Booklet A	In each question sheet, this must be filled by the student.			
Group Number		Surname		Signature
List Number		Name		
Student Number		e-mail		

KIM101E Final August 16,2016

1atm=101325Pa R=8.314 J/mol K R= 0.082 L atm/mol K

1) Which of the following substances has only the London dispersion forces as the type of intermolecular forces of attraction? (^{1}H ^{12}C ^{16}O ^{14}N ^{32}S $^{35.5}Cl$)
A) CH_3OH B) NH_3 C) H_2S D) CH_4 E) HCl

2) Which of the following species is unstable ? ($_{3}Li$ $_{4}Be$ $_{7}N$ $_{10}Ne$ $_{11}Na$)
A) Li_2^+ B) Be_2^{2+} C) N_2^{2+} D) Na_2^{2+} E) Ne_2^{2+}

3) For the reaction of 2 $SO_{2(g)}$ + $O_{2(g)}$ ↔ 2 $SO_{3(g)}$ the equilibrium constant is K= 35.5. When 0.10 mol of $SO_{2(g)}$, 0.20 mol of $O_{2(g)}$ and 0.052 mol of $SO_{3(g)}$ are added in a 2.0 Liter vessel, which of the following statements is true?
I. Reaction is at the equilibrium. III. Concentration of SO_3(g) will increase.
II. Forward reaction occurs. IV. Concentration of O_2(g) will decrease.
A) II, III, IV B) I, IV C) I D) II, III E) I, II, III, IV

4) Why the normal melting point of ICl (27.2 °C) is so much higher than that of Br_2 (-7.2 °C)? (The molecules of both substances have the same number of electrons.)
A) ICl molecules have a lower molecular weight.
B) ICl molecules have London dispersion forces.
C) ICl molecules form hydrogen bonding.
D) Iodine in ICl is more electronegative than bromine in Br_2.
E) ICl molecules are polar.

5) Calculate the pH of the 0.01 M $Ba(OH)_2$ solution.
A) 2.0 B) 1.7 C) 12.0 D) 12.3 E) 7.0

6) The normal boiling point of isooctane (C_8H_{18}), a gasoline component, is 99.2 °C and its enthalpy of vaporization is 35.76 kJ/mol. What is the vapor pressure of isooctane at 25 °C?
A) 90.2 mmHg B) 65.6 mm Hg C) 42.9 mmHg D) 130.2 mmHg E) 30.1 mmHg

7) Li metal has a body centered cubic (bcc) structure. Its density is 0.53 g/cm^3 and its atomic mass is 6.94 g/mol. Calculate the edge length of the unit cell of Li metal.
A) 153.6 pm B) 351.6 pm C) 527.4 pm D) 263.7 pm E) 410.3 pm

8) What is the molarity of sodium chloride in 1.0 L solution that is 13.0% sodium chloride by mass and that has a density of 1.10 g/mL? (^{23}Na $^{35.5}Cl$ ^{16}O ^{1}H)
A) 1.43×10^{-2} B) 1.43 C) 2.23 D) 2.45 E) 2.56

9) On a clear day at sea level, with a temperature of 25°C, the partial pressure of N_2 in air is 0.78 atm and the concentration of nitrogen in water is 5.3×10^{-4} M. At what partial pressure of N_2 in atm, the concentration in water is 1.1×10^{-3} M?
A) 1.0 atm B) 0.63 atm C) 0.78 atm D) 2.1 atm E)1.6 atm

10) A solution made by dissolving 9.81 g of a nonvolatile nonelectrolyte in 90.0g of water boiled at 100.37°C at 760 mmHg. What is the approximate molecular weight of the substance? (For water, K_b = 0.51 °C/m)
A) 240 g/mol B) 150 g/mol C) 79 g/mol D) 61 g/mol E) 34 g/mol

11) The following oxidation-reduction (redox) reaction occurs in acid solution.
$U^{4+}_{(aq)}$ + $MnO_4^-{}_{(aq)}$ → $UO_2^+{}_{(aq)}$ + $Mn^{2+}_{(aq)}$ (not balanced)
How many milliliters of 0.216 M $KMnO_4$ solution are required to react with 11.6 g of UF_4 (the source of the U^{4+} ion) (For UF_4, M_w = 314.0 g/mol)?
A) 34.2 mL B) 3.42 mL C) 1.71 mL D) 6.84 mL E) 17.1 mL

12) Which of the following statements is false ?
A) Water and salt are formed in a neutralization reaction
B) Strong acids are completely ionized in water
C) Lewis base is any species that donates an electron pair
D) Organic acids that shown by the general formula of RCOOH are strong acids
E) NH_3 is formed by the hydrolysis of NH_4Cl with water.

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KIM101E Final August 16,2016

13) Calculate the osmotic pressure of a 0.2 M KCl solution at 25°C. (^{39}K $^{35.5}$Cl)

A) 990 kPa B) 495 kPa C) 83 kPa D) 42 kPa E) 325 kPa

14) The vapor pressure of pure water at 25°C is 23.8 torr. Calculate the vapor pressure of water in torr unit at 25°C above a solution prepared by dissolving 35g of urea (a nonvolatile and non-electrolyte substance, its molar weight is 60.0 g/mol) in 75g of water. (^{16}O ^{1}H)

A) 3.3 B) 27 C) 2.9 D) 0.88 E) 21

15) Under certain temperature and pressure density of oxygen is 1.30 g/L. A 21.0 mL volume of $O_{2\,(g)}$ effuses in 1.000 s from a device. When the same device is used under the same conditions, effusion rate of an unknown gas is 15.0 mL/s. Calculate the density of this unknown gas. (^{16}O)

A) 1.51 g/L B) 2.55 g/L C) 0.66 g/L D) 0.39 g/L E) 0.21 g/L

16) Calculate the change in internal energy (ΔU) when 2 moles of CO are converted to 2 moles of CO_2 at 1 atm and 25°C.

$2\,CO_{(g)} + O_{2(g)} \rightarrow 2\,CO_{2(g)}$ $\Delta H = -566.0$ kJ/mol

A) –568,5 kJ/mol B) 563,5 kJ/mol C) –1912,8 kJ/mol D) –1915,7 kJ/mol E) –566 kJ/mol

17) Which one of the followings is a weak acid?

A)HCl B) HBr C) HF D) HI E) None

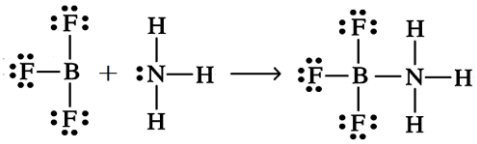
18) According to VSEPR theory, which of the following has the largest bond angle? ($_1$H $_6$C $_7$N $_{16}$S $_9$F $_5$B $_{15}$P)

A) HCN B) SF_2 C) BF_3 D) H_2S E) PF_3

19) Calculate the pH of the 0.10 M CH_3COOH solution (for acetic acid $K_a = 1.8 \times 10^{-5}$)

A) 1.0 B) 2.9 C) 4.7 D) 5.7 E) None

20) Which of the following statements is wrong according to the reaction ?



A) BF_3 is a Lewis acid

B) BF_3 takes electron pair

C) According to Arrhenius, this is a neutralization reaction

D) Electron pair on the nitrogen is used in the formation of chemical bonding

E) None

21) The work done when a gas is compressed in a cylinder is 462 J. During this process, there is a heat transfer of 128 J from the gas to the surroundings. Calculate the internal energy change (ΔU) for this process.

A) 590 J B) –590 J C) 0 J D) –334 J E) 334 J

22) For the reaction of $2\,SO_{2(g)} + O_{2(g)} \leftrightarrow 2\,SO_{3(g)}$ the equilibrium constant in terms of molar concentration is $K_c = 35.5$ at 25°C. What is the value of equilibrium constant in terms partial pressures (K_p) at 25°C?

A) 1.5 B) 0.06 C) 21197.7 D) 867.5 E) None

23) Using bond energies, calculate the enthalpy change (ΔH) for the following reaction.

$H_2S_{(g)} + 2\,F_{2\,(g)} \rightarrow 2\,HF_{(g)} + SF_{2\,(g)}$ (Bond energies; H–S: 340 kJ/mol; F–F: 159 kJ/mol; H–F: 570 kJ/mol; S–F:310 kJ/mol)

A) + 381 kJ/mol B) + 2758 kJ/mol C) +62 kJ/mol D) – 762 kJ/mol E) – 381 kJ/mol

24) For the reaction of $2\,SO_{2(g)} + O_{2(g)} \leftrightarrow 2\,SO_{3(g)}$, the enthalpy change is $\Delta H = -197.8$ kJ. Which of the following condition increases the equilibrium constant?

I. Decreasing of the concentration of $O_{2(g)}$
II. Increasing the temperature
III. Adding $SO_{3(g)}$
IV. Decreasing Temperature

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

25) Predict the molecular shape and hybridization type of $SeCl_4$. $_{34}$Se $_{17}$Cl

A) seesaw, sp^3d B) trigonal bipyramidal, sp^3d C) T-Shaped, sp^3d D) trigonal bipyramidal, sp^3d^2 E) tetrahedral, sp^3