

(Limiting reactants)

Q1. (2020)

(M_r of Fe_2O_3 =) 160

(moles $\text{Fe}_2\text{O}_3 = \frac{3000}{160} =$)
18.75 (mol)

(moles Al = $\frac{1000}{27} =$) 37.0 (mol)

(aluminium is limiting because)
37.0 mol is less than the (2 x
18.75 =) 37.5 mol (aluminium
needed)

or

iron oxide is in excess because
18.75 mol is more than the
($\frac{37.0}{2} =$) 18.5 mol (iron oxide
needed)

approach 1:

**(finding required mass of
aluminium by moles method)**

(M_r of Fe_2O_3 =) 160 (1)

(moles $\text{Fe}_2\text{O}_3 = \frac{3000}{160} =$)
18.75 (mol) (1)

(moles Al needed
= $18.75 \times 2 =$) 37.5 (mol)

and

(mass Al needed = $37.5 \times 27 =$)
1012.5 (g) **or** 1.0125 kg (1)

(so) 1.00 kg of aluminium is not
enough (1)

approach 2:
(finding required mass of
aluminium by proportion
method)

(M_r of Fe_2O_3 =) 160 (1)

(3.00 kg Fe_2O_3 needs)

$$\frac{3.00}{160} \times 2 \times 27 \text{ (kg Al) (1)}$$

(=) 1.0125 (kg) (1)

(so) 1.00 kg of aluminium is not
enough (1)

approach 3:
(finding required mass of iron
oxide by moles method)

M_r of Fe_2O_3 =) 160 (1)

(moles Al = $\frac{1000}{27}$ =) 37.0 (mol)
(1)

(moles Fe_2O_3 needed) = $\frac{37.0}{2}$ =
18.5 (mol)

and

(mass Fe_2O_3 needed =
 18.5×160 =) 2960 (g) **or**
2.96 (kg) (1)

(so) 3.00 kg of iron oxide is an
excess (1)

approach 4:
(finding required mass of iron
oxide by proportion method)

(M_r of Fe_2O_3 =) 160 (1)

(1.00 kg Al needs) $\frac{1.00}{2 \times 27} \times 160$
(kg Fe_2O_3) (1)

(=) 2.96 (kg) (1)

(so) 3.00 kg of iron oxide is an
excess (1)