Stoichiometric test

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Password

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School

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Class

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Date

Average grade ___, ____.

Instructions for students:

Carefully read task requirements and write your response in the space provided following each task. After you complete the task, please rate its difficulty by circling one of the seven offered options (extremely easy, very easy, easy, neither easy nor difficult, difficult, very difficult or extremely difficult).

Throughout the test the following data may be required for solving tasks:

Relative atomic masses: A_r(H)=1; A_r(C)=12; A_r(N)=14; A_r(O)=16; A_r(Na)=23; A_r(Al)=27; A_r(P)=31; A_r(S)=32; A_r(Cl)=35.5; A_r(K)=39; A_r(Ca)=40; A_r(Cr)=52; A_r(Fe)=55.8; A_r(Mn)=55; A_r(Cu)=63.5; A_r(Zn)=65.4; A_r(I)=126.9; A_r(Ba)=137.3; A_r(Ag)=107.9; A_r(Hg)=200,6; A_r(Pb)=207.2

1. Calculate the mass of the aluminum oxide that is produced in reaction of iron(III) oxide and elemental aluminum if 2.7 g of aluminum reacted completely with iron(III) oxide according to the following chemical equation:

$$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2\ Fe$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

2. How many moles of hydrogen could be produced in the reaction of 1.31 g of zinc with hydrochloric acid according to the following chemical equation?

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

3. Determine the amount of nitrogen(II) oxide, that is produced in the reaction of 6.35 g of copper with the required amount of dilute nitric acid?

$$Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO + H_2O$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

4. Calculate the amount of gaseous hydrogen chloride that is dissolved in water, if this solution can dissolve 25 g of calcium carbonate.

$$CaCO_3 + HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

5. How many oxygen molecules are formed in the reaction of potassium permanganate with 11.33 g of 30 % hydrogen peroxide solution in the presence of sulfuric acid?

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

6. How many iodine atoms are built in iodine molecules, produced in the reaction of 100 g of 8.3 % potassium iodide solution with the corresponding amount of potassium dichromate in the presence of nitric acid?

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

7. What is the volume of hydrogen required to reacts with 2.8 dm^3 of oxygen to produce liquid water (STP)? Density of water is 1 g/cm^3.

$$2H_2 + O_2 \rightarrow 2H_2O$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

8. How many molecules of water is produced in the reaction of 3.4 g of hydrogen sulfide with corresponding amount of oxygen according to the following equation:

$$2H_2S + 3O_2 \rightarrow 2H_2O + 2SO_2$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

9. Calculate the volume of carbon monoxide (STP), which is produced from the oxidation of 3.6 g of carbon by the following chemical equation:

$$2C + O_2 \rightarrow 2CO?$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

10. Determine the number of molecules of phosphorus(V) oxide which are produced in the reaction of 16 g of oxygen, according to the following chemical equation.

$$P_4 + 5O_2 \rightarrow P_4O_{10}?$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

11. Calculate the volume of barium chloride solution, concentration of which is 0.1 mol/dm^3, necessary to yield 2.33 g of barium sulfate in reaction with sodium sulfate.

$$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + NaCl$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

12. A piece of zinc weighing 4.6792 g was put in dilute sulfuric acid solution. After some time this piece was removed, dried and measured. It has been found that its current mass is twice less than its initial mass. Calculate the volume of gas (STP) produced during this reaction.

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

13. How many cm^3 of 40 % phosphoric acid, density of which is 1.25 g/cm^3, needs to be added for complete neutralization of 50 cm^3 of sodium hydroxide solution, mass concentration of which is 4 g/dm^3?

$$H_3PO_4 + NaOH \rightarrow Na_3PO_4 + H_2O$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

14. Calculate the number of oxygen molecules that are produced by analysis of $6.023 \cdot 10^{23}$ "molecules" of mercury(II) oxide according to the following equation:

$$2HgO \rightarrow 2Hg + O_2$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

15. What is the mass of sodium oxide, needed to react with water, to yield 4 moles of sodium hydroxide?

$$Na_2O + H_2O \rightarrow 2NaOH$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

16. Calculate the mass of potassium chlorate, necessary for obtaining 3.2 g of oxygen by thermal decomposition to potassium chloride.

$$KClO_3 \rightarrow KCl + O_2$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

17. At higher temperatures, boron burn to form boron(III) oxide. How many moles of oxygen is necessary for combustion of 0.1 mol of boron?

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

18. Silver coin weighing 9.70 g was dissolved in nitric acid. The reaction of dissolution is represented by the following chemical equation:

$$3Ag + 4HNO_3 \rightarrow 3AgNO_3 + NO + 2H_2O$$

The whole silver from the solution is then precipitated as silver chromate by adding the saturated solution of potassium dichromate:

$$AgNO_3 + K_2Cr_2O_7 + H_2O \rightarrow Ag_2CrO_4 + KNO_3 + HNO_3$$

The mass of precipitate after drying was 13.88 g. Calculate the mass percentage of silver in the coin.

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

19. 23.4 g sample of trivalent metal carbonate was annealed and 6.72 dm^3 of carbon dioxide (STP) was produced. Calculate the relative atomic mass of metal.

$$M_2(CO_3)_3 \rightarrow M_2O_3 + CO_2$$

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult

20. A sample of aluminum and copper alloy has a density of 1.13 g/cm^3. Inserting the sample into the beaker with distilled water, the level of water increases by 9.70 cm^3. Dissolving the sample in hydrochloric acid releases 6.72 dm^3 of hydrogen measured under STP. Calculate the percentage of aluminum in the alloy. The reactivity series of metals table is given below.

K, Na, Ca, Mg, Al, Zn, Cr, Fe, Cd, Co, Ni, Sn, Pb, H, Cu, Hg, Ag, Pd, Pt, Au

extremely easy	very easy	easy	neither easy nor difficult	difficult	very difficult	extremely difficult