

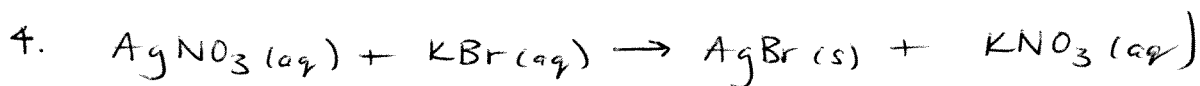
Percent Yield

Q# 2, 4, 5, 7, 10 pg. 321

2. theoretical yield - amount of product predicted on paper (in theory)

actual yield - amount produced in the lab

analogy - actual yield = mark received on a test
theoretical yield = test total



m 14.00g

M. 169.872g/mol

actual 14.64g

187.772g/mol

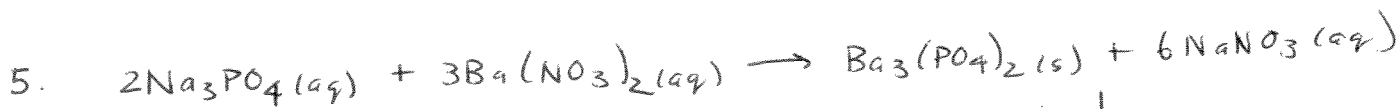
$$n_{\text{AgNO}_3} = \frac{14.00\text{g}}{169.872\text{g/mol}} = 0.082415\text{mol}$$

$$n_{\text{AgBr}} = 0.082415\text{mol AgNO}_3 \times \frac{1\text{mol AgBr}}{1\text{mol AgNO}_3} = 0.082415\text{mol}$$

$$m_{\text{AgBr}} = 0.082415\text{mol} \times 187.772 \frac{\text{g}}{\text{mol}} = 15.48\text{g}$$

$$\% \text{ yield} = \frac{14.64\text{g}}{15.48\text{g}} \times 100 = 94.57\%$$

∴ the % yield is 94.57%



m 5.00g

10.90g

7.69g actual

M. 163.940g/mol

261.335g/mol

601.921g/mol

n $\frac{0.03050\text{mol}}{2}$

0.041709mol
3

0.01525

0.01390 smaller ∴
↑, ↓

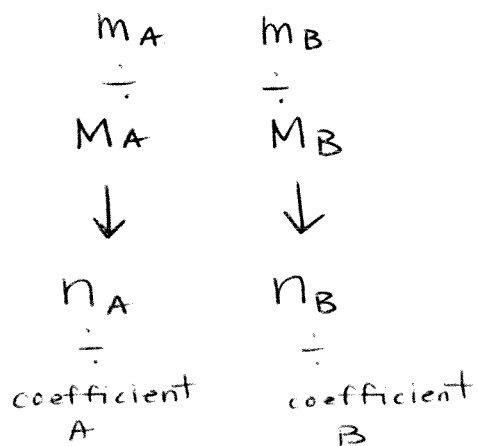
$$n_{\text{Ba}_3(\text{PO}_4)_2} = 0.041709 \text{ mol Ba}(\text{NO}_3)_2 \times \frac{1 \text{ mol Ba}_3(\text{PO}_4)_2}{3 \text{ mol Ba}(\text{NO}_3)_2}$$

$$= 0.013903 \text{ mol}$$

$$m_{\text{Ba}_3(\text{PO}_4)_2} = 0.013903 \text{ mol} \times 601.921 \frac{\text{g}}{\text{mol}} = 8.369 \text{ g}$$

$$\% \text{ yield} = \frac{7.69 \text{ g}}{8.369 \text{ g}} \times 100 = 91.9 \%$$

∴ the % yield is 91.9 %.



smaller # is
LR

$$n_C = \text{smaller } \# \text{ moles} \times \frac{\text{mol ratio C}}{\text{mol ratio smaller } \#}$$

$$m_C = n_C \times M_C$$

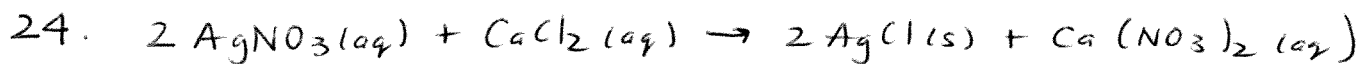
$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

10. a) use glass stir rod as wood can absorb the chemicals

b) don't transfer or rinse with a bit of solvent & add to reaction beaker

c) use low heat (hot plate or oven) or dry over time in a dessicator

d) rinse graduated cylinder and add to reaction beaker



$$126.23\text{g} - 124.75\text{g} \\ = 1.48\text{g}$$

$$\text{actual} \\ 2.36\text{g} - 1.27\text{g} \\ = 1.09\text{g}$$

$$M \quad 169.872 \text{ g/mol}$$

$$143.321 \text{ g/mol}$$

$$n_{\text{AgNO}_3} = \frac{1.48\text{g}}{169.872 \text{ g/mol}} = 0.008712 \text{ mol}$$

$$n_{\text{AgCl}} = 0.008712 \text{ mol AgNO}_3 \times \frac{2 \text{ mol AgCl}}{2 \text{ mol AgNO}_3} = 0.008712 \text{ mol}$$

$$m_{\text{AgCl}} = 0.008712 \text{ mol} \times 143.321 \frac{\text{g}}{\text{mol}} = 1.25 \text{ g theoretical}$$

$$\% \text{ yield} = \frac{1.09\text{g}}{1.25\text{g}} \times 100 = 87.2\%$$

\therefore the % yield is 87.2%.

Q# 1, 2, 4-16, 18-21, 23, 26

1. e) 163.94 g/mol 2. $N_{\text{formu}} = 3.500 \text{ mol} \times 6.022 \times 10^{23} \frac{\text{form. units}}{\text{mol}}$
 $= 2.108 \times 10^{24} \text{ form units.}$

e) $\frac{\text{g}}{\text{mol}}$ $1 \text{ mol} = 6.022 \times 10^{23} \text{ atoms}$

4. a) CO_2 5. $M_{\text{atom}} = \frac{24 \text{ g}}{6.022 \times 10^{23}} = 4.0 \times 10^{-23} \text{ g}$ b)

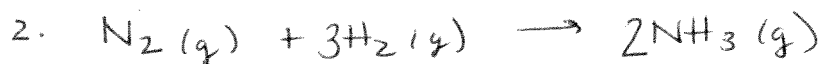
6. e) 7. b) 8. $n_{\text{CH}_4} = \frac{4 \text{ g}}{16.043 \text{ g/mol}} = 0.249 \text{ mol}$ b) $n_{\text{H}_2} = \frac{8 \text{ g}}{2.016 \text{ g/mol}} = 3.97 \text{ mol}$ $n_{\text{N}_2} = \frac{28 \text{ g}}{28.014 \text{ g/mol}} = 1.00 \text{ mol}$

$n_{\text{Cl}_2} = \frac{35 \text{ g}}{70.906 \text{ g/mol}} = 0.494 \text{ mol}$ $n_{\text{O}_2} = \frac{64 \text{ g}}{31.998 \text{ g/mol}} = 2.00 \text{ mol}$

9. molecular molar mass - molecules (covalent) compounds.
 formula unit molar mass - ionic compounds

10. % composition

11. empirical formula - shows the smallest whole # ratio of the elements in a compound



m 10.0 g ?

M 28.014 g/mol 2.016 g/mol

$n_{\text{H}_2} = 1.071 \text{ mol} \times 2.016 \frac{\text{g}}{\text{mol}}$
 $= 2.16 \text{ g}$

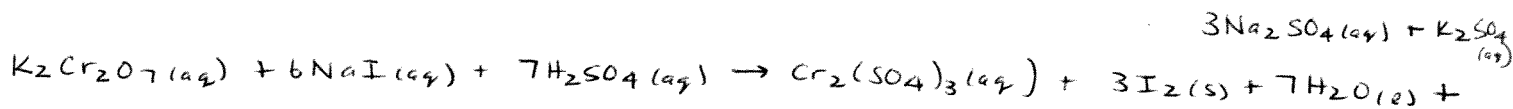
$n_{\text{N}_2} = \frac{10.0 \text{ g}}{28.014 \text{ g/mol}}$
 $= 0.3570 \text{ mol}$

$n_{\text{H}_2} = 0.3570 \text{ mol } \cancel{\text{N}_2} \times \frac{3 \text{ mol } \text{H}_2}{1 \text{ mol } \cancel{\text{N}_2}}$
 $= 1.071 \text{ mol}$

$$16: 86.5 = \frac{38.5g}{x} \times 100$$

$$0.865 = \frac{38.5g}{x}$$

$$x = 44.5g$$



m ?

44.5g

$$M \quad 294.181 \frac{g}{mol}$$

$$253.808 g/mol$$

$$n_{I_2} = \frac{44.5g}{253.808 g/mol} = 0.1753 \text{ mol} \quad n_{K_2Cr_2O_7} = 0.1753 \text{ mol } I_2 \times \frac{1 \text{ mol } K_2Cr_2O_7}{3 \text{ mol } I_2} = 0.05844 \text{ mol}$$

$$m_{K_2Cr_2O_7} = 0.05844 \text{ mol} \times 294.181 \frac{g}{mol} = 17.2g$$

∴ 17.2g of potassium dichromate would be needed.

$$18. \quad \% K = \frac{2.7g}{10.0g} \times 100 = 27\%$$

$$\% Cr = \frac{3.5g}{10.0g} \times 100 = 35\%$$

$$\% O = \frac{3.8g}{10.0g} \times 100 = 38\%$$

∴ % composition is 27% K, 35% Cr and 38% O.

$$19. \quad \% Na = \frac{2(22.990)}{2(22.990) + 32.065 + 4(15.999)} \times 100 = \frac{45.98}{142.041} \times 100 = 32.37\%$$

$$\% S = \frac{32.065}{142.041} \times 100 = 22.57\%$$

$$\% O = \frac{4(15.999)}{142.041} \times 100 = 45.05\%$$

∴ % Na is 32.37% and % S is 22.57% and % O is 45.05%.

20. Assume 100g sample

$$m_{\text{Pb}} = 51.89 \text{ g}$$

$$m_{\text{S}} = 16.06 \text{ g}$$

$$m_{\text{O}} = 32.05 \text{ g}$$

$$n_{\text{Pb}} = \frac{51.89 \text{ g}}{207.2 \text{ g/mol}} \\ = 0.2504 \text{ mol}$$

$$n_{\text{S}} = \frac{16.06 \text{ g}}{32.06 \text{ g/mol}} \\ = 0.5009 \text{ mol}$$

$$n_{\text{O}} = \frac{32.05 \text{ g}}{15.999 \text{ g/mol}} \\ = 2.003 \text{ mol}$$

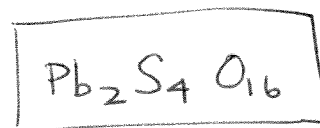
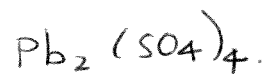
$$\begin{array}{ccc} \text{Pb} & : & \text{S} & : & \text{O} \\ \frac{0.2504}{0.2504} & : & \frac{0.5009}{0.2504} & : & \frac{2.003}{0.2504} \\ 1 & : & 2 & : & 8 \end{array}$$

∴ the empirical formula is $\text{Pb}_1 \text{S}_2 \text{O}_8$ PbS_2O_8

$$\begin{aligned} \text{empirical molar mass} &= 207.2 \frac{\text{g}}{\text{mol}} + 2(32.06 \frac{\text{g}}{\text{mol}}) + 8(15.999 \frac{\text{g}}{\text{mol}}) \\ &= 399.322 \frac{\text{g}}{\text{mol}} \end{aligned}$$

$$\text{molecular multiplier} = \frac{798.7 \frac{\text{g}}{\text{mol}}}{399.322 \frac{\text{g}}{\text{mol}}} = 2$$

∴ molecular formula $\text{PbS}_2\text{O}_8 \times 2$



lead IV sulfate

21. $m_{\text{S}} = 5.096 - 3.653 = 1.443 \text{ g}$

$$m_{\text{A}} = 3.653 \text{ g}$$

$$\% \text{A} = \frac{3.653 \text{ g}}{5.096 \text{ g}} \times 100$$

$$= 71.68 \%$$

$$\% \text{S} = \frac{1.443 \text{ g}}{5.096 \text{ g}} \times 100$$

$$= 28.32 \%$$

23. a) 18.0% C 2.5% H 63.5% I 16.0% O

b) 400 g/mol

a) Assume 100 g sample

$$m_C = 18.0 \text{ g}$$

$$m_H = \frac{2.5 \text{ g}}{1.008 \text{ g/mol}}$$

$$m_I = 63.5 \text{ g}$$

$$m_O = 16.0 \text{ g}$$

$$n_C = \frac{18.0 \text{ g}}{12.011 \text{ g/mol}}$$

$$= 1.499 \text{ mol}$$

$$= 2.480 \text{ mol}$$

$$n_I = \frac{63.5 \text{ g}}{126.904 \text{ g/mol}}$$

$$= 0.5004 \text{ mol}$$

$$n_O = \frac{16.0 \text{ g}}{15.999 \text{ g/mol}}$$

$$= 1.000 \text{ mol}$$

C : H : I : O

$$\frac{1.499}{0.5004}$$

$$\frac{2.480}{0.5004}$$

$$\frac{0.5004}{0.5004}$$

$$\frac{1.000}{0.5004}$$

3

:

5

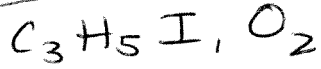
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1

:

2

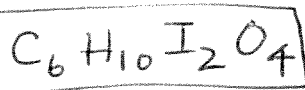
∴ empirical formula is



b) empirical mass = $3(12.011) + 5(1.008) + 126.904 + 2(15.999)$
 $= 199.975 \text{ g/mol}$

$$\text{molecular multiplier} = \frac{400 \text{ g/mol}}{199.975 \text{ g/mol}} = 2$$

∴ molecular formula is



- 26.
- sample dissolves in the solvent
 - sample passes through filter paper
 - sample impurity (starting material)
 - side reactions ?
 - sample (reactants left in beaker)

11

