

**The Activity Series**

1) Answer the following questions in full sentences.

a) Why does gold occur native (uncombined) whereas zinc does not?

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b) Why were gold and silver used to make coins in the past?

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c) Why do we know so little about the lifestyles of the people of the Iron Age?

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2) The following metals are listed in order of reactivity (most reactive first)

Potassium > aluminum > iron > silver

a) Describe what each metal does when

(i) heated in air (think O<sub>2</sub>) .....

(ii) added to dilute hydrochloric acid.....

b) Which of the four metals would be suitable for making saucepans? Explain why the others are not.

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3) Describe what you would **see** if you dropped a piece of copper wire into some silver nitrate solution in a test tube. (a picture of this is in your book) Write a word equation for the reaction.

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4) Complete the following word equations.

a) zinc + lead nitrate solution .....

b) iron + zinc sulfate solution .....

c) lead + copper nitrate solution .....

d) magnesium + zinc chloride solution .....

e) copper + sodium chloride solution .....

f) zinc + iron sulfate solution .....

g) gold + silver nitrate solution .....

h) magnesium + calcium nitrate solution .....

5) Three metals **X**, **Y** and **Z** have the following reactions:-

**Y** will displace **X** from a solution of its salt.

**Z** will displace both **X** and **Y** from solutions of their salts.

Place the three metals in order of reactivity, starting with the **least** reactive. [hint; write the equations first. Then, based on the information in the problem, decided on the most spontaneous direction.]

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6) Here is a list of metals in order of decreasing reactivity. **Q** and **R** are mystery metals.



- a) Will Q react with cold water? .....
- b) Will R react with cold water? .....
- c) Will R react with dilute hydrochloric acid? .....
- d) Will R displace copper from copper sulfate solution? .....
- e) Write word equations for any reactions in parts a) to d)

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Answers:

1. Answer the following questions:

- (a) Gold occurs as a native because it is a good oxidizing agent. This means that it doesn't like to give up electrons, and would rather be an element. Zinc, however, is more reactive than gold. It easily gives up electrons if needed to something that wants electrons, like gold ions.
- (b) If you want coins to last, make them with non-reactive metals. This would be copper, silver, gold, and platinum. Gold treasure from sunken ships looks as beautiful as the day it was mined and formed. Iron or other metals will eventually corrode in the presence of acid, air, water, and heat.
- (c) Hmm? Well, they did not have a written language, but more important, they used tools that did not last very long.

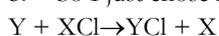
2. Potassium reacts with moisture in air; iron and aluminum will react with acid. Aluminum is a more active metal, so it will react faster. Silver is not active. If I were to make a pot, I would not use potassium, because as soon as I added water or heat, it would burst into a lovely purple flame and probably explode on my stove. Yikes! Silver metal is too expensive. So I will go with aluminum or iron. I have pots made of both, but I love my cast iron pots.

3. Copper metal in the presence of silver cations becomes a very good reducing agent. It will give electrons to silver cations, reducing them to silver metal. I should see silver needles, crystals of silver metal. The solution will start out transparent and colorless, but as the reaction progresses, I should see the solution turn blue as more and more copper(II) ions are liberated from the copper metal through oxidation.

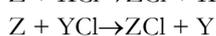
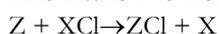
4. Write the word equations:

- (a) Zinc + lead nitrate forms lead metal and zinc nitrate.
- (b) Iron + zinc nitrate does not react.
- (c) Lead + copper(II) nitrate forms lead(II) nitrate and copper metal
- (d) Magnesium + zinc chloride forms zinc metal and magnesium chloride
- (e) Copper + sodium chloride does not react
- (f) Zinc + iron(II) sulfate forms zinc sulfate and iron metal
- (g) Gold + silver nitrate does not react
- (h) Magnesium + calcium nitrate does not react

5. So I just chose X, Y, and Z to have a charge of 1+.



This means Y is more active than X and is above X in the activity series.



This means that both X and Y are below Z in the activity series.

Most active	Y	Z	
Least active	X	Y&X, but Y is above X	
Most active			Z
			Y
Least active			X

6. (Look at the activity series chart) Since Q is below K (less active) but more active than calcium and calcium will react with water to give hydrogen gas, I would say that Q will react with cold water. R on the other hand will not react with cold water. R will react with acid, but not very vigorously. R will displace copper(II) ions in copper(II) sulfate. This means R is a good reducing agent and will reduce copper to its metal.

- (a) Q + water yields hydrogen gas and Q hydroxide
- (b) No reaction
- (c) R + acid yields hydrogen gas and R chloride
- (d) R + copper(II) sulfate yields R sulfate and copper metal