1021_2nd Exam_1021113

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

1) Identify LiBr.
   A) strong acid
   B) nonelectrolyte
   C) weak acid
   D) weak electrolyte
   E) strong electrolyte

   Answer: E

2) Balance the chemical equation given below, and determine the number of milliliters of 0.00300 M phosphoric acid required to neutralize 45.00 mL of 0.00150 M calcium hydroxide.

   _____ $Ca(OH)_2(aq)$ + _____ $H_3PO_4(aq) \rightarrow$ _____ $Ca_3(PO_4)_2(aq)$ + _____ $H_2O(l)$
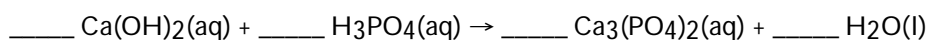
   A) 22.5 mL   B) 15.0 mL   C) 3.04 mL   D) 33.8 mL

   Answer: B

3) Which of the following signs on q and w represent a system that is doing work on the surroundings, as well as gaining heat from the surroundings?
   A) q = -, w = +
   B) q = +, w = +
   C) q = +, w = -
   D) q = -, w = -
   E) None of these represent the system referenced above.

   Answer: C

4) What is the oxidation number of the chromium atom in K_2CrO_4 ?
   A) +2   B) -2   C) +7   D) +6

   Answer: D

5) The volume of a gas is inversely proportional to the pressure of a gas is known as
   A) Ideal Gas Law
   B) Avogadro's Law
   C) Dalton's Law
   D) Boyle's Law
   E) Charles's Law

   Answer: D

6) Give the <u>complete ionic equation</u> for the reaction (if any) that occurs when aqueous solutions of lithium sulfide and copper (II) nitrate are mixed.
   A) $2 Li^+(aq) + S^{2-}(aq) + Cu^{2+}(aq) + 2 NO_3^-(aq) \rightarrow CuS(s) + 2 Li^+(aq) + 2 NO_3^-(aq)$
   B) $Li^+(aq) + S^-(aq) + Cu^+(aq) + NO_3^-(aq) \rightarrow CuS(s) + LiNO_3(aq)$
   C) $Li^+(aq) + SO_4^{2-}(aq) + Cu^+(aq) + NO_3^-(aq) \rightarrow CuS(s) + Li^+(aq) + NO_3^-(aq)$
   D) $2 Li^+(aq) + S^{2-}(aq) + Cu^{2+}(aq) + 2 NO_3^-(aq) \rightarrow Cu^{2+}(aq) + S^{2-}(aq) + 2 LiNO_3(s)$
   E) No reaction occurs.

   Answer: A

7) Identify the spectator ions in the following molecular equation.

$$LiCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + LiNO_3(aq)$$
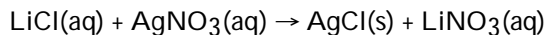
    A) Ag^+ and NO_3^-

    B) Li^+ and Cl^-

    C) Ag^+ and Cl^-

    D) Li^+ and NO_3^-

    E) There are no spectator ions in this reaction.

Answer: D

8) What is the volume of 9.783×10^{23} atoms of Kr at 9.25 atm and 512K?

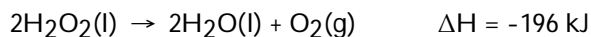   A) 1.85 L   B) 7.38 L   C) 15.4 L   D) 3.69 L   E) 30.8 L

Answer: B

9) A balloon contains 0.76 mol N_2, 0.18 mol O_2, 0.031 mol He and 0.026 mol H_2 at 749 mm Hg. What is the partial pressure of O_2?

    A) 23 mm Hg   B) 570 mm Hg   C) 140 mm Hg   D) 20 mm Hg

Answer: C

10) Hydrogen peroxide decomposes to water and oxygen at constant pressure by the following reaction:

$$2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g) \qquad \Delta H = -196 \text{ kJ}$$

Calculate the value of q (kJ) in this exothermic reaction when 4.00 g of hydrogen peroxide decomposes at constant pressure?

    A) -2.31×10^4 kJ

    B) -23.1 kJ

    C) -0.0217 kJ

    D) -11.5 kJ

    E) 1.44 kJ

Answer: D

11) When 0.455 g of anthracene, $C_{14}H_{10}$, is combusted in a bomb calorimeter that has a water jacket containing 500.0 g of water, the temperature of the water increases by 8.63°C. Assuming that the specific heat of water is 4.18 J/(g · °C), and that the heat absorption by the calorimeter is negligible, estimate the enthalpy of combustion per mole of anthracene.

    A) +39.7 kJ/mol   B) -8120 kJ/mol   C) -7060 kJ/mol   D) -39.7 kJ/mol

Answer: C

12) Using the following equation for the combustion of octane, calculate the amount of moles of carbon dioxide formed from 100.0 g of octane. The molar mass of octane is 114.33 g/mole. The molar mass of carbon dioxide is 44.0095 g/mole.

$$2\,C_8H_{18} + 25\,O_2 \rightarrow 16\,CO_2 + 18\,H_2O \qquad \Delta H°_{rxn} = -11018 \text{ kJ}$$
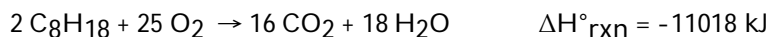
    A) 8.000 moles   B) 18.18 moles   C) 6.997 moles   D) 10.93 moles   E) 14.00 moles
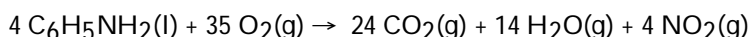
Answer: C

13) Convert 1.50 atm to torr.
   A) 1520 torr   B) 1000 torr   C) 760 torr   D) 1140 torr   E) 875 torr

   Answer: D

14) An instrument used to atmospheric pressure is called a
   A) barometer
   B) spectrometer
   C) spectrophotometer
   D) manometer
   E) sphygmomanometer

   Answer: A

15) A 6.55 g sample of aniline ($C_6H_5NH_2$, molar mass = 93.13 g/mol) was combusted in a bomb calorimeter. If the temperature rose by 32.9°C, use the information below to determine the heat capacity of the calorimeter.

   $$4\ C_6H_5NH_2(l) + 35\ O_2(g) \rightarrow\ 24\ CO_2(g) + 14\ H_2O(g) + 4\ NO_2(g)$$

   $$\Delta H°_{rxn} = -1.28 \times 10^4\ kJ$$

   A) 12.8 kJ/°C   B) 6.84 kJ/°C   C) 97.3 kJ/°C   D) 38.9 kJ/°C   E) 5.94 kJ/°C

   Answer: B

16) Two solutions, initially at 24.69°C, are mixed in a coffee cup calorimeter (C_{cal} = 105.5 J/°C). When a 200.0 mL volume of 0.100 M $AgNO_3$ solution is mixed with a 100.0 mL sample of 0.100 M NaCl solution, the temperature in the calorimeter rises to 25.16°C. Determine the $\Delta H°_{rxn}$, in units of kJ/mol AgCl. Assume that the density and heat capacity of the solutions is the same as that of water. Hint: Write a balanced reaction for the process.
   A) -25 kJ/mol AgCl
   B) -59 kJ/mol AgCl
   C) -32 kJ/mol AgCl
   D) -78 kJ/mol AgCl
   E) -64 kJ/mol AgCl

   Answer: E

17) Which of the following solutions will have the highest concentration of chloride ions?
   A) 0.40 M $MgCl_2$
   B) 0.60 M $AlCl_3$
   C) 0.40 M $CaCl_2$
   D) 0.20 M LiCl
   E) All of these solutions have the same concentration of chloride ions.

   Answer: B

18) A mixture of 10.0 g of Ne and 10.0 g Ar have a total pressure of 1.6 atm. What is the partial pressure of Ne?
   A) 1.1 atm   B) 0.54 atm   C) 0.40 atm   D) 1.3 atm   E) 0.80 atm

   Answer: A

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19) A syringe contains 589 mL of CO at 325 K and 1.2 atm pressure. A second syringe contains 473 mL of N_2 at 298 K and 2.6 atm. What is the final pressure if the contents of these two syringes are injected into a 1.00 L container at STP?

   A) 1.1 atm   B) 1.9 atm   C) 3.8 atm   D) 0.59 atm   E) 1.7 atm

Answer: E

20) Which of the following is TRUE if $\Delta E_{sys} = - 115$ J?

    A) The system is losing 115 J, while the surroundings are gaining 115 J.
    B) The system is gaining 115 J, while the surroundings are losing 115 J.
    C) Both the system and the surroundings are losing 115 J.
    D) Both the system and the surroundings are gaining 115 J.
    E) None of the above are true.

Answer: A

21) Using the following equation for the combustion of octane, calculate the heat of reaction for 400.0 g of octane. The molar mass of octane is 114.33 g/mole.

$$2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O \qquad \Delta H°_{rxn} = -11018\ kJ$$
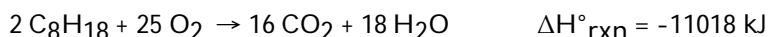
    A) 19.28 kJ   B) 19280 kJ   C) 38560 kJ   D) 50400 kJ

Answer: B

22) Identify what a coffee cup calorimeter measures.

    A) measures ΔE for oxidation reactions
    B) measures ΔT for combustion solutions
    C) measures ΔH for reduction solutions
    D) measures ΔE for hydrolysis reactions
    E) measures ΔH for aqueous solutions

Answer: E

23) What is the density of hydrogen gas at STP?

    A) 0.0450 g/L   B) 0.0899 g/L   C) 11.1 g/L   D) 0.0823 g/L
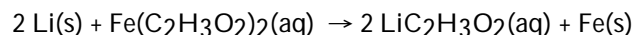
Answer: B

24) A 55.0-L steel tank at 20.0°C contains acetylene gas, C_2H_2, at a pressure of 1.39 atm. Assuming ideal behavior, how many grams of acetylene are in the tank?

    A) 3.17 g   B) 1210 g   C) 82.9 g   D) 8.20 g

Answer: C

25) Determine the reducing agent in the following reaction.

$$2\ Li(s) + Fe(C_2H_3O_2)_2(aq) \rightarrow 2\ LiC_2H_3O_2(aq) + Fe(s)$$

    A) Li   B) H   C) C   D) Fe   E) O
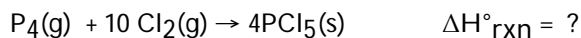
Answer: A

26) Determine the oxidation state of nitrogen in NO.
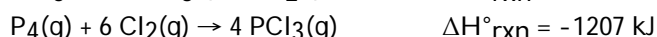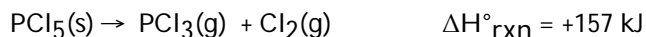
    A) 0   B) +4   C) +5   D) +2   E) +3

Answer: D

27) Use the standard reaction enthalpies given below to determine $\Delta H°_{rxn}$ for the following reaction:

$$P_4(g) + 10\ Cl_2(g) \rightarrow 4PCl_5(s) \qquad \Delta H°_{rxn} = ?$$

Given:

$$PCl_5(s) \rightarrow PCl_3(g) + Cl_2(g) \qquad \Delta H°_{rxn} = +157\ kJ$$
$$P_4(g) + 6\ Cl_2(g) \rightarrow 4\ PCl_3(g) \qquad \Delta H°_{rxn} = -1207\ kJ$$

A) -1364 kJ   B) -1786 kJ   C) -1835 kJ   D) -2100. kJ   E) -1050. kJ

Answer: C

28) How many grams of H_2 gas can be produced by the reaction of 54.0 grams of Al(s) with an excess of dilute hydrochloric acid in the reaction shown below?

$$2\ Al(s) + 6\ HCl(aq) \rightarrow 2\ AlCl_3(aq) + 3\ H_2(g)$$
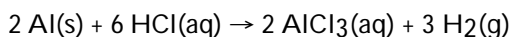
A) 2.68 g   B) 12.1 g   C) 4.04 g   D) 6.05 g

Answer: D

29) Which substance is the limiting reactant when 2.0 g of sulfur reacts with 3.0 g of oxygen and 4.0 g of sodium hydroxide according to the following chemical equation :

$$2\ S(s) + 3\ O_2(g) + 4\ NaOH(aq) \rightarrow 2\ Na_2SO_4(aq) + 2\ H_2O(l)$$
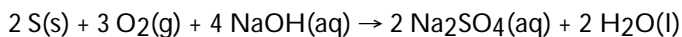
A) S(s)
 B) NaOH(aq)
 C) O$_2$(g)
 D) None of these substances is the limiting reactant.

Answer: B

30) What reagent could be used to separate Br^- from $CH_3CO_2^-$ when added to an aqueous solution containing both?

A) Ba(OH)$_2$(aq)   B) AgNO$_3$(aq)   C) CuSO$_4$(aq)   D) NaI(aq)

Answer: B

31) Calculate the temperature, in K, of 2.20 moles of gas occupying 3.30 L at 3.50 atm.

A) 28.0 K   B) -209 K   C) 337 K   D) 64.0 K

Answer: D

32) If NO and NH$_3$ are allowed to effuse through a porous membrane under identical conditions, the rate of effusion for NH$_3$ will be _____ times that of NO .

A) 0.75   B) 0.57   C) 1.3   D) 1.8

Answer: C

33) A 0.465 g sample of an unknown compound occupies 245 mL at 298 K and 1.22 atm. What is the molar mass of the unknown compound?

A) 12.2 g/mol   B) 81.8 g/mol   C) 33.9 g/mol   D) 26.3 g/mol   E) 38.0 g/mol

Answer: E

34) Determine the theoretical yield of H_2S (in moles) if 64 mol Al_2S_3 and 64 mol H_2O are reacted according to the following balanced reaction. A possibly useful molar mass is Al_2S_3 = 150.17 g/mol.

$$Al_2S_3(s) + 6\ H_2O(l) \rightarrow 2\ Al(OH)_3(s) + 3\ H_2S(g)$$
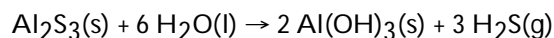
    A) 64 mol H_2S B) 32 mol H_2S C) 128 mol H_2S D) 192 mol H_2S E) 96 mol H_2S
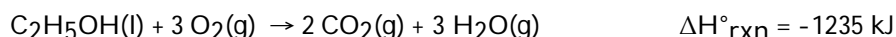
Answer: B

35) Which of the following processes is exothermic?
    A) a candle flame
    B) the vaporization of water
    C) the chemical reaction in a "cold pack" often used to treat injuries
    D) baking bread
    E) None of the above are exothermic.

Answer: A

36) A 21.8 g sample of ethanol (C_2H_5OH) is burned in a bomb calorimeter, according to the following reaction. If the temperature rises from 25.0 to 62.3°C, determine the heat capacity of the calorimeter. The molar mass of ethanol is 46.07 g/mol.

$$C_2H_5OH(l) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 3\ H_2O(g) \qquad \Delta H°_{rxn} = -1235\ kJ$$

   A) 15.7 kJ/°C   B) 63.7 kJ/°C   C) 4.99 kJ/°C   D) 5.65 kJ/°C   E) 33.1 kJ/°C

Answer: A

37) When 5.00 mol of benzene is vaporized at a constant pressure of 1.00 atm and at its normal boiling point of 80.1°C, 169.5 kJ are absorbed and $P\Delta V$ for the vaporization process is equal to 14.5 kJ then
    A) ΔE = 169.5 kJ and ΔH = 184.0 kJ.   B) ΔE = 184.0 kJ and ΔH = 169.5 kJ.
    C) ΔE = 169.5 kJ and ΔH = 155.0 kJ.   D) ΔE = 155.0 kJ and ΔH = 169.5 kJ.

Answer: D

38) A 12.8 g sample of ethanol (C_2H_5OH) is burned in a bomb calorimeter with a heat capacity of 5.65 kJ/°C. Using the information below, determine the final temperature of the calorimeter if the initial temperature is 25.0°C. The molar mass of ethanol is 46.07 g/mol.

$$C_2H_5OH(l) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 3\ H_2O(g) \qquad \Delta H°_{rxn} = -1235\ kJ$$
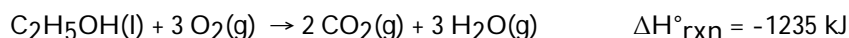
    A) 60.7°C   B) 28.1°C   C) 111°C   D) 85.7°C   E) 74.2°C

Answer: D

39) A piece of iron (mass = 25.0 g) at 398 K is placed in a styrofoam coffee cup containing 25.0 mL of water at 298 K. Assuming that no heat is lost to the cup or the surroundings, what will the final temperature of the water be? The specific heat capacity of iron = 0.449 J/g°C and water = 4.18 J/g°C.
    A) 388 K   B) 325 K   C) 308 K   D) 348 K   E) 287 K

Answer: C

40) Pure acetic acid ($HC_2H_3O_2$) is a liquid and is known as glacial acetic acid. Calculate the molarity of a solution prepared by dissolving 10.00 mL of glacial acetic acid at 25°C in sufficient water to give 500.0 mL of solution. The density of glacial acetic acid at 25°C is 1.05 g/mL.

   A) 3.50×10^{-4} M
   B) 0.350 M
   C) 21.0 M
   D) 0.0210 M
   E) 1.26×10^3 M

Answer: B