Shedding Light on Atoms Episode 1: The Dawn of Modern Chemistry

Name: __________________________

Part A
1. Everything on Earth is made of ________________.

2. The ancient Greeks believed that all matter is composed of only four elements: __________, __________, __________, and __________.

3. What does the word “atom” mean?

____________________________________________________________________________________

____________________________________________________________________________________

Part B

Part C

4. What is the modern definition of an element?

____________________________________________________________________________________

____________________________________________________________________________________

5. Use a Periodic Table to complete the tables below.

<table>
<thead>
<tr>
<th>Element Name</th>
<th>Element Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neon</td>
<td>Ne</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N</td>
</tr>
<tr>
<td>Helium</td>
<td>He</td>
</tr>
<tr>
<td>Vanadium</td>
<td>V</td>
</tr>
<tr>
<td>Sodium</td>
<td>Na</td>
</tr>
<tr>
<td>Copper</td>
<td>Cu</td>
</tr>
<tr>
<td>Carbon</td>
<td>C</td>
</tr>
<tr>
<td>Sc</td>
<td>Sr</td>
</tr>
<tr>
<td>Si</td>
<td>S</td>
</tr>
<tr>
<td>Se</td>
<td>Se</td>
</tr>
<tr>
<td>Mg</td>
<td>Mn</td>
</tr>
</tbody>
</table>

6. What is a compound?

____________________________________________________________________________________

____________________________________________________________________________________

Part D

7. State the type and number of atoms that make up the following compounds. The first one has been done for you.
   (a) Water, H₂O, is made of 2 hydrogen atoms and 1 oxygen atom bonded together.
   (b) carbon dioxide, CO₂

   (c) ammonia, NH₃,

   (d) Chloromethane, CH₃Cl,

8. What is a mixture? Give two examples.

____________________________________________________________________________________

____________________________________________________________________________________

Part E

9. When was carbon dioxide discovered? _______________________________________________________________________

10. The chemical equation for the reaction between limestone and hydrochloric acid can be written as:

(Word Equation) ____________________________________________________________

(Symbol Equation) ____________________________________________________________

11. List the reactants in the reaction above: ____________________________________________

12. List the products of the reaction above: ____________________________________________

13. When was oxygen discovered? _______________________________________________________________________

14. The chemical equation for the reaction where hydrogen peroxide decomposes to produce water and oxygen can be written as:

(Word Equation) ____________________________________________________________

(Symbol Equation) ____________________________________________________________
15. The manganese dioxide did not chemically react but instead acted as a “catalyst”. What is a catalyst?

16. To start a fire, you need three things:
   (a) A fuel. List three examples. ____________________________
   (b) Oxygen, and ____________________________
   (c) _______ _______ List three examples. ____________________________

17. What is the “ignition temperature” of a fuel?

18. Why is water so good at putting out wood fires? (There are two reasons)

Skill-Building Exercise: Writing Chemical Equations
19. Use the information below to write word equations.
   (a) Methane chemically reacts with oxygen (when it burns) to produce carbon dioxide and water.

20. Use the information below to write word and symbol equations.
   Copper carbonate (CuCO₃) breaks apart and produces carbon dioxide (CO₂) and copper oxide (CuO). (This occurs when it is heated.)

21. Tin oxide (SnO₂) is produced when tin (Sn) chemically reacts with oxygen (O₂).

Skill-Building Exercise: Balancing Chemical Equations
The balanced chemical equation for the hydrogen peroxide reaction above is 2H₂O₂ → O₂ + 2H₂O.
22. The expression 2H₂O in the chemical equation indicates two separate water molecules are produced which represents a total of _____ H atoms and _____ O atoms.
23. The expression 2H₂O₂ in the chemical equation indicates two separate hydrogen peroxide molecules which represents a total of _____ H atoms and _____ O atoms.

When balancing equations, it’s best simply to balance the first atom you come across first and then the second atom and so on. Balance the following equations.

24. _____ H₂ + _____ Cl₂ → _____ HCl
   (Draw extra diagrams if you need to)
   (If you only need 1 of something, you don’t need to write the number in)

25. _____ N₂ + _____ H₂ → _____ NH₃
   (Draw extra diagrams if you need to)

26. _____ Li + _____ S → _____ Li₂S
27. _____ K + _____ Cl₂ → _____ KCl
28. _____ Ca + _____ O₂ → _____ CaO
29. _____ Na + _____ O₂ → _____ Na₂O

Note: Why do H₂O, CaO, and CO₂ exist, while there is no such thing as H₂O₂, HO₂, C₂O, or CaO₂ for example? The reason that atoms bond together only in certain combinations has not been covered yet. But it will be!