Periodic Table of the Elements

1A 1	2A 2	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	8B 9	8B 10	1B 11	2B 12	3A 13	4A 14	5A 15	6A 16	7A 17	8A 18
1 H 1.0079																	2 He 4.0026
3 Li 6.941	4 Be 9.0122											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9898	12 Mg 24.3050											13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.82	50 Sn 118.710	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.39
55 Cs 132.9054	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.9665	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.9804	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)									

58 Ce 140.115	59 Pr 140.9076	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.9253	66 Dy 162.50	67 Ho 164.9303	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.967
90 Th 232.0381	91 Pa 231.0359	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

Msci 18 0924
18:02, basic, multiple choice, $>$ 1 min, fixed.
001

Carbonic acid (H_2CO_3) is a diprotic acid with $K_{a1} = 4.2 \times 10^{-7}$ and $K_a = 4.8 \times 10^{-11}$. The ion product for water is $K_w = 1.0 \times 10^{-14}$.

What is the $[H_3O^+]$ concentration in a saturated carbonic acid solution that is 0.037 molar?

1. 3.7×10^{-20} M

2. 7.4×10^{-2} M

3. 6.5×10^{-4} M

4. 1.2×10^{-4} M **correct**

5. 4.2×10^{-7} M

Explanation:

Msci 46 0013
18:01, basic, multiple choice, $>$ 1 min, fixed.
002

What is the pH of a 2×10^{-3} M HF? K_a for HF is 7.2×10^{-4}.

1. 2.92

2. 3.05 **correct**

3. 6.8

4. 11.08

Explanation:

PH 10 77 78
18:01, general, multiple choice, $>$ 1 min, wording-variable.
003

What is the pH of 0.15 M $NaHSO_3$(aq) if $K_{a1} = 0.015$, $K_{a2} = 1.2 \times 10^{-7}$, $pK_{a1} = 1.81$ and $pK_{a2} = 6.91$?

1. 4.36 **correct**

2. 8.31

3. 7.82

4. 6.92

5. 3.02

6. None of these

Explanation:
$pK_{a1} = 1.81$ $pK_{a2} = 6.91$
$M = 0.15$ M

This is a salt of a polyprotic acid. The salt will dissociate into solution. The cation is an extremely weak acid and does not affect the equilibrium. The anion can then either protonate or deprotonate; the extent to which these processes occur is determined by the relative values of pK_{a1} and pK_{a2}. The pH is

$$\begin{aligned} pH &= \frac{1}{2}(pK_{a1} + pK_{a2}) \\ &= \frac{1}{2}(1.81 + 6.91) \\ &= 4.36\,. \end{aligned}$$

Note the pH of a salt solution of a polyprotic acid is independent of the concentration of the salt as long as it is not extremely dilute.

ChemPrin3e T10 38
18:99, general, multiple choice, $<$ 1 min, fixed.
004

Write the charge balance equation for a dilute aqueous solution of HI.

1. $[I^-] = [OH^-] + [H_3O^+]$

2. $[H_3O^+] = [OH^-]$

3. $[H_3O^+] = [I^-]$

4. $[H_3O^+] = [I^-] + [OH^-]$ **correct**

5. $[HI]_{initial} = [I^-]$

Explanation:

ChemPrin3e T10 54
18:99, general, multiple choice, $<$ 1 min, fixed.
005
For a solution labeled "0.10 M H_3PO_4(aq),"

1. $[H_2PO_4^-]$ is greater than 0.10 M.

2. $[H^+] = 0.30$ M.

3. $[PO_4^{3-}] = 0.10$ M.

4. $[H^+] = 0.10$ M.

5. $[H^+]$ is less than 0.10 M. **correct**

Explanation:

Equil Sol
18:99, general, multiple choice, $<$ 1 min, .
006
A weakly acidic solution with a pH near 7 is formed when 1×10^{-7} moles of H_2SO_3 is added to 1 liter of water.

How many equations must be solved in order to accurately calculate all of the unknown concentrations formed at equilibrium in solution?

1. 5 **correct**

2. 4

3. 3

4. 2

5. 1

6. 6

7. 7

Explanation:
There are 5 ions that make contributions in this solution: H_2SO_3, HSO_3^-, SO_3^{2-}, H^+, and OH^-.

Msci 18 0907
18:02, basic, multiple choice, $>$ 1 min, fixed.
007
What is the concentration of SO_4^{2-} in 2.0 M H_2SO_4? K_{a1} is strong and $K_{a2} = 1.2 \times 10^{-2}$.

1. 2.0×10^{-1} M

2. 1.2×10^{-2} M **correct**

3. 4.0×10^{-1} M

4. 1.0×10^{-7} M

5. 4.0×10^{-2} M

Explanation:

DAL 19 002
18:03, general, multiple choice, $<$ 1 min, fixed.
008
There are three sources of protons to be considered in calculating the pH of a solution formed when equal volumes of 1×10^{-8} M HCl and 1×10^{-2} M acetic acid (HAc) are added to water. Assume a K_a of 1.8×10^{-5} for acetic acid.

Rank from most to least, the concentration of protons contributed at equilibrium from HCl, HAc and H_2O.

1. HCl, HAc, H_2O

2. HAc, HCl, H_2O

3. HAc, H_2O, HCl **correct**

4. H_2O, HCl, HAc

5. HCl, H_2O, HAc

Explanation: