ATOMIC STUCTURE WORKSHEET

*Atomic Structure 1. Nucleus, Isotopes and Average Mass*

1. Which of the following statements is true?

(A) neutrons and electrons have approximately the same mass

(B) the atomic number represents the number of neutrons in an atom

(C) the number of electrons is the same as the number of protons in a neutral atom

(D) the number of electrons is the same as the number of neutrons in a neutral atom

(E) the number of neutrons is the same as the number of protons in a neutral atom

2. How many of each type of sub-atomic particles are contained in an atom of 110Cd?

(A) 110 neutrons, 48 protons, 48 electrons.

(B) 48 electrons, 62 protons, 48 neutrons.

(C) 62 electrons, 62 protons, 48 neutrons.

(D) 48 neutrons, 48 protons, 48 electrons.

(E) 62 neutrons, 48 protons, 48 electrons.

3. In which of these pairs do the atoms have the same number of neutrons?

i) hydrogen-3 and lithium-6 ii) carbon-14 and nitrogen-15 iii) 207Pb and 213Ra

(A) i), ii) and iii) (B) ii) only (C) ii) and iii) only

(D) iii) only (E) None of these

4. Consider the following four atoms and state which could be isotopes of each other:

Atom 1 has 22 protons in its nucleus

Atom 2 has a mass of 40 and contains 22 neutrons

Atom 3 has a mass of 40 and contains 20 protons

Atom 4 is an argon atom

(A) atoms 1 and 2 (B) atoms 1 and 3 (C) atoms 2 and 4

(D) atoms 2 and 3 (E) all are isotopes of each other

5. A hypothetical element Q has two isotopes with the masses and abundances shown below. If Q appeared in the periodic table, what would be its atomic mass?

Q isotope 1 31.163 amu 35.160%

Q isotope 2 34.296 amu 64.840%

(A) 30.197 (B) 33.195 (C) 34.016

(D) 35.221 (E) 32.500

6. The average atomic mass of Ga is 69.72. Ga has 2 isotopes, 69Ga (isotopic mass = 68.93 amu, abundance 60.11 %) and 71Ga. What is the isotopic mass of 71Ga?

(A) 71.22 amu (B) 70.91 amu (C) 69.96 amu

(D) 70.51 amu (E) 70.99 amu

7. Lithium forms compounds which are used in dry cells and storage batteries and in high-temperature lubricants. It has two naturally occurring isotopes, 6Li (isotopic mass = 6.015121 amu) and 7Li (isotopic mass = 7.016003 amu). Lithium has an atomic mass of 6.9409 amu. What is the percent abundance of lithium-6?

(A) 86.66% (B) 46.16% (C) 7.503%

(D) 6.080% (E) cannot be determined from this

*Atomic Structure 1. Light and Hydrogen Spectra*

8. Select the arrangement of electromagnetic radiation which starts with the lowest energy and increases to the greatest photon energy?

(A) radio, visible, infrared, ultraviolet

(B) microwave, infrared, visible, ultraviolet

(C) visible, ultraviolet, infrared, gamma rays

(D) X-radiation, visible, infrared, microwave

(E) microwave, ultraviolet, infrared, X-ray

9. Which has these types of electromagnetic radiation arranged in order of increasing wavelength?

(A) visible, ultraviolet, x-ray

(B) radiowaves, visible, ultraviolet

(C) ultraviolet, visible, infrared

(D) x-ray, visible, ultraviolet

(E) None of these

10. Which of the following statements is false?

(A) infrared has less energy than red light

(B) violet light has a longer wavelength than ultraviolet

(C) gamma rays have the highest frequency

(D) X-rays have a longer wavelength than ultraviolet

(E) green light is more energetic than yellow

11. What is the wavelength of light that has an energy of 3.2 x 10-20 J given that c = 3 x 108 m/s and h = 6.6 x 10-34 Js?

(A) 3.85 x 1013 m (B) 161,000 m (C) 6,200 nm

(D) 6.2 x 10-7 m (E) 6.2 x 10-5 m

12. Green light has a wavelength of 550 nm. What is the energy of a photon of green light in joules?

(A) 3.61 x 10-19 J (B) 1.80 x 10-19 J (C) 2.77 x 1018 J

(D) 3.64 x 10-22 J (E) 1.20 x 10-23 J

13. Calculate the frequency of a photon absorbed when the hydrogen atom undergoes a transition from n = 2 to n = 4?

(A) 6.169 x 1014 s-1 (B) 8.226 x 1014 s-1 (C) 2.742 x 1014 s-1

(D) 2.056 x 106 s-1 (E) 2.742 x 106 s-1

14. Calculate the wavelength of the photon emitted when the hydrogen atom undergoes a transition from n = 5 to n = 3 (R = 1.096776 x 107 m-1)

(A) 2051 nm (B) 384.6 nm (C) 683.8 nm

(D) 1282 nm (E) 1.282 x 10-6 nm

15. A hydrogen atom in its ground state absorbs a photon of wavelength 97.2 nm. To what energy level does the electron move? RH = 1.096776 x 107 m-1

(A) n=2 (B) n=3 (C) n=4

(D) n=5 (E) n=7

*Atomic Structure 3 and 4. Electron Configurations*

16. Select the correct electron configuration for Te

(A) [Kr]5s24d105p4 (B) none of these(C) [Kr]5s25p64d8

(D) [Kr]5s25d105p4 (E) [Kr]5s24f14

17. Select the correct electron configuration for Cu.

(A) [Ar]4s24p63d3 (B) [Ar]4s24d9 (C) [Ar]4s14d10

(D) [Ar]4s13d10 (E) [Ar]4s23d9

18. An atom has a valence shell electron configuration of s2p3. To which group in the periodic table does it belong?

(A) transition metals (B) chalcogens (C) halogens

(D) pnictogens (E) noble gases

19. How many unpaired electrons are there in a cobalt atom?

(A) one (B) two (C) three

(D) four (E) five

20. Which of the following could represent a 1p orbital?



*Atomic Structure 5. Periodic Properties 1*

21. Which of the following lists of atoms are arranged in order of INCREASING size?

(A) Se > Si > Sb > Bi (B) Cs < Sr < Pb < I (C) Cs < Ca < Rb < Sr

(D) Br < Sr < Ba < Cs (E) Ca < Cs < Sr < Rb

22. Which of the following lists of atoms are arranged in order of decreasing atomic size?

(A) Na > K > Rb > Cs (B) F > N > B > Be (C) B > Be > C > N

(D) C > N > O > F (E) none are arranged in order of decreasing atomic size

23. Which of the following lists of atoms are arranged in order of INCREASING ionization energy?

(A) Li < O < N < F (B) Li < N < O < F (C) F < O < N < Li

(B) Na < Sr < O < F (E) Ca > Cs > S > Se

24. Select the element with the largest second ionization energy [IE2]

(A) Al (B) Rb (C) Sr (D) Ca (E) K

25. An atom has the following ionization energies: IE1 = 800 kJ/mol, IE2 = 2,430 kJ/mol, IE3 = 3,660 kJ/mol, IE4 = 25,000 kJ/mol. Which of the following is most likely to be the element?

(A) Li (B) B (C) N (D) O (E) Ne

*Atomic Structure 6. Periodic Properties 2*: *Making Cations and Ionic Compounds*

26. What is the electron configuration of the Fe2+ ion?

(A) [Ar]4s23d6 (B) [Ar]4s23d4 (C) [Ar]4s23d8

(D) [Ar]3d6 (E) [Ar]3d5

27. How many unpaired electrons are there is a ferric ion (Fe3+)?

(A) 4 (B) 3 (C) 1 (D) 2 (E) 5

28. Consider the set of isoelectronic atoms and ions A2-, B-, C, D+ and E2+. Which arrangement of relative radii is correct?

(A) A2- > B-> C < D+ > E2+ (B) A2- < B-< C > D+ < E2+

(C) A2- > B-> C > D+ > E2+ (D) none of these

(E) E2+ > D+ > C > B- > A2-

29. Which ion is larger in each pair? i) O2- or S2- ii) Fe2+ or Fe3+ iii) S2- or K+

(A) S2-, Fe2+, S2- (B) S2-, Fe3+, S2- (C) O2-, Fe3+, K+

(D) S2-, Fe2+, K+ (E) None of these

30. Choose the name-formula pair that doesn’t match.

(A) copper(II)bromide, CuBr2 (B) silver carbonate, AgCO3

(C) iron(II)sulfite, FeSO3 (D) aluminum phosphate, AlPO4

(E) magnesium hydroxide, Mg(OH)2

31. Give the names of the following anions S2-, ClO4- and NO2-.

(A) sulfide ion, perchlorate ion, nitrite ion

(B) sulfide ion, perchlorite ion, nitrate ion

(C) sulfite ion, perchlorate ion, nitrate ion

(D) sulfide ion, chlorate ion, nitrate ion

(E) sulfate ion, perchlorate ion, nitrite ion

32. How many protons, neutrons and electrons, respectively, are there in the barium cation, 136Ba2+?

(A) 56, 80, 56 (B) 56, 80, 54 (C) 56, 80, 58

(D) 58, 80, 56 (E) 56, 136, 54

33. Which pair of particles have the same electron configuration?

(A) Cl–, S (B) Kr, Ar (C) Cl–, Ca2+

(D) Al3+, P3– (E) K, K+

34. The prefix “bi” is added to anion names to indicate an extra positive hydrogen, as for example, in **bi**carbonate compared to carbonate. Which of the following anions would be known as bisulfate?

(A) HS- (B) (SO4)22- (C) HSO42-

(D) HSO4- (E) H2SO4

35. What is the chemical formula of magnesium phosphate?

(A) MgP (B) Mg3P2 (C) MgPO4

(D) Mg2(PO4)3 (E) Mg3(PO4)2

36. Which of the following does not have a charge of –2?

(A) carbonate (B) sulfate (C) phosphate

(D) oxide (E) all have a charge of -2