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**University Examinations 2016/2017**

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE PHYSICAL AND BIOLOGICAL SCIENCES, AND BACHELOR OF EDUCATION SCIENCE

**SCH 3201: PHYSICAL CHEMISTRY II**

**DATE: December, 2016 TIME: HOURS**

**INSTRUCTIONS:** *Answer questions* ***one*** *and any other* ***two*** *questions.*

**QUESTION ONE - (30 MARKS)**

1. For the purpose of physical chemistry, the universe is divided into two parts. Name them and provide an explanation for each. (4 Marks)
2. Give mechanical and molecular definitions of work and heat. (4 Marks)
3. Calculate the work done when 50g of iron reacts with hydrochloric acid in;
4. a closed vessel of fixed volume (4 Marks)
5. an open beaker at $25℃$ (atomic number of Fe=26) (4 Marks)
6. Between internal energy and volume, which is a state function? Explain your choice.

(2 Marks)

1. Explain the following concepts;
2. Internal energy (2 Marks)
3. Enthalpy (2 Marks)
4. Exothermic reaction (2 Marks)
5. Collision number (2 Marks)
6. Caesium (m.p. 29$℃$, b.p 686$℃$) was introduced into a container and heated to 500$℃$. When a hole of diameter 0.50mm was opened in the container for 100s, a mass loss of 385 mg was measured. Calculate the vapour pressure of liquid caesium at 500K. (Given that the mass loss $∆$m in an interval $∆t$ is related to the collision flux by $∆m= z\_{w}A\_{o}m∆t$ where $A\_{0}$ is the area of the hole and m is the mass of one atom. (4 Marks)

**QUESTION TWO (20 MARKS)**

1. (i) State Hess’s law. (2 Marks)

(ii) Explain the difference between standard enthalpy of vaporization and standard enthalpy of fusion. (3 Marks)

1. The standard reaction enthalpy for the hydrogenation of propene;

is -124kJ$mol^{-1}$. The standard reaction enthalpy for the combustion of propene;

 

is -2220 $kJmol^{-1}$. Calculate the standard enthalpy of combustion of propene.(8 Marks)

You’re given H2O (l)$ \rightarrow $ H2 (g) + ½O2(g) = 286 kJ$mol^{-1}$

1. Show that in expansion work, the general expression is;

 , (7 Marks)

given that the definition of work is given as $dw = - Fdz$ where F$ = force $

$dz= distance$.

**QUESTION THREE (20 MARKS)**

1. State the first law of thermodynamics. (2 Marks)
2. Explain what is the compression factor, Z, of a gas. (4 Marks)
3. Explain how the perfect gas equation of state (pV= nRT) arises by combination of Boyle’s law, Charles’s law, and Avogadro’s principle. (6 Marks)
4. Explain the following terms as used in molecular motion of gases;
5. Diffusion (2 Marks)
6. Thermal conduction (2 Marks)
7. Viscocity (2 Marks)
8. Effusion (2 Marks)

**QUESTION FOUR (20 MARKS)**

1. State the difference between adiabatic system and diathermic system. (4 Marks)
2. Water is heated to boiling under a pressure of 1.0atm. When an electric current of 0.50A from a 12V supply is passed for 300s through a resistance in thermal contact with it, it is found that 0.798g of water is vaporized. Calculate the molar internal energy and enthalpy changes at the boiling point (373.15K) (7 Marks)
3. What does the term Heat capacity (C) mean? (2 Marks)
4. Aqueous silver ion reacts with aqueous chlorine ion to yield a white precipitate of solid silver chloride;



When 10.0 mL of 1.00M AgNO3 solution is added to 10.0 ml of NaCl solution at 25$℃$ in a calorimeter a white precipitate of AgCl forms and the temperature of the aqueous mixture increases to 32.6$℃$. Assuming that the specific heat of the aqueous mixture is 4.18J/ (g$℃$) , that the density of the mixture is 1.00 g/ml. Calculate $∆H$ in kJ/$mol$AgCl for the reaction. Use the formular below;

Heat evolved = (Specific heat) x (mass of mixture) x (Temperature change)(7 Marks)