# 114-1 Semester General Chemistry Midterm Exam(C)-20251105

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which one of the following is an exothermic process?
   A) condensation of water vapor
   B) ice melting
   C) boiling soup
   D) water evaporating
   E) Ammonium thiocyanate and barium hydroxide are mixed at 25 °C: the temperature drops.

   Answer: A

2) Which one of the following statements is true?
   A) Enthalpy is a state function.
   B) H is the value of q measured under conditions of constant volume.
   C) The enthalpy change of a reaction is the reciprocal of the $\Delta H$ of the reverse reaction.
   D) The enthalpy change for a reaction is independent of the state of the reactants and products.
   E) Enthalpy is an intensive property.

   Answer: A

3) The temperature of a 12.58 g sample of calcium carbonate [$CaCO_3$ (s)] increases from 23.6 °C to 38.2 °C. If the specific heat of calcium carbonate is 0.82 J/g-K, how many joules of heat are absorbed?
   A) 5.0 B) 151 C) 410 D) 7.5 E) 0.82

   Answer: B

4) For which one of the following equations is $\Delta H°_{rxn}$ equal to $\Delta H_f°$ for the product?
   A) $Xe\ (g) + 2F_2\ (g) \rightarrow XeF_4\ (g)$
   B) $CH_4\ (g) + 2Cl_2\ (g) \rightarrow CH_2Cl_2\ (l) + 2HCl\ (g)$
   C) $2CO\ (g) + O_2\ (g) \rightarrow 2CO_2\ (g)$
   D) $C\ (diamond) + O_2\ (g) \rightarrow CO_2\ (g)$
   E) $N_2\ (g) + O_3\ (g) \rightarrow N_2O_3\ (g)$

   Answer: A

5) The change in the internal energy of a system that absorbs 2,500 J of heat and that does 7,655 J of work on the surroundings is _____ J.

   A) 5,155 B) -5,155 C) -10,155 D) $1.91 \times 10^7$ E) 10,155

   Answer: B

6) The value of $\Delta H°$ for the reaction below is -790 kJ. The enthalpy change accompanying the reaction of 0.95 g of S is _____ kJ.

   $2S\ (s) + 3O_2\ (g) \rightarrow 2SO_3\ (g)$

   A) 23 B) -790 C) 12 D) -23 E) -12

   Answer: E

7) The value of $\Delta H°$ for the reaction below is +128.1 kJ:

$$CH_3OH\ (l) \rightarrow CO\ (g) + 2H_2\ (g)$$

How many kJ of heat are consumed when 5.10 g of $H_2$ (g) is formed as shown in the equation?

A) 326 B) 62.0 C) 653 D) 163 E) 128

Answer: D

8) $\Delta H$ for the reaction

$$IF_5\ (g) \rightarrow IF_3\ (g) + F_2\ (g)$$

is _____ kJ, give the data below.

$IF\ (g) + F_2\ (g) \rightarrow IF_3\ (g)$ $\Delta H = -390$ kJ

$IF\ (g) + 2\,F_2\ (g) \rightarrow IF_5\ (g)$ $\Delta H = -745$ kJ

A) +1135 B) +355 C) -35 D) -1135 E) +35

Answer: B

9) The specific heat of liquid bromine is 0.226 J/g-K. How much heat (J) is required to raise the temperature of 10.0 mL of bromine from 25.00 °C to 27.30 °C? The density of liquid bromine: 3.12 g/mL.

A) 32.4 B) 5.20 C) 10.4 D) 16.2 E) 300

Answer: D

10) All of the orbitals in a given subshell have the same value of the _____ quantum number.

A) angular momentum
B) principal
C) magnetic
D) A and B
E) B and C

Answer: D

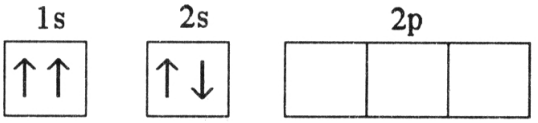
11) Which quantum numbers must be the same for the orbitals that they designate to be degenerate in a many-electron system?

A) n, l, $m_l$, and $m_s$
B) n and l only
C) n only
D) n, l, and $m_l$
E) $m_s$ only

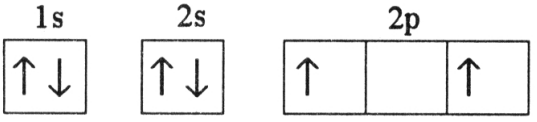
Answer: B

12) Which electron configuration represents a violation of the Pauli exclusion principle?

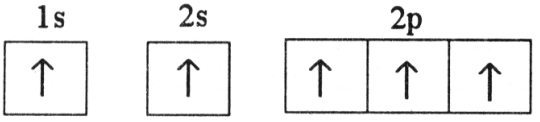
A)



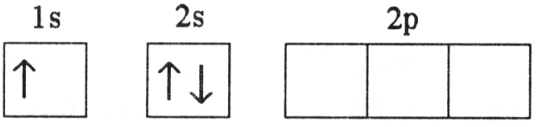

B)



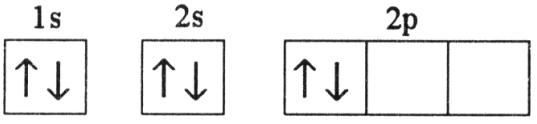

C)




D)



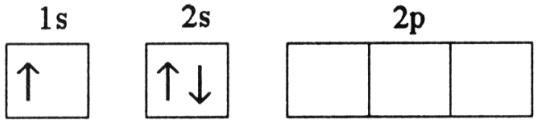

E)



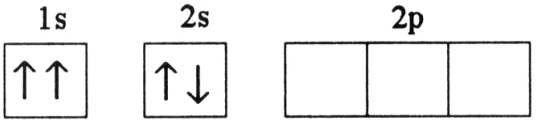

Answer: A

13) Which electron configuration denotes an atom in its ground state?

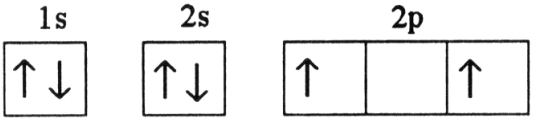
A)



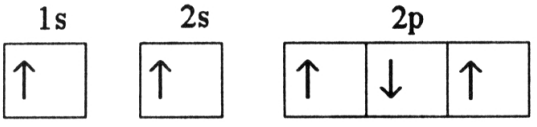

B)



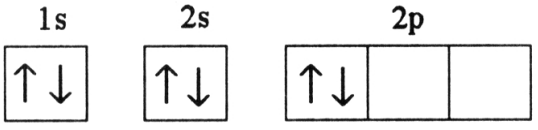

C)




D)




E)




Answer: C

14) The lowest orbital energy is reached when the number of electrons with the same spin is maximized. This statement describes _____.

A) deBroglie hypothesis
B) Hund's rule
C) Planck's constant
D) Heisenberg Uncertainty Principle
E) Pauli Exclusion Principle

Answer: B

15) The wavelength of a photon that has an energy of $5.25 \times 10^{-19}$ J is _____ m.

$h = 6.626 \times 10^{-34}$ J·s

A) $2.64 \times 10^{6}$ B) $3.79 \times 10^{-7}$ C) $2.38 \times 10^{23}$ D) $4.21 \times 10^{-24}$ E) $3.79 \times 10^{7}$

Answer: B

16) The condensed electron configuration of silicon, element 14, is _____.

A) $[He]2s^4$ B) $[He]2s^4 2p^6$ C) $[He]2s^6 2p^2$ D) $[Ne]2p^{10}$ E) $[Ne]3s^2 3p^2$

Answer: E

17) The n = 5 to n = 3 transition in the Bohr hydrogen atom corresponds to the _____ of a photon with a wavelength of _____ nm.

$$\frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \qquad R_H = 1.096776 \times 10^7\ m^{-1}.$$

A) absorption, 657
B) emission, 657
C) absorption, 1280
D) emission, 389
E) emission, 1280

Answer: E

18) In the following list, only _____ is not an example of matter.
A) dust
B) planets
C) table salt
D) elemental phosphorus
E) light

Answer: E

19) A combination of sand, salt, and water is an example of a _____.
A) pure substance
B) solid
C) heterogeneous mixture
D) homogeneous mixture
E) compound

Answer: C

20) Which one of the following has the element name and symbol correctly matched?
A) Ag, silver
B) Mg, manganese
C) C, copper
D) P, potassium
E) Sn, silicon

Answer: A

21) Which of the following is not an exact number?
A) The number of centimeters in an inch.
B) The number of seconds in a ~~year.~~ day
C) The number of millimeters in a kilometer.
D) The number of liters in a gallon.
E) The number of grams in a kilogram.

Answer: D

22) The length of the side of a cube having a density of 12.6 g/ml and a mass of 7.65 g is _____ cm.
A) 0.847 B) 3.20 C) 0.584 D) 1.02 E) 1.32

Answer: A

23) Osmium has a density of 22.6 g/cm$^3$. The mass of a block of osmium that measures 1.01 cm × 0.233 cm × 0.648 cm is _____ g.

A) 3.45 B) $6.75 \times 10^3$ C) $6.75 \times 10^{-3}$ D) 34.5 E) 148

Answer: A

24) The correct answer (reported to the proper number of significant figures) to the following is _____.

(2.05631)(6.9391136) / 12.59326 = _____

A) 1.133064
B) 1.1361
C) 1.13306
D) 1.1330639
E) none of the above

Answer: C

25) The density of mercury is 13.6 g/cm$^3$. The density of mercury is _____ kg/m$^3$.

A) $1.36 \times 10^{-5}$ B) $1.36 \times 10^{-4}$ C) $1.36 \times 10^{4}$ D) $1.36 \times 10^{-2}$ E) $1.36 \times 10^{8}$

Answer: C

26) Consider the following selected postulates of Dalton's atomic theory:

(i) Each element is composed of extremely small particles called atoms.
(ii) Atoms are indivisible.
(iii) Atoms of a given element are identical.
(iv) Atoms of different elements are different and have different properties.

Which of the postulates is(are) no longer considered valid?

A) (iii) only B) (iii) and (iv) C) (ii) only D) (ii) and (iii) E) (i) and (ii)

Answer: D

27) Which one of the following is not true concerning cathode rays?

A) They travel in straight lines in the absence of electric or magnetic fields.
B) They impart a negative charge to metals exposed to them.
C) They originate from the negative electrode.
D) They are made up of electrons.
E) The characteristics of cathode rays depend on the material from which they are emitted.

Answer: E

28) Silver has two naturally occurring isotopes with the following isotopic masses:

$^{107}_{47}$~~Ar~~ Ag $^{107}_{47}$~~Ar~~ Ag

106.90509 108.9047

The average atomic mass of silver is 107.8682 amu. The fractional abundance of the lighter of the two isotopes is _____.

A) 0.75783 B) 0.24221 C) 0.48168 D) 0.51835 E) 0.90474

Answer: D

29) The average atomic weight of copper, which has two naturally occurring isotopes, is 63.5. One of the isotopes has an atomic weight of 62.9 amu and constitutes 69.1% of the copper isotopes. The other isotope has an abundance of 30.9%. The atomic weight (amu) of the second isotope is _____ amu.

A) 28.1 B) 63.8 C) 64.1 D) 64.8 E) 63.2

Answer: D

30) Which formula/name pair is incorrect?

A) $Mg(MnO_4)_2$ magnesium permanganate
B) $Mn(NO_3)_2$ manganese(II) nitrate
C) $Mg_3N_2$ magnesium nitrite
D) $Mg(NO_3)_2$ magnesium nitrate
E) $Mn(NO_2)_2$ manganese(II) nitrite

Answer: C

31) The correct name for $K_2S$ is _____.

A) potassium bisulfide
B) dipotassium sulfate
C) potassium disulfide
D) potassium sulfate
E) potassium sulfide

Answer: E

32) The correct name for $HIO_2$ is _____.

A) iodous acid
B) periodic acid
C) hypoiodic acid
D) hydriodic acid
E) periodous acid

Answer: A

33) What is the molecular formula for 1-hexanol?

A) $C_6H_{12}OH$ B) $C_7H_{13}OH$ C) $C_6H_{14}OH$ D) $C_7H_{14}OH$ E) $C_6H_{13}OH$

Answer: E

34) The name of the ionic compound $RbBrO_4$ is _____.

A) rubidium bromate
B) rubidium hypobromate
C) rubidium bromide
D) rubidium perbromite
E) rubidium perbromate

Answer: E

35) When the following equation is balanced, the coefficients are _____.

$$C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$$

A) 2, 12, 8, 9 B) 4, 4, 32, 36 C) 1, 4, 8, 9 D) 2, 3, 4, 4 E) 2, 25, 16, 18

Answer: E

36) Which one of the following is not true concerning automotive air bags?

A) They are loaded with sodium azide initially
B) A gas is produced when the air bag activates.
C) They are inflated as a result of a decomposition reaction
D) The gas used for inflating them is oxygen
E) The two products of the decomposition reaction are sodium and nitrogen

Answer: D

37) Which of the following are decomposition reactions?

1) $CH_4\,(g) + O_2\,(g) \rightarrow CO_2\,(g) + H_2O\,(l)$
2) $CaO\,(s) + CO_2\,(g) \rightarrow CaCO_3\,(s)$
3) $Mg\,(s) + O_2\,(g) \rightarrow MgO\,(s)$
4) $PbCO_3\,(s) \rightarrow PbO\,(s) + CO_2\,(g)$

A) 4 only B) 1, 2, 3, and 4 C) 2, 3, and 4 D) 2 and 3 E) 1, 2, and 3

Answer: A

38) What is the mass % of carbon in dimethylsulfoxide ($C_2H_6SO$) rounded to three significant figures?

A) 60.0 B) 7.74 C) 30.7 D) 20.6 E) 79.8

Answer: C

39) Gaseous argon has a density of 1.40 g/L at standard conditions. How many argon atoms are in 1.00 L of argon gas at standard conditions?

A) $3.43 \times 10^{25}$ B) $6.02 \times 10^{23}$ C) $1.59 \times 10^{25}$ D) $2.11 \times 10^{22}$ E) $4.76 \times 10^{22}$

Answer: D

40) The total number of atoms in 0.111 mol of $Fe(CO)_3(PH_3)_2$ is _____.

A) 15.0 B) $4.46 \times 10^{21}$ C) $2.76 \times 10^{-24}$ D) $1.00 \times 10^{24}$ E) 1.67

Answer: D

41) The molecular formula of aspartame, the generic name of NutraSweet®, is $C_{14}H_{18}N_2O_5$.
The molar mass of aspartame, rounded to the nearest integer, is _____ g.

A) 43 B) 24 C) 39 D) 156 E) 294

Answer: E

42) Sulfur and oxygen react to produce sulfur trioxide. In a particular experiment, 7.9 grams of $SO_3$ are produced by the reaction of 5.0 grams of $O_2$ with 6.0 grams of S. What is the % yield of $SO_3$ in this experiment?

$S\,(s) + O_2\,(g) \rightarrow SO_3\,(g)$ (not balanced)

A) 95 B) 99 C) 63 D) 32 E) 75

Answer: A

43) The net ionic equation for formation of an aqueous solution of $NiI_2$ accompanied by evolution of $CO_2$ gas via mixing solid $NiCO_3$ and aqueous hydriodic acid is _____.

A) $2NiCO_3\ (s) + HI\ (aq) \rightarrow 2H_2O\ (l) + CO_2\ (g) + 2Ni^{2+}\ (aq)$

B) $NiCO_3\ (s) + 2HI\ (aq) \rightarrow H_2O\ (l) + CO_2\ (g) + Ni^{2+}\ (aq) + 2I^-\ (aq)$

C) $NiCO_3\ (s) + 2HI\ (aq) \rightarrow 2H_2O\ (l) + CO_2\ (g) + NiI_2\ (aq)$

D) $NiCO_3\ (s) + I^-\ (aq) \rightarrow 2H_2O\ (l) + CO_2\ (g) + Ni^{2+}\ (aq) + HI\ (aq)$

E) $NiCO_3\ (s) + 2H^+\ (aq) \rightarrow H_2O\ (l) + CO_2\ (g) + Ni^{2+}\ (aq)$

Answer: E

44) When aqueous solutions of _____ are mixed, a precipitate forms.

A) NaI and KBr

B) $Li_2CO_3$ and CsI

C) KOH and $Ba(NO_3)_2$

D) $K_2SO_4$ and $CrCl_3$

E) $NiBr_2$ and $AgNO_3$

Answer: E

45) Which combination will produce a precipitate?

A) $NH_4OH\ (aq)$ and $HCl\ (aq)$

B) $NaOH\ (aq)$ and $Fe(NO_3)_2\ (aq)$

C) $NaCl\ (aq)$ and $HC_2H_3O_2\ (aq)$

D) $AgNO_3\ (aq)$ and $Ca(C_2H_3O_2)_2\ (aq)$

E) $NaOH\ (aq)$ and $HCl\ (aq)$

Answer: B

46) Which one of the following is <u>not</u> true concerning 2.00 L of 0.100 M solution of $Ca_3(PO_4)_2$?

A) This solution contains 1.60 mol of oxygen atoms.

B) 1.00 L of this solution is required to furnish 0.300 mol of $Ca^{2+}$ ions.

C) There are $6.02 \times 10^{22}$ phosphorus atoms in 500.0 mL of this solution.

D) This solution contains 0.200 mol of $Ca_3(PO_4)_2$.

E) This solution contains $6.67 \times 10^{-2}$ mol of $Ca^{2+}$.

Answer: ~~A~~ Answer: E

47) What mass (g) of $CaF_2$ is formed when 47.8 mL of 0.334 M NaF is treated with an excess of aqueous calcium nitrate?

A) 0.623 B) 2.49 C) 0.472 D) 0.943 E) 1.25

Answer: A

48) Based on the activity series, which one of the reactions below will occur

**TABLE 4.5 Activity Series of Metals in Aqueous Solution**

| Metal | Oxidation Reaction |
|---|---|
| Lithium | $Li(s) \longrightarrow Li^+(aq) + e^-$ |
| Potassium | $K(s) \longrightarrow K^+(aq) + e^-$ |
| Barium | $Ba(s) \longrightarrow Ba^{2+}(aq) + 2e^-$ |
| Calcium | $Ca(s) \longrightarrow Ca^{2+}(aq) + 2e^-$ |
| Sodium | $Na(s) \longrightarrow Na^+(aq) + e^-$ |
| Magnesium | $Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$ |
| Aluminum | $Al(s) \longrightarrow Al^{3+}(aq) + 3e^-$ |
| Manganese | $Mn(s) \longrightarrow Mn^{2+}(aq) + 2e^-$ |
| Zinc | $Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$ |
| Chromium | $Cr(s) \longrightarrow Cr^{3+}(aq) + 3e^-$ |
| Iron | $Fe(s) \longrightarrow Fe^{2+}(aq) + 2e^-$ |
| Cobalt | $Co(s) \longrightarrow Co^{2+}(aq) + 2e^-$ |
| Nickel | $Ni(s) \longrightarrow Ni^{2+}(aq) + 2e^-$ |
| Tin | $Sn(s) \longrightarrow Sn^{2+}(aq) + 2e^-$ |
| Lead | $Pb(s) \longrightarrow Pb^{2+}(aq) + 2e^-$ |
| Hydrogen | $H_2(g) \longrightarrow 2H^+(aq) + 2e^-$ |
| Copper | $Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^-$ |
| Silver | $Ag(s) \longrightarrow Ag^+(aq) + e^-$ |
| Mercury | $Hg(l) \longrightarrow Hg^{2+}(aq) + 2e^-$ |
| Platinum | $Pt(s) \longrightarrow Pt^{2+}(aq) + 2e^-$ |
| Gold | $Au(s) \longrightarrow Au^{3+}(aq) + 3e^-$ |


A) Fe (s) + $ZnCl_2$ (aq) →$FeCl_2$ (aq) + Zn (s)

B) Pb (s) + $NiI_2$ (aq) →$PbI_2$ (aq) + Ni (s)

C) $SnBr_2$ (aq) + Cu (s) →$CuBr_2$ (aq) + Sn (s)

D) Mn (s) + $NiCl_2$ (aq) →$MnCl_2$ (aq) + Ni (s)

E) None of the reactions will occur.

Answer: D

49) What volume (mL) of $7.48 \times 10^{-2}$ M perchloric acid can be neutralized with 115 mL of 0.244 M sodium hydroxide?

A) 8.60 B) 125 C) 188 D) 375 E) 750

Answer: D

50) The molarity (M) of an aqueous solution containing 22.5 g of sucrose ($C_{12}H_{22}O_{11}$) in 35.5 mL of solution is _____.

A) 1.85 B) 0.104 C) $1.85 \times 10^{-3}$ D) 0.0657 E) 3.52

Answer: A