



Sohag University  
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Chemistry Department



Faculty of Science  
Time 2 hours

Final Physical and Inorganic Chemistry Exam for  
First year Students, Faculty of Pharmacy  
First Semester 2015– 2016

كيميا و عامه  
د فیر با نسه

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**Answer the following Questions:**

Useful atomic numbers and constants:  ${}_1\text{H}$ ,  ${}_4\text{Be}$ ,  ${}_5\text{B}$ ,  ${}_7\text{N}$ ,  ${}_8\text{O}$ ,  ${}_9\text{F}$ ,  ${}_{17}\text{Cl}$ ,  ${}_{53}\text{I}$ ,  $R = 0.08206 \text{ L-atm/mol-K}$

**Question [1] (20 marks, 5 per each)**

- [A] Write the chemical formula for the following compounds: copper(II)phosphate, iron(II) nitrate, ammonium nitrate, perchloric acid, mercury(I) chloride (5 marks)
- [B] The work function of cesium metal is  $3.42 \times 10^{-18} \text{ J}$ . (a) Calculate the minimum frequency of light required to release electron from the metal. (b) Calculate the kinetic energy of the ejected electrons if light of frequency  $1.0 \times 10^5 \text{ s}^{-1}$  is used to irradiate the metal ( $h = 6.63 \times 10^{-34} \text{ J.s}$ ) (5 marks)
- [C] Calculate the frequency (Hz) and wavelength (nm) of the emitted photon when an electron drops from the  $n=4$  to the  $n=3$  level in a hydrogen atom? ( $R_H = 2.18 \times 10^{-18} \text{ J}$ ,  $h = 6.63 \times 10^{-34}$ ) (5 marks)
- [D] i- A fluorine atom has a total of nine electrons. Write the four quantum numbers for each of the nine electrons in the ground state. ii- What is an isotope, Give an example? (5 marks)

**Question [2] (25 marks)**

- [A] i- State the Pauli exclusion principle, Hund's rule, and dipole moment. ii- Predict whether each of the following molecules has a dipole moment:  $\text{CH}_2\text{Cl}_2$ ,  $\text{CHCl}_3$ ,  $\text{BF}_3$ , and  $\text{BrCl}$  (5 marks)
- [B] Use the VSEPR model to predict the geometry of the following molecules and ion:  $\text{BF}_3$ ,  $\text{PCl}_5$ ,  $\text{H}_2\text{O}$ , and  $\text{I}_3^-$  (10 marks)
- [C] Draw the resonance structure for the molecule nitrous oxide,  $\text{N}_2\text{O}$  (the atomic arrangement is  $\text{NNO}$ ). Indicate formal charges. Rank the structures in their relative importance to the overall properties of the molecule. (5 marks)
- [D] Describe the hybridization state of phosphorus in phosphorous pentachloride ( $\text{PCl}_5$ ). (5 marks)

**Question [3] (20 marks, 2 per each)**

(Make a table in you answering paper and write the correct answer(s) of each of the following)

- [1] If mater is uniform throughout, cannot be separated into other substances by physical processes, but can be separated into other substances by chemical processes, it is (an element- a heterogeneous mixture- a homogeneous mixture- a compound).
- [2] A sample of a gas (1.5 mol) is contained in a 15.0L cylinder. The temperature is increased from 100°C to 150°C. The ratio of the final pressure to initial pressure ( $P_2/P_1$ ) is (1.5 ; 0.667 ; 0.882 ; 1.13).
- [3] Suppose the pressure inside a pressure cooker reaches 1.2 atm, then the temperature at which water will boil in this cooker is (>100°C; 100°C; <100°C).
- [4] CH<sub>3</sub>OH boils at 65°C, CH<sub>3</sub>SH boils at 6°C due to difference in (molecular weight, hydrogen bonding – dispersion forces- molecular shape).
- [5] The intermolecular force that must be overcome to convert Br<sub>2</sub> from liquid to gas is (London-dispersion forces, dipole-dipole attraction, covalent interaction, Van der Waals forces).
- [6] List the substances: BaCl<sub>2</sub>, H<sub>2</sub>, CO and HF (i) in order of attractive force in the liquid state, and (ii) in order of increasing boiling points.
- [7] The direct conversion process of gas to solid is called (vaporization–condensation– decomposition– deposition).
- [8] The following processes are exothermic except (freezing– sublimation– condensation - solidification).
- [9] CsCl crystallize in unit cell that contains a Cs<sup>+</sup> ions at the center of a cube and a Cl<sup>-</sup> ion at each corner. How many Cs<sup>+</sup> and Cl<sup>-</sup> ions are in a unit cell? (1, 1 ; 1, 2 ; 2, 2; 1,8).
- [10] According to the kinetic–molecular theory, molecules of different gases at the same temperature always have the same (molecular mass – pressure – average kinetic energy – average density).

**Question number [4] (25 marks, 5 per each)**

- A. (i) What conditions are represented by the abbreviation STP? (ii) What is the molar volume of ideal gas at STP? (iii) Calculate the molar volume of an ideal gas at room temperature which is 25°C?
- B. Vessel A contains CO(g) at 0°C and 1 atm. Vessel B contains SO<sub>2</sub>(g) at 20°C and 0.5 atm. The two vessel have the same volume. (i) Which vessel have more molecule? (ii) Which contains more mass? (iii) In which vessel is the average kinetic energy of molecules higher? (amu: C=12, O=16 and S=32).
- C. Distinguish between adhesive force and cohesive forces. Do viscosity and surface tension reflect adhesive forces or cohesive forces of attraction?
- D. What is the unit cell? What properties does it have?
- E. A mineral composed of Ba, O, and Ti, has the cubic unit cell shown in the drawing. (a) What is the empirical formula of this mineral? (b) What is the coordination of each ion in the structure (consider neighboring unit cell).

