

The Periodic Table

<i>IA</i> H 1 1.01																	<i>VIIIA</i> He 2 4.00
<i>IIA</i> Li 3 6.94	Be 4 9.01											<i>IIIA</i> B 5 10.81	<i>IVA</i> C 6 12.01	<i>V A</i> N 7 14.01	<i>VIA</i> O 8 16.00	<i>VIIA</i> F 9 19.00	Ne 10 20.18
Na 11 22.99	Mg 12 24.31											Al 13 26.98	Si 14 28.09	P 15 30.97	S 16 32.07	Cl 17 35.45	Ar 18 39.95
K 19 39.10	Ca 20 40.08	<i>IIIB</i> Sc 21 44.96	<i>IVB</i> Ti 22 47.88	<i>VB</i> V 23 50.94	<i>VIB</i> Cr 24 52.00	<i>VII B</i> Mn 25 54.94	<i>VIII B</i> Fe 26 55.85	<i>VIII B</i> Co 27 58.93	<i>VIII B</i> Ni 28 58.69	<i>IB</i> Cu 29 63.55	<i>IIB</i> Zn 30 65.39	Ga 31 69.72	Ge 32 72.61	As 33 74.92	Se 34 78.96	Br 35 79.90	Kr 36 83.80
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 263	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)	Ds 110 (271)	Rg 111 (272)	Uub 112 (285)	Uut 113 (284)	Uuq 114 (289)	Uup 115 (288)			
Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97				
Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11				

Some Useful Formulae and Constants:

$$\text{pH} = \text{pK}_a + \log_{10}\left\{\frac{[\text{Conjugate base}]}{[\text{Conjugate acid}]}\right\}$$

$$K_w = 1 \times 10^{-14} \text{ @ } 25^\circ\text{C}$$

SID

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Last _____ First _____

Question 1 Consider the following system at equilibrium at 500 K:

5 Points



The production of $\text{PCl}_3(\text{g})$ is favored by:

Indicate **True** or **False** for each of the following:

- | | |
|---|--|
| <input type="checkbox"/> Increasing the temperature. _____ | <input type="checkbox"/> Decreasing the volume. _____ |
| <input type="checkbox"/> Decreasing the pressure. _____ | <input type="checkbox"/> Adding PCl_5 . _____ |
| | <input type="checkbox"/> Removing Cl_2 . _____ |

Question 2 Consider the following system at equilibrium at 573 K:

4 Points



If the **Volume** of the equilibrium system is suddenly decreased at constant temperature:

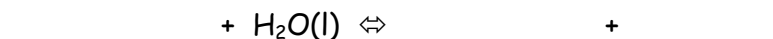
The reaction must:

The number of moles of Cl_2 will:

- | | |
|--|--|
| <input type="checkbox"/> Run in the forward direction. | <input type="checkbox"/> Increase. |
| <input type="checkbox"/> Run in the reverse direction. | <input type="checkbox"/> Decrease. |
| <input type="checkbox"/> Remain the same | <input type="checkbox"/> Remain the same |

Question 3 Write a net ionic equation to show that **ammonia** behaves as a **base** in **water**.

4 Points



Question 4 Assign each species on the **left** to a **category** on the **right**.

8 Points

- | | | |
|---|-------|----------------|
| <input type="checkbox"/> NaOH | _____ | 1. Strong Acid |
| <input type="checkbox"/> HNO₂ | _____ | 2. Weak Acid |
| <input type="checkbox"/> HCN | _____ | 3. Strong Base |
| <input type="checkbox"/> C₉H₇N | _____ | 4. Weak Base |

Question 5 An aqueous solution has a **hydroxide** ion concentration of $1.0 \times 10^{-5} \text{ M}$.

6 Points

- | | |
|--|--------|
| <input type="checkbox"/> What is the hydronium ion concentration in this solution? | _____M |
| <input type="checkbox"/> Is this solution acidic , basic or neutral ? | _____ |

Question 6 The pH of an aqueous solution at 25 °C was found to be 7.30.

9 Points

- The **hydronium** ion concentration is: _____ M
- The **hydroxide** ion concentration is: _____ M
- The **pOH** is: _____

Question 7 Arrange the following solutions in order of decreasing acidity:

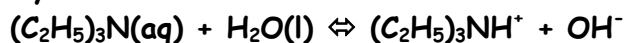
6 Points

1 = most acidic ; 3 = least acidic

- $[H_3O^+] = 1 \times 10^{-10} M$ _____
- $pOH = 7$ _____
- $[OH^-] = 1 \times 10^{-13} M$ _____

Question 8 In the following **net ionic equation**, identify **each reactant** as either a **Bronsted-Lowry acid** or a **Bronsted-Lowry base**:

6 Points



Bronsted-Lowry acid: BLA

Bronsted-Lowry base: BLB

- $(C_2H_5)_3N$ _____ H_2O _____

Question 9 Give the formula for:

6 Points

- The **conjugate acid** of HCO_3^- _____
- The **conjugate base** of HCO_3^- _____

Question 10 Which of the following aqueous solutions are buffer solutions?

6 Points

- 0.24 M HI + 0.18 M NaI 0.34 M NH_4NO_3 + 0.39 M $NaNO_3$
- 0.10 M CH_3COOH + 0.18 M CH_3COOK 0.10 M HCl + 0.21 M NaF
- 0.27 M NH_4Br + 0.31 M NH_3

Question 11 A buffer solution is **0.622 M** in **HCN** and **0.373 M** in **KCN**. If **K_a** for **HCN** is **4.0 × 10⁻¹⁰**, what is the pH of this buffer solution?

4 Points

Must show work

pH =

Question 12 A 1L buffer solution contains 0.25 mol of NaCN and 0.15 mol of HCN.
8 Points (Chose a number from the list on the right that best describes what happens upon -)

- Addition of 0.05 mol of HCl will cause the [HCN] to _____ 1. Increase significantly
- Addition of 0.05 mol of HCl will cause the pOH to _____ 2. Increase
- Addition of 0.05 mol of NaOH will cause the [HCN] to _____ 3. Increase slightly
- Addition of 0.2 mol of NaOH will cause the pH to _____ 4. Decrease significantly
- Addition of 0.2 mol of NaOH will cause the pH to _____ 5. Decrease
- Addition of 0.2 mol of NaOH will cause the pH to _____ 6. Decrease slightly

Question 13 Write a balanced nuclear equation for the following:
8 Points

- $^{238}_{92}\text{U}$ undergoing alpha emission: _____ = _____
- $^{137}_{55}\text{Cs}$ undergoing beta decay: _____ = _____
- ^{10}C undergoing positron emission: _____ = _____
- $^{51}_{24}\text{Cr}$ undergoing electron capture: _____ = _____

Question 14 You need to make an aqueous solution of **0.121 M ammonium carbonate** for an experiment
8 Points in lab, using a **125 mL** volumetric flask. How much solid **ammonium carbonate** should you add?
Must show work

Question 15 How many moles of hydrochloric acid will be formed upon the complete reaction of 1.5 moles of water with excess chlorine gas?

4 Points



Must show work and include a balanced chemical equation.

Question 16 How many grams of solid aluminum hydroxide are required to neutralize 15.5 mL of a 2.65 M solution of perchloric acid.

8 Points

Must show work and include a balanced chemical equation.

mol

g

Exam III Score