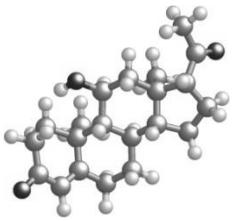

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Mole – Mass Calculations – Answers

Answer One:

a) $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

b) moles = mass in grams ÷ relative atomic mass

moles of Mg used = 18.0 ÷ 24.0 = 0.750 mol

from the balanced chemical equation, 2 mol of Mg produces 2 mol of MgO

∴ 0.750 mol of Mg will produce $^2/_2 \times 0.750 = 0.750$ mol of MgO

relative molecular mass of MgO = 24.0 + 16.0 = 40.0

mass in grams = moles × relative molecular mass

mass of MgO = 0.750 × 40.0 = 30.0 g (3 s.f.)

Answer Two:

a) $MgCO_3(s) \rightarrow MgO(s) + CO_2(g)$

b) relative molecular mass of MgO = 24.0 + 12.0 = 40.0

moles = mass in grams ÷ relative molecular mass

moles of MgO produced = 8.0 ÷ 40.0 = 0.200 mol

from the balanced chemical equation, 1 mol of MgO originates from 1 mol of $MgCO_3$

∴ 0.200 mol of MgO will originate from $^1/_1 \times 0.200 = 0.200$ mol of $MgCO_3$

relative molecular mass of $MgCO_3$ = 24.0 + 12.0 + (3 × 16.0) = 84.0

mass in grams = moles × relative molecular mass

mass of $MgCO_3$ = 0.200 × 84.0 = 16.8 g (3 s.f.)

Answer Three:

a) $Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(s) + H_2(g)$

b) moles = mass in grams ÷ relative atomic mass

moles of Ca used = 2.0 ÷ 40.0 = 0.0500 mol

from the balanced chemical equation, 1 mol of Ca produces 1 mol of $Ca(OH)_2$

∴ 0.0500 mol of Ca produces $^1/_1 \times 0.0500 = 0.0500$ mol of $Ca(OH)_2$

relative molecular mass of $Ca(OH)_2$ = 40.0 + (2 × 16.0) + (2 × 1.0) = 74.0

mass in grams = moles × relative molecular mass

mass of $Ca(OH)_2$ = 0.0500 × 74.0 = 3.70 g (3 s.f.)

Answer Four:

a) $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$

b) relative molecular mass of CuO = 63.5 + 16.0 = 79.5

moles = mass in grams ÷ relative molecular mass

moles of CuO used = 15.9 ÷ 79.5 = 0.200 mol

from the balanced chemical equation, 1 mol of CuO reacts with 1 mol of H_2SO_4

∴ 0.200 mol of CuO will react with $^1/_1 \times 0.200$ = 0.200 mol of H_2SO_4

0.300 mol of H_2SO_4 are available, ∴ H_2SO_4 is in excess and CuO is the limiting reagent

from the balanced chemical equation, 1 mol of CuO produces 1 mol of $CuSO_4$

∴ 0.200 mol of CuO will produce $^1/_1 \times 0.200$ = 0.200 mol of $CuSO_4$

relative molecular mass of $CuSO_4$ = 63.5 + 32.0 + (4 × 16.0) = 159.5

mass in grams = moles × relative molecular mass

mass of $CuSO_4$ = 0.200 × 159.5 = <u>31.9 g</u> (3 s.f.)

Answer Five:

a) $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$

b) moles = mass in grams ÷ relative atomic mass

moles of Al = 9.0 ÷ 27.0 = 0.333 mol

from the balanced chemical equation, 4 mol of Al produce 2 mol of Al_2O_3

∴ 0.333 mol of Al will produce $^2/_4 \times 0.333$ = 0.166 mol of Al_2O_3

relative molecular mass of Al_2O_3 = (2 × 27.0) + (3 × 16.0) = 102.0

mass in grams = moles × relative molecular mass

mass of Al_2O_3 = 0.166 × 102.0 = <u>16.9 g</u> (3 s.f.)

Answer Six:

a) $2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$

b) relative molecular mass of $Pb(NO_3)_2$ = 207.0 + (2 × 14.0) + (6 × 16.0) = 331.0

moles = mass in grams ÷ relative molecular mass

moles of $Pb(NO_3)_2$ used = 110.3 ÷ 331.0 = 0.333 mol

from the balanced chemical equation, 2 mol of $Pb(NO_3)_2$ produce 2 mol of PbO

∴ 0.333 mol of $Pb(NO_3)_2$ produces $^2/_2 \times 0.333$ = 0.333 mol of PbO

relative molecular mass of PbO = 207.0 + 16.0 = 223.0

mass in grams = moles × relative molecular mass

mass of PbO = 0.333 × 223.0 = <u>74.3 g</u> (3 s.f.)

Answer Seven:

relative molecular mass of CO_2 = 12.0 + (2 × 16.0) = 44.0

moles = mass in grams ÷ relative molecular mass

moles of CO_2 produced = 11.0 ÷ 44.0 = 0.250 mol

from the balanced chemical equation, 1 mol of CO_2 originates from 1 mol of MCO_3

∴ 0.250 mol of CO_2 originates from $^1/_1$ × 0.250 = 0.250 mol of MCO_3

0.250 mol of MCO_3 weighs 49.25 g

relative molecular mass = mass in grams ÷ moles

the relative molecular mass of MCO_3 = 49.25 ÷ 0.25 = 197

relative atomic mass of M = 197 – the relative molecular mass of CO_3^{2-}

relative atomic mass of M = 197 – (12.0 + (3 × 16.0)) = 137 (3 s.f.)

the Group II metal is barium

Answer Eight:

a) $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$

b) relative molecular mass of Fe_2O_3 = (2 × 56.0) + (3 × 16.0) = 160

moles = mass in grams ÷ relative molecular mass

moles of Fe_2O_3 used = 8.0 ÷ 160.0 = 0.0500 mol

relative molecular mass of CO = 12.0 + 16.0 = 28.0

moles of CO used = 5.6 ÷ 28.0 = 0.200 mol

from the balanced chemical equation, 1 mol of Fe_2O_3 reacts with 3 mol of CO

∴ 0.0500 mol of Fe_2O_3 will react with 0.0500 × $^3/_1$ = 0.150 mol of CO

0.200 mol of CO are available, ∴ CO is in excess and Fe_2O_3 is the limiting reagent

from the balanced chemical equation, 1 mol of Fe_2O_3 produces 2 mol of Fe

∴ 0.0500 mol of Fe_2O_3 produces $^2/_1$ × 0.0500 = 0.100 mol of Fe

mass in grams = moles × relative atomic mass

mass of Fe produced = 0.100 × 56.0 = 5.60 g (3 s.f.)

Answer Nine:

a)	**Carbon**	**Hydrogen**
divide each element's percentage by the element's relative atomic mass:	80.0 ÷ 12.0 = 6.67	20.0 ÷ 1.0 = 20.0
divide by smallest answer to obtain the simplest ratio of elements:	6.67 ÷ 6.67 = 1	20 ÷ 6.67 = 3
∴ simple empirical formula =	CH_3	
calculate the relative molecular mass of the simple empirical formula, CH_3:	12.0 + (3 × 1.0) = 15.0	
divide the relative molecular mass of the actual compound by the relative molecular mass of the simple empirical formula:	30.0 ÷ 15.0 = 2	
∴ the true molecular formula is:	2 × CH_3 = C_2H_6	

b) $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$

c) relative molecular mass of $C_2H_6 = (2 \times 12.0) + (6 \times 1.0) = 30.0$

moles = mass in grams ÷ relative molecular mass

moles of C_2H_6 that are burned = 6.0 ÷ 30.0 = 0.200 mol

from the balanced chemical equation, 2 mol of C_2H_6 produces 4 mol of CO_2

∴ 0.200 mol of C_2H_6 produces $^4/_2 \times 0.200 = 0.400$ mol CO_2

relative molecular mass of $CO_2 = 12.0 + (2 \times 16.0) = 44.0$

mass in grams = moles × relative molecular mass

mass of $CO_2 = 0.400 \times 44.0 =$ <u>17.6 g</u> (3 s.f.)

Answer Ten:

moles = mass in grams ÷ relative atomic mass

moles of silver produced = 21.6 ÷ 108.0 = 0.200 mol

from the balanced chemical equation, 2 mol of Ag originates from 1 mol of M

∴ 0.200 mol of Ag originates from $^1/_2 \times 0.200 = 0.100$ mol of M

0.100 mol of M weighs 6.5 g

relative molecular mass = mass in grams ÷ moles

relative molecular mass of M = 6.5 ÷ 0.100 = <u>65.0</u> (3 s.f.)

M is probably <u>zinc</u>