Student Instructions

1. Ensure that you have blank paper and a Data Booklet.
2. Record all answers on a separate piece of paper.
3. Answer keys are provided by your teacher.
4. When you have finished with this Study Booklet please return it to your teacher.

Make NO MARKS on this study booklet!
1. Which of the following is an ionic compound?
   A. H₂  B. NH₃  C. CO₃²⁻  D. K₂Cr₂O₇

   **Use the following Bohr model diagram to answer the next question.**

   ![Bohr model diagram]

2. Which of the following is represented by the diagram above?
   A. neon atom  B. carbon ion  C. magnesium ion  D. magnesium atom

   **Use the following Bohr model diagram to answer the next question.**

   ![Bohr model diagram]

3. How many valence electrons are illustrated?
   A. 1  B. 7  C. 16  D. 17

4. How many unpaired electrons are present in a nitrogen atom?
   A. 2  B. 3  C. 5  D. 7

   **Use the following Lewis diagram to answer the next 2 questions.**

   ![Lewis diagram]

5. Which of the following is represented by X : X ?
   A. a noble gas  B. an alkali metal  
   C. a diatomic molecule  D. an alkaline earth metal

6. Which of the following products could be formed from the two molecules represented above?
   A. water  B. neon gas  C. carbon dioxide  D. hydrogen fluoride
7. How many lone pairs and bonding pairs of electrons surround the central oxygen atom in a Lewis diagram of water?

\[
\text{H} \quad \text{\textbullet} \quad \text{O} \\
\quad \text{H}
\]

<table>
<thead>
<tr>
<th>Lone Pairs</th>
<th>Bonding Pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
</tr>
</tbody>
</table>

8. Coffee has a pH of 5. Which of the following shows the correct colour of each pH indicator when a small amount of black coffee is tested?

<table>
<thead>
<tr>
<th>pH Indicator</th>
<th>Test Tube 1</th>
<th>Test Tube 2</th>
<th>Test Tube 3</th>
<th>Test Tube 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>red litmus</td>
<td>no colour change</td>
<td>turns blue</td>
<td>no colour change</td>
<td>no colour change</td>
</tr>
<tr>
<td>blue litmus</td>
<td>turns red</td>
<td>no colour change</td>
<td>no colour change</td>
<td>turns red</td>
</tr>
<tr>
<td>phenolphthalein</td>
<td>no colour change</td>
<td>turns pink</td>
<td>no colour change</td>
<td>no colour change</td>
</tr>
</tbody>
</table>

Use the following information to answer the next question.

A student is given four test tubes. He is asked to determine whether the substance in each test tube is acidic, basic or neutral. He makes the following observations:

<table>
<thead>
<tr>
<th>pH Indicator</th>
<th>Test Tube 1</th>
<th>Test Tube 2</th>
<th>Test Tube 3</th>
<th>Test Tube 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>red litmus</td>
<td>no colour change</td>
<td>turns blue</td>
<td>no colour change</td>
<td>no colour change</td>
</tr>
<tr>
<td>blue litmus</td>
<td>turns red</td>
<td>no colour change</td>
<td>no colour change</td>
<td>turns red</td>
</tr>
<tr>
<td>phenolphthalein</td>
<td>no colour change</td>
<td>turns pink</td>
<td>no colour change</td>
<td>no colour change</td>
</tr>
</tbody>
</table>

9. Which of the following conclusions is supported by the observations?
   A. Test Tube 1 is basic  
   B. Test Tube 2 is neutral.  
   C. Test Tube 3 is acidic.  
   D. Test Tube 4 is acidic.

10. Which of the following is most likely to cause blue litmus paper to turn red?
    A. soap  
    B. table salt  
    C. lemon juice  
    D. oven cleaner
Use the following information to answer the next question.

**Sulphuric Acid Spill Threatens China's 900-Year-Old Grand Canal**

**Beijing** -- Chinese officials attempted to head off an environmental disaster after a ship capsized, dumping 220 tons of sulphuric acid into the country's 900-year-old Grand Canal. Three hundred tons of liquid alkali were poured into the water to neutralize the acid, state media reported.

Adapted from *The Vancouver Sun*, Saturday, August 5, 2006, page A18.

11. Which of the following could be the "liquid alkali" that was poured into the Grand Canal?
   A. HCL  
   B. H₂O  
   C. NaCl  
   D. NaOH

12. What is the name of the compound HCN?
   A. cyanous acid  
   B. hydrocyanic acid  
   C. hydrogen (I) cyanide  
   D. hydrogen carbon nitride

13. Which of the following is a representation for acetic acid?

![Acetic acid diagram]

A. I only  
B. I and II only  
C. I, III, and IV only  
D. II, III and IV only

14. How many atoms of each of the following elements are present in the compound copper (II) phosphate?

<table>
<thead>
<tr>
<th></th>
<th>Copper</th>
<th>Phosphorous</th>
<th>Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>
15. What is the name of the compound MnS₂?
   A. manganese sulphide  B. magnesium sulphide
   C. manganese(II) sulphide  D. manganese(IV) sulphide

16. What is the chemical formula for dinitrogen pentoxide?
   A. NO  B. N₂O₅  C. N₅O₂  D. (N₂O)₅

17. Which of the following is an inorganic compound?
   A. NO₂  B. C₃H₈  C. C₆H₁₂O₆  D. CH₃COOH

18. What is the coefficient needed in front of O₂ in order to balance the following equation?

   ___ NH₄
   A. 1  B. 2  C. 3  D. 4

19. What type of reaction would be expected when sodium phosphate reacts with calcium chloride?
   A. synthesis  B. combustion  C. decomposition  D. double replacement

20. Solid zinc reacts with sulphuric acid to produce hydrogen gas. What is the other product that would result from this reaction?

   ZN + H₂
   A. O₂  B. H₂S  C. H₂O  D. ZnSO₄

21. Which of the following are used to speed up this chemical reaction?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>a catalyst</td>
</tr>
<tr>
<td>II</td>
<td>increased temperature</td>
</tr>
<tr>
<td>III</td>
<td>increased surface area</td>
</tr>
</tbody>
</table>

   A. I only  B. I and II only  C. II and III only  D. I, II and III

---

**Catalytic Converters**

The catalytic converter in a car reduces nitrogen oxide pollution. The converter has a ceramic honeycomb structure plated with platinum and rhodium and is located in the exhaust system close enough to the engine to stay warm. The honeycomb structure provides a large surface area over which the exhaust gases can react. As the gases from the car engine are channeled through the warm honeycomb, the metals remove the oxygen from the nitrogen monoxide (NO) molecules and the oxygen atoms form O₂:

2NO → O₂
22. What process is illustrated above?
A. a nuclear reaction producing a beta particle  
B. a nuclear reaction producing an alpha particle  
C. a chemical change producing a hydrogen atom  
D. a nuclear fusion reaction producing two new elements

23. Which of the following is a concern when nuclear energy is used to produce electricity?
A. Nuclear waste material has a very short half-life.  
B. Nuclear energy does not produce a lot of electricity  
C. An accident at a reactor could release a large amount of radioactivity.  
D. Radioactivity emitted during normal operation of a reactor can harm workers or those living nearby.

Use the following cartoon to answer the next question.

At the home for old atoms…
-------------------------------------------
"When I was young I used to feel so alive and dangerous! Would you believe I started life as a uranium-238? Then one day I accidentally emitted an alpha particle. Now look at me -- an old atom of lead-206. It seems that all my life since then has been nothing but decay, decay, decay…"

24. What element was formed during the first decay of uranium-238?
A. lead-206         B. radium-226    C. thorium-234      D. uranium-234
25. Which of the following reactions would produce a proton?

A. $^{263}_{106}$ Sg $\rightarrow ^{259}_{104}$ Rf +

B. $^{239}_{93}$ Np $\rightarrow ^{239}_{94}$ Pu +

C. $^{4}_{2}$ He + $^{14}_{7}$ N $\rightarrow ^{17}_{8}$ O +

D. $^{1}_{0}$ n + $^{235}_{92}$ U $\rightarrow ^{92}_{36}$ Kr + $^{141}_{36}$ Ba +

26. Which two of the following atomic models represents elements that can easily combine with each other to form a covalent compound?

A. I and II  
B. I and IV  
C. II and III  
D. III and IV

27. Which of the following Lewis diagrams shows the valence electron arrangement for carbon?

A. C

B. C

C. C

D. C

28. Which element will not combine with oxygen?

A. J  
B. K  
C. L  
D. M
29. Which of the following represents the Lewis diagram of the molecule formed in the reaction shown below?

: \[ \cdot \cdot \cdot + \cdot \cdot \cdot \rightarrow ? \]

A. \( \cdot \cdot \cdot \cdot \cdot \)
B. \( \cdot \cdot \cdot \cdot \cdot \cdot \cdot \)
C. \( \cdot \cdot \cdot \cdot \cdot \cdot \cdot \)
D. \( \cdot \cdot \cdot \cdot \cdot \cdot \cdot \)

30. Which of the following is the term given to the scale on which each unit represents a 10-fold change in the hydrogen ion concentration?

A. pH   B. indicator   C. acid/base   D. neutralization

31. Which of the following represents an organic molecule?

A. \( \)
B. \( \)
C. \( \)
D. \( \)

32. Which of the following correctly classifies each formula as an acid, base or salt

<table>
<thead>
<tr>
<th></th>
<th>Acid</th>
<th>Base</th>
<th>Salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ca(OH)</td>
<td>H</td>
<td>MgCl</td>
</tr>
<tr>
<td>B</td>
<td>H</td>
<td>Ca(OH)</td>
<td>MgCl</td>
</tr>
<tr>
<td>C</td>
<td>MgCl</td>
<td>H</td>
<td>Ca(OH)</td>
</tr>
<tr>
<td>D</td>
<td>Ca(OH)</td>
<td>MgCl</td>
<td>H</td>
</tr>
</tbody>
</table>
Use the following diagram of a molecule to answer the next question.

33. What compound is represented by the illustrated molecule?
A. nitric acid  
B. hydrogen nitride  
C. nitrogen trioxide  
D. nitrogen hydroxide

34. If the compound HF reacts with KOH, what type of reaction has occurred?
A. combustion  
B. neutralization  
C. decomposition  
D. single replacement

35. Which of the following elements is more reactive than sodium?
A. neon  
B. lithium  
C. potassium  
D. magnesium

36. Which of the following are characteristics of metals?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>They have a positive ion charge.</td>
</tr>
<tr>
<td>II</td>
<td>They lose electrons when forming ions.</td>
</tr>
<tr>
<td>III</td>
<td>They are found on the left-hand side of the Periodic Table.</td>
</tr>
</tbody>
</table>

A. I only  
B. I and III only  
C. II and III only  
D. I, II and III only

37. Which of the following will form an acidic solution when dissolved in water?
A. NO₂  
B. CaO  
C. CuO  
D. Na₂O

Use the following illustration to answer the next question.

38. Which formula is represented by the illustration?
A. C₃H₇  
B. 3CH₃  
C. CH₃COOH  
D. CH₃CH₂CH₃
39. Which of the following would provide the best data to support the Law of Conservation of Mass?

A. ![Image A]
B. ![Image B]
C. ![Image C]
D. ![Image D]

40. If four molecules of ammonia undergo decomposition, how many molecules of nitrogen and hydrogen will form?

Use the following illustration of four reactant molecules of ammonia to answer the next question.

Use the following illustration of four reactant molecules of ammonia to answer the next question.

<table>
<thead>
<tr>
<th></th>
<th>Nitrogen molecules</th>
<th>Hydrogen molecules</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>
41. Which set of ordered coefficients correctly balances the following equation?

\[ \_ \_ \text{K}_3 \]

A. 1, 2, 3, 2  B. 2, 1, 3, 2  C. 2, 2, 1, 3  D. 2, 3, 3, 1

42. Which of the following products would balance the reaction?

\[ \text{CH}_4 + 2\text{O} \]

A. CO  B. CO\(_2\)  C. 2CO  D. 2CO\(_2\)

43. When calcium metal is added to water, it reacts to produce calcium hydroxide and hydrogen gas. Which one of the following reactions would progress at the greatest rate?

A.  

B.  

C.  

D.  

Use the following information from a student's experiment to answer the next question.

A student used three different catalysts to increase the rate at which H\(_2\)O\(_2\) decomposes into O\(_2\) and water. He filled in the Observation Chart below.

<table>
<thead>
<tr>
<th>Test Tube</th>
<th>Catalyst</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>no catalyst</td>
<td>no bubbles</td>
</tr>
<tr>
<td>1</td>
<td>MnO</td>
<td>bubbles form rapidly</td>
</tr>
<tr>
<td>2</td>
<td>CuO</td>
<td>bubbles form slowly</td>
</tr>
<tr>
<td>3</td>
<td>ZnO</td>
<td>bubbles form very slowly</td>
</tr>
</tbody>
</table>

He also measured the volume of O\(_2\) produced during each reaction with different catalysts and recorded the information on the graph below.
44. Which conclusion is supported by the observations?
   A. $\text{MnO}_2$ is the most effective catalyst.
   B. Catalysts have no effect on reaction rate.
   C. The reaction occurs most quickly if ZnO is added.
   D. All three catalysts cause $\text{O}_2$ to be produced at the same rate.

45. What isotope has 25 protons and 29 neutrons?
   A. copper-25    B. copper-54    C. manganese-29    D. manganese-54

46. A fossil is removed from a bedrock layer and is found to contain 1/4 of the original amount of carbon-14. What conclusion can be made about the age of the fossil?
   A. It is 1 433 years old.    B. It is 5 730 years old.
   C. It is 11 460 years old.   D. It is 22 920 years old.

47. Which of the following are correct statements about nuclear fusion?

   | I | Mass is converted into energy. |
   | II | The reaction occurs in hydrogen bombs and in the Sun. |
   | III | The process divides a nucleus into two or more fragments, releasing neutrons and energy. |

   A. I and II only    B. I and III only    C. II and III only    D. I, II and III

48. Which of the following completes the nuclear reaction shown?

   $$^{235}_{92}\text{U} + ^{1}_0\text{n} \rightarrow ^{94}_{38}\text{Sr} + ^{140}_{54}\text{Xe} + \square$$

   A. one proton    B. two protons    C. one neutron    D. two neutrons

49. The total energy due to random molecular motion is called
50. Which of the following describes a proton?

<table>
<thead>
<tr>
<th>Charge</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. none</td>
<td>in the nucleus</td>
</tr>
<tr>
<td>B. positive</td>
<td>in the nucleus</td>
</tr>
<tr>
<td>C. positive</td>
<td>outside the nucleus</td>
</tr>
<tr>
<td>D. negative</td>
<td>outside the nucleus</td>
</tr>
</tbody>
</table>

51. Which of the following elements exists as a covalently bonded molecule?
   A. gold      B. helium      C. sodium      D. bromine

Use the following Bohn diagram to answer the next question.

52. The Bohr diagram represents
   A. a sodium ion      B. a fluoride ion
   C. a helium atom     D. a fluorine atom

53. An atom of phosphorus has how many valence electrons?
   A. 1      B. 3      C. 5      D. 15

Use the following Lewis diagram to answer question 54.

••

54. The Lewis diagram above represents either
   A. a helium atom or a lithium ion      B. a neon atom or a fluorine atom
   C. an argon atom or a fluorine atom   D. a potassium atom or a calcium atom

55. How are lone pairs and bonding pairs of electron similar?
   A. both have no charge      B. both form ionic bonds
   C. both form covalent bonds   D. both are valence electrons
56. The water from the Great Salt Lake in Utah has the following effects on acid-base indicators:

- Indigo carmine turns blue.
- Phenolphthalein turns pink.
- Bromothymol blue turns blue.

What is its pH?
A. 8  B. 10  C. 12  D. 14

57. What colour would bromthymol blue turn in acetic acid?
A. red  B. blue  C. yellow  D. colourless

58. Which of the following, when dissolved in rainwater, cause acid precipitation?
A. alkali metals  B. metal oxides
C. non-metal oxides  D. alkaline earth metals

59. What is the chemical formula for ammonium oxide?
A. Al₂O₃  B. Am₂O₃  C. NH₄O  D. (NH₄)₂O

60. What is the name of the compound represented by the formula Cu(HCO₃)₂?
A. copper carbonate  B. copper bicarbonate
C. copper (II) carbonate  D. copper (II) bicarbonate

61. What is the written expression for the Cr²⁺ ion?
A. chromium  B. chromium (I)  C. chromium (II)  D. chromium (IV)

62. When Rh⁴⁺ combines with PO₄³⁻, what is the name of the compound that is formed?
A. rhodium phosphate  B. rhodium phosphide
C. rhodium (IV) phosphide  D. rhodium (IV) phosphate

63. What is the formula for the compound dinitrogen pentoxide?
A. NO₄  B. NO₅  C. N₂O₄  D. N₂O₅

64. Which of the following is an inorganic compound?
A. HCl  B. CH₃OH  C. CH₃CH₃  D. HCl₂C₂F₂H

65. What coefficient is needed for I₂ in order to balance the equation?

A. 1  B. 2  C. 3  D. 4
66. Which of the following shows the balanced reaction as hydrogen and oxygen combine to produce water?

A. 

B. 

C. 

D. 

67. Which set of ordered coefficients balances the equation shown below?

\[ \_\text{KHCO} \]

A. 3, 1, 3, 1, 3  B. 3, 1, 1, 3  C. 3, 1, 3, 1  D. 3, 1, 1, 3, 3

68. What type of reaction is represented by the equation?

\[ 2\text{C}_8 \]

A. synthesis  B. combustion  C. decomposition  D. single replacement

69. What products are produced when sodium hydroxide reacts with hydrogen phosphate?

A. NaOH and H₂O  B. Na₃PO₄ and H₂O  C. NaOH and H₃PO₄  D. Na₃PO₄ and P(OH)₃

70. Karen notices that cupcake recipes always have shorter cooking times than larger cakes. Which of the following factors accounts for this observation?
A. presence of a catalyst  
B. increased surface area  
C. increased temperature  
D. increased concentration

71. Which of the following represents an isotope?  
A. H\textsubscript{2}  
B. plutonium  
C. potassium-40  
D. silver sulphide

72. A rock sample originally contained 8g of U-235 but now contains only 2g of U-235. How old is the rock?  
A. 710 Ma  
B. 1420 Ma  
C. 2130 Ma  
D. 2840 Ma

Use the following information to answer the next question.

\[
\begin{align*}
^{214}_{83}\text{Bi} & \rightarrow ^{214}_{84}\text{Po} + \_?\_ \\
\end{align*}
\]

73. Which of the following could complete the nuclear equation?  
A. I only  
B. II only  
C. I and II only  
D. I, II and III

74. Which reaction occurs when an alpha particle hits a beryllium-9 nucleus?  
A. \[
\frac{9}{4}\text{Be} + \frac{2}{4}\text{He} \rightarrow \frac{12}{6}\text{C} + \frac{1}{0}\text{n}
\]
B. \[
\frac{4}{9}\text{Be} + \frac{2}{4}\text{He} \rightarrow \frac{12}{6}\text{C} + \frac{1}{0}\text{n}
\]
C. \[
\frac{4}{9}\text{Be} + \frac{2}{4}\text{He} \rightarrow \frac{6}{12}\text{Mg} + \frac{0}{1}\text{n}
\]
D. \[
\frac{9}{4}\text{Be} + \frac{4}{2}\text{He} \rightarrow \frac{12}{6}\text{Mg} + \frac{1}{0}\text{n}
\]
Use the following diagram of a boron atom to answer the next question.

75. Subatomic particle X is
   A. an ion.       B. a proton.       C. a neutron.       D. an electron.

76. Which of the following is a list of diatomic elements?
   A. H₂, N₂, O₂, F₂, Cl₂, Br₂, I₂
   B. H₂, N₂, O₂, Br₂, F₂, C₂, Na₂
   C. H₂, N₂, O₂, He₂, Ne₂, Cl₂, Br₂
   D. N₂, Rn₂, O₂, He₂, Cl₂, Ne₂, Br₂

Use the following Bohr diagram of a molecule to answer the next two questions.

77. The molecule has four covalent bonds.
   A. The statement is supported by the diagram.
   B. The statement is refuted by the diagram.
   C. The statement is neither supported nor refuted by the diagram.

78. How many lone pairs of electrons are in the molecule?
   A. 0       B. 2       C. 4       D. 6
Use the following Lewis diagram for a carbon atom to answer the next question.

\[ \cdot C \cdot \]

79. What does the number of dots represent?
A. the number of protons in the atom  
B. the total number of electrons in the atom  
C. the number of electrons lost from the atom  
D. the number of valence electrons in the atom

80. An atom of which of the following elements has the most unpaired electrons?
A. neon  
B. boron  
C. fluorine  
D. hydrogen

Use the following Lewis diagram to answer the next question.

\[ \cdot X \cdot \cdot Y \cdot \]

81. Which of the following pairs of elements could be represented by X and Y

Use the following article to answer the next 3 questions.

**Acid Rain**

Normal rainwater is naturally slightly acidic with a pH that ranges between 4.4 and 5.6. This is the result of carbon dioxide in the air reacting to produce weak carbonic acid. Sea spray, rotting vegetation, plankton and, in some locations, volcanoes are important natural sources of CO₂.

If the pH is less than 4.4, precipitation is called acid rain. The chief culprit in acid rain is sulfur dioxide from fossil fuel combustion. Sulfuric acid eventually forms when sulfur dioxide reacts with rainwater.

Adapted from an article by Red Pearce, "acid rain," NewScientist.com, November 5, 1997.

82. Which indicator would be used to determine if a rainwater sample is acid rain?
A. methyl orange  
B. indigo carmine  
C. phenolphthalein  
D. bromthymol blue

83. What is the formula of the acid responsible for acid rain?
A. H₂S  
B. SO₂  
C. H₂CO₃  
D. H₂SO₄

84. The “chief culprit” in acid rain is an example of which of the following?
A. a base  
B. a metal oxide  
C. non-metal oxide  
D. a diatomic molecule

85. Calcium phosphate is found in bones and teeth. What is the chemical formula for this compound?
A. Ca₃P₂  
B. Ca₃PO₄  
C. Ca₃(PO₃)₂  
D. Ca₃(PO₄)₂

86. What is the ion charge for neptunium in the compound Np₂O₅?
A. 3+  
B. 4+  
C. 5+  
D. 6+
87. What is the name for the compound CoSe?
A. cobalt selenide  
B. cobalt(I) selenide  
C. cobalt(II) selenide  
D. cobalt monoselenide

88. What is the chemical formula for diarsenic pentaoxide?
A. AsO  
B. AsO$_3$  
C. As$_2$O$_5$  
D. As$_5$O$_2$

89. Which of the following represents an inorganic compound?
A. CH$_3$CH$_3$  
B. sodium chloride

90. According to the law of conservation of mass, how much zinc was produced?
A. 20 g  
B. 44 g  
C. 52 g  
D. 128 g

91. What coefficient is needed in front of CO$_2$ to balance the following combustion reaction?

$$\underline{\text{C}_2\text{H}_6} + \underline{\text{O}_2} \rightarrow \underline{\text{CO}_2} + \underline{\text{H}_2\text{O}}$$

A. 1  
B. 4  
C. 6  
D. 7

92. Magnesium chloride reacts with sodium sulfide to produce magnesium sulphide and sodium chloride. What is the coefficient needed in front of sodium chloride to balance this reaction?
A. 1  
B. 2  
C. 3  
D. 4

Use the following diagram of a lab set-up to answer the next two questions.
93. What type of chemical reaction would result from the mixing of the two solutions?
A. synthesis  B. neutralization  C. single replacement  D. double replacement

94. Which of the following is a product of the chemical reaction?
A. PbI  B. H₂O  C. KNO₂  D. KNO₃

Use the following photographs of kindling and a tree trunk to answer the next question.

95. Which of the following explains why kindling burns faster than a tree trunk?
A. It acts as a catalyst.  B. It has a greater surface area.
C. It contains more thermal energy.  D. It has a greater concentration of wood.

96. What does the mass number of an isotope represent?
A. the number of protons  B. the number of neutrons
C. the number of electrons  D. the total number of protons and neutrons

97. Cobalt-60, \(^{60}\text{Co}\), undergoes beta decay. What is the daughter isotope in this nuclear reaction?
A. \(^{59}\text{Fe}\)  B. \(^{56}\text{Mn}\)  C. \(^{60}\text{Ni}\)  D. \(^{59}\text{Co}\)
98. A sealed container contains 200 g of radioactive iodine. After 24 days, the container has only 25 g of radioactive iodine. What is the half-life of this isotope of iodine?
   A. 3 days          B. 8 days          C. 12 days          D. 24 days

   Use the following diagram showing the nuclear decay of U-238 to answer the next question.

99. Which of the following particles are emitted during the 3-step decay process as U-238 decays to U-234?
   A. 2 protons and 4 beta particles  B. 1 alpha particle and 2 protons
   C. 2 alpha particles and 2 protons  D. 1 alpha particle and 2 beta particles
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