General Chemistry Practice Full year course

1. A student measures a sample of lithium oxide to be 177.2234 g. Another student measures a sample of lithium oxide to be 74.62 g. Added together, the sum of these samples is (with the proper number of significant figures):

(A) 251.8434 g

**(B) 251.843 g**

(C) 251.84 g

(D) 251.8 g

(E) 252. g

1. Which of the following chemical formulae is **incorrect**?

(A) (NH4)2O

(B) Ca(NO3)2

(C) LiOH

**(D) Sr2(PO4)3**

(E) MgCO3

1. Which of the following pairs of elements will form a molecule?

(A) Sodium and calcium

**(B) Carbon and oxygen**

(C) Cesium and magnesium

(D) Fluorine and barium

(E) Calcium and iodine

1. 243Am2+ has:

**(A) 95 protons, 148 neutrons, 93 electrons**

(B) 95 protons, 148 neutrons, 97 electrons

(C) 95 protons, 146 neutrons, 95 electrons

(D) 243 protons, 241 neutrons, 241 electrons

(E) 243 protons, 243 neutrons, 241 electrons

1. The PCl5 is:

(A) a metal

(B) a non-metal

(C) an alloy

**(D) a molecule**

(E) an ionic compound

1. A fictitious element, Beyonceium, has two naturally occurring isotopes. 212By has a mass of 211.976 g/mol and is 10.2338% abundant.  213By has a mass of 212.992 g/mol and is 89.7662% abundant.  What is the average atomic mass of Beyonceium?

**(A) 212.888 g/mol**

(B) 212.080 g/mol

(C) 212.484 g/mol

(D) 212.288 g/mol

(E) 212.028 g/mol

1. The chemical formula of calcium sulfate is:

(A) Ca2SO4

**(B) CaSO4**

(C) CaS

(D) CaS2

(E) Ca(SO4)2

1. The names of Mg3(PO4)2 and SF6 are:

(A) trimagnesium diphosphide and sulfur hexafluoride

(B) magnesium phosphide and sulfur hexafluoride

(C) trimagnesium phosphate and sulfur fluoride

(D) trimagnesium diphosphate and sulfur hexafluoride

**(E) magnesium phosphate and sulfur hexafluoride**

1. A student (Chem stick fig1) requires 0.835 moles of LiF for a reaction. How many grams of LiF should she weigh out?

(A) 0.835 g

(B) 25.94 g

**(C) 21.66 g**

(D) 0.03219 g

(E) 31.07 g

1. When the reaction

C11H24 (l) + O2 (g) → CO2 (g) + H2O (g) is correctly balanced,

(A) 11 O2 are consumed

**(B) 17 O2 are consumed**

(C) 18 O2 are consumed

(D) 34 O2 are consumed

(E) 36 O2 are consumed

1. A student (Chem stick fig1) obtains 293.55 grams of platinum. This is:

(A) 1.50 platinum atoms

**(B) 9.06 x 1023 platinum atoms**

(C) 4.64 x 1021 platinum atoms

(D) 1.77 x 1026 platinum atoms

(E) 3.45 x 1028 platinum atoms

1. In an excess amount of oxygen, how many grams of CO2 (g) are theoretically produced from the combustion of 1711.5 g of sucrose [C12H22O11 (s), molar mass of 342.3 g/mol]?

C12H22O11 (s) +  O2 (g)  12 CO2 (g) + 11 H2O (g)

(A) 220.0 g CO2 (g) are produced

**(B) 2641 g CO2 (g) are produced**

(C) 528.1 g CO2 (g) are produced

(D) 585,846 g CO2 (g) are produced

(E) 60.00 g CO2 (g) are produced

1. The mass percent composition of CaSO4 is:

(A) 16.7% Ca, 16.7% S, 66.7% O

(B) 20.0% Ca, 20.0% S, 60.0% O

(C) 25.1% Ca, 20.5% S, 54.4% O

**(D) 29.4% Ca, 23.6% S, 47.0% O**

(E) 33.3% Ca, 33.3 % S, 33.3% O

1. A student places 46.76 g of NaCl (s) into a 2.000-L volumetric flask and fills to the mark with water. The concentration of the solution is:

**(A) 0.0500 M**

(B) 0.1000 M

(C) 0.2000 M

(D) 0.4000 M

(E) 0.8000 M

1. There are 1.291 x 1024 methylphenidate molecules in 500.0 g of methylphenidate. What is the molar mass of methylphenidate?

**(A) 233.3 g/mol**

(B) 2.582 g/mol

(C) 384.6 g/mol

(D) 367.4 g/mol

(E) The answer cannot be calculated without the molecular formula of methylphenidate.

1. A student biker stick fig1 places 454.7 g of a gas into a 80.0-L container at 313 K and measures the pressure to be 2.06 atm. This gas is:

(A) O2 (g)

(B) N2 (g)

**(C) Cl2 (g)**

(D) H2 (g)

(E) He (g)

1. What is the density (in g/L) of CH4 (g) at 298 K and 720 mm Hg?
   1. 0.545 g/L
   2. **0.621 g/L**
   3. 1.61 g/L
   4. 3.24 g/L
   5. 7.17 x 10-4 g/L
2. A student obtains a gas in a 3.20 liter glass flask at 23.0 ºC and 1.02 atm. He cools the gas in the flask to 11.5 ºC. The pressure of the gas inside the flask at 11.5 ºC is:
   1. 1.63 atm
   2. 1.02 atm
   3. 1.96 atm
   4. **0.980 atm**
   5. 0.510 atm
3. Consider the following five gases: CO (g) CO2 (g) Xe (g) N2O4 (g) F2 (g)

Of these, the gas with the **highest** velocity at room temperature is:

**(A) CO (g)**

(B) CO2 (g)

(C) Xe (g)

(D) N2O4 (g)

(E) F2 (g)

1. A student combusts 88.2 grams of propane gas (C3H8) in excess oxygen gas to produce carbon dioxide gas and steam at 1.00 atm and 390 K. How many liters of steam are produced?

C3H8 (g) + 5 O2 (g)  3 CO2 (g) + 4 H2O (g)

(A) 2.00 L of H2O are produced

(B) 8.00 L of H2O are produced

(C) 64.0 L of H2O are produced

(D) 128 L of H2O are produced

**(E) 256 L of H2O are produced**

1. A sample of Cl2 (g) is observed to effuse through a porous barrier in 0.855 minutes. Under the same conditions, the same number of moles of an unknown gas requires 1.16 minutes to effuse through the same barrier. Which of the following is the unknown gas?

(A) O2 (g)

(B) N2 (g)

(C) Cl2 (g)

(D) H2 (g)

**(E) Xe (g)**

1. The root-mean-square speed of Cl2 (g) at 1.20 atm and 350 K is:

(A) 34.9 m/s.

(B) 123 m/s.

**(C) 351 m/s.**

(D) 1.23 x 106 m/s.

(E) 11.1 m/s.

1. Use the data in the table below to answer the following question:

H°f (kJ/mol)

CO2 (g) - 393.5

C3H8 (g) - 104.0

H2O (l) - 285.9

What is ΔH˚reaction for the following reaction?

C3H8 (g) + 5 O2 (g) → 3 CO2 (g) + 4 H2O (l)

(A) -783.4 kJ

**(B) -2220.1 kJ**

(C) -2428.1 kJ

(D) +2428.1 kJ

(E) + 575.4 kJ

1. Which of the following equations is exothermic?

(A) H2O(l) 🡪 H2O(g)

(B) CO2(s) 🡪 CO2(g)

(C) H2O(s) 🡪 H2O(l)

**(D) CH4(g) + 2 O2(g) 🡪 CO2(g) + 2 H2O(g)**

1. How much heat is required to raise the temperature of 150.0 grams of water from 20.6 °C to 90.0°C?

**(A) 43.6 kJ**

(B) 12.9 kJ

(C) 10.4 kJ

(D) 2.16 kJ

(E) 20.8 kJ

1. The heat of formation (H°f) of Mg(OH)2 (s) is –925 kJ/mol. The chemical equation associated with this reaction is:

(A) Mg (s) + 2 O (g) + 2 H (g) → Mg(OH)2 (s)

(B) Mg (s) + 2 (OH-) (aq) → Mg(OH)2 (s)

(C) Mg (s) + 2 OH- (aq) → Mg(OH)2 (s)

(D) Mg (s) + 2 O2 (g) + 2 H2 (g) → Mg(OH)2 (s)

**(E) Mg (s) + O2 (g) + H2 (g) → Mg(OH)2 (s)**

1. 25 kJ of heat will cause a 200.0 gram sample of H2O (l) to increase from 0.0 ºC to:

(A) 5000 ºC

(B) 0.125 ºC

(C) 125 ºC

**(D) 29.9 ºC**

(E) 8.00 ºC

1. Determine ΔH° for the reaction 3 Fe2O3 (s) + CO (g) → CO2 (g) + 2 Fe3O4 (s), using:

Fe2O3 (s) + 3 CO (g) → 2 Fe (s) + 3 CO2 (g) H° = -28.0 kJ

3 Fe (s) + 4 CO2 (g) → 4 CO (g) + Fe3O4 (s) H° = +12.5 kJ

(A) - 105.5 kJ

(B) - 74.8 kJ

(C) - 1570 kJ

(D) - 211.0 kJ

**(E) -59.0 kJ**

1. A student mixes two solutions: K3PO4 (aq) and Ca(NO3)2 (aq). The solid precipitate formed is:

(A) KNO3 (s)

**(B) Ca3(PO4)2 (s)**

(C) KOH (s)

(D) CaO (s)

(E) K3PO4 (s)

1. Consider the electromagnetic spectrum. Which of the following statements is **FALSE**?

(A) Blue light is lower in energy than x-rays

(B) Violet light and red light have the same velocity in a vacuum

(C) Yellow light has a lower frequency than x-rays

**(D) Green light has a shorter wavelength than x-rays**

(E) X-rays and green light have the same velocity in a vacuum

1. The frequency of red laser photons having a wavelength of 630 nm is:

(A) 1.60 x 10-9 

(B) 1.60 x 109 

**(C) 4.76 x 1014 **

(D) 2.10 x 1014 

(E) 8.91 x 1014 

1. The energy of **one mole** of blue photons having a wavelength of 480 nm is:

**(A) 249 kJ.**

(B) 284 kJ.

(C) 302 kJ.

(D) 604 kJ.

(E) 906 kJ.

1. Consider the Bohr Model for the Hydrogen Atom. Which of the following electron transitions releases the **most** energy?

(A) n = 7 to n = 6

**(B) n = 2 to n = 1**

(C) n = 1 to n = 2

(D) n = 5 to n = 4

(E) n = 3 to n = 4

1. Consider the Bohr Model for the Hydrogen Atom. Which of the following electron transitions releases electromagnetic radiation with the **longest** wavelength?

**(A) n = 7 to n = 6**

(B) n = 2 to n = 1

(C) n = 1 to n = 2

(D) n = 5 to n = 4

(E) n = 3 to n = 4

1. Which of the following sets of quantum numbers is not valid?

(A) n = 1, l = 0, ml = 0, ms = +½

(B) n = 3, l = 1, ml = 0, ms = +½

(C) n = 3, l = 2, ml = -2, ms = -½

(D) n = 2, l = 1, ml = 0, ms = +½

**(E) n = 1, l = 1, ml = 1, ms = +½**

1. Which set of four quantum numbers describes the orbital pictured below?



(A) n = 1, l = 0, ml = 0, ms = +½

(B) n = 1, l = 1, ml = 0, ms = +½

**(C) n = 2, l = 1, ml = 0, ms = +½**

(D) n = 2, l = 2, ml = 0, ms = +½

(E) n = 3, l = 2, ml = 1, ms = +½

1. deBroglie’s proposition regarding the nature of matter was:

**(A) All matter exhibits a wavelength: λ = h/mv.**

(B) All photons are in the visible region of the electromagnetic spectrum.

(C) The frequency of electromagnetic radiation is inversely proportional to the energy.

(D) All matter exhibits energy: E=mc2.

(E) Matter that is greater in energy than UV is IR.

1. The ground-state electron configuration of an oxygen **atom** is:

(A) 1s22s23s23p1

(B) 1s22s23s1

**(C) 1s22s22p4**

(D) 1s22s22p5

(E) 1s22s23s3

1. There are \_\_\_ **unpaired** electrons in a ground-state nitrogen atom.

(A) 0

(B) 1

(C) 2

**(D) 3**

(E) 4

1. The ground-state electron configuration of an oxide ion (O2-) is:

(A) 1s22s23s23p2

(B) 1s22s23s1

**(C) 1s22s22p4**

(D) 1s22s22p63s23p2

**(E) 1s22s22p6**

1. Na+, Na, N3-, and N. Which of the following statements is correct?

(A) Na+ is larger than Na

**(B) N3- is larger than N**

1. The Lewis Dot Structure of CO2 depicts:

**(A) There are no lone pairs of electrons on the carbon atom**

(B) There is one lone **pair** of electrons on the carbon atom

(C) There are two lone **pairs** of electrons on the carbon atom

(D) There are four lone **pairs** of electrons on the carbon atom

(E) There are six lone **pairs** of electrons on the carbon atom

1. The oxygen-oxygen bond order in the ozone molecule (O3) is:

(A) 1.00

(B) 1.33

**(C) 1.50**

(D) 1.75

(E) 2.00

1. The H-P-H bond angle in PH3 is:

(A) 180°

(B) 120°

(C) 109.5°

(D) A little greater than 109.5°

**(E) A little less than 109.5°**

1. The nitrogen-oxygen-nitrogen bond angle in nitrate, NO3- is:

(A) 45°

(B) 60°

(C) 90°

**(D) 120°**

(E) 109.5°

1. A student (Chem stick fig1) proposes the Lewis Dot Structure below for the thiocyanate ion. Determine the formal charge on sulfur in this structure.



(A) The sulfur has a formal charge of -2

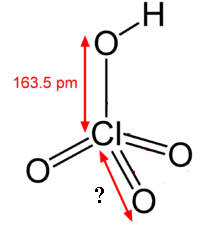
(B) The sulfur has a formal charge of -1

**(C) The sulfur has a formal charge of 0**

(D) The sulfur has a formal charge of +1

(E) The sulfur has a formal charge of +2

1. Consider perchloric acid (HClO4; shown below). The length of the chlorine/oxygen bond shown on the bottom side of the picture (with a question mark and diagonal arrow) is:



(A) 163.5 pm

(B) Greater than 163.5 pm

**(C) Less than 163.5 pm**

1. The deviation from the ideal bond angle in water can be attributed to:

(A) π-Bonding

(B) Polymerization

(C) Hydrogen bonding

**(D) Lone pairs of electrons on oxygen**

(E) Hydrophobia

1. Molecular orbital theory predicts the O22- ion (a minus **two** charge) has a bond order of:

(A) 0.0

(B) 0.5

**(C) 1.0**

(D) 1.5

(E) 2.0

1. Molecular orbital theory predicts the N22- ion (a minus **two** charge) is:

**(A) paramagnetic**

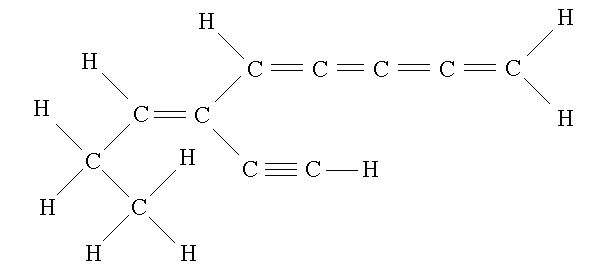
(B) diamagnetic

(C) trimagnetic

(D) totally-magnetic

(E) the-hills-magnetic

1. Consider the molecule below and identify the **correct** statement.



**(A) There are 2 carbons that have sp3 hybridization schemes**

(B) There are 3 carbons that have sp3 hybridization schemes

(C) There are 4 carbons that have sp3 hybridization schemes

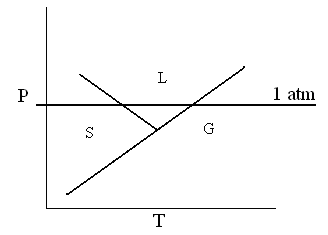
(D) There are 5 carbons that have sp3 hybridization schemes

(E) There are 6 carbons that have sp3 hybridization schemes

1. The phase diagram below is for:

**(A) H2O**

(B) CO2



1. Sodium fluoride melts near 993 ºC. Sodium chloride melts near 804 ºC. The difference in melting points can be attributed to:

(A) Different intermolecular forces (dispersion, dipole-dipole, hydrogen bonding)

(B) Different ionic charges (+1, +2, +3, -1, -2, -3…)

**(C) Different distances between nuclei (ionic size)**

(D) The sheet-like structure

(E) Network covalent compounds

1. Which of the following is **false**?

(A) Carbon dioxide is a non-polar molecule which exhibits dispersion forces.

(B) **Cesium oxide is a non-polar molecule which exhibits dipole-dipole forces.**

(C) Water is a polar molecule which exhibits hydrogen bonding.

(D) Quartz is a network covalent compound.

(E) Network covalent compounds typically melt at higher temperatures than molecules.

1. Consider CH3CH2OH, CaO, CH3CH3, CH3OCH3, CaS, and Ar. Arranged in increasing melting point, these are:

**Lowest melting point Highest melting point**

(A) CH3CH2OH < Ar < CH3CH3 < CH3OCH3 < CaO < CaS

(B) Ar < CH3CH3 < CH3OCH3 < CH3CH2OH < CaO < CaS

(C) Ar < CH3OCH3 < CH3CH3 < CH3CH2OH < CaS < CaO

**(D) Ar < CH3CH3 < CH3OCH3 < CH3CH2OH < CaS < CaO**

(E) Ar < CH3CH3 < CH3CH2OH < CH3OCH3 < CaO < CaS

1. Draw the Lewis Dot Structure for CH3OCH3. The intermolecular forces present in CH3OCH3 are:

(A) Dispersion forces only

**(B) Dispersion forces and dipole-dipole forces**

(C) Dispersion forces, dipole-dipole forces, and hydrogen bonding

(D) Hydrogen bonding only

1. The reaction below will produce:

R**·** + CH2CH2 →

(A) Quartz

(B) A network covalent compound

(C) An ionic compound

(D) Soap

**(E) A polymer**

1. A student biker stick fig1 dissolves 13.50 g of an unknown polymer in 900 mL of water at 304 K. She measures the osmotic pressure to be 0.0441 mm Hg. What is the molar mass of the polymer?

**(A) 6.45 x 106 g/mol**

(B) 5.46 x 106 g/mol

(C) 2.55 x 105 g/mol

(D) 2.50 x 106 g/mol

(E) 1.25 x 106 g/mol

1. A student (biker stick fig1) obtains a 100.0 gram sample of 14C (t1/2 = 5730 years). How long will it take so that only 20.0 grams of 14C remain?

(A) 5730 years

(B) 1,150 years

(C) 11,500 years

**(D) 13,300 years**

(E) 28,650 years

1. The following are initial rate data for: **A + B 🡪 C**

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment | Initial [A] | Initial [B] | Initial Rate |
| 1 | 0.10 | 0.10 | 4.5 |
| 2 | 0.20 | 0.10 | 18.0 |
| 3 | 0.10 | 0.20 | 9.0 |

(A) The rate law is Rate = k[A]1[B]2

(B) The rate law is Rate = k[A]0[B]2

(C) The rate law is Rate = k[A]2[B]0

**(D) The rate law is Rate = k[A]2[B]1**

(E) The rate law is Rate = k[A]1[B]1

1. The boiling point of 1.83 m aqueous KCl (aq) is:

(A) 101.05 °C

(B) 101.02 °C

(C) 102.05 °C

**(D) 101.87 °C**

(E) 102.09 °C

1. The equilibrium law expression for the reaction 2 NO (g) + O2(g) ⬄ 2 NO2(g) is:

(A) Kc = 

(B) Kc = 

(C) Kc = 

(D) Kc = 

**(E) Kc = **

1. A solution was made 2.3 x 10-3 M in [Pb2+] and 1.3 x 10-3 M in [F-]. [Ksp (PbF2) = 3.7 x 10-8]

(A) A solid will form

**(B) A solid will not form**

1. Consider the system 4 FeCl3(aq) + 3 O2(g) ⬄ 2 Fe2O3(aq) + 6 Cl2(g) Kc = 0.0844

A student prepares the system and measures:

[FeCl3] = 0.0390 M [O2] = 0.0260 M [Fe2O3] = 0.0127 M [Cl2] = 0.0552 M

(A) The system is at equilibrium.

**(B) The system is not at equilibrium.**

1. The following reaction is at equilibrium:

2HBr (g) ⬄ H2 (g) + Br2 (g) ΔHo = +72 kJ (endothermic)

**(A) The concentration of Br2 (g) increases when the system is heated**

(B) The concentration of Br2 (g) decreases when the system is heated

(C) The concentration of Br2 (g) stays the same when the system is heated

1. The following reaction is at equilibrium:

2HBr (g) ⬄ H2 (g) + Br2 (g) ΔHo = +72 kJ (endothermic)

(A) The concentration of H2 (g) increases when Br2 (g) is added

(B) **The concentration of H2 (g) decreases when Br2 (g) is added**

(C) The concentration of H2 (g) stays the same when Br2r (g) is added

1. The pH of 0.200 M HCl (aq) is:

(A) 2.00

(B) 0.200

(C) 0.301

(D) 1.04

**(E) 0.699**

1. The pH of 0.040 M CH3COOH (aq) [K =1.8 x 10-5] is:

(A) 3.74

(B) 0.0360

(C) 0.00360

(D) 2.72

**(E) 3.07**

1. A student obtains 0.175 M CH3COOH (aq). The “ICE” table used to solve the equilibrium expression for this weak acid is: D

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| (A) | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | CH3COOH (aq) | + H2O (l) | ⬄ | CH3COO- (aq) | + H3O+ (aq) | | I | 0 |  |  | 0.175 | 0.175 | | C | +x |  |  | +x | +x | | E | x |  |  | 0.175+x | 0.175+x | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| (B) | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | CH3COOH (aq) | + H2O (l) | ⬄ | CH3COO- (aq) | + H3O+ (aq) | | I | 0 |  |  | 0 | 0 | | C | -x |  |  | +x/2 | +x/2 | | E | -x |  |  | x | x | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| (C) | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | CH3COOH (aq) | + H2O (l) | ⬄ | CH3COO- (aq) | + H3O+ (aq) | | I | 0.175 |  |  | 0 | 0 | | C | -x |  |  | +x/2 | +x/2 | | E | 0.175-x |  |  | x/2 | x/2 | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| (D) | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | CH3COOH (aq) | + H2O (l) | ⬄ | CH3COO- (aq) | + H3O+ (aq) | | I | 0.175 |  |  | 0 | 0 | | C | -x |  |  | +x | +x | | E | 0.175-x |  |  | x | x | |

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| (E) | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | CH3COOH (aq) | + H2O (l) | ⬄ | CH3COO- (aq) | + H3O+ (aq) | | I | 0.175 |  |  | 0.175 | 0.175 | | C | -x |  |  | +x | +x | | E | 0.175-x |  |  | 0.175+x | 0.175+x | |

1. A student prepares a solution of 0.0800 M nitric acid, HNO3 (aq). The pH is:

**(A) 1.10**

(B) 0.0800

(C) 0.900

(D) 0.00120

(E) 1.20

1. A student prepares a solution of 0.670 M benzoic acid, C6H5COOH (aq). The [OH-] is:

(A) 0.250 M

(B) 1.250 M

(C) 0.899 M

**(D) 1.54 x 10-12 M**

(E) 0.00650 M

1. A student titrates 0.5222 grams of KHP (potassium hydrogen phthalate; MW=204.2 g/mol) to the equivalence point with 24.08 mL of NaOH (aq). The concentration of the NaOH solution is:

(A) 0.09722 M

(B) 0.1722 M

**(C) 0.1062 M**

(D) 1.722 x 10-4 M

(E) 9.416 M

1. The pH of a buffer system which is 0.885 M C6H5COOH (aq) and 0.885 M C6H5COONa (aq) is:

(A) 0.0531

**(B) 4.20**

(C) 4.32

(D) 7.24

(E) 13.12

1. The pH of 0.200 M NH4NO3 (aq), is:

(A) Greater than 7.00

(B) 7.00

**(C) Less than 7.00**

1. Consider the reaction of ammonia (NH3), and water. The conjugate acid is:

(A) H2O

(B) NH3

(C) HCOO-

(D) H+

**(E) NH4+**

1. Which of the following processes exhibits an increase in entropy of the system?

(A) NH4NO3 (aq) → NH4NO3 (s)

(B) CH3CH2OH (l) → CH3CH2OH (s)

**(C) N2O4 (g) → 2 NO2 (g)**

(D) H2O (g) → H2O (s)

(E) CH3OH (g) → CH3OH (l)

1. The system CaO (s) + C (graphite) ↔ Ca (s) + CO (g) is allowed to reach equilibrium where qrev is measured to be 303 kJ at 298 K. ΔS is:

(A) 0.984 J/K

(B) -0.984 J/K

(C) -102 J/K

(D) 9.84 x 103 J/K

**(E) 1.02 x 103 J/K**

|  |  |  |  |
| --- | --- | --- | --- |
| Formula | ΔHºf (kJ/mol) | ΔGºf (kJ/mol) | Sº (J/mol●K) |
| C3H8 (g) | -103.8 | -23.56 | 270.2 |
| O2 (g) | 0 | 0 | 205.0 |
| CO2 (g) | -393.5 | -394.4 | 213.6 |
| H2O (l) | -285.8 | -237.2 | 69.91 |

C3H8 (g) + 5 O2 (g) → 3 CO2 (g) + 4 H2O (l)

ΔSºreaction (298 K) for the combustion of propane is:

**(A) -374.8 J/K**

(B) +393.5 J/K

(C) 0 J/K

(D) -393.5 J/K

(E) +374.8 J/K

1. The oxidation number of each tungsten in SrW2O5 is:

(A) +2

(B) +3

**(C) +4**

(D) +5

(E) +6

1. Determine S for the reaction 2 C2H4O (l) + 2 H2O (l) → 2 C2H6O (l) + O2 (g)

using the following two reactions:

(1) 2 CO2 (g) + 3 H2O (l) → C2H6O (l) + 3 O2 (g) S1 = +371 kJ

(2) 2 CO2 (g) + 2 H2O (g) → C2H4O (l) + 5/2O2 (g) S2 = -1167 kJ

(A) - 796 kJ

(B) + 1538 kJ

(C) - 1592 kJ

**(D) + 3076 kJ**

(E) - 1963 kJ

1. Consider Na (aq), Pb (aq), Zn (aq), Ag (aq), and Li (aq). The strongest reducing agent is:

(A) Na (aq)

(B) Pb (aq)

(C) Zn (aq)

(D) Ag (aq)

**(E) Li (aq)**

1. Consider a "General Chemistry Battery" in which one beaker contains aqueous tin sulfate (SnSO4) and a tin metal electrode and the other beaker contains aqueous lead sulfate (PbSO4) and a lead metal electrode. Which of the following statements is **false**?

(A) The mass of the tin electrode will decrease as the process proceeds

**(B) Sn2+ (aq) is oxidized**

(C) Electrons flow from the tin beaker to the lead beaker

(D) The cell potential is 0.012 V

(E) The concentration of Pb2+ (aq) decreases as the process proceeds

1. A student provides a current of 5.500 amps through an aqueous solution of AgNO3 for

3.000 hours. The voltage is such that silver metal is deposited at the cathode. The mass of silver deposited is:

**(A) 66.42 g**

(B) 121.3 g

(C) 40.43 g

(D) 161.7 g

(E) 5.45 g

1. Consider F2 (g), Cl2 (g), Cu2+ (aq), H+ (aq), and Li+ (aq). The strongest oxidizing agent is:

**(A) F2 (g)**

(B) Cl2 (g)

(C) Cu2+ (aq)

(D) H+ (aq)

(E) Li+ (aq)

1. When the reaction Mn2+ (aq) + BiO3- (aq) → Bi3+ (aq) + MnO4- (aq) is correctly balanced in acid,

(A) 1 BiO3- (aq) is consumed

(B) 2 BiO3- (aq) are consumed

(C) 3 BiO3- (aq) are consumed

**(D) 5 BiO3- (aq) are consumed**

(E) 8 BiO3- (aq) are consumed

1. A student obtains a sample of C-11 (t1/2 = 20.39 minutes) containing 1.000 g.  How long will it take for the sample to decay to 0.723 g of C-11?

(A) 8.54 minutes

(B) 9.04 minutes

**(C) 9.54 minutes**

(D) 10.04 minutes

(E) 10.54 minutes

1. When an X-ray is generated,

(A) An electron is converted to a helium nucleus

(B) A gamma ray is released

(C) Two gamma rays are released

(D) **A proton is converted to a neutron**

(E) A neutron is converted to a proton

1. A radioactive decay series that begins with No-259 ends with formation of the stable

nuclide Bi-211. How many alpha particle emissions and how many beta particle emissions are involved in the sequence of radioactive decays?

(A) 7 alpha and 22 beta decays.

(B) 14 alpha and 11 beta decays.

(C) 48 alpha and 24 beta decays.

(D) 12 alpha and 11 beta decays.

**(E) 12 alpha and 5 beta decays.**

1. How many **unpaired** electrons are present in [Fe(H2O)6]3+?

[Fe is the Fe3+ ion; H2O is water; and the Fe3+ is **high spin**].

(A) 0

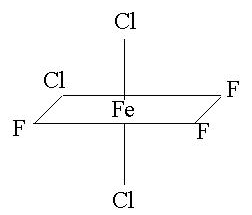
(B) 1

(C) 2

(D) 3

**(E) 5**

1. The complex:



(A) is cis-[FeCl3F3]3-

(B) is trans-[FeCl3F3]3-

**(C) is mer-[FeCl3F3]3-**

(D) is fac-[FeCl3F3]3-

(E) is Usher-[FeCl3F3]3-

1. In a condensation reaction, an ester is produced from:

(A) a ketone and a carboxylic acid

**(B) an alcohol and a carboxylic acid**

(C) an alkene and a carboxylic acid

(D) an aldehyde and a ketone

(E) an amide and an alkene

1. An organic compound with the formula C100H198 is:

(A) an alkane

(B) an amino acid

**(C) an alkyne**

(D) an ester

(E) an amide

1. The systematic name of



(A) is 5-isopropyl-3-methyloctane

(B) is 5-isopropyl-3-methylpentane

(C) is 3-methyl-3-ethylpentane

**(D) is 4-ethyl-3-methyloctane**

(E) is 2,3-dimethylheptane

1. The molecular formula of



(A) is C7H14

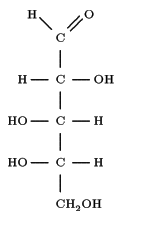
(B) is C6H14

(C) is C7H9

(D) **is C7H8**

(E) is C6H8

1. A structure of arabinose is shown below. The arabinose shown has:



(A) one chiral carbon

(B) two chiral carbons

(C) **three chiral carbons**

(D) four chiral carbons

(E) five chiral carbons

1. Methyl salicylate (the compound that smells like wintergreen) contains:



(A) an alcohol and a ketone

(B) an alcohol and an ether

**(C) an alcohol and an ester**

(D) an alcohol and an amide

(E) an alcohol and an aldehyde

1. Complete the following condensation reaction: A
2. Complete the following addition reaction: A

