<table>
<thead>
<tr>
<th>Sheet</th>
<th>Problem</th>
<th>Random Answer</th>
</tr>
</thead>
</table>
| 1     | Balance the following equation  
       ___ O₂ + ___ H₂ → ___ H₂O | 1, 6, 2, 3 |
| 2     | Balance the following equation  
       ___ Mg + ___ N₂ → ___ Mg₃N₂ | 1, 2, 2 |
| 3     | Balance the following equation  
       ___ Ca + ___ AgOH → ___ Ca(OH)₂ + ___ Ag | 3, 1, 1 |
| 4     | Balance the following equation  
       ___ MgCl₂ + ___ Na₃P → ___ NaCl + ___ Mg₃P₂ | 1, 2, 1, 2 |
| 5     | Balance the following equation  
       ___ C₃H₆ + ___ O₂ → ___ CO₂ + ___ H₂O | 3, 2, 6, 1 |
| 6     | Balance the following equation  
       ___ H₂O₂ → ___ H₂O + ___ O₂ | 2, 9, 6, 6 |
| 7     | Balance the following equation  
       ___ P + ___ O₂ → ___ P₂O₅ | 2, 2, 1 |
| 8     | Balance the following equation  
       ___ Mg + ___ HCl → ___ MgCl₂ + ___ H₂ | 4, 5, 2 |
| 9     | Balance the following equation  
       ___ Cr + ___ Fe(NO₃)₂ → ___ Fe + ___ Cr(NO₃)₃ | 1, 2, 1, 1 |
| 10    | Balance the following equation  
       ___ Al₂(SO₄)₃ + ___ KOH → ___ Al(OH)₃ + ___ K₂SO₄ | 2, 3, 3, 2 |
<table>
<thead>
<tr>
<th>Sheet</th>
<th>Problem</th>
<th>Random Answer</th>
</tr>
</thead>
</table>
| 1     | Balance the following equation  
\[ \_\_ O_2 + \_\_ H_2 \rightarrow \_\_ H_2O \] | 1, 6, 2, 3 |
| 2     | Balance the following equation  
\[ \_\_ Mg + \_\_ N_2 \rightarrow \_\_ Mg_3N_2 \] | 1, 2, 2 |
| 3     | Balance the following equation  
\[ \_\_ Ca + \_\_ AgOH \rightarrow \_\_ Ca(OH)_2 + \_\_ Ag \] | 3, 1, 1 |
| 4     | Balance the following equation  
\[ \_\_ MgCl_2 + \_\_ Na_3P \rightarrow \_\_ NaCl + \_\_ Mg_3P_2 \] | 1, 2, 1, 2 |
| 5     | Balance the following equation  
\[ \_\_ C_3H_6 + \_\_ O_2 \rightarrow \_\_ CO_2 + \_\_ H_2O \] | 3, 2, 6, 1 |
| 6     | Balance the following equation  
\[ \_\_ H_2O_2 \rightarrow \_\_ H_2O + \_\_ O_2 \] | 2, 9, 6, 6 |
| 7     | Balance the following equation  
\[ \_\_ P + \_\_ O_2 \rightarrow \_\_ P_2O_5 \] | 2, 2, 1 |
| 8     | Balance the following equation  
\[ \_\_ Mg + \_\_ HCl \rightarrow \_\_ MgCl_2 + \_\_ H_2 \] | 4, 5, 2 |
| 9     | Balance the following equation  
\[ \_\_ Cr + \_\_ Fe(NO_3)_2 \rightarrow \_\_ Fe + \_\_ Cr(NO_3)_3 \] | 1, 2, 1, 1 |
| 10    | Balance the following equation  
\[ \_\_ Al_2(SO_4)_3 + \_\_ KOH \rightarrow \_\_ Al(OH)_3 + \_\_ K_2SO_4 \] | 2, 3, 3, 2 |
\[\frac{4}{3}x^3 + 5 = 53\]
\[\frac{4}{3}x^3 + 5 - 5 = 53 - 5\]
\[\frac{4}{3}x^3 = 48\]
\[\frac{3}{3}x^3 = \frac{48}{3}\]
\[x^3 = 16\]
\[(\frac{4}{3})^\frac{3}{3} = (16)^\frac{3}{3}\]
\[x = \pm 8\]

************
\[\sqrt{2x - 5} = 7\]
\[(\sqrt{2x - 5})^2 = 7^2\]
\[2x - 5 = 49\]
\[2x - 5 + 5 = 49 + 5\]
\[2x = 54\]
\[\frac{2x}{2} = \frac{54}{2}\]
\[x = 27\]

************
\[\sqrt{2x - 4} = x - 2\]
\[(\sqrt{2x - 4})^2 = (x - 2)^2\]
\[2x - 4 = x^2 - 4x + 4\]
\[2x - 2x - 4 + 4 = x^2 - 4x - 2x + 4 + 4\]
\[0 = x^2 - 6x + 8\]
\[0 = (x - 4)(x - 2)\]
\[so \ x = 4, 2\]

************
\[\sqrt{x + 2} = 10 - x\]
\[(\sqrt{x + 2})^2 = (10 - x)^2\]
\[x + 2 = 100 - 20x + x^2\]
\[x - x + 2 = 100 - 20x - x + x^2\]
\[0 = 98 - 21x + x^2\]
\[0 = x^2 - 21x + 98\]
\[0 = (x - 14)(x - 7)\]
\[so \ x = 7 \text{ since } 14 \text{ will not check}\]

************
\[\sqrt{5x + 6} = \sqrt{7x - 6}\]
\[(\sqrt{5x + 6})^2 = (\sqrt{7x - 6})^2\]
\[5x + 6 = 7x - 6\]
\[5x - 5x + 6 = 7x - 5x - 6\]
\[6 = 2x - 6\]
\[6 + 6 = 2x - 6 + 6\]
\[12 = 2x \quad so \quad \frac{12}{2} = \frac{2x}{2} \text{ and } x = 6\]

************
\[2\sqrt{x - 1} = \sqrt{26 + x}\]
\[(2\sqrt{x - 1})^2 = (\sqrt{26 + x})^2\]
\[(2)^2(\sqrt{x - 1})^2 = (\sqrt{26 + x})^2\]
\[4(x - 1) = 26 + x\]
\[4x - 4 = 26 + x\]
\[4x - x - 4 = 26 + x - x\]
\[3x - 4 = 26\]
\[3x - 4 + 4 = 26 + 4\]
\[3x = 30\]
\[\frac{3x}{3} = \frac{30}{3}\]
\[x = 10\]

************
\[
\sqrt[3]{2x - 4} = -2 \\
(\sqrt[3]{2x - 4})^3 = (-2)^3 \\
2x - 4 = -8 \\
2x - 4 + 4 = -8 + 4 \\
2x = -4 \\
2x + 4 = -8 \\
x = -2 \\
\]

***************

\[
(2x + 10)^2 - x = 1 \\
(2x + 10)^2 - x + x = 1 + x \\
(2x + 10)^2 = x + 1 \\
\left[ (2x + 10)^2 \right]^2 = (x + 1)^2 \\
2x + 10 = x^2 + 2x + 1 \\
2x - 2x + 10 = x^2 + 2x - 2x + 1 \\
10 = x^2 + 1 \\
10 - 1 = x^2 + 1 - 1 \\
9 = x^2 \\
x = \pm 3 \\
***************

\[
3(2x + 4)^\frac{4}{3} = 48 \\
\frac{3}{3}(2x + 4)^\frac{4}{3} = \frac{48}{3} \\
(2x + 4)^\frac{4}{3} = 16 \\
\left[ (2x + 4)^{\frac{4}{3}} \right]^3 = (16)^{\frac{3}{4}} \\
2x + 4 = \pm 8 \\
2x + 4 - 4 = \pm 8 - 4 \\
so \ 2x = 4 \ and \ 2x = -12 \\
2x - 4 = \pm -12 \\
2 - 2 = \pm -12 \\
x = 2, -6 \\
***************
\]

\[
(2x + 1)^2 = (5 - 2x)^2 \\
\left[ (2x + 1)^2 \right]^\frac{2}{3} = \left[ (5 - 2x)^2 \right]^\frac{2}{3} \\
2x + 1 = 5 - 2x \\
2x + 2x + 1 = 5 - 2x + 2x \\
4x + 1 = 5 \\
4x + 1 - 1 = 5 - 1 \\
4x = 4 \\
\frac{4x}{4} = \frac{4}{4} \\
x = 1 \\
***************
\]

\[
(x + 14)^\frac{1}{7} = (2x)^\frac{1}{7} \\
\left[ (x + 14)^\frac{1}{7} \right]^7 = \left[ (2x)^\frac{1}{7} \right]^7 \\
x + 14 = (2x)^7 \\
x + 14 = 4x^2 \\
x - x + 14 - 14 = 4x^2 - x - 14 \\
0 = 4x^2 - x - 14 \\
using \ quadratic \ formula \\
a = 4 \ b = -1 \ c = -14 \\
-b \pm \sqrt{b^2 - 4ac} \\
\frac{2a}{2a} \\
\frac{-(-1) \pm \sqrt{(-1)^2 - 4(4)(-14)}}{2(4)} \\
\frac{1 \pm \sqrt{1 + 224}}{8} \\
\frac{1 \pm 15}{8} = \frac{1 \pm 15}{8} = 2 \ or \ -7 \ 4 \\
only \ 2 \ checks \ so \ x = 2 \\
***************
\]

\[
\sqrt[3]{x - 2} = 4 \\
\left[ \sqrt[3]{x - 2} \right]^3 = 4^3 \\
x - 2 = 64 \\
x - 2 + 2 = 64 + 2 \\
x = 66 \\
\]
<table>
<thead>
<tr>
<th>Sheet #</th>
<th>Problem</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( \frac{4}{3}x^3 + 5 = 53 )</td>
<td>( x = 27 )</td>
</tr>
<tr>
<td>2</td>
<td>( \sqrt[3]{x-2} = 4 )</td>
<td>( x = \pm 8 )</td>
</tr>
<tr>
<td>3</td>
<td>((-14)^{1/4} = (2x)^{1/2})</td>
<td>( x = 66 )</td>
</tr>
<tr>
<td>4</td>
<td>((2x+1)^{1/2} = (5-2x)^{1/3})</td>
<td>( x = 2 )</td>
</tr>
<tr>
<td>5</td>
<td>(3(2x + 4)^{4/3} = 48)</td>
<td>( x = 1 )</td>
</tr>
<tr>
<td>6</td>
<td>((2x+10)^{1/3} - x = 1)</td>
<td>( x = -6, 2 )</td>
</tr>
<tr>
<td>7</td>
<td>(\sqrt[3]{2x-4} = -2)</td>
<td>( x = \pm 3 )</td>
</tr>
<tr>
<td>8</td>
<td>(2\sqrt{x-1} = \sqrt{26+x})</td>
<td>( x = -2 )</td>
</tr>
<tr>
<td>9</td>
<td>(\sqrt{5x+6} = \sqrt{7x-6})</td>
<td>( x = 10 )</td>
</tr>
<tr>
<td>10</td>
<td>(\sqrt{x + 2} = 10 - x)</td>
<td>( x = 6 )</td>
</tr>
<tr>
<td>11</td>
<td>(\sqrt{2x-4} = x - 2)</td>
<td>( x = 7 )</td>
</tr>
<tr>
<td>12</td>
<td>(\sqrt{2x-5} = 7)</td>
<td>( x = 4, 2)</td>
</tr>
</tbody>
</table>
ANSWERS:

\[ 4 \]
\[ 3x^3 + 5 = 53 \]
\[ 3x^3 + 5 - 5 = 53 - 5 \]
\[ 3x^3 = 48 \]
\[ \frac{3x^3}{3} = \frac{48}{3} \]
\[ x^3 = 16 \]
\[ (x^3)^\frac{3}{3} = (16)^\frac{3}{3} \]
\[ x = \pm 8 \]

***************

\[ \sqrt{2x - 5} = 7 \]
\[ (\sqrt{2x - 5})^2 = 7^2 \]
\[ 2x - 5 = 49 \]
\[ 2x - 5 + 5 = 49 + 5 \]
\[ 2x = 54 \]
\[ \frac{2x}{2} = \frac{54}{2} \]
\[ x = 27 \]

***************

\[ \sqrt{2x - 4} = x - 2 \]
\[ (\sqrt{2x - 4})^2 = (x - 2)^2 \]
\[ 2x - 4 = x^2 - 4x + 4 \]
\[ 2x - 2x - 4 + 4 = x^2 - 4x - 2x + 4 + 4 \]
\[ 0 = x^2 - 6x + 8 \]
\[ 0 = (x - 4)(x - 2) \]
\[ so \ x = 4, 2 \]

***************

\[ \sqrt{x + 2} = 10 - x \]
\[ (\sqrt{x + 2})^2 = (10 - x)^2 \]
\[ x + 2 = 100 - 20x + x^2 \]
\[ x - x + 2 - 2 = 100 - 2 - 20x - x + x^2 \]
\[ 0 = 98 - 21x + x^2 \]
\[ 0 = x^2 - 21x + 98 \]
\[ 0 = (x - 14)(x - 7) \]
\[ so \ x = 7 \] since 14 will not check

***************

\[ \sqrt{5x + 6} = \sqrt{7x - 6} \]
\[ (\sqrt{5x + 6})^2 = (\sqrt{7x - 6})^2 \]
\[ 5x + 6 = 7x - 6 \]
\[ 5x - 5x + 6 = 7x - 5x - 6 \]
\[ 6 = 2x - 6 \]
\[ 6 + 6 = 2x - 6 + 6 \]
\[ 12 = 2x \]
\[ so \ \frac{12}{2} = \frac{2x}{2} and \ x = 6 \]

***************

\[ 2\sqrt{x - 1} = \sqrt{26 + x} \]
\[ (2\sqrt{x - 1})^2 = (\sqrt{26 + x})^2 \]
\[ (2)^2(\sqrt{x - 1})^2 = (\sqrt{26 + x})^2 \]
\[ 4(x - 1) = 26 + x \]
\[ 4x - 4 = 26 + x \]
\[ 4x - x - 4 = 26 + x - x \]
\[ 3x - 4 = 26 \]
\[ 3x - 4 + 4 = 26 + 4 \]
\[ 3x = 30 \]
\[ \frac{3x}{3} = \frac{30}{3} \]
\[ x = 10 \]

***************
\[
\sqrt[3]{2x - 4} = -2 \\
(\sqrt[3]{2x - 4})^3 = (-2)^3 \\
2x - 4 = -8 \\
2x - 4 + 4 = -8 + 4 \\
2x = -4 \\
2x = -4 \\
x = -2 \\
\\
(2x + 10)^{\frac{1}{2}} - x = 1 \\
(2x + 10)^{\frac{1}{2}} - x + x = 1 + x \\
(2x + 10)^{\frac{1}{2}} = x + 1 \\
\left[ (2x + 10)^{\frac{1}{2}} \right]^2 = (x + 1)^2 \\
2x + 10 = x^2 + 2x + 1 \\
2x - 2x + 10 = x^2 + 2x - 2x + 1 \\
10 = x^2 + 1 \\
10 - 1 = x^2 + 1 - 1 \\
9 = x^2 \\
x = \pm 3 \\
\\
3(2x + 4)^{\frac{4}{3}} = 48 \\
\frac{3}{3} (2x + 4)^{\frac{4}{3}} = 48 \frac{3}{3} \\
(2x + 4)^{\frac{4}{3}} = 16 \\
\left[ (2x + 4)^{\frac{4}{3}} \right]^3 = (16)^3 \\
2x + 4 = \pm 8 \\
2x + 4 - 4 = \pm 8 - 4 \\
so 2x = 4 \text{ and } 2x = -12 \\
2x = 4 \\
\frac{2x}{2} = \frac{2}{2} \\
x = 2, -6 \\
\\
(2x + 1)^{\frac{1}{2}} = (5 - 2x)^{\frac{1}{2}} \\
\left[ (2x + 1)^{\frac{1}{2}} \right]^2 = \left[ (5 - 2x)^{\frac{1}{2}} \right]^2 \\
2x + 1 = 5 - 2x \\
2x + 2x + 1 = 5 - 2x + 2x \\
4x + 1 = 5 \\
4x + 1 - 1 = 5 - 1 \\
4x = 4 \\
\frac{4x}{4} = \frac{4}{4} \\
x = 1 \\
\\
(x + 14)^{\frac{1}{4}} = (2x)^{\frac{1}{4}} \\
\left[ (x + 14)^{\frac{1}{4}} \right]^4 = \left[ (2x)^{\frac{1}{4}} \right]^4 \\
x + 14 = (2x)^2 \\
x + 14 = 4x^2 \\
x - x + 14 - 14 = 4x^2 - x - 14 \\
0 = 4x^2 - x - 14 \\
using \text{ quadratic formula} \\
a = 4 \quad b = -1 \quad c = -14 \\
\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
\frac{-(-1) \pm \sqrt{(-1)^2 - 4(4)(-14)}}{2(4)} \\
\frac{1 \pm \sqrt{1 + 224}}{8} \\
\frac{1 \pm \sqrt{225}}{8} = \frac{1 \pm 15}{8} = 2 \text{ or } -\frac{7}{2} \\
only 2 \text{ checks so } x = 2 \\
\\
\frac{3}{2}x - 2 = 4 \\
\left[ \frac{3}{2}x - 2 \right]^3 = 4^3 \\
x - 2 = 64 \\
x - 2 + 2 = 64 + 2 \\
x = 66
Search and Rescue

Search and Rescue is an improved version of the (classroom strategy called Scavenger Hunt) in that it uses support stations (called Rescue Stations in this activity). The activity provides an interactive opportunity for students to practice important processes, discover important nuances to procedures and concepts, or to mentally wrestle with meaningful information or concepts. It's relatively easy to manage, and students typically love it while they are learning.

The basic idea of Search and Rescue is that in small groups, students answer questions, seek out the answer they just determined and then answer another question that is there waiting for them. More specifically, the activity uses about 5 to 12 meaningful questions, problems or prompts that are distributed around the room on the walls. (To keep this explanation as simple as possible, the word question will only be used from this point forward.) The answers are distributed likewise. The students form groups of one (for safety if desired) to three at one of the questions on the wall—distributing themselves so that every question has 1 to 3 students standing there, ready to go. On the signal from the teacher, each group works through the question they are with to get determine an answer, then moves to the paper on the wall with the answer they just determined. Right with that answer will be another question for them to begin answering. To facilitate the students’ progress and to provide time for the teacher to help and monitor those in greatest need, the teacher hangs a rescue station in an isolated part of the room. The rescue station is a place where every question has completed answers along with explanations for the student groups who may need some help.
Setting up for Search and Rescue

Questions, Problems or Prompts

For maximum impact, these all need to require some processing and result in a unique response that can be written and displayed big enough to be interpreted from across the classroom. If the questions call for quick answers, the game will go too fast and not provide meaningful process. If the responses are not unique, the activity will close in on itself and collapse. The questions will ideally require about one to three minutes for students to develop or determine. Give each question a name, letter or word to represent it.

Provide a name (like Bill or Carol), letter, or some other label for each question. Do NOT number them, and be very careful not to assign letters in any predetermined order like alphabetically. Assigning an order to the questions will short-circuit the activity and cause it to collapse.

Response Sheet

A response sheet for each student will greatly facilitate your management of the activity and your ability to hold students accountable for meaningful engagement. Develop a response sheet that is prepared and duplicated in advance. Using a grid or some pattern of your choice, make a space for each response and write the name, letter or word for the questions in the spaces, one for each question and one for each space.

Question and Answer Sheets for the Walls

There are a number of ways these can be prepared. At the same time, however, there are certain key points that must be understood and stuck to. What follows is an explanation of one procedure followed by some adaptations that can help.

1. Prepare one piece of paper for each question. If you have 8 questions, prepare 8 pieces of paper.
2. To prepare the paper, fold it as one might start folding a letter to fit into a standard envelope. Fold the top third of the paper so that this top third covers the middle third when folded down.
3. Write one question under the flap of the first sheet on the top half of the partially covered piece of paper. Put the name, letter or other question identifier with the question. Write the answer to this question on the exposed bottom third of another of your folded papers – write the answer big enough so it can be seen from a distance. Do NOT put the question's label with the answer – the students are to search the room until they find the answer to the question they were answering.
4. Continue this pattern until you write the answer to your last question on the exposed bottom third of the folded paper on which you recorded your first question.

An alternative approach is to create a separate piece of paper with each question’s answer written really big on it so it can be put on the wall about 7 feet off the floor above where the answer is on a question answer sheet. This approach makes it easier for the students to find their next question because they can see the answer they are looking for above the heads of the other students working around the room.

Setting the Classroom for Search and Rescue

Place the question/answer sheets on the walls scattered around the room. They should be deliberately placed in a random pattern. Place the rescue station in an isolated spot so you can stand near it to monitor all that is happening during the activity and still help and control those students who need it the most.

Facilitating Search and Rescue

1. Make sure each student has one of your preprepared response sheets.
2. Have the students form groups of one, two or three with one group for each question sheet.
3. Ask them to wait until you tell them to begin.
4. Tell them that as you give directions for the activity, you will pause after each step for them to make sure everyone in their group understands that step.
5. Start by telling students that on your signal they are to answer the question, and record their thoughts. They should also record an answer on their answer sheet.
6. Explain to them how the questions are labeled.
7. Tell them that when they finish answering a question, they are to find the answer on the wall and then begin answering the question that is there.
8. They are to continue in this pattern until they finish (make sure you have something else to work on while others finish), or they are to continue this pattern until you call time.
9. Let them know that they may go to the rescue station to get help with any of the questions, but make sure they know they are to leave their papers somewhere in the center of the classroom while they are using the rescue station.
10. After everyone is finished, or after you have called time, follow through by having each group do one of the following:
   a. Summarize what was learned or done as they answered the questions
   b. List main points that could be determined from the questions and answers
   c. Make up other questions and annotated responses that could have been included to process the same content
   d. Construct a thinking map or other graphic organizer to represent main ideas, patterns or procedures brought out from the activity

**Draw Final Closure**

1. Have student share, compare and repair their response sheets with other groups
2. Collect response sheets and record accordingly
3. Have groups share their work from the follow-through described in number 10 above (perhaps by gallery walk) in order to come back as a group one more time to add to their follow through before turning it in.
## Search & Rescue

<table>
<thead>
<tr>
<th>Sheet</th>
<th>Problem</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>