

## PART 1 - CHEMISTRY

Topic : Electrochemistry

## SECTION-A : (Maximum Marks : 12)

This section contains **THREE** questions.

Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

For each question, choose the option(s) corresponding to (all) the correct answer(s).

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 ONLY if (all) the correct option(s) is(are) chosen;

Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;

Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;

Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases.

For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks; choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of options will get -1 marks.

1. At 300 K, the molar conductivities of the aqueous solutions of three salts at two different concentrations are given below:

| Salt            | Concentration (M) | Molar conductivity ( $\text{S cm}^2 \text{mol}^{-1}$ ) |
|-----------------|-------------------|--------------------------------------------------------|
| $\text{NaNO}_3$ | 0.01              | 111                                                    |
|                 | 0.04              | 101                                                    |
| $\text{NaCl}$   | 0.01              | 117                                                    |
|                 | 0.04              | 107                                                    |
| $\text{AgNO}_3$ | 0.01              | 125                                                    |
|                 | 0.04              | 116                                                    |

The conductivity of a saturated aqueous solution of  $\text{AgCl}$  is  $1.40 \times 10^{-6} \text{ S cm}^{-1}$  at 300 K. If the solubility of  $\text{AgCl}$  in water at 300 K is  $X \text{ mol L}^{-1}$ , then  $\log_{10}(X^{-1})$  is

(Assume that  $\text{AgCl}$  dissolved in water ionizes completely and that the molar conductivity of saturated  $\text{AgCl}$  solution is equal to its limiting molar conductivity.)

[JEE Advanced 2026 Paper 2]

(A) 3

(B) 4

(C) 5

(D) 6

Scan or tap for the full solution



Space for Rough Work

2. In a conductometric titration, small volume of titrant of higher concentration is added stepwise to a larger volume of titrate of much lower concentration, and the conductance is measured after each addition.

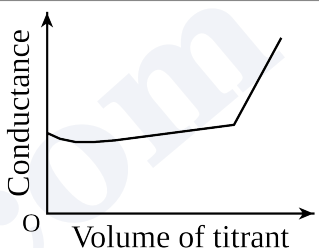
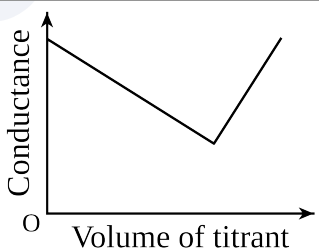
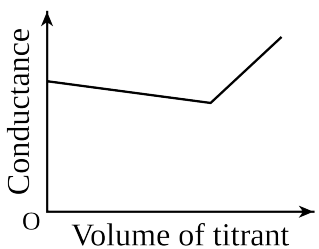
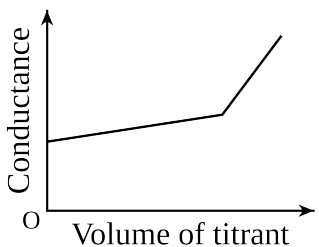
The limiting ionic conductivity ( $\Lambda_0$ ) values (in  $\text{mS m}^2 \text{mol}^{-1}$ ) for different ions in aqueous solutions are given below:

| Ions        | $\text{Ag}^+$ | $\text{K}^+$ | $\text{Na}^+$ | $\text{H}^+$ | $\text{NO}_3^-$ | $\text{Cl}^-$ | $\text{SO}_4^{2-}$ | $\text{OH}^-$ | $\text{CH}_3\text{COO}^-$ |
|-------------|---------------|--------------|---------------|--------------|-----------------|---------------|--------------------|---------------|---------------------------|
| $\Lambda_0$ | 6.2           | 7.4          | 5.0           | 35.0         | 7.2             | 7.6           | 16.0               | 19.9          | 4.1                       |

For different combinations of titrates and titrants given in **List-I**, the graphs of 'conductance' versus 'volume of titrant' are given in **List-II**.

Match each entry in **List-I** with the appropriate entry in **List-II** and choose the correct option.

[JEE Advanced 2024 Paper 1]

| List-I |                                                    | List-II |                                                                                       |
|--------|----------------------------------------------------|---------|---------------------------------------------------------------------------------------|
| P.     | Titrate: KCl<br>Titrant: $\text{AgNO}_3$           | 1.      |    |
| Q.     | Titrate: $\text{AgNO}_3$<br>Titrant: KCl           | 2.      |   |
| R.     | Titrate: NaOH<br>Titrant: HCl                      | 3.      |  |
| S.     | Titrate: NaOH<br>Titrant: $\text{CH}_3\text{COOH}$ | 4.      |  |

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| List-I |  | List-II |  |
|--------|--|---------|--|
|        |  | 5.      |  |

(A) P-4, Q-3, R-2, S-5 (B) P-2, Q-4, R-3, S-1 (C) P-3, Q-4, R-2, S-5 (D) P-4, Q-3, R-2, S-1

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3. An aqueous solution of hydrazine ( $\text{N}_2\text{H}_4$ ) is electrochemically oxidized by  $\text{O}_2$ , thereby releasing chemical energy in the form of electrical energy. One of the products generated from the electrochemical reaction is  $\text{N}_2(\text{g})$ .

Choose the correct statement(s) about the above process

[JEE Advanced 2024 Paper 2]

- (A)  $\text{OH}^-$  ions react with  $\text{N}_2\text{H}_4$  at the anode to form  $\text{N}_2(\text{g})$  and water, releasing 4 electrons to the anode.
- (B) At the cathode,  $\text{N}_2\text{H}_4$  breaks to  $\text{N}_2(\text{g})$  and nascent hydrogen released at the electrode reacts with oxygen to form water.
- (C) At the cathode, molecular oxygen gets converted to  $\text{OH}^-$ .
- (D) Oxides of nitrogen are major by-products of the electrochemical process.

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**SECTION-B : (Maximum Marks : 8)**

This section contains **TWO** questions.

The answer to each question is a **NUMERICAL VALUE**.

For each question, enter the correct numerical value of the answer (in decimal notation, truncated / rounded-off to the **SECOND DECIMAL PLACE**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) in the place designated to enter the answer.

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If **ONLY** the correct answer is entered;

Zero Marks : 0 In all other cases.

4. In an electrochemical cell, dichromate ions in aqueous acidic medium are reduced to  $\text{Cr}^{3+}$ . The current (in amperes) that flows through the cell for 48.25 minutes to produce 1 mole of  $\text{Cr}^{3+}$  is \_\_\_\_\_.

Use: 1 Faraday = 96500 C mol<sup>-1</sup>

[JEE Advanced 2025 Paper 1]

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full solution



5. An electrochemical cell is fueled by the combustion of butane at 1 bar and 298 K. Its cell potential is  $\frac{X}{F} \times 10^3$  volts, where F is the Faraday constant. The value of X is \_\_\_\_\_.

Use: Standard Gibbs energies of formation at 298 K are:  $\Delta_f G^\circ_{\text{CO}_2} = -394 \text{ kJ mol}^{-1}$ ;  $\Delta_f G^\circ_{\text{water}} = -237 \text{ kJ mol}^{-1}$ ;  $\Delta_f G^\circ_{\text{butane}} = -18 \text{ kJ mol}^{-1}$

[JEE Advanced 2025 Paper 2]

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## JEE ADVANCED ELECTROCHEMISTRY — PYQS

Test Pattern : **JEE (Advanced)**

## ANSWER KEY

## SECTION-A

[illegible]

## SECTION-B

|              |     |                |  |  |  |  |  |  |  |
|--------------|-----|----------------|--|--|--|--|--|--|--|
| <b>Ques.</b> | 4   | 5              |  |  |  |  |  |  |  |
| <b>Ans.</b>  | 100 | 105.4 to 105.6 |  |  |  |  |  |  |  |