

2016 年第 48 屆國際化學奧林匹亞競賽

國內初選筆試解答

一、單選題

1. A	2. C	3. E	4. B	5. D
6. A	7. B	8. E	9. E	10. D
11. C	12. D	13. A	14. D	15. B
16. D	17. C	18. E	19. C	20. B
21. A	22. E	23. B	24. C	

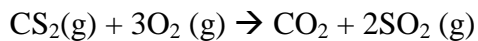
二、多選題

				25. CD
26. BCD	27. CE	28. 送分	29. ABC	30. DE
31. ADE	32. CE	33. AD	34. ACE	35. AC
36. BC	37. ABE	38. BCDE	39. ABD	40. AD
41. BCE				

三、非選擇題 (共 4 大題，每題 15 分)

1.

(a) (5 分)



(b) (5 分) 爆炸前

(c) (5 分) 爆炸後

設爆炸前容器內原 $\text{CS}_2(\text{g})$ 有 n 莫耳、 $\text{O}_2(\text{g})$ 有 m 莫耳， $m > 3n$ 。

	$\text{CS}_2(\text{g})$	$\text{O}_2(\text{g})$	$\text{CO}_2(\text{g})$	$\text{SO}_2(\text{g})$
爆炸前	n	m	0	0
爆炸後	0	$m-3n$	n	$2n$

$$\text{爆炸後 } 3.00 \text{ atm} \times 10.0 \text{ L} = (n+m) \times 0.082 \times 373.15 \text{ T}$$

$$\text{爆炸後 } 2.40 \text{ atm} \times 10.0 \text{ L} = m \times 0.082 \times 373.15 \text{ T}$$

$$n = 6 / 0.082 / 373.15 = 0.196 \text{ mole}$$

$$m = 0.784 \text{ mole}$$

(5 分) 爆炸前容器內 $\text{CS}_2(\text{g})$ 所占分壓為 $3.00 \text{ atm} \times n/(n+m) = 0.60 \text{ atm}$

(5 分) 爆炸後容器內 $\text{O}_2(\text{g})$ 所占分壓為 $2.40 \text{ atm} \times (m-3n)/m = 0.60 \text{ atm}$

2.

(a) The ratio of $[\text{C}_2\text{O}_4^{2-}]/[\text{Zn}^{2+}] = ?$ (5 分)

$$[\text{Zn}^{2+}] = [\text{C}_2\text{O}_4^{2-}] + [\text{HC}_2\text{O}_4^-] + [\text{H}_2\text{C}_2\text{O}_4]$$

$$[\text{HC}_2\text{O}_4^-] = (\text{K}_{b1}[\text{C}_2\text{O}_4^{2-}])/[\text{OH}^-] = 20 [\text{C}_2\text{O}_4^{2-}]$$

$$[\text{H}_2\text{C}_2\text{O}_4] = (\text{K}_{b2} [\text{HC}_2\text{O}_4^-])/[\text{OH}^-]$$

$$= (\text{K}_{b2} \text{K}_{b1}[\text{C}_2\text{O}_4^{2-}])/[\text{OH}^-]/[\text{OH}^-] = 0.4 [\text{C}_2\text{O}_4^{2-}]$$

$$[\text{Zn}^{2+}] = [\text{C}_2\text{O}_4^{2-}] (1+20+0.4) = 21.4 [\text{C}_2\text{O}_4^{2-}]$$

$$[\text{C}_2\text{O}_4^{2-}]/[\text{Zn}^{2+}] = 1/21.4 = \underline{0.047}$$

(b) Calculating the solubility of ZnC_2O_4 (M). (5 分)

$$[\text{Zn}^{2+}][\text{C}_2\text{O}_4^{2-}] = \text{K}_{sp}$$

$$[\text{Zn}^{2+}](\text{Zn}^{2+}/21.4) = 7.5 \times 10^{-9}$$

$$[\text{Zn}^{2+}]^2 = 16.05 \times 10^{-8}$$

$$[\text{Zn}^{2+}] = \underline{4.0 \times 10^{-4} \text{ M}}$$

(c) What is the concentration of $\text{H}_2\text{C}_2\text{O}_4$ (M) ? (5 分)

$$[\text{H}_2\text{C}_2\text{O}_4] = 0.4 [\text{C}_2\text{O}_4^{2-}] = (0.4/21.4) [\text{Zn}^{2+}]$$

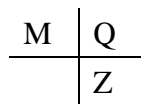
$$= (0.4/21.4) \times 4 \times 10^{-4} \text{ M}$$

$$= \underline{7.48 \times 10^{-6} \text{ M}} \text{ (or } 7.5 \times 10^{-6} \text{)}$$

3.

Ans: 以下答案均需有推導或說明才得滿分。

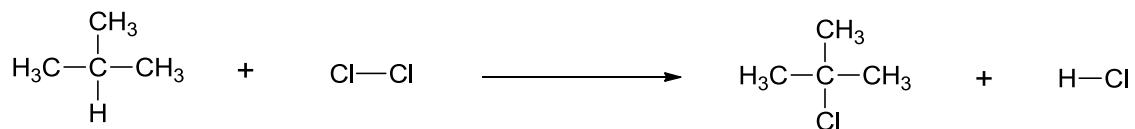
(a) (3分)



(b) (6分)M 為氮(N)，Q 為氧(O)，Z 為硫(S)

(c) (6分) $(\text{NH}_4)_2\text{SO}_4$

4. (a) (6 分) $C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$

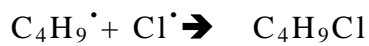
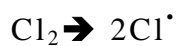


(b) (5 分)

$$\Delta H = -(431 + 331) + (381 + 243) = -138 \text{ kJ/mol}$$

(c) (1 分) 放熱反應

(d) (3 分)



或

