

**KWANTLEN UNIVERSITY COLLEGE
CHEMISTRY 1105 FINAL EXAM
SPRING 2002**

Answers:

1. a) i) HClO_2 ii) Na_2SO_4 iii) P_4O_{10} iv) $\text{Fe}_2(\text{SO}_3)_3$ v) $\text{Ca}(\text{OH})_2 \cdot 2\text{H}_2\text{O}$

b) i) ammonium sulfide ii) aluminum chlorate iii) nickel(II) cyanide
iv) hydroiodic acid v) iron(III) carbonate

2. a)

Nuclear Symbol	Number of Protons	Number of Electrons	Number of Neutrons	Atomic Number	Mass Number
$^{27}\text{Al}^{3+}$	13	10	14	13	27
$^{31}\text{S}^{2-}$	16	18	15	16	31
^{84}Kr	36	36	48	36	84

b) 64.94 amu

3. a) $3 \text{Na}_2\text{CO}_3(\text{aq}) + 2 \text{Al}(\text{NO}_3)_3(\text{aq}) \rightarrow \text{Al}_2(\text{CO}_3)_3(\text{s}) + 6 \text{NaNO}_3(\text{aq})$

$2 \text{Al}^{3+}(\text{aq}) + 3 \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{Al}_2(\text{CO}_3)_3(\text{s})$

b) $2\text{C}_8\text{H}_{18}(\text{l}) + 25 \text{O}_2 \rightarrow 16 \text{CO}_2(\text{g}) + 18 \text{H}_2\text{O}(\text{l})$

4. a) empirical formula: $\text{C}_3\text{H}_6\text{O}_2$

b) molar mass = 74.1 g/mol; molecular formula: $\text{C}_3\text{H}_6\text{O}_2$

5. a) density of $\text{CO}_2(\text{g})$: 1.74 g/L

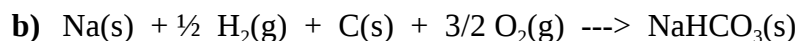
b) $P_{\text{total}} = 15.6 \text{ atm}$; $P_{\text{He}} = 12.0 \text{ atm}$; $P_{\text{Ne}} = 2.38 \text{ atm}$; $P_{\text{Ar}} = 1.20 \text{ atm}$

6. a) limiting reagent: $\text{Fe}(\text{NO}_3)_3$

- b) theoretical yield of $\text{Fe}_2\text{S}_3(\text{s})$: 2.29g
- c) percentage yield of Fe_2S_3 : 94.0 %
- d) concentration of HNO_3 : 0.600 M

7. ΔH for the neutralization reaction: -56 kJ

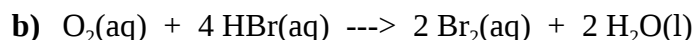
8. a) $\Delta H^\circ = +36.2 \text{ kJ}$



$$\Delta H_f^\circ (\text{NaHCO}_3(\text{s})) = -950.81 \text{ kJ/mol}$$

c) ΔH_f° for $\text{NO}_2(\text{g})$: +34 kJ/mol

9. a)
$$\frac{[\text{HCN}]^2}{[\text{NH}_3]^2 [\text{CH}_4]^2 [\text{O}_2]^3}$$



c) $K_c = (1/4.4 \times 10^{-4})^{1/2} = 48$

d)	<u>moles of N_2</u>	<u>K_c</u>
i) O_2 is removed	D	N.C.
ii) NH_3 is added	I	N.C.
iii) volume of container is increased	D	N.C.
iv) temperature is increased	D	I
v) water is added (assume volume does not change)	N.C.	N.C.

10. a) $[\text{CH}_4]_{\text{equil.}} = 0.0080 \text{ M}$; $[\text{H}_2]_{\text{equil.}} = 0.078 \text{ M}$

b) $K_c = 0.19$

11. a) weakest acid: HCO_3^- ; conjugate base: CO_3^{2-} ; $K_b = 2.1 \times 10^{-4}$

b)

HI : strong acid <u>True</u>	NH_3 : strong base <u>False</u>
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HCN : weak acid True

H_2PO_4^- : amphoteric True

LiOH : strong base True

PO_4^{3-} : amphoteric False

NO_3^- : strong base False

SO_4^{2-} : weak base True

12. a) $[\text{OH}^-] = 5.00 \times 10^{-4} \text{ M}$; $\text{pOH} = 3.30$; $[\text{H}_3\text{O}^+] = 2.00 \times 10^{-11} \text{ M}$; $\text{pH} = 10.7$

b) $\text{pH} = 1.60$

13. a) $\text{pH} = 2.36$; percent ionization = 4.4 %

b) $\text{pH} = 8.72$

c) $\text{pH} = 3.72$

d) $\text{pH} = 3.72$

14. a) $\text{S}_2\text{O}_3^{2-}$ +2 b) HSO_3^- +4 c) H_2S -2 d) SO_4^{2-} +6

15. a) $2 \text{ClO}_3^-(\text{aq}) + 5 \text{SO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{l}) \rightarrow \text{Cl}_2(\text{g}) + 5 \text{SO}_4^{2-}(\text{aq}) + 8 \text{H}^+(\text{aq})$

b) oxidizing agent: ClO_3^-

c) species oxidized: SO_2

16. Molar mass of Reserpine: 610 g/mol