Name: _____ Class: _____ Date: _____ ID: A

Exam 2 (Practice)

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. A compound dissolves in water to form an aqueous solution that is a poor conductor of electricity. The compound may be composed of
a. covalent molecules.
b. a strong base.
c. ions.
d. a soluble salt.
e. a strong acid.

____ 2. Which of the following compounds is insoluble in water?
a. NH_4Br
b. KBr
c. $ZnCl_2$
d. $PbBr_2$
e. LiBr

____ 3. When a solution of lithium chloride and a solution of ammonium sulfate are mixed,
a. a new salt is formed.
b. no reaction occurs.
c. a precipitate forms.
d. an acid and a base are formed.
e. a gas is evolved.

____ 4. Aqueous solutions of sodium sulfide and copper(II) chloride are mixed together. Which statement is correct?
a. CuS will precipitate from solution.
b. NaCl will precipitate from solution.
c. No precipitate will form.
d. Both NaCl and CuS will precipitate from solution.
e. No reaction will occur.

____ 5. Which of the following reactions involves neither oxidation nor reduction?
a. $N_2 + 3H_2 \rightarrow 2NH_3$
b. $NH_4NO_2 \rightarrow N_2 + 2H_2O$
c. $Cu + 2Ag^+ \rightarrow Cu^{2+} + 2Ag$
d. $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$
e. $C_2H_4 + H_2 \rightarrow C_2H_6$

____ 6. The sum of the oxidation numbers of all the atoms in the dichromate ion, $Cr_2O_7^{2-}$, is
a. 0.
b. +4.
c. +2.
d. +6.
e. –2.

____ 7. Which of the following species would be expected to function as a reducing agent?
a. Ba^{2+}
b. Zn^{2+}
c. ClO_4^-
d. Cs^+
e. V^{2+}

____ 8. All of the following reactions are described as decomposition reactions except
a. $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$.
b. $2H_2O(g) \rightarrow 2H_2(g) + O_2(g)$.
c. $BaCl_2 \cdot 2H_2O(s) \rightarrow BaCl_2(s) + 2H_2O(g)$.
d. $CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$.
e. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$.

____ 9. In basic solution, H_2O_2 oxidizes Cr^{3+} to CrO_4^{2-} and is reduced to OH^-. What is the lowest whole-number coefficient for OH^- in the balanced net ionic equation?
a. 6
b. 10
c. 4
d. 16
e. 8

____ 10. A 29.0-g sample of NaOH is dissolved in water, and the solution is diluted to give a final volume of 1.60 L. The molarity of the final solution is
a. 18.1 *M*.
b. 0.453 *M*.
c. 0.725 *M*.
d. 0.0552 *M*.
e. 0.862 *M*.

____ 11. In a volumetric analysis experiment, a solution of sodium oxalate ($Na_2C_2O_4$) in acidic solution is titrated with a solution of potassium permanganate ($KMnO_4$) according to the following balanced chemical equation:

$2KMnO_4(aq) + 8H_2SO_4(aq) + 5Na_2C_2O_4(aq) \rightarrow 2MnSO_4(aq) + 8H_2O(l) + 10CO_2(g) + 5Na_2SO_4(aq) + K_2SO_4(aq)$

It required 25.0 mL of 0.0448 *M* $KMnO_4$ to reach the endpoint. What mass of $Na_2C_2O_4$ was present initially?

a. 2.40 g
b. 0.0600 g
c. 15.0 g
d. 0.150 g
e. 0.375 g

____ 12. The energy associated with a motionless rock on the top of Mount Shasta is

a. potential energy.
b. temperature.
c. heat.
d. internal energy.
e. kinetic energy.

____ 13. For which of the following reactions is ΔH not equal to ΔU?

a. $C(s) + O_2(g) \rightarrow CO_2(g)$
b. $Hg(s) \rightarrow Hg(l)$
c. $2HF(g) \rightarrow H_2(g) + F_2(g)$
d. $CH_4(g) + C_3H_8(g) \rightarrow 2C_2H_6(g)$
e. $I_2(s) \rightarrow I_2(g)$

____ 14. Given:

$60C(s) \rightarrow C_{60}(s)$; $\Delta H = 2320$ kJ

what is ΔH for the following thermochemical equation?

$\frac{1}{60}C_{60}(s) \rightarrow C(s)$

a. +38.7 kJ
b. +2320 kJ
c. –139 MJ
d. –2320 kJ
e. –38.7 kJ

____ 15. It is relatively easy to change the temperature of a substance that
a. is very massive.
b. is an insulator.
c. has a high specific heat capacity.
d. has a low specific heat capacity.
e. is brittle.

____ 16. How much heat is gained by iron when 22.6 g of iron is warmed from 20.7°C to 65.9°C? The specific heat of iron is 0.449 J/(g · °C).
a. 2.10×10^2 J
b. 29.59 J
c. 20.29 J
d. 4.59×10^2 J
e. 6.69×10^2 J

____ 17. A 170.0-g sample of metal at 79.0°C is added to 170.0 g of $H_2O(l)$ at 17.0°C in an insulated container. The temperature rises to 19.9°C. Neglecting the heat capacity of the container, what is the specific heat of the metal? The specific heat of $H_2O(l)$ is 4.18 J/(g · °C).
a. 4.18 J/(g · °C)
b. 84.8 J/(g · °C)
c. 0.206 J/(g · °C)
d. –0.206 J/(g · °C)
e. 20.3 J/(g · °C)

____ 18. What is $\Delta H°$ for the following phase change?

$NaCl(s) \rightarrow NaCl(l)$

Substance	$\Delta H°_f$ (kJ/mol)
$NaCl(s)$	–411.12
$NaCl(l)$	–385.92

a. 797.04 kJ
b. 25.20 kJ
c. –797.04 kJ
d. –25.20 kJ
e. 0 kJ

____ 19. What is ΔH° for the following reaction?

$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$

Substance	ΔH°_f (kJ/mol)
$C_2H_2(g)$	+226.7
$CO_2(g)$	–393.5
$H_2O(l)$	–285.8

a. +1692.2 kJ
b. –452.6 kJ
c. –1692.2 kJ
d. +2599.0 kJ
e. –2599.0 kJ

____ 20. What is the standard enthalpy change for the following reaction?

$3CH_4(g) + 4O_3(g) \rightarrow 3CO_2(g) + 6H_2O(g)$

Substance	ΔH°_f (kJ/mol)
$CH_4(g)$	–74.87
$O_3(g)$	+142.7
$CO_2(g)$	–393.5
$H_2O(g)$	–241.8

a. –2285.1 kJ
b. –2977.5 kJ
c. +2977.5 kJ
d. +2285.1 kJ
e. –3426.5 kJ

____ 21. Calculate the change in enthalpy when 52.0 g of solid chromium at 25°C and 1 atm pressure is oxidized. (ΔH°_f for $Cr_2O_3(s)$ is –1135 kJ/mol.)
$4Cr(s) + 3O_2(g) \rightarrow 2Cr_2O_3(s)$

a. –1135 kJ
b. –284 kJ
c. –568 kJ
d. +1135 kJ
e. +568 kJ

____ 22. A photon of red light has a ____ frequency and a ____ wavelength than a photon of blue light.
a. lower, longer
b. higher, shorter
c. lower, shorter
d. higher, longer
e. lower, lower

____ 23. Which of the following statements is a valid conclusion from the Heisenberg uncertainty principle?
a. The square of the wave function is proportional to the probability of finding a particle in space.
b. Particles can exhibit wavelike behavior.
c. The orbits proposed by Bohr's model of the atom are correct.
d. An electron in a 2p orbital is always closer to the nucleus than an electron in a 3p orbital.
e. The act of measuring a particle's position changes its momentum, and vice versa.

____ 24. All the following statements about the quantum numbers are true except
a. m_l has $2l + 1$ possible values.
b. n may take integral values from 1 to ∞.
c. m_l may take integral values of $+l$ to $-l$, including zero.
d. l may take integral values from 1 to $n - 1$.
e. m_s may take only the values of $+\frac{1}{2}$ and $-\frac{1}{2}$.

____ 25. Which of the following is a representation of a 1s orbital?
a. 
b. 
c. 
d. 
e. 

Exam 2
Answer Section

MULTIPLE CHOICE

1. ANS: A PTS: 1 DIF: easy REF: 4.1
   OBJ: Explain how an electrolyte makes a solution electrically conductive.
   TOP: chemical reactions | ions in aqueous solution KEY: electrolyte | nonelectrolyte
   MSC: general chemistry
2. ANS: D PTS: 1 DIF: moderate REF: 4.1
   OBJ: Use the solubility rules. (Example 4.1)
   TOP: chemical reactions | ions in aqueous solution KEY: solubility rules
   MSC: general chemistry
3. ANS: B PTS: 1 DIF: difficult REF: 4.3
   OBJ: Recognize precipitation (exchange) reactions.
   TOP: chemical reactions | types of chemical reactions KEY: precipitation reaction
   MSC: general chemistry
4. ANS: A PTS: 1 DIF: easy REF: 4.3
   OBJ: Decide whether a precipitation reaction will occur. (Example 4.3)
   TOP: chemical reactions | types of chemical reactions KEY: precipitation reaction
   MSC: general chemistry
5. ANS: D PTS: 1 DIF: moderate REF: 4.5
   OBJ: Define an oxidation-reduction reaction.
   TOP: chemical reactions | types of chemical reactions KEY: oxidation-reduction reaction
   MSC: general chemistry
6. ANS: E PTS: 1 DIF: moderate REF: 4.5
   OBJ: Learn the oxidation-number rules. TOP: chemical reactions | types of chemical reactions
   KEY: oxidation-reduction reaction MSC: general chemistry
7. ANS: E PTS: 1 DIF: moderate REF: 4.5
   OBJ: Determine the species undergoing oxidation and reduction.
   TOP: chemical reactions | types of chemical reactions
   KEY: oxidation-reduction reaction | oxidation number MSC: general chemistry
8. ANS: D PTS: 1 DIF: easy REF: 4.5
   OBJ: Recognize combination reactions, decomposition reactions, displacement reactions, and combustion reactions. TOP: chemical reactions | types of chemical reactions
   KEY: oxidation-reduction reaction | common oxidation-reduction reactions
   MSC: general chemistry
9. ANS: B PTS: 1 DIF: difficult REF: 4.6
   OBJ: Balance simple oxidation-reduction reactions by the half-reaction method. (Example 4.8)
   TOP: chemical reactions | types of chemical reactions
   KEY: balancing oxidation-reduction equations | half-reaction method
   MSC: general chemistry
10. ANS: B PTS: 1 DIF: easy REF: 4.7
    OBJ: Calculate the molarity from mass and volume. (Example 4.9)
    TOP: chemical reactions | working with solutions KEY: concentration
    MSC: general chemistry

11. ANS: E PTS: 1 DIF: moderate REF: 4.10
OBJ: Calculate the quantity of substance in a titrated solution. (Example 4.14)
TOP: chemical reactions | quantitative analysis KEY: volumetric analysis
MSC: general chemistry
12. ANS: A PTS: 1 DIF: easy REF: 6.1
OBJ: Define energy, kinetic energy, potential energy, and internal energy.
TOP: thermochemistry | heats of reaction KEY: energy | potential energy
MSC: general chemistry
13. ANS: E PTS: 1 DIF: moderate REF: 6.3
OBJ: Explain how enthalpy and internal energy are related. TOP: thermochemistry | heats of reaction
KEY: enthalpy | enthalpy and internal energy MSC: general chemistry
14. ANS: E PTS: 1 DIF: easy REF: 6.4
OBJ: Manipulate a thermochemical equation using these rules. (Example 6.3)
TOP: thermochemistry | heats of reaction KEY: thermochemical equation
MSC: general chemistry
15. ANS: D PTS: 1 DIF: easy REF: 6.6
OBJ: Relate the heat absorbed or evolved to the specific heat, mass, and temperature change.
TOP: thermochemistry | heats of reaction KEY: calorimetry | specific heat
MSC: general chemistry
16. ANS: D PTS: 1 DIF: moderate REF: 6.6
OBJ: Calculate using this relation between heat and specific heat. (Example 6. 5)
TOP: thermochemistry | heats of reaction
KEY: calorimetry | measuring heats of reaction MSC: general chemistry
17. ANS: C PTS: 1 DIF: difficult REF: 6.6
OBJ: Calculate using this relation between heat and specific heat. (Example 6. 5)
TOP: thermochemistry | heats of reaction KEY: calorimetry | specific heat
MSC: general chemistry
18. ANS: B PTS: 1 DIF: moderate REF: 6.8
OBJ: Calculate the heat of a phase transition using standard enthalpies of formation for the different phases. (Example 6.8) TOP: thermochemistry | heats of reaction
KEY: standard enthalpies of formation MSC: general chemistry
19. ANS: E PTS: 1 DIF: moderate REF: 6.8
OBJ: Calculate the heat (enthalpy) of reaction from the standard enthalpies of formation of the substances in the reaction. (Example 6.9) TOP: thermochemistry | heats of reaction
KEY: standard enthalpies of formation MSC: general chemistry
20. ANS: B PTS: 1 DIF: moderate REF: 6.8
OBJ: Calculate the heat (enthalpy) of reaction from the standard enthalpies of formation of the substances in the reaction. (Example 6.9) TOP: thermochemistry | heats of reaction
KEY: standard enthalpies of formation MSC: general chemistry
21. ANS: C PTS: 1 DIF: moderate REF: 6.8
OBJ: Calculate the heat (enthalpy) of reaction from the standard enthalpies of formation of the substances in the reaction. (Example 6.9) TOP: thermochemistry | heats of reaction
KEY: standard enthalpies of formation MSC: general chemistry
22. ANS: A PTS: 1 DIF: moderate REF: 7.1
OBJ: Describe the different regions of the electromagnetic spectrum.
TOP: atomic theory | light KEY: electromagnetic radiation
MSC: general chemistry

23. ANS: E PTS: 1 DIF: moderate REF: 7.4
OBJ: State Heisenberg's uncertainty principle. TOP: atomic theory | quantum mechanics
KEY: wave functions | Heisenberg's uncertainty principle MSC: general chemistry
24. ANS: D PTS: 1 DIF: easy REF: 7.5
OBJ: State the rules for the allowed values for each quantum number.
TOP: atomic theory | quantum mechanics KEY: quantum numbers
MSC: general chemistry
25. ANS: C PTS: 1 DIF: easy REF: 7.5
OBJ: Describe the shapes of s, p, and d orbitals. TOP: atomic theory | quantum mechanics
KEY: atomic orbital shape MSC: general chemistry

Name: _____ Class: _____ Date: _____ ID: A

Exam 2 sample 2 (Portable)

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which compounds will not dissolve in water in large amounts at 20°C?

$Ca(NO_3)_2$	$MgCO_3$	PbI_2	K_2SO_4
I.	II.	III.	IV.

a. II & III
b. III & IV
c. III & IV
d. I & II
e. I & IV

____ 2. Which substance is oxidized in the reaction below?

$NaNO_3 + Pb \rightarrow NaNO_2 + PbO$

a. Na^+
b. $NaNO_2$
c. $NaNO_3$
d. PbO
e. none of these choices

____ 3. In which of the following compounds does the sulfur atom have the highest (i.e., most positive) oxidation number?
a. Na_2SO_4
b. H_2S
c. SO_2
d. H_2SO_3
e. S_8

____ 4. How many moles of NaOH are present in 25.0 mL of a 0.1000 M NaOH solution?
a. 100 mol
b. 2.50 mol
c. 2.50×10^{-3} mol
d. 25.0 mol
e. 0.100 mol

____ 5. Determine the ammonium ion concentration of a solution that results when 4.53 g of $(NH_4)_2SO_4$ is dissolved in water and diluted to exactly 100.0 mL.
a. 1.37 M
b. 0.686 M
c. 2.51 M
d. 1.03 M
e. 0.343 M

____ 6. If a 45.0 mL sample of 2.20 M Na_2SO_4 is diluted to yield a final solution that is 0.110 M in sodium ions, what is the volume of the final solution?
a. 4500 mL
b. 900 mL
c. 450 mL
d. 1800 mL
e. 110 mL

____ 7. How many grams of KCl are in 125.0 mL of 0.375 M KCl?
a. 3.49×10^{-3} g
b. 46.9 g
c. 0.938 g
d. 3.49 g
e. 0.0469 g

____ 8. A solution is prepared by dissolving 20.0 g of NaI in enough water to make 300.0 mL of solution. How many moles of ions are in 25.0 mL of this solution?
a. 0.0222 mol
b. 0.445 mol
c. 0.0445 mol
d. 0.111 mol
e. 0.0111 mol

____ 9. A solution is made by dissolving 60.0 g of $AlCl_3$ in enough water to make 250.0 mL of solution. How many moles of chloride ions are in 5.00 mL of solution?
a. 1.25×10^{-3} mol
b. 9.00×10^{-3} mol
c. 3.00×10^{-3} mol
d. 1.80×10^{-2} mol
e. 2.70×10^{-2} mol

____ 10. A 25.00 mL sample of HCl solution is neutralized by exactly 31.22 mL of 0.08152 M $Ca(OH)_2$. What is the molarity of the HCl solution?
a. 0.08152 M
b. 0.1018 M
c. 0. 09453 M
d. 0.1021 M
e. 0.2036 M

____ 11. A 25.00 mL sample of H_3PO_4 solution is neutralized by exactly 54.93 mL of 0.04345 M $Ca(OH)_2$. What is the molarity of the H_3PO_4 solution?
a. 0.09546 M
b. 0.2897 M
c. 0.2148 M
d. 0.0636 M
e. 0.1432 M

____ 12. Which of the following is an example of potential energy?
a. a rock rolling down a mountain
b. atoms vibrating back and forth around a specific location
c. electrons flowing through an electrical conductor
d. a fat molecule stored in the body
e. the sound of a dog barking

____ 13. A 20.0 g sample of aluminum (specific heat = 0.902 J g^{-1} $°C^{-1}$) with an initial temperature of 48.6°C is heated with 427 J of energy. What is the final temperature of the sample?
a. 23.7°C
b. 74.8°C
c. 72.3°C
d. 26.2°C
e. 24.9°C

____ 14. What is the enthalpy change when 175 g of C_3H_8 are burned in excess O_2?
$C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(l)$ $\Delta H° = -2220$ kJ

a. -3.89×10^5 kJ
b. -1.79×10^{-3} kJ
c. -3.47×10^0 kJ
d. -1.71×10^7 kJ
e. -8.82×10^3 kJ

____ 15. Determine the heat of reaction for the process
$C_2H_4(g) + 6HCl(g) \rightarrow 2CHCl_3(g) + 4H_2(g)$
using the information given below:
$2C(s) + 2H_2(g) \rightarrow C_2H_4(g)$ $\Delta H° = 52.3$ kJ

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$ $\Delta H° = -184.6$kJ

$C(s) + 1/2H_2(g) + 3/2Cl_2(g) \rightarrow CHCl_3(g)$ $\Delta H° = -103.1$ kJ

a. −29.2 kJ
b. −295.3 kJ
c. + 398.4 kJ
d. + 295.3 kJ
e. +29.2 kJ

____ 16. Light has a wavelength of 582 nm. What is its frequency? The speed of light is 3.00×10^8 m/s.
a. 1.94×10^3 Hz
b. 5.15×10^{14} Hz
c. 1.75×10^2 Hz
d. 1.75×10^{20} Hz
e. 1.94×10^{13} Hz

____ 17. What is the phenomenon that occurs when excited gaseous elements emit only a few colored lines?
a. Planck's constant
b. photoelectric effect
c. electromagnetic spectrum
d. quantum theory
e. line spectrum

____ 18. According to the Bohr model for the hydrogen atom, the energy necessary to excite an electron from $n = 2$ to $n = 3$ is _____ the energy necessary to excite an electron from $n = 3$ to $n = 4$.
a. either more than or equal to
b. equal to
c. less than
d. more than
e. either less than or equal to

____ 19. If $l = 2$, what value can m_l have?
a. $m_l = +1$
b. $m_l = 0, +1, +2$
c. $m_l = +2$
d. $m_l = -1, 0, +1$
e. $m_l = -2, -1, 0, +1, +2$

____ 20. How many electrons can the third principal quantum level hold?
a. 18
b. 8
c. 2
d. 16
e. 32

____ 21. What is the correct electron configuration for beryllium (Be)?
a. $1s^2 2s^2 2p^6$
b. $1s^2 2s^2$
c. $1s^2 2s^2 2p^1$
d. $1s^2 2s^2 2p^2$
e. $1s^2 2s^2 2p^4$

____ 22. What is the electron configuration of arsenide ion, As^{3-}?
a. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$
b. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10}$
c. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$
d. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
e. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^6$

____ 23. What is the electron configuration of Li^+?
a. $1s^1$
b. $1s^2 2s^2 2p^1$
c. $1s^2 2s^2$
d. $1s^2$
e. $1s^2 2s^1$

____ 24. Substances that have the same electron configuration are:
a. lanthanides.
b. paramagnetic.
c. isoelectronic.
d. diamagnetic.
e. ferromagnetic.

____ 25. Which statement is false?
a. Mg^{2+} is smaller than Ca^{2+}.
b. Cl^- is smaller than S^{2-}.
c. N^{3-} is larger than Ne.
d. Br^- is larger than Kr.
e. K^+ is smaller than Ar.

Exam 2 sample 2
Answer Section

MULTIPLE CHOICE

1. ANS: A PTS: 1
   TOP: 5.1 Exchange Reactions: Precipitation and Net Ionic Equations
2. ANS: E PTS: 1 TOP: 5.3 Oxidation-Reduction Reactions
3. ANS: A PTS: 1 TOP: 5.4 Oxidation Numbers and Redox Reactions
4. ANS: C PTS: 1 TOP: 5.6 Solution Concentration
5. ANS: B PTS: 1 TOP: 5.6 Solution Concentration
6. ANS: D PTS: 1 TOP: 5.6 Solution Concentration
7. ANS: D PTS: 1 TOP: 5.6 Solution Concentration
8. ANS: A PTS: 1 TOP: 5.6 Solution Concentration
9. ANS: E PTS: 1 TOP: 5.6 Solution Concentration
10. ANS: E PTS: 1 TOP: 5.8 Aqueous Solution Titrations
11. ANS: D PTS: 1 TOP: 5.8 Aqueous Solution Titrations
12. ANS: D PTS: 1 TOP: 6.1 The Nature of Energy
13. ANS: C PTS: 1 TOP: 6.3 Heat Capacity
14. ANS: E PTS: 1 TOP: 6.6 Enthalpy Changes for Chemical Reactions
15. ANS: D PTS: 1 TOP: 6.9 Hess's Law
16. ANS: B PTS: 1 TOP: 7.1 Electromagnetic Radiation and Matter
17. ANS: E PTS: 1 TOP: 7.2 Planck's Quantum Theory
18. ANS: D PTS: 1 TOP: 7.3 The Bohr Model of the Hydrogen Atom
19. ANS: E PTS: 1
    TOP: 7.5 Quantum Numbers, Energy Levels and Atomic Orbitals
20. ANS: A PTS: 1
    TOP: 7.5 Quantum Numbers, Energy Levels and Atomic Orbitals
21. ANS: B PTS: 1 TOP: 7.7 Atom Electron Configurations
22. ANS: A PTS: 1 TOP: 7.8 Ion Electron Configurations
23. ANS: D PTS: 1 TOP: 7.8 Ion Electron Configurations
24. ANS: C PTS: 1 TOP: 7.8 Ion Electron Configurations
25. ANS: E PTS: 1 TOP: 7.10 Periodic Trends: Ionic Radii