OXYGEN, GENERAL PROPERTIES

5.1. Select the properties of oxygen element.
A. there are 6 electrons in the last energy level.
B. It is found in air.
C. Chemical symbol is O.
D. It is in 2^{nd} period and 6A group in the periodic table.
E. Relative molecular mass is 32 g.
F. Atomic number is 8.
G. Relative atomic mass is 16.
H. Chemical formula is O_2.

5.2. Choose the properties of oxygen gas;
A. It makes non polar covalent bond
B. Molar mass is 32 g/mol.
C. Nuclear charge is +8.
D. Number of bonds is 2.
E. Colorless gas.
F. Chemical formula is O_2.
G. Chemical symbol is O.

5.3. Fill the blanks with elemental oxygen or compound of oxygen
A. the most abundant element in Earth`s crust is ……oxygen
B. ……..is found in most of the compounds in life like proteins, fats and carbohydrates.
C. …….oxygen constitutes of 49.3% in Earth crust, 85.8% in sea water and 90% in cucumber.
D. ……oxygen constitutes of 1/5 of air.
E. …….oxygen has the properties of colorless, tasteless, odorless and less soluble in water.

5.4. Determine the statements related whether elemental oxygen or compound of oxygen.
A. Oxygen is found in many natural substances such as clay and sand.
B. Oxygen is heavier than air.
C. Mass percent of oxygen in water is 89%.

5.5. Choose the physical properties of oxygen;
A. Oxygen is lighter than air.
B. Solid
C. Liquid
D. Gas
E. Colorless
F. Yellow
G. Less soluble in water
H. Well soluble in water
I. Heavier than water.
J. Pungent smell
K. Sweet taste

5.6. There are two balloons: In one there is oxygen and in the other there is air. Can you determine oxygen by appearance? Which physical properties can be used to determine oxygen?

5.7. Explain by which methods oxygen is obtained in pure form;
A. from water B. from air

5.8. Choose the physical properties of oxygen;
A. Conducts electricity
B. Sour taste
C. Tasteless
D. Bitter
E. Nonconductor of electricity
F. Blue
G. Boiling point is -183^oC.
H. Melting point is -196^oC.
I. Odorless

5.9. Choose the correct statement about oxygen;
A. Gaseous in standard conditions.
B. Having odor
C. Found in nature in free and compound forms.
D. Solid and liquid forms are colored.

PREPARATION OF OXYGEN

6.1. Choose the method to prepare oxygen in industry;
A. Decomposition of $KMnO_4$
B. Decomposition of HgO
C. Photosynthesis
D. From liquefied air
E. From electrolysis of water.

6.2. Choose the method to prepare oxygen in laboratory;
A. Decomposition of $KClO_3$
B. Decomposition of water
C. Decomposition of H_2O_2
D. Photosynthesis

6.3. Complete the following reactions of oxygen, balance the reactions;
Indicate the types of reactions according to heat change.
A. $KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + ? - Q$
B. $KClO_3 \rightarrow KCl + ? - Q$
C. $H_2O \rightarrow ? + ? - Q$
D. $HgO \rightarrow ? + ? - Q$

$$E.\ H_2O_2 \xrightarrow{[MnO_2]} H_2O + ? - Q$$

$$F.\ CO_2 + H_2O \xrightarrow[Light,\ chlorophyll]{} C_6H_{12}O_6 + ? - Q$$

6.4. Write down the reactions to obtain oxygen by;
A. Decomposition of water
B. Decomposition of HgO
C. Decomposition of H_2O_2

6.5. Explain the preparation of oxygen from H_2SO_4, $KMnO_4$, $KClO_3$, HgO. Discuss preparations by the reaction equations.

6.6. Calculate the amount of oxygen obtained from the decomposition of 6 moles of water. Calculate the mass of oxygen and water.

6.7. Calculate the amount of $KMnO_4$ which produces 2 moles of oxygen. Calculate the mass of K_2MnO_4.

6.8. Calculate the maximum amount of oxygen from decomposition of 1 mole of substances;
A. $H_2O_2 \rightarrow H_2O + O_2\uparrow$
B. $KClO_3 \rightarrow KCl + O_2\uparrow$

6.9. Calculate the mass of $KMnO_4$ to obtain 6.4 g of O_2.

6.10. In the world all plants annually absorb 200 billion tons of CO_2. Calculate the mass of oxygen produced by photosynthesis.

CHEMICAL PROPERTIES OF OXYGEN

7.1. Write the formula of the oxides according to given oxidation states.

IV	II	IV	V	III	II
A. SO;	B. CO;	C. CO;	D. PO;	E. PO;	F. NO

7.2. Write the formula of the oxides according to given oxidation states.

+3	+2	+2	+2	+1	+3
A. AlO;	B. ZnO;	C. CuO;	D. CaO;	E. CuO;	F. CrO

7.3. Complete the formulas of substances in given chemical equations and balance them.
Write type of the reactions and name the products

$$A.\ O_2 + S \xrightarrow{IV} SO$$

$$B.\ O_2 + P \xrightarrow{V} PO$$

$$C.\ O_2 + C \xrightarrow{IV} CO$$

$$D.\ O_2 + CO \xrightarrow{VI} CO$$

$$E.\ O_2 + SO \xrightarrow{IV} SO$$

$$C.\ O_2 + NO \xrightarrow{IV} NO$$

7.4. Complete the reactions of metals with oxygen. Name the products. Indicate the type of reactions according to heat change.
A. $Ca + O_2 \rightarrow ?$
B. $Al + O_2 \rightarrow ?$
C. $Fe + O_2 \rightarrow ?$
D. $Li + O_2 \rightarrow ?$
E. $Cu + O_2 \rightarrow ?$
F. $Zn + O_2 \rightarrow ?$

7.5. Write burning rections of given elements in oxygen
A. Phosphorous(V) B. Barium C. Aluminum
D. Lithium E. Carbon(IV) F. Sulfur(IV)

7.6. Choose substance which give reaction with oxygen. Write the possible reactions.
A. Lithium B. Calcium C. Iron D. Aluminum

7.7. Complete the following reactions of oxygen, and balance the reactions;

$$A.\ CH_4 + O_2 \xrightarrow{IV} CO + H_2O$$

$$B.\ C_2H_2 + O_2 \xrightarrow{IV} CO + H_2O$$

$$C.\ H_2S + O_2 \xrightarrow{IV} SO + H_2O$$

$$D.\ C_3H_8 + ? \xrightarrow{IV} CO + H_2O$$

$$E.\ C_4H_{10} + ? \xrightarrow{III\ \ IV} CO + H_2O$$

$$F.\ FeS + ? \rightarrow FeO + SO\uparrow$$

7.8. Choose the process where oxygen is consumed.
A. Respiration B. Burning C. Photosynthesis
D. putrefication

7.9. Complete the reactions and choose the oxidation reactions.
A. $CaO + CO_2 \rightarrow CaCO_3$
B. $Ca + O_2 \rightarrow ?$

II IV
C. $CO + ? \rightarrow CO$
VI
D. $SO + H_2O \rightarrow H_2SO_4$
Electricity
E. $H_2O \rightarrow H_2 + ?$
VI
F. $SO_2 + O_2 \rightarrow SO$

7.10. Choose formulas of the oxides from the compounds given below and name them.
Write the preparation reaction of oxides by burning of element in oxygen.
H_2O CH_4 HNO_4 Al_2O_3 NaCl SO_2 P_2O_5
$Ca(OH)_2$ CO_2

7.11. Choose formulas of the oxides and name them.
KNO_3 Fe_2O_3 PH_3 Cl_2O FeS FeO $CaCO_3$
Cu_2O HCl CuO

7.12. Calculate the mole number and mass of oxygen which is needed react with 4 moles of magnesium.

7.13. Calculate the mole number of water which is produced from 5 mole of hydrogen. How many mole of oxygen is used in this reaction?

7.14. Calculate the mole number of oxygen needed to burn 5 mole of methane (CH_4). How many mole of carbon dioxide produced?

7.15. 1 mole of methane is needed to boil 1 L of water. How many mole of oxygen is necessary to burn 1 mole of methane? Calculate the mole number of carbon dioxide and water produced from the reaction.

OXIDATION-REDUCTION REACTIONS

8.1. Determine the oxidation states of elements in given compounds below.
A. I_2 B. P_2O_5 C. SO_2 D. CO
E. CO_2 F: SO_3

8.2. Determine the oxidation states of elements in given compounds below.
A. H_2 B. H_2S C. S D. NH_3
E. CH_4 F: HCl

8.3. Determine the oxidation states of elements in given compounds below.
A. Na_2O B. FeO C. Al_2O_3 D. PbO_2
E. Fe_2O_3 F: ZnO

8.4. Determine the oxidation states of elements in given compounds below.
A. H_2SO_4 B. HNO_3 C. $KMnO_4$
D. $K_2Cr_2O_7$ E. $FeCl_2$ F: $FeCl_3$

8.5. Complete the equations by putting electrons to proper side of the equations. Indicate oxidizing and reducing agents. Determine processes that whether they are reduction or oxidation.
A. $Zn^o \rightarrow Zn^{+2}$
B. $Al^o \rightarrow Al^{+3}$
C. $Li^o \rightarrow Li^{+1}$
D. $H_2^o \rightarrow 2H^{+1}$
E. $O_2^o \rightarrow 2O^{-2}$
F. $Cl_2^o \rightarrow 2Cl^{-1}$

8.6. Complete the equations by putting electrons to proper side of the equations. Indicate oxidizing and reducing agents. Determine processes that whether they are reduction or oxidation.
A. $Br_2^o \rightarrow 2Br^{-1}$
B. $N_2^o \rightarrow 2N^{+2}$
C. $C^o \rightarrow C^{+4}$
D. $N_2^o \rightarrow 2N^{-3}$
E. $S^o \rightarrow S^{+4}$
F. $Cu^{+2} \rightarrow Cu^o$

8.7. Complete the equations by putting electrons to proper side of the equations. Indicate oxidizing and reducing agents. Determine processes that whether they are reduction or oxidation.
A. $S^o \rightarrow S^{-2}$
B. $Fe^{+3} \rightarrow Fe^o$
C. $S^{+4} \rightarrow S^{+6}$
D. $Mn^{+7} \rightarrow Mn^{+2}$
E. $I_2^o \rightarrow 2I^{-1}$
F. $N^{+2} \rightarrow N^{+4}$

8.8. Select the redox reactions.
A. $2HgO \rightarrow 2Hg + O_2\uparrow$
B. $Na_2O + H_2O \rightarrow 2NaOH$
C. $3H_2 + N_2 \leftrightarrow 2NH_3$
D. $CaCO_3 \leftrightarrow CaO + CO_2\uparrow$
E. $2H_2O \rightarrow 2H_2\uparrow + O_2\uparrow$
F. $CuCl_2 + Fe \rightarrow FeCl_2 + Cu$

8.9. Select the redox reactions.

A. $4Al + 3O_2 \rightarrow Al_2O_3 \uparrow$
B. $SO_3 + H_2O \rightarrow H_2SO_4$
C. $Cu(OH)_2 \rightarrow CuO + H_2O$
D. $2KClO_3 \rightarrow 2KCl + 3O_2 \uparrow$
E. $S + O_2 \rightarrow SO_2$
F. $2Cu + O_2 \rightarrow 2CuO$

8.10. Balance the redox reactions by electron balance method. Show oxidizing and reducing agents.
A. $Li + O_2 \rightarrow Li_2O \uparrow$
B. $Ca + O_2 \rightarrow CaO$
C. $3H_2 + O_2 \rightarrow H_2O$
D. $KClO_3 \rightarrow KCl + O_2 \uparrow$
E. $CO + O_2 \rightarrow CO_2$
F. $SO_2 + O_2 \rightarrow SO_3$

8.11. Balance the redox reactions by electron balance method.
A. $Al + S \rightarrow Al_2S_3$
B. $Al + I_2 \rightarrow Al_2I_3$
C. $Al + O_2 \rightarrow Al_2O_3$
D. $H_2O_2 \rightarrow H_2O + O_2 \uparrow$
E. $CH_4 + O_2 \rightarrow CO_2 + H_2O$
F. $NH_3 + O_2 \rightarrow N_2 + H_2O$

8.12. Select the redox reactions and balance them by electron balance method.
A. $Al(OH)_3 \rightarrow Al_2O_3 + H_2O$
B. $Ag_2O \rightarrow Ag + O_2 \uparrow$
C. $SO_3 + Na_2O \rightarrow Na_2SO_4$
D. $Al + HCl \rightarrow AlCl_3 + H_2 \uparrow$
E. $CuO + HCl \rightarrow CuCl_2 + H_2O$
F. $N_2 + O_2 \rightarrow NO$

8.13. Calculate the mole and mass of oxygen necessary to oxidize sulfur dioxide to obtain 4 mole of sulfur trioxide.

8.14. Calculate the mole and mass of hydrogen peroxide if it produces 6 mole of oxygen when decomposed. How many mole of water produced?

USES OF OXYGEN, AIR, COMPOSITION OF AIR

9.1. Explain for what purpose oxygen is used
A. in medicine
B. for cutting and welding metals
C. in metallurgy

9.2. Name the gaseous and liquid oxides which are necessary for growth of plants.

9.3. For what purpose, combustion of methane and acetylene are used? Write these reactions.

9.4. Choose the processes in which oxygen is used and produced.
A. respiration B. photosynthesis
C. fermentation D. petrification E. corrosion
F. combustion

9.5. Select the correct use of oxygen below,
A. in medicine for respiration,
B. in metallurgy to burn fuel in order to get high temperature,
C. in meteorology balloon to check weather conditions,
D. in acetylene welding tools to reach high temperatures,
E. in diver's tubes it is mixed with helium gas,
F. in warehouses to store grains and to extend their shelf life.

9.6. Select the correct statement for the use of oxygen gas,
A. As an oxidizer in rocket fuel,
B. As a component of explosive material (in liquid form),
C. To enrich air in greenhouses,
D. In the composition of air used to speed up the decomposition of garbage material,
E. In chemical industry to oxidize metals,
F. To get protective atmosphere.

9.7. Select the substances in atmosphere found in constant composition, indicate their compositions in air by volume;
A. nitrogen
B. water vapor
C. oxygen
D. dust
E. noble gases
F. carbon oxides

9.8. Select the air pollutant substances produced by human activities;
A. oxygen
B. argon
C. sulfur dioxide
D. nitrogen oxides
E. carbon dioxide

9.9. Make a list of substances found in air either constant or changeable composition;

Composition of air

Constant composition | Changeable composition

9.10. Name the oxides in air with constant composition; explain how carbon dioxide is produced in air.

9.11. Select the following processes in which oxygen is used;
A. Welding of metals,
B. Photosynthesis,
C. Cutting of Metals,
D. Burning of fuel.

9.12. Select the correct responses about the gases found in air in constant compositions;
A. Oxygen, nitrogen, hydrogen
B. Oxygen, nitrogen, carbon dioxide
C. Oxygen, carbon dioxide, sulfur trioxide,
D. Argon, nitrogen, hydrogen

9.13. Purpose a method to identify the gases in the bottles;
A. air B. nitrogen C. oxygen

9.14. Calculate the relative molar masses of the following gases;
A. carbon dioxide,
B. sulfur trioxide,
C. carbon monoxide,
D. nitrogen dioxide.

9.15. A man uses 720 L of oxygen in 24 hours. Calculate the volume of air which have this amount of oxygen.

9.16. Mass of air in 1-m^3 is 1.28 kg. Calculate;
A. mass of air in a classroom with 12x6x2.5 m dimensions,
B. volume of oxygen in the same classroom,
C. volume of oxygen for 25 students

9.17. To boil water in a 1-L kettle 45-L of oxygen is used. What is the volume of air used?

COMBUSTION IN AIR, AIR AROUND US

10.1. Which of the given substances below burn faster in oxygen or in air?
A. Sulfur B. Phosphorus C. Carbon
D. Hydrogen E. Methane

10.2. Does one or two reaction show the combustions of substances in air or in oxygen? Why?

10.3. Explain why wet wood burn slowly.

10.4. Explain why many metals for example aluminum does not burn in large pieces, but they burn with explosions when they are powdered. Write the combustion reactions of Al, Mg, Li and Fe metals.

10.5. Explain, why water does not extinguish the fires of petroleum, gasoline and petroleum products. Write the combustion reactions of;
A. C_3H_8 (propane) B. C_4H_{10} (butane).

10.6. Explain why CO_2 gas put off fire.

10.7. Explain which method must be used to extinguish a camp fire.

10.8. Write the formula of simple form of oxygen gas.

10.9. Complete the reactions below;
A. $O_2 + uv \rightarrow$
B. $O_3 + uv \rightarrow$

10.10 Write the uses of ozone gas.

10.11. Calculate the amount of ozone gas which is produced from oxygen with;
A. 6 mol B. 12 mol C. 18 mol
Calculate the mass of ozone.