4g 32g

1) $2H_2 + O_2 \rightarrow 2H_2O$ (combustion (3 moles)

(36g) 4 H 4 (36g)

2 O 2

100g H2 100g / 2g/mol

50 mol 2:2 50 mol H_2O × 18 × 18g/mol = (900g H_2O)

50g O_2 each 50g / 32g/mol = 1.56 mol × 2 = 3.12 mol H_2O = (56.16 g H_2O)

50g / 32g/mol = 1.56 mol

3.125 moles

21.875 mol xs = 43.75g xs

256g 384 8×80

2) $S_8 + 12O_2 \rightarrow 8SO_3$ (24 moles)

(640) 8 S 8 (640)

24 O 24

100g S_8 100g / 256g/mol = 0.39 mol 1:8 3.125 moles × 80 = (250g SO_3)

50g each 50g / 256 = 0.195 mol 50 / 32 = 1.56 mol O_2 → 1.56 mol O_2 × 8 mol SO_3 / 12 mol O_2 = 1.04 mol SO_3

0.13 mol

× 80 g/mol

(83.2)

0.065 mol xs × 256g = 16.64g xs

200.5 × 16 × 2 200.5 × 2 + 32

3) $2HgO \rightarrow 2Hg + O_2$ (3 moles)

(433) 2 Hg 2 (433)

2 O 2

100g HgO 100g / 216.5 g/mol = 0.46 mol 2:2 0.46 mol Hg = (92.6)

50g each 50g / 216.5 g/mole = 0.23 moles HgO × 2 moles Hg / 2 moles HgO × 200.5g / mole Hg = (46.3g)

3 moles

65.5 2x36.5 65.5 + 71 2

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

(138.5) 1 Zn 1 (138.5)

2 H 2

100g Zn: 100g/65.5 = 1.53 mol 2 Cl 2 1.53 mol x 136.5 g/mol = 209 gr

50g Zn: 50g/65.5 g/mol = 0.76 mol 50g/36.5 g/mole = 1.36 moles

0.68 moles

0.08 x 65.5 g/mole = 5.24 g xs

0.68 moles $ZnCl_2$ x 136.5 g/mole = 92.82 g

2x23 2x18 2x40

5) $2Na + 2H_2O \rightarrow 2NaOH + H_2$

(82) Na (82) 3 moles

O

100g Na: 100g/23 g/mole = 4.3 moles H 4.3 mole x 40 g/mol = 174 gr

50 gr Na: 50g/23 g/mol = 2.17 moles Na x 2 mole NaOH / 2 mol Na = 2.17 moles NaOH x 40 g/mole NaOH = 87 g

50g/18 g/mol = 2.8 mole H_2O - 2.17 moles used = 0.61 moles left x 18 g/mol = 10.98 g

120 16 568 2x4 120 16x36.5

6) $C_{10}H_{16} + 8Cl_2 \rightarrow 10C + 16HCl$

(704) 10 C 10 (704) 20 moles

16 H 16

16 Cl 16

100 gr Na: 100 gr/136 g/mol = 0.74 mol 1:10 = 7.4 moles x 12 g/mol = 88.8 g

50 g Na: 50g/136 g/mol = 0.37 mol moles - 0.088 used 50g/71 g/mol Cl_2 = 0.704 mole Cl2 x 10 mol C / 8 mol Cl_2 = 0.88 moles C x 12 g/mole C

0.282 moles xs = 38.4 g xs 10.56 g

136 64

56 + 3 352 28+32

7) $4Si_2H_3 + 11\ O_2 \rightarrow 8\ SiO_2 + 6\ H_2O$ — 6 moles

588 324 — 588

8 Si 8

12 H 12

22 O 22

100g 1st Rx: 100/68 = 1.47 moles — 1:2 — 2 x 1.47 = 2.94 moles x 60 g/mol = 176.5 g

50 g second: 50g/54 g/mol = 0.847 mol — 50g/32 g/mol = 1.56 mol O_2 x (8 mol SiO_2 / 11 mol O_2) = 1.13 moles x 60 g/mole = 66 g

0.568 mol needed

x 59 g/mol = 16.5 g xs

8) $4\ Fe + 3\ O_2 \rightarrow 2\ Fe_2O_3$ — 1.5 moles

56 160

320 — 320

4 Fe 4

6 O 6

100 g 1st Rx: 100g/56 g/mol = 1.79 — 4:2 — 0.89 mol x 160 g/mol = 142.9 g

50 g: 50g/55.8 g/mol — 50g/32 g/mol — 2/4 — 0.45 mol x 160 g/mol = 71.8 g

0.90 mol — 3/4 — 1.563 mol

0.675 mol used

0.888 mol xs x 32 g/mol = 28.4 g xs

9) $2C_7H_6O_2 + 15\ O_2 \rightarrow 14\ CO_2 + 6\ H_2O$ — 21 moles

84 6 32 — 244 — 480 — 616 44 — 108

724 — 724

14 C 14

12 H 12

34 O 34

100 g 1st Rx: 100g/122 = 0.82 mol — 5.74 mol x 44 g/mol = 252.5 g

50 g second: 50g/122 g/mol = 0.41 mol — 50g/32 g/mol = 1.56 mol O_2 x (14 mol CO_2 / 15 mol O_2) = 1.46 moles CO_2 x 44 g/mol CO_2 = 64.1 g

0.21 mol

1.5 moles

480 352 2×160 319.2 512 64

10) $4\,FeS_2 + 11\,O_2 \rightarrow 2\,Fe_2O_3 + 8\,SO_2$

832 832

4 Fe 4

8 S 8

100g pure FeS2 / 120 g/mol = 0.83 mol 22 O 22 0.42 mol × 160 g/mol = 67g

50g impure / 120 g/mol 0.42 mol (LR) 160

50g / 32 g/mol 1.5625 mol 1.155 mol = 0.41 mol xs × 32g/mol = 13.04g xs

3/4

0.21 mol Fe_2O_3 × 159 g/mol Fe_2O_3 = 33.4g

11) $Fe_2O_3 + 3\,H_2 \rightarrow 2\,Fe + 3\,H_2O$

160

2 Fe 2

3 O 3

6 H 6

6 moles

100gr / 160gr/mol = 0.625 moles 1:2 1.25 mol × 55.8 g/mole = 69.75g Fe

12) $2\,K + Br_2 \rightarrow 2\,KBr$

39.1

2 K 2

2 Br 2

100g / 39.1 g/mol = 2.56 mol $\xrightarrow{2:2}$ 2.56 mol × 119 g/mol = 304.64g

24 2

13) $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

4 C 4

100/26 g/mol = 4 H 4

3.846 moles 10 O 10 7.69 moles × 44 g/mol = 338.5

2:4

14) $2H_2O_2 \rightarrow 2H_2O + O_2$

4 H 4

4 O 4

100 g / 34 g/mol = 2.94 moles → 2.94 moles × 18 g/mol = 52.9 g

84 + 16

15) $C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$

7 C 7

100 g / 100 g/mol = 1 mole 11 H 11 → 7 moles × 44 g/mol = 308 gr

22 O 22

28 52

(6) $SiO_2 + 4HF \rightarrow SiF_4 + 2H_2O$

1 Si 1
2 O 2
4 H 4
4 F 4

$100\,g / 60\,g/mol$ = 1.67 mol

1.67 mol × 104 g/mol = 173.68 g

17) $2KClO_3 \rightarrow 2KCl + 3O_2$

2 K 2
2 Cl 2
6 O 6

$100\,g / 122.6\,g/mol$ = 0.816 moles × 74.6 g/mol = 60.9 g

18) $4KClO_3 \rightarrow 3KClO_4 + KCl$

4 K 4
4 Cl 4
12 O 12

~~2.25~~ mol 0.612 moles × 138.6 g/mol
= 84.8 g

$100\,g / 122.6\,g/mol$ = 0.816 mol

284

19) $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$

12 H 12
4 P 4
16 O 16

$100g / 284 g/mol = 0.352$ moles $\times 4 = 1.41$ mol $\times$ 98 g/mol
$= 138.2 g$

20) $4Sb + 3O_2 \rightarrow Sb_4O_6$

121.5

4 Sb 4
6 O 6

583 g/mol

$100 / 121.5$ g/mol $= 0.82 / 4 = 0.205$ mol $\times$ ~~217.8~~ g/mol
$=$ ~~44.6~~ g 119.5

56 + 8

21) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

3 C 3
8 H 8
10 O 10

$100g / 44 g/mol$

$= 2.27$ moles $\times 3 = 6.82$ moles $\times$ 44 g/mole $= 300$

22) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$