**BC SCIENCE 10 - Chapter 4 Practice Booklet**

**Matching**

***Match the correct number of valence electrons possessed by elements in the chemical family with the appropriate description of those elements. Each description may be used only once.***

|  |  |
| --- | --- |
| a) | atoms of these elements normally form 2- ions in ionic compounds |
| b) | the Lewis structure for these atoms has only paired electrons |
| c) | these elements always form 1+ cations |
| d) | the group includes boron and aluminum |
| e) | these elements are the most reactive non-metals |
| f) | the Lewis structure for these atoms shows 4 unpaired electrons |
| g) | the alkaline earth metals |
| h) | these elements require 3 electrons to complete their valence shell |

\_\_\_\_ 1) 1 valence electron

\_\_\_\_ 2) 2 valence electrons

\_\_\_\_ 3) 3 valence electrons

\_\_\_\_ 4) 4 valence electrons

\_\_\_\_ 5) 5 valence electrons

\_\_\_\_ 6) 6 valence electrons

\_\_\_\_ 7) 7 valence electrons

\_\_\_\_ 8) 8 valence electrons

***Match the type of compound (ionic or covalent) with the appropriate description. Each type of compound may be used more than once.***

|  |  |  |  |
| --- | --- | --- | --- |
| a) | ionic compound | b) | covalent compound |

\_\_\_\_ 9) this compound forms when metals react with non-metals

\_\_\_\_ 10) molecules exist in this compound

\_\_\_\_ 11) the formula name of this compound requires the use of prefixes

\_\_\_\_ 12) the chemical formula represents only a ratio of elements in this compound

\_\_\_\_ 13) valence electrons are shared to form this compound

\_\_\_\_ 14) the name of this compound may include Roman numerals

\_\_\_\_ 15) table sugar, water, and candle wax are examples of this compound

\_\_\_\_ 16) table salt, chalk, and rust are examples of this compound

\_\_\_\_ 17) electrons are transferred when this compound forms

\_\_\_\_ 18) this compound forms when non-metals react with non-metals

***Match the compound name with the appropriate total number of atoms that chemical formula contains. Each compound name may be used only once.***

|  |  |  |  |
| --- | --- | --- | --- |
| a) | ammonium phosphate | d) | aluminum permanganate |
| b) | iron(II) dichromate | e) | tin(IV) nitrate |
| c) | lead(IV) acetate | f) | tetraphosphorus decaoxide |

\_\_\_\_ 19) 10

\_\_\_\_ 20) 14

\_\_\_\_ 21) 16

\_\_\_\_ 22) 17

\_\_\_\_ 23) 20

\_\_\_\_ 24) 29

***Match each set of coefficients with the appropriate formula equation that they balance. The coefficients are given in the order they appear, from left to right, in the balanced equation. Each set of coefficients may be used only once.***

|  |  |  |  |
| --- | --- | --- | --- |
| a) | 3, 2, 1, 6 | c) | 2, 7, 4, 6 |
| b) | 3, 2, 6, 1 | d) | 1, 3, 1, 3 |

\_\_\_\_ 25) Ca(NO3)2 + Na3PO4  NaNO3 + Ca3(PO4)2

\_\_\_\_ 26) Cr + AgNO3  Cr(NO3)3 + Ag

\_\_\_\_ 27) C2H6 + O2  CO2 + H2O

\_\_\_\_ 28) H2SO4 + Al(OH)3  Al2(SO4)3 + H2O

**Short Answer**

 29) Identify the three subatomic particles and compare their masses, charges, and locations within the atom.

 30) Explain how an element’s atomic number and mass number can be used to determine the subatomic particles present in an atom of that element.

 31) If protons and neutrons each contribute one whole atomic mass unit to an atom and electrons contribute virtually no mass to an atom, explain why the majority of atomic mass numbers in the periodic table are fractional values.

 32) An element is a member of group 1 and also of period 2 in the periodic table. Without referring to the periodic table, describe what this information tells you about this element’s electron arrangement.

 33) Describe how the Bohr diagram and the Lewis diagram for an atom of chlorine would differ from each other.

 34) Explain how the bond existing in HCl differs from the bond existing in NaCl.

 35) Some chemical compounds require the use of prefixes in their names while others do not. Explain why, using an example of each type of compound.

 36) Some ionic compounds require the use of Roman numerals in their names, while others do not. Explain why, using an example of each type of compound in your answer.

 37) Write a balanced formula equation for the reaction of solid sodium metal with liquid water to produce an aqueous solution of sodium hydroxide and hydrogen gas.

 38) Write a balanced formula equation for the reaction of an aqueous solution of ammonium phosphate with an aqueous solution of tin(IV) nitrate to produce an aqueous ammonium nitrate and solid tin(IV) phosphate.

**Problem**

 39) ***Complete the following table for the three different subatomic particles in an atom***.

|  |  |  |  |
| --- | --- | --- | --- |
| Name of Particle | Charge on Particle | Location in Atom | Relative Mass |
|  |  | surrounding nucleus |  |
|  |  |  | 1 |
|  | 1+ |  |  |

 40) ***Complete the following table using your periodic table.***

|  |  |  |  |
| --- | --- | --- | --- |
| Element Name | Number of Protons in Nucleus | Number of Neutrons in Nucleus | Number of Electrons in Most Common Ion |
|  | 20 |  |  |
| phosphorus |  |  |  |
|  | 9 |  |  |
| aluminum |  |  |  |

 41) ***Use the periodic table to complete the following table***.

|  |  |  |
| --- | --- | --- |
| Chemical Family Number | Number of Valence Electrons | Most Common Ion Charge |
|  | 7 |  |
| 13 |  |  |
|  | 2 |  |
| 1 |  |  |

 42) Draw a Bohr diagram for the covalent compound NH3. Include the complete make-up of each element’s nucleus and all the electrons contained in the molecule.

 43) Draw the Lewis structures for the following atoms:

a) aluminum b) chlorine

c) oxygen d) neon

 44) ***Complete the following table for covalent compounds***.

|  |  |  |  |
| --- | --- | --- | --- |
| Molecular Formula  | Lewis Structure of Molecule | Number of Bonding Electron Pairs | Number of Lone Electron Pairs |
| PF3 |  |  |  |
| H2S |  |  |  |

 45) Draw Lewis structures for the following ionic compounds:

a) potassium fluoride (KF) b) strontium oxide (SrO)

 46) ***Complete the following table containing ionic and/or covalent compounds.***

|  |  |  |
| --- | --- | --- |
| Chemical Formula | Name of Compound | Ionic or Covalent? |
| (NH4)2Cr2O7 |  |  |
|  | tin(IV) acetate |  |
| P4O10 |  |  |
|  | dichlorine heptaoxide |  |

 47) ***Balance the following formula equations.***

a) C6H14 + O2  CO2 + H2O

b) Pb(NO3)4 + Al2(SO4)3  Pb(SO4)2 + Al(NO3)3

c) H3PO4 + Sr(OH)2  Sr3(PO4)2 + H2O

 48) ***Convert the following word equations into balanced formula equations.***

a) barium bromide + lithium chromate  barium chromate + lithium bromide

b) sodium hydrogen carbonate  sodium carbonate + carbon dioxide + water

c) lead(IV) acetate + potassium phosphate  lead(IV) phosphate + potassium acetate

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**Answer Section**

**MATCHING**

 1) C

 2) G

 3) D

 4) F

 5) H

 6) A

 7) E

 8) B

 9) A

 10) B

 11) B

 12) A

 13) B

 14) A

 15) B

 16) A

 17) A

 18) B

 19) B

 20) F

 21) D

 22) E

 23) A

 24) C

 25) B

 26) D

 27) C

 28) A

**SHORT ANSWER**

 29) The three subatomic particles are the proton, the neutron, and the electron. Protons carry a 1+ charge and contribute one atomic mass unit. They exist in the nucleus of the atom. Neutrons carry no charge but contribute one atomic mass unit and exist in the nucleus of the atom. Together, protons and neutrons account for virtually all the atom’s mass. Electrons carry a 1- charge and exist in a cloud outside of the nucleus, effectively determining the volume of the atom while contributing virtually no mass.

\*

 30) The atomic number equals the number of protons in the nucleus and the number of electrons in a neutral atom of that element. The mass number (rounded to the nearest whole number) minus the atomic number gives the number of neutrons in the nucleus of the most common isotope of the element.

\*

 31) The atomic mass numbers listed in the periodic table represent the average atomic masses of all the naturally occurring isotopes of each element and are, therefore, usually fractional values.

\*

 32) Being a member of group 1, this element must have one electron in its valence shell. Being a member of period 2, the valence electron shell of the atom must be the second energy level.

\*

 33) The Bohr diagram would show a nucleus with 17 protons and 18 neutrons surrounded by three concentric circles representing all the electron “shells” in the chlorine atom. The circle closest to the nucleus would show 2 electrons; the next circle would show 4 pairs of electrons, for a total of 8 electrons; and the outer circle would show three pairs of electrons and one unpaired electron for a total of 7 electrons. In place of the nucleus and the two inner electron shells, the Lewis diagram would simply show the symbol “Cl.” No circles would surround this symbol. Instead, the diagram would show just three pairs of dots and one unpaired dot, each occupying one of the four corners of a “cross.” These seven dots would represent the seven valence electrons of chlorine.

\*

 34) The bond in HCl is a covalent bond resulting from the sharing of a pair of valence electrons between the hydrogen and chlorine nucleus forming a neutral molecule. In NaCl, a valence electron from sodium has been transferred to the valence shell of chlorine forming a positive sodium ion and a negative chloride ion. The attractive force between the sodium cation and the chloride anion is an ionic bond.

 35) Ionic compounds do not require the use of prefixes in their names because the formulas that are written for ionic compounds simply represent the smallest whole number ratio of cations to anions that are electrically neutral. An example of an ionic compound would be Na2O, whose name is simply sodium oxide rather than disodium monoxide. Covalent compounds require the use of prefixes in their names as these formulas do not represent ratios but rather the actual atoms existing in the molecule. An example of a covalent compound would be Cl2O, whose name is dichlorine monoxide rather than chlorine oxide.

\*

 36) Ionic compounds containing a metal that can only form one charge as a cation do not require the use of Roman numerals in their names. For example, the compound Zn(NO3)2 is simply zinc nitrate rather than zinc(II) nitrate because a zinc cation is always 2+. However, the compound Fe(NO3)2 is iron(II) nitrate because iron can also form a 3+ ion and the Roman numeral indicates which of the two iron cations exists in the compound.

\*

 37) 2 Na(s) + 2 H2O(l)  2 NaOH(aq) + H2(g)

\*

 38) 4 (NH4)3PO4(aq) + 3 Sn(NO3)4(aq)  Sn3(PO4)4(s) + 12 NH4NO3(aq)

**PROBLEM**

 39)

|  |  |  |  |
| --- | --- | --- | --- |
| Name of Particle | Charge on Particle | Location in Atom | Relative Mass |
| electron | 1- | surrounding nucleus | 0 |
| neutron | 0 | within nucleus | 1 |
| proton | 1+ | within nucleus | 1 |

\*

 40)

|  |  |  |  |
| --- | --- | --- | --- |
| Element Name | Number of Protons in Nucleus | Number of Neutrons in Nucleus | Number of Electrons in Most Common Ion |
| calcium | 20 | 20 | 18 |
| phosphorus | 15 | 16 | 18 |
| fluorine | 9 | 10 | 10 |
| aluminum | 13 | 14 | 10 |

 41)

|  |  |  |
| --- | --- | --- |
| Chemical Family Number | Number of Valence Electrons | Most Common Ion Charge |
| 17 | 7 | 1- |
| 13 | 3 | 3+ |
| 2 | 2 | 2+ |
| 1 | 1 | 1+ |

\*

 42)



 43)



 44)



 45)



 46)

|  |  |  |
| --- | --- | --- |
| Chemical Formula  | Name of Compound | Ionic or Covalent? |
| (NH4)2Cr2O7 | ammonium dichromate | ionic |
| Sn(CH3COO)4 | tin(IV) acetate | ionic |
| P4O10 | tetraphosphorus decaoxide | covalent |
| Cl2O7 | dichlorine heptaoxide | covalent |

\*

 47) a) 2 C6H14 + 19 O2  12 CO2 + 14 H2O

b) 3 Pb(NO3)4 + 2 Al2(SO4)3  3 Pb(SO4)2 + 4 Al(NO3)3

c) 2 H3PO4 + 3 Sr(OH)2  Sr3(PO4)2 + 6 H2O

\*

 48) a) BaBr2 + Li2CrO4  BaCrO4 + 2 LiBr

b) 2 NaHCO3  Na2CO3 + CO2 + H2O

c) 3 Pb(CH3COO)4 + 4 K3PO4  Pb3(PO4)4 + 12 KCH3COO