

Name: _____ **Score:** _____

Multiple choice questions are worth two points each.

- The compound CH_3NH_2 reacts with water to form CH_3NH_3^+ and OH^- . In this reaction, CH_3NH_2 is acting as a(n)
a. salt
b. base
c. acid
d. solvent
Answer **b**
- H_3O^+ is called the
a. hydroxide ion
b. hydrogen ion
c. hydrate ion
d. hydronium ion
Answer **d**
- If the concentration of a dilute solution of nitric acid (HNO_3) is 0.00010 M, what is the pH of that solution?
a. 14.0
b. 7.0
c. 4.0
d. 5.0
Answer **c**
- Uranium-238 decays by emission of an alpha particle. The other product of this decay is
a. ${}^{234}_{92}\text{U}$
b. ${}^{234}_{91}\text{Pa}$
c. ${}^{234}_{88}\text{Ra}$
d. ${}^{234}_{90}\text{Th}$
Answer **d**
- One difference between a chemical reaction and a nuclear reaction is that in a nuclear reaction
a. only small amounts of energy are absorbed or emitted.
b. only the valence electrons are involved.
c. atoms retain their identity.
d. atoms often change from one element to another.
Answer **d**
- After three half-lives, what fraction of the original radioactive isotope remains in a sample?
a. 1/4
b. 1/8
c. 1/16
d. none
Answer **b**
- The mass of a helium nucleus is slightly less than the sum of its parts (2 protons and 2 neutrons) because
a. the mass of protons and neutrons are not precisely known.
b. some of the mass is given to electrons.
c. the mass of a proton is larger than the mass of a neutron.
d. some of the mass is converted to binding energy.
Answer **d**

Please write legibly! If I can't read it, I can't grade it!

8. Match the term with its definition. (7 points)

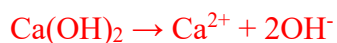
__E__ pH	A. a concentration term expressed in moles per liter
__G__ alpha particle	B. a compound that can behave both as an acid and as a base
__A__ molarity	C. a solution with $\text{pH} > 7$
__B__ amphoteric	D. the force that holds the nucleons together in an atom's nucleus
__H__ critical mass	E. $-\log[\text{H}^+]$
__D__ binding energy	F. the substance in which a solute is dissolved
__C__ basic	G. a helium nucleus emitted in nuclear reaction
	H. the minimum amount of an isotope necessary to sustain a chain reaction.
	I. a solution with $[\text{H}^+] > 1 \times 10^{-7} \text{ M}$

9. Write reactions for the following: (2 points each)

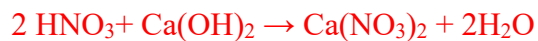
a. The dissociation of nitric acid (HNO_3 , a strong acid)



b. The dissociation of calcium hydroxide (Ca(OH)_2 , a strong base)



c. The reaction of nitric acid (HNO_3) with calcium hydroxide (Ca(OH)_2).



Please write legibly! If I can't read it, I can't grade it!

10. Complete the following table: (6 points)

Compound	Molarity	pH	pOH	Acidic, Basic or Neutral?
HCl	0.012 M	1.92	12.08	Acidic
KOH	0.0035 M	11.54	$\text{KOH} \rightarrow \text{K}^+ + \text{OH}^-$ [OH ⁻] = 0.0035 M pOH = 2.46	Basic

11. Write the nuclear equation for the decay of Po-210 if it undergoes 2 consecutive alpha decay followed by a beta decay followed by another alpha decay? (6 points)



12. In a carbon-14 dating experiment, a fossil was found to have 3.13% of its natural abundance of carbon-14 (in other words, if it originally would have contained 100 g ¹⁴C, it now only contains 3.13g ¹⁴C). (6 points)

a. How many half-lives have passed?

3.13% means the fraction remaining is 0.0313 or 1/0.0313 remains. Since 1/0.0313= 32 that means that 1/32nd of the material remains that requires

1→1/2→1/4→1/8→1/16→1/32 **five half lives**

b. If the half-life of ¹⁴C is 5730 years, how old is the fossil? (10 points)

If five half-lives have passed, the object must be 5(5730) = 28,650 years old.

Please write legibly! If I can't read it, I can't grade it!

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = -\log[\text{H}^+], [\text{H}^+] = 10^{-\text{pH}}$$

Periodic Table of the Elements																																																																																					
1 1A												13 IIIA		14 IVA		15 VA		16 VIA		17 VIIA		18 VIIIA																																																															
1 H 1.008	2 He 4.003																		3 Li 6.941		4 Be 9.012																		5 B 10.811		6 C 12.011		7 N 14.007		8 O 15.999		9 F 18.998		10 Ne 20.180																																				
3 Na 22.990		4 Mg 24.305		5 Al 26.982		6 Si 28.086		7 P 30.974		8 S 32.066		9 Cl 35.453		10 Ar 39.948																		11 K 39.098		12 Ca 40.078		13 Sc 44.956		14 Ti 47.867		15 V 50.942		16 Cr 51.996		17 Mn 54.938		18 Fe 55.845		19 Co 58.933		20 Ni 58.693		21 Cu 63.546		22 Zn 65.38		23 Ga 69.723		24 Ge 72.631		25 As 74.922		26 Se 78.971		27 Br 79.904		28 Kr 83.798																			
29 Rb 85.468		30 Sr 87.62		31 Y 88.906		32 Zr 91.224		33 Nb 92.906		34 Mo 95.95		35 Tc 98.907		36 Ru 101.07		37 Rh 102.96		38 Pd 106.42		39 Ag 107.868		40 Cd 112.414		41 In 114.818		42 Sn 118.711		43 Sb 121.760		44 Te 127.6		45 I 126.904		46 Xe 131.294																		47 Cs 132.905		48 Ba 137.328		49 La 138.905		50 Ce 140.116		51 Pr 140.908		52 Nd 144.243		53 Pm 144.913		54 Sm 150.36		55 Eu 151.964		56 Gd 157.25		57 Tb 158.925		58 Dy 162.500		59 Ho 164.930		60 Er 167.259		61 Tm 168.934		62 Yb 173.055		63 Lu 174.967	
59 Fr 223.020		60 Ra 226.025		61 Ac 227.028		62 Th 232.038		63 Pa 231.036		64 U 238.029		65 Np 237.048		66 Pu 244.064		67 Am 243.061		68 Cm 247.070		69 Bk 247.070		70 Cf 251.080		71 Es [254]		72 Fm 257.095		73 Md 258.1		74 No 259.101		75 Lr [262]																		76 Cs 132.905		77 Ba 137.328		78 La 138.905		79 Ce 140.116		80 Pr 140.908		81 Nd 144.243		82 Pm 144.913		83 Sm 150.36		84 Eu 151.964		85 Gd 157.25		86 Tb 158.925		87 Dy 162.500		88 Ho 164.930		89 Er 167.259		90 Tm 168.934		91 Yb 173.055		92 Lu 174.967			
																		Lanthanide Series																		Actinide Series																																																	