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**கல்வி அமைச்சு**
**Ministry of Education**

**අ.පොෙ.ස උසස් පෙළ උපකාරක සම්මන්ත්‍රණය – 2023**
ஆதரவு கருத்தரங்கு – 2023
G.C.E Advance level support seminar – 2023

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| රසායන විද්‍යාව I<br>இரசாயனவியல் I<br>Chemistry I | **02** **E** **I** | පැය දෙකයි<br>இரண்டு மணித்தியாலம்<br>Two hours |

**Instructions**

- A periodic table is provided.
- This question paper has **09** pages.
- Answer all the questions.
- **Use of calculators is not allowed**.
- Write your exam number in the given space on the answer sheet.
- Read the other instructions given at the back of the answer sheet carefully.

For each question from 1 to 50, select the correct or most appropriate answer from the answers (1), (2), (3), (4), (5) and mark it with a cross (x) as per the instructions on the back of the answer sheet.

Universal gas constant $R = 8.314\ \text{J K}^{-1}\ \text{mol}^{-1}$ Plank constant $h = 6.626 \times 10^{-34}\ \text{J s}$

Avogadro's constant $N_A = 6.022 \times 10^{23}\ \text{mol}^{-1}$ Speed of light $c = 3 \times 10^{8}\ \text{m s}^{-1}$

**1.** Who stated that, under suitable conditions, radiation can behave like a stream of particles and that matter has wavelike properties?

(1) Max Planck (2) Louis De Broglie (3) Albert Einstein
(4) Niels Bohr (5) Ernest Rutherford

**2.** Which statement about quantum numbers is **false**?

(1) $_{24}$Cr has 7 electrons, which is the azimuthal quantum number, $l = 0$
(2) There are 3 orbitals with quantum numbers n = 3 and $l = 1$.
(3) The electron with a quantum number set $(2, 0, 0, +1/2)$ resides in the 2 s orbital.
(4) $2l + 1$ Gives the number of sub energy levels in a principal energy level.
(5) $_{20}$Ca has 4 electrons with a magnetic quantum number $m_l = +1$.

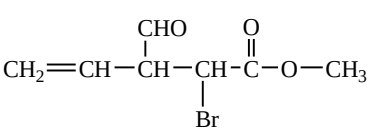
**3.** The order of increasing ionic radii of $Li^+$, $Na^+$, $O^{2-}$, $F^-$ and $N^{3-}$ is,

(1) $Li^+ < Na^+ < F^- < O^{2-} < N^{3-}$ (2) $Li^+ < Na^+ < N^{3-} < O^{2-} < F^-$
(3) $Na^+ < Li^+ < F^- < O^{2-} < N^{3-}$ (4) $N^{3-} < O^{2-} < F^- < Na^+ < Li^+$
(5) $N^{3-} < O^{2-} < F^- < Li^+ < Na^+$

**4.** A molecule or ion pair whose electron pair geometry is Trigonal bipyramidal and See-saw shaped is,

(1) $IF_4^-, XeO_2F_2$ (2) $XeF_4, IF_4^+$ (3) $XeF_4, SF_4$
(4) $SF_4, PCl_4^+$ (5) $IF_4^+, XeO_2F_2$

**5.** The IUPAC name of the following compound is,



(1) methyl 2–bromo–3–formyl–4–penteneoate (2) methyl–3–formyl–2–bromo–4–pentenoate
(3) methyl 2–bromo–3–formyl–4–pentenoate (4) methyl 3–formyl–2–bromo–4–pentenoate
(5) methyl–2–bromo–3–formyl–4–penteneoate

**6.** Which of the following answers correctly indicates the dominant secondary interaction for the given chemical species?

(1) $I_2(s)$ ; dipole – dipole interactions
(2) $CH_3COOH(l)$ ; dipole – dipole interactions
(3) $I_3^-$ ; ion – dipole interactions
(4) KI(aq) ; Ion – Induce dipole interactions
(5) $O_2(aq)$ ; dipole – Induce dipole interactions

**7.** The water solubility of $M(OH)_2$ salt, which is sparingly soluble in water is $2.0\times10^{-2}$ mol $dm^{-3}$ at 25 $^oC$. What is the solubility in g $dm^{-3}$ of $M(OH)_2$ in a solution of pH 13 at 25 $^oC$? (M = 40, O = 16, H = 1)

(1) 0.0592 (2) 0.148 (3) 0.2368 (4) 0.592 (5) 5.92

**8.** Choose the statement that correctly describes the variance of the property given in brackets.

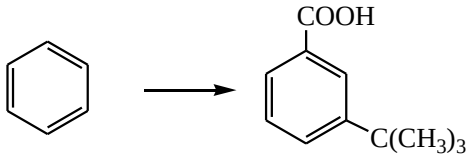
(1) $Na^+ < K^+$ ( Polarizing power)
(2) $Cl^- < F^-$ (Polarizability)
(3) Na < Mg (Metallic bond strength)
(4) S < O ( The energy released when an electron is gained)
(5) $CO_2$ < CO (C – O Bond length)

**9.** When hydrocarbons X and Y are reacted separately with HBr, the products are P and Q respectively. When P and Q are reacted separately with benzene ($C_6H_6$) in the presence of anhydrous $AlCl_3$, only the product from Q decolourizes $H^+/KMnO_4$. The product of the reaction of Q with aqueous KOH yields R and it gives a turbidity after a short while when reacts with anhydrous $ZnCl_2$/concentrated HCl. Compounds X and Y can be respectively,

(1) $CH_3CH=CH_2$ , $H_3C-\overset{\overset{CH_3}{|}}{C}=CH_2$
(2) $H_3C-\overset{\overset{CH_3}{|}}{C}=CH_2$ , $CH_3CH=CH_2$
(3) $CH_3CH=CHCH_3$ , $CH_3CH_2CH=CH_2$
(4) $H_3C-\overset{\overset{CH_3}{|}}{CH}-CH=CH_2$ , $H_3C-\overset{\overset{CH_3}{|}}{C}=CHCH_3$
(5) $CH_3CH=CHCH_3$ , $H_3C-\overset{\overset{CH_3}{|}}{C}=CH_2$

**10.** The temperature in Celsius at which the root mean speed of $O_2$ gas at 27 $^0C$ is equal to the root mean speed of $SO_2$ gas? (Assuming that $SO_2$ and $O_2$ gases behave ideally). (S = 32 , O = 16)

(1) 18.08 (2) 24.49 (3) 150 (4) 327 (5) 600

**11.** The correct order of reactions to convert  is,



(1) Anhydrous $AlCl_3/CH_3Cl$ , Anhydrous $AlCl_3/(CH_3)_3CCl$ , $H^+/KMnO_4$
(2) Anhydrous $AlCl_3/CH_3Cl$ , $H^+/KMnO_4$ , Anhydrous $AlCl_3/(CH_3)_3CCl$
(3) Anhydrous $AlCl_3/(CH_3)_3CCl$ , Anhydrous $AlCl_3/CH_3Cl$ , $H^+/KMnO_4$
(4) Anhydrous $AlCl_3/(CH_3)_3CCl$ , $H^+/KMnO_4$ , Anhydrous $AlCl_3/(CH_3)_3CCl$
(5) Anhydrous $AlCl_3/(CH_3)_3CCl$ , $H^+/KMnO_4$ , Anhydrous $AlCl_3/CH_3Cl$

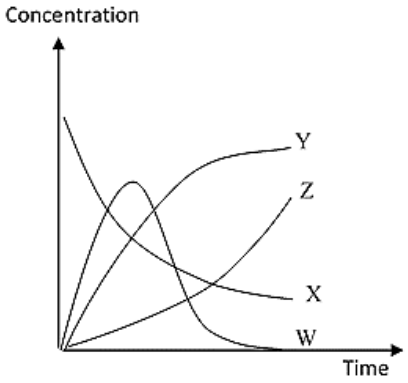
**12.** 25.0 $cm^3$ of a solution made by dissolving 11.76 g of $K_2Cr_2O_7$ in 500.0 $cm^3$ of water was added with an excess of KI. The released $I_2$ was titrated with $Na_2S_2O_3$ solution. If the volume of $Na_2S_2O_3$ consumed is 30.0 $cm^3$, what is the concentration of $Na_2S_2O_3$ solution in mol $dm^{-3}$ (molar mass of $K_2Cr_2O_7$ is 294 g $mol^{-1}$)

(1) 0.04 (2) 0.08 (3) 0.20 (4) 0.40 (5) 0.80

**13.** When the concentration of X is doubled at 25 $^0$C in the reaction $X(g) \rightarrow Y(g) + Z(g)$, the rate of reaction doubles. Only one transition state is formed during this reaction. If the half-life time of the reaction is 15 min, what is the rate of the reaction in units of mol dm$^{-3}$ min$^{-1}$ at 25 $^0$C when the concentration of X(g) is 0.20 mol dm$^{-3}$?

(1) 2.165 (2) $4.62 \times 10^{-2}$ (3) 21.65 (4) $9.24 \times 10^{-3}$ (5) 43.30

**14.** The variation of concentration of each component with time of reaction A(g) + B(g) $\xrightarrow{\text{Catalyst}}$ C(g) + D(g) is shown in the graph below.




Which of the following variations is correct according to the graph?

(1) From Y and Z the change in concentration of products.
(2) From W the change in concentration of one reactant.
(3) From X the change in concentration of one product.
(4) From Z the change in concentration of the catalyst.
(5) From W the change in concentration of the intermediate

**15.** $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)\ ; (\Delta H < 0)$ equilibrium exists in a closed container at a temperature of 500 K. At 500 K the equilibrium constant is $K_C = 6.1 \times 10^{-2}$ .
Which of the following statements is true?

(1) At 500 K for the equilibrium $\frac{2}{3} NH_3(g) \rightleftharpoons \frac{1}{3} N_2(g) + H_2(g)$, $K_C = \left( \frac{1}{6.1 \times 10^{-2}} \right)^{\frac{1}{3}}$.

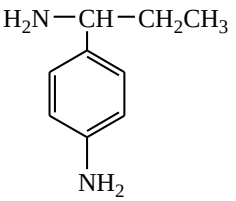
(2) After $N_2(g)$ is introduced into the system at 500 K the equilibrium constant $K_C$ is higher than $K_C = 6.1 \times 10^{-2}$

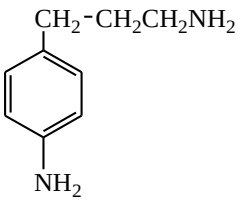
(3) As the temperature of the system is raised to 700 K, the rate of forward reaction decreases.

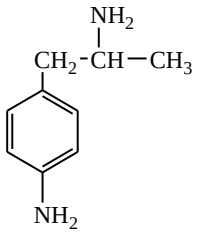
(4) Once $CO_2(g)$ is introduced into the system, the equilibrium constant $K_C$ is less than $K_C = 6.1 \times 10^{-2}$ at the above temperature.

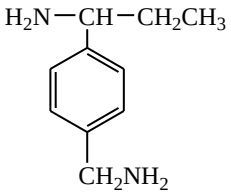
(5) The value of $K_1/K_2$ at 700 K is larger than that at 500 K. $K_1$ and $K_2$ are the rate constants of the forward and backward reactions, respectively.

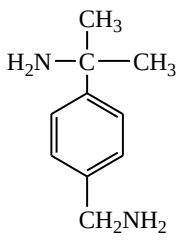
**16.** Compound X reacts with $NaNO_2$ and diluted HCl, to give Y at above 10 $^O$C. Y reacts with Na as well as with NaOH. Y gives Z at high temperature with anhydrous $Al_2O_3$. The product obtained from the reaction of Z and $Br_2$ reacts with alcoholic KOH to give another product and the last product reacts with $NH_3$ /$AgNO_3$ to give a white precipitate. Compound X can be,

(1) 


(2) 


(3) 


(4) 


(5) 

**17.** $H_2S$ gas is bubbled through 1 $dm^3$ of a solution containing 0.10 mol $dm^{-3}$ $SnCl_2(aq)$, and 0.1 mol $dm^{-3}$ $MnCl_2(aq)$ at a temperature of 298 K. The pH range that should exist in the solution for SnS to precipitate and MnS not to precipitate from this solution is

(solubility products of SnS and MnS are respectively $1.0\times10^{-25}\,mol^2dm^{-6}$ and $1.0\times10^{-14}\,mol^2dm^{-6}$.
$\left[H^+(aq)\right]^2\times\left[S^{2-}(aq)\right]=1\times10^{-29}\ mol^3\ dm^{-9}$ ඔවි.)

(1) 1.5 – 4.0 (2) 1.5 – 6.0 (3) 2.5 – 8.0 (4) 4.0 – 9.0 (5) 5.0 – 9.0

**18.** Titration of 5.0 $cm^3$ of an aqueous NaOH solution of density 1.1 g $dm^{-3}$ required 5.5 $cm^3$ volume of $1.0\times10^{-3}$ mol $dm^{-3}$HCl. Find the composition of aqueous NaOH solution in ppm (Na = 23, O = 16, H = 1)

(1) 40 (2) 44 (3) 4,000 (4) 40,000 (5) 44,000

**19.** Corresponding to the thermal decomposition of $CaCO_3(s)$ at 298 K, $\Delta H^\theta=+179.68\,kJ\,mol^{-1}$ and $\Delta S^\theta=+160.0\,J\,mol^{-1}\,K^{-1}$. The $\Delta G^\theta$ value corresponding to the thermal decomposition of $CaCO_3(s)$ at 298 K and the minimum temperature at which thermal decomposition of $CaCO_3$ starts are respectively?( ($\Delta H^0$ and $\Delta S^0$ assumed to be independent of temperature).

(1) 132 kJ $mol^{-1}$, 1123 $^0C$
(2) 132 kJ $mol^{-1}$, 850 $^0C$
(3) 47.501 kJ $mol^{-1}$, 850 $^0C$
(4) 47501 kJ $mol^{-1}$, 850 K
(5) – 47501 kJ $mol^{-1}$, 850 K

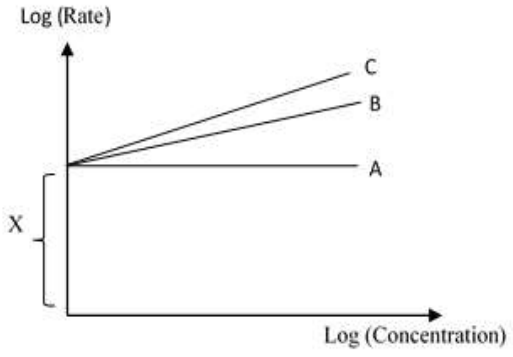
**20.** Which of the following is not a chain propagation step in methane chlorination,

(1) $\dot{C}H_2Cl + Cl_2 \rightarrow CH_2Cl_2 + Cl^{\cdot}$
(2) $CH_3Cl + Cl^{\cdot} \rightarrow \dot{C}H_2Cl + HCl$
(3) $\dot{C}H_3 + Cl_2 \rightarrow CH_3Cl + Cl^{\cdot}$
(4) $\dot{C}H_3 + Cl^{\cdot} \rightarrow CH_3Cl$
(5) $CH_2Cl_2 + Cl^{\cdot} \rightarrow \dot{C}HCl_2 + HCl$

**21.** When 10.00 $cm^3$ of $C_3H_8$ (propane) gas and 80.00 $cm^3$ of $O_2$ gas are placed in a vessel and given electrical energy, $C_3H_8$ will burn completely. When all volumes are measured at room temperature and pressure, The percent change in volume of the gas mixture after the reaction and the volume after the reaction is passed through an alkaline medium are, respectively,

(1) 33.33 % and 30.00 $cm^3$
(2) 38.50 % and 30.00 $cm^3$
(3) 38.50 % and 60.00 $cm^3$
(4) 66.67 % and 30.00 $cm^3$
(5) 77.77 % and 70.00 $cm^3$

**22.** Below are the shapes of graphs that can be obtained from initial rate experiments.
The order of the reaction can be deduced by drawing the relevant graphs.
The correct statement about the above graph is,

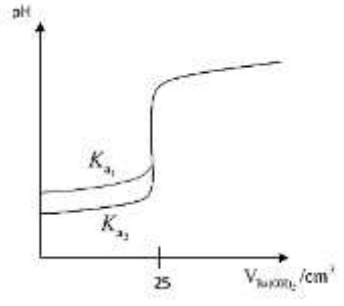


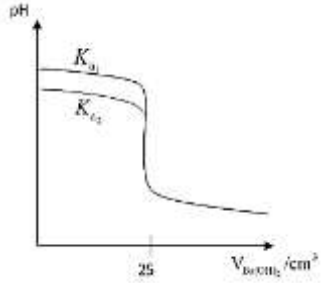

(1) Line C corresponds to a first-order reaction
(2) The rate constant k can be calculated from the value of X
(3) Line A corresponds to a first-order reaction
(4) Line B corresponds to a Zeroth-order reaction
(5) The rate can be obtained by the value of X.

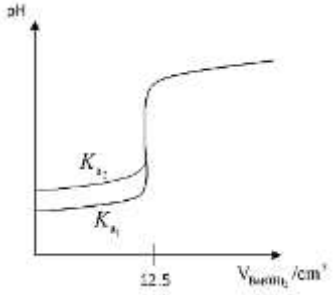
**23.** The **false** statement regarding the compressibility of an ideal gas and a real gas is,

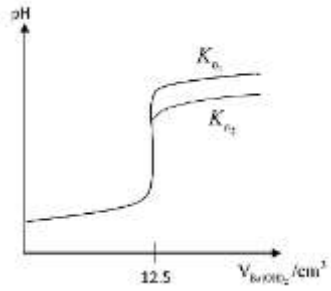
(1) A real gas at standard temperature and pressure is more easily compressed than an ideal gas if its volume is less than 22.4 $dm^3$.
(2) At very low pressures, the molar volume of a real gas at any temperature is nearly the same as that of an ideal gas.
(3) A real gas at a given temperature and moderate pressure may have a compressibility factor of 1.0.
(4) $CH_4$ is easier to compress than $N_2$ over a greater pressure range at a given temperature.
(5) At high pressures, the compressibility factor of a real gas approaches 1.0 as the temperature increases.

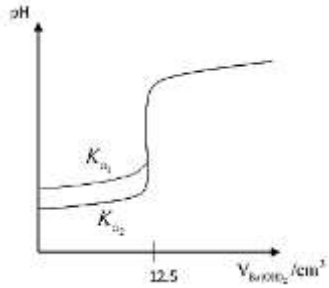
**24.** HA and HB are two weak monobasic acids with concentrations of 0.10 mol $dm^{-3}$. Their dissociation constants are $K_{a_1}$ and $K_{a_2}$ respectively. ($K_{a_1} < K_{a_2}$). 25.00 $cm^3$ of each of these solutions are taken into separate titration flasks and titrated with 0.10 mol $dm^{-3}$ $Ba(OH)_2$ solution. The graph showing the variation of pH values in the two flasks is

(1) 


(2) 


(3) 


(4) 


(5) 


**25.** Which of the following is **true** regarding greenhouse gases?

(1) Although they can absorb infrared rays from the atmosphere, they cannot remain stable in the atmosphere for long periods.
(2) Homo diatomic and monoatomic gases can act as greenhouse gases.
(3) Gases like NO, and CO which remain in the atmosphere for a long time are also considered greenhouse gases.
(4) Because halogenated hydrocarbons exist in very small amounts in the atmosphere, they do not act as greenhouse gases.
(5) Due to the action of denitrifying bacteria on nitrogen-containing compounds, $N_2O$, a greenhouse gas, is mainly added to the atmosphere.

**26.** Which of the following is **true** about chlorine and its compounds?

(1) $Cl_2$ gas reacts with Cu metal to give only CuCl(s).
(2) $Cl_2$ gas reacts with excess $NH_3$ to form $N_2$ and $NCl_3$.
(3) $ClO^-$ ion is stable at low temperature and disproportionate at high temperature to form $Cl^-$ and $ClO_3^-$ ions.
(4) Among the oxo acids of Chlorine, $HClO_4$ is a weak monobasic acid..
(5) The solution resulting from the reaction of Cl2 gas with hot concentrated NaOH exhibits bleaching properties.

**27.** The details of the products obtained from the hydrolysis of 3 covalent chlorides A, B, and C are as follows

A – The solution from hydrolysis is acidic.
B – Hydrolysis gives a weak acid and a weak base.
C – Hydrolysis yields a compound with a strong acid and a giant covalent molecular structure.

A, B, and C chlorides respectively,

(1) $MgCl_2$, $SiCl_4$, $NH_3$
(2) $AlCl_3$, $NH_3$, $AsCl_3$
(3) $NCl_3$, $PCl_3$, $SiCl_4$
(4) $PCl_5$, $BiCl_3$, $CCl_4$
(5) $AlCl_3$, $NCl_3$, $SiCl_4$

**28.** Which of the following statements is **true**?

(1) If $\Delta G < 0$ of the forward reaction at the given temperature and pressure, the corresponding backward reaction can be carried out by a continuous supply of external energy.
(2) The standard enthalpy of formation of a compound is given by zeroing the formation enthalpy at 1 atm pressure of the elements in the reference form.
(3) Whenever an exothermic reaction occurs, the entropy of the environment increases only in open systems.
(4) Hess's law is a consequence of the state function property of enthalpy and can also be used when the steps of a process are hypothetically applied.
(5) The standard bond dissociation enthalpy of $O_2(g)$ is equal to the standard enthalpy of formation of atomic oxygen at that temperature.

**29.** The **correct** statement regarding Fe and its compounds is

(1) A Prussian blue precipitate of $KFe[Fe(CN)_6]$ is obtained when a solution of potassium ferrocyanide is added to an aqueous solution of the $Fe^{2+}$ salt.
(2) When ammonium thiocyanate solution is added to an aqueous solution of $Fe^{2+}$ salt, a blood red solution is obtained.
(3) Compound $Fe_3O_4$ is not oxidized by $KMnO_4$ in an acidic medium.
(4) $Fe^{3+}$ ion is contained in the brown complex formed in the $NO_3^-$ ion detection brown ring test.
(5) The $Fe^{2+}$ ion contains 5 unpaired electrons.

**30.** Which of the following statements about acid chlorides is **false**?

(1) Acid chlorides react with aqueous NaOH via a quaternary intermediate.
(2) Acid chlorides form phenyl esters with phenols.
(3) Acid chlorides react with aqueous NaOH to form the corresponding carboxylic acid.
(4) Acid chlorides react with primary amines to form secondary amides.
(5) Acid chlorides other than HCOCl are reacted with RMgBr followed by $H^+/H_2O$ to give a tertiary alcohol.

- For each question **31** to **40**, one or more responses out of the four responses (a), (b), (c), and (d) given is/are correct. Select the correct response/responses. In accordance with the instructions given on your answer sheet, mark

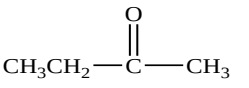
(1) if only (a) and (b) are correct
(2) if only (b) and (c) are correct
(3) if only (b) and (c) are correct
(4) if only (b) and (c) are correct
(5) if **any other** number or combination of responses is correct

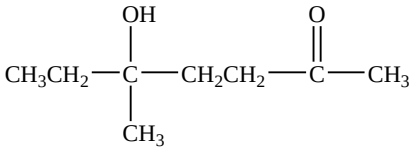
**Summary of the above instructions**

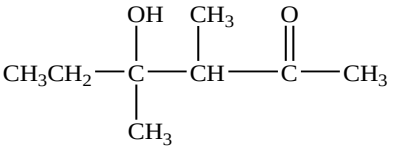
| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| Only (a) and (b) are correct | Only (b) and (c) are correct | Only (c) and (d) are correct | Only (d) and (a) are correct | **Any other** number or combination of responses is correct. |

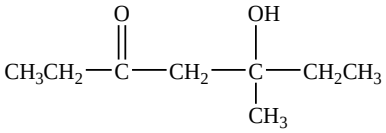
**31.** Which of the following statement/s about acid rain is/are **correct**?

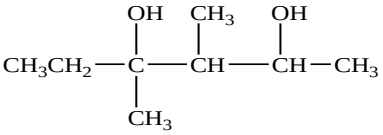
(a) Acid rain occurs when the pH value of rainwater becomes less than 6.5.
(b) The increase in aqueous concentration of $Al^{3+}$, and $Mn^{2+}$ ions is very harmful to aquatic organisms.
(c) $Ca(OH)_2$ is used to reduce $SO_2$ emissions to the atmosphere.
(d) NO gas released by vehicle exhaust is the cause of acid rain.

**32.** Which of the following product/s is/are formed when  reacts with NaOH?

(a) 

(b) 

(c) 

(d) 

**33.**

$$Zn^{2+}(aq) + 2e \rightleftharpoons Zn(s)\ ,\ E^{\theta} = -0.76\,V$$

$$AgCl(s) + e \rightleftharpoons Ag(s) + Cl^{-}(aq)\ ,\ E^{\theta} = 0.22\,V$$

A standard electrochemical cell was constructed with $Zn^{2+}$/ Zn(s) and AgCl(s)/$Cl^{-}$(aq)/Ag(s) electrodes. Which statement(s) is/are true regarding the electromotive force of this cell?

(a) The electromotive force of the cell is less than 0.98 V when the concentration of $Zn^{2+}$ is 2.0 mol $dm^{-3}$

(b) The electromotive force of the cell is less than 0.98 V when the concentration of $Cl^{-}$ (aq) is 2.0 mol $dm^{-3}$

(c) The electromotive force decreases below 0.54 V as the mass of AgCl(s) increases

(d) The electromotive force becomes greater than 0.54 V, When the concentration of $Cl^{-}$ (aq) is 0.5 mol $dm^{-3}$.

**34.** Which of the following compound/compounds gives $C_2H_6$ on reaction with $C_2H_5MgBr$?

(a) $CH_3CHO$ (b) $C_2H_5OH$

(c) $CH_3 - C \equiv C - H$ (d) $C_2H_5Cl$

**35.** During the electrolysis of a $Na_2SO_4$ solution using inert electrodes, the reactions that can take place near the anode and cathode are as follows

$$2SO_4^{2-}(aq) \rightarrow S_2O_8^{2-}(aq) + 2e \qquad E^{\theta} = +2.05\ V$$

$$2H_2O(l) \rightarrow O_2(g) + 4H^{+} + 4e \qquad E^{\theta} = +1.23\ V$$

$$2H_2O(l) + 2e \rightarrow H_2(g) + 2OH^{-}(aq) \qquad E^{\theta} = -0.83\ V$$

$$Na^{+}(aq) + e \rightarrow Na(s) \qquad E^{\theta} = -2.71\ V$$

Which of the following reactions is/are true,

(a) $O_2$ gas is released at the anode and $H_2$ gas is released at the cathode.

(b) The pH of the electrolyte increases near the cathode.

(c) Cell reaction is spontaneous.

(d) $S_2O_8^{2-}(aq)$ is formed at the anode and $H_2$ gas is released at the cathode.

**36.** The true statements/statements about the production of $TiO_2$ by rutile are,

(a) During the chlorination process, the temperature of the mixture is raised to about 950 $^{o}$C.

(b) Chlorination results in $TiCl_4$ (s).

(c) Initially, the mixture of rutile and coke is heated to a temperature of 100 $^{o}$C.

(d) The chloride process contributes to global warming.

**37.** Which of the following reactions is/are true regarding $H_2SO_4$ acid?

(a) It reacts with carbon to produce two gases with acidic properties.

(b) It can act as a catalyst.

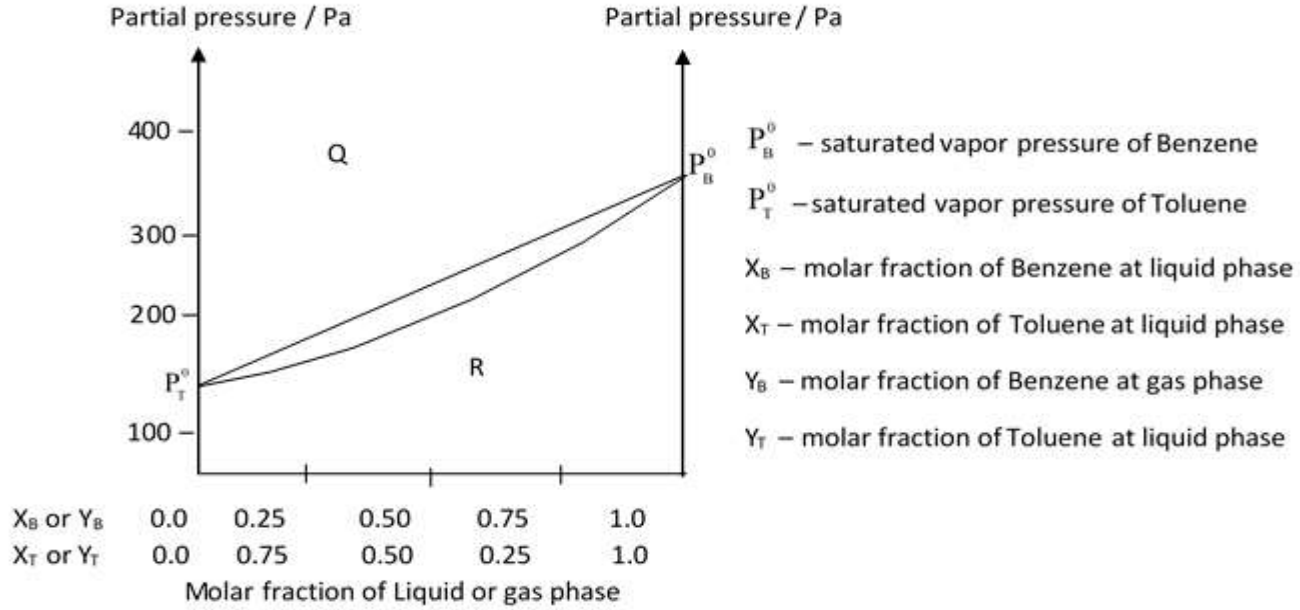
(c) Reaction with S(s) produces a gas with bleaching properties.

(d) Although it can oxidize active metals such as Mg, it cannot oxidize metals of low activity such as Cu.

**38.** Which of the following statement/s is/are true regarding the experiment to find the relative atomic mass of a Mg metal is?

(a) The pressure of dry $H_2$ gas cannot be calculated because $H_2$ gas is collected by the downward displacement of water.
(b) The rate of $H_2$ production increases when a thin copper wire is used to hold the Mg strip while inserting it into the burette.
(c) This test can be used to find the percentage of Zn contained in a piece of brass.
(d) This method cannot be used to find the relative atomic mass of Na

**39.** Below is a graph of pressure versus mole fraction for a mixture of benzene and toluene.




Which of the following statement/s is/are true regarding the above graph?

(a) The boiling point of benzene is lower than that of toluene.
(b) In the fractional distillation of a mixture of benzene and toluene, more toluene is present in the vapor zone.
(c) Liquid-vapour equilibrium exists in the Q region.
(d) The top line of the graph agrees with Raoult's law.

**40.** Which of the following is the true statement/statement related to the extraction of X block elements

(a) Oxidation methods in the presence of coke-like materials are not successful in extracting pure elements.
(b) A brine solution is more suitable for extracting Mg metal.
(c) The membrane cell method uses only $BaCl_2$ and NaOH to precipitate and remove unwanted ions.
(d) During the Mg extraction process, the temperature in the electrochemical cell is maintained in the range of $700 – 800\ ^{o}C$

- In question Nos; **41** to **50**, two statements are given in respect of each question.
  From the table given below, select the response, out of the responses (1), (2), (3), (4) and (5) that **best** fits the two statements and mark appropriately on your answer sheet.

| Response | First statement | Second statement |
|---|---|---|
| (1) | True | True and correctly explains the first statement |
| (2) | True | True and does **not** explain the first statement correctly |
| (3) | True | False |
| (4) | False | True |
| (5) | False | False |

| | First statement | Second statement |
|---|---|---|
| (41) | The heated Na metal reacts with ammonia to release a colourless diatomic gas. | $NH_3(g)$ can act as oxidising agent. |
| (42) | The molecules of an ideal gas spread completely the entire vessel. | Ideal gas molecules behave independently of each other. |
| (43) | $H_2O_2$ can react chemically to give $O_2$ or $H_2O$ as products. | The oxidation number of oxygen in $H_2O_2$ is –1. |
| (44) | The rate of the following reaction is independent of CO concentration, where the rate law is $R = k[NO_2(g)]^2$. $NO_2(g) + CO(g) \rightarrow CO_2(g) + NO(g)$ | In any reaction in the gas region, the concentration of all the reactants affects the rate change of the reaction |
| (45) | $C_2H_5NH_2$ is less basic than $C_2H_5OH$. | The stability of $C_2H_5\overset{+}{N}H_3$ relative to $C_2H_5NH_2$ is greater than the stability of $C_2H_5\overset{+}{O}H_2$ relative to $C_2H_5OH$. |
| (46) | $RCOOCH_3$ reacts with $C_2H_5MgBr$ to give $RCOC_2H_5$. | The reaction of $RCOOCH_3$ with Grignard is a nucleophilic substitution reaction. |
| (47) | In the fractional distillation process for ethanol production, the first fraction of the distillate is discarded unused. | Methanol is a toxic alcohol. |
| (48) | Diazonium salts are treated with $H_3PO_2/H_2O$ to give benzene. | The diazonium group may be replaced by another atom or group. |
| (49) | An aqueous mixture of $CH_3NH_2(aq)$ and $CH_3\overset{+}{N}H_3Cl^-(aq)$ behaves as a buffer solution. | As the ratio of $\frac{[CH_3\overset{+}{N}H_3(aq)]}{[CH_3NH_2(aq)]}$ increases in a solution containing $CH_3NH_2(aq)$ and $CH_3\overset{+}{N}H_3Cl^-(aq)$, the pH value of the solution increases. |
| (50) | Acids can be used to coagulate the latex. | $-COO^-$ groups are present in the outer layer of a rubber particle. |

## The Periodic Table

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 **H** | | | | | | | | | | | | | | | | 2 **He** |
| 2 | 3 **Li** | 4 **Be** | | | | | | | | | | | 5 **B** | 6 **C** | 7 **N** | 8 **O** | 9 **F** | 10 **Ne** |
| 3 | 11 **Na** | 12 **Mg** | | | | | | | | | | | 13 **Al** | 14 **Si** | 15 **P** | 16 **S** | 17 **Cl** | 18 **Ar** |
| 4 | 19 **K** | 20 **Ca** | 21 **Se** | 22 **Ti** | 23 **V** | 24 **Cr** | 25 **Mn** | 26 **Fe** | 27 **Co** | 28 **Ni** | 29 **Cu** | 30 **Zn** | 31 **Ga** | 32 **Ge** | 33 **As** | 34 **Se** | 35 **Br** | 36 **Kr** |
| 5 | 37 **Rb** | 38 **Sr** | 39 **Y** | 40 **Zr** | 41 **Nb** | 42 **Mo** | 43 **Tc** | 44 **Ru** | 45 **Rh** | 46 **Pd** | 47 **Ag** | 48 **Cd** | 49 **In** | 50 **Sn** | 51 **Sb** | 52 **Te** | 53 **I** | 54 **Xe** |
| 6 | 55 **Cs** | 56 **Ba** | **La-Lu** | 72 **Hf** | 73 **Ta** | 74 **W** | 75 **Re** | 76 **Os** | 77 **Ir** | 78 **Pt** | 79 **Au** | 80 **Hg** | 81 **Tl** | 82 **Pb** | 83 **Bi** | 84 **Po** | 85 **At** | 86 **Rn** |
| 7 | 87 **Fr** | 88 **Ra** | **Ac-Lr** | 104 **Rf** | 105 **Db** | 106 **Sg** | 107 **Bh** | 108 **Hs** | 109 **Mt** | 110 **Uun** | 111 **Uuu** | 112 **Uub** | 113 **Uut** | … | | | | |

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