

CHEMISTRY IN SOCIETY N4: PROPERTIES OF METALS & ALLOYS HOMEWORK

1. Look at this list of elements.

gold foil, hydrogen gas, molten iron and sulphur powder, liquid oxygen, magnesium ribbon, bromine liquid, calcium granules, phosphorus sticks, carbon rods, copper foil.

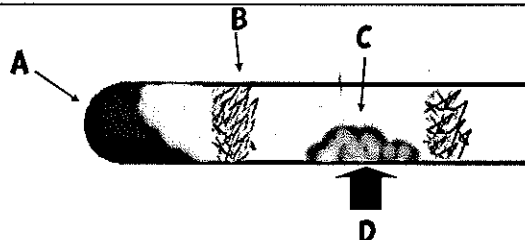
Which of these substances conduct electricity?

2. The properties of each metal allow chemists to choose what to use the metal for.

Copy and complete this table making the *use* match the *property*.

METAL'S NAME	USE	REASON WHY
ALUMINIUM	AIRCRAFT BODIES	
COPPER		GOOD ELECTRICAL CONDUCTOR
IRON	BRIDGES	
LEAD		SOFT
ZINC	COATING IRON OBJECTS	
MERCURY	THERMOMETERS	

3. This apparatus shown can be used to compare the reactivity of different metals.



- What is the name of substance **A** used to supply oxygen on heating?
- How can this experiment be used to compare the reactivity of different metals?

4. (a) Name three metals which are stored under oil.

(b) What does this indicate about the reactivity of these metals?

(c) Write a word equation for the reaction of one of these metals with oxygen.

(d) Write an equation for the reaction using symbols and formulae.

5. The following experiments were set up to investigate the rate of reaction of four metals: **W**, **X**, **Y** and **Z** with dilute hydrochloric acid

Place the four metals in order of reactivity.

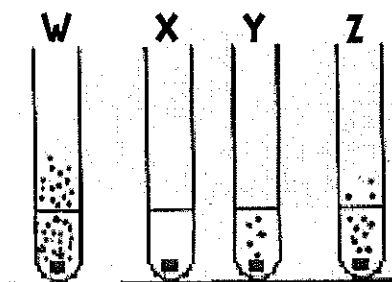
Start with the most reactive.

b. State three factors which must be kept the same for the comparison to be a fair one.

c. Which gas is produced in the reaction of a metal with dilute hydrochloric acid?

d. Write a word equation for the reaction of magnesium with dilute hydrochloric acid.

e. Write an chemical equation for the reaction using symbols and formulae.



6. When sodium metal is added to cold water, the metal melts to form the shape of a ball and quickly moves about the surface of the water. Hydrogen gas is rapidly produced and sodium hydroxide solution is formed.

a. How can you test that this gas is actually hydrogen?

b. Write a word equation for the reaction.

c. Write an equation for the reaction using symbols and formulae.

d. Explain why the metal melts.

e. Name a metal which reacts more vigorously than sodium with water.

7. Which of the following metals reacts with dilute acid ?

- i. copper ii. zinc iii. magnesium iv. gold v. iron vi. silver

8. calcium lithium silver zinc

- a. Which metal must be stored under oil?
b. Which metal safely reacts with water, allowing the gas given off to be collected?
c. Which metal does NOT react with water but reacts with dilute acid?

9. When two metals were added to (i) *cold water* and (ii) *dilute acid*, no difference in activity was seen. The metals could have been

- A zinc and calcium B. silver and copper C lead and magnesium D. iron and gold.

10. i. gold ii. sodium iii. magnesium iv. copper

Identify these metals by considering the following reactions. Which metal:

- a. combines with the oxygen of the air and reacts vigorously with water
b. reacts slowly with the oxygen of the air when heated but does NOT react with water
c. does NOT react with the oxygen of the air and does NOT react with water
d. reacts vigorously with the oxygen of the air when heated and reacts slowly with water

11. Some metals are found uncombined in the earth's crust but most have to be extracted from ores.

- a. What is meant by each of the terms underlined?
b. Name two metals which are found uncombined.
c. What can you say about the reactivity of metals which are found uncombined?
d. Name a metal that can be extracted from its ore by heating with carbon

12. The earliest people on earth used gold and silver for making Jewellery. Other metals like sodium and magnesium were unknown until approximately 200 years ago.

- a. Explain why gold and silver were among the first metals to be discovered.
b. Explain why sodium and magnesium were not discovered until quite recently.

13. On heating *iron oxide*, *sodium oxide* & *silver oxide*, one decomposed to form the metal and oxygen gas. On heating with carbon, another one reacted to form the metal.

- a. Which metal oxide would decompose on heating alone?
b. Which metal oxide would not decompose on heating with carbon?

14. The U.K. recycles many important metals.

- (a) What is meant by the recycling of metals? (b) Why it is so important to recycle all metals?

15. Which of the following metals

- a.) is found *uncombined* in the earth's crust b.) is found as an *ore*.

- i. silver ii. sodium iii. iron iv. gold v. copper vi. aluminium

16. A. aluminium B. gold C. copper D. tin

- Which metal was FIRST to be discovered?
- Which metal was NOT discovered until the nineteenth century?

17. Questions i to iv refer to the **heating alone** of metal oxides. Decide whether the metal oxide *breaks up or does NOT break up to give the metal*

i. sodium oxide ii. silver oxide iii. copper oxide iv. mercury oxide

18. Questions i to vi refer to the **heating** of metal oxides **with carbon**. In each case decide whether the metal oxide *breaks up or does NOT break up to give the metal*

i. calcium oxide ii. magnesium oxide iii. lead oxide iv. copper oxide
v. sodium oxide vi. iron oxide

19. Iron (II) oxide is broken up by heating with carbon, but barium oxide is unaffected by this treatment. Which of the following statements can be deduced from these facts?

- Iron is a more reactive metal than barium.
- Oxides of metals are stable compounds.
- Barium ions form atoms less easily than do iron (II) ions.

20. The following facts are known about four metals. P, Q, R and S.

- R displaces P and S from solutions of their ions;
- Q reacts with water. R does not;
- only the oxide of metal S can be decomposed to give metal.

The order of reactivity (most reactive first) is A. RQSP B. QSPR C. PSQR D. QRPS.

21. A metallic element reacts with dilute hydrochloric acid releasing hydrogen. The oxide of the metal can be decomposed by heating with carbon. The position of this metal in the reactivity series could be found in-between

A. silver & copper B. zinc & tin C. magnesium & sodium D. calcium & aluminium

22. The following information relates to four metals. W X Y and Z

- W displaces X from a solution of its compound;
- only Z is stored under oil;
- only the oxide of metal Y releases oxygen on heating

The order of reactivity is (*most reactive first*)

A. YWXZ B. ZWXY C. ZXWY D. YXWZ

23. A, B, C and D are four metals

- The oxide of C does not decompose on heating, while that of A does.
- B reacts with dilute acid to produce hydrogen gas; D does not.
- When D is added to a solution containing ions of the metal A, A is displaced and D dissolves,
- C reacts readily with cold water. B reacts slowly with steam.

Use this information to place the four metals in order of reactivity. (*most reactive first*)

24. The results of experiments with four metals W, X, Y and Z and their compounds are summarised in the table below.

METAL	COLUMN 1 metal with dilute acid	COLUMN 2 heat on metal oxide	COLUMN 3 metal with cold water
W	HYDROGEN EVOLVED	NO REACTION	HYDROGEN FORMED
X	NO REACTION	NO REACTION	NO REACTION
Y	HYDROGEN EVOLVED	NO REACTION	VERY SLOW REACTION
Z	NO REACTION	METAL FORMED	NO REACTION

- What can you learn about the metals' reactivity by looking at a. Column 1 alone? b. Column 2 alone? c. Now use ALL the information to put the metals in an order of reactivity (most reactive first) d. Suggest names for each of the metals W, X, Y & Z

25. Information about metals M, E, T, A, and L, and their compounds is listed below.

- A reacts vigorously with water. M slowly, while E, T and L do not react.
- T displaces E from a solution containing ions of E.
- Carbon reduces the oxides of E and T but not the other oxides.
- M, A and L react with dilute hydrochloric acid while T and E do not.

- Look at each bit of information in turn from (i) to (iv). what can be concluded about the relative reactivity of each of these metals?
- Use the above information to place the five metals in order of reactivity (most reactive first).
- When nitrates of these metals are heated only one decomposes to give the metal. Which one?

26. Copy and complete this table.

METAL	HOW IS THE METAL PRODUCED? 1. HEATING ALONE or 2. HEATING WITH CARBON or 3. ELECTROLYSIS	DATE OF DISCOVERY (USE DATA BOOK)
MERCURY		
LEAD		
IRON		
MAGNESIUM		
ALUMINIUM		
SODIUM		

What is the connection between the *ease of getting the metal* and *date of its discovery*?

27. Iron is produced from its ore by a process called *smelting*. The chemical reactions take place in a huge tower.

a. What name is given to the tower?

The following reactions take place in the tower. Write a word equation for each.

- the burning of the coke
- the production of carbon monoxide gas
- the formation of iron metal from the ore

28. Alloys can be made with very specific properties. Some are very hard, some are resistant to corrosion and some have special magnetic or electrical properties.

- What is meant by an alloy?
- Name three alloys and give a use for each.
- Explain why two alloys, both made up of aluminium & copper, can have different strengths.

29. Information about everyday alloys are given below. Match the numbers with the lettered boxes below.

ALLOY	ELEMENTS IN THE MIX	SPECIAL PROPERTY	USE
WOODS METAL	BISMUTH, LEAD, TIN & CADMIUM	6	IT IS USED AS A HEAT SENSITIVE PLUG IN FIRE SPRINKLERS.
14 CARAT GOLD	3	MORE SCRATCH RESISTANT THAN PURE, 24 CARAT, GOLD.	IT IS USED TO MAKE RINGS, BRACELET, WATCHES ETC.
1	MERCURY, SILVER, TIN AND COPPER	WHEN MADE AT FIRST IT IS SOFT BUT BECOMES VERY HARD IN A SHORT TIME	FILLING CAVITIES IN DECAYED TEETH
SOLDER	4	MELTS AT A LOW TEMPERATURE & CONDUCTS ELECTRICITY	8
STRUCTURAL STEEL	5	STRONG STEEL OF MEDIUM HARDNESS	GIRDERS FOR BUILDING RAIL TRACK.
2	IRON, CARBON, CHROMIUM, NICKEL, MANGANESE, SILICON	7	9

A1. STAINLESS STEEL	E1. GOLD, SILVER & COPPER : 14 PARTS GOLD & 10 PARTS SILVER & COPPER	P1. CORROSION RESISTANT (DOES NOT RUST)	U1. KNIVES, FORKS & SPOONS & HE KITCHEN SINK
A2. DENTAL AMALGAM	E2. LEAD & TIN	P2. MELTS AT A LOWER TEMPERATURE THAN BOILING WATER.	U2. TO JOIN WIRES IN AN ELECTRICAL CIRCUIT.
	E3. IRON, CARBON, CHROMIUM, NICKEL, MANGANESE, SILICON		

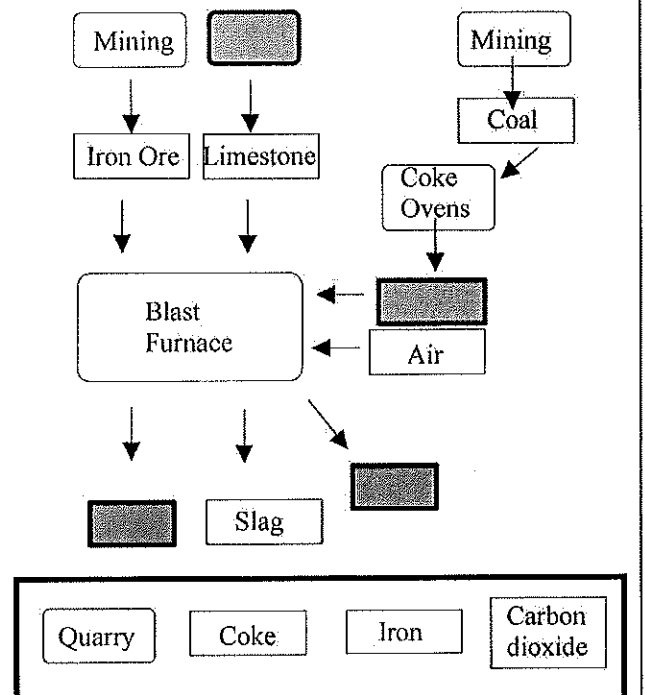
30. Construct a flow diagram for a blast furnace using the item at the bottom to replace the grey areas.

Iron from Iron Ore

Iron ore is mined then mixed with coke and Limestone. Coke is made from coal by heating in ovens and removing all the gases and oils that from. Limestone comes from quarries.

The mixture of these three is added to a blast furnace. The coke burns in a blast of air to gives high temperatures. This also produces carbon monoxide gas and this gas takes the oxygen away from the iron making carbon dioxide. The iron forms as a liquid at these temperatures.

The limestone forms another liquid with the sand and other impurities in the iron ore. This liquid is called slag



USE THESE BOXES TO COMPLETE THE FLOW DIAGRAM