HYDROGEN

1. Write down the formulae of some compounds of hydrogen with chloride, oxide and sodium ions.

2. List down physical and chemical properties of hydrogen gas.

3. Explain how hydrogen might be future's energy source.

4. Explain why hydrogen is placed among the alkali metals in the periodic table.

5. Calculate the density of hydrogen gas at STP in g/mL.

6. Suggest the preparation methods of hydrogen in industry and in laboratory with related reactions.

7. Write down formula of compounds for an acid, a base and a salt which contain hydrogen.

8. Complete the following table below.

Formula	Name	Type of the compound
H_2CO_3		
	ammonia	
		Salt (contain hydrogen)

9. Complete and balance the following reactions below,

A. ……. + O_2 → H_2O

B. K + ….. → KOH + …….

C. H_2O + Electricity → ……. + …….

D. Mg + HNO_3 → ……. + …….

E. K + H_2 → …….

F. N_2 + H_2 → …….

G. C + H_2O(steam) → ……. + …….

H. CH_4 + H_2O(steam) → ……. + …….

I. C_2H_6 + (heat) → ……. + …….

J. ……. + ……. → $ZnCl_2$ + $H_2\uparrow$

K. Al + ……. → $Al_2(SO_4)_3$+ $H_2\uparrow$

10. Complete the following transformations below.

A. H_2 → HCl → NaCl → Na → NaH

B. H_2O → H_2 → NH_3 → $(NH_4)_2SO_4$

C. C → H_2 → CaH_2 → $Ca(OH)_2$ → $CaCO_3$

11. Explain what water gas is, how it is obtained and why it is so important.

12. Explain why hydrogen is considered as an ecological fuel. Discuss the answer by a reaction.

13. Find the oxidation state of hydrogen in the following compounds.

A. CH_4 B. NH_3 C. KH

D. $Ca(HCO_3)_2$ E. NaOH

14. Calculate the mass of copper that can be obtained from the reaction of enough hydrogen gas with 320 g of copper (II) oxide.

15. Find the volume of an acid obtained by the reaction of 200 L of hydrogen and 300 L of chlorine gases.

16. 224 L of hydrogen was obtained at STP from the reaction of 500 g of sodium sample with excess water. Find the percent purity of the sodium sample.

17. A compound of hydrogen and carbon was analyzed to contain 20% hydrogen by mass. Density of the compound is calculated as 1.3393 g/L at STP. Find the molecular formula of the compound.

18. Relative density of a gaseous compound with respect to hydrogen is 13 and it contains 7.69% hydrogen and the rest is carbon. What is the volume of carbon dioxide at STP produced by the combustion of 15.6 g of this compound?

19. Calculate the mass of methane gas must be used to obtain 268.8 L of water gas by the following reaction at STP.

$$CH_4 + H_2O \rightarrow CO + 3H_2$$

20. The hydrogen gas produced by the first reaction is used then to obtain ammonia in the second reaction. Calculate the mass of ethane gas must be used to prepare 448 L of ammonia at STP.

$$C_2H_6(g) + \text{heat} \rightarrow 2C + 3H_2(g)$$
$$3H_2 + N_2 \rightarrow 2NH_3$$

21. 100 L oxygen and 250 L hydrogen gases are mixed in a closed cylinder and allowed to react to produce gaseous water at the same conditions. What is the total volume of gases in the cylinder after the reaction completed?

22. Hydrogen is a good reducing agent; reduces metal oxides to pure metals. A 300 g sample of iron (II) oxide is reduced by 89.6 L of hydrogen gas at STP and 224 g of pure iron is obtained. Calculate the percentage purity of iron (II) oxide.

23. Natural gas that we use in our daily life contains about 95% methane. It is known that when methane is heated with a catalyst, it decomposes to give carbon and hydrogen gas.
Find the volume of hydrogen gas that can be obtained from methane found in 10 m^3 natural gas at the same conditions.

24. A 2.4 g of an unknown alkaline earth metal is allowed to react with enough hydrochloric acid. 2.24 L of hydrogen gas at STP is measured to obtain. Find the alkaline earth metal used in the reaction.

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