**Unit 1 and 2: Matter and Chemical Bonding and Reactions Review**

**Multiple Choice:** *Identify the letter of the choice that best completes the statement or answers the question.*

 1. The person given credit for developing the first modern periodic table is

|  |  |  |  |
| --- | --- | --- | --- |
| a. | Dalton | d. | Mendeleev |
| b. | Democritus | e. | Chadwick |
| c. | Thomson |

 2. Which of the following matches of group number and common name is incorrect?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | Group 7 - transition metals | d. | Group 2 - actinides |
| b. | Group 2 - alkali earth metals | e. | Group 18 - noble gases |
| c. | Group 17 - halogens |

 3. Why does ionization energy increase from left to right in a period?

|  |  |
| --- | --- |
| a. | Nuclear charge increases from left to right in a period. |
| b. | Nuclear charge decreases from left to right in a period. |
| c. | The number of energy levels increases from left to right in a period. |
| d. | The number of energy levels decreases from left to right in a period. |
| e. | The number of electrons decreases from left to right in a period. |

 4. Why does electron affinity increase from bottom to top in a chemical family?

|  |  |
| --- | --- |
| a. | Nuclear charge increases from bottom to top in a chemical family. |
| b. | Nuclear charge decreases from bottom to top in a chemical family. |
| c. | The number of energy levels increases from bottom to top in a chemical family. |
| d. | The number of energy levels decreases from bottom to top in a chemical family. |
| e. | The number of electrons increases from bottom to top in a chemical family. |

 5. Which of the following formulas does NOT represent a molecular compound?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | CO2(g) | d. | PCl5(g) |
| b. | CoCl2(s) | e. | HCl(g) |
| c. | SO2(g) |

 6. An electron dot diagram for a nitrogen atom should show

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 1 lone pair and 3 bonding electrons | d. | 3 lone pairs and 1 bonding electrons |
| b. | 2 lone pairs and 2 bonding electrons | e. | 3 bonding electrons |
| c. | 2 lone pairs and 3 bonding electrons |

 7. The formula for lithium sulfate is

|  |  |  |  |
| --- | --- | --- | --- |
| a. | Li1SO4(s) | d. | Li3SO4(s) |
| b. | Li2SO3(s) | e. | Li1SO3(s) |
| c. | Li2SO4(s) |

 8. Hydrogen can be used as an alternative fuel for automobiles. Classify the following chemical reaction:
2H2(g) + O2(g) 🡪 2H2O(g)

|  |  |  |  |
| --- | --- | --- | --- |
| a. | combustion reaction | d. | double displacement |
| b. | decomposition reaction | e. | simple decomposition |
| c. | single displacement |

 9. Classify the following reaction: Mg(OH)2 + 2HNO3 🡪 Mg(NO3)2  + 2H2O

|  |  |  |  |
| --- | --- | --- | --- |
| a. | combustion | d. | single displacement |
| b. | synthesis | e. | double displacement |
| c. | decomposition |

 10. The greenhouse effect is caused by

|  |  |  |  |
| --- | --- | --- | --- |
| a. | infrared radiation | d. | carbon dioxide |
| b. | ultraviolet radiation | e. | all of the above |
| c. | water |

 11. Classify the following chemical reaction: 3NaOH + H3PO4 🡪 Na3PO4 + 3H2O

|  |  |  |  |
| --- | --- | --- | --- |
| a. | combustion | d. | single displacement |
| b. | synthesis | e. | double displacement |
| c. | decomposition |

**Short Answer**

 12. Why does ionization energy increase from left to right in a period on the periodic table?

 13. This question has been removed.

 14. Which element has the smallest atomic radius?

 15. Examine the following 1st, 2nd, and 3rd ionization energies and state which element is most likely a noble gas.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **1st****(eV)** | **2nd****(eV)** | **3rd****(eV)** |
| **Element X** | 5.139 | 47.286 | 71.64 |
| **Element Y** | 7.646 | 15.035 | 80.143 |
| **Element Z** | 21.564 | 40.962 | 63.45 |

 16. Provide both the classical name and the IUPAC name for the following acids.

|  |  |  |
| --- | --- | --- |
|  | **Aqueous (aq)** | **Non-aqueous** |
| (a) HClO3(aq) |  |  |
| (b) HNO2(aq) |  |  |
| (c) HI(aq) |  |  |

 17. Draw the electron dot diagrams for oxygen, sodium, boron, and neon.

 18. Use electron dot diagrams to explain why hydrogen and nitrogen are diatomic elements.

 19. Predict the products and write a balanced chemical equation for the following chemical reaction:

Sodium metal is added to water.

 20. Complete the following chemical reaction equation, including states of matter and balancing:

Na2SO4(aq) + Pb(NO3)2(aq) 🡪 What type of reaction is this?

1. a) Explain, in your own words, why ionic compounds are brittle, have extremely high melting points, and are solid at SATP. b) What is the structural diagram for CaCl2 and MgO
2. Give an example of a compound that has polar covalent bonds but is a) non-polar overall b) polar overall. Represent these compounds with proper diagrams indicating their bond and overall polarity. What intermolecular forces are present in each molecule?

**Unit #1 and 2: Matter and Chemical Bonding Review and Chemical Reactions Answer Section**

**MULTIPLE CHOICE**

 1.D 2.D 3.A 4.D 5.B 6.A 7.C 8.A 9.E 10.E 11.E

**SHORT ANSWER**

 12. Ionization energy increases because atomic radius decreases. This happens because the nuclear charge increases, but the number of energy levels does not. Therefore, the nucleus has a stronger hold on the electrons as the nuclear charge increases.

 13. This question has been removed.

 14. helium 15. element Z

 16.

|  |  |  |
| --- | --- | --- |
|  | **Aqueous** | **Non-aquesou** |
| (a) HClO3(aq) | chloric acid | hydrogen chlorate |
| (b) HNO2(aq) | nitrous acid | hydrogen nitrite |
| (c) HI(aq) | hydroiodic acid | hydrogen iodide |

 17.

|  |
| --- |
|  |
| oxygen | sodium | boron | neon |

 18. To obtain a full valence shell, hydrogen atoms will form covalent bonds with one another. Nitrogen will do the same with itself, in order to give each atom a stable octet.

 19. 2Na(s) + 2HOH(l) H2(g) + 2NaOH(aq)

 20. Na2SO4(aq) + Pb(NO3)2(aq) 🡪 PbSO4(s) + 2NaNO3(aq) Double Displacement Reaction

 21. a)-Brittle: if lattice is shifted by an impact, like charges are forced next to each other and repel.

-Relatively strong attraction between ions: the ionic bonds must be overcome to a large degree to break down the crystal lattice and allow the substance to melt.

-Ions arrange themselves so that there is maximum proximity to ions of opposite charge, but maximum distance from ions of same charge. A crystal lattice is formed and ordered particles result in a solid.

22. a) CO2, CH4, CCl4 b) HCl, HF, CH3Cl, H2O

London Dispersion Forces: CO2, CH4, CCl4 Dipole-dipole Forces and London Dispersion Forces: HCl, CH3Cl

Hydrogen Bonding and London Dispersion Forces: H2O, HF