1. Ammonia can be made by the following reaction:

\[ \_ \text{N}_2(g) + \_ \text{H}_2(g) \rightarrow \_ \text{NH}_3(g) \]

When the equation is properly balanced, the sum of the coefficients is

A: 6

2. Welders commonly use an apparatus that contains a tank of acetylene (C₂H₂) gas and a tank of oxygen gas. When burned in pure oxygen, acetylene generates a large amount of heat according to the reaction below:

\[ 2\text{C}_2\text{H}_2(g) + 5\text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(g) + 4\text{CO}_2(g) \]

What volume of carbon dioxide gas at STP is produced if 1.00 g of acetylene is combusted completely?

A: 1.72 L

3. Calculate the molarity of 3.51 g of NaCl in 25 mL of water.

A: 2.40 M
4. What is the final pressure in the above apparatus if the valve connecting the two bulbs opens (assume negligible volume of the valve) allowing both bulbs filled with He to mix. Assume ideal gas behavior and constant temperature.

A: 1.30 atm

5. According to the reaction below, what is the theoretical yield of hydrogen gas when 2.50 g of Zn and 0.376 g of HCl are reacted. How much excess reactant is left over in grams.

\[
\text{Zn(s) + 2HCl(aq) \rightarrow ZnCl}_2(aq) + \text{H}_2(g)
\]

A: 0.0104 g H₂

2.16 g excess reactant left
6. The specific heat of graphite (molar mass = 12.01 g/mol) is 0.71 J/g °C. Calculate the energy required to raise the temperature of 2.4 moles of graphite by 25.0 °C.

A: 511 J

7. Given the following data:

\[ \text{C}_2\text{H}_2(\text{g}) + \frac{5}{2} \text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \Delta H = -1300. \text{kJ} \]

\[ \text{C(s)} + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) \quad \Delta H = -394 \text{kJ} \]

\[ \text{H}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l}) \quad \Delta H = -286 \text{kJ} \]

Calculate $\Delta H$ for the following reaction:

\[ 2\text{C(s)} + \text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_2(\text{g}) \]

A: 226 kJ

8. Draw the electron configuration for the following ions

Cl\(^-\): ________________________________ 1s\(^2\)2s\(^2\)2p\(^6\)3s\(^2\)3p\(^6\)

Fe\(^{2+}\): ________________________________ 1s\(^2\)2s\(^2\)2p\(^6\)3s\(^2\)3p\(^6\)4s\(^2\)3d\(^4\) or 1s\(^2\)2s\(^2\)2p\(^6\)3s\(^2\)3p\(^6\)3d\(^6\)
9. Draw a Lewis structure (with the proper VSEPR arrangement) for the following compound and name the shape of each molecule

\[ \text{H}_2\text{S} \]
Shape is bent

10. The reaction that occurs in heat packs used to treat sports injuries is

\[ 4\text{Fe(s)} + 3\text{O}_2(\text{g}) \rightarrow 2\text{Fe}_2\text{O}_3(\text{s}) \quad \Delta H = -1652 \text{ kJ} \]

How much heat is released when 1.00 g of Fe(s) is reacted with excess O₂(g)?
A: -7.39 kJ

11. How many grams of AgOH (molar mass = 169.9 g/mol) would be produced from 21.25 grams of AgNO₃ (molar mass = 124.9 g/mol) according to the reaction below:

\[ \text{AgNO}_3(\text{aq}) + \text{LiOH}(\text{aq}) \rightarrow \text{AgOH}(\text{s}) + \text{LiNO}_3(\text{aq}) \]

A: 15.6 g

What would the percent yield be if 14.8 g of AgOH were made?
A: 94.9%
Chemistry Placement Exam – Sample Test

1. The product of 0.1400 \times 6.02 \times 10^{23} will have how many significant figures?
   - a. 2
   - b. 3
   - c. 23
   - d. 10^{23}
   - e. 7

   ANSWER: B

2. How many significant figures should there be in the answer when you divide 4.1 by 7.464?
   - a. 7
   - b. 4
   - c. 3
   - d. 2
   - e. 1

   ANS: D

3. How many significant figures are there in the result of the following calculation?
   \((4.321/2.8) \times (6.9234 \times 10^5)\)
   - a. 1
   - b. 2
   - c. 3
   - d. 4
   - e. 5

   ANS: B

4. The result of the following calculation has how many significant figures?
   \((1.433) (33.1^\circ C – 31.1^\circ C)(612)\)
   - a. 1
   - b. 2
   - c. 3
   - d. 4
   - e. 5

   ANS: B
5. A student finds that the weight of an empty beaker is 14.049 g. She places a solid in the beaker to give a combined mass of 14.142 g. To how many significant figures is the mass of the solid known?
   a. 2
   b. 3
   c. 1
   d. 5
   e. 4
   ANS: A

6. Calculate the mass of a rectangular solid that has a density of 3.96 g/cm³ and measures 2.50 cm by 1.80 cm by 3.00 cm.
   a. 3.41 g
   b. 53.5 g
   c. 9.90 g
   d. 28.9 g
   e. 56.5 g
   ANS: B

7. Find the volume of an object that has a density of 3.14 g/mL and a mass of 94.7 g.
   a. 30.2 mL
   b. mL
   c. 297 mL
   d. mL
   e. mL
   ANS: A

8. If a 100.-g sample of platinum metal has a volume of 4.671 mL, what is the density of platinum in g/cm³?
   a. 21.4 g/cm³
   b. 2.14 g/cm³
   c. 0.0467 g/cm³
   d. 467 g/cm³
   e. none of these
   ANS: A
9. An experiment requires 74.2 mL of ethyl alcohol. If the density of ethyl alcohol is 0.790 g/cm³, what is the mass of 74.2 mL of ethyl alcohol?

<table>
<thead>
<tr>
<th>Option</th>
<th>Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>93.9</td>
</tr>
<tr>
<td>b.</td>
<td>10.6</td>
</tr>
<tr>
<td>c.</td>
<td>58.6</td>
</tr>
<tr>
<td>d.</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>none of these</td>
</tr>
</tbody>
</table>

ANS: C

10. If a 100.-g sample of a metal has a volume of 8.65 mL, what is the density of the metal?

<table>
<thead>
<tr>
<th>Option</th>
<th>Density (g/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>11.6</td>
</tr>
<tr>
<td>b.</td>
<td>1.16</td>
</tr>
<tr>
<td>c.</td>
<td>0.0865</td>
</tr>
<tr>
<td>d.</td>
<td>9</td>
</tr>
<tr>
<td>e.</td>
<td>none of these</td>
</tr>
</tbody>
</table>

ANS: A

11. The volume (in milliliters) occupied by 41.9 g of mercury (density = 13.6 g/mL) is

<table>
<thead>
<tr>
<th>Option</th>
<th>Volume (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>570</td>
</tr>
<tr>
<td>b.</td>
<td>3.08</td>
</tr>
<tr>
<td>c.</td>
<td>0.325</td>
</tr>
<tr>
<td>d.</td>
<td>28.3</td>
</tr>
<tr>
<td>e.</td>
<td>none of these</td>
</tr>
</tbody>
</table>

ANS: B

12. How many protons, electrons, and neutrons, respectively, does $^{31}$P have?

<table>
<thead>
<tr>
<th>Option</th>
<th>Protons, Electrons, Neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>15, 15, 16</td>
</tr>
<tr>
<td>b.</td>
<td>15, 16, 15</td>
</tr>
<tr>
<td>c.</td>
<td>16, 15, 31</td>
</tr>
<tr>
<td>d.</td>
<td>15, 15, 31</td>
</tr>
<tr>
<td>e.</td>
<td>15, 31, 16</td>
</tr>
</tbody>
</table>

ANS: A

13. How many protons, electrons, and neutrons, respectively, does oxygen have?

<table>
<thead>
<tr>
<th>Option</th>
<th>Protons, Electrons, Neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>8, 18, 8</td>
</tr>
<tr>
<td>b.</td>
<td>8, 8, 8</td>
</tr>
<tr>
<td>c.</td>
<td>8, 10, 8</td>
</tr>
<tr>
<td>d.</td>
<td>8, 14, 8</td>
</tr>
<tr>
<td>e.</td>
<td>8, 18, 16</td>
</tr>
</tbody>
</table>

ANS: B
14. The atom with 69 neutrons and 50 protons has a mass number of
   a. 69
   b. 50
   c. 19
   d. 119
   e. cannot be determined from information given
   ANS: D

15. How many neutrons are contained in an iodine nucleus with a mass number of 131?
   a. 53
   b. 74
   c. 78
   d. 127
   e. 131
   ANS: C

16. The binary compound PCl₃ is called
   a. phosphorus chloride
   b. triphosphorus chloride
   c. monophosphorus trichloride
   d. phosphorus trichloride
   e. none of these
   ANS: D

17. The correct formula for ammonium sulfate is
   a. NH₄SO₃
   b. NH₄SO₄
   c. (NH₄)₂SO₃
   d. (NH₄)₂SO₄
   e. (NH₃)₂SO₃
   ANS: D

18. The name of the BrO₃⁻ ion is
   a. bromate ion
   b. bromite ion
   c. hypobromite ion
   d. perbromate ion
   e. bromoxide ion
   ANS: A
19. The name for MnBr₂ is
   a. manganese(II) bromide
   b. manganese(I) bromide
   c. magnesium bromide
   d. manganese bromide
   e. manganese(III) bromide

   ANS: A

20. The name for Al(OH)₃ is
   a. aluminum(III) hydroxide
   b. aluminum trihydroxide
   c. aluminum hydroxide
   d. monaluminum trihydroxide
   e. aluminum(I) hydroxide

   ANS: C

21. The name for Ba(NO₃)₂ is
   a. barium dinitrate
   b. barium(II) nitrate
   c. barium nitrite
   d. barium(I) nitrate
   e. barium nitrate

   ANS: E

22. The name for PCl₅ is ______________.

   ANS: phosphorus pentachloride

23. The name for N₂O is ______________.

   ANS: dinitrogen monoxide

24. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

   Sn + NaOH $\rightarrow$ Na₂SnO₂ + H₂

   a. 1
   b. 2
   c. 3
   d. 4
   e. 5

   ANS: A
25. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[ \text{Na}_2\text{S}_2\text{O}_3 + \text{I}_2 \rightarrow \text{NaI} + \text{Na}_2\text{S}_4\text{O}_6 \]

<table>
<thead>
<tr>
<th>Option</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>2</td>
</tr>
<tr>
<td>c.</td>
<td>3</td>
</tr>
<tr>
<td>d.</td>
<td>4</td>
</tr>
<tr>
<td>e.</td>
<td>6</td>
</tr>
</tbody>
</table>

ANS: B

26. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[ \text{Pb(NO}_3\text{)}_2 + \text{K}_2\text{CO}_3 \rightarrow \text{PbCO}_3 + \text{KNO}_3 \]

<table>
<thead>
<tr>
<th>Option</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>5</td>
</tr>
<tr>
<td>b.</td>
<td>4</td>
</tr>
<tr>
<td>c.</td>
<td>3</td>
</tr>
<tr>
<td>d.</td>
<td>2</td>
</tr>
<tr>
<td>e.</td>
<td>1</td>
</tr>
</tbody>
</table>

ANS: D

27. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[ \text{Al} + \text{Fe}_3\text{O}_4 \rightarrow \text{Al}_2\text{O}_3 + \text{Fe} \]

<table>
<thead>
<tr>
<th>Option</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>3</td>
</tr>
<tr>
<td>c.</td>
<td>6</td>
</tr>
<tr>
<td>d.</td>
<td>9</td>
</tr>
<tr>
<td>e.</td>
<td>12</td>
</tr>
</tbody>
</table>

ANS: D

28. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[ \text{CH}_3\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} \]

<table>
<thead>
<tr>
<th>Option</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>2</td>
</tr>
<tr>
<td>c.</td>
<td>3</td>
</tr>
<tr>
<td>d.</td>
<td>4</td>
</tr>
<tr>
<td>e.</td>
<td>6</td>
</tr>
</tbody>
</table>

ANS: D
29. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[
P_4O_{10} + H_2O \rightarrow H_3PO_4
\]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>10</td>
</tr>
<tr>
<td>b.</td>
<td>6</td>
</tr>
<tr>
<td>c.</td>
<td>4</td>
</tr>
<tr>
<td>d.</td>
<td>2</td>
</tr>
<tr>
<td>e.</td>
<td>1</td>
</tr>
</tbody>
</table>

ANS: E

30. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[
NO_2 + H_2O \rightarrow HNO_3 + NO
\]

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>2</td>
</tr>
<tr>
<td>c.</td>
<td>3</td>
</tr>
<tr>
<td>d.</td>
<td>4</td>
</tr>
<tr>
<td>e.</td>
<td>5</td>
</tr>
</tbody>
</table>

ANS: C

31. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[
MnO_2 + HCl \rightarrow MnCl_2 + Cl_2 + H_2O
\]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>5</td>
</tr>
<tr>
<td>b.</td>
<td>4</td>
</tr>
<tr>
<td>c.</td>
<td>3</td>
</tr>
<tr>
<td>d.</td>
<td>2</td>
</tr>
<tr>
<td>e.</td>
<td>1</td>
</tr>
</tbody>
</table>

ANS: B
32. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?

\[ \text{PCl}_5 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_4 + \text{HCl} \]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>2</td>
</tr>
<tr>
<td>c.</td>
<td>3</td>
</tr>
<tr>
<td>d.</td>
<td>4</td>
</tr>
<tr>
<td>e.</td>
<td>5</td>
</tr>
</tbody>
</table>

ANS: E

33. How many atoms of calcium are present in 58.2 g of calcium?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$8.74 \cdot 10^{23}$</td>
</tr>
<tr>
<td>b.</td>
<td>$2.41 \cdot 10^{-24}$</td>
</tr>
<tr>
<td>c.</td>
<td>$3.50 \cdot 10^{25}$</td>
</tr>
<tr>
<td>d.</td>
<td>$6.02 \cdot 10^{23}$</td>
</tr>
<tr>
<td>e.</td>
<td>none of these</td>
</tr>
</tbody>
</table>

ANS: A

34. A 30.5-g sample of Ca contains how many calcium atoms?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$4.58 \cdot 10^{23}$ atoms</td>
</tr>
<tr>
<td>b.</td>
<td>61.0 atoms</td>
</tr>
<tr>
<td>c.</td>
<td>$7.61 \cdot 10^{1}$ atoms</td>
</tr>
<tr>
<td>d.</td>
<td>$1.84 \cdot 10^{25}$ atoms</td>
</tr>
<tr>
<td>e.</td>
<td>30.5 atoms</td>
</tr>
</tbody>
</table>

ANS: A

35. Calculate the mass of $3.53 \cdot 10^{26}$ atoms of silver.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$6.32 \cdot 10^{4}$ g</td>
</tr>
<tr>
<td>b.</td>
<td>$3.81 \cdot 10^{28}$ g</td>
</tr>
<tr>
<td>c.</td>
<td>$1.97 \cdot 10^{48}$ g</td>
</tr>
<tr>
<td>d.</td>
<td>$5.86 \cdot 10^{2}$ g</td>
</tr>
<tr>
<td>e.</td>
<td>none of these</td>
</tr>
</tbody>
</table>

ANS: A
36. 66.4 g of Pt represents how many atoms?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$2.05 \cdot 10^{23}$ atoms</td>
</tr>
<tr>
<td>b.</td>
<td>0.340 atoms</td>
</tr>
<tr>
<td>c.</td>
<td>$4.00 \cdot 10^{25}$ atoms</td>
</tr>
<tr>
<td>d.</td>
<td>$2.15 \cdot 10^{-20}$ atoms</td>
</tr>
<tr>
<td>e.</td>
<td>none of these</td>
</tr>
</tbody>
</table>

ANS: A

37. A sample containing 0.398 mol of sodium has a mass of ________ g.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>9.15</td>
</tr>
<tr>
<td>b.</td>
<td>$1.73 \cdot 10^{-2}$</td>
</tr>
<tr>
<td>c.</td>
<td>23.388</td>
</tr>
<tr>
<td>d.</td>
<td>$5.78 \cdot 10^1$</td>
</tr>
<tr>
<td>e.</td>
<td>$2.40 \cdot 10^{23}$</td>
</tr>
</tbody>
</table>

ANS: A

38. A 3.37-mol sample of aluminum represents how many atoms?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>$2.03 \cdot 10^{24}$ atoms</td>
</tr>
<tr>
<td>b.</td>
<td>$5.60 \cdot 10^{24}$ atoms</td>
</tr>
<tr>
<td>c.</td>
<td>$1.25 \cdot 10^{23}$ atoms</td>
</tr>
<tr>
<td>d.</td>
<td>$5.48 \cdot 10^{25}$ atoms</td>
</tr>
<tr>
<td>e.</td>
<td>none of these</td>
</tr>
</tbody>
</table>

ANS: A

39. A 7.11-g sample of potassium chlorate was decomposed according to the following equation:

$$2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$$

How many moles of oxygen are formed?

A) 2.78 g  
B) 0.0580 mol  
C) 0.0387 mol  
D) 0.0870 mol  
E) none of these

ANS: D
40. Consider the following reaction:
\[ \text{CH}_4(\text{g}) + 4\text{Cl}_2(\text{g}) \rightarrow \text{CCl}_4(\text{g}) + 4\text{HCl}(\text{g}) \]
What mass of CCl₄ is formed by the reaction of 5.14 g of methane with an excess of chlorine?
A) 12.3 g  
B) 0.54 g  
C) 791 g  
D) 49.3 g  
E) none of these
ANS: D

41. Nitric oxide, NO, is made from the oxidation of NH₃, and the reaction is represented by the equation:
\[ 4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O} \]
What mass of NO can be produced from 7.55 g of NH₃?
A) 4.28 g NO  
B) 13.3 g NO  
C) 7.55 g NO  
D) 20.0 g NO  
E) 16.6 g NO
ANS: B

42. Nitric oxide, NO, is made from the oxidation of NH₃, and the reaction is represented by the equation:
\[ 4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O} \]
What mass of O₂ would be required to react completely with 6.85 g of NH₃?
A) 4.56 g O₂  
B) 10.3 g O₂  
C) 8.04 g O₂  
D) 16.1 g O₂  
E) 12.9 g O₂
ANS: D

43. For the reaction \( \text{P}_4\text{O}_{10}(s) + 6\text{H}_2\text{O}(l) \rightarrow 4\text{H}_3\text{PO}_4(\text{aq}) \), what mass of \( \text{P}_4\text{O}_{10} \) must be consumed if \( 3.71 \times 10^{23} \) molecules of H₂O are also consumed?
A) \( 1.05 \times 10^3 \) g \( \text{P}_4\text{O}_{10} \)  
B) 29.1 g \( \text{P}_4\text{O}_{10} \)  
C) 175 g \( \text{P}_4\text{O}_{10} \)  
D) 1.85 g \( \text{P}_4\text{O}_{10} \)  
E) 66.6 g \( \text{P}_4\text{O}_{10} \)
ANS: B
44. Phosphoric acid can be prepared by reaction of sulfuric acid with “phosphate rock” according to the equation:

\[ \text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{SO}_4 \rightarrow 3\text{CaSO}_4 + 2\text{H}_3\text{PO}_4 \]

Suppose the reaction is carried out starting with 129 g of Ca\(_3\)(PO\(_4\))\(_2\) and 97.4 g of H\(_2\)SO\(_4\). Which substance is the limiting reactant?

A) Ca\(_3\)(PO\(_4\))\(_2\)
B) H\(_2\)SO\(_4\)
C) CaSO\(_4\)
D) H\(_3\)PO\(_4\)
E) none of these

ANS: B

45. Suppose the reaction \(\text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{SO}_4 \rightarrow 3\text{CaSO}_4 + 2\text{H}_3\text{PO}_4\) is carried out starting with 153 g of Ca\(_3\)(PO\(_4\))\(_2\) and 76.8 g of H\(_2\)SO\(_4\). How much phosphoric acid will be produced?

A) 76.7 g
B) 51.1 g
C) 229.8 g
D) 115.1 g
E) 96.7 g

ANS: B

46. SO\(_2\) reacts with H\(_2\)S as follows:

\[ 2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 3\text{S} + 2\text{H}_2\text{O} \]

When 7.50 g of H\(_2\)S reacts with 12.75 g of SO\(_2\), which statement applies?

A) 6.38 g of sulfur are formed.
B) 10.6 g of sulfur are formed.
C) 0.0216 moles of H\(_2\)S remain.
D) 1.13 g of H\(_2\)S remain.
E) SO\(_2\) is the limiting reagent.

ANS: B

47. Consider the following reaction:

\[ \text{CH}_4(g) + 4\text{Cl}_2(g) \rightarrow \text{CCl}_4(g) + 4\text{HCl}(g) \]

What mass of CCl\(_4\) will be formed if 1.20 moles of methane react with 1.11 moles of chlorine?

A) 185 g
B) 171 g
C) 683 g
D) 42.7 g
E) 19.7 g

ANS: D
48. The electron configuration for the barium atom is:
   A) $1s^22s^22p^63s^23p^64s^23d^{10}$
   B) [Xe]6s
   C) $1s^22s^22p^63s^23p^64s^1$
   D) $1s^22s^22p^63s^23p^64s^2$
   E) none of these

ANS: B

49. The electron configuration for the carbon atom is:
   A) $1s^22s^22p^2$
   B) [He]2s
   C) [Ne]2s$^2$2p$^2$
   D) $1s^22p^4$
   E) none of these

ANS: A

50. All alkaline earths have the following number of valence electrons:
   A) 1
   B) 3
   C) 6
   D) 2
   E) none of these

ANS: D

51. Order the elements S, Cl, and F in terms of increasing ionization energy.
   A) S, Cl, F
   B) Cl, F, S
   C) F, S, Cl
   D) F, Cl, S
   E) S, F, Cl

ANS: A

52. Order the elements S, Cl, and F in terms of increasing atomic radii.
   A) S, Cl, F
   B) Cl, F, S
   C) F, S, Cl
   D) F, Cl, S
   E) S, F, Cl

ANS: D
53. \(1s^22s^22p^63s^23p^64s^23d^{10}\) is the correct electron configuration for which of the following atoms?
A) Ca
B) Ti
C) Ge
D) Zr
E) none of these
ANS: B

54. Which of the following compounds contains only one unshared pair of valence electrons?
A) NH\(_3\)
B) H\(_2\)O
C) CH\(_4\)
D) NaCl
E) BF\(_3\)
ANS: A

55. Which of the following Lewis structures best describes BF\(_3\)?
A)
B)
C)
D)
E)
ANS: A
56. The molecular structure of OF$_2$ is
   A) pyramidal
   B) none of these
   C) octahedral
   D) trigonal planar
   E) V-shaped

   ANS: E

57. NI$_3$
   A) pyramidal
   B) tetrahedral
   C) square planar
   D) octahedral
   E) none of these

   ANS: A

58. SiH$_4$
   A) pyramidal
   B) tetrahedral
   C) square planar
   D) octahedral
   E) none of these

   ANS: B

59. The molecular structure of NCl$_3$ is
   A) pyramidal
   B) none of these
   C) octahedral
   D) trigonal planar
   E) bent

   ANS: A

60. A 16.4-g sample of HF is dissolved in water to give $2.0 \times 10^2$ mL of solution. The concentration of the solution is:
   A) 0.82 M
   B) 0.16 M
   C) 0.08 M
   D) 4.1 M
   E) 8.2 M

   ANS: D
61. A 38.1-g sample of SrCl₂ is dissolved in 112.5 mL of solution. Calculate the molarity of this solution.
A) 27.0 \text{ M}
B) 2.14 \text{ M}
C) 53.7 \text{ M}
D) 0.339 \text{ M}
E) none of these
ANS: B

62. You mix 55 mL of 1.00 M silver nitrate with 25 mL of 0.84 M sodium chloride. What mass of silver chloride should you form?
A) 3.0 g
B) 6.0 g
C) 3.3 g
D) 6.6 g
E) none of these
ANS: A

63. Calculate the \([H^+]\) in a solution that has a pH of 9.88.
A) 4.1 M
B) 9.9 M
C) \(7.6 \times 10^{-5} \text{ M}\)
D) \(1.3 \times 10^{-10} \text{ M}\)
E) none of these
ANS: D

64. Calculate the \([H^+]\) in a solution that has a pH of 2.73.
A) 2.7 M
B) 11.3 M
C) \(1.9 \times 10^{-3} \text{ M}\)
D) \(5.4 \times 10^{-12} \text{ M}\)
E) none of these
ANS: C

65. Calculate the \([H^+]\) in a solution that has a pH of 8.73.
A) \(1.9 \times 10^{-9} \text{ M}\)
B) \(5.4 \times 10^{-6} \text{ M}\)
C) \(8.7 \times 10^{-9} \text{ M}\)
D) \(9.4 \times 10^{-1} \text{ M}\)
E) \(7.2 \times 10^{-1} \text{ M}\)
ANS: A
66. The pH of a solution at 25°C in which \([\text{OH}^-] = 3.9 \times 10^{-5} \text{ M}\) is:
   A) 4.41
   B) 3.90
   C) 9.59
   D) 4.80
   E) none of these
   ANS: C

67. You fill a balloon with 2.50 moles of gas at 22°C at a pressure of 1.62 atm. What is the volume of the balloon?
   A) 15.7 L
   B) 98.0 L
   C) 37.4 L
   D) 2.79 L
   E) 22.4 L
   ANS: C

68. What volume is occupied by 21.0 g of methane (CH₄) at 27°C and 1.25 atm?
   A) 37.2 L
   B) 25.8 L
   C) 2.32 L
   D) 4.14 \times 10^2 \text{ L}
   E) not enough data to calculate
   ANS: B

69. Gaseous C₂H₄ reacts with O₂ according to the following equation:
   \[ \text{C}_2\text{H}_4(g) + 3\text{O}_2(g) \rightarrow 2\text{CO}_2 + \text{H}_2\text{O}(g) \]
   What volume of oxygen gas at STP is needed to react with 5.75 mol of C₂H₄?
   A) 17.3 L
   B) 42.9 L
   C) 3.86 \times 10^2 \text{ L}
   D) 1.29 \times 10^2 \text{ L}
   E) Not enough information is given to solve the problem.
   ANS: C
70. Given the equation: 

\[ 2\text{KClO}_3(s) \rightarrow 2\text{KCl}(s) + 3\text{O}_2(g) \]

A 3.00-g sample of KClO₃ is decomposed and the oxygen at 24.0°C and 0.717 atm is collected. What volume of oxygen gas will be collected assuming 100% yield?

A) \(8.32 \times 10^2\) mL  
B) \(1.01 \times 10^3\) mL  
C) \(1.25 \times 10^1\) mL  
D) \(5.55 \times 10^2\) mL  
E) none of these

ANS: C