JEE Main 2024 Chemistry Question Paper Feb 1 Shift 1

Time Allowed :3 Hours	Maximum Marks :300	Total Questions :90

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 90 questions, out of which 75 are to attempted. The maximum marks are 300.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
4. 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

Chemistry
SECTION A

1. In Kjeldahl's estimation of nitrogen, CuSO4 acts as

(1) Oxidizing agent
(2) Reducing agent
(3) Catalyst
(4) Reagent

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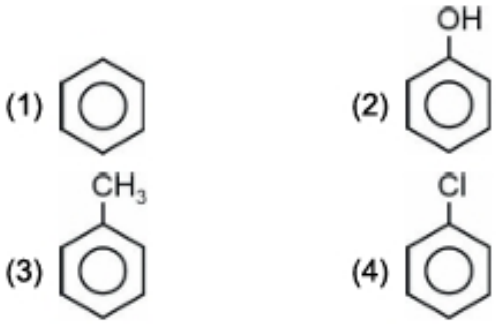
2. Which of the following is most likely attacked by an electrophile?



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3. Statement-I: PH3 will have a lower boiling point than NH3.
Statement-II: There are strong van der Waals forces in NH3 and weak hydrogen bonding in PH3.

(1) Statement-I and Statement-II both are true
(2) Statement-I and Statement-II both are false
(3) Statement-I is true but Statement-II is false
(4) Statement-I is false but Statement-II is true

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4. Which of the following have a trigonal bipyramidal shape?

(1) PF5, PBr5, [PtCl4] 2-, SF6, BrF5, PCl5, [Fe(CO)5] only
(2) BrF5, PF5, PCl5 and PBr5 only
(3) PF5, PCl5 and [Fe(CO)5] only
(4) [Fe(CO)5], BrF5, PF5, PBr5, PCl5 only

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5. Which of the following is correct for adiabatic free expansion against vacuum?

(1) q = 0, $\Delta U = 0$, W = 0
(2) q = 0, $\Delta U = 0$
(3) q = 0, $\Delta U \neq 0$, W = 0
(4) q = 0, $\Delta U \neq 0$, W $\neq$ 0

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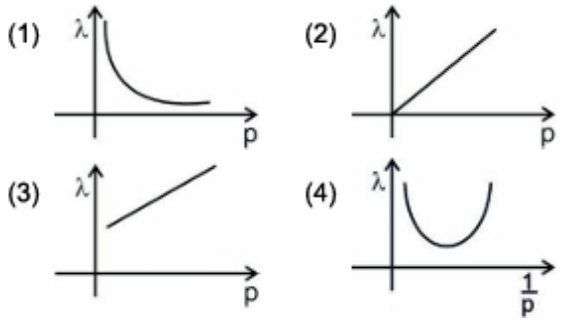
6. Which of the following is the correct plot between λ (de Broglie wavelength) and p (momentum)?



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7. Balance the following reaction and find x, y, and A:

$$\mathbf{Cr_2O_7^{2-}} + x\mathbf{H^+} + y\mathbf{e^-} \rightarrow 2\mathbf{Cr^{3+}} + A\mathbf{H_2O}$$

(1) $x = 7$, $y = 6$, $A = 14$
(2) $x = 14$, $y = 6$, $A = 7$
(3) $x = 14$, $y = 3$, $A = 7$
(4) $x = 8$, $y = 2$, $A = 1$

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8. The complementary strand of DNA for ATGCTTCA is:

(1) TACGAAGA
(2) TACGAAGT
(3) TAGCAACA
(4) TAGTCACT

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9. What is the pH of CH_3COO-NH_4^+ salt?
Given K_a of $CH_3COOH = 1.8 \times 10^{-5}$
Given K_b of $NH_4OH = 1.8 \times 10^{-5}$
(At 25°C)

(1) 7
(2) 9

(3) 8.9
(4) 7.8

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10. We are given with 3 NaCl samples and their van't Hoff factors

Sample	van't Hoff factor
Sample-1 (0.1M)	i_1
Sample-2 (0.01M)	i_2
Sample-3 (0.001M)	i_3

(1) $i_1 = i_2 = i_3$
(2) $i_1 > i_2 > i_3$
(3) $i_3 > i_2 > i_1$
(4) $i_1 > i_3 > i_2$

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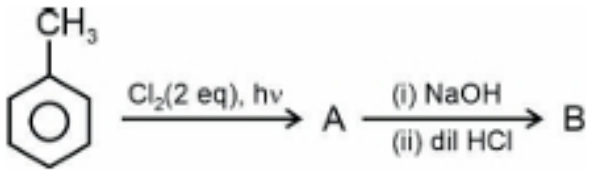
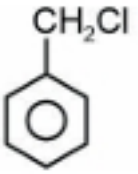
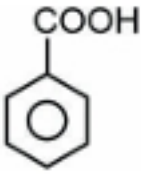
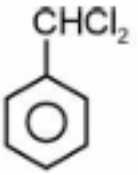
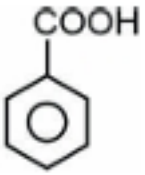
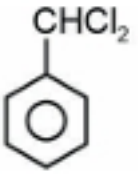
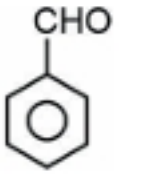
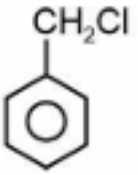
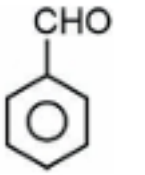
11. A and B in the following reaction are:



(1) (A)  (B) 

(2) (A)  (B) 

(3) (A)  (B) 

(4) (A)  (B) 

12. We have a mixture of gases having 2 moles of monoatomic gas

$$C_{v,m} = \frac{3R}{2}$$

and 6 moles of diatomic gas

$$C_{v,m} = \frac{5R}{2}$$

Find molar heat capacity $C_{v,m}$ of the mixture.

(1) $\frac{9R}{4}$
(2) $\frac{9R}{2}$
(3) $3R$
(4) $4R$

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13. Assertion (A): KCN reacts with R-X to give cyanide and AgCN reacts with R-X to give isocyanide mainly.
Reason (R): KCN and AgCN both are ionic compounds.

(1) Both Assertion and Reason are true and Reason explains Assertion.
(2) Both Assertion and Reason are true but Reason does not explain Assertion.
(3) Assertion is true and Reason is false.
(4) Assertion is false but reason is true.

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14. Consider the following two statements.

Statement I: $[\mathrm{Ni}(H_2O)_6]^{2+}$ is green in color.
Statement II: $[\mathrm{Ni}(CN)_4]^{2-}$ is colorless.

(1) Statement I is true, Statement II is false
(2) Statement I is true, Statement II is true
(3) Statement I is false, Statement II is true
(4) Statement I is false, Statement II is false

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15. Statement-I: Potassium hydrogen phthalate is the primary standard for NaOH solution.
Statement-II: Phenolphthalein is used to detect completion of titration.

(1) Both Statement-I and Statement-II are correct
(2) Statement-I is correct and Statement-II is incorrect
(3) Statement-I is incorrect and Statement-II is correct
(4) Both Statement-I and Statement-II are incorrect

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16. Statement-I: In aniline, $-NH_2$ group is a strong deactivating group for all ESR.
Statement-II: Aniline does not show Friedel-Craft alkylation reaction.

(1) Both statement-I and statement-II are correct
(2) Both statement-I and statement-II are incorrect
(3) Statement-I is correct and statement-II is incorrect
(4) Statement-I is incorrect and statement-II is correct

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17. Which of the following is homoleptic complex?

(1) $[Ni(CN)_4]^{2-}$
(2) $[Cu(H_2O)_3Cl_3]$
(3) $[PtCl_2Br_2]^{2-}$
(4) $[Cu(NH_3)_5Cl]Cl_2$

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18. For ionic reaction in organic compounds, which type of bond cleavage occurs?

(1) Heterolytic cleavage
(2) Homolytic cleavage
(3) Free radical
(4) No cleavage of bond

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19. Ka values of three acids A, B, and C are 10^{-3}, 5×10^{-9}, and 9×10^{-11} respectively. The acidic strength order of these acids is

(1) A ¿ B ¿ C
(2) B ¿ A ¿ C
(3) C ¿ B ¿ A
(4) C ¿ A ¿ B

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20. Which of the following is a disproportionation reaction?

(A) $Cu^{+} \longrightarrow Cu^{2+} + Cu$
(B) $MnO_4^{2-} \longrightarrow MnO_4^{+} + MnO_2$
(C) $H_2O_2 \longrightarrow O_2 + H_2O$
(D) $Cr_2O_7^{2-} \longrightarrow Cr^{3+} + H_2O$

(1) All A, B, C and D
(2) A and B only
(3) A and C only
(4) A, B and C only

SECTION B

21. Find out total possible optical isomers of 2-chlorobutane.

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22. We are given with following cell reaction:

$$2H^{+} + 2e^{-} \longrightarrow H_2$$

If $P_{H_2} = 2\,\text{atm}$, $[H^{+}] = 1\,\text{M}$, and E_{cell} for reaction is given by $-x \times 10^{-3}\,\text{V}$, find out x.

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23. Total number of deactivating groups among the following

$$-C = N, -N = C - CH_3, -C = C - CH_3, -N = C - CH_3$$

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24. How many oxides are amphoteric in nature?

$$SnO_2, PbO_2, SiO_2, P_2O_5, Al_2O_3, CO_2, CO, NO, N_2O$$

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25. For carbon dating of a wood sample

$$\left(\frac{C^{14}}{C^{12}}\right)_t = \left(\frac{C^{14}}{C^{12}}\right)_0 \left(\frac{1}{2}\right)^n$$

If Half-life of C^{14} is 1580 years, what is the life of wood sample (in yr)?

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26. What is the minimum energy (in eV) required for an electron to excite from ground state to 1st excited state for hydrogen atom?

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27. Find out moles of precipitate product formed when 72 moles of $PbCl_2$ reacts with 50 moles of $(NH_4)_2SO_4$.
