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- (ix) Which of the following aqueous solutions will have the highest boiling point?
- A. 0.20 m glucose
B. 0.10 m Na_2SO_4
C. 0.25 m sucrose
D. 0.10 m NaCl
- (x) The molecules of CO_2 in dry ice form the:
- A. Ionic crystals
B. Covalent crystals
C. Molecular crystals
D. Any type of crystal
- (xi) If a liquid has pH of 7 then:
- A. It must be colourless
B. Its boiling point must be $100^\circ C$
C. It must be a solution
D. It must be neutral
- (xii) Which one of the following oxides is amphoteric oxide?
- A. CO_2
B. SO_2
C. CO
D. ZnO
- (xiii) Consider three one-liter flasks labeled A, B and C filled with the gases NO , NO_2 and N_2O , respectively, each at STP. Which flask contains the fewest molecules?
- A. Flask A
B. Flask B
C. All are the same
D. Flask C
- (xiv) The wavelength of green light is 500 nm. Its frequency is equal to:
- A. $6 \times 10^{14} Hz$
B. 6 Hz
C. 1.5 Hz
D. $1.5 \times 10^2 Hz$
- (xv) The normal boiling point of diethyl ether is $34.6^\circ C$ and of water is $100^\circ C$. Which has the higher vapor pressure at $20^\circ C$?
- A. Water
B. Diethyl ether
C. They are the same
D. It depends upon elevation
- (xvi) The stoichiometric calculation of a chemical reaction results in:
- A. Actual yield
B. Theoretical yield
C. Percentage yield
D. None of these
- (xvii) If ΔH value is less than zero then reaction will be:
- A. Exothermic
B. Endothermic
C. May or may not be Exothermic or Endothermic
D. None of these

For Examiner's use only:

Total Marks:

17

Marks Obtained:

--- 1HA 1509 (L) ---



CHEMISTRY HSSC-I

(Revised Syllabus)

22

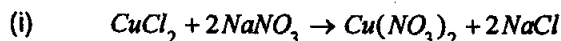
Time allowed: 2:35 Hours

Total Marks Sections B and C: 68

NOTE: Sections 'B' and 'C' comprise pages 1-2 and questions therein are to be answered on the separately provided answer book. Answer any fourteen parts from Section 'B' and attempt any two questions from Section 'C'. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION - B (Marks 42)

Q. 2 Attempt any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. (14 x 3 = 42)



If 15 grams of copper (II) chloride react with 20 grams of sodium nitrate, how much sodium chloride can be formed? (atomic mass Cu=64 g/mol, Cl=35.5 g/mol O=16 g/mol, Na=23 g/mol, N=14 g/mol)

(ii) Define the following :

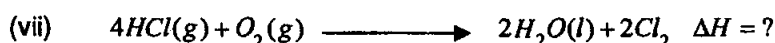
- Pauli's exclusion principle
- Hund's rule
- Aufbau principle

(iii) Methane, Water and Ammonia are AB_4 type molecules but they have different molecular geometries. Give reasons.

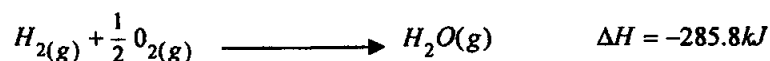
(iv) If 90.0g $C_6H_{12}O_6$ is dissolved in 255g of H_2O , what will be the boiling point of the resulting solution? ($K_b=0.52$)

(v) Time required for given volume of N_2 to diffuse through an orifice is 35 seconds. If same volume of an unknown gas takes 50 seconds to diffuse through the same orifice under same conditions then calculate Molar mass of unknown gas.

(vi) What are amphoteric oxides? Give two examples.



Calculate the enthalpy change of the above reaction from the following data:

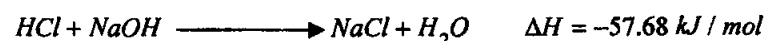


(viii) What is Dalton's Law of Partial Pressure? Give its two applications.

(ix) What is the pH of a $1 dm^3$ solution containing 0.240 mol CH_3COOH and 0.180 mol CH_3COONa ?

$$K_a(CH_3COOH) = 1.8 \times 10^{-5}$$

(x) Hydrochloric acid is neutralized with Sodium hydroxide in the following reaction:



In a coffee cup calorimeter $100 cm^3$ of $1M HCl$ and $100 cm^3$ of $1M NaOH$ are mixed at $24.6^\circ C$.

What is the final temperature of a mixture? Assume that density of both solution is 1.00g/ml and heat capacity of water is $4.18 j / gc^\circ$.

(xi) Write three uses of electrochemical series.

(xii) What are the factors affecting the surface tension of a liquid.

(xiii) Discuss the following properties of crystalline solids:

- Isomorphism
- Transition Temperature

- (xiv) a. Write an expression for K_{sp} of $PbSO_4$.
- b. The value of K_{sp} is 1.96×10^{-8} . What is the solubility of $PbSO_4$?
- (xv) What is the effect of catalyst on the following?
- a. The rate of reaction
- b. The energy of activation
- c. The equilibrium position of a reversible reaction
- (xvi) Derive van der Waal's equation for real gases.
- (xvii) When 0.01kg of $CaCO_3$ is decomposed. What is the volume of CO_2 produced at STP?
- (xviii) In the equilibrium $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ $\Delta H = 91.46 kJ / m$
- What is the effect on the position of equilibrium if?
- a. Temperature is increased
- b. Pressure is decreased
- c. Any amount of nitrogen is added to the equilibrium mixture
- (xix) During the kinetic study of the reaction, $2A + B \rightarrow C + D$, following result were obtained:

Run	[A] / mol L ⁻¹	[B] / mol L ⁻¹	Initial rate of formation of D / mol L ⁻¹ min ⁻¹
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

- Find
- a. Order of the reaction
- b. Unit of rate constant

SECTION – C (Marks 26)

- Note:** Attempt any TWO questions. All questions carry equal marks. (2 x 13 = 26)
- Q. 3**
- a. How will you explain that elevation in boiling point is a colligative property? (03)
- b. Define osmotic pressure. Mention daily life applications of osmosis. (04)
- c. Calculate the concentration of solute in parts per million of the following mixtures: (06)
- (i) If 500 mg of Ca^{+2} is present in 2.5 g tablet
- (ii) If 22mg of Ca^{+2} is present per kilogram of solution
- (iii) If 0.006 g of Mg^{+2} is present per kilogram of solution
- Q. 4**
- a. Give the postulates of Kinetic Molecular Theory of Gases. (03)
- b. Gases do not show ideal behaviors at very low temperatures or very high pressures. Explain why? (04)
- c. One mole of CO_2 gas is maintained at 300K. Its volume is $250 cm^3$. Calculate the pressure exerted by the gas under the conditions: (06)
- (i) When gas is ideal
- (ii) When gas is non-ideal ($a = 3.590 atm dm^6 mol^{-1}$ $b = 0.0428 dm^3 mol^{-1}$)
- Q. 5**
- a. State lechatelier's principle. How can one predict the effect of change in concentration and temperature upon chemical reaction at equilibrium using Lechatelier's principle? (05)
- b. When a 0.218 mol sample of hydrogen iodide was heated in a flask of volume $1 dm^3$, the following equilibrium was established at 700 K. (03)
- $$2HI(g) \rightleftharpoons H_2(g) + I_2(g)$$
- The equilibrium mixture was found to contain 0.023 mol of hydrogen. Calculate the number of moles of iodine and the number of moles of hydrogen iodide in the equilibrium mixture.
- c. Define pH. Calculate the pH of 0.001M H_2SO_4 . (03)
- d. Give two applications of Buffers. (02)

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Answer Sheet No. 23

Sig. of Candidate. _____

Sig. of Invigilator. _____

CHEMISTRY HSSC-I**SECTION – A (Marks 17)****Time allowed: 25 Minutes****(Revised Syllabus)**

NOTE:- Section-A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

- (i) The total number of atoms in 64 g of sulphur dioxide is:
A. 1.806×10^{24} B. 12.04×10^{23} C. 6.02×10^{23} D. 2.408×10^{24}
- (ii) Which from of energy has the highest energy?
A. Microwaves (*wavelength* = 10^{-2} m) B. X-rays (*wavelength* = 10^{-8} m)
C. Infrared (*wavelength* = 10^{-5} m) D. Ultraviolet (*wavelength* = 10^{-7} m)
- (iii) According to MO theory, the species O_2^{+1} possess:
A. Bond order of 2.5 B. Three unpaired electrons
C. Diamagnetic character D. stability more than O_2
- (iv) Equal masses of CH_4 and H_2 are mixed in a container at $25^\circ C$. Fraction of total pressure exerted by methane is:
A. $\frac{1}{2}$ B. $\frac{1}{3}$ C. $\frac{1}{9}$ D. $\frac{8}{9}$
- (v) Consider the following reaction:
 $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H = -197 \text{ kJ/mol}$
Which of the following will not shift the equilibrium to the right?
A. Adding more O_2 B. Adding a catalyst
C. Increasing the pressure D. Decreasing the temperature
- (vi) Which one of the following oxides dissolves in water to form acidic solution?
A. MgO B. Na_2O C. SO_2 D. SiO_2
- (vii) If reduction potential for four divalent elements X, Y, Z and W are $-1.46V$, $-0.36V$, $0.51V$, $-1.24V$ respectively then:
A. X will replace Z^{+2} from aq. solution B. Y will replace Z^{+2} from aq. solution
C. W will replace Z^{+2} from aq. solution D. All the statements are correct
- (viii) The temperature at which partially immiscible pair of liquid leads to the formation of a single phase is called:
A. Transition temperature B. Absolute temperature
C. Upper Consulate temperature D. Room temperature
- (ix) Polymorphs substances have:
A. Same chemical and physical properties
B. Different chemical and physical properties
C. Same chemical and different physical properties
D. None of these

- (x) The buffer solution of pH 4.76 is prepared by mixing: (pka of acetic acid 4.76)
- Equal quantities of CH_3COOH & CH_3COONa
 - Different quantities of CH_3COOH & CH_3COONa
 - Two moles of CH_3COOH & one mole of CH_3COONa
 - Two moles of CH_3COOH & half mole of CH_3COONa
- (xi) The Aufbau Principle states that:
- Only two electrons can occupy an orbital
 - Electrons enter the lowest available energy level
 - Electrons remain unpaired if possible
 - Orbitals are regions in space where one is likely to find an electron
- (xii) In the Bronsted-Lowry system, a base is defined as:
- A proton donor
 - A hydroxide donor
 - An electron-pair acceptor
 - A proton acceptor
- (xiii) Which set of compounds are placed in the order of instantaneous dipole, dipole-dipole and hydrogen bonding as the primary intermolecular forces?
- CH_4 , H_2O , H_2Se
 - CH_4 , H_2Se , H_2O
 - H_2Se , CH_4 , H_2O
 - H_2O , H_2Se , CH_4
- (xiv) Enthalpy changes for the reaction, $4H_{(g)} \rightarrow 2H_{2(g)}$ is $\Delta H = -869.6$ kJ. The dissociation energy of H – H bond is:
- +217.4 kJ
 - 434.8 kJ
 - 869.6 kJ
 - +434.8 kJ
- (xv) The ideal gas law predicts that the molar volume (volume of one mole) of gas equals:
- $\frac{gRT}{PV}$
 - $\frac{(MW)P}{RT}$
 - $\frac{1}{2} ms^{-2}$
 - $\frac{RT}{P}$
- (xvi) In which of the following reactions, oxidation No of Nitrogen does not change:
- $NO_2 + H_2O \rightarrow HNO_3 + HNO_2$
 - $N_2 + O_2 \rightarrow 2NO$
 - $2NO_2 \rightarrow N_2O_4$
 - $NH_4NO_2 \rightarrow N_2 + H_2O$
- (xvii) Which of the following hybrid orbitals is/are used by carbon atoms to form the C – C and C – H bonds in ethene, (C_2H_4)?
- sp^2 and sp^3 hybrid orbitals
 - sp^2 hybrid orbitals
 - sp^3 hybrid orbitals
 - sp hybrid orbitals

For Examiner's use only:

Total Marks:

17

Marks Obtained:



CHEMISTRY HSSC-I

24

(Revised Syllabus)

Time allowed: 2:35 Hours

Total Marks Sections B and C: 68

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SECTION - B (Marks 42)

Q. 2 Attempt any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. (14 x 3 = 42)

- (i) Sulfur dioxide can be produced from the reaction of hydrogen sulfide and oxygen as shown by the following reaction:



How many grams of sulfur dioxide can be produced from 70.0 g of hydrogen sulfide and 125 g of oxygen?

- (ii) 50cm^3 of a gas effuses through a tiny aperture in 146 sec. The same volume of CO_2 effuses under the same condition in 115 sec. Determine molar mass of A.

- (iii) Keeping in mind the discharge tube experiment. Justify the following facts:

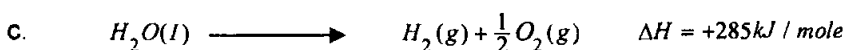
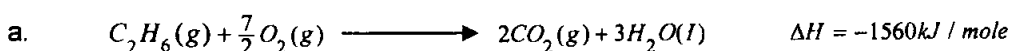
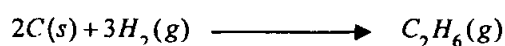
- Whichever gas is used in the discharge tube, the nature of the cathode rays remains the same.
- The e/m ratio of positive rays for different gasses are different but those for cathode rays the e/m values is the same.

- (iv) Predict the geometries of BF_3 and NH_3 on the basis of V.S.E.P.R theory.

- (v) a. Write an expression for the K_{sp} of $Mg(OH)_2$

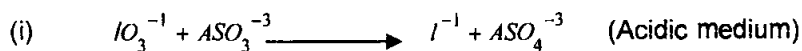
- b. The value for K_{sp} is 2.00×10^{-11} . Calculate $[Mg^{2+}(aq)]$ in the saturated solution of $Mg(OH)_2$.

- (vi) Calculate ΔH for the reaction from the data given below:



- (vii) Give three statements of Raoult's Law.

- (viii) Balance the following reactions by ion-electron method.



- (ix) Discuss the following properties of crystalline solids:

- Anisotropy
- polymorphism

- (x) What are the factors affecting the viscosity of a liquid?

- (xi) Give applications of Dalton's Law of partial pressure.

- (xii) Write three uses of a Liquid crystals.

- (xiii) Hydrogen atom and He^{+1} are momoelectronic system but the size of He^{+1} is much smaller than H-atom. Why?

- (xiv) If one make a solution by adding 83 grams of sodium hydroxide to 750 mL of water. The density of solution is 1 gm/mL.
- What is the molality of sodium hydroxide in this solution?
 - What is the percent by mass of sodium hydroxide in this solution?
- (xv) What are acidic, bases and amphotric substances? Give one example of each substance.
- (xvi) A violet photon has a frequency of 7.100×10^{14} Hz .
- What is the wavelength (in nm) of the photon?
 - What is the energy of the photon?
 - What is the energy of 1 mole of these violet photons?
- (xvii) a. Define boiling point.
- b. Why does the boiling point of the group 5 hydrides increase from PH_3 to BiH_3 ?
- c. Why is the boiling point of water much higher than the rest of the hydrides in group 6?
- (xviii) Discuss three factors which affect rate of chemical reactions.
- (xix) Consider the reaction: $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

The following data were obtained from three experiments using the method of initial rates:

	Initial[NO] / mol L ⁻¹	Initial[O ₂] / mol L ⁻¹	Initial rate NO / mol L ⁻¹ S ⁻¹
Experiment 1	0.010	0.010	25×10^{-5}
Experiment 2	0.020	0.010	10×10^{-4}
Experiment 3	0.010	0.020	50×10^{-5}

- Determine the order of the reaction for each reactant.
- Write the rate equation for the reaction.

SECTION – C (Marks 26)

- Note:** Attempt any TWO questions. All questions carry equal marks. (2 x 13 = 26)
- Q. 3**
- Give the postulates of Bohr's atomic model. (04)
 - Derive the formula for calculating the energy of electron in nth orbit using Bohr's atomic model. (06)
 - How will you determine the charge on an electron using Faraday law of electrolysis and Avogadro's number? (03)
- Q. 4**
- What is Law of mass action? Derive an equation for Kc expression of a general reversible reaction. (04)
 - What are the effect of changing temperature and pressure on the following gaseous reactions? (04)
 - $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ Endothermic Reaction
 - $2HI \rightleftharpoons H_2 + I_2$ Endothermic Reaction
 - What is atomic orbital hybridization. Explain hybridization in water H_2O and $BeCl_2$? (05)
- Q. 5**
- How will you explain that lowering of vapour pressure is a colligative property? (03)
 - How will you measure the molar mass of nonvolatile nonelectrolyte solute in a volatile solvent by Landsberger's method. (04)
 - You are provided with 80% (w/w) H_2SO_4 having density 1.8 g/cm^3 . How much volume of this solution is required to obtain 1 dm^3 of 20% (w/w) H_2SO_4 with a density of 1.25 g/cm^3 . (06)

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- (xi) A standard hydrogen electrode has zero ELECTRODE POTENTIAL because:
- A. Hydrogen is the easiest to oxidize. B. The electrode potential is assumed to be zero
C. Hydrogen atom has only one electron D. Hydrogen is the lightest element
- (xii) According to LOWRY BRONSTED concept, the reaction possesses:
- A. An acid and three bases B. Two acids and two bases
C. An acid and a base D. Three acids and a base
- (xiii) The HEAT OF NEUTRALIZATION of a strong acid and base is:
- A. Variable B. Nearly constant
C. First increases then decreases D. Zero
- (xiv) For a reversible reaction if the concentrations of reactants are doubled at a definite temperature, the equilibrium constant will:
- A. Be doubled B. Be halved
C. Become one fourth D. Remain the same
- (xv) In HYDROGEN atom, an orbit has a radius of about $0.529A^{\circ}$. What is the maximum number of electrons that can be accommodated?
- A. 2 B. 16
C. 8 D. 72
- (xvi) Which of the following is a NON-POLAR molecule that contains POLAR BONDS?
- A. H_2O B. SO_2
C. CCl_4 D. Cl_2
- (xvii) In zero order reaction, the rate is independent of:
- A. Temperature of reaction B. Concentration of reactants
C. Concentration of products D. None of these

For Examiner's use only:

Total Marks:

17

Marks Obtained:

— 1HA 1509 —



CHEMISTRY HSSC-I

(Old Syllabus)

26

Time allowed: 2:35 Hours

Total Marks Sections B and C: 68

NOTE:- Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Attempt any FOURTEEN parts. The answer to all parts should not exceed 5 to 6 lines. (14 x3 = 42)

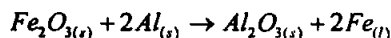
- (i) Calculate moles, formula units and total number of ions in 100g of $KClO_3$.
(Atomic Masses: O=16, Cl=35.5, K=39)
- (ii) Actual yield is always less than theoretical yield. Explain.
- (iii) How is crystallized substance dried?
- (iv) Graphically explain that $-273.16^\circ C$ is the lowest possible temperature.
- (v) Explain BOYLE'S LAW and AVOGADRO'S LAW on the basis of KINETIC MOLECULAR THEORY OF GASES.
- (vi) Calculate the number of formula units of $NaCl$ in a unit cell of sodium chloride.
- (vii) Arrange the following substances in increasing order of VAPOUR PRESSURE and explain this behaviour.
Isopentane, carbon tetrachloride, chloroform, diethyl ether.
- (viii) Explain the following crystal systems and given one example in each case.
a. HEXAGONAL
b. ORTHORHOMBIC
- (ix) Calculate the wave number for the PHOTON emitted when electron jumps from $n = 4$ to $n = 2$ and indicate in which region of spectrum, the photon will appear.
- (x) BF_3 and NF_3 are tetra-atomic molecules BF_3 is NON-POLAR whereas NF_3 is polar. Explain this difference with respect to their structures.
- (xi) Prove that $\Delta H = q_p$
- (xii) $CO_{(g)} + H_2O_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$ $\Delta H = -41.84 KJmol^{-1}$
For the above reaction at equilibrium, explain the effect of change of temperature and volume.
- (xiii) Differentiate between HYDRATION and HYDROLYSIS.
- (xiv) Calculate the MOLARITY OF GLUCOSE ($C_6H_{12}O_6$) solution when 25 g of it are dissolved in $150cm^3$ of solution. (At wts; H = 1, C = 12, O = 16)
- (xv) Explain that aqueous solution of NH_4Cl is acidic whereas the aqueous solution of Na_2CO_3 is basic in nature.
- (xvi) The vapour pressure of pure BENZENE at a certain temperature is 630 mm Hg. A NON-VOLATILE solid weighing 20 g is added in 40 g of BENZENE. The vapour pressure of the solution is 600 mm Hg. What is the molecular mass of the solid substance?
(The molecular mass of benzene is $78g mol^{-1}$)
- (xvii) How do surface area and light affect the RATE OF REACTION?
- (xviii) Derive Henderson's equation for a BUFFER solution containing a mixture of CH_3COOH and CH_3COONa .
- (xix) Give the electronic configuration of:
a. Fe-26 b. Cs-55 c. Cd-48

SECTION – C (Marks 26)

Note:- Attempt any TWO questions. All questions carry equal marks.

(13 x 2 = 26)

Q. 3 a. The THERMITE reaction, used to weld rails together in the building of rail roads, is described by the following equation:



(Atomic masses : $O = 16$, $Al = 27$, $Fe = 56$)

(i) Calculate the mass of IRON metal that can be prepared from 150 g of ALUMINIUM and 250 g of IRON (III)oxide (Fe_2O_3). (3)

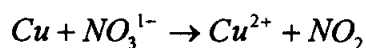
(ii) Calculate the amount of excess reactant (in grams) left after chemical reaction. (2)

b. Neutrons were discovered by CHADWICK. These are neutral particles.

(i) Write an equation for the decay of free neutron. (1)

(ii) What are slow neutrons? Why are they important? (2)

c. Balance the following equation by ION-ELECTRON method (acidic medium). (3)



d. Define the following terms.

(i) Solubility product (ii) Enthalpy of sublimation (2)

Q. 4 a. One mole of METHANE is maintained at 300 K. Its volume is 250 cm^3 . Calculate the pressure exerted by the gas when gas is non-ideal. ($a = 2.253 \text{ atm.dm}^6.\text{mol}^{-1}$, $b = 0.0428 \text{ dm}^3.\text{mol}^{-1}$) (3)

b. Arrange the following compounds in decreasing order of lattice energy. Give the reason for this arrangement. ($NaCl$, $LiCl$, KCl) (3)

c. Differentiate between an ORBIT and ORBITAL. (3)

d. (i) Draw a labelled diagram of Bomb calorimeter. (2)

(ii) What is the use of gas inlet in bomb calorimeter? (0.5)

(iii) Define heat capacity. Also give its mathematical form. (1.5)

Q. 5 a. Explain the following with reasons:

(i) Earthenware vessels keep water cool. (2)

(ii) The electrical conductivity of metals decreases by increasing temperature. (2)

b. What is hybridization? Discuss SP^3 and SP^2 HYBRIDIZATION giving one example of each. (5)

c. Give one example each of HOMOGENEOUS CATALYSIS and HETEROGENEOUS CATALYSIS. (2)

d. Calculate the mass of an ELECTRON using the values of 'e' and 'e/m'. (2)

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