

KC Discoverer Lab

The computer database can provide a wealth of information. Learning to find that information requires a great deal of experience. The database "KC Discoverer" is used for this lab. The program is copyrighted but may be used in room 404.

The questions that follow are meant to: (1) familiarize users with this program, its functions, and its database of information; (2) encourage you to discover properties of the elements and explore data about them; (3) teach simple facts about the relationships among the elements.

Following each question is the clues you can use to help find the answer. These clues are functions of "KC? Discover" and are placed in brackets []. In most cases there are alternative routes to an answer.

Introductory Questions - Give symbol of element as answer. Each person must turn in their own results.

1. What elements are yellow? [FIND, color, yellow].
2. What elements melt below 303 K? [SORT, melting pt.,14, <ENTER>,303, s].
3. Which are the five most expensive pure elements? The five least expensive pure elements? [SORT, cost(pure)...].
4. Compare the relative abundances in the cosmos of the alkali metals with those of the halogens? Find which of the alkali metals (and then the halogens) has the greatest relative abundance in the cosmos. [TABLE, SORT, rel.abund.cosmos, ...].
5. Compare the terrestrial abundances (Earth's crust) of the coinage metals with those of the alkali metals? Give values of all the coinage metals and the highest value in the alkali metal group. [TABLE, GRAPH, abund.earth crust, group, d (d displays the value)]
6. What elements were discovered between _____ and _____?
 - 1) B.C. to 1000
 - 2) 1750 to 1800
 - 3) 1941 to present[FIND or SORT]
7. Give the years in which the elements of group _____ were discovered?
 - 1) 1
 - 2) 17[TABLE, GRAPH, discovered year, G, d (to display value)]
8. List the 1st ionization energies for these pairs of elements:
 - 1) Na and Mg
 - 2) K and CaExplain differences, if any?
[FIND, symbol, view element screen]

Trend Questions

1. Some elements, such as nobelium, are man made (synthetic). Which element was the last naturally-occurring element to be discovered and in what year? (hint: different approaches give different answer.)
2. We use copper for electrical wiring. If Cu somehow became in short supply, what element would make the best substitute and why.
3. Type can be set by forcing a molten metal into molds for the letters. The metal is then covered with copper. Setting type requires a metal that is solid at 298 K, but that melts at a relatively low temperature (below 700 K). It should have a high density to offer good support for the copper. What element would be the best choice? What would be your second choice?
4. A mystery element is expensive because it is not readily available on the surface of the Earth. It has a high density and can be scratched by glass or iron. It can be melted in a chromium or vanadium crucible. It forms the chloride MCl_3 . What is the mystery element (M)?
5. Identify the element with the following properties:
 - reacts mildly with 6 M HCl or NaOH
 - does not react with water at room temperatures
 - has an electrical conductivity of at least $200 \text{ m } \Omega \text{ cm}^{-1}$
 - cost less than \$5 per 100 grams pure.
 - 1) if this element burns in air, write a balanced equation for the reaction
 - 2) how much energy would it take (in kJ) to melt 1 kg of this element
 - 3) would this element make a good replacement for copper as an electrical conductor?
6. A, B, C, and D belong to a family, the members of which are all gases. A is commonly used in advertising signs. B was first discovered on the sun and is used in weather balloons. C was used to make the first compounds of an element of this group. D is the family member which is present in the largest amount. Identify A, B, C, D.
7. E and F are members of a family containing both gaseous and solid elements. E forms a diatomic molecule and is the major constituent of the atmosphere. Element F is a dangerous poison and a metalloid. Identify E, F.
8. G, H, and I belong to a family of very active metals, all of which react with chlorine to produce salts with the general formula XCl (X here is a variable). G is a member of the first period to contain 18 elements. H has the highest ionization energy of these three elements and I has the lowest. Identify G, H, I.
9. J, K, and L belong to the same family and all are metals. A compound of J is a major component of bones and teeth. K is commonly used in flash bulbs for producing light. L is a radioactive element discovered by Marie Curie. Identify J, K, L.
10. M is a gas and has some properties similar to the elements in both Group 1 and Group 17. It is a unique element in this respect. Identify M.
11. N, O, and P commonly form -1 ions when they combine with metals. N is a liquid and O is a non-radioactive solid. P is the most chemically reactive of all the elements. Identify N, O, P.

12. Q, R, S, and T are in different families but in the same period. Q is a gas used for water purification. R is a yellow non-metallic solid. S is a metalloid used in transistors. T is a metal of low density used in air-craft construction. Identify Q, R, S, and T.

13. U, V, W, and X are all transition elements. U is an excellent conductor of heat and electricity and is commonly used in wiring and cookware. V is the only metal that is a liquid at room temperature. W is the metal which is produced in the largest quantity. Although once used in coins, X is now used mostly in expensive jewelry. Identify U, V, W, and X.

14. Y is an actinide fuel used in nuclear reactors. Z is the actinide named for the creator of the Periodic Table. Identify Y, and Z.

15. All elements beyond bismuth (83) are radioactive, and those beyond 106 in the actinide series are extremely difficult to synthesize. It is thought that elements 114 and 164 might exist in 'islands of nuclear stability' and could be isolated. Should scientist successfully synthesize elements 114 and 164, what values would you expect for: atomic weight, density, atomic volume, melting point, common oxidation numbers. Also predict color and reaction with air, water, acid, and base for these elements, and write formulas for their oxides and chlorides.

16. Discuss the likelihood that element 168, should it exist, would be a *noble liquid*.