Review Worksheet

1. The principal quantum number corresponds to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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2. The maximum number of electrons possible for the 3rd energy level is a) 32 b) 2 c) 18 d) 8

3. The outermost shell of any atom can hold a maximum of a) 8 electrons b) 2 electrons c) 18 electrons d) 32 electrons

4. Unlike the Bohr model of the atom, the orbital model describes an electron

a) as stationary b) as an energy microcosmos c) in a definite path around the nucleus d) in terms of probable location

5. The principal quantum number describes an electron’s

a) average distance from the nucleus b) path c) velocity d) mass

6. A 2*s* electron: a) is probably farther from the nucleus than a 1*s* electron b) travels in an elliptical path around the nucleus c) is usually farther from the nucleus than a 2*p* electron d) has more energy than a 2*p* electron

1. [**Enrichment**] The number of sublevels in the fifth principal energy level is

a) seven b) three c) five d) four

8. The highest energy sublevel in the 3rd energy level is a) 4s b) 3s c) 3p d) 3d

9. The maximum number of electrons in any principal electron energy level is

a) the atomic number (Z) b) n2 c) 8 d) 2n2

10. The expression 3s2 3p6 3d10 represents a) the kernel of potassium b) the maximum number of electrons in the M shell (n=3) c) the electron configuration of the first transition element d) the electron configuration of argon

11. [**Enrichment**] The 4*f* sublevel is filled next after

a) the 6s sublevel b) the 5p sublevel c) the 5s sublevel d) the 4d sublevel

12. If all electrons occupy the lowest available energy levels of an atom, the atom is said to be a) completely filled b) excited c) inert d) in the ground state

13. Oxygen has a) half-filled 2py and 2pz orbitals b) half-filled 2s and 2py orbitals c) two half-filled s orbitals d) one completely unfilled 2p orbital

14. Before any pairing occurs in the p orbitals, each orbital must contain at least one electron. This is called a) Bohr’s Law b) Heisenberg’s Uncertainty Principal c) Hund’s rule d) the Pauli Exclusion Principle

### 15. A *p* orbital is a) best described as a cube b) sphere shaped c) too complicated to describe d) dumbbell shaped

### 16. The sublevel of lowest energy is a) 3d b) 2s c) 3p d) 2p

### 17. 1s2 2s2 2px12py1 is the electron configuration of

### a) carbon b) lithium c) silicon d) nitrogen

### 18. 1s2 or is the representation of a) H b) Hf c) Hg d) He

### 19. The number of orbitals in a fluorine atom is a) 1 b) 2 c) 5 d) 4

### 20. When sodium loses one electron, the result is a) a positively charged ion b) the atomic number of neon c) an ion with –1 charge d) a transmutation

### 21. The particles which are most intimately involved in chemical reactions are

### a) protons b) neutrinos c) neutrons d) electrons

22. Electrons always want to exist at their lowest energy level. This is the

### a) Aufbau Principle b) Heisenberg’s Uncertainty Principal c) Hund’s Rule d) Pauli Exclusion Principle

Base your answers to questions 23-25 on the following electronic configuration of a neutral atom:

1s2 2s2 2p6 3s2 3p4

### 23. What is the total number of *s* electrons in this atom? a) 6 b) 2 c) 16 d) 4

### 24. The total number of electrons in the second principal energy level of this atom is

### a) 6 b) 2 c) 8 d) 4

### 25. How many orbitals are half-filled in an atom of this element in the ground state?

### a) 1 b) 2 c) 3 d) 6

### 26. Sulfur has four stable isotopes with the following natural percent of abundance: 16S32 (95.002%), 16S33 (0.76%), 16S34 (4.22%), and 16S36 (0.014%). Based on relative abundance, what is sulfur’s atomic weight? (ignore significant figures)

27. Calculate the energy of a photon of green light with a wavelength of 5.10 x 10-5 cm. h = 6.626 x 10-34 Js c = 2.998 x 108m/s

### Worksheet Modern Atomic Theory

Answer Key

1. Bohr Energy Levels (rows on the Periodic Table)
2. C the 3rd energy level (n = 3) … 2n2 = 18
3. A only include the “s” and “p” orbitals with their electrons (valence)
4. D
5. A
6. A
7. C strictly speaking, each energy level has the same # of sublevels
8. D the 3rd energy level (n = 3) … 3s 3p 3d
9. D
10. B
11. A diagonal rule
12. D
13. A px, py, and pz are conventions used to show 3 dimensions of the orbitals
14. C
15. D
16. B energy ranking within the same energy level … s 🡪 p 🡪 d 🡪 f
17. A
18. D
19. C 1s 2s 2p 2p 2p … 5 orbitals
20. A
21. D
22. A
23. A
24. C n = 2 … 2s2, 2p6 🡪 8 e-
25. B p sublevel has 3 orbitals … 1 orbital has 2 e-, the other 2 orbitals each have 1 e-

26. (95.002%) 32 + (0.76%) 33 + (4.22%) 34 + (0.014%) 36 =

Divide each % by 100% to get a decimal

(0.95002) 32 + (0.0076) 33 + (0.04422) 34 + (0.00014) 36 =

30.401 + 0.251 + 1.435 + 0.005 = **32.09 amu**

27. Calculate the energy of a photon of green light with a wavelength of 5.10 x 10-5 cm. h = 6.626 x 10-34 Js c = 2.998 x 108m/s

ν = c/λ E = hν

λ = 5.10 x 10-5 cm x 1 m/100cm = 5.10 x 10-7 m

E = hc/λ = (6.626 x 10-34 Js)(2.998 x 108m/s) / 5.10 x 10-7 m = **3.90 x 10-19 j**