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(සියලු හිමිකම් ඇවිරිණි)
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ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව / இலங்கைப் பரீட்சைத் திணைக்களம் / Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය 1997 අගෝස්තු (නව නිර්දේශය)
கல்விப் பொதுத் தராதரப்பத்திர(உயர் தர)ப் பரீட்சை, 1997 ஒகஸ்ற் (புதிய பாடத்திட்டம்)
General Certificate of Education (Adv. Level) Examination, August 1997 (New Syllabus)

රසායන විද්‍යාව I
இரசாயனவியல் I
Chemistry I

02
E | I

පැ දෙකයි / இரண்டு மணி / Two hours

Important : This question paper consists of **two** sheets. Put the sheets together in the correct **order of pages before** answering.

*Enter your **Index Number** in the space provided on the answer sheet.*
*Use of calculators is **not** allowed.*

*You should attempt **all** the questions in this paper. For each question there are five responses of which only **one** is correct. When you have selected the response which you cosider to be the best answer to a question, mark your response on the answer sheet. Answer easier questions first and leave aside any questions which you find too difficult and come back to them later.*

Universal gas constant, $R = 8{\cdot}314\ J\ K^{-1}\ mol^{-1}$

The following abbreviations have been used.

aq = aqueous
C = Celsius or Centigrade or Coulomb
g = gas
l = liquid
$mol\ dm^{-3}$ = moles per cubic decimetre
s = solid

Other abbreviations also follow standard usage.

1. The principal valencies of the element of atomic number 34 are
(1) 2 and 4. (2) 2 and 6. (3) 1 and 3. (4) 2 and 3. (5) 3 and 5.

2. Which one of the following compounds has the highest ionic character?
(1) LiCl (2) HF (3) LiBr (4) RbCl (5) HI

3. The concentration of an aqueous solution of methanol is 10%, **by weight**. If the relative atomic masses of carbon, hydrogen and oxygen are respectively 12 , 1 and 16, the mole fraction of methanol in this solution is
(1) 0.1111. (2) 0.8889. (3) 0.0588. (4) 0.9412. (5) 0.0625.

4. Which one of the following statements concerning the chemistry of phosphorus is true?
(1) The H_3PO_3 molecule has three O—H bonds.
(2) The H_3PO_3 molecule has two O—H bonds.
(3) The H_3PO_2 molecule has two O—H bonds.
(4) Phosphorus does not react with chlorine.
(5) Phosphorus reacts with water.

5. The straight-chain organic compound of molecular formula $C_3H_4Cl_2$
(1) exists as 4 isomers. (2) exists as 5 isomers.
(3) exists as 6 isomers. (4) exists as 7 isomers.
(5) exists as 8 isomers.

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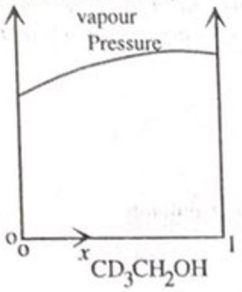
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6. 0.80 mol of a gas which behaves ideally, is present in a closed vessel at a temperature of 300 K and under a pressure of 4.157×10^5 N m^{-2}. The volume of this vessel is
(1) 480×10^{-5} m^3. (2) 480×10^{-3} dm^3. (3) 720×10^{-5} m^3.
(4) 720×10^{-3} dm^3. (5) 960×10^{-5} m^3.

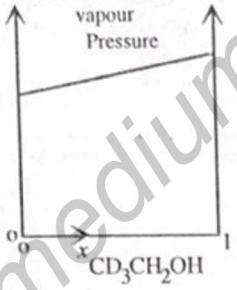
7. When the inorganic compoound, **X** was treated with dilute hydrochloric acid, a colourless gas and a coloured solution were obtained. When this gas was passed into an aqueous solution of hydrogen sulphide, a precipitate was obtained. When an excess of aqueous ammonia was added to the coloured solution referred to above, a coloured precipitate was obtained. Which one of the following could be X?
(1) $Fe(NO_2)_3$ (2) $Cr_2(SO_3)_3$ (3) $Cr_2(CO_3)_3$ (4) $CuSO_3$ (5) $Cu(NO_2)_2$

8. Aqueous $Pb(NO_3)_2$ / HNO_3
(1) gives a precipitate with $ClCH = CHCH_2COBr$.
(2) gives a precipitate with $BrCH_2CH_2COOH$.
(3) gives a precipitate with $I_2CHCH_2COCH_2CH_2Br$.
(4) gives a precipitate with C_6H_5I
(5) does not give a precipitate with any of the above.

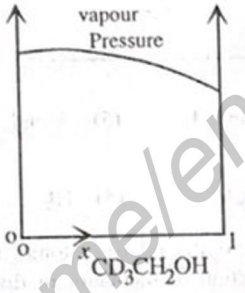
9. The vapour pressure variation of the binary system consisting of CD_3CH_2OH and $DCH_2CH_2CH_2OH$
(1) takes the form,



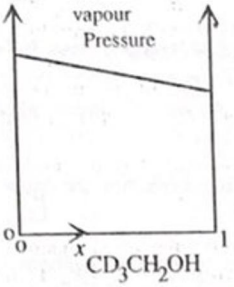
(2) takes the form,



(3) takes the form,



(4) takes the form,



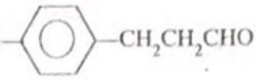
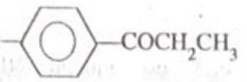
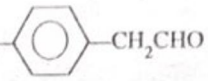
(5) takes none of the forms shown above.

10. Naturally occuring chlorine contains 75% of the $^{35}_{17}Cl$ isotope and 25% of the $^{37}_{17}Cl$ isotope. The relative atomic mass of naturally occuring chlorine
(1) is 36. (2) is 35·51. (3) is 35·47. (4) is 36·5.
(5) cannot be accurately calculated with the data supplied.

11. For the purpose of calculating the lattice energy of the hypothetical compound 'CaF',
(1) the second ionization energy of calcium is necessary.
(2) the first ionization energy of calcium is neccessary.
(3) the first ionization energy of fluorine is necessary.
(4) the standard entnalphy change pertaining to the process, $F(g) + 2e \longrightarrow F^{2-}(g)$ is necessary.
(5) none of the above is necessary.

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12. Which one of the following wil **not** undergo a chemical change in the presence of aqueous H_2O_2?
(1) NH_4MnO_4 / dilute HCl (2) $NaMnO_4$ / dilute HNO_3
(3) MnO_2 / dilute H_2SO_4 (4) MnO_2 (5) HI

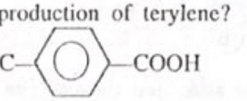
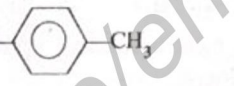
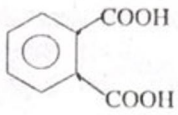
13. The organic compound, **Y** dissolves in aqueous sodium hydroxide. It gives a precipitate with Brady's reagent. It reduces Fehling's solution. Which one of the following is most likely to be **Y**?
(1) $HOOCCH_2CH_2CH_2COCH_3$
(2) 
(3) 
(4) 
(5) $HOCH_2CH_2CH_2CH_2CH_2CH_2CHO$

14. Which one of the following has the largest ionic radius?
(1) S^{2-} (2) Na^+ (3) F^- (4) O^{2-} (5) Mg^{2+}

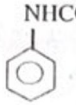
15. The first seven successive ionization energies of an element are respectively as follows: 1018, 1910, 2919, 4972, 6280, 21276 and 25403 kJ mol^{-1}. This element
(1) belongs to group 2 of the periodic table.
(2) belongs to group 3 of the periodic table.
(3) belongs to group 4 of the periodic table.
(4) belongs to group 5 of the periodic table.
(5) belongs to group 6 of the periodic table.

16. Which one of the following statements concerning environmental pollution casued by acidic substances is most appropriate?
(1) N_2 is an important factor. (2) O_2 is an important factor.
(3) Coal and O_2 are important factors. (4) H_2O is an important factor.
(5) All of the above are important factors.

17. Which one of the following is most closely connected with apatite?
(1) Ca_2PO_4Cl (2) $Ca_3PO_4F_3$ (3) $Ca_5(PO_4)_3F$ (4) $CaMgPO_4F$ (5) $Ca_2MgPO_4F_2Cl$

18. Which one of the following is **not** necessary for the production of terylene?
(1) $HOCH_2CH_2OH$
(2) 
(3) 
(4) $CH_2=CH_2$
(5) 

19. The size of the atomic nucleus was first determined by
(1) making use of α-particle scattering. (2) making use of β-particle scattering.
(3) using high-speed electrons. (4) using neutron beams.
(5) making use of α-particle absorption.

20. Which one of the following statements concerning the nitration of  is most appropriate?
(1) A mixture of the 1 - nitro derivative and the 3 - nitro derivative is obtained.
(2) A mixture of the 2 - nitro derivative and the 3 - nitro derivative is obtained.
(3) A mixture of the 2 - nitro derivative and the 4 - nitro derivative is obtained.
(4) The 4 - nitro derivative is obtained.
(5) The 2 - nitro derivative is obtained.

21. NH_4OH and NH_4CNS were added to an aqueous solution of an inorganic compound, **Z**, and the reaction mixture was kept aside for a few minutes. Then, this reaction mixture was acidified with dilute sulphuric acid. A red solution was thus produced. Which one of the following is most likely to be **Z**?
(1) $NiSO_4$ (2) $Cr_2(SO_4)_3$ (3) $Mn(NO_3)_2$ (4) $K_4Fe(CN)_6$ (5) $FeSO_4$

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22. 50.0 cm^3 of 0.1 mol dm^{-3} aqueous NaOH solution was mixed with 100.0 cm^3 of 0.1 mol dm^{-3} aqueous CH_3COOH solution. The pH of this mixture was 4.75. 1.0 cm^3 of aqueous 0.1 mol dm^{-3} KOH was added to the above mixture. The pH of the solution finally obtained
(1) is likely to increase to 4.90.
(2) is likely to decrease to 4.70.
(3) is likely to decrease to 4.65
(4) is likely to decrease to 4.60
(5) is likely to remain constant as 4.75.

23. The colour-change pH intervals of four acid-base indicators, **P**, **Q**, **R**, and **S** are shown in the Table below.

Indicator	Colour-change pH interval
P	3.9 — 5.1
Q	4.0 — 5.4
R	4.7 — 6.3
S	8.3 — 9.1

Which one of the statements concerning the titration between 0.1 mol dm^{-3} aqueous NH_3 solution and 0.1 mol dm^{-3} aqueous $HClO_4$ solution is most appropriate?
(1) For this titration, **Q** is a suitable indicator.
(2) For this titration, **P** and **Q** are suitable indicators.
(3) For this titration, **S** is a suitable indicator.
(4) For this titration, **P**, **Q** and **R** are suitable indicators.
(5) For this titration, **Q**, **R** and **S** are suitable indicators.

24. When an organic compound, **A** was boiled with concentrated HCl and allowed to cool, a white crystalline solid, **B** was obtained. When **B** was filtered off, separated, washed with water and then treated with $NaHCO_3$ solution, bubbles of gas were liberated. $NaNO_2$ was added to the filtrate and it was neutrailzed with aqueous NH_3. When bromine water was added to this neutral solution, a white precipitate was obtained. Which one of the following could be **A**?
(1) $C_6H_5NHCOCH_2CH_3$ (2) $CH_3CH_2CH_2NHCOC_6H_5$ (3) $C_6H_5NHCOC_6H_5$
(4) $(C_6H_5)_2NCOC_2H_5$ (5) $(CH_3)_3CNHCOCH_2C_6H_5$

25. It has become necessary to synthesise $H_2NCH_2CH_2CH_2CH_2NH_2$ starting from ethene. The most appropriate first step for this purpose is
(1) reacting ethene with aqueous sulphuric acid.
(2) reacting ethene with aqueous hydrobromic acid.
(3) reacting ethene with Cl_2.
(4) reacting ethene with aqueous KCN.
(5) reacting ethene with alcoholic $ClCH_2CN$.

26. The chemical formula of scandium thiosulphate is
(1) ScS_2O_3 . (2) $Sc(S_2O_3)_2$. (3) $Sc_2(S_2O_3)_3$.
(4) $Sc_3(S_2O_3)_2$. (5) none of the above.

27. The shape of the POClBrF molecule
(1) is planar. (2) takes the form of a square pyramid.
(3) is octahedral. (4) is tetrahedral
(5) is trigonal bipyramidal

● **Consider the following compounds in connection with questions No. 28—30.**

K_2CrO_4	$ZnSO_4$	$CuCl_2$	$FeCl_3$	$NiSO_4$
(A)	**(B)**	**(C)**	**(D)**	**(E)**

28. Which of the above is/are likely to give a precipitate with dilute HCl saturated with H_2S?
(1) **A** only. (2) **A** and **B** only. (3) **C** only.
(4) **A, C** and **D** only. (5) **B** and **E** only.

29. Which of the above is/ are likely to liberate I_2 with KI, under certain specific conditions?
(1) **A** and **B** only. (2) **A, C** and **D** only. (3) **A** and **D** only.
(4) **A** and **C** only. (5) **C, D** and **E** only.

30. Which of the above will oxidize CH_3CHO under certain specific conditions?
(1) **A** only. (2) **B** and **D** only. (3) **A** and **C** only.
(4) **C** only. (5) **A, B** and **E** only.

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Instructions for questions No. 31 to 40

For each of the questions 31 to 40 four responses (*a*), (*b*), (*c*), (*d*) are given. One or more of these is/are correct. Select the correct response/responses. Mark × against,

(1) if only (*a*) and (*b*) are correct.
(2) if only (*b*) and (*c*) are correct.
(3) if only (*c*) and (*d*) are correct.
(4) If only (*d*) and (*a*) are correct.
(5) If only one response or any other number of responses are correct.

Summary of Instructions				
(1)	(2)	(3)	(4)	(5)
Only (*a*) and (*b*) correct	Only (*b*) and (*c*) correct	Only (*c*) and (*d*) correct	Only (*d*) and (*a*) correct	Only one response or any other number of responses correct

31. Which of the following will react with phenol?
(*a*) $RbHCO_3$ (*b*) $C_6H_5OCH_2CH_3$
(*c*) Concentrated nitric acid (*d*) Ethanoyl chloride

32. Which of the following will assist the corrosion of iron that is taking place in air?
(*a*) Mg (*b*) NaCl (*c*) CO_2 (*d*) NO

33. Consider following reaction,

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta\overset{\ominus}{H} = -46 \text{ kJ (per mole of } NH_3 \text{ formed)}$$

Which of the following statements / statement concerning the above reaction are / is true?

(*a*) At all temperatures, $K_p = \dfrac{(P_{NH_3})^2}{P_{N_2} \times (P_{H_2})^3}$

(*b*) At constant temperature, K_p increases when P_{N_2} is increased.

(*c*) At constant temperature, K_p decreases when P_{N_2} is increased.

(*d*) At constant pressure, the amount of NH_3 in equilibrium reaction mixture increases when the temperature is decreased.

34. Which one of the following relationships / relationship concerning the pH of the aqueous solutions, 0.1 mol dm^{-3} Na_2CO_3, 0.1 mol dm^{-3} $KHCO_3$, 0.1 mol dm^{-3} $Ba(ClO_4)_2$ and 0.1 mol dm^{-3} $C_6H_5NH_3^+ HSO_4^-$ are / is true?

(*a*) $C_6H_5NH_3^+ HSO_4^- < KHCO_3 < Na_2CO_3$
(*b*) $C_6H_5NH_3^+ HSO_4^- < Ba(ClO_4)_2 < KHCO_3$
(*c*) $Ba(ClO_4)_2 < Na_2CO_3 < KHCO_3$
(*d*) $Na_2CO_3 < KHCO_3 < Ba(ClO_4)_2$

35. Which of the following could be deduced using the equation $PV = \frac{1}{3} mN\overline{c^2}$?
(*a*) Boyle's law (*b*) Charles' law
(*c*) Deviations from gas laws (*d*) Avogadro constant, *L*

36. Which of the following statements / statement are / is true?
(*a*) Electric fields do not affect the path of cathode rays.
(*b*) Magnitic fields do not affect the path of cathode rays.
(*c*) Electric fields do not affect the path of fast-moving neutrons.
(*d*) Magnetic fields do not affect the path of fast-moving neutrons.

37. Strong hydrogen bonds
(*a*) exist in CH_3OH liquid. (*b*) exist in CH_3COOH liquid.
(*c*) exist in liquid NH_3. (*d*) exist in liquid HF.

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38. Which of the following statements / statement concerning the mechanism of the reaction occuring between C_6H_5CHO and HCN are/is true?
   (*a*) The initial attack is by the $:\bar{C}N$ ion on the C atom of the $>C=O$ group
   (*b*) The second attack is by the H^+ ion.
   (*c*) The initial attack is by $C\bar{N}:$ on the O atom.
   (*d*) The initial attack is by one of the lone pairs of electrons present in the $>C=\ddot{O}:$ group.

39. Which of the following statements/statement concerning bleaching powder are/is true?
   (*a*) Limestone is necessary for manufacturing it.
   (*b*) Salt is necessary for manufacturing it.
   (*c*) It changes the colour of $K_2Cr_2O_7$ / hot concentrated H_2SO_4.
   (*d*) It removes the colour of $FeCl_3$ in aqueous ammonia medium.

40. Which of the following are/is necessary for the manufacture of caustic soda for commercial applications?
   (*a*) Carbon (*b*) Iron (*c*) Sulphur (*d*) Thermal energy

● In questions No. **41** to **50**, two statements are given in respect of each question. From the Table given below, select the description (1), (2), (3), (4), (5) that **best** fits the two statements given for each of the questions and mark appropriately.

First Statement	Second Statement
(1) Ture	True, and correctly explains the first statement.
(2) True	True, but does **not** explain the first statement correctly.
(3) True	False
(4) False	True
(5) False	False

	First Statement	Second Statement
41.	The shape of the electron density distribution of the 1*s* orbital of the hydrogen atom is spherical.	According to the Bhor Theory, the electron in the hydrogen atom moves in a circular path.
42.	Propanone reacts with aniline.	An acid-base reaction occurs between aniline and propanone.
43.	Citronella oil can be extracted by steam distillation.	Raoult's law can be applied to this distillation.
44.	Nitrogen gas cannot act as an oxidizing agent.	The electronegativity of nitrogen is less than the electronegativity of oxygen.
45.	The specific heat capacity of liquid water is anomalously high.	In liquid water, strong interactions occur between H_2O molecules.
46.	All catalysts increase the rates of the relevant chemical reactions.	All catalysts decrease the activation energies of the relevant chemical reactions.
47.	Alkenes are not converted into an oxidized state by alkaline $KMnO_4$.	The MnO_4^- ion does not show oxidizing properties in alkaline solution.
48.	The hardness of diamond is very much higher than the hardness of solid carbon dioxide.	The C—C bond strength is very much higher than the C=O bond strength.
49.	Optical isomers cannot be obtained by subjecting propene to addition reactions.	Propene does not exist as geometrical isomers.
50.	NO_2 cannot act as an oxidizing agent.	NO_2 can be converted easily to HNO_3.

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Which one of the following statements concerning the electrolysis of some aqueous solutions is **false**?

(1) The mass of Cd liberated during a definite time is proportional to the electric current that is passed through a $Cd(NO_3)_2$ solution.

(2) The mass of Cu liberated by a definite electric current is proportional to the time during which the current is passed through a $Cu(NO_3)_2$ solution.

(3) The masses of Cd and Cu liberated when a definite quantity of electricity is passed through aqueous $CdSO_4$ and $CuSO_4$ solutions are proportional to the molar masses of those elements.

(4) The masses of Ag, Hg and Fe liberated when a definite quantity of electricity is passed through aqueous $AgNO_3$, $HgSO_4$ and $FeCl_3$ solutions are proportinal to the molar masses of those elements.

(5) The masses of Ag and Cu liberated when a definite quantity of electricity is passed through aqueous Ag_2SO_4 and $CuSO_4$ solutions are proportional to the chemical equivalents of those elements.

52. $SrCrO_4$ is dissolved in dilute nitric acid. The colour of this solution is

(1) purple. (2) green. (3) yellow. (4) orange. (5) red.

53. The relationship among K_b of $NH_3(aq)$, K_a of $NH_4^+(aq)$ and K_w at the same temperature is

(1) $\frac{K_a}{K_b} = K_w$. (2) $\frac{K_b}{K_a} = K_w$ (3) $K_a - K_b = K_w$

(4) $K_a \times K_b = (K_w)^{\frac{1}{2}}$ (5) none of the above.

54. $Zn^{2+}(aq) + 2e \longrightarrow Zn(s) \quad \overset{\ominus}{E} = -0.76$ V

$Ag^+(aq) + e \longrightarrow Ag(s) \quad \overset{\ominus}{E} = +0.80$ V

Which one of the following statements concerning the cell,

$Zn(s) \mid Zn^{2+}(aq, 1 \text{ mol dm}^{-3}) \,\|\, Ag^+(aq, 1 \text{ mol dm}^{-3}) \mid Ag(s)$

is **false**?

(1) Oxidation takes place at the Zn electrode.

(2) Reduction takes place at the Ag electrode.

(3) The $\overset{\ominus}{E}$ of this cell is + 1.56 V.

(4) The $\overset{\ominus}{E}$ of this cell is + 0.84 V.

(5) In this cell, the Zn electrode has a negative electrical charge.

55. The reactions between $H_2(g)$ and $Cl_2(g)$ is catalysed by palladium. Which one of the following statements concerning this reaction is most appropriate?

(1) The enthalpy change of formation of $HCl(g)$ is decreased by palladium.

(2) The enthalpy change of decomposition of $HCl(g)$ is decreased by palladium.

(3) H_2 is adsorbed on palladium.

(4) Cl_2 is adsorbed on palladium.

(5) Both hydrogen and chlorine are adsorbed on palladium.

56. The water solubility of $Cu(OH)_2$ at a certain temperature is x mol dm^{-3}. The solubility of $Cu(OH)_2$ in 2.0 mol dm^{-3} aqueous ammonia at the same temperature is

(1) x^3 mol dm^{-3}. (2) $\frac{x^3}{4}$ mol dm^{-3}. (3) x^2 mol dm^{-3}.

(4) $\frac{x^2}{2}$ mol dm^{-3}. (5) none of the above.

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57. The straight-chain hydrocarbon of molecular formula, $C_{11}H_{20}$ was subjected to oxidation under vigor oxidizing conditions. In this reaction, the reactive carbon-carbon bonds were broken, and two carboxylic acid were obtained as products. This hydrocarbon

(1) is likely to be $CH_3CH = CHCH_2CH_2CH_2CH = CHCH_2CH_2CH_3$.

(2) is likely to be $CH_3CH_2CH = CHCH_2CH_2CH_2C \equiv CCH_2CH_3$.

(3) is likely to be $CH_3CH_2CH = C = CHCH_2CH_2CH_2CH_2CH_2CH_3$.

(4) is likely to be $CH_3CH_2CH_2C \equiv CCH_2CH_2CH_2CH = CHCH_3$.

(5) is likely to be $CH_3C \equiv CCH_2CH_2CH_2C \equiv CCH_2CH_2CH_3$.

58. Which one of the following concerning halogens is most likely to be **false**?

(1) $3Cl_2 + 8NH_3 \longrightarrow N_2 + 6NH_4Cl$

(2) $3Cl_2 + 2NH_3 \longrightarrow N_2 + 6HCl$

(3) $I_2 + 2H_2O \longrightarrow H_3O^+ + I^- + HOI$

(4) $Cl_2 + 2HF \longrightarrow 2HCl + F_2$

(5) $Br_2 + 2HI \longrightarrow 2HBr + I_2$

59. Which one of the following is true?

(1) Avogadro constant = $\dfrac{96490\ C}{2 \times \text{charge on the alpha particle}}$

(2) Avogadro constant = $\dfrac{96500\ C}{\text{charge on the sodium ion}}$

(3) Avogadro constant = $\dfrac{F}{\text{charge on the oxide ion}}$

(4) Avogadro constant = $\dfrac{F}{\text{charge on a mole of electrons}}$

(5) Avogadro constant = $\dfrac{96490\ C}{\text{charge on a mole of protons}}$

60. The element Q is a non-metal. It forms stable diatomic molecules. The reaction between Q and hot concentrated ceasium hydroxide

(1) is likely to give CsQ and CsQO.

(2) is likely to give $CsQO_4$ and $CsQO_2$.

(3) is likely to give $CsQO_3$ and CsQO.

(4) is likely to give CsQ and $CsQO_3$.

(5) is likely to give $CsQO_3$ and $CsQO_4$.

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