

112-1 Semester General Chemistry Midterm Exam (A)-20231108

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

1) Which one of the following has the element name and symbol correctly matched?

- A) Tn, tin B) Fe, iron C) S, sodium D) B, bromine E) N, neon

Answer: B

2) If matter is uniform throughout and cannot be separated into other substances by physical means, it is _____.

- A) either an element or a compound
B) an element
C) a heterogeneous mixture
D) a homogeneous mixture
E) a compound

Answer: A

3) In the following list, only _____ is not an example of a chemical reaction.

- A) a burning candle
B) the rusting of iron
C) dissolution of a penny in nitric acid
D) the condensation of water vapor
E) the formation of polyethylene from ethylene

Answer: D

4) Which one of the following is an intensive property?

- A) amount B) mass C) volume D) heat content E) temperature

Answer: E

5) Which of the following is an illustration of the law of constant composition?

- A) Water can be separated into other substances by a chemical process.
B) Water is 11% hydrogen and 89% oxygen by mass.
C) Water and salt have different boiling points.
D) Water boils at 100 °C at 1 atm pressure.
E) Water is a compound.

Answer: B

6) Of the following, _____ is the largest mass.

- A) 2.5×10^{15} pg
B) 2.5×10^{10} ng
C) 25 kg
D) 2.5×10^9 fg
E) 2.5×10^{-2} mg

Answer: C

7) Which one of the following is the highest temperature?

- A) 302 K
B) 96 °F
C) 38 °C
D) none of the above
E) the freezing point of water

Answer: C

8) Iron has a density of 7.9 g/cm^3 . What is the mass of a cube of iron with the length of one side equal to 55.0 mm?

- A) $2.1 \times 10^4 \text{ g}$ B) $4.3 \times 10^2 \text{ g}$ C) $2.3 \times 10^{-2} \text{ g}$ D) $1.3 \times 10^3 \text{ g}$ E) 1.4 g

Answer: D

9) A wooden object has a mass of 10.782 g and occupies a volume of 13.72 mL. What is the density of the object determined to an appropriate number of significant figures?

- A) $8 \times 10^{-1} \text{ g/mL}$
B) $7.9 \times 10^{-1} \text{ g/mL}$
C) $7.86 \times 10^{-1} \text{ g/mL}$
D) $7.859 \times 10^{-1} \text{ g/mL}$
E) $7.8586 \times 10^{-1} \text{ g/mL}$

Answer: D

10) Which one of the following is not one of the postulates of Dalton's atomic theory?

- A) Compounds are formed when atoms of more than one element combine; a given compound always has the same relative number and kind of atoms.
B) All atoms of a given element are identical; the atoms of different elements are different and have different properties.
C) Atoms are composed of protons, neutrons, and electrons.
D) Each element is composed of extremely small particles called atoms.
E) Atoms of an element are not changed into different types of atoms by chemical reactions: atoms are neither created nor destroyed in chemical reactions.

Answer: C

11) In the Rutherford nuclear-atom model, _____.

- A) the three principal subatomic particles (protons, neutrons, and electrons) all have essentially the same mass
B) mass is spread essentially uniformly throughout the atom
C) the three principal subatomic particles (protons, neutrons, and electrons) all have essentially the same mass and mass is spread essentially uniformly throughout the atom
D) the light subatomic particles, protons and neutrons, reside in the nucleus
E) the heavy subatomic particles, protons and neutrons, reside in the nucleus

Answer: E

12) An atom of the most common isotope of gold, ^{197}Au , has _____ protons, _____ neutrons, and _____ electrons.

- A) 79, 118, 79 B) 79, 118, 118 C) 197, 79, 118 D) 79, 197, 197 E) 118, 79, 39

Answer: A

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

$^{107}_{47}\text{Ag}$	$^{107}_{47}\text{Ag}$
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) 0.90474 C) 0.48168 D) 0.24221 E) 0.51835

Answer: E

14) Which compounds do not have the same empirical formula?

- A) $\text{C}_2\text{H}_5\text{COOCH}_3$, CH_3CHO
- B) $\text{C}_2\text{H}_4\text{O}_2$, $\text{C}_6\text{H}_{12}\text{O}_6$
- C) C_2H_2 , C_6H_6
- D) C_2H_4 , C_3H_6
- E) CO , CO_2

Answer: E

15) The element X has three naturally occurring isotopes. The isotopic masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is _____ amu.

Isotope	Abundance	Mass
^{53}X	19.61	52.62
^{56}X	53.91	56.29
^{58}X	26.48	58.31

- A) 56.11
- B) 57.23
- C) 56.29
- D) 55.74
- E) 33.33

Answer: A

16) 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) 63.8
- B) 63.2
- C) 64.1
- D) 28.1
- E) 64.8

Answer: E

17) Which formula/name pair is incorrect?

- A) $\text{Mg}(\text{MnO}_4)_2$ magnesium permanganate
- B) Mg_3N_2 magnesium nitrite
- C) $\text{Mn}(\text{NO}_2)_2$ manganese(II) nitrite
- D) $\text{Mg}(\text{NO}_3)_2$ magnesium nitrate
- E) $\text{Mn}(\text{NO}_3)_2$ manganese(II) nitrate

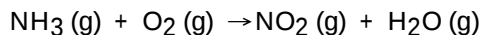
Answer: B

18) The correct name for CaH_2 is _____.

- A) calcium hydride
- B) calcium dihydride
- C) hydrocalcium
- D) calcium hydroxide
- E) calcium dihydroxide

Answer: A

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



- A) 4, 7, 4, 6
- B) 1, 1, 1, 1
- C) 4, 3, 4, 3
- D) 2, 3, 2, 3
- E) 1, 3, 1, 2

Answer: A

20) Of the reactions below, which one is a decomposition reaction?

- A) $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$
- B) $2\text{CH}_4 + 4\text{O}_2 \rightarrow 2\text{CO}_2 + 4\text{H}_2\text{O}$
- C) $2\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$
- D) $\text{NH}_4\text{Cl} \rightarrow \text{NH}_3 + \text{HCl}$
- E) $\text{Cd}(\text{NO}_3)_2 + \text{Na}_2\text{S} \rightarrow \text{CdS} + 2\text{NaNO}_3$

Answer: D

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

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

Answer: B

22) Calculate the percentage by mass of chlorine in $\text{PtCl}_2(\text{NH}_3)_2$.

- A) 18.09
- B) 25.05
- C) 23.63
- D) 12.53
- E) 11.82

Answer: C

23) A 30.5 gram sample of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) contains _____ mol of glucose.

- A) 0.424
- B) 0.169
- C) 5.90
- D) 2.36
- E) 0.136

Answer: B

24) The molecular formula of aspartame, the generic name of NutraSweet®, is $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_5$. The molar mass of aspartame, rounded to the nearest integer, is _____ g.

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

Answer: B

25) Propane (C_3H_8) reacts with oxygen in the air to produce carbon dioxide and water. In a particular experiment, 38.0 grams of carbon dioxide are produced from the reaction of 22.05 grams of propane with excess oxygen. What is the % yield in this reaction?

- A) 86.4
- B) 66.0
- C) 94.5
- D) 38.0
- E) 57.6

Answer: E

26) A compound contains 40.0% C, 6.71% H, and 53.29% O by mass. The molecular weight of the compound is 60.05 amu. The molecular formula of this compound is _____.

- A) $\text{C}_2\text{H}_4\text{O}_2$
- B) CH_2O
- C) CHO_2
- D) $\text{C}_2\text{H}_2\text{O}_4$
- E) $\text{C}_2\text{H}_3\text{O}_4$

Answer: A

27) The balanced molecular equation for complete neutralization of H_2SO_4 by KOH in aqueous solution is _____.

- A) $2\text{H}^+ (\text{aq}) + 2\text{KOH} (\text{aq}) \rightarrow 2\text{H}_2\text{O} (\text{l}) + 2\text{K}^+ (\text{aq})$
- B) $2\text{H}^+ (\text{aq}) + 2\text{OH}^- (\text{aq}) \rightarrow 2\text{H}_2\text{O} (\text{l})$
- C) $\text{H}_2\text{SO}_4 (\text{aq}) + 2\text{OH}^- (\text{aq}) \rightarrow 2\text{H}_2\text{O} (\text{l}) + \text{SO}_4^{2-} (\text{aq})$
- D) $\text{H}_2\text{SO}_4 (\text{aq}) + 2\text{KOH} (\text{aq}) \rightarrow 2\text{H}_2\text{O} (\text{l}) + \text{K}_2\text{SO}_4 (\text{s})$
- E) $\text{H}_2\text{SO}_4 (\text{aq}) + 2\text{KOH} (\text{aq}) \rightarrow 2\text{H}_2\text{O} (\text{l}) + \text{K}_2\text{SO}_4 (\text{aq})$

Answer: E

28) The net ionic equation for formation of an aqueous solution of $\text{Al}(\text{NO}_3)_3$ via mixing solid $\text{Al}(\text{OH})_3$ and aqueous nitric acid is _____.

- A) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{HNO}_3 (\text{aq}) \rightarrow 3\text{H}_2\text{O} (\text{l}) + \text{Al}(\text{NO}_3)_3 (\text{aq})$
- B) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{NO}_3^- (\text{aq}) \rightarrow 3\text{OH}^- (\text{aq}) + \text{Al}(\text{NO}_3)_3 (\text{aq})$
- C) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{H}^+ (\text{aq}) \rightarrow 3\text{H}_2\text{O} (\text{l}) + \text{Al}^{3+} (\text{aq})$
- D) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{NO}_3^- (\text{aq}) \rightarrow 3\text{OH}^- (\text{aq}) + \text{Al}(\text{NO}_3)_3 (\text{s})$
- E) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{HNO}_3 (\text{aq}) \rightarrow 3\text{H}_2\text{O} (\text{l}) + \text{Al}^{3+} (\text{aq}) + \text{NO}_3^- (\text{aq})$

Answer: C

29) The balanced net ionic equation for precipitation of CaCO_3 when aqueous solutions of Na_2CO_3 and CaCl_2 are mixed is _____.

- A) $2\text{Na}^+ (\text{aq}) + 2\text{Cl}^- (\text{aq}) \rightarrow 2\text{NaCl} (\text{aq})$
- B) $\text{Na}^+ (\text{aq}) + \text{Cl}^- (\text{aq}) \rightarrow \text{NaCl} (\text{aq})$
- C) $2\text{Na}^+ (\text{aq}) + \text{CO}_3^{2-} (\text{aq}) \rightarrow \text{Na}_2\text{CO}_3 (\text{aq})$
- D) $\text{Na}_2\text{CO}_3 (\text{aq}) + \text{CaCl}_2 (\text{aq}) \rightarrow 2\text{NaCl} (\text{aq}) + \text{CaCO}_3 (\text{s})$
- E) $\text{Ca}^{2+} (\text{aq}) + \text{CO}_3^{2-} (\text{aq}) \rightarrow \text{CaCO}_3 (\text{s})$

Answer: E 無正確答案，送分

30) Which combination will produce a precipitate?

- A) $\text{KOH} (\text{aq})$ and $\text{HNO}_3 (\text{aq})$
- B) $\text{AgC}_2\text{H}_3\text{O}_2 (\text{aq})$ and $\text{HC}_2\text{H}_3\text{O}_2 (\text{aq})$
- C) $\text{Pb}(\text{NO}_3)_2 (\text{aq})$ and $\text{HCl} (\text{aq})$
- D) $\text{NaOH} (\text{aq})$ and $\text{Sr}(\text{NO}_3)_2 (\text{aq})$
- E) $\text{Cu}(\text{NO}_3)_2 (\text{aq})$ and $\text{KC}_2\text{H}_3\text{O}_2 (\text{aq})$

Answer: C

31) Of the reactions below, only _____ is not spontaneous.

- A) $2\text{Al} (\text{s}) + 6\text{HBr} (\text{aq}) \rightarrow 2\text{AlBr}_3 (\text{aq}) + 3\text{H}_2 (\text{g})$
- B) $2\text{Ag} (\text{s}) + 2\text{HNO}_3 (\text{aq}) \rightarrow 2\text{AgNO}_3 (\text{aq}) + \text{H}_2 (\text{g})$
- C) $\text{Zn} (\text{s}) + 2\text{HI} (\text{aq}) \rightarrow \text{ZnI}_2 (\text{aq}) + \text{H}_2 (\text{g})$
- D) $\text{Mg} (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow \text{MgCl}_2 (\text{aq}) + \text{H}_2 (\text{g})$
- E) $2\text{Ni} (\text{s}) + \text{H}_2\text{SO}_4 (\text{aq}) \rightarrow \text{Ni}_2\text{SO}_4 (\text{aq}) + \text{H}_2 (\text{g})$

Answer: B

32) Which of the following is an oxidation-reduction reaction?

- A) $\text{HCl (aq)} + \text{NaOH (aq)} \rightarrow \text{H}_2\text{O (l)} + \text{NaCl (aq)}$
- B) $\text{AgNO}_3 \text{ (aq)} + \text{HCl (aq)} \rightarrow \text{AgCl (s)} + \text{HNO}_3 \text{ (aq)}$
- C) $\text{H}_2\text{CO}_3 \text{ (aq)} + \text{Ca(NO}_3)_2 \text{ (aq)} \rightarrow 2\text{HNO}_3 \text{ (aq)} + \text{CaCO}_3 \text{ (s)}$
- D) $\text{Ba(C}_2\text{H}_3\text{O}_2)_2 \text{ (aq)} + \text{Na}_2\text{SO}_4 \text{ (aq)} \rightarrow \text{BaSO}_4 \text{ (s)} + 2\text{NaC}_2\text{H}_3\text{O}_2 \text{ (aq)}$
- E) $\text{Cu (s)} + 2\text{AgNO}_3 \text{ (aq)} \rightarrow 2\text{Ag (s)} + \text{Cu(NO}_3)_2 \text{ (aq)}$

Answer: E

33) What are the respective concentrations (M) of Fe^{3+} and I^- afforded by dissolving 0.200 mol FeI_3 in water and diluting to 725 mL?

- A) 0.276 and 0.828
- B) 0.145 and 0.0483
- C) 0.276 and 0.276
- D) 0.828 and 0.276
- E) 0.145 and 0.435

Answer: A

34) What volume (L) of 0.250 M HNO_3 is required to neutralize a solution prepared by dissolving 17.5 g of NaOH in 350 mL of water?

- A) 0.070
- B) 0.44
- C) 1.75×10^{-3}
- D) 50.0
- E) 1.75

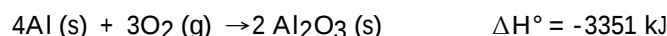
Answer: E

35) Which one of the following conditions would always result in an increase in the internal energy of a system?

- A) The system loses heat and has work done on it by the surroundings.
- B) The system loses heat and does work on the surroundings.
- C) The system gains heat and does work on the surroundings.
- D) The system gains heat and has work done on it by the surroundings.
- E) None of the above is correct.

Answer: D

36) The reaction



is _____, and therefore heat is _____ by the reaction.

- A) exothermic, released
- B) endothermic, absorbed
- C) endothermic, released
- D) exothermic, absorbed
- E) thermoneutral, neither released nor absorbed

Answer: A

37) Which one of the following is an exothermic process?

- A) boiling soup
- B) water evaporating
- C) condensation of water vapor
- D) ice melting
- E) Ammonium thiocyanate and barium hydroxide are mixed at 25 °C: the temperature drops.

Answer: C

38) For which one of the following reactions is $\Delta H^\circ_{\text{rxn}}$ equal to the heat of formation of the product?

- A) $6\text{C (s)} + 6\text{H (g)} \rightarrow \text{C}_6\text{H}_6 \text{ (l)}$
- B) $\text{N}_2 \text{ (g)} + 3\text{H}_2 \text{ (g)} \rightarrow 2\text{NH}_3 \text{ (g)}$
- C) $\text{P (g)} + 4\text{H (g)} + \text{Br (g)} \rightarrow \text{PH}_4\text{Br (l)}$
- D) $12\text{C (g)} + 11\text{H}_2 \text{ (g)} + 11\text{O (g)} \rightarrow \text{C}_6\text{H}_{22}\text{O}_{11} \text{ (g)}$
- E) $(1/2)\text{N}_2 \text{ (g)} + \text{O}_2 \text{ (g)} \rightarrow \text{NO}_2 \text{ (g)}$

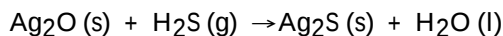
Answer: E

39) Which one of the choices below is not considered a fossil fuel?

- A) anthracite coal
- B) petroleum
- C) hydrogen
- D) natural gas
- E) crude oil

Answer: C

40) Given the data in the table below, $\Delta H^\circ_{\text{rxn}}$ for the reaction



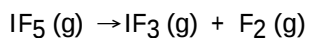
is _____ kJ.

Substance	ΔH°_f (kJ/mol)
Ag ₂ O (s)	-31.0
Ag ₂ S (s)	-32.6
H ₂ S (g)	-20.6
H ₂ O (l)	-286

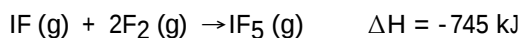
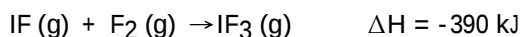
- A) -202
- B) -308
- C) -267
- D) -370
- E) More data are needed to complete the calculation.

Answer: C

41) ΔH for the reaction



is _____ kJ, give the data below.



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

Answer: D

42) The photoelectric effect is _____.

- A) the total reflection of light by metals giving them their typical luster
- B) the ejection of electrons by a metal when struck with light of sufficient energy
- C) the production of current by silicon solar cells when exposed to sunlight
- D) a relativistic effect
- E) the darkening of photographic film when exposed to an electric field

Answer: B

43) In the Bohr model of the atom, _____.

- A) electron paths are controlled by probability
- B) electrons travel in circular paths called orbitals
- C) electrons can have any energy
- D) electron energies are quantized
- E) both A and C

Answer: D

44) The uncertainty principle states that _____.

- A) it is impossible to know how many electrons there are in an atom
- B) it is impossible to know the exact position and momentum of an electron
- C) matter and energy are really the same thing
- D) there can only be one uncertain digit in a reported number
- E) it is impossible to know anything with certainty

Answer: B

45) Which of the subshells below do not exist due to the constraints upon the angular momentum quantum number?

- A) 4p
- B) 4f
- C) 4s
- D) 4d
- E) none of the above

Answer: E

46) Which quantum numbers must be the same for the orbitals that they designate to be degenerate in a one-electron system (such as hydrogen)?

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

Answer: C

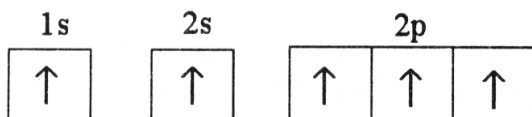
47) Which of the following is a valid set of four quantum numbers? (n , l , m_l , m_s)

- A) 2, 2, 1, $-1/2$
- B) 1, 0, 1, $+1/2$
- C) 1, 1, 0, $-1/2$
- D) 2, 1, +2, $+1/2$
- E) 2, 1, 0, $+1/2$

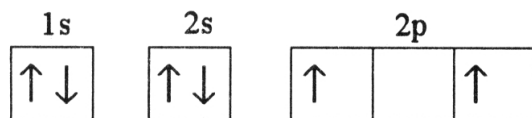
Answer: E

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

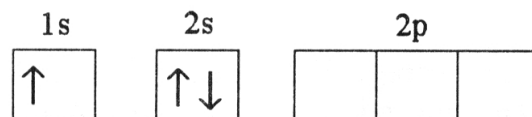
A)



B)



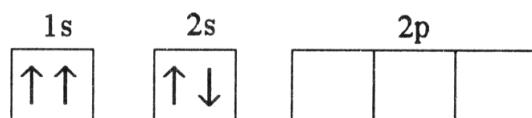
C)



D)



E)



Answer: E

49) The $n = 2$ to $n = 6$ transition in the Bohr hydrogen atom corresponds to the _____ of a photon with a wavelength of _____ nm.

R_H is the Rydberg constant $= 1.096776 \times 10^7 \text{ m}^{-1}$.

$$\frac{1}{\lambda} = (R_H) \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

- A) absorption, 410
- B) absorption, 660
- C) emission, 390
- D) emission, 410
- E) emission, 94

Answer: A

50) The total number of orbitals in a shell is given by _____.

- A) $2n + 1$
- B) $2l + 1$
- C) $2n$
- D) n^2
- E) l^2

Answer: D