

## <필답, 작업형 반응식 미정계수법>

### 제1종 분말 분해식(NaHCO<sub>3</sub>)

1) 270℃ 분해식 미정계수법



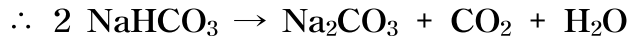
$$\textcircled{1}\text{Na: } a = 2b \rightarrow b = a/2$$

$$\textcircled{2}\text{H: } a = 2d \rightarrow d = a/2$$

$$\textcircled{3}\text{C: } a = b + c$$

$$\textcircled{4}\text{O: } 3a = 3b + 2c + d \rightarrow 3a = (3a/2) + 2c + (a/2) \rightarrow a = 2c \rightarrow c = a/2$$

$a \text{ NaHCO}_3 \rightarrow (a/2) \text{ Na}_2\text{CO}_3 + (a/2) \text{ CO}_2 + (a/2) \text{ H}_2\text{O}$  이므로  $a$ 에 2를 대입해서 최소의 정수비로 맞추어 주면,



2) 850℃ 분해식 미정계수법



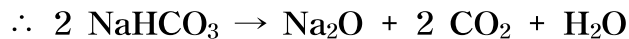
$$\textcircled{1}\text{Na: } a = 2b \rightarrow b = a/2$$

$$\textcircled{2}\text{H: } a = 2d \rightarrow d = a/2$$

$$\textcircled{3}\text{C: } a = c$$

$$\textcircled{4}\text{O: } 3a = b + 2c + d$$

$a \text{ NaHCO}_3 \rightarrow (a/2) \text{ Na}_2\text{O} + a \text{ CO}_2 + (a/2) \text{ H}_2\text{O}$  이므로  $a$ 에 2를 대입해서 최소의 정수비로 맞추어 주면,



### 제 2종 분말 분해식(KHCO<sub>3</sub>)



$$\textcircled{1}\text{K: } a = 2b \rightarrow b = a/2$$

$$\textcircled{2}\text{H: } a = 2d \rightarrow d = a/2$$

$$\textcircled{3}\text{C: } a = b + c$$

$$\textcircled{4}\text{O: } 3a = 3b + 2c + d \rightarrow 3a = (3a/2) + 2c + (a/2) \rightarrow a = 2c \rightarrow c = a/2$$

$a \text{ KHCO}_3 \rightarrow (a/2) \text{ K}_2\text{CO}_3 + (a/2) \text{ CO}_2 + (a/2) \text{ H}_2\text{O}$  이므로  $a$ 에 2를 대입해서 최소의 정수비로 맞추어 주면,



제 3종 분말 분해식(NH<sub>4</sub>H<sub>2</sub>PO<sub>4</sub>)

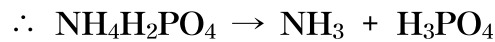
1) 1차 분해식



①N:  $a = b$

②H:  $6a = 3b + 3c$

③PO<sub>4</sub>:  $a = c$



2) 2차 분해식



①N:  $a = b$

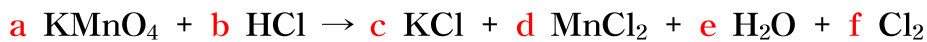
②H:  $6a = 3b + c + 2d$

③P:  $a = c$

④O:  $4a = 3c + d \rightarrow a = d$



1. 과망간산칼륨 + 염산 미정계수법



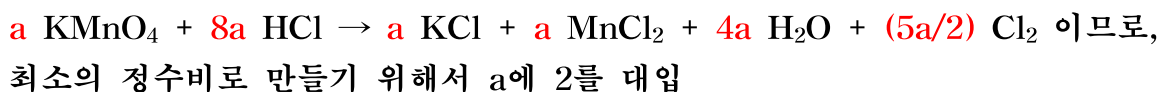
①K:  $a = c$

②Mn:  $a = d$

③O:  $4a = e$

④H:  $b = 2e \rightarrow b = 8a$

⑤Cl:  $b = c + 2d + f \rightarrow 8a = a + 2a + 2f \rightarrow f = 5a/2$



## 2. 과망간산칼륨 + 황산 미정계수법



$$\textcircled{1}\text{K: } a = 2c \rightarrow c = a/2$$

$$\textcircled{2}\text{Mn: } a = d$$

$$\textcircled{3}\text{H: } 2b = 2e \rightarrow b = e = 3a/2$$

$$\textcircled{4}\text{SO}_4\text{: } b = c + d \rightarrow b = (a/2) + a \rightarrow b = 3a/2$$

$$\textcircled{5}\text{O: } 4a = e + 2f \rightarrow 4a = (3a/2) + 2f \rightarrow f = 5a/4$$



이므로, 최소의 정수비로 만들기 위해서 a에 4를 대입



## 3. 과망간산칼륨 열 분해식



$$\textcircled{1}\text{K: } a = 2b \rightarrow b = a/2$$

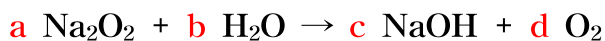
$$\textcircled{2}\text{Mn: } a = b + c \rightarrow a = (a/2) + c \rightarrow c = a/2$$

$$\textcircled{3}\text{O: } 4a = 4b + 2c + 2d \rightarrow 4a = 2a + a + 2d \rightarrow d = a/2$$

$a \text{KMnO}_4 \rightarrow (a/2) \text{K}_2\text{MnO}_4 + (a/2) \text{MnO}_2 + (a/2) \text{O}_2$  이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입



## 4. 과산화나트륨 + 물 미정계수법



$$\textcircled{1}\text{Na: } 2a = c$$

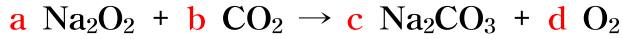
$$\textcircled{2}\text{O: } 2a + b = c + 2d \rightarrow 2a + a = 2a + 2d \rightarrow d = a/2$$

$$\textcircled{3}\text{H: } 2b = c \rightarrow 2a = 2b \text{ 이므로 } a = b$$

$a \text{Na}_2\text{O}_2 + a \text{H}_2\text{O} \rightarrow 2a \text{NaOH} + (a/2) \text{O}_2$  이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입



5. 과산화나트륨 + 이산화탄소 미정계수법

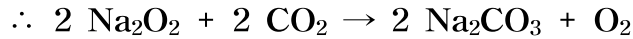


$$\textcircled{1}\text{Na: } 2a = 2c \rightarrow a = c$$

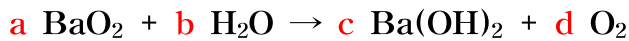
$$\textcircled{2}\text{O: } 2a + 2b = 3c + 2d \rightarrow 2a + 2a = 3a + 2d \rightarrow d = (a/2)$$

$$\textcircled{3}\text{C: } b = c \rightarrow b = a$$

$a \text{ Na}_2\text{O}_2 + a \text{ CO}_2 \rightarrow a \text{ Na}_2\text{CO}_3 + (a/2) \text{ O}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



6. 과산화바륨 + 물 미정계수법

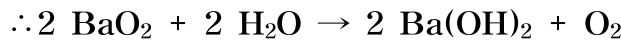


$$\textcircled{1}\text{Ba: } a = c$$

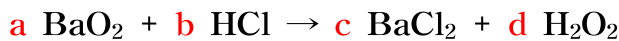
$$\textcircled{2}\text{O: } 2a + b = 2c + 2d \rightarrow 2a + a = 2a + 2d \rightarrow d = a/2$$

$$\textcircled{3}\text{H: } 2b = 2c \rightarrow b = c = a$$

$a \text{ BaO}_2 + a \text{ H}_2\text{O} \rightarrow a \text{ Ba(OH)}_2 + (a/2) \text{ O}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



7. 과산화바륨 + 염산 미정계수법



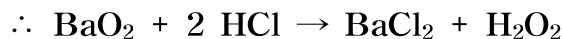
$$\textcircled{1}\text{Ba: } a = c$$

$$\textcircled{2}\text{O: } 2a = 2d \rightarrow a = d$$

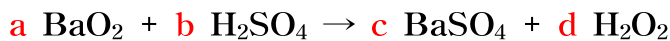
$$\textcircled{3}\text{H: } b = 2d \rightarrow b = 2a$$

$$\textcircled{4}\text{Cl: } b = 2c$$

$a \text{ BaO}_2 + 2a \text{ HCl} \rightarrow a \text{ BaCl}_2 + a \text{ H}_2\text{O}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



8. 과산화바륨 + 황산 미정계수법



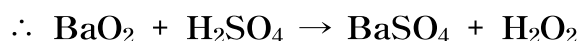
$$\textcircled{1}\text{Ba: } a = c$$

$$\textcircled{2}\text{O: } 2a = 2d \rightarrow a = d$$

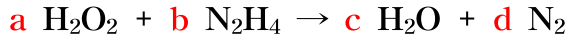
$$\textcircled{3}\text{H: } 2b = 2d \rightarrow b = a$$

$$\textcircled{4}\text{SO}_4: b = c$$

$a \text{ BaO}_2 + a \text{ H}_2\text{SO}_4 \rightarrow a \text{ BaSO}_4 + a \text{ H}_2\text{O}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



9. 과산화수소 + 히드라진 미정계수법



$$\textcircled{1}\text{H: } 2a + 4b = 2c \rightarrow 2a + 4b = 4a \rightarrow b = a/2$$

$$\textcircled{2}\text{O: } 2a = c$$

$$\textcircled{3}\text{N: } 2b = 2d \rightarrow d = a/2$$

$a \text{H}_2\text{O}_2 + (a/2) \text{N}_2\text{H}_4 \rightarrow 2a \text{H}_2\text{O} + (a/2) \text{N}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



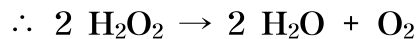
10. 과산화수소 분해식 미정계수법



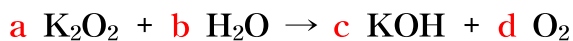
$$\textcircled{1}\text{H: } 2a = 2b \rightarrow a = b$$

$$\textcircled{2}\text{O: } 2a = b + 2c \rightarrow c = a/2$$

$a \text{H}_2\text{O}_2 \rightarrow a \text{H}_2\text{O} + (a/2) \text{O}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



11. 과산화칼륨 + 물 미정계수법



$$\textcircled{1}\text{K: } 2a = c$$

$$\textcircled{2}\text{O: } 2a + b = c + 2d \rightarrow 2a + a = 2a + 2d \rightarrow d = a/2$$

$$\textcircled{3}\text{H: } 2b = c \rightarrow 2a = 2b \text{ 이므로 } a = b$$

$a \text{K}_2\text{O}_2 + a \text{H}_2\text{O} \rightarrow 2a \text{KOH} + (a/2) \text{O}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



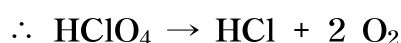
12. 과염소산 분해식 미정계수법



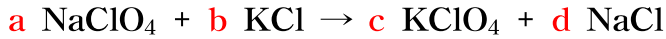
$$\textcircled{1}\text{HCl: } a = b$$

$$\textcircled{2}\text{O: } 4a = 2c \rightarrow 2a = c$$

$a \text{HClO}_4 \rightarrow a \text{HCl} + 2a \text{O}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



13. 과염소산나트륨 + 염화칼륨 미정계수법



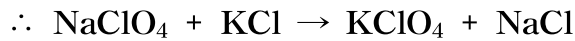
①Na:  $a = d$

②ClO<sub>4</sub>:  $a = c$

③K:  $b = c$

④Cl:  $b = d$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



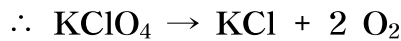
14. 과염소산칼륨 610°C 열 분해식 미정계수법



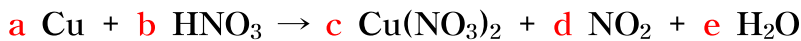
①KCl:  $a = b$

②O:  $4a = 2c \rightarrow 2a = c$

$a \text{ KClO}_4 \rightarrow a \text{ KCl} + 2a \text{ O}_2$  이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



15. 구리 + 진한질산 미정계수법



①Cu:  $a = c \rightarrow a = b/4$

②H:  $b = 2e \rightarrow e = b/2$

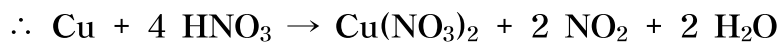
③N:  $b = 2c + d \rightarrow 3b = 6c + 3d$

③-④  $\rightarrow b/2 = d$

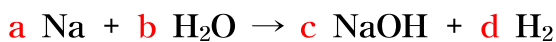
④O:  $3b = 6c + 2d + e \rightarrow 5b/2 = 6c + 2d$

$\rightarrow 3b/2 = 6c \rightarrow c = b/4$

$(b/4) \text{ Cu} + b \text{ HNO}_3 \rightarrow (b/4) \text{ Cu(NO}_3)_2 + (b/2) \text{ NO}_2 + (b/2) \text{ H}_2\text{O}$  이므로, 최소의 정수비로 만들기 위해서 b에 4를 대입



16. 나트륨 + 물 미정계수법

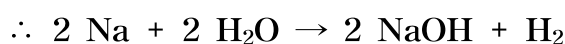


①Na:  $a = c$

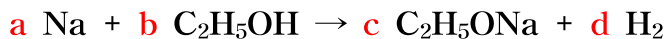
②H:  $b = 2d \rightarrow d = a/2$

③OH:  $b = c \rightarrow b = a$

$a \text{ Na} + a \text{ H}_2\text{O} \rightarrow a \text{ NaOH} + (a/2) \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입



17. 나트륨 + 에탄올 미정계수법



①Na:  $a = c$

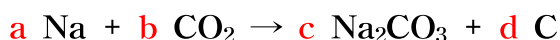
②C<sub>2</sub>H<sub>5</sub>O:  $b = c$

③H:  $b = 2d \rightarrow d = a/2$

$a \text{ Na} + a \text{ C}_2\text{H}_5\text{OH} \rightarrow a \text{ C}_2\text{H}_5\text{ONa} + (a/2) \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



18. 나트륨 + 이산화탄소 미정계수법

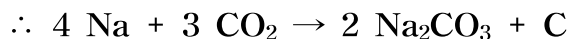


①Na:  $a = 2c \rightarrow c = a/2$

②C:  $b = c + d \rightarrow d = a/4$

③O:  $2b = 3c \rightarrow b = 3a/4$

$a \text{ Na} + (3a/4) \text{ CO}_2 \rightarrow (a/2) \text{ Na}_2\text{CO}_3 + (a/4) \text{ C}$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



19. 나트륨 연소식 미정계수법



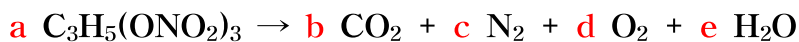
①Na:  $a = 2c \rightarrow c = a/2$

②O:  $2b = c \rightarrow b = a/4$

$a \text{ Na} + (a/4) \text{ O}_2 \rightarrow (a/2) \text{ Na}_2\text{O}$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



20. 니트로글리세린 열분해식 미정계수법



①C:  $3a = b$

②H:  $5a = 2e \rightarrow e = 5a/2$

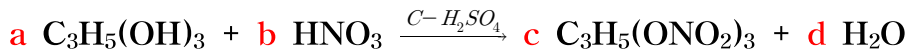
③O:  $9a = 2b + 2d + e \rightarrow 9a = 6a + (5a/2) + 2d \rightarrow d = a/4$

④N:  $3a = 2c \rightarrow c = 3a/2$

$a \text{ C}_3\text{H}_5(\text{ONO}_2)_3 \rightarrow 3a \text{ CO}_2 + (3a/2) \text{ N}_2 + (a/4) \text{ O}_2 + (5a/2) \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



21. 니트로글리세린 제조법 미정계수법



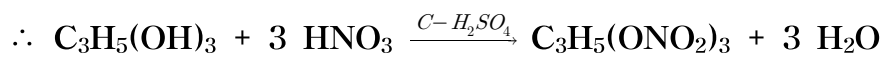
①C<sub>3</sub>H<sub>5</sub>:  $a = c$

②O:  $3a + 3b = 9c + d$

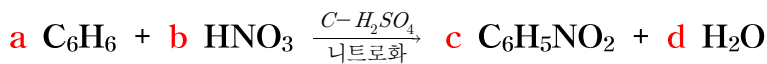
③H:  $3a + b = 2d \rightarrow 6a = 2d \rightarrow d = 3a$

④N:  $b = 3c \rightarrow b = 3a$

$a \text{ C}_3\text{H}_5(\text{OH})_3 + 3a \text{ HNO}_3 \rightarrow a \text{ C}_3\text{H}_5(\text{ONO}_2)_3 + 3a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



22. 니트로벤젠 제조법 미정계수법



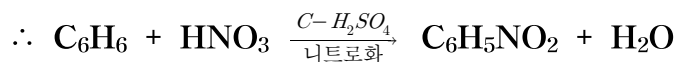
①C<sub>6</sub>H<sub>5</sub>:  $a = c$

②H:  $a + b = 2d \rightarrow a = d$

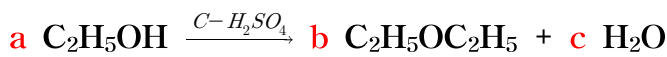
③NO<sub>2</sub>:  $b = c \rightarrow a = b$

④O:  $b = d$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



23. 디에틸에테르 제조 미정계수법

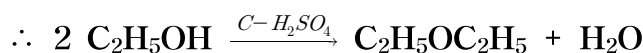


①C<sub>2</sub>H<sub>5</sub>:  $a = 2b \rightarrow b = a/2$

②O:  $a = b + c$

③H:  $a = 2c \rightarrow c = a/2$

$a \text{ C}_2\text{H}_5\text{OH} \xrightarrow{\text{C-H}_2\text{SO}_4} (a/2) \text{ C}_2\text{H}_5\text{OC}_2\text{H}_5 + (a/2) \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입





24. 마그네슘 + 물 미정계수법

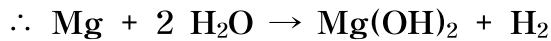


①Mg:  $a = c$

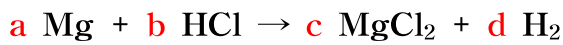
②OH:  $b = 2c \rightarrow b = 2a$

③H:  $b = 2d \rightarrow d = a$

$a \text{ Mg} + 2a \text{ H}_2\text{O} \rightarrow a \text{ Mg(OH)}_2 + a \text{ H}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



25. 마그네슘 + 염산 미정계수법

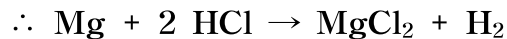


①Mg:  $a = c$

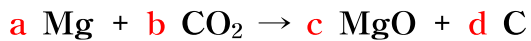
②Cl:  $b = 2c \rightarrow b = 2a$

③H:  $b = 2d \rightarrow d = a$

$a \text{ Mg} + 2a \text{ HCl} \rightarrow a \text{ MgCl}_2 + a \text{ H}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



26. 마그네슘 + 이산화탄소 미정계수법

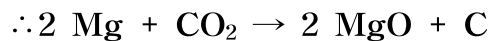


①Mg:  $a = c$

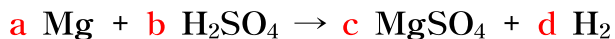
②C:  $b = d \rightarrow d = a/2$

③O:  $2b = c \rightarrow b = a/2$

$a \text{ Mg} + (a/2) \text{ CO}_2 \rightarrow a \text{ MgO} + (a/2) \text{ C}$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



27. 마그네슘 + 황산 미정계수법

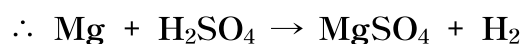


①Mg:  $a = c$

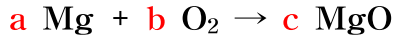
②SO<sub>4</sub>:  $b = c$

③H:  $2b = 2d \rightarrow b = d = c = a$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



28. 마그네슘 연소식 미정계수법



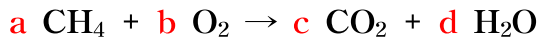
①Mg:  $a = c$

②O:  $2b = c \rightarrow b = a/2$

$a \text{ Mg} + (a/2) \text{ O}_2 \rightarrow a \text{ MgO}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



29. 메탄 분해식 미정계수법

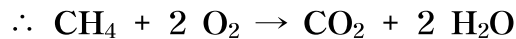


①C:  $a = c$

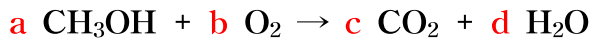
②H:  $4a = 2d \rightarrow d = 2a$

③O:  $2b = 2c + d \rightarrow 2b = 2a + 2a \rightarrow b = 2a$

$a \text{ CH}_4 + 2a \text{ O}_2 \rightarrow a \text{ CO}_2 + 2a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



30. 메탄올 연소식 미정계수법

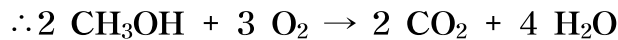


①C:  $a = c$

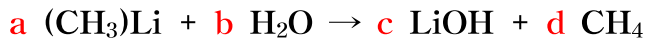
②H:  $4a = 2d \rightarrow d = 2a$

③O:  $a + 2b = 2c + d \rightarrow a + 2b = 2a + 2a \rightarrow b = 3a/2$

$a \text{ CH}_3\text{OH} + (3a/2) \text{ O}_2 \rightarrow a \text{ CO}_2 + 2a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



31. 메틸리튬 + 물 미정계수법



①CH<sub>3</sub>:  $a = d$

②Li:  $a = c$

③OH:  $b = c$

④H:  $b = d$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



32. 삼산화크롬 + 물 미정계수법

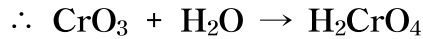


$$\textcircled{1}\text{Cr: } a = c$$

$$\textcircled{2}\text{O: } 3a + b = 4c$$

$$\textcircled{3}\text{H: } 2b = 2c \rightarrow b = c$$

$a = b = c$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



33. 삼산화크롬 열분해식 미정계수법



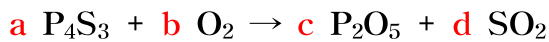
$$\textcircled{1}\text{Cr: } a = 2b \rightarrow b = a/2$$

$$\textcircled{2}\text{O: } 3a = 3b + 2c \rightarrow c = 3a/4$$

$a \text{ CrO}_3 \rightarrow (a/2) \text{ Cr}_2\text{O}_3 + (3a/4) \text{ O}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



34. 삼황화린 연소식 미정계수법

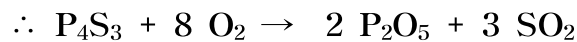


$$\textcircled{1}\text{P: } 4a = 2c \rightarrow c = 2a$$

$$\textcircled{2}\text{S: } 3a = d$$

$$\textcircled{3}\text{O: } 2b = 5c + 2d \rightarrow b = 8a$$

$a \text{ P}_4\text{S}_3 + 8a \text{ O}_2 \rightarrow 2a \text{ P}_2\text{O}_5 + 3a \text{ SO}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



35. 수소화알루미늄리튬 + 물 미정계수법



$$\textcircled{1}\text{Li: } a = c$$

$$\textcircled{2}\text{Al: } a = d$$

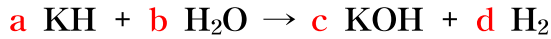
$$\textcircled{3}\text{OH: } b = c + 3d \rightarrow b = 4a$$

$$\textcircled{4}\text{H: } 4a + b = 2e \rightarrow 8a = 2e \rightarrow e = 4a$$

$a \text{ LiAlH}_4 + 4a \text{ H}_2\text{O} \rightarrow a \text{ LiOH} + a \text{ Al(OH)}_3 + 4a \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



36. 수소화칼륨 + 물 미정계수법

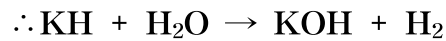


①K:  $a = c$

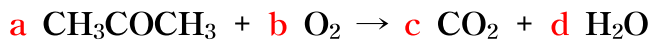
②OH:  $b = c$

③H:  $a + b = 2d \rightarrow d = a$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



37. 아세톤 연소식 미정계수법



①C:  $3a = c$

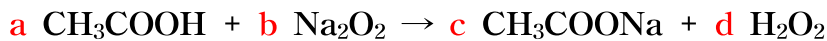
②H:  $6a = 2d \rightarrow d = 3a$

③O:  $a + 2b = 2c + d \rightarrow b = 4a$

$a \text{ CH}_3\text{COCH}_3 + 4a \text{ O}_2 \rightarrow 3a \text{ CO}_2 + 3a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



38. 아세트산 + 과산화나트륨 미정계수법



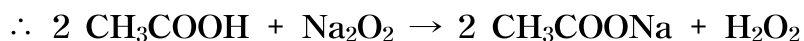
①CH<sub>3</sub>COO:  $a = c$

②H:  $a = 2d \rightarrow d = a/2$

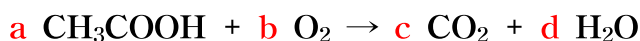
③Na:  $2b = c$

④O:  $2b = 2d \rightarrow b = d$

$a \text{ CH}_3\text{COOH} + (a/2) \text{ Na}_2\text{O}_2 \rightarrow a \text{ CH}_3\text{COONa} + (a/2) \text{ H}_2\text{O}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



39. 아세트산 연소식 미정계수법

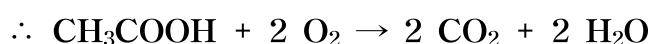


①C:  $2a = c$

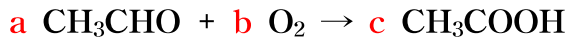
②H:  $4a = 2d \rightarrow d = 2a$

③O:  $2a + 2b = 2c + d \rightarrow b = 2a$

$a \text{ CH}_3\text{COOH} + 2a \text{ O}_2 \rightarrow 2a \text{ CO}_2 + 2a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



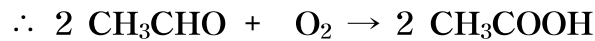
40. 아세트알데히드 산화식 미정계수법



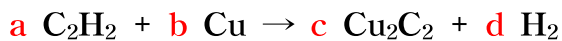
$$\textcircled{1}\text{C: } 2a = 2c \rightarrow a = c$$

$$\textcircled{2}\text{O: } a + 2b = 2c \rightarrow b = a/2$$

$a \text{ CH}_3\text{CHO} + (a/2) \text{ O}_2 \rightarrow a \text{ CH}_3\text{COOH}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



41. 아세틸렌 + 구리 미정계수법

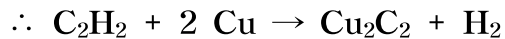


$$\textcircled{1}\text{C: } 2a = 2c \rightarrow a = c$$

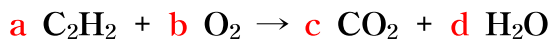
$$\textcircled{2}\text{H: } 2a = 2d \rightarrow a = d$$

$$\textcircled{3}\text{Cu: } b = 2c \rightarrow b = 2a$$

$a \text{ C}_2\text{H}_2 + 2a \text{ Cu} \rightarrow a \text{ Cu}_2\text{C}_2 + a \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



42. 아세틸렌 연소식 미정계수법

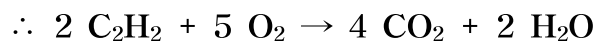


$$\textcircled{1}\text{C: } 2a = c$$

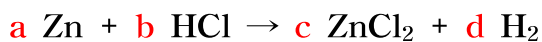
$$\textcircled{2}\text{H: } 2a = 2d \rightarrow a = d$$

$$\textcircled{3}\text{O: } 2b = 2c + d \rightarrow b = 5a/2$$

$a \text{ C}_2\text{H}_2 + (5a/2) \text{ O}_2 \rightarrow 2a \text{ CO}_2 + a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



43. 아연 + 염산 미정계수법

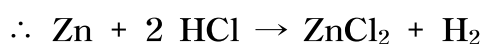


$$\textcircled{1}\text{Zn: } a = c$$

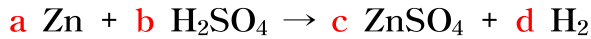
$$\textcircled{2}\text{H: } b = 2d \rightarrow d = a$$

$$\textcircled{3}\text{Cl: } b = 2c \rightarrow b = 2a$$

$a \text{ Zn} + 2a \text{ HCl} \rightarrow a \text{ ZnCl}_2 + a \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



44. 아연 + 황산 미정계수법

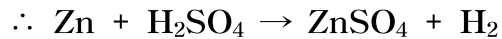


①Zn:  $a = c$

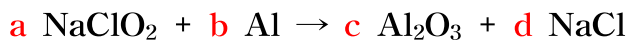
②H:  $2b = 2d \rightarrow d = b$

③SO<sub>4</sub>:  $b = c$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



45. 아염소산나트륨 + 알루미늄 미정계수법

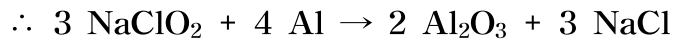


①NaCl:  $a = d$

②O:  $2a = 3c \rightarrow c = \frac{2a}{3}$

③Al:  $b = 2c \rightarrow b = \frac{4a}{3}$

$a \text{ NaClO}_2 + (\frac{4a}{3}) \text{ Al} \rightarrow (\frac{2a}{3}) \text{ Al}_2\text{O}_3 + a \text{ NaCl}$ 이므로, 최소의 정수비로 만들기 위해서 a에 3을 대입



46. 알루미늄 + 물 미정계수법

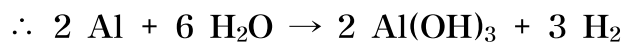


①Al:  $a = c$

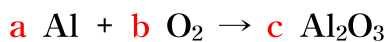
②OH:  $b = 3c \rightarrow b = 3a$

③H:  $b = 2d \rightarrow d = \frac{3a}{2}$

$a \text{ Al} + 3a \text{ H}_2\text{O} \rightarrow a \text{ Al(OH)}_3 + (\frac{3a}{2}) \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입



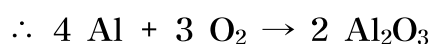
47. 알루미늄 연소식 미정계수법



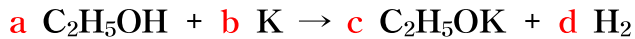
①Al:  $a = 2c \rightarrow c = \frac{a}{2}$

②O:  $2b = 3c \rightarrow 2b = \frac{3a}{2} \rightarrow b = \frac{3a}{4}$

$a \text{ Al} + (\frac{3a}{4}) \text{ O}_2 \rightarrow (\frac{a}{2}) \text{ Al}_2\text{O}_3$ 이므로, 최소의 정수비로 만들기 위해서 a에 4를 대입



48. 에탄올 + 칼륨 미정계수법



①C<sub>2</sub>H<sub>5</sub>O:  $a = c$

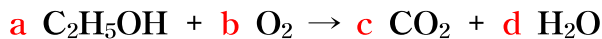
②H:  $a = 2d \rightarrow d = a/2$

③K:  $b = c$

$a \text{ C}_2\text{H}_5\text{OH} + a \text{ K} \rightarrow a \text{ C}_2\text{H}_5\text{OK} + (a/2) \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입



49. 에탄올 연소식 미정계수법

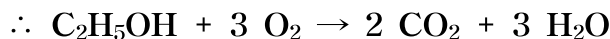


①C:  $2a = c$

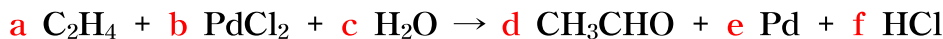
②H:  $6a = 2d \rightarrow d = 3a$

③O:  $a + 2b = 2c + d \rightarrow a + 2b = 4a + 3a \rightarrow b = 3a$

$a \text{ C}_2\text{H}_5\text{OH} + 3a \text{ O}_2 \rightarrow 2a \text{ CO}_2 + 3a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



50. 에틸렌 산화식 미정계수법



①C:  $2a = 2d \rightarrow a = d$

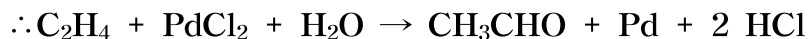
②H:  $4a + 2c = 4d + f \rightarrow f = 2c \rightarrow f = 2a$

③Pd:  $b = e$

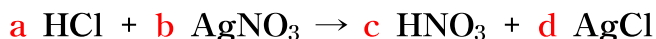
④Cl:  $2b = f \rightarrow 2b = 2c \rightarrow b = c$

⑤O:  $c = d$

$a \text{ C}_2\text{H}_4 + a \text{ PdCl}_2 + a \text{ H}_2\text{O} \rightarrow a \text{ CH}_3\text{CHO} + a \text{ Pd} + 2a \text{ HCl}$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입( $a = b = c = d = e, f = 2a$ )



51. 염산 + 질산은 미정계수법

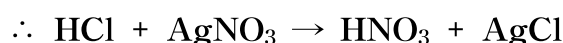


①H:  $a = c$

②Cl:  $a = d$

③Ag:  $b = d$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



52. 염소산칼륨 + 황산 미정계수법



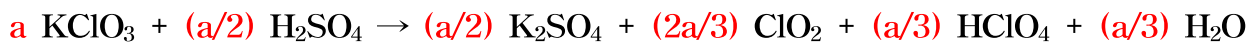
①K:  $a = 2c \rightarrow c = a/2$

②Cl:  $a = d + e \rightarrow 2a = 2d + 2e \quad \text{③}-\text{②} \rightarrow a = 2e + f = e + 2f \rightarrow e = f$

③O:  $3a = 2d + 4e + f \rightarrow 3a = 2d + (5a/3) \rightarrow 4a/3 = 2d \rightarrow d = 2a/3$

④H:  $2b = e + 2f \rightarrow a = e + 2f \rightarrow a = 3e \rightarrow e = a/3$

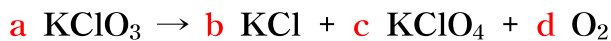
⑤SO<sub>4</sub>:  $b = c \rightarrow b = a/2$



이므로, 최소의 정수비로 만들기 위해서 a에 6을 대입(분모 3과 2의 최소 공배수)



53. 염소산칼륨 400℃ 열분해식 미정계수법



①K:  $a = b + c$

②Cl:  $a = b + c$

③O:  $3a = 4c + 2d$

이 반응식은 미정계수법으로 풀 수 없다.



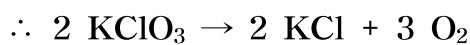
54. 염소산칼륨 540~560℃ 열분해식 미정계수법



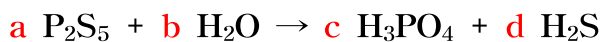
①KCl:  $a = b$

②O:  $3a = 2c \rightarrow c = 3a/2$

$a \text{ KClO}_3 \rightarrow a \text{ KCl} + (3a/2) \text{ O}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입



55. 오황화린 + 물 미정계수법



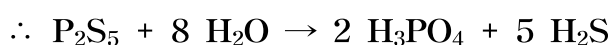
①P:  $2a = c$

②S:  $5a = d$

③H:  $2b = 3c + d$

④O:  $b = 4c \rightarrow b = 8a$

$a \text{ P}_2\text{S}_5 + 8a \text{ H}_2\text{O} \rightarrow 2a \text{ H}_3\text{PO}_4 + 5a \text{ H}_2\text{S}$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입





56. 이산화망간 + 과산화수소 미정계수법

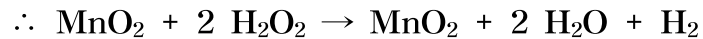


①MnO<sub>2</sub>:  $a = c$  (반응 전 후에 변화가 없는 촉매)

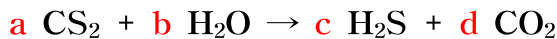
②H<sub>2</sub>O:  $b = d$

③H:  $b = 2e \rightarrow e = b/2$

$a \text{ MnO}_2 + b \text{ H}_2\text{O}_2 \rightarrow a \text{ MnO}_2 + b \text{ H}_2\text{O} + (b/2) \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입, b에 2를 대입



57. 이황화탄소 + 물 미정계수법



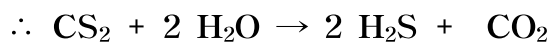
①C:  $a = d$

②S:  $2a = c$

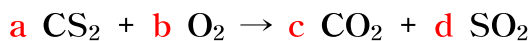
③H:  $2b = 2c \rightarrow b = c = 2a$

④O:  $b = 2d \rightarrow d = a$

$a \text{ CS}_2 + 2a \text{ H}_2\text{O} \rightarrow 2a \text{ H}_2\text{S} + a \text{ CO}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



58. 이황화탄소 연소식

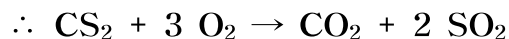


①C:  $a = c$

②S:  $2a = d$

③O:  $2b = 2c + 2d \rightarrow b = 3a$

$a \text{ CS}_2 + 3a \text{ O}_2 \rightarrow a \text{ CO}_2 + 2a \text{ SO}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



59. 인화알루미늄 + 물 미정계수법



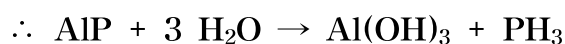
①Al:  $a = c$

②P:  $a = d$

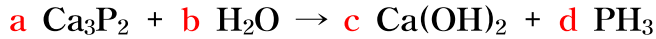
③OH:  $b = 3c \rightarrow b = 3a$

④H:  $b = 3d$

$a \text{ AlP} + 3a \text{ H}_2\text{O} \rightarrow a \text{ Al(OH)}_3 + a \text{ PH}_3$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



60. 인화칼슘 + 물 미정계수법



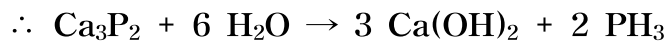
$$\textcircled{1}\text{Ca: } 3a = c$$

$$\textcircled{2}\text{P: } 2a = d$$

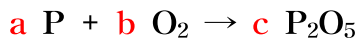
$$\textcircled{3}\text{OH: } b = 2c \rightarrow b = 6a$$

$$\textcircled{4}\text{H: } b = 3d$$

$a \text{ Ca}_3\text{P}_2 + 6a \text{ H}_2\text{O} \rightarrow 3a \text{ Ca(OH)}_2 + 2a \text{ PH}_3$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



61. 적린 연소식 미정계수법



$$\textcircled{1}\text{P: } a = 2c \rightarrow c = a/2$$

$$\textcircled{2}\text{O: } 2b = 5c \rightarrow b = 5a/4$$

$a \text{ P} + (5a/4) \text{ O}_2 \rightarrow (a/2) \text{ P}_2\text{O}_5$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



62. 중크롬산칼륨 열 분해식 미정계수법



$$\textcircled{1}\text{K: } 2a = 2b \rightarrow a = b$$

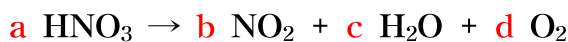
$$\textcircled{2}\text{Cr: } 2a = b + 2c \rightarrow c = a/2$$

$$\textcircled{3}\text{O: } 7a = 4b + 3c + 2d \rightarrow d = 3a/4$$

$a \text{ K}_2\text{Cr}_2\text{O}_7 \rightarrow a \text{ K}_2\text{CrO}_4 + (a/2) \text{ Cr}_2\text{O}_3 + (3a/4) \text{ O}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



63. 질산 열분해식 미정계수법



$$\textcircled{1}\text{H: } a = 2c \rightarrow c = a/2$$

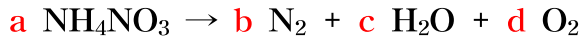
$$\textcircled{2}\text{NO}_2: a = b$$

$$\textcircled{3}\text{O: } a = c + 2d \rightarrow d = a/4$$

$a \text{ HNO}_3 \rightarrow a \text{ NO}_2 + (a/2) \text{ H}_2\text{O} + (a/4) \text{ O}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



64. 질산암모늄 열분해식 미정계수법

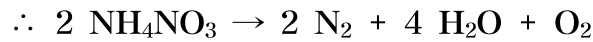


$$\textcircled{1}\text{N: } 2a = 2b \rightarrow a = b$$

$$\textcircled{2}\text{H: } 4a = 2c \rightarrow c = 2a$$

$$\textcircled{3}\text{O: } 3a = c + 2d \rightarrow d = a/2$$

$a \text{ NH}_4\text{NO}_3 \rightarrow a \text{ N}_2 + 2a \text{ H}_2\text{O} + (a/2) \text{ O}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



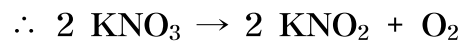
65. 질산칼륨 분해식 미정계수법



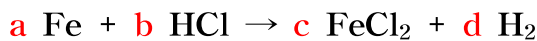
$$\textcircled{1}\text{KNO}_2: a = b$$

$$\textcircled{2}\text{O: } a = 2c \rightarrow c = a/2$$

$a \text{ KNO}_3 \rightarrow a \text{ KNO}_2 + (a/2) \text{ O}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



66. 철 + 염산 미정계수법

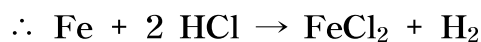


$$\textcircled{1}\text{Fe: } a = c$$

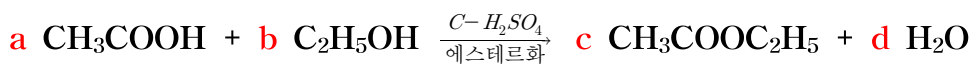
$$\textcircled{2}\text{H: } b = 2d \rightarrow d = a$$

$$\textcircled{3}\text{Cl: } b = 2c \rightarrow b = 2a$$

$a \text{ Fe} + 2a \text{ HCl} \rightarrow a \text{ FeCl}_2 + a \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



67. 초산에틸 제조 미정계수법



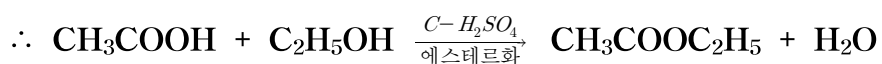
$$\textcircled{1}\text{CH}_3\text{COO: } a = c$$

$$\textcircled{2}\text{C}_2\text{H}_5: b = c$$

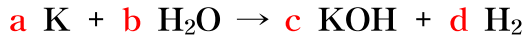
$$\textcircled{3}\text{H: } a = d$$

$$\textcircled{4}\text{OH: } b = d$$

$a = b = c = d$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



68. 칼륨 + 물 미정계수법

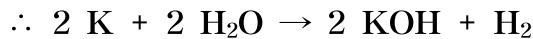


①K:  $a = c$

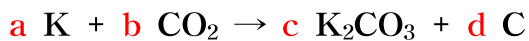
②OH:  $b = c$

③H:  $b = 2d \rightarrow d = a/2$

$a \text{ K} + a \text{ H}_2\text{O} \rightarrow a \text{ KOH} + (a/2) \text{ H}_2$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



69. 칼륨 + 이산화탄소 미정계수법

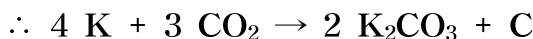


①K:  $a = 2c \rightarrow c = a/2$

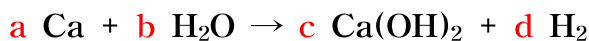
②C:  $b = c + d \rightarrow d = a/4$

③O:  $2b = 3c \rightarrow b = 3a/4$

$a \text{ K} + (3a/4) \text{ CO}_2 \rightarrow (a/2) \text{ K}_2\text{CO}_3 + (a/4) \text{ C}$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 4를 대입



70. 칼슘 + 물 미정계수법

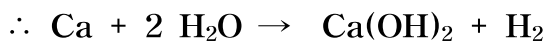


①Ca:  $a = c$

②OH:  $b = 2c \rightarrow b = 2a$

③H:  $b = 2d \rightarrow d = a$

$a \text{ Ca} + 2a \text{ H}_2\text{O} \rightarrow a \text{ Ca(OH)}_2 + a \text{ H}_2$  이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



71. 탄산마그네슘 산화식 미정계수법

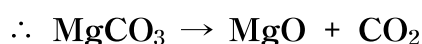


①Mg:  $a = b$

②C:  $a = c$

③O:  $3a = b + 2c$

$a = b = c$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



72. 탄산수소나트륨 + 황산 미정계수법



①Na:  $a = 2c \rightarrow c = a/2$

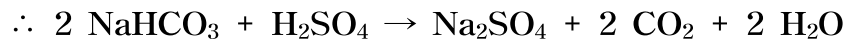
②H:  $a + 2b = 2e$

③CO<sub>2</sub>:  $a = d$

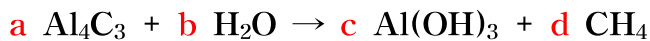
④O:  $a = e$

⑤SO<sub>4</sub>:  $b = c \rightarrow b = a/2$

$a \text{ NaHCO}_3 + (a/2) \text{ H}_2\text{SO}_4 \rightarrow (a/2) \text{ Na}_2\text{SO}_4 + a \text{ CO}_2 + a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서 a에 2를 대입



73. 탄화알루미늄 + 물



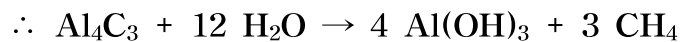
①Al:  $4a = c$

②C:  $3a = d$

③OH:  $b = 3c$

④H:  $b = 4d \rightarrow b = 12a$

$a \text{ Al}_4\text{C}_3 + 12a \text{ H}_2\text{O} \rightarrow 4a \text{ Al(OH)}_3 + 3a \text{ CH}_4$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



74. 탄화칼슘 + 물 미정계수법



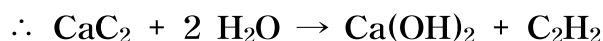
①Ca:  $a = c$

②C:  $2a = 2d \rightarrow a = d$

③OH:  $b = 2c$

④H:  $b = 2d \rightarrow b = 2a$

$a \text{ CaC}_2 + 2a \text{ H}_2\text{O} \rightarrow a \text{ Ca(OH)}_2 + a \text{ C}_2\text{H}_2$ 이므로, 최소의 정수비로 만들기 위해서 a에 1을 대입



75. 트리니트로톨루엔 분해식 미정계수법



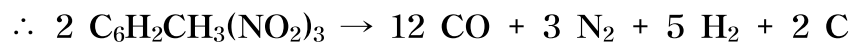
$$\textcircled{1}\text{C: } 7a = b + e \rightarrow e = a$$

$$\textcircled{2}\text{H: } 5a = 2d \rightarrow d = 5a/2$$

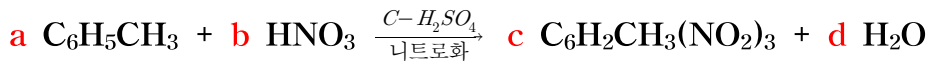
$$\textcircled{3}\text{N: } 3a = 2c \rightarrow c = 3a/2$$

$$\textcircled{4}\text{O: } 6a = b$$

$a \text{ C}_6\text{H}_2\text{CH}_3(\text{NO}_2)_3 \rightarrow 6a \text{ CO} + (3a/2) \text{ N}_2 + (5a/2) \text{ H}_2 + a \text{ C}$ 이므로, 최소의 정수 비로 만들기 위해서  $a$ 에 2를 대입



76. 트리니트로톨루엔 제조 미정계수법



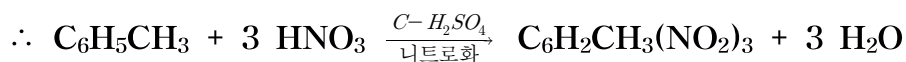
$$\textcircled{1}\text{C}_6\text{H}_2\text{CH}_3: a = c$$

$$\textcircled{2}\text{H: } 3a + b = 2d$$

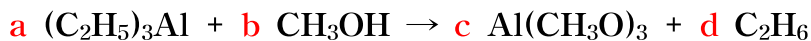
$$\textcircled{3}\text{NO}_2: b = 3c \rightarrow b = 3a$$

$$\textcircled{4}\text{O: } b = d \rightarrow d = 3a$$

$a \text{ C}_6\text{H}_5\text{CH}_3 + 3a \text{ HNO}_3 \rightarrow a \text{ C}_6\text{H}_2\text{CH}_3(\text{NO}_2)_3 + 3a \text{ H}_2\text{O}$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



77. 트리에틸알루미늄 + 메틸알코올 미정계수법



$$\textcircled{1}\text{C}_2\text{H}_5: 3a = d$$

$$\textcircled{2}\text{Al: } a = c$$

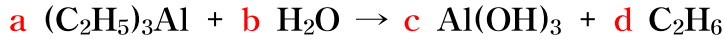
$$\textcircled{3}\text{CH}_3\text{O: } b = 3c \rightarrow b = 3a$$

$$\textcircled{4}\text{H: } b = d$$

$a (\text{C}_2\text{H}_5)_3\text{Al} + 3a \text{ CH}_3\text{OH} \rightarrow a \text{ Al}(\text{CH}_3\text{O})_3 + 3a \text{ C}_2\text{H}_6$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



78. 트리에틸알루미늄 + 물 미정계수법



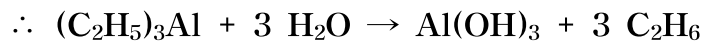
$$\textcircled{1} C_2H_5: 3a = d$$

$$\textcircled{2} Al: a = c$$

$$\textcircled{3} OH: b = 3c \rightarrow b = 3a$$

$$\textcircled{4} H: b = d$$

$a (C_2H_5)_3Al + 3a H_2O \rightarrow c Al(OH)_3 + 3a C_2H_6$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입



79. 트리에틸알루미늄 연소식 미정계수법



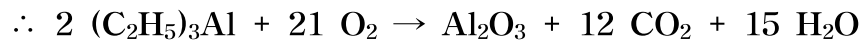
$$\textcircled{1} C: 6a = d$$

$$\textcircled{2} H: 15a = 2e \rightarrow e = 15a/2$$

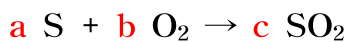
$$\textcircled{3} Al: a = 2c \rightarrow c = a/2$$

$$\textcircled{4} O: 2b = 3c + 2d + e \rightarrow 2b = (3a/2) + 12a + (15a/2) \rightarrow b = 21a/2$$

$a (C_2H_5)_3Al + (21a/2) O_2 \rightarrow (a/2) Al_2O_3 + 6a CO_2 + (15a/2) H_2O$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 2를 대입



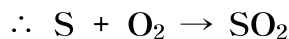
80. 황 + 산소 미정계수법



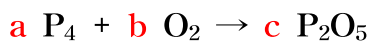
$$\textcircled{1} S: a = c$$

$$\textcircled{2} O: 2b = 2c \rightarrow b = c$$

$a = b = c$  이므로 계수는 1이 된다. (최소의 정수비를 맞추어 주기 때문에)



81. 황린 연소식 미정계수법



$$\textcircled{1} P: 4a = 2c \rightarrow c = 2a$$

$$\textcircled{2} O: 2b = 5c \rightarrow b = 5a$$

$a P + 5a O_2 \rightarrow 2a P_2O_5$ 이므로, 최소의 정수비로 만들기 위해서  $a$ 에 1을 대입

