1. Metals bend instead of cracking because _____.

(A) the sea of electrons can bend without splitting
(B) their larger nuclei resist strain
(C) metal ions, being positive and negative, hold on to each other
(D) metal ions are all positive

Hint: In dumping their electrons into a sea of electrons, metal atoms become positive metal ions that, because they are all identical, line up in straight rows and columns.

Being identical, any row or column of metal ions can roll over neighboring rows and columns without cracking the rows and columns apart.

2. When a metal is bent, metal atoms _____.

(A) repel each other more
(B) roll over one another
(C) become more attracted to each other
(D) become more ionized

Hint: When subjected to a mechanical force, rows of metal ions slide or roll over one another, causing the metal to bend instead of crack apart.

3. Adding atoms of a second metal to another metal _____.

(A) rearranges the rows of metal atoms
(B) loosens the bonds between metal atoms and weakens the metal
(C) hinders metal atoms from rolling over one another
(D) softens a metal

Hint: Sprinkling in other atoms in between the rows of metal ions prevents the rows from sliding over one another.

4. Increasing a metal's strength can be done by _____.

(A) adding negative ions of another metal
(B) adding positive metal ions of another metal
(C) adding electrons
(D) adding more of the same positive metal ions

Hint: Sprinkling in other atoms changes a metal into an alloy which, because it prevents rows of ions from rolling over one another, makes an alloy stronger than the original metal.

5. Which of the following is not a metal alloy?

(A) porcelain
(B) bronze
(C) pewter
(D) brass

Hint: Bronze is an alloy of copper sprinkled with tin. Pewter is an alloy of tin sprinkled with copper. Brass is an alloy of copper and zinc in many different proportions. Porcelain is non-metallic, made by heating various types of clay.

6. An element that releases three electrons into the sea of electrons will produce a metal that is _____ than an element that releases only one electron into the sea of electrons.

(A) shinier
(B) harder
(C) softer
(D) no difference in strength

Hint: By dumping three electrons into a sea of electrons, the ions are now very positive and much more attracted to the sea of electrons than if only one electron had been released. A greater attraction results in a harder metal.

7. Metals feel colder than cloth because metals _____.

(A) conduct heat poorly
(B) are generally cooler than their surroundings
(C) conduct heat extremely well
(D) do not reflect heat back into the skin

Hint: The sensation of cold is the brain's sensing the temperature of the skin.

Metals conduct heat away from the skin so fast that the skin becomes cold. The brain mistakenly thinks that the skin is cold because the object being touched is cold.

8. Metals are good conductors of heat for the same reason they are good conductors of electricity because _____.

(A) they allow their electrons to run free
(B) their atoms are in a state to continual motion
(C) their intramolecular bonds are very weak
(D) their intermolecular bonds are very strong

Hint: Heat energy in a metal is transferred to electrons in the form of kinetic energy.

Heated electrons are able to race between the long rows of metal ions. When the electrons slam into distant metal ions, the kinetic energy is transferred to the metal ions.

When we touch those distant metal ions, their kinetic energy is transferred to our skin, which we sense as heat.

9. The reason metals are colder than non-metals is that _____.

(A) metals do not store heat as well as non-metals
(B) metals cannot conduct heat as well as non-metals
(C) metals lose heat to the air faster than non-metals
(D) metals are not colder than non-metals; they only feel colder

Hint: Metals feel colder because they rapidly conduct heat away from the skin. The brain thinks that the reason the skin is cold is that it touched something cold.

10. Alloys are not only stronger; they are also better conductors of heat.

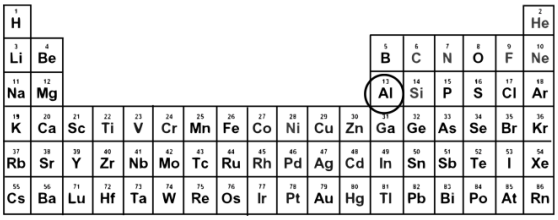
(A) True
(B) False

Hint: Since the atoms sprinkled into a metal obstruct the path between the rows and columns of metal ions, alloys are not as good conductors of heat and electricity as pure metals.

11. The main reason aluminum is harder than magnesium is that _____.

(A) aluminum releases three electrons into the sea of electrons while magnesium only releases two electrons
(B) aluminum has more interior electrons than magnesium has
(C) aluminum has more unpaired electrons than magnesium
(D) aluminum's interior electrons do not shield its nucleus from the sea of electrons as well as magnesium's interior electrons do

Hint: In general, the more electrons a metal atom dumps into the sea of electrons, the more attracted the ions are to the sea of electrons, and the harder the metal.



12. Which statement is not a reason gold is soft and malleable?

(A) Gold atoms arrange themselves loosely.
(B) Gold releases a small percentage of its electrons into the sea of electrons.
(C) Gold releases only one electron into the sea of electrons.
(D) Being a transition metal, gold can handle extra electrons in its Ring 6.

Hint: The space between gold atoms and the electrical forces between them are what determine gold's density. A nucleus' attraction to the loss of only a few electrons is less than the loss of many electrons.

13. Heat conduction and electrical conduction are excellent in metals because _____.

(A) heat and electrical conduction both depend on long rows of positive ions
(B) heat and electrical conduction both depend on long rows of electrons
(C) heat and electrical conduction both depend on the flow of electrical charges along adjacent nuclei
D) heat and electrical conduction both depend on the unobstructed flow of electrons

Hint: The flow of electricity occurs when electrons move. but the flow of electricity is not the flow of electrons. Electricity is the flow of electrical charges through slowly moving electrons.

14. Arrange the following in order of best conductor of heat.

(A) pure silver, diamond, alloy of silver
(B) alloy of silver, diamond, pure silver
(C) diamond, pure silver, alloy of silver
(D) diamond, alloy of silver, pure silver

Hint: Diamonds have such a rigid lattice structure that movement of carbon atoms at one end of the crystal immediately creates movement of carbon atoms at distant points in the crystal.

The transfer of heat in a diamond does not depend on electrons speeding between rows and columns of metal ions.

Alloys conduct heat (and electricity) less well than pure metals because the additional atoms in alloys lie in the aisles between the rows and columns of metal ions and obstruct the movement of electrons.

15. Metals are shiny for all of the following reasons, except _____.

(A) their electrons readily absorb electromagnetic radiation
(B) electrons in a metal are at many different energy levels
(C) electrons in a metal do not absorb electromagnetic radiation in red and orange range
(D) white light is made up of all the electromagnetic radiation in the visible spectrum

Hint: Metals are shiny because they reflect white light. They reflect white light because they are reflecting light in every wavelength of the visible spectrum. All the frequencies combined form white light.

Metals are able to reflect light in every wavelength of the visible spectrum because their sea of electrons are at so many different energy levels that they can absorb almost any frequency of light and reflect it back out again.