JEE Main 2023 25 Jan Shift 1 Chemistry Question Paper

Time Allowed :180 minutes	**Maximum Marks :**300	**Total questions :**90

General Instructions

Read the following instructions very carefully and strictly follow them:

(A) The test is of 3 hours duration.

(B) The question paper consists of 90 questions. The maximum marks are 300.

(C) There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.

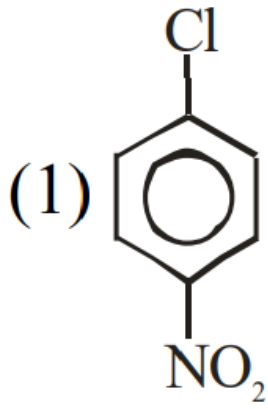
(D) Each part (subject) has two sections.

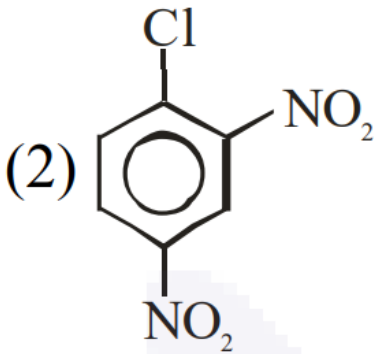
(i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and –1 mark for wrong answer.

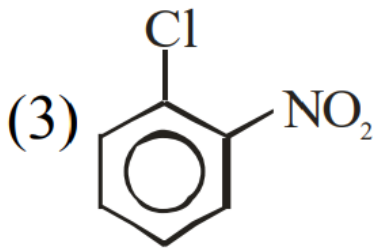
(ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

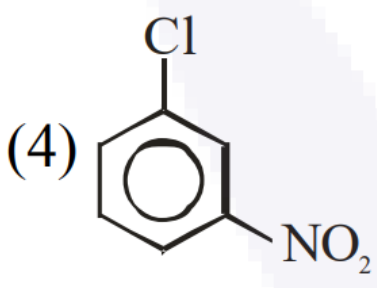
Section-A

1. The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with OH^- is:

(1) 

(2) 

(3) 

(4) 

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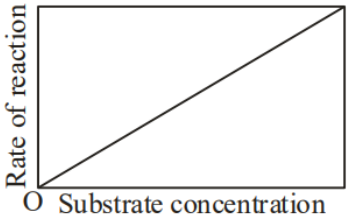
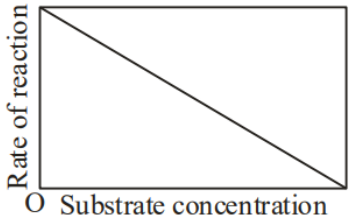
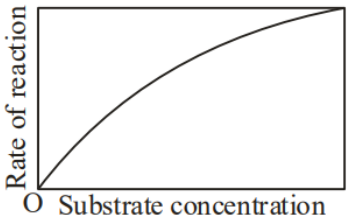
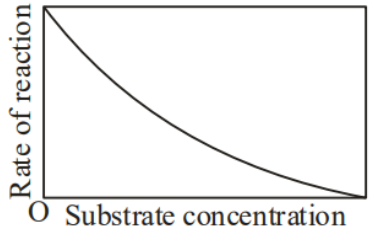
2. The variation of the rate of an enzyme-catalyzed reaction with substrate

concentration is correctly represented by which graph?

(a) 

(b) 

(c) 

(d) 

Options:

1. a
2. b.
3. c.
4. d.

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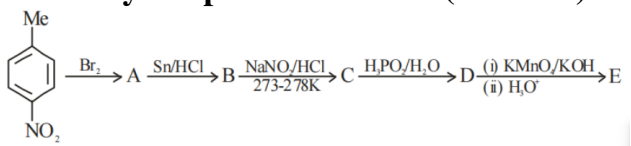
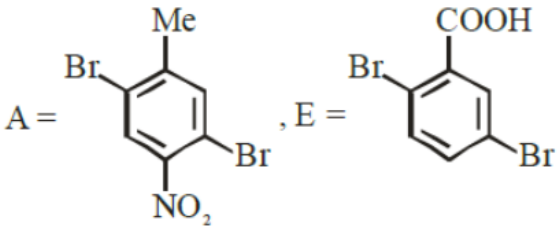
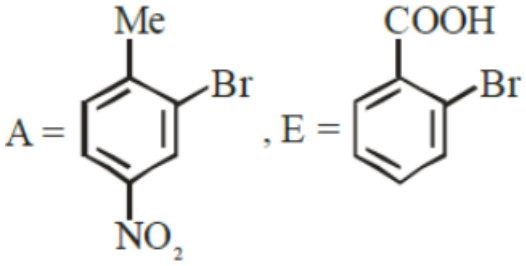
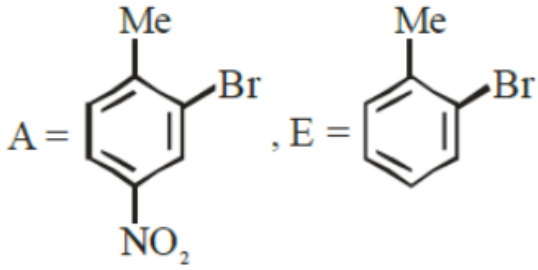
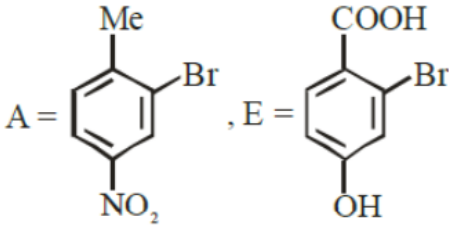
3. Identify the product formed (A and E) in the following reaction sequence:



(A) 

(B) 

(C) 

(D) 

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4. Match List I with List II and choose the correct answer from the options given below:

List I (Elements)	List II (Colour imparted to the flame)
K	Brick Red
Ca	Violet
Sr	Apple Green
Ba	Crimson Red

(A) A-II, B-I, C-III, D-IV

(B) A-II, B-IV, C-I, D-III

(C) A-II, B-I, C-IV, D-III

(D) A-IV, B-III, C-II, D-I

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5. Reaction of thionyl chloride with white phosphorus forms a compound [A], which on hydrolysis gives [B], a dibasic acid. [A] and [B] are respectively:

(A) P_4O_6 and H_3PO_3

(B) PCl_3 and H_3PO_3

(C) PCl_5 and H_3PO_4

(D) $POCl_3$ and H_3PO_4

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6. A cubic solid is made up of two elements X and Y. Atoms of X are present on every alternate corner and one at the center of the cube. Y is at $\frac{1}{4}$ of the total faces. The empirical formula of the compound is:

(A) $X_2Y_{1.5}$

(B) $X_{2.5}Y$

(C) $XY_{2.5}$

(D) $X_{1.5}Y_2$

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7. The radius of the 2^{nd} orbit of Li^{2+} is x. The expected radius of the 3^{rd} orbit of Be^{3+} is:

(A) $\frac{9}{4}x$

(B) $\frac{4}{9}x$

(C) $\frac{27}{16}x$

(D) $\frac{16}{27}x$

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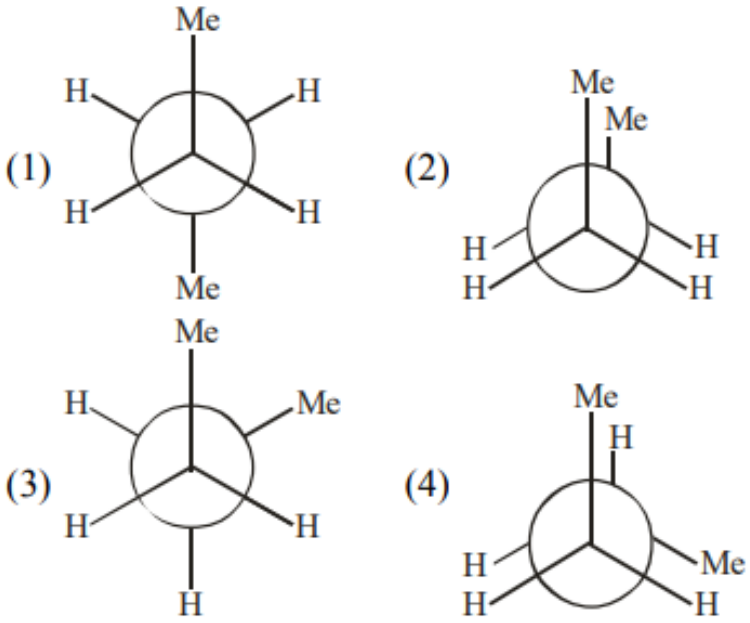
8. Which of the following conformations will be the most stable?



(A) (1)

(B) (2)

(C) (3)

(D) (4)

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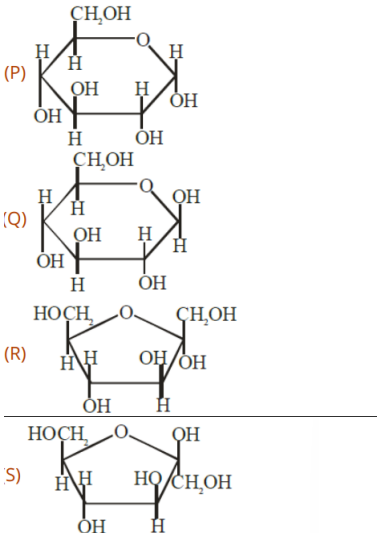
9. Match items of Row I with those of Row II:

Row I:



Row II:

(A) [(i)] α-D-(-)-Fructofuranose

(B) [(ii)] β-D-(-)-Fructofuranose

(C) [(iii)] α-D-(+)-Glucopyranose

(D) [(iv)] β-D-(+)-Glucopyranose

Correct Match:

(A) (1) P $\rightarrow$ iv, Q $\rightarrow$ iii, R $\rightarrow$ i, S $\rightarrow$ ii

(B) (2) P $\rightarrow$ i, Q $\rightarrow$ ii, R $\rightarrow$ iii, S $\rightarrow$ iv

(C) (3) P $\rightarrow$ iii, Q $\rightarrow$ iv, R $\rightarrow$ ii, S $\rightarrow$ i

(D) (4) P $\rightarrow$ iii, Q $\rightarrow$ iv, R $\rightarrow$ i, S $\rightarrow$ ii

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10. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Acetal/Ketal is stable in basic medium.

Reason R: The high leaving tendency of alkoxide ion gives the stability to acetal/ketal in basic medium.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is NOT the correct explanation of A

(C) A is true but R is false

(D) A is false but R is true

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11. Inert gases have positive electron gain enthalpy. Its correct order is:

(A) Xe $<$ Kr $<$ Ne $<$ He

(B) He $<$ Ne $<$ Kr $<$ Xe

(C) He $<$ Xe $<$ Kr $<$ Ne

(D) He $<$ Kr $<$ Xe $<$ Ne

12. Which one of the following reactions does not occur during the extraction of copper?

(A) $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

(B) $2FeS + 3O_2 \rightarrow 2FeO + 2SO_2$

(C) $CaO + SiO_2 \rightarrow CaSiO_3$

(D) $FeO + SiO_2 \rightarrow FeSiO_3$

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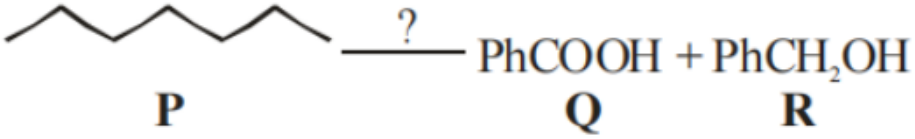
13. The correct sequence of reagents for the preparation of Q and R is:



(A) (i) CrO_3, 770 K, 20 atm; (ii) CrO_2Cl_2, H^+; (iii) NaOH; (iv) H_3O^+

(B) (i) CrO_2Cl_2, H_3O^+; (ii) CrO_3, 770 K, 20 atm; (iii) NaOH; (iv) H_3O^+

(C) (i) $KMnO_4$, OH^{--}; (ii) MoO_3, Δ; (iii) NaOH; (iv) H_3O^+

(D) (i) MoO_3, Δ; (ii) CrO_2Cl_2, H_3O^+; (iii) NaOH; (iv) H_3O^+

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14. The correct order in aqueous medium of basic strength in case of methyl-substituted amines is:

(A) $Me_2NH > MeNH_2 > Me_3N > NH_3$

(B) $Me_2N > Me_3NH > MeNH_2 > NH_3$

(C) $NH_3 > Me_3N > MeNH_2 > Me_2NH$

(D) $Me_3N > Me_2NH > MeNH_2 > NH_3$

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15. 25-volume hydrogen peroxide means:

(A) 1 L marketed solution contains 250 g of H_2O_2

(B) 1 L marketed solution contains 75 g of H_2O_2

(C) 1 L marketed solution contains 25 g of H_2O_2

(D) 1 L marketed solution contains 25 g of H_2O

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16. Which of the following statements is incorrect for antibiotics?

(A) An antibiotic must be a product of metabolism.

(B) An antibiotic is a synthetic substance produced as a structural analogue of naturally occurring antibiotic.

(C) An antibiotic should promote the survival of microorganisms.

(D) An antibiotic should be effective in low concentrations.

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17. Compound A reacts with NH_3Cl and forms B and C. Compound B reacts with H_2O and CO_2 to form C. The compounds A, B, and C are:

(A) $CaCl_2$, NH_3, NH_4HCO_3

(B) $CaCl_2$, NH_4^+, $(NH_4)_2CO_3$

(C) $Ca(OH)_2$, NH_3, NH_4HCO_3

(D) $Ca(OH)_2$, NH_4^+, $(NH_4)_2CO_3$

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18. Some reactions of NO_2 relevant to photochemical smog formation are:

Identify A, B, X, and Y:

(A) X = O, Y = NO, A = O_2, B = O_3

(B) X = N_2O, Y = O, A = O_3, B = NO

(C) X = $\frac{1}{2}$ O_2, Y = NO_2, A = O_3, B = O_2

(D) X = NO, Y = O, A = O_2, B = N_2O_3

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19. Match the List-I with List-II:

Cations (List-I)	Group Reaction (List-II)
P → Pb^{2+}, Cu^{2+}	(i) H_2S gas in presence of dilute HCl
Q → Al^{3+}, Fe^{3+}	(ii) $(NH_4)_2CO_3$ in presence of NH_4OH
R → Co^{2+}, Ni^{2+}	(iii) NH_4OH in presence of NH_4Cl
S → Ba^{2+}, Ca^{2+}	(iv) H_2S in presence of NH_4OH

(1) P→ i, Q→ iii, R→ ii, S→ iv

(2) P→ iv, Q→ ii, R→ iii, S→ i

(3) P→ iii, Q→ i, R→ iv, S→ ii

(4) P→ i, Q→ iii, R→ iv, S→ ii

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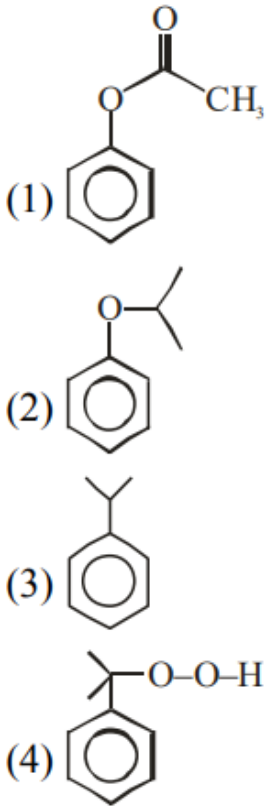
20. In the cumene to phenol preparation in the presence of air, the intermediate is:



Section B

21. An athlete is given 100 g of glucose ($C_6H_12O_6$) for energy, which is equivalent to 1800 kJ of energy. If 50% of this energy is utilized for activities, the weight of extra water needed to perspire is _____ g. (Nearest integer)

Given: Enthalpy of evaporation of water = 45 kJ/mol; molar masses: C = 12 g/mol, H = 1 g/mol, O = 16 g/mol.

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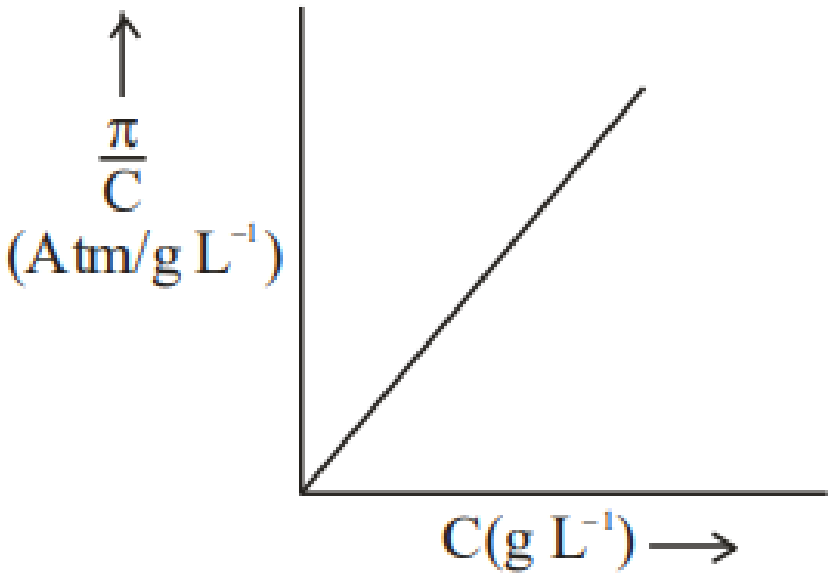
22. A litre of buffer solution contains 0.1 mole of each NH_3 and NH_4Cl. On addition of 0.02 mole of HCl, the pH of the solution is found to be _____ $\times 10^{-3}$ (Nearest integer).

Given: $pK_b(NH_3)$ = 4.745; $\log 2 = 0.301$; $\log 3 = 0.477$; T = 298 K.



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23. The osmotic pressure of solutions of PVC in cyclohexanone at 300 K are plotted on the graph. The molar mass of PVC is _____ g mol^{-1} (Nearest integer).

Given: R = 0.083 L atm K^{-1} mol^{-1}

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24. How many of the following metal ions have a similar value of spin-only magnetic moment in the gaseous state?

V^{3+}, Cr^{3+}, Fe^{2+}, Ni^{3+}

Given: Atomic numbers: V = 23, Cr = 24, Fe = 26, Ni = 28.

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25. The density of a monobasic strong acid (Molar mass 24.2 g mol^{-1}) is 1.21 kg L^{-1}. The volume of its solution required for the complete neutralization of 25 mL of 0.24 M NaOH is _____ $\times 10^{-3}$ mL (Nearest integer).

26. For the first-order reaction $A \rightarrow B$, the half-life is 30 min. The time taken for 75% completion of the reaction is _____ min (Nearest integer).

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27. The total number of lone pairs of electrons on oxygen atoms of ozone is _____.

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28. In sulphur estimation, 0.471 g of an organic compound gave 1.4439 g of barium sulphate. The percentage of sulphur in the compound is _____ (Nearest Integer).
Given: Atomic masses: Ba = 137, S = 32, O = 16.

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29. The number of paramagnetic species from the following is _____.

$$[Ni(CN)_4]^{2-}, [Ni(CO)_4], [NiCl_4]^{2-}, [Fe(CN)_6]^{3-}, [Cu(NH_3)_4]^{2+}, [Fe(H_2O)_6]^{2+}$$

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30. Consider the cell:

$$Pt(s)—H_2(g)(1\ atm)—H^+(aq,1\ M)——Fe^{3+}(aq),Fe^{2+}(aq)—Pt(s)$$

Given: $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.771\,V$, $E^\circ_{H^+/H_2} = 0\,V$, $T = 298\,K$.
If the potential of the cell is 0.712 V, the ratio of concentration of Fe^{2+} to Fe^{3+} is _____ (Nearest integer).