

Metal, Alloys, & The USS KIDD



Numerous metals and alloys were used in the construction of the USS KIDD. In its simplest definition, an alloy is a mixture of a metal and another element. Different metals and alloys have different strengths, weaknesses, and properties. The most common alloy found in the makeup of the KIDD is steel. Steel is an alloy made up of iron and carbon and, at times, other trace elements. The skin or sides of the ship consist of steel that is 3/8 inch thick. Steel is very strong and durable, but when exposed to water or oxygen in the air, a chemical reaction will occur, causing it to corrode, or rust. To prevent this, the steel surfaces aboard ship are painted with a protective layer to prevent corrosion.

Brass is another common alloy found aboard ship. Brass is a bright, shiny metal alloy mostly made of copper and zinc, with other elements sometimes added in such as aluminum, arsenic, tin, or lead. Brass is very malleable (soft), non-magnetic, and corrosion resistant. It has low-friction properties and favorable resonance qualities. For these reasons, brass is used for plumbing fixtures, ammunition powder casings, ship's bells, and more.

Bronze is an alloy similar to brass except that it is made up of copper and tin mostly in varying amounts for different uses. Compared to brass, it is a darker, reddish-brown in color. Like brass, it is resistant to corrosion and is non-magnetic. Unlike brass, it is stronger and has greater resistance to metal fatigue. The KIDD's propellers are made from bronze, as are the cables and turnbuckles on the railings, the dogs on the hatches, and the anchor windlass.

Zinc bricks called "sacrificial anodes" are attached to the KIDD's steel hull near the bronze propellers. The flow of water around the hull, particularly around the propellers, produces a static electrical charge. This occurrence in an area of dissimilar metals—the steel hull and the bronze propellers—can cause accelerated corrosion. The zinc anodes dissolve into the seawater faster than the nearby steel or bronze and thus slow the deterioration of the nearby metals to a more normal rate of decay.

Copper can be found throughout the ship in wiring, plumbing, and the ship's boilers because of its resistance to corrosion and superior electrical conductivity. Platinum was used in some of the radar and sonar equipment due to it being very malleable and ductile, as well as its resistance to corrosion under high temperatures. Aluminum was used to replace some of the KIDD's superstructure and decks due to its corrosion resistance, light weight, and durability. However, the Navy stopped using aluminum in destroyer hull construction because of its lower melting point during fires as compared to steel.

1. Using the Periodic Table on Page 3, find each of the following elements and list their chemical symbol and atomic number:

a. Iron _____

f. Tin _____

b. Carbon _____

g. Arsenic _____

c. Copper _____

h. Lead _____

d. Zinc _____

i. Platinum _____

e. Aluminum _____

2. What is an "alloy"? _____

3. Name three (3) alloys found aboard the USS KIDD: _____

4. Based on the previous paragraphs, what chemical reaction is of greater concern among all of the metal alloys aboard a ship like the USS KIDD? Give its scientific and common name.

5. "Friction" is the force resisting the motion of surfaces sliding against one another. Friction can produce a static electrical charge, as well as heat. In which use aboard the KIDD would the low-friction property of brass be most important?

6. Class Discussion: What can you find in your school or in your home that uses the same metals and metallic alloys found aboard the USS KIDD in the same or similar manners?

Periodic Table of the Elements

1 1IA 11A	2 1IA 2A	18 VIII 8A															
1 H Hydrogen 1.0079	3 Li Lithium 6.941	4 Be Beryllium 9.01218	5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.998403	10 Ne Neon 20.1797	11 Na Sodium 22.989768	12 Mg Magnesium 24.305	13 Al Aluminum 26.981539	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.065	17 Cl Chlorine 35.4527	18 Ar Argon 39.948	
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.95591	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.64	33 As Arsenic 74.92159	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium 98.9062	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.757	52 Te Tellurium 127.6	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90543	56 Ba Barium 137.327	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98037	84 Po Polonium [209]	85 At Astatine 209	86 Rn Radon 222.0176
87 Fr Francium 223.017	88 Ra Radium 226.0254	89-103 Actinide Series	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Nh Nihonium [284]	114 Fl Flerovium [289]	115 Uup Ununpentium [294]	116 Uuh Ununhexium [293]	117 Uus Ununseptium [294]	118 Uuo Ununoctium [294]

Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetals	Nonmetals	Halogens	Noble Gas	Lanthanides	Actinides
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Teacher's Answer Key

1. Using the Periodic Table on Page 3, find each of the following elements and list their chemical symbol and atomic number:

a. Iron **Fe 26**

f. Tin **Sn 50**

b. Carbon **C 6**

g. Arsenic **As 33**

c. Copper **Cu 29**

h. Lead **Pb 82**

d. Zinc **Zn 30**

i. Platinum **Pt 78**

e. Aluminum **Al 13**

2. What is an "alloy"? **A mixture of a metal and another element.**

3. Name three (3) alloys found aboard the USS KIDD: **steel, brass, bronze**

4. Based on the previous paragraphs, what chemical reaction is of greater concern among all of the metal alloys aboard a ship like the USS KIDD? Give its scientific and common name.

Corrosion, also known as rust.

5. "Friction" is the force resisting the motion of surfaces sliding against one another. Friction can produce a static electrical charge, as well as heat. In which use aboard the KIDD would the low-friction property of brass be most important?

Ammunition powder casings – a static electrical charge or generated heat could produce an explosion.

6. Class Discussion: What can you find in your school or in your home that uses the same metals and metallic alloys found aboard the USS KIDD in the same or similar manners?

Answers will vary but may include the following: steel in the structural framing of the building; copper, brass, or bronze tubing or parts in the plumbing; aluminum siding on a house; aluminum on water fountains; copper in electrical wiring; copper or bronze in the building's hot water heater (identical to a boiler, just with lower temperatures); platinum and copper in electrical components like radios, televisions, game systems, computers (KIDD has radios and a fire control computer).