**Redox Chemistry Metal Magician**

**Theory Redox Reactions**

* **Red**uction and **Ox**idation reactions
* Occur simultaneously
* Involve the **transfer of electrons**

The reaction between iron and copper(II) sulfate is a redox reaction. Make observations during the reaction and draw a diagram to explain the reaction that is occurring.

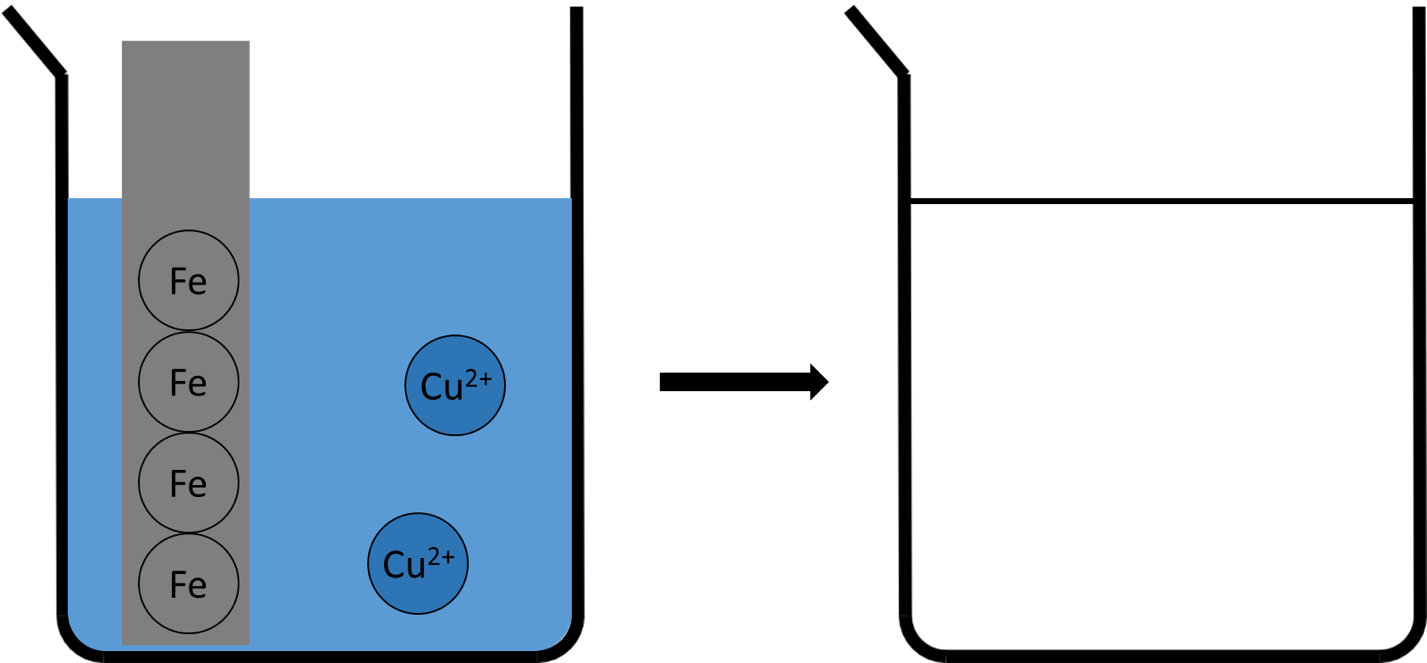
**Materials**

* 1 × test tube
* 10 mL of 1.0 M CuSO4
* Iron (steel) wool
* Glass stirring rod
* 10 mL measuring cylinder
* Test tube rack

**Procedure**

1. Place test tube in a test tube rack
2. Place some iron wool in the text tube, pushing it to the bottom with a glass stirring rod
3. Add 10 mL 1.0 M CuSO4 to the test tube

Observations:



|  |
| --- |
| **Acid Base Chemistry Solution Detective** |

*Supporting material for Lukins, N. et al. (2010), Experiment 45 Unknown solutions, Heinemann Chemistry 1 teacher’s resource and assessment book 4th edition, Harcourt Education, Port Melbourne, Australia.*

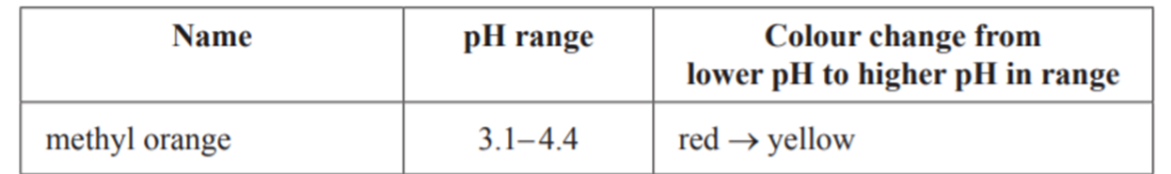
**Purpose**

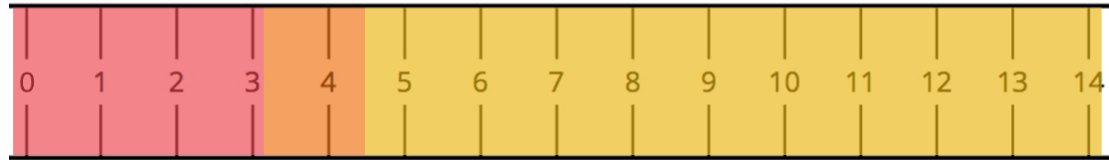
You have been provided with four unknown samples, A-D. In no particular order, the unknown samples are:

* 0.1 M HCl
* 1.0 M HCl
* 0.1 M NaOH
* Water, H2O

The aim of the investigation is to experimentally identify unknown samples A-D. You will be provided with the indicator methyl orange. The details for methyl orange are shown below.

*Extract from VCAA Data Book, Acid-base Indicators*





**Materials**

* 1 × multi-well plate
* 4 unknown samples labelled A-D
* Methyl orange indicator
* 5x transfer pipettes

**Theory**

Before you begin, consider what samples of water, 0.1 M NaOH, 0.1 M HCl and 1.0 M HCl might look like at the molecular level by colouring in the particles that make up each liquid/solution. Predict the pH of each sample and the colour if methyl orange was added to each.

*Key*

|  |  |  |
| --- | --- | --- |
| **H2O**  Image result for black and white circles | **H+**  Image result for black and white circles | **OH-**  Image result for black and white circles |

|  |  |
| --- | --- |
| **H2O** | **0.1 M OH-** |
| ***Predicted pH:***  ***Predicted colour:*** | ***Predicted pH:***  ***Predicted colour:*** |
| **1.0 M H+** | **0.1 M H+** |
| ***Predicted pH:***  ***Predicted colour:*** | ***Predicted pH:***  ***Predicted colour:*** |

**Procedure**

Write a procedure of how you plan to identify the four unknown samples using only the materials available to you. Explain your thinking.

**Results**

Record you observations in a table.

**Conclusion**

State the identity of the four unknown substances in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| **A** | **B** | **C** | **D** |
|  |  |  |  |

**Clue**

Combine equal amounts of each unknown.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **H2O** | **0.1 M [H+]** | **1.0 M [H+]** | **0.1 M [OH-]** |
| **H2O** |  |  |  |  |
| *Solution colour* |  |
| * 1. **M**   **[H+]** |  |  |  |  |
| *Solution colour* |  |  |
| 1. **M**   **[H+]** |  |  |  |  |
| *Solution colour* |  |  |  |
| **0.1 M [OH-]** |  |  |  |  |
| *Solution colour* |  |  |  |  |

**Gas Chemistry Gas Laws**

**Theory**

From our general knowledge some observations of the **properties of gases**:

* Low density
* Spread out to fill any container
* Easily compressed
* Mix rapidly

The **kinetic molecular theory model** is used to explain the behaviour of gases. According to the theory:

* Gases consist of very small particles, occupying very little of the available space
* Gas particles move in rapid, straight line motion
* There are negligible forces between gas particles
* Collisions between gas particles and the container do not cause the gas particle to lose energy of motion
* Increase in temperature (heat energy) increases the average kinetic energy of the gas particles

**Gas pressure (P)** is defined as the force of gas particle collisions per unit area of surface. Gas pressure increases with an increase in:

* number of collisions
* energy of collisions

**Remember**

* The atmosphere in the classroom consists of gas particles;
* They will be colliding with all objects in the classroom, exerting pressure on them

**Purpose**

To investigate the gas laws by observing and explaining the relationship between temperature and pressure, pressure and volume and number of moles and pressure.

**Station 1**

Aim: To determine the relationship between temperature and pressure.

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| --- | --- |
| **Procedure** | **Observations** |
| 1. Boil the kettle. 2. Half fill the bottle with boiling water. 3. Pour out the water and put the lid on the bottle. 4. Place the bottle in the ice bath. 5. Record your observations. 6. Remove the bottle from the ice bath, and place to the side. |  |

Make a conclusion about the relationship between temperature and pressure.

Draw a diagram to represent what occurred at the particle level after cooling.

|  |  |  |
| --- | --- | --- |
|  | 🡪 |  |
| Before cooling |  | After cooling |

Additional notes.

**Station 2**

Aim: To determine the relationship between pressure and volume

|  |  |
| --- | --- |
| **Procedure** | **Observations** |
| 1. Place three marshmallows in the side arm flask and then seal with the stopper. 2. Ensure the rubber hose is connected between the side arm and the vacuum pump. 3. Turn on the vacuum pump to reduce the pressure in the flask. 4. Record you observations. 5. Turn off the vacuum pump. 6. Put the used marshmallows in the bin. |  |

Make a conclusion about the relationship between pressure and volume.

Draw a diagram to represent what is occurred at the particle level after the pressure was reduced.

|  |  |  |
| --- | --- | --- |
|  | 🡪 |  |
| Atmospheric pressure |  | After reducing pressure |

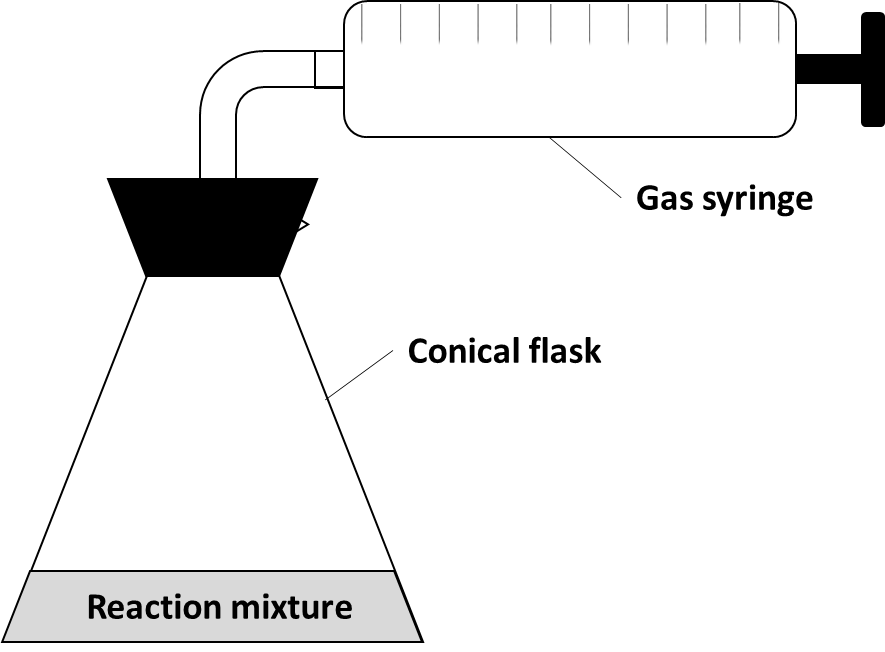
Additional notes.

**Station 3**

Aim: To determine the relationship between the amount of gas (yes, number of mole!) and volume

1. Eliminate all air from the syringe by pushing the plunger all the way in.
2. Take one conical flask containing 0.50 g of sodium hydrogen carbonate, NaHCO3.
3. Measure 50 mL of vinegar using a measuring cylinder.
4. Add the 50 mL of vinegar to the conical flask and immediately connect the rubber stopper/syringe apparatus and shown in the diagram.

\*NOTE: Hold syringe horizontally.



1. Record you observations.
2. Take a second conical flask containing 0.50 g of sodium hydrogen carbonate, NaHCO3.
3. Dilute vinegar by adding 5 mL of vinegar to a 50 mL measuring cylinder and making the solution up to 50 mL with water.
4. Add the 50 mL of diluted vinegar to the conical flask and immediately connect the rubber stopper/syringe apparatus and shown in the diagram.
5. Record you observations.

Make a conclusion about the relationship between the number of mole of a gas and volume.

Draw a diagram to represent what is occurred at the particle level as the number of mole of CO2 increased.

|  |  |  |
| --- | --- | --- |
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| Reaction with dilute acid |  | Reaction with concentrated acid |

Additional notes.