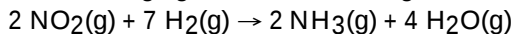


1011_2nd Exam_1011114

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

1) Identify the reducing agent in the following reaction:



- A) H_2
- B) H_2O
- C) NO_2
- D) NH_3
- E) There is no reducing agent.

Answer: A

2) Which of the following is a characteristic of an ideal gas?

- A) Individual gas particles occupy fixed volume.
- B) Collisions between gas particles and container walls are not elastic
- C) Collisions between gas particles are perfectly elastic
- D) Gas cannot be compressed infinitely.
- E) Inter-particle forces are prominent.

Answer: C

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

- A) $2 \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$
- B) $\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2(\text{g})$
- C) $\text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{NH}_4\text{OH}(\text{aq})$
- D) $\text{Mg}(\text{OH})_2(\text{s}) \rightarrow \text{Mg}^{2+}(\text{aq}) + 2 \text{OH}^-(\text{aq})$
- E) $\text{HCl}(\text{aq}) + \text{NaH}_2\text{PO}_4(\text{aq}) \rightarrow \text{H}_3\text{PO}_4(\text{aq}) + \text{NaCl}(\text{aq})$

Answer: B

4) What is the concentration of $\text{Br}^-(\text{aq})$ in a solution prepared by mixing 75.0 mL of 0.62 M iron(III) bromide with 75.0 mL of water? Assume volumes are additive.

- A) 0.31 M
- B) 1.9 M
- C) 0.93 M
- D) 0.62 M
- E) 1.23 M

Answer: C

5) $2 \text{LiOH}(\text{s}) \rightarrow \text{Li}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{l})$ $\Delta H^\circ = 379.1 \text{ kJ}$

$\text{LiH}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{LiOH}(\text{s}) + \text{H}_2(\text{g})$ $\Delta H^\circ = -111.0 \text{ kJ}$

$2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{l})$ $\Delta H^\circ = -285.9 \text{ kJ}$

Compute ΔH° in kJ for $2 \text{LiH}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{Li}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{l})$

- A) -17.7 kJ
- B) -128.8 kJ
- C) -303.6 kJ
- D) +125.2 kJ
- E) +128.8 kJ

Answer: B

6) An automobile tire at 32.0 psi at 25.0°C is driven on a trip. At the end of the trip the pressure is 35.0 psi. What is the temperature of the tire in degrees Celsius?

- A) 27.3 °C
- B) 57.0 °C
- C) 60.0 °C
- D) 22.8 °C
- E) 52.9 °C

Answer: E

- 7) Subtracting the vapor pressure of water from the total pressure of a gas collected over water is an example of the application of:
- A) Dalton's Law
 - B) Avogadro's Hypothesis
 - C) Graham's Law
 - D) ideal gas law
 - E) van der Waals Theory

Answer: A

- 8) Coal contains an impurity that reacts with oxygen during the combustion process, producing oxides that are major environmental pollutants. This impurity is:
- A) carbon dioxide
 - B) sulfur
 - C) nitrogen
 - D) peat
 - E) acid rain

Answer: B

- 9) The standard enthalpy of formation of $\text{NiSO}_4(\text{s})$ at 25°C is -872.9 kJ/mole . The chemical equation to which this value applies is:
- A) $\text{Ni}(\text{s}) + \text{S}(\text{s}) + 2\text{O}_2(\text{g}) \rightarrow \text{NiSO}_4(\text{s})$
 - B) $\text{NiSO}_4(\text{s}) \rightarrow \text{Ni}(\text{s}) + \text{S}(\text{s}) + 4\text{O}(\text{g})$
 - C) $\text{Ni}(\text{s}) + 1/8\text{S}_8(\text{s}) + 1/2\text{O}_2(\text{g}) \rightarrow \text{NiSO}_4(\text{s})$
 - D) $\text{Ni}(\text{s}) + \text{S}(\text{s}) + 4\text{O}(\text{g}) \rightarrow \text{NiSO}_4(\text{s})$
 - E) $1/2\text{Ni}(\text{s}) + 1/2\text{S}(\text{s}) + 1/2\text{O}_2(\text{g}) \rightarrow 1/2\text{NiSO}_4(\text{s})$

Answer: A

- 10) A disproportionation reaction is one in which:
- A) water must be added
 - B) both reactants are reduced
 - C) the equation is not balanced
 - D) the same substance is oxidized and reduced
 - E) more of one substance reacts than another

Answer: D

- 11) What is the final temperature in the bomb calorimeter if 1.785 grams of benzoic acid ($\text{HC}_7\text{H}_5\text{O}_2$) is combusted in a calorimeter with a heat capacity of $5.02\text{ kJ/}^\circ\text{C}$ and initial temperature of 24.62°C ? The heat of combustion of benzoic acid is -26.42 kJ/g .
- A) 34.0°C B) 31.2°C C) 15.5°C D) 51.0°C E) 29.8°C

Answer: A

- 12) To increase the volume of a fixed amount of gas from 100 cm^3 to 200 cm^3 :
- A) increase the temperature from 25.0 to 50.0°C at constant pressure
 - B) reduce the temperature from 400 K to 200 K at constant pressure
 - C) increase the pressure from 1.00 to 2.00 atm at constant temperature
 - D) reduce the pressure from 608 mm Hg to 0.40 atm at constant temperature
 - E) decrease the temperature from 600 K to 400 K

Answer: D

13) Which of the following combinations is correct?

- A) HNO_3 /weak acid
- B) H_3PO_4 /strong acid
- C) NaOH /weak base
- D) NH_3 /strong base
- E) HClO_4 /strong acid

Answer: E

14) A 10.0 L container of unknown gas at 25.0°C contains 87.1 g of gas at 12.5 atm. What gas is in the container?

- A) NH_3
- B) SO_2
- C) C_2H_2
- D) F_2
- E) NO_2

Answer: A

15) Select a statement that best describes the oxidation process.

- A) In oxidation process some elements experience oxidation state increase.
- B) In oxidation process some elements change their oxidation state.
- C) In oxidation process all elements change oxidation state.
- D) In oxidation process only oxygen increases its oxidation state.
- E) In oxidation process all elements experience an increase in oxidation state.

Answer: A

16) The statement, "For a fixed mass of gas at constant temperature, gas volume is inversely proportional to gas pressure." is known as:

- A) Boyle's Law
- B) Kelvin's Law
- C) Charles' Law
- D) Graham's Law
- E) Avogadro's Law

Answer: A

17) The substance $\text{C}_5\text{H}_5\text{OH}$ in water solution is a:

- A) strong electrolyte
- B) strong base
- C) strong acid
- D) weak electrolyte
- E) nonelectrolyte

Answer: E

18) Choose the INCORRECT statement.

- A) Net ionic equations include only the actual participants of the reaction.
- B) An acid produces hydride ions in solution.
- C) A precipitate is formed when certain anions and cations react to form an insoluble ionic solid.
- D) Most molecular compounds are either nonelectrolytes or weak electrolytes.
- E) Most ionic compounds are strong electrolytes.

Answer: B

19) In which of the following pairs is the oxidation number for the underlined element INCORRECT?

- A) $\underline{\text{Cl}}\text{O}_4^-$ /(+7)
- B) $\underline{\text{C}}\text{O}_2$ /+4
- C) $\text{H}\underline{\text{C}}\text{O}_3^-$ /+3
- D) $\underline{\text{S}}_2\text{O}_3^{2-}$ /+2
- E) $\underline{\text{Fe}}_2\text{O}_3$ /+3

Answer: C

20) For the reaction $\text{H}_2(\text{g}) + 1/2 \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g})$ $\Delta H^\circ = -241.8 \text{ kJ/mol}$,
what mass of $\text{H}_2(\text{g})$ is required to liberate $1.00 \times 10^3 \text{ kJ}$ of heat?

- A) 8.34 g B) 66.2 g C) 2.05 g D) 4.17 g E) 16.7 g

Answer: A

21) Consider the reaction: $\text{CO}_2(\text{g}) + 2\text{HCl}(\text{g}) \rightarrow \text{COCl}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
 ΔH°_f -393.51 -92.30 -223.01 -285.85 kJ/mol

Compute ΔH° for this reaction.

- A) -69.25 kJ B) 23.05 kJ C) -994.67 kJ D) -23.05 kJ E) 69.25 kJ

Answer: E

22) Which of the following is probably the poorest electrical conductor?

- A) 0.5 M CH_3OH
B) 0.5 M NH_3
C) 0.5 M K_2SO_4
D) 0.5 M HF
E) 0.5 M CaCl_2

Answer: A

23) The heat of combustion of several fuels are listed in the table below. On a per gram basis, which fuel releases the most energy?

Fuel	ΔH_{comb} (kJ/mole)
C(s)	-393.5
$\text{CH}_4(\text{g})$	-890.8
$\text{CH}_3\text{OH}(\text{l})$	726.1
$\text{C}_3\text{H}_8(\text{g})$	2219.2
$\text{H}_2(\text{g})$	-285.8

- A) $\text{CH}_4(\text{g})$ B) C(s) C) $\text{C}_3\text{H}_8(\text{g})$ D) $\text{CH}_3\text{OH}(\text{l})$ E) $\text{H}_2(\text{g})$

Answer: E

24) Choose the INCORRECT statement.

- A) Heat moves from a warmer body to a colder one.
B) Kinetic energy is the energy of motion.
C) Heat is energy transferred as a result of a temperature difference.
D) Potential energy is energy in action.
E) Pressure volume work is calculated by $w = P \cdot V$.

Answer: D

25) What volume of 0.38 M hydrochloric acid is required for complete neutralization of 15 mL of 0.19 M calcium hydroxide?

- A) 30 mL B) 19 mL C) 7.5 mL D) 15 mL E) 38 mL

Answer: D

26) The fact that a balloon filled with helium will leak more slowly than one filled with hydrogen is explained by citing:

- A) van der Waals Theory
- B) Graham's Law
- C) ideal gas law
- D) Avogadro's Hypothesis
- E) Dalton's Law

Answer: B

27) Lead, water, sulfur, and arsenic have specific heats of 0.128, 4.18, 0.706, and 0.329 J g⁻¹°C⁻¹, respectively. Which of the following would need the smallest quantity of heat to change the temperature of 5 g by 10°C?

- A) water
- B) lead
- C) arsenic
- D) sulfur

Answer: B

28) 53.5 g of an ideal gas of molecular weight = 30.5 g/mol is confined at a pressure of 133 mmHg. The density of the gas is 0.228 g/L. Compute the temperature of the gas in degrees Celsius.

- A) 285°C
- B) 261°C
- C) -12.°C
- D) -57°C
- E) 12.°C

Answer: E

29) Oxygen gas at 34.5°C expands from 34.5 L to 45.7 L against a constant pressure of 750 mmHg. What is the work done in joules by the system?

- A) 1.12×10^3 J
- B) -1.12×10^3 J
- C) 4.55×10^3 J
- D) -9.09×10^4 J
- E) 9.09×10^4 J

Answer: B

30) 500 g of Al is heated to 100.0°C and dropped into a 100.0 g glass beaker that contains 200.0 g of H₂O. The temperature of the glass and water is 20.0°C. What is the final temperature? (Specific heat of Al = 0.29 J/g °C, specific heat of glass = 0.84 J/g °C)

- A) 50.0 °C
- B) 28.9 °C
- C) 30.9 °C
- D) 25.0 °C
- E) 46.6 °C

Answer: C

31) A 1.37 L vessel contains He at a temperature of 24.5°C and a pressure of 205 mmHg. A 721 mL vessel contains Ne at a temperature of 36.2°C and a pressure of 0.185 atm. Both of these gases are placed in a 2.00 L vessel at 302 K. What is the final pressure (in atm) in the 2.00 L vessel?

- A) 0.0657 atm
- B) 0.455 atm
- C) 0.390 atm
- D) 0.187 atm
- E) 0.250 atm

Answer: E

32) Calculate the height in meters of a column of liquid ethanol (density = 0.7893 g/cm³) required to exert the same pressure as 760 mmHg (d = 13.60 g/cm³).

- A) 1.31×10^4 m
- B) 0.0708 m
- C) 70.8 m
- D) 44.1 m
- E) 13.1 m

Answer: E

33) How much heat is needed to raise the temperature of 5.28 gal of water from 25.0°C to 88.0°C (1 gal = 3.785 L)?

- A) 997 kJ
- B) 133 kJ
- C) 1390 kJ
- D) 5260 kJ
- E) 316 kJ

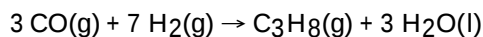
Answer: D

34) Which of the following solutions has the highest fluoride concentration?

- A) a solution having 1.5 mg F⁻/L
- B) 0.05 M CaF₂
- C) a solution having 0.06 M F⁻
- D) 2.1 mg NaF/L
- E) 0.05 M NaF

Answer: B

35) Calculate the volume of H₂(g) expressed at STP, required to react with 3.00 L of CO(g) at STP in the following reaction:



- A) 7.00 L
- B) 22.4 L
- C) 1.00 L
- D) 10.0 L
- E) 3.00 L

Answer: A

36) How much heat is required to raise the temperature of 175 g of aluminum from 21.0°C to 145°C? The specific heat of aluminum is 0.903 J g⁻¹ °C⁻¹.

- A) 1.27 J
- B) 22.9 kJ
- C) 24.0 kJ
- D) 19.6 kJ

Answer: D

37) The relationship between the "absolute temperature" on the Kelvin scale and the Celsius temperature is given by:

- A) $T(\text{K}) = t(^{\circ}\text{C}) + 273.15$
- B) $T(\text{K}) = 5/8[t(^{\circ}\text{C})] - 32$
- C) $t(^{\circ}\text{C}) = T(\text{K}) + 273.15$
- D) $T(\text{K}) = 8/5[t(^{\circ}\text{C})] + 32$
- E) $t(^{\circ}\text{C}) = 98.6 + T(\text{K})$

Answer: A

38) Enthalpy is defined as:

- A) the sum of the kinetic and potential energies
- B) the heat of combustion
- C) the work not limited to pressure volume work
- D) the energy contained within a system
- E) the sum of the internal energy and the pressure-volume product of a system

Answer: E

39) If someone were to light a cigar at one end of a closed room, persons at the other end of the room might soon perceive an odor due to gaseous emissions from the cigar. Such a phenomenon is an example of:

- A) effusion
- B) barometry
- C) diffusion
- D) ideality
- E) monometry

Answer: C

40) Write the net ionic equation for the reaction of ammonium chloride and iron(III) hydroxide.

- A) $3 \text{ NH}_4^+ + \text{Fe(OH)}_3\text{(s)} \rightarrow 3 \text{ NH}_3\text{(aq)} + 3 \text{ H}_2\text{O} + \text{Fe}^{3+}$
- B) $3 \text{ NH}_4^+ + 3 \text{ OH}^- \rightarrow 3 \text{ NH}_3\text{(aq)} + 3 \text{ H}_2\text{O}$
- C) $3 \text{ NH}_4\text{Cl(aq)} + \text{Fe(OH)}_3\text{(s)} \rightarrow 3 \text{ NH}_3\text{(aq)} + 3 \text{ H}_2\text{O} + \text{FeCl}_3$
- D) $3 \text{ NH}_4\text{Cl(aq)} + 3 \text{ OH}^- \rightarrow 3 \text{ NH}_3\text{(aq)} + 3 \text{ H}_2\text{O} + 3 \text{ Cl}^-$
- E) no reaction

Answer: A

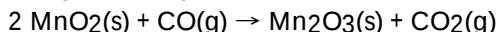
41) Choose the INCORRECT statement.

- A) The specific heat is the heat capacity for one mole of substance.
- B) The heat capacity is the quantity of heat required to change the temperature of the system by one degree.
- C) Temperatures of two bodies are equal when the average kinetic energies of the two bodies become the same.
- D) Most metals have low specific heats, as metals can be heated quickly.
- E) The law of conservation of energy can be written: $q_{\text{system}} + q_{\text{surroundings}} = 0$.

Answer: A

42) Given the reactions below, compute ΔH° for the reaction:

(ΔH° 's are all given in kJ)

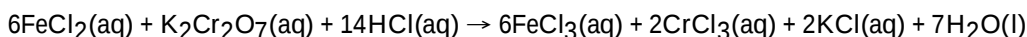


Reaction	$\Delta H^\circ_{\text{rxn}}$
$\text{MnO}_2(\text{s}) + \text{CO}(\text{g}) \rightarrow \text{MnO}(\text{s}) + \text{CO}_2(\text{g})$	- 150.6
$\text{Mn}_3\text{O}_4(\text{s}) + \text{CO}(\text{g}) \rightarrow 3 \text{MnO}(\text{s}) + \text{CO}_2(\text{g})$	- 54.4
$3 \text{Mn}_2\text{O}_3(\text{s}) + \text{CO}(\text{g}) \rightarrow 2 \text{Mn}_3\text{O}_4(\text{s}) + \text{CO}_2(\text{g})$	- 142.3

- A) -46.1 kJ B) -104.5 kJ C) -347.3 kJ D) -217.1 kJ E) -389.1 kJ

Answer: D

43) Iron in the form FeCl_2 can be determined by titration with potassium dichromate:



An iron sample of mass 0.800 g required 18.80 mL of 0.0120 M $\text{K}_2\text{Cr}_2\text{O}_7(\text{aq})$ to reach the end point. How many moles of FeCl_2 were in the sample?

- A) 1.13×10^{-4} mol
- B) 2.26×10^{-4} mol
- C) 3.75×10^{-5} mol
- D) 1.43×10^{-2} mol
- E) 1.35×10^{-3} mol

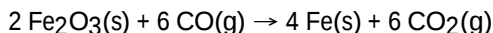
Answer: E

44) The energy of molecules of a gas:

- A) is the same for all molecules at constant temperature
- B) increases with a decrease in temperature
- C) increases with an increase in pressure
- D) is dependent on concentration
- E) is distributed over a wide range at constant temperature

Answer: E

45) Calculate the enthalpy change for the following reaction at 25°C. The value of ΔH°_f in kJ/mol is given below each species:



-824.2 -110.5 0 -393.5

- A) -49.6 kJ B) -3350 kJ C) 541 kJ D) -24.8 kJ E) -1380 kJ

Answer: A

46) What is the ratio of the diffusion rates of Cl_2 and O_2 ? Rate $\text{Cl}_2 : \text{O}_2 =$

- A) 0.67 B) 0.45 C) 0.69 D) 0.47 E) 1.5

Answer: A

47) To have a standard enthalpy of formation referenced to 0 J/mol, the substance must:

- I) be a simple substance (chemical element)
- II) be in its most stable form
- III) be under 1 atm of pressure
- IV) have a concentration of 1.0000 M

A) II, IV B) I, III C) I, III, IV D) II, III, IV E) I, II, III

Answer: E

48) Which statement below best describes net ionic equations?

- A) A net ionic reaction is a balanced chemical equation that clearly shows spectator ions in a reaction.
- B) A net ionic equation is obtained when the ions forming the precipitate are removed from the molecular equation.
- C) A net ionic equation lists all ions in the solution.
- D) A net ionic equation is a balanced chemical equation that includes only ions that actually participate in a reaction.
- E) A net ionic equation is a balanced chemical equation that includes all the ions present in a reaction mixture.

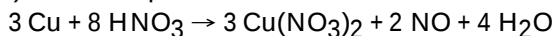
Answer: D

49) What mass of water vapor would occupy a volume of 54 L at 200°C and 76 torr, assuming ideal behavior?

A) 1.8 g B) 5.4 g C) 4.3 g D) 7.2 g E) 2.5 g

Answer: E

50) A 0.411 g sample of powdered copper mixed with an inert, soluble additive was fully consumed by 23.4 mL of 0.602 M nitric acid, producing copper(II) nitrate, water, and nitric oxide (NO) gas. What was the percent copper (by mass) in the sample?



A) 34.4% B) 68.3% C) 56.9% D) 65.3% E) 81.7%

Answer: E