ and H₃PO₄  (c) H₂CO₃ and H₂SO₄
   (d) H₂SO₄ and HNO₃  (e) H₃PO₄ and HNO₃