SAMPLE QUESTIONS

NITROGEN and PHOSPHORUS

1. Choose correct statements and correct the incorrect statements.
A. Nitrogen is a second period and V-A group element in the periodic table.
B. There are 7 protons and 7 neutrons in the nucleus of nitrogen atom and around the nucleus there are 7 electrons.
C. Superior oxide of nitrogen is N_2O_5.
D. Nitrogen has several allotropic forms.
E. The highest oxidation state of nitrogen is +5 and the lowest is -3.
F. Elemental nitrogen has simple N_2 form.

2. Choose correct statements and correct the incorrect statements.
A. In the molecule of nitrogen there is a triple non polar covalent bond.
B. Nitrogen molecules are unstable and easily undergo chemical reactions.
C. Nitrogen is dissolved easily in water.
D. Nitrogen is obtained from air in liquefied form.
E. Nitrogen is a colorless and odorless gas.
F. Nitrogen is 21% and 78% oxygen by volume in air.
G. Nitrogen is used in the synthesis of ammonia and to cool down the various objects to low temperatures.

3. Determine the oxidation states of nitrogen in the following compounds:
NH_3, N_2, N_2O, NO, N_2O_3, N_2O_5, HNO_3.
In which nitrogen is reductant and in which it is oxidant.

4. Explain the types of bonds and their formation in the following compounds: N_2, O_2, and F_2. Based on the bounding explain how activity of non metals change from nitrogen to fluorine.

5. Write down the reaction equations of nitrogen with;
A. H_2; B. O_2; C. Li; D. Ca; E. K; F. Al.

6. Explain how nitrogen is obtained in industry?

7. Calculate the mass of magnesium necessary which reacted with 33.6 L of nitrogen at STP. Calculate the mass of magnesium nitride obtained.

8. Calculate the volume of hydrogen and nitrogen gases necessary to obtain 20 m^3 of ammonia with 40% theoretical yield.

9. Calculate:
A. mass of nitrogen with:
1. 5.6 L; 2. 112 mL; 3. 2.24 m^3 volumes at STP;

B. volume of nitrogen at STP with:
1. 56 g; 2. 84 kg; 3. 28 tons masses.

10. Write down the reaction equations to obtain ammonia with:
A. a synthesis reaction; B. a double displacement reaction;
Give the conditions of the reaction.

11. Write reaction equations of ammonia with water and following acids:
A. hydrochloric acid B. hydrogen bromide C. hydrogen bromide D. nitric acid
E. sulfuric acid

12. Give the formulas of following ammonium salts:
A. chloride B. nitrate C. sulfide D. bromide E. carbonate F. hydrogen sulfate
G. dihydrogen phosphate H. sulfate I. hydrogen phosphate

13. Complete the reaction equations to obtain ammonia:
A. $N_2 + H_2$ (temp.) $\rightarrow$ B. $(NH_4)_2SO_4 + KOH$ (temp.) $\rightarrow$

C. NH_4NO_3 + NaOH (temp.) → D. NH_4Cl + NaOH (temp.) →
E. NH_4Cl + $Ca(OH)_2$ (temp.) → F. NH_4Br + $Ba(OH)_2$ (temp.) →

14. Perform the transformations below:

A. $N_2 \rightarrow NH_3 \rightarrow NH_4Cl \rightarrow NH_3$

$(NH_4)_2SO_4$
NH_4HSO_4

B. $NH_3 \rightarrow NH_4Cl \rightarrow NH_4NO_3 \rightarrow NH_4OH \rightarrow NH_4OH$

C. $(NH_4)_2CO_3 \rightarrow NH_3 \rightarrow (NH_4)_2SO_4$

NH_4Cl

D) nitrogen → ammonia → ammonium nitrate

Ammonium hydrogen sulfate → ammonium sulfate → ammonium hydroxide

ammonia

15. Calculate the volume at STP of ammonia with a mass of:
A. 34 g B. 85 g C. 17 kg

16. Calculate the mass of ammonia with a volume of at STP:
A. 1.12 L B. 89.6 L C. 2.24 m^3

17. Calculate the mass percentage of ammonia in a solution that is obtained through dissolution of 700 L of ammonia in 1 L of water.

18. 10% aqueous ammonia solution by mass is called "ammonia solution". Calculate:
A. the mass of ammonia and water;
B. the volume of ammonia and water necessary to prepare 200 mL solution with a density of 0.96 g/mL.

19. Write the formula of oxides of nitrogen with following oxidation states:
+1, +2, +3, +4, +5

20. Choose the statements that refer to nitrogen monoxide or nitrogen dioxide:
A. colorless gas;
B. reddish-brown gas;
C. 1.6 times heavier than air;
D. slightly heavier than air;
E. is obtained in air through thunderstorms;
F. is obtained by getting in contact with oxygen of another nitric oxide;
G. is poisonous, it irritates the mucous;
H. it oxidizes easily with oxygen from air;
I. It forms nitric acid by reaction with water.

21. Perform the following transformation:
$N_2 \rightarrow NH_3 \rightarrow NO \rightarrow NO_2 \rightarrow HNO_3$

22. Choose the corresponding areas of application from column B for the substances from column A:

A	
A. Ammonia	1) to obtain mineral fertilizers.
	2) to obtain the nitric acid in industry.
B. Nitric acid	3) to obtain the nitric acid in laboratory.
	4) in medicines.
C. Nitrates	5) to obtain the drugs.
	6) to obtain the explosive substances.

D. Ammonium salt 7) to obtain the dyes.

23. 27 kg nitrogen monoxide was obtained by catalytic oxidation of 17 kg of ammonia. Calculate the percent yield of the reaction.

24. The nitric acid was obtained by interaction of strong sulfuric acid with 170 g of sodium nitrate. Find:
A. mass of nitric acid, if the theoretical yield of the reaction is 90 %;
B. the mass of 63 % nitric acid solution, if the theoretical yield of the reaction is 90 %;
C. The percent yield of nitric acid, if its mass is 113.4 g

25. Complete the statements:
A. In the periodic table phosphorus is placed ……..
B. In the nucleus of phosphorus atom there are …… protons and …… neutrons, and around nucleus there are ……. electrons.
C. In the outer most shell of phosphorus atom there are ……. electrons, therefore it gains …… , electrons displaying minimum ……. oxidation state or displaying maximum …….. oxidation state.
D. Highest oxidation state phosphorus has ……. character and it corresponds ……
E. It is found in ……. Phosphates in Earth's crust and in the living organisms as ……..
F. It is found in nature in only …… form.
G. It has some allotropes ……., ……
H. The word "phosphorus" means …….
I. It is used to produce ……..

26. Determine the oxidation state of phosphorus in the following compounds:
PH_3, Ba_3P_2, P_2O_5, HPO_3, H_3PO_4, PCl_5, P_2O_3, K_3PO_4.

27. Complete the following reaction:
A. $P + ? \rightarrow P_2O_5$ B. $P + ? \rightarrow PF_5$ C. $P + ? \rightarrow Ca_3P_2$
D. $P + ? \rightarrow Na_3P$ E. $P + ? \rightarrow P_2O_3$ F. $P + ? \rightarrow K_3P$
G. $P + ? \rightarrow PCl_5$ H. $P + ? \rightarrow AlP$

28. Write the molecular equations of the following ionic equations:
A. $3Ca^{+2} + 2PO_4^{-3} \rightarrow Ca_3(PO_4)_2\downarrow$
B. $3Ba^{+2} + 2PO_4^{-3} \rightarrow Ba_3(PO_4)_2\downarrow$
C. $P_2O_5 + 6OH^- \rightarrow 2PO_4^{-3} + 3H_2O\downarrow$
D. $3Ag^+ + PO_4^{-3} \rightarrow Ag_3(PO_4)_2\downarrow$
E. $H_3PO_4 + 2OH^- \rightarrow Ca_3(PO_4)_2\downarrow$
F. $Ca_3(PO_4)_2 + 4H^+ \rightarrow 3Ca^{+2} + 2H_2PO_4^-$

29. Write the chemical formulas for the following mineral fertilizers: mono ammonium phosphate, diammonium phosphate, double superphosphate, ammonium nitrate, potassium nitrate, potassium chloride, ammonium sulfate. What nutrients do they contain? Give a classification method of mineral fertilizers.

30. Find the mass phosphorus which is found in human bones with 20 kg mass, if it is known that the mass percentage of calcium phosphate is 58 % in bones.

30. 620 g of calcium phosphate were treated through boiling 60% sulfuric acid. Find:
a) the mass of product;
b) the mass of 60% sulfuric acid solution necessary for reaction.