



## Faculty of Health Sciences

### Chemistry Placement Test Sample- MCPT-H

#### Basic Info & Sample Questions for Students

#### Basic Info

##### *Overview*

The MCPT-H is a timed, computerized multiple choice test given to MU prospective students attempting to register in all majors of the Faculty of Health Sciences with Baccalaureate basis of admission.

##### *Structure*

The standard MCPT-H is composed of one section that tests the student's knowledge in chemical kinetics, chemical equilibrium, acid-base reactions and pH scale, in addition to bases of organic chemistry.

- Length: 30 min
- Questions: 25 multiple choice questions
- Evaluation: 4 points for each question

- 1) The pH of a 1 M sulfuric acid ( $\text{H}_2\text{SO}_4$ ) solution is:
- 0.3
  - 0.1
  - 0.1
  - 0.3
- 2) The pH of a buffer solution containing 0.40M  $\text{CH}_3\text{COOH}$  ( $\text{pK}_a = 4.74$ ) and 0.20M  $\text{CH}_3\text{COO}^- \text{Na}^+$  is:
- 4.43
  - 2.22
  - 5.55
  - 4.90
- 3) The volume of 1 M sulfuric acid ( $\text{H}_2\text{SO}_4$ ) required to neutralize 10 ml of 1M NaOH is:
- 15 ml
  - 10 ml
  - 5 ml
  - 100 ml
- 4) Which of following reactions has  $K_c = K_p$  :
- $\text{N}_2 (\text{g}) + 2\text{O}_2 (\text{g}) \rightleftharpoons \text{N}_2\text{O}_4 (\text{g})$
  - $\text{H}_2 (\text{g}) + \text{Cl}_2 (\text{g}) \rightleftharpoons 2\text{HCl} (\text{g})$
  - $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$
  - $\text{N}_2 (\text{g}) + 3\text{H}_2 (\text{s}) \rightleftharpoons 2\text{NH}_3 (\text{g})$
- 5) For the reaction:  $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$ ,  $K_p$  expression is:
- $P_{\text{CO}_2} \times P_{\text{H}_2\text{O}}$
  - $P_{\text{CO}_2}/P_{\text{H}_2\text{O}}$
  - $P_{\text{H}_2\text{O}}$
  - $P_{\text{CO}_2}$
- 6) In ammonia synthesis:  $\text{N}_2 (\text{g}) + 3\text{H}_2 (\text{g}) \rightleftharpoons 2\text{NH}_3 (\text{g})$  the equilibrium concentrations of  $\text{NH}_3$ ,  $\text{N}_2$  and  $\text{H}_2$  are 0.25 M, 0.11 M and 1.91 M, respectively. The equilibrium constant  $K_c$  for this reaction is:
- 0.0815
  - $8.2 \times 10^{-3}$
  - 8.2
  - 0.82
- 7) The equilibrium position in:  $\text{SO}_2 (\text{g}) + \text{Cl}_2 (\text{g}) \rightleftharpoons \text{SO}_2\text{Cl}_2 (\text{g})$  can be shifted forward by:
- Removing  $\text{SO}_2$
  - Removing  $\text{SO}_2$  and  $\text{Cl}_2$
  - Removing  $\text{Cl}_2$
  - Adding  $\text{Cl}_2$

8) Thermal decomposition of 46.0 g of potassium chlorate  $\text{KClO}_3$  (s) gives  $\text{KCl}$  (s) and  $\text{O}_2$  (g). The mass of  $\text{O}_2$  (g) obtained in grams is:



- 12.0 g
- 18.0 g
- 6.0 g
- 36.0 g

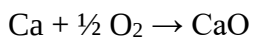
9) 2.4 g of magnesium  $\text{Mg}$ (s) are burned in excess oxygen. What is the mass of  $\text{MgO}$  formed?

- 1.6 g
- 14.0 g
- 4.0 g
- 4.4 g

10) The oxidation number of carbon in  $\text{CO}_2$  is:

- -2
- +4
- +2
- +1

11) Which of the following is a correct half-reaction for the reaction:



- $\text{Ca} \rightarrow \text{Ca}^+ + 1\text{e}^-$
- $\text{Ca} + 2\text{e}^- \rightarrow \text{Ca}^{2-}$
- $\text{Ca} \rightarrow \text{Ca}^{2+} + 2\text{e}^-$
- $\text{Ca} + 1\text{e}^- \rightarrow \text{Ca}^-$

12) Which of the following is not a redox reaction?

- $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
- $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$
- $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$
- $2\text{K} + \text{Cl}_2 \rightarrow 2\text{KCl}$

13) Arrange the following species: (a)  $\text{H}_2\text{S}$ , (b)  $\text{S}_8$ , (c)  $\text{H}_2\text{SO}_4$ , (d)  $\text{S}^{2-}$  in order of increasing oxidation number of the sulfur atom:

- $< (\text{d}) < (\text{b}) < (\text{c})$
- $= (\text{d}) < (\text{b}) < (\text{c})$
- $< (\text{b}) < (\text{d}) < (\text{a})$
- $< (\text{d}) = (\text{a}) < (\text{c})$

14) The electron configuration of Fluorine F ( ${}_{9}\text{F}$ ) is:

- $1s^2, 2s^2, 2p^5$
- $1s^2, 2s^2, 2p^6, 3s^1$
- $1s^2, 2s^2, 2p^6$
- $1s^2, 2s^2, 2p^4$

15) The number of neutrons and protons in Carbon  ${}^{12}_6\text{C}$  is:

- 6
- 12
- 8
- 10

16) The number of oxygen atoms, in 1.60 g of  $\text{O}_2$  ( ${}^{16}\text{O}$ ), is:

- $6.023 \times 10^{22}$
- $9.59 \times 10^{22}$
- $3.07 \times 10^{24}$
- $9.82 \times 10^{25}$

17) Chlorine has two isotopes:  ${}^{35}_{17}\text{Cl}$  and  ${}^{37}_{17}\text{Cl}$ . If the average atomic mass of chlorine is 35.5 amu, the relative abundance of  ${}^{35}_{17}\text{Cl}$  and  ${}^{37}_{17}\text{Cl}$  respectively are:

- 64% and 36%
- 75.5 % and 24.5%
- 70% and 30%
- 60% and 40%

18) The rate of a reaction is expressed in:

- $\text{Mol.L}^{-1}.\text{s}^{-1}$
- $\text{Mol.L}^{-1}$
- $\text{Mol.L}.\text{s}^{-1}$
- $\text{L.mol}^{-1}.\text{s}^{-1}$

19) The rate data for the reaction  $\text{A} + \text{B} \rightarrow \text{Products}$  are:

| [A]  | [B]  | Rate(M/s)             |
|------|------|-----------------------|
| 1.50 | 1.50 | $3.20 \times 10^{-1}$ |
| 1.50 | 2.50 | $3.20 \times 10^{-1}$ |
| 3.00 | 1.50 | $6.40 \times 10^{-1}$ |

The Rate Law of the reaction is

- $\text{Rate} = k [\text{A}][\text{B}]^2$
- $\text{Rate} = k [\text{A}]$
- $\text{Rate} = k [\text{A}][\text{B}]$
- $\text{Rate} = k [\text{B}]$

20) The reaction  $\text{NH}_4^+(\text{aq}) + \text{NO}_2^-(\text{aq}) \rightarrow \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$  is first order in  $[\text{NH}_4^+]$  and  $[\text{NO}_2^-]$ . If the rate constant of the reaction is  $3.0 \times 10^{-4} \text{ M}^{-1}\text{s}^{-1}$ , and  $[\text{NH}_4^+] = 0.26 \text{ M}$  and  $[\text{NO}_2^-] = 0.080 \text{ M}$ , The rate of the reaction is:

- $6.2 \times 10^{-6} \text{ M.s}^{-1}$
- $1.3 \times 10^{-4} \text{ M.s}^{-1}$

- $2.4 \times 10^{-8} \text{ M.s}^{-1}$
- $3.2 \times 10^{-3} \text{ M.s}^{-1}$

21) What is the weight % of Calcium in calcium carbonate  $\text{CaCO}_3$ ?

- 30.0 %
- 40.0 %
- 60.0 %
- 55.5 %

22) Which of the following would decolorize a red solution of bromine ( $\text{Br}_2$ ) dissolved in hexane?

- $\begin{array}{c} \text{OH} \\ | \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \end{array}$
- $\begin{array}{c} \text{H} \\ \backslash \\ \text{H}_2\text{C}=\text{C}-\text{CH}_3 \end{array}$
- $\begin{array}{c} \text{H}_2 \\ | \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{OH} \\ | \\ \text{H}_2 \end{array}$
- $\begin{array}{c} \text{H}_2 \\ | \\ \text{H}_3\text{C}-\text{C}-\text{CH}_3 \end{array}$

23) An organic compound with the formula  $\text{C}_2\text{H}_5\text{-O-C}_2\text{H}_5$  is most likely:

- Ethanol
- Acetic acid
- Ethanal
- Diethylether

24) The molecular formula of a compound having 37.5 wt% C, 12.5 wt% H and 50 wt % O by mass, is:

- $\text{CH}_4\text{O}$
- $\text{C}_2\text{H}_4\text{O}$
- $\text{C}_3\text{H}_5\text{O}$
- $\text{C}_4\text{H}_6\text{O}$

25) Alkenes always contain this functional group:

- $\text{-OH}$
- $\text{C=O}$
- $\text{C=NH}$
- $\text{C=C}$