

# Chemistry 1411

## Test-2 Review

Q.1 Consider two organic molecules, ethanol and benzene. One dissolves in water and the other does not.

Why?

- A) They have different molar masses.
- B) One is ionic, the other is not.
- C) One is an electrolyte, the other is not.
- D) Ethanol contains a polar O–H bond, and benzene does not.
- E) Two of these are correct.

Q.2 unknown substance dissolves readily in water but not in benzene (a nonpolar solvent). Molecules of what type are present in the substance?

- A) neither polar nor nonpolar
- B) polar
- C) either polar or nonpolar
- D) nonpolar
- E) none of these

Q.3 Which of the following is *not* a strong base?

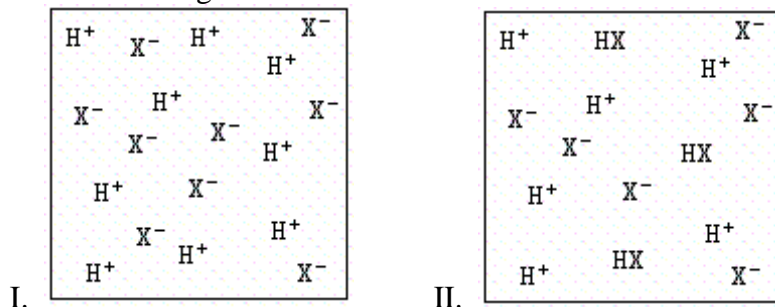
- A)  $\text{Ca}(\text{OH})_2$
- B)  $\text{KOH}$
- C)  $\text{NH}_3$
- D)  $\text{LiOH}$
- E)  $\text{Sr}(\text{OH})_2$

Q.4 Which of the following is paired incorrectly?

- A)  $\text{H}_2\text{SO}_4$  – strong acid
- B)  $\text{HNO}_3$  – weak acid
- C)  $\text{Ba}(\text{OH})_2$  – strong base
- D)  $\text{HCl}$  – strong acid
- E)  $\text{NH}_3$  – weak base

Q.5 Solid acid  $\text{HX}$  is mixed with water. Two possible solutions can be obtained.

Which of the following is true?



- A) In case I,  $\text{HX}$  is acting like a weak acid, and in case II,  $\text{HX}$  is acting like a strong acid.
- B) In case I,  $\text{HX}$  is acting like a strong acid, and in case II,  $\text{HX}$  is acting like a weak acid.

- C) In both cases, HX is acting like a strong acid.
- D) In both cases, HX is acting like a weak acid.
- E) HX is not soluble in water.

Q.6 6.4-g sample of HF is dissolved in water to give  $2.0 \times 10^2$  mL of solution. The concentration of the solution is:

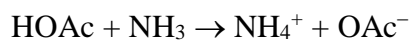
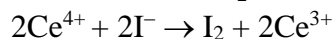
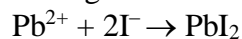
- Q.7 1.00 mL of a  $3.50 \times 10^{-4}$  M solution of oleic acid is diluted with 9.00 mL of petroleum ether, forming solution A. Then 2.00 mL of solution A is diluted with 8.00 mL of petroleum ether, forming solution B. What is the concentration of solution B?
- A)  $3.50 \times 10^{-6}$  M
  - B)  $9.72 \times 10^{-6}$  M
  - C)  $7.00 \times 10^{-5}$  M
  - D)  $7.78 \times 10^{-5}$  M
  - E)  $7.00 \times 10^{-6}$  M

Q.8 What mass of calcium chloride,  $\text{CaCl}_2$ , is needed to prepare 3.950 L of a 1.49 M solution?

Q.9 What mass of solute is contained in 256 mL of a 0.838 M ammonium chloride solution?

- Q.10 You have equal masses of different solutes dissolved in equal volumes of solution. Which of the solutes would make the solution having the highest molar concentration?
- A) NaOH
  - B) KCl
  - C) KOH
  - D) LiOH
  - E) all the same

Q.11 following reactions:



are examples of

- A) acid-base reactions
  - B) unbalanced reactions
  - C) precipitation, acid-base, and redox reactions, respectively
  - D) redox, acid-base, and precipitation reactions, respectively
  - E) precipitation, redox, and acid-base reactions, respectively
- Q.12 Which of the following salts is insoluble in water?

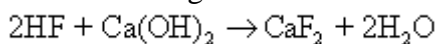
- A)  $\text{Na}_2\text{S}$
- B)  $\text{K}_2\text{CO}_3$
- C)  $\text{Pb}(\text{NO}_3)_2$
- D)  $\text{CaCl}_2$
- E) All of these are soluble in water.

Q.13 Consider an aqueous solution of calcium nitrate added to an aqueous solution of sodium phosphate. What is the formula of the solid formed in the reaction?

- A)  $\text{Ca}(\text{PO}_4)_2$
- B)  $\text{CaPO}_4$
- C)  $\text{Ca}_3(\text{PO}_4)_2$
- D)  $\text{Ca}_3(\text{PO}_3)_2$
- E) none of these

Q.14 You have 88.6 mL of a 2.50 M solution of  $\text{Na}_2\text{CrO}_4(\text{aq})$ . You also have 125 mL of a 2.50 M solution of  $\text{AgNO}_3(\text{aq})$ . Calculate the concentration of  $\text{Na}^+$  after the two solutions are mixed together.

Q.15 With what volume of 5.00 M HF will 4.72 g of calcium hydroxide react completely, according to the following reaction?



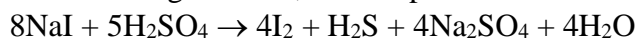
Q.16 The oxidation state of iodine in  $\text{IO}_3^-$  is:

- A) 0
- B) +3
- C) -3
- D) +5
- E) -5

Q.17 In the reaction  $2\text{Cs}(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{CsCl}(\text{s})$ ,  $\text{Cl}_2$  is

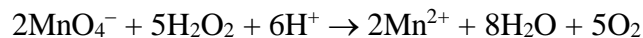
- A) the reducing agent
- B) the oxidizing agent
- C) oxidized
- D) the electron donor
- E) two of these

Q.18 In the following reaction, which species is oxidized?



- A) sodium
- B) iodine
- C) sulfur
- D) hydrogen
- E) Oxygen

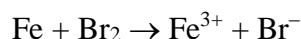
Q.19 Given the reaction:



determine the number of electrons involved in this reaction.

- A) 10
- B) 8
- C) 6
- D) 4
- E) 2

Q.20 Balance the following oxidation-reduction reaction using the oxidation number method:



Q.21 Which of the following would represent the *greatest* pressure?

- A) 0.680 atm
- B) 517 mmHg
- C) 11.4 psi
- D) 62106 Pa
- E) 14.1 in Hg

Q.22 A gas sample is held at constant pressure. The gas occupies 3.62 L of volume when the temperature is 21.6°C. Determine the temperature at which the volume of the gas is 3.42 L.

- A) 312 K
- B) 278 K
- C) 20.4 K
- D) 295 K
- E) 552 K

Q.23 Gaseous chlorine is held in two separate containers at identical temperature and pressure. The volume of container 1 is 1.30 L, and it contains 6.70 mol of the gas. The volume of container 2 is 2.33 L. How many moles of the gas are in container 2?

- A) 12.0 mol
- B) 20.3 mol
- C) 0.452 mol
- D) 3.74 mol
- E) none of these

Q.24 Consider a sample of gas in a container on a comfortable spring day. The Celsius temperature suddenly doubles, and you transfer the gas to a container with twice the volume of the first container. If the original pressure was 12 atm, what is a good estimate for the new pressure?

- A) 3 atm
- B) 5.5 atm
- C) 6.4 atm
- D) 12 atm
- E) 15 atm

Q.25 You are holding four identical balloons each containing 10.0 g of a different gas. The balloon containing which gas is the largest balloon?

- A) H<sub>2</sub>

- B) He
- C) Ne
- D) O<sub>2</sub>
- E) All have the same volume.

Q.26 You fill a balloon with 2.50 moles of gas at 22°C at a pressure of 1.62 atm. What is the volume of the balloon?

- A) 15.7 L
- B) 98.0 L
- C) 37.4 L
- D) 2.79 L
- E) 22.4 L

Q.27 A 3.60 L sample of carbon monoxide is collected at 55°C and 0.869 atm. What volume will the gas occupy at 1.05 atm and 25°C?

- A) 1.35 L
- B) 3.95 L
- C) 2.71 L
- D) 3.28 L
- E) none of these

Q.28 What conditions of  $P$ ,  $T$ , and  $n$ , respectively, are most ideal?

- A) high  $P$ , high  $T$ , high  $n$
- B) low  $P$ , low  $T$ , low  $n$
- C) high  $P$ , low  $T$ , high  $n$
- D) low  $P$ , high  $T$ , high  $n$
- E) low  $P$ , high  $T$ , low  $n$

Q.29 Sample of 35.1 g of methane gas has a volume of 3.11 L at a pressure of 2.70 atm. Calculate the temperature.

- A) 2.92 K
- B) 46.8 K
- C) 320 K
- D) 32.4 K
- E) 35.0 K

Q.30 Which two variables are *directly* proportional to each other (if all other conditions remain constant)?

1.  $T$  and  $n$
2.  $V$  and  $n$
3.  $V$  and  $T$

- A) 1 only
- B) 2 only
- C) 3 only
- D) 1 and 2 only

E) 2 and 3 only

Q.31 Which gas has the highest density?

- A) He
- B) Cl<sub>2</sub>
- C) CH<sub>4</sub>
- D) NH<sub>3</sub>
- E) all gases the same

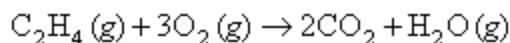
Q.32 It is found that 250. mL of a gas at STP has a mass of 0.700 g. What is the molar mass?

- A) 62.7 g/mol
- B) 2.80 g/mol
- C) 15.9 g/mol
- D) 11.2 g/mol
- E) 128 g/mol

Q.33 In the reaction  $2\text{NH}_3(\text{g}) + 3\text{Cl}_2(\text{g}) \rightarrow \text{N}_2(\text{g}) + 6\text{HCl}(\text{g})$ , you react 5.0 L of NH<sub>3</sub> with 5.0 L of Cl<sub>2</sub> measured at the same conditions in a closed container. Calculate the ratio of pressures in the container ( $P_{\text{final}}/P_{\text{initial}}$ ).

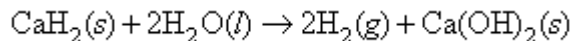
- A) 0.75
- B) 1.00
- C) 1.33
- D) 1.50
- E) none of these

Q.34 Gaseous C<sub>2</sub>H<sub>4</sub> reacts with O<sub>2</sub> according to the following equation:



What volume of oxygen gas at STP is needed to react with 5.75 mol of C<sub>2</sub>H<sub>4</sub>

Q.35 Calcium hydride combines with water according to the equation:



Beginning with 84.0 g of CaH<sub>2</sub> and 42.0 g of H<sub>2</sub>O, what volume of H<sub>2</sub> will be produced at 273 K and a pressure of 1327 torr?

Q.36 Gaseous mixture containing 1.5 mol Ar and 3.5 mol CO<sub>2</sub> has a total pressure of 7.3 atm. What is the partial pressure of CO<sub>2</sub>?

- A) 2.2 atm
- B) 1.4 atm
- C) 17 atm
- D) 5.1 atm
- E) 7.3 atm

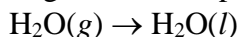
Q.37 Following are postulates of the kinetic-molecular theory of gases *except*:

- A) The collisions between molecules are elastic.
- B) The gas molecules are in constant motion.
- C) At a constant temperature, each molecule has the same kinetic energy.
- D) The volumes of the molecules are negligible compared with the volume of the container.
- E) The gas molecules are in rapid motion.

Q.38 Rate of effusion of an unknown gas was measured and found to be 11.9 mL/min. Under identical conditions, the rate of effusion of pure oxygen (O<sub>2</sub>) gas is 14.0 mL/min. Based on this information, the identity of the unknown gas could be:

- A) F<sub>2</sub>
- B) NO
- C) CO<sub>2</sub>
- D) C<sub>2</sub>H<sub>2</sub>
- E) none of these

Q.39 of the following statements correctly describes the signs of  $q$  and  $w$  for the following exothermic process at  $P = 1$  atm and  $T = 370$  K?

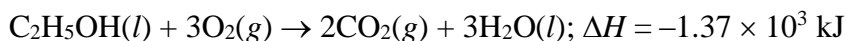


- A)  $q$  and  $w$  are negative.
- B)  $q$  is positive,  $w$  is negative.
- C)  $q$  is negative,  $w$  is positive.
- D)  $q$  and  $w$  are both positive.
- E)  $q$  and  $w$  are both zero.

Q.40 Calculate the work associated with the compression of a gas from 121.0 L to 80.0 L at a constant pressure of 13.1 atm.

- A) -537 L atm
- B) 537 L atm
- C) 3.13 L atm
- D) -3.13 L atm
- E) 101 L atm

Q.41 Consider the reaction:



Consider the following propositions:

- I. The reaction is endothermic
- II. The reaction is exothermic.
- III. The enthalpy term would be different if the water formed was gaseous.

Which of these propositions is (are) true?

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

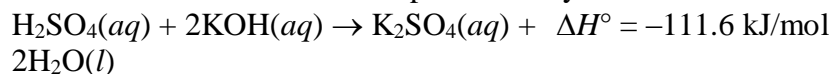
Q.42 A 45.9 g sample of a metal is heated to 95.2°C and then placed in a calorimeter containing 120.0 g of water ( $c = 4.18 \text{ J/g}^\circ\text{C}$ ) at 21.6°C. The final temperature of the water is 24.5°C. Which metal was used?

- A) Aluminum ( $c = 0.89 \text{ J/g}^\circ\text{C}$ )
- B) Iron ( $c = 0.45 \text{ J/g}^\circ\text{C}$ )
- C) Copper ( $c = 0.20 \text{ J/g}^\circ\text{C}$ )
- D) Lead ( $c = 0.14 \text{ J/g}^\circ\text{C}$ )
- E) none of these

Q.43 A bomb calorimeter has a heat capacity of 2.47 kJ/K. When a 0.109-g sample of ethylene ( $\text{C}_2\text{H}_4$ ) was burned in this calorimeter, the temperature increased by 2.22 K. Calculate the energy of combustion for one mole of ethylene.

- A)  $-5.29 \text{ kJ/mol}$
- B)  $-50.3 \text{ kJ/mol}$
- C)  $-636 \text{ kJ/mol}$
- D)  $-0.269 \text{ kJ/mol}$
- E)  $-1.41 \times 10^3 \text{ kJ/mol}$

Q.44 What is the enthalpy change when 49.4 mL of 0.430 M sulfuric acid reacts with 23.3 mL of 0.309 M potassium hydroxide?



- A)  $-0.402 \text{ kJ}$
- B)  $-3.17 \text{ kJ}$
- C)  $-2.37 \text{ kJ}$
- D)  $-0.803 \text{ kJ}$
- E)  $-112 \text{ kJ}$

Q.45 Given the following processes:

	$\Delta H$ (kJ/mol)
$3\text{B} \rightarrow 2\text{C} + \text{D}$	-125
$(1/2)\text{A} \rightarrow \text{B}$	150
$\text{E} + \text{A} \rightarrow \text{D}$	350

Calculate  $\Delta H$  for:  $\text{B} \rightarrow \text{E} + 2\text{C}$

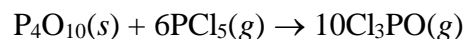


- A) 325 kJ/mol
- B) 525 kJ/mol
- C) -175 kJ/mol
- D) -325 kJ/mol
- E) none of these

Q.46 Given the heats of the following reactions:

	$\Delta H^\circ(\text{kJ})$
I. $\text{P}_4(\text{s}) + 6\text{Cl}_2(\text{g}) \rightarrow 4\text{PCl}_3(\text{g})$	-1225.6
II. $\text{P}_4(\text{s}) + 5\text{O}_2(\text{g}) \rightarrow \text{P}_4\text{O}_{10}(\text{s})$	-2967.3
III. $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5(\text{g})$	-84.2
IV. $\text{PCl}_3(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{Cl}_3\text{PO}(\text{g})$	-285.7

Calculate the value of  $\Delta H^\circ$  for the reaction below:



- A) -110.5 kJ
- B) -610.1 kJ
- C) -2682.2 kJ
- D) -7555.0 kJ
- E) None of these is within 5% of the correct answer.

Q. 47 The heat of combustion of acetylene,  $\text{C}_2\text{H}_2(\text{g})$ , at  $25^\circ\text{C}$  is  $-1299 \text{ kJ/mol}$ . At this temperature,  $\Delta H_f^\circ$  values for  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{l})$  are  $-393$  and  $-286 \text{ kJ/mol}$ , respectively. Calculate  $\Delta H_f^\circ$  for acetylene.

- A) 2376 kJ/mol
- B) 625 kJ/mol
- C) 227 kJ/mol
- D) -625 kJ/mol
- E) -227 kJ/mol

Q.48 Consider the following standard heats of formation:

$$\text{P}_4\text{O}_{10}(\text{s}) = -3110 \text{ kJ/mol}$$

$$\text{H}_2\text{O}(\text{l}) = -286 \text{ kJ/mol}$$

$$\text{H}_3\text{PO}_4(\text{s}) = -1279 \text{ kJ/mol}$$

Calculate the change in enthalpy for the following process:



Q.49 For the complete combustion of 1.000 mole of ethane gas at 298 K and 1 atm pressure,  $\Delta H^\circ = -1560 \text{ kJ/mol}$ . What will be the heat released when 4.42 g of ethane is combusted under these conditions?

- A) -230 kJ
- B) 230 kJ

- C) 10588 kJ
- D) -10588 kJ
- E) none of these

2.50 Acetylene ( $C_2H_2$ ) and butane ( $C_4H_{10}$ ) are gaseous fuels. Determine the ratio of energy available from the combustion of a given volume of acetylene to butane at the same temperature and pressure using the following data:  
 The change in enthalpy of combustion for  $C_2H_2(g) = -49.9$  kJ/g.  
 The change in enthalpy of combustion for  $C_4H_{10}(g) = -49.5$  kJ/g.

### Test 2 Review Key

1. D      2. B      3. C      4. B      5. B      6. 1.4M      7. E
8. 653 g      9. 11.5g      10. D      11. E      12. E      13. C
- 14 2.07 M      15 25.5 mL      16 D      17 B      18 B      19 A
20. (2,3,2.6)      21. C      22. B      23. A      24.C      25.A      26.C
- 27.C      28.E      29. B      30.E      31.B      32. A      33.C      34. 386L
- 35.29.9 L      36. D      37.C      38.C      39.C      40.B      41. E
- 42.B      43.E      44.A      45.C      46. B      47. C      48. -290 KJ
49. B

50. About 2.21 times the volume of acetylene is needed to furnish the same energy as a given volume of butane.