



FEDERAL PUBLIC SERVICE COMMISSION  
SPECIAL COMPETITIVE EXAMINATION-2023 FOR  
RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL  
GOVERNMENT

Roll Number

**CHEMISTRY, PAPER-I**

<b>TIME ALLOWED: THREE HOURS</b>	<b>(PART-I MCQs)</b>	<b>MAXIMUM MARKS: 20</b>
<b>PART-I (MCQs) : MAXIMUM 30 MINUTES</b>	<b>(PART-II)</b>	<b>MAXIMUM MARKS: 80</b>
<b>NOTE: (i) First attempt PART-I (MCQs) on separate OMR Answer Sheet which shall be taken back after 30 minutes.</b>		
<b>(ii) Overwriting/cutting of the options/answers will not be given credit.</b>		
<b>(iii) There is no negative marking. All MCQs must be attempted.</b>		

**PART-I (MCQs)(COMPULSORY)**

**Q.1. (i) Select the best option/answer and fill in the appropriate Box  on the OMR Answer Sheet.(20x1=20)**  
**(ii) Answers given anywhere else, other than OMR Answer Sheet, will not be considered.**

- Write the values for l, n, and m for  $\Psi_{3,1,0}$ ?**  
(A) 1, 3, 0 (B) 3, 1, 0 (C) 0, 3, 1 (D) None of these
- What is the magnetic quantum number of the orbital  $2p_z$ ?**  
(A) 1 (B)  $\pm 1$  (C) -1 (D) None of these
- The weight of silver displaced by a quantity of electricity which displaces 5600ml of O<sub>2</sub> at STP will be:**  
(A) 5.4g (B) 10.8g (C) 54.9g (D) None of these
- On electrolysis of dilute sulphuric acid using platinum electrodes, the product obtained at the anode will be:**  
(A) Hydrogen (B) Oxygen (C) Hydrogen sulphide (D) None of these
- The coefficient of performance of a refrigerator is 5. If the temperature inside of said refrigerator is -20° C. Calculate the temperature of the surrounding where it releases heat.**  
(A) 11° C. (B) 21° C. (C) 31° C. (D) None of these
- When an ideal monoatomic gas is heated at constant pressure, the fraction of heat energy that increases the internal energy of the gas is:**  
(A) 2/5 (B) 3/5 (C) 3/7 (D) None of these
- If the concentration of material X is doubled and that of Y is halved, how many times will the rate of the elementary reaction  $3X + Y = X_2Y$  change?**  
(A)  $r_2 = 4.5r_1$  (B)  $r_2 = 5r_1$  (C)  $r_2 = 2r_1$  (D) None of these
- The chemical reaction,  $2O_3 \rightarrow 3O_2$  Proceeds as**  
 $O_3 \rightleftharpoons O_2 + [O]$  (fast)  
 $[O] + O_3 \rightarrow 2O_2$  (slow)  
**The rate law expression will be:**  
(A) Rate = k [O] [O<sub>3</sub>] (B) Rate = k [O<sub>3</sub>]<sup>2</sup> [O<sub>2</sub>]<sup>-1</sup> (C) Rate = k [O<sub>3</sub>]<sup>2</sup> (D) None of these
- Which one of the following is an example of adsorption?**  
(A) Ammonia in contact with water (B) Anhydrous CaCl<sub>2</sub> with water  
(C) Silica gel in contact with water vapours (D) None of these
- The movement of colloidal particles towards the oppositely charged electrodes on passing electric current is known as:**  
(A) Tyndall effect (B) Cataphoresis (C) Brownian movement (D) None of these
- The process of separating a crystalloid, from a colloid by filtration is called:**  
(A) Emulsification (B) Dialysis (C) Coagulation (D) None of these
- Which of the following is used as a carrier gas in gas chromatography?**  
(A) Carbon dioxide (B) Oxygen (C) Helium (D) None of these
- What is Eluent?**  
(A) Liquid solution (B) Liquid solution that is a result from Elution  
(C) Solute (D) None of these
- Which of the following HPLC detectors is used as a bulk property or general purpose detector?**  
(A) Electrochemical detector (B) Fluorescence detector  
(C) UV-Visible detector (D) None of these
- Benzoin oxime is known as:**  
(A) Dioxime (B) Cupron (C) Cupric acid (D) None of these
- In crystal field theory (CFT), the energy gap between t<sub>2g</sub> and e<sub>g</sub> sets is denoted by:**  
(A) 10Dq (B) 20Dq (C) 0Dq (D) None of these
- The chemical formula of caustic potash is:**  
(A) NaOH (B) Ca(OH)<sub>2</sub> (C) NH<sub>4</sub>OH (D) None of these
- Which one of the following elements shows the maximum number of different oxidation states in its compounds?**  
(A) Eu (B) Am (C) Cd (D) None of these

## CHEMISTRY, PAPER-I

19. Gun metal is an alloy of:  
(A) Cu and Al (B) Cu and Sn (C) Cu, Zn and Sn (D) None of these
20. The number of unpaired electrons in gaseous species of  $Mn^{3+}$ ,  $Cr^{3+}$  and  $V^{3+}$  respectively are:  
(A) 4, 4 and 2 (B) 3, 3 and 2 (C) 4, 3 and 2 (D) None of these

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### PART-II

<b>TIME ALLOWED: THREE HOURS</b>	<b>PART-I (MCQS)</b>	<b>MAXIMUM MARKS = 20</b>
<b>PART-I(MCQS): MAXIMUM 30 MINUTES</b>	<b>PART-II</b>	<b>MAXIMUM MARKS = 80</b>
<b>NOTE: (i) Part-II is to be attempted on the separate Answer Book.</b>		
<b>(ii) Attempt ONLY FOUR questions from PART-II by selecting TWO questions from EACH SECTION. ALL questions carry EQUAL marks.</b>		
<b>(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.</b>		
<b>(iv) Write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.</b>		
<b>(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.</b>		
<b>(vi) Extra attempt of any question or any part of the question will not be considered.</b>		

- Q. 2.** (a) Derive Schrodinger wave equation for motion of a particle in one dimensional Box. (10)  
(b) What is a well-behaved function? What are the requirements of a physically acceptable wave function? (06)  
(c) What are the postulates of Quantum Mechanics? (04) (20)
- Q. 3.** (a) Describe briefly the experimental techniques for determination of order of reaction. (10)  
(b) Write a note on Transition state theory of reaction rates. (06)  
(c) Postulates of Collision theory. (04) (20)
- Q. 4.** (a) Give a comprehensive classification of various chromatographic techniques. Also mention potential application of each. (10)  
(b) Define and explain Langmuir adsorption isotherm. What are its limitations? (06)  
(c) Explain Liquid junction potential. (04) (20)
- Q. 5.** (a) State John-Teller theorem. Explain it using suitable examples from coordination complexes. (10)  
(b) Valence shell electron pair repulsion theory can be used to predict the shapes of molecules. Using this theory explain the shapes acquired by  $BF_3$  and  $IF_5$ . (06)  
(c) Postulates of Valence Bond Theory (VBT). (04) (20)
- Q. 6.** (a) State and explain Kohlrausch's law. Give its applications. (10)  
(b) What is called Nernst equation, and the significance of the Nernst equation? (05)  
(c) What is the derivation of Debye-Hückel? (05) (20)
- Q. 7.** (a) What is the standard equation of Gibbs free energy? Describe relationship between Free Energy and Equilibrium Constant. (10)  
(b) Explain 3rd law of thermodynamics. How this law is useful to determine the absolute value of entropy? (05)  
(c) Explain heat capacities and their dependence on Temperature, Pressure and Volume. (05) (20)
- Q. 8.** (a) Explain Gaussian distribution. Explain the difference between Gaussian and non-Gaussian distribution. (08)  
(b) What is electrophoresis? Give its principle. (06)  
(c) Give postulates of Werner's theory of coordination complexes. (06) (20)

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