

1. Which of the following atoms has the highest first ionization energy?
 - (a) Cs
 - (b) Cl
 - (c) I
 - (d) Ar
 - (e) Na
2. Which of the following atoms has the highest third ionization energy?
 - (a) Si
 - (b) Al
 - (c) S
 - (d) Mg
 - (e) P
3. Which of the following elements has the smallest (least favorable) electron affinity?
 - (a) B
 - (b) C
 - (c) O
 - (d) F
 - (e) Ne
4. Which of the following atoms/ions has the largest radius?
 - (a) Te^{2-}
 - (b) Ce^{4+}
 - (c) I^-
 - (d) Ba^{2+}
 - (e) Xe
5. What is the correct electron configuration for Fe^{3+} ?
6. Which of the following compounds would you expect to have the largest lattice energy (strongest ionic bonding)?
 - (a) KBr
 - (b) NaCl
 - (c) SrO

- (d) LiF
- (e) ScN

7. As we move down group 7A (F @ Cl @ Br @ I) which of the following statements are true?

- (a) The size of the 1s subshell decreases
- (b) The atomic radius increases
- (c) The 1st ionization energy increases
- (d) Both (a) and (b) are true
- (e) All three responses, (a) (b) & (c), are true

8. Which of the following elements has the highest 3rd ionization energy?

- (a) Al
- (b) S
- (c) P
- (d) Mg
- (e) Si

9. Arrange the following elements: Ne, O, S, As & Ca, in order of increasing atomic radius.

10. Arrange the following elements: Ne, F, Li & O, in order of increasing electron affinity.

11. Which of the following substances are paramagnetic (contain unpaired electrons)?

- (a) ZnO
- (b) Cl₂
- (c) AgCl
- (d) MnO
- (e) Both (c) AgCl and (d) MnO are paramagnetic

12. Which of the following molecules will have the shortest carbon-halogen bonds?

- (a) CF₄
- (b) CCl₄
- (c) CBr₄

- (d) Cl_4

13. Which of the following atoms has the highest second ionization energy?

- (a) Sr
- (b) Zr
- (c) Rb
- (d) Ba
- (e) Y

14. Which of the following elements has the smallest (least favorable) electron affinity?

- (a) Br
- (b) Se
- (c) Ge
- (d) F
- (e) Kr

15. Which of the following oxides would you expect to give a basic solution when it dissolves in water?

- (a) SrO
- (b) P_4O_{10}
- (c) SO_3
- (d) CO_2
- (e) P_4O_{10} , SO_3 and CO_2 will all produce basic solutions upon dissolving in H_2O

16. Which of the following compounds would you expect to have the largest lattice energy (strongest ionic bonding)?

- (a) KBr
- (b) NaCl
- (c) CaO
- (d) ZnO
- (e) SrO

17. Which of the following elements has the highest 5th ionization energy?

- (a) Cr

- (b) Te
- (c) Se
- (d) Nb
- (e) Ti

18. Which of the following elements has the highest 1st ionization energy?

- (a) Rb
- (b) Te
- (c) Se
- (d) Nb
- (e) Ti

19. Which of the following elements has the largest atomic radius?

- (a) Cl
- (b) P
- (c) As
- (d) Ne
- (e) Br

20. Which of the following elements has the highest 1st ionization energy?

- (a) Rb
- (b) Sn
- (c) S
- (d) Ar
- (e) Se

21. Which of the following elements has the highest 2nd ionization energy?

- (a) Rb
- (b) Sn
- (c) S
- (d) Ar
- (e) Se

22. Arrange the following elements: Ar, S, P, Si & Cl, in order of increasing electron affinity.

23. Which of the following oxides will form an acidic solution when dissolved in water?

- (a) CaO
- (b) WO_3
- (c) Fe_2O_3
- (d) SO_2
- (e) TiO_2

24. What is the electron configuration for Sb^{5+} ?

25. Which of the following atoms/ions will have the largest radius?

- (a) Mg
- (b) Al^{3+}
- (c) F
- (d) Be
- (e) Mg^{2+}

26. Which of the following compounds will have the largest lattice energy (most negative, strongest ionic bonding)?

- (a) MgO
- (b) CaO
- (c) NaF
- (d) SrS
- (e) NaCl

27. As we move across period 3 (Na® Mg® Al® Si® P® S® Cl® Ar) which of the following statements is false?

- (a) The number of electrons increases
- (b) The atomic radius decreases
- (c) The 1st ionization energy decreases
- (d) The size of the 2s orbital decreases

28. Which of the following elements has the highest 3rd ionization energy?

- (a) Ga
- (b) Se
- (c) As
- (d) Ca
- (e) Ge

29. Arrange the following elements: Cl, F, Si, In & Sr, in order of increasing atomic radius.

30. Arrange the following elements: Cl, Si, Al & Ar, in order of increasing electron affinity.

31. Which of the following elements has the highest 1st ionization energy?

- (a) Sr
- (b) Sn
- (c) Se
- (d) S
- (e) Cd

32. Which of the following elements has the highest 4th ionization energy?

(a) Te (b) Se (c) As (d) In (e) Ge

33. Which of the following elements has the highest 1st ionization energy?

(a) Cl (b) I (c) Se (d) S (e) Na

34. Arrange the following elements: Ne, Cl, Se, Br & Sb, in order of increasing atomic radius.

35. What is the proper electron configuration for Mn²⁺?

36. Which of the following atoms/ions will have the smallest radius?

- (a) Ba²⁺
- (b) Xe
- (c) I⁻
- (d) Te²⁻
- (e) La³⁺

37. Which of the following subatomic particles are most important in determining the chemical reactivity and physical properties of an atom?

- (a) the protons
- (b) the neutrons
- (c) the inner (core) electrons
- (d) the outer (valence) electrons
- (e) none of the above

38. Which of the following oxides will react with water to form an acidic solution?

- (a) CO_2
- (b) SO_3
- (c) CaO
- (d) both CO_2 and SO_3
- (e) all three: CO_2 , SO_3 and CaO

39. Arrange the following atoms in order of increasing first ionization energy: F, He, Ge, Ca, Rb, C.

1. Ar
2. Mg
3. Ne
4. Te^{2-}
5. $[\text{Ar}] 3d^5$
6. ScN
7. Both (a) and (b) are true
8. Mg
9. [smallest] $\text{Ne} < \text{O} < \text{S} < \text{As} < \text{Ca}$ [largest]
10. (c) [smallest EA, least negative] $\text{Ne} < \text{Li} < \text{O} < \text{F}$ [largest EA, most negative]
11. MnO
12. CF_4
13. Rb
14. Kr
15. SrO
16. ZnO
17. Ti
18. Se
19. As

20. Ar
21. Rb or Ar (Obviously Rb has a very high 2nd ionization energy, but so does Ar. In both cases you are removing core electrons so it is not clear which one will have the highest second ionization energy.)
22. [smallest EA, least negative] Ar < P < Si < S < Cl [largest EA, most negative]
23. SO₂
24. [Kr] 4d¹⁰
25. Mg
26. MgO
27. The 1st ionization energy decreases
28. Ca
29. [smallest] F < Cl < Si < In < Sr [largest]
30. [smallest EA, least negative] Ar < Al < Si < Cl [largest EA, most negative]
31. S
32. In
33. Cl
34. [smallest] Ne < Cl < Br < Se < Sb [largest]
35. [Ar] 3d⁵
36. La³⁺
37. the outer (valence) electrons
38. both CO₂ and SO₃
39. Lowest IE Rb < Ca < Ge < C < F < Ne Highest IE