ORDINARY LEVEL CHEMISTRY PROBLEMS

PART 2: OXYGEN, COMBUSTION AND THE ATMOSPHERE

1. (a). Name
   (i). two major components of air
   (ii). the process by which the components of air are separated.
   (b). Explain why the process you have named in a (ii) can be used to separate the components of air.
   (c). Which one of the two components of air are useful as a plant nutrient?

2. (a). A clean sample of steel wool was placed in a test tube containing some water and the test tube was inverted in a trough of water. After three days the volume of air in the test tube changed from 20 cm^3 to 16 cm^3 and a brown layer formed on the steel wool.
   (i). Write the formula of the brown solid.
   (ii). Calculate the percentage decrease in the volume of air in the tube.

3. Oxygen can be prepared in the laboratory using hydrogen peroxide and a substance X.
   (a). Name X.
   (b). Write equation leading to the formation of oxygen.
   (c). State
   (i). the role of X.
   (ii). the conditions for the reaction
   (d). Name one process that increases the amount of oxygen in the atmosphere.

4. (a). State two properties which show that air is a mixture.
   (b). Name two gases, other than oxygen, that are constituent of air and give their approximate percentages in air.
   (c). Describe an experiment to determine the percentage of oxygen in air. Show how the percentage can be calculated from the results.
   (d). (i). State what is observed when burning sulphur is lowered into a jar of oxygen.
   (ii). Write the name and formula of the product of the reaction between sulphur and oxygen.

5. (a). Draw a diagram of the setup of the apparatus that can be used to show thatiron does not rust in the absence of moisture.
   (b). State one other conditions necessary for rusting to take place.
   (c). Name two methods for preventing rusting.

6. (a). State the approximate percentage of oxygen in the atmosphere.
   (b). Name the process by which oxygen is
   (i). used up from the atmosphere.
   (ii). replaced in the atmosphere.
   (c). State what would be observed if a piece of burning phosphorus is lowered into a jar of oxygen.

7. (a). With the aid of diagram describe an experiment you would carry out to show that rusting requires both oxygen and water in order to occur.
   (b). Describe four ways of preventing rusting.

8. When hydrogen peroxide was exposed to sunlight, a gas was formed.
   (a). (i). Name the gas.
   (ii). State how the gas could be identified
   (iii). Write an equation for the reaction leading to the formation of the gas.
   (b). Name one reagent that can be used to speed up the rate of formation of the gas.

9. (a). When 17 g of hydrogen peroxide was exposed to sunlight, 6dm^3 of a gas was evolved at room temperature.
   (i). Write equation for the reaction that took place.
   (ii). Calculate the volume of the gas evolved at room temperature.
   (H=1; O=16; 1 mole of a gas occupies 24 dm^3 at room temperature.
   (b). Manganese (IV) oxide is added to 17 g of hydrogen peroxide and the mixture exposed to sunlight at room temperature.
   (i). Determine the volume of the liquid evolved at room temperature.
   (ii). Give a reason for your answer

10. (a). State the conditions necessary for rusting to occur.
   (b). During an investigation to show the conditions under which an iron nail may rust, an experiment was set up as shown in figure 3 below:

State the conditions which was eliminated.
   (c). State one disadvantage of rusting.
   (d). (i). What is galvanised iron?
   (ii). State one use of galvanised iron.

11. (a). Draw a labelled diagram to show how a sample of oxygen can be prepared in laboratory from hydrogen peroxide. Write the equation for the reaction that takes place.
   (b). State and explain what happens when each of the following substances are lowered in a gas jar of oxygen and water added to the products.
   (i). Burning sodium
   (ii). Ignited magnesium
   (iii). Hot iron.
   (c). Name one natural process by which oxygen can be obtained
   (d). State two uses of oxygen to society.

(e). Calculate the volume of oxygen liberated when 16 g of potassium chlorate (V) is heated.
(K=39; Cl=35.5; O=16; 1 mole of gas occupies 24000 ml at s.t.p.)

12. (a). Write the formulae of the oxides of:
(i). sulphur.
(ii). aluminium.
(b). State the type of bond that exists in the oxide of
(i). sulphur.
(ii). aluminium.
(c). State the class to which the oxides of the following elements belong.
(i). sulphur.
(ii). aluminium.

13. (a). How can calcium oxide (quick lime) be obtained on the large-scale?
(b). Write equation for the reaction that occurs.
(c). State three uses of calcium oxide.
(d). What would you observe when water is added to fresh calcium oxide?
(e). Calculate the mass of 0.25 moles of calcium oxide. (Ca=40; O=16)
(f). How would you obtain calcium nitrate starting with calcium oxide?

14. Oxygen can be prepared from hydrogen peroxide in the presence of a catalyst only.
(a). (i). Name the catalyst used.
(ii). Write equation for the formation of oxygen.
(b). (i). What is meant by the rate of formation of oxygen.
(ii). State three ways in which the rate of formation of oxygen is increased.

15. (a). The reaction between sodium peroxide and water is used in the preparation of oxygen.Write an equation for the reaction.
(b). Oxygen was passed over heated zinc.
(i). State what was observed.
(ii). Write an equation for the reaction.

16. Hydrogen peroxide was added to manganese (IV) oxide.
(a). State;
(i). What was observed?
(ii). The role of manganese (IV) oxide.
(b). Write an equation for the reaction between:
(i). Hydrogen peroxide and manganese (IV) oxide.
(ii). Sodium and theproduct in (b) (i).

17. (a). Calcium was burnt in air. Write equation(s) for the reaction that took place.
(b). Few drops of water were added to the product in (a).
(i). State what was observed.
(ii). Write equation for the reaction that took place.
(c). Name one compound which when heated forms the same product as that in (a) above.

18. (a). Oxygen can be prepared using sodium peroxide and water.

(i). Write an equation for the reaction between sodium peroxide and water.

(ii). Name one other substance from which oxygen can be prepared in the laboratory.

(b). (i). State the condition(s) under which oxygen can react with iron.

(ii). Write an equation for the reaction that takes place when iron is treated with oxygen under the condition(s) you have stated in b (i).

19. The oxides of some elements are listed below.

- Lead (II) oxide
- Sulphur dioxide
- Copper (II) oxide
- Aluminium oxide

(a). State the oxides(s) which will react with

(i). acid only.

(ii). alkalis only.

(iii). both acids and alkalis.

(b). When excess oxygen was passed over 1.6 g of a strongly heated metal Z, 1.8 g of an oxide of the metal was obtained. Determine the empirical formula of the oxide of Z. [Z = 63.6]

20. (a). When a solid Q was added to hydrogen peroxide, oxygen was evolved.

(i). Identify Q.

(ii). Write equation for the reaction that took place.

(b). Briefly describe how oxygen can be prepared in the laboratory using sodium peroxide. [*Your answer should include equation(s) and method of collection and diagrams.*]

(c). Draw a labelled diagram of the setup of apparatus that can be used to prepare oxygen by electrolysis of water.

(d). State how oxygen can react with sodium and iron, and in each case, write equation to illustrate your answer.

21. State whether the following oxides are acidic, basic, neutral or amphoteric.

ZnO; SO_2; Al_2O_3;CuO; CO; P_2O_5; NO; NO_2; Fe_2O_3; PbO

22. (a). Sodium metal was burnt in excess oxygen

(i). State what was observed

(ii). Write equation for the reaction that took place

(b). Water was added to the solid product in (a)

(i). State what was observed

(ii). Write the equation for the reaction

23. (a). Copper, zinc and phosphorus can react with oxygen.

(i). State the condition(s) under which these elements react with oxygen.

(ii). State what is observed during the reaction of each of the elements with air

(iii). Write equation for the reaction that takes place in each case.

(b). The products of the reactions of these elements wit oxygen were separately added to water, dilute sulphuric acid and sodium hydroxide solution. Name the element(s) whose product reacted with

(i). Water

(ii). Dilute sulphuric acid

(iii). Sodium hydroxide solution

(c). Give a reason for your answer in each case

(d). State what observed in (b) (ii) and (iii)
(e). Write equation for the reactions that take place in (b)

24. (a). What is meant by the term 'acid anhydride'
(b). Give three examples of acid anhydrides
(c). Write equations to show how the acid anhydrides you have named react with water

25. (a). State the conditions under which oxygen can react with
(i). Sulphur
(ii). Copper
(b). Write equation for the reaction between oxygen and
(i). Sulphur
(ii). Copper
(c). State which one of the compounds formed in (b) (i) and (ii) will react with dilute hydrochloric acid. Give a reason for your answer.

26. Air is a mixture consisting of mainly two gases X and Y in the ratio 1:4 by volume respectively
(a). Name gas
(i). X
(ii). Y
(b). State a suitable a method by which the mixture of X and Y can be separated. Give a reason for your answer.
(c). Give one industrial use of
(i). X
(ii). Y

27. (a). The elements copper, zinc and sulphur react with oxygen to form their oxides. Write the formula of the oxide of each of the elements and state the type of oxide whose formula you have written
(b). Excess dilute sodium hydroxide was added to a mixture of oxides of zinc and copper. State what was observed and give a reason for your observation.
(c). State what is observed and write the equation for the reaction when each of the following is added to warm dilute sulphuric acid
(i). Zinc oxide
(ii). Copper(II) oxide
(iii). Iron(III) oxide