Domaći zadatak 8, Uvod u laboratorijski rad

1. Izračunati zapreminu 15 g ugljendioksida.

2. Izračunati broj molekula bromovodonika u 32 dm^3 ovog jedinjenja u gasovitom stanju.

3. Aminofenol sadrži četiri elementa: ugljenik, vodonik, azot i kiseonik. Analiza čvrstog uzorka aminofenola je pokazala da se elementi prisutni u sledećim masenim procentima: C = 66,1%; H = 6,4%; N = 12,8 % i O =14,7 %. Odrediti empirijsku formulu ove supstance.

4. Izvesti najjednostavniju formulu kristalohidrata kalcijum-hlorida, ako se zna da 10,95 g kristalohidrata pri dehidrataciji gubi 5,4 g vode.

5. Koliko grama hlorovodonične kiseline je potrebno za neutralizaciju 10 g natrijum-hidroksida.
$$HCl + NaOH \rightarrow NaCl + H_2O$$
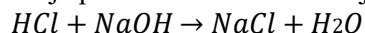
6. Pri rastvaranju magnezijuma u sumpornoj kiselini dobijeno je 18 g magnezijum-sulfata. Kolika je masa magnezijuma i masa sumporne kiseline potrebna da bi se dobila ova masa proizvoda?
$$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$$
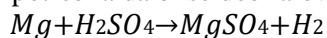
7. Koliko mL kiseonika i azot(II)-oksida se dobija termičkim razlaganjem 100 mL azot(IV)-oksida?
$$2NO_2 \rightarrow 2NO + O_2$$
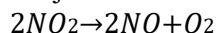
8. Pomešano je 14 molova vode i 15 molova kiseonika, u sudu pod povišenim pritiskom, pri čemu nastaje vodonik-peroksid. Koji od dva reaktanta je u višku i koliko grama proizvoda nastaje?
$$2H_2O + O_2 \rightarrow 2H_2O_2$$
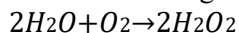
1. $m(CO_2) = 15 g$

$M(CO_2) = A(C) + 2 \cdot A(O) = 12g + 2 \cdot 16g = 44g$

$22,4 dm^3 : 44g = V(CO_2) : 15g$

$V(CO_2) = \dfrac{22,4 \cdot dm^3 \cdot 15g}{44g} = 7,64 dm^3$

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2. $V(HBr) = 32 dm^3$

$V = V_m \cdot n = V_m \cdot \dfrac{m(HBr)}{M(HBr)} \Rightarrow m(HBr) = \dfrac{V \cdot M(HBr)}{V_m}$

$N_a : M(HBr) = N(HBr) : m(HBr)$

$N_a : M(HBr) = N(HBr) : \dfrac{V \cdot M(HBr)}{V_m}$

$N_a \cdot \dfrac{V \cdot M(HBr)}{V_m} = M(HBr) \cdot N(HBr)$

$N(HBr) = \dfrac{N_a}{V_m} \cdot V \cancel{M(HBr)} \cdot \dfrac{1}{\cancel{M(HBr)}}$

$N(HBr) = \dfrac{6,02 \cdot 10^{23}}{22,4 dm^3} \cdot 32 dm^3 = 8,6 \cdot 10^{23}$

3.

66,1 % C $A(C) = 12\ g/mol$

6,4 % H $A(H) = 1\ g/mol$

12,3 % N $A(N) = 14\ g/mol$

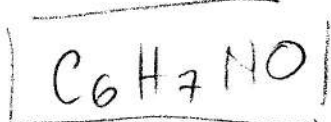14,7 % O $A(O) = 16\ g/mol$

$$\frac{\omega(C)}{A(C)} : \frac{\omega(H)}{A(H)} : \frac{\omega(N)}{A(N)} : \frac{\omega(O)}{A(O)}$$

$$\frac{66,1\ g}{12\ g/mol} : \frac{6,4\ g}{1\ g/mol} : \frac{12,3\ g}{14\ g/mol} : \frac{14,7\ g}{16\ g/mol}$$

$5,51\ mol : 6,4\ mol : 0,91\ mol : 0,92\ mol \quad /: 0,91\ mol$

6   :   7   :   1   :   1

$\boxed{C_6H_7NO}$

4. $m(CaCl_2 \cdot xH_2O) = 10,95 g$

$m(xH_2O) = 5,4 g$

$m(CaCl_2) = m(CaCl_2 \cdot xH_2O) - m(xH_2O) = 10,95g - 5,4g = 5,55g$

$M(CaCl_2) = A(Ca) + 2 A(Cl) = 40 g/mol + 2 \cdot 35,5 g/mol = 111 g/mol$

$$\frac{m(CaCl_2)}{M(CaCl_2)} : \frac{m(H_2O)}{M(H_2O)} = \frac{5,55 g}{111 g/mol} : \frac{5,4 g}{18 g/mol} =$$

$= 0,05 mol : 0,3 mol = 1 mol : 6 mol$

ФОРМУЛА $CaCl_2 \cdot 6H_2O$

5. $HCl + NaOH \longrightarrow NaCl + H_2O$
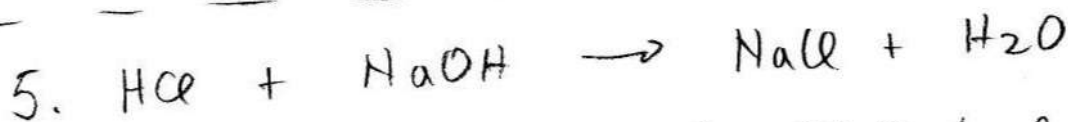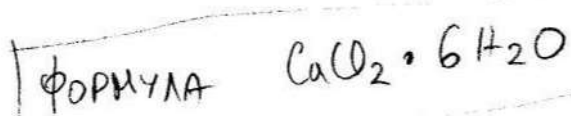
$m(HCl) = ?$

$m(NaOH) = 10 g$

$M(HCl) = 36,5 g/mol$

$M(NaOH) = 23 g/t + 16 g/t + 1 g/mol = 40 g/mol$

$M(NaOH) : m(NaOH) = M(HCl) : m(HCl)$

$m(HCl) = \dfrac{m(NaOH) \cdot M(HCl)}{M(NaOH)} = \dfrac{10 g \cdot 36,5 g/mol}{40 g/mol} = \boxed{9,125 g}$

6. $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$
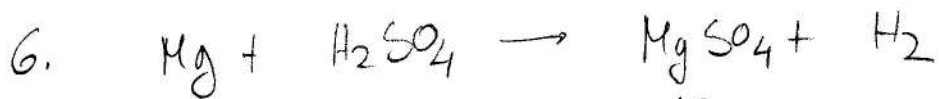
$m(Mg)=?$

$m(H_2SO_4)=?$

$M(MgSO_4) \overset{18g}{=} 24g/mol + 32g/mol + 4 \cdot 16g/mol = 120g/mol$

$M(H_2SO_4) = 2 \cdot 1g/mol + 32g/mol + 4 \cdot 16g/mol$

$M(H_2SO_4) = 98g/mol$

$M(MgSO_4) : m(MgSO_4) = A(Mg) : m(Mg)$

$m(Mg) = \dfrac{m(MgSO_4) \cdot A(Mg)}{M(MgSO_4)} = \dfrac{18g \cdot 24g/mol}{120g/mol} = \boxed{3,6g}$

$m(H_2SO_4) = \dfrac{m(MgSO_4) \cdot M(H_2SO_4)}{M(MgSO_4)} = \dfrac{18g \cdot 98g/mol}{120g/mol} = \boxed{14,7g}$

$\underline{m(Mg) + m(H_2SO_4) = 18,3g}$

7.

$2NO_2 \rightarrow 2NO + O_2$

$V(O_2)=? ml$

$V(NO)=? ml$

$V(NO_2) = 100 ml$

$n(NO_2) = \dfrac{V(NO_2)}{V_m} = \dfrac{100ml}{22,4 ml/ml} = 4,46 ml$

$n(NO) = n(NO_2) = 2 \cdot n(O_2) \Rightarrow V(NO) = V(NO_2) = 2V(O_2)$

$V(NO) = 100 ml$

$V(O_2) = 50 ml$

8.

$2H_2O + O_2 \rightarrow 2H_2O_2$
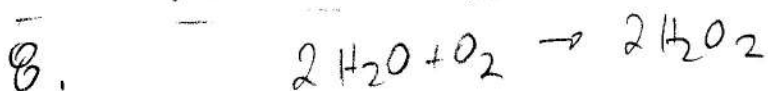
$n(H_2O) = 14 mol$ У лишку є O_2

$n(O_2) = 15 mol$

$n(H_2O) = n(H_2O_2)$

$m(H_2O_2) = n(H_2O_2) \cdot M(H_2O_2) = 14 mol \cdot 34g/mol = \boxed{476g}$