DATE: NAME: CLASS:

ANSWER KEY	Chapter 12 Test Answer Key	BLM 12.5.1A

Answers to Multiple-Choice Questions

1. c
2. d
3. c
4. b
5. a
6. d
7. c
8. b
9. d
10. d
11. b
12. b
13. c
14. a
15. a

Answers to Numerical Response Questions

16.	CO: +2; CO_2: +4; CH_4: –4; C_2H_6: –3
17.	SO_2: +4; SO_3: +6; SO: +2; H_2SO_3: +4
18.	2.1 g
19.	6.1 g
20.	31.6 g Cl_2

Answers to Written Response Questions

21. a) Oxidation : $2Cl^-(aq) - 2e^- \rightarrow Cl_2(g)$
Reduction: $MnO_4^-(aq) + 8H^+ + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$

b) $5 \times$ oxidation half-reaction: $10Cl^-(aq) - 10e^- \rightarrow 5Cl_2(g)$
$2 \times$ reduction half-reaction: $2MnO_4^-(aq) + 16H^+(aq) + 10e^- \rightarrow 2Mn^{2+}(aq) + 8H_2O(l)$

Overall reaction: $10Cl^-(aq) + 2MnO_4^-(aq) + 16H^+(aq) \rightarrow 5Cl_2(g) + 2Mn^{2+}(aq) + 8H_2O(l)$

c) $n(MnO_4^-) = c \times V = 1.3 \text{ mol/L} \times 0.021 \text{ L} = 0.0273 \text{ mol}$

$$0.0273 \cancel{\text{ mol } MnO_4^-} \times \frac{10 \text{ mol } Cl^-}{2 \cancel{\text{ mol } MnO_4^-}} = 0.1365 \text{ mol } Cl^-$$

$$n(\text{ NaCl}) = \frac{n}{V} = \frac{0.1365 \text{ mol}}{0.100 \text{ L}} = 1.36 \text{ mol/L}$$

22. a) $Br_2(aq) + IO_3^-(aq) \rightarrow Br^-(aq) + IO_4^-(aq)$

Reduction: $Br_2(aq) + 2e^- \rightarrow 2Br^-(aq)$
Oxidation : $IO_3^-(aq) \rightarrow IO_4^-(aq)$

$IO_3^-(aq) + H_2O(l) \rightarrow IO_4^-(aq) + 2H^+(aq)$
$IO_3^-(aq) + H_2O(l) + 2OH^-(aq) \rightarrow IO_4^-(aq) + 2H^+(aq) + 2OH^-(aq)$
$IO_3^-(aq) + 2OH^-(aq) \rightarrow IO_4^-(aq) + H_2O(l) + 2e^-$

Add the two balanced half-reactions:
$Br_2(aq) + IO_3^-(aq) + 2OH^-(aq) \rightarrow IO_4^-(aq) + 2Br^-(aq) + H_2O(l)$

b) $$n(Br_2) = \frac{m}{M} = \frac{4.00 \cancel{\text{ g}}}{159.8 \frac{\cancel{\text{g}}}{\text{mol}}} = 0.02503 \text{ mol}$$

$$n(KIO_3) = 0.02503 \cancel{\text{ mol } Br_2} \times \frac{1 \text{ mol } KIO_3(aq)}{1 \cancel{\text{ mol } Br_2}} = 0.02503 \text{ mol } KIO_3(aq)$$

$$V(KIO_3) = \frac{n}{c} = \frac{0.02503 \cancel{\text{ mol}}}{0.788 \frac{\cancel{\text{mol}}}{\text{L}}} = 0.03176 \text{ L} = 31.8 \text{ mL}$$

23. $I^-(aq) + S_2O_8^{2-}(aq) \rightarrow I_3^- + SO_2(g)$

Oxidation: $3I^-(aq) \rightarrow I_3^-(aq) + 2e^-$
Reduction: $S_2O_8^{2-}(aq) \rightarrow 2SO_2(g)$
$S_2O_8^{2-}(aq) \rightarrow 2SO_2(g) + 4H_2O(l)$

$8H^+(aq) + S_2O_8^{2-}(aq) \rightarrow 2SO_2(g) + 4H_2O(l)$
$8H^+(aq) + S_2O_8^{2-}(aq) + 6e^- \rightarrow 2SO_2(g) + 4H_2O(l)$

Oxidation × 3: $9I^-(aq) \rightarrow 3I_3^-(aq) + 6e^-$
Overall reaction: $8H^+(aq) + S_2O_8^{2-}(aq) + 9I^-(aq) \rightarrow 2SO_2(g) + 4H_2O(l) + 3I_3^-(aq)$