

**Chemistry and Introduction to Biochemistry**  
 INTERNATIONAL SCHOOL OF MEDICINE (CORSO F)  
 Academic Year 2015-2016 - 20<sup>th</sup> December 2016

Surname and Name

Matriculation No.

.....  
 .....  
**Multiple choice questions:** select the correct answer (one) by crossing the corresponding box.

**Formulas:** draw all the atoms, bonds and charges (when applicable).

**Quantitative exercises:** briefly explain your chosen procedure and copy the final result(s) in the brackets at the end of the text.

1) Nitrogen belongs to the V group of the periodic table, therefore it has:

- a total of 5 electrons [ ]  
 5 electrons in the outer shell [ ]  
 3 electrons in the outer shell [ ]  
 5 electronic shells [ ]

2) Which of the following compounds do produce an acidic solution in water?:

- sodium nitrate [ ]  
 ammonium chloride ( $K_b$  of ammonia =  $1.8 \times 10^{-5}$  M) [ ]  
 potassium cyanide ( $K_a$  of hydrogen cyanide =  $1 \times 10^{-10}$  M) [ ]  
 potassium sulphate [ ]

3) Indicate which of the following solutions exerts the same osmotic pressure of a 0.2 M solution of calcium hydroxide:

- 0.2 M magnesium chloride [ ]  
 0.2 M glucose [ ]  
 0.2 M sodium hydroxide [ ]  
 0.2 M acetic acid [ ]

4) Given the following homogeneous equilibrium in the gas phase:  $A \rightleftharpoons B + C$ , indicate in which condition the concentration of A decreases:

- after a Volume drop [ ]  
 after adding B [ ]  
 after subtracting C [ ]  
 never [ ]

5) Which is the molar concentration of  $H_3O^+$  in a solution of sodium hydroxide 0.01 M?

- $10^{-2}$  M [ ]  
 0.01 M [ ]  
 $10^{-14}$  M [ ]  
 $10^{-12}$  M [ ]

6) Draw the chemical formula of each compound indicating all the atoms, bonds and charges (when applicable): *cis*-1,2-di-fluoro ethene, lithium phosphate, glucose, 2-propanol.

7) A solution of sodium di-hydrogen phosphate has a concentration of 0.5 M. Calculate how many ml of water need to be added to 1 ml of this solution in order to obtain a final solution 0.12 M.  
[Answer: .....]

8) Calculate the pH of a solution obtained by mixing 3 ml of commercial ammonia (30% w/w,  $d=0.92$  g/ml) and 3 g of ammonium chloride in water, up to a final volume of 500 ml.  
[Answer: .....]

9) Calculate the osmotic pressure of a solution made by dissolving 0.6 g of zinc nitrate in 100 ml of water, at 37°C.

[Answer: .....]

10) In a cylinder of 2 L at 1000 K, 5 mol of molecular iodine and 1.5 mol of molecular hydrogen are added. Once the gaseous and homogeneous equilibrium has been reached, the concentration of hydrogen iodide is 0.5 M. Calculate  $K_c$  for the equilibrium:  $I_2 + H_2 \rightleftharpoons 2HI$ .

[Answer: .....]