



CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (ENGLISH)

NCERT BASED EXERCISE

In Text Questions

1. Why are solid rigid?



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2. Why do solids have a definite volume?



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3. Classify the following as amorphous or crystalline solids. Polyurethane. Naphthalene, benzoic acid, teflon, potassium nitrate, cellophane, polyvinyl chloride, fibre glass, copper.



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4. Why is glass considered a supercooled liquid?



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5. Refractive index of a solid is observed to have the same value along all directions. Comment on the nature of this solid. Would it show cleavage property?



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6. Solid A is a very hard electrical insulator in solid as well as in molten state and melts at extremely high temperature . What type of solid is it?



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7. Ionic solids conduct electricity in molten state but not in solid state. Explain.



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8. What type of solids are electrical conductors, malleable or ductile?



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9. Give the significance of a lattice point.



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10. Name the parameters that characterize a unit cell.



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11. Distinguish between

- a. Hexagonal and monoclinic unit cells
- b. Face-centred and end-centred unit cells



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12. Explain how much portion of an atom located at (i) corner and (ii) body-centre of a cubic unit cell is part of its neighbouring unit cell.



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13. What is the two dimensional coordination number of a molecule in square close-packed layer?



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14. A compound forms hexagonal close-packed structure. What is the total number of voids in 0.5 mol of it? How many of these are tetrahedral voids?

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15. A compound is formed by two elements Y and Z . The element Z forms ccp and atoms Y occupy $\frac{1}{3}$ rd of tetrahedral voids. The formula of the compound is

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16. Which of the following lattices has the highest packing efficiency (i) simple cubic (ii) body-centred cubic and (iii) hexagonal close-packed lattice?

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17. An element with molar mass $2.7 \times 10^{-2} \text{ kg mol}^{-1}$ forms a cubic unit cell with edge length 405 pm. If its density is $2.7 \times 10^3 \text{ kg m}^{-3}$, what is the nature of the cubic unit cell?



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18. What type of defect can arise when a solid is heated? Which physical property is affected by it and in what way?



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19. What type of stoichiometric defect is shown by:

(i) ZnS (ii) AgBr



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20. Explain how vacancies are introduced in an ionic solid when a cation of higher valency is added as an impurity in it.



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21. Ionic solids. Which have anionic vacancies due to metal excess defect, develop colour. Explain with the help of a suitable example.



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22. A group 14 element is to be converted into n-type semiconductor by doping it with a suitable impurity. To which group should this impurity belong?



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23. What type of substances would make better permanent magnets, ferromagnetic or ferrimagnetic. Justify your answer.



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24. Calculate the mass percentage of benzene (C_6H_6) and carbon tetrachloride (CCl_4) if 22g of benzene is dissolved in 122g of carbon tetrachloride.



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25. Calculate the mole fraction of benzene in solution containing 30% by mass in carbon tetrachloride.



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26. Calculate the molarity of each of the following solutions: (a) 30 g of $Co(NO_3)_2 \cdot 6H_2O$ in 4.3 L of solution (b) 30 mL of 0.5 M H_2SO_4 diluted to 500 mL.



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27. Calculate the mass of urea (NH_2CONH_2) required in making 2.5 kg of 0.25 molal aqueous solution.



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28. Calculate (a) molality (b) molarity and (c) mole fraction of KI if the density of 20% (mass/mass) aqueous KI is 1.202 g mL^{-1} .



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29. H_2S , a toxic gas with rotten egg like smell, is used for the qualitative analysis. If the solubility of H_2S in water at STP is 0.195m, calculate Henry's law constant.



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30. Henry's law constant for CO_2 in water is 1.67×10^8 Pa at 298 K. Calculate the quantity of CO_2 in 500 mL of soda water when packed under 2.5 atm CO_2 pressure at 298K.



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31. The vapour pressure of pure liquids A and B are 450 and 700 mm Hg respectively, at 350 K. find out the composition of the liquid mixture if total vapour pressure is 600 mm Hg. Also find the composition of the vapour phase.



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32. Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50 g urea is dissolved in 850 g of water. The vapour pressure of water for this solution and its relative lowering are respectively.



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33. Boiling point of water at 750 mm Hg is 99.63°C . How much sucrose is to be added to 500g of water such that it boils at 100°C .



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34. Calculate the mass of ascorbic acid (vitamin C, $\text{C}_6\text{H}_8\text{O}_6$) to be dissolved in 75g of acetic acid to lower its melting point by 1.5°C . $K_f = 3.9\text{K kg mol}^{-1}$



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35. Calculate the osmotic pressure in pascals exerted by a solution prepared by dissolving 1.0 g of polymer of molar mass 185,000 in 450 mL of water at 37°C .



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36. How would you determine the standard electrode potential of the system $\text{Mg}^{2+}|\text{Mg}$



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37. can you store copper sulphate solution in a zinc pot?



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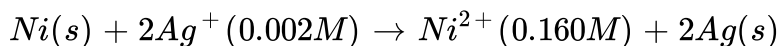
38. Consult the table of standard electrode potentials and suggest three substances that can oxidise ferrous ions under suitable conditions.

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39. Calculate the potential of hydrogen electrode in contact with a solution whose pH is 10.

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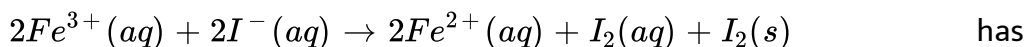
40. Calculate the mf of the cell in which the following reaction takes place



given that $E_{cell}^{\ominus} = 1.05V$

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41. The cell in which the following reaction occurs



$E_{cell}^0 = 0.236V$ at 298 K.

Calculate the stadard gibbs energy and the equilibrium constant of the cell reaction.



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42. Why does the conductivity of a solution decrease with dilution?



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43. Suggest a way to determine the Λ_m° value of water.



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44. The molar conductivity of 0.025 mol L^{-1} methanoic acid is $46.1 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate its degree of dissociation and dissociation constant.

Given

$$v^0(H^+) = 349.6 \text{ S cm}^2 \text{ mol}^{-1} \text{ and } \lambda^0(HCOO^-) = 54.6 \text{ S cm}^2 \text{ mol}^{-1}$$



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45. If a current of 0.5 ampere flows through a metallic wire of 2 hours, then how many electrons would flow through the wire?



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46. Suggest a list of metals that are extracted electrolytically.



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47. Consider the reaction: $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

what is the quantity of electricity in coulombs needed to reduce 1 mol of $Cr_2O_7^{2-}$?



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48. Write the chemistry of recharging the lead storage battery, highlighting all the materials that are involved during recharging.



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49. Suggest two materials other than hydrogen that can be used as fuels in fuel cells.



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50. Explain how rusting of iron is envisaged as setting up of an electrochemical cell.



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Ncert Exercise

1. Define the term amorphous, give a few examples of amorphous solids.



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2. classify each of the following solids as ionic, metallic, molecular, network (covalent) or amorphous,

- | | |
|--|----------------|
| (i) Tetraphosphorus decoxide (P_4O_{10}) | (vii) Graphite |
| (ii) Ammonium phosphate ($(NH_4)_3PO_4$) | (viii) Brass |
| (iii) SiC | (ix) Rb |
| (iv) I_2 | (x) LiBr |
| (v) P_4 | (xi) Si |
| (vi) Plastic | |



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3. What is meant by the term "coordination number"?

b. What is the coordination number of atoms:

i. in a cubic closed-packed structure?

ii. In a body-centred cubic structure?



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4. How can you determine the atomic mass of an unknown metal if you know its density and the dimension of its unit cell? Explain.



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5. a. "Stability of a crystal is reflected in the magnitude of its melting points" Comment.

b. Melting points of some compounds are given below water = $273K$, ethyl alcohol = $153.7K$, diethyl ether = $156.8K$, methane = $90.5K$.

What can you say about the intermolecular forces between the molecules of these compounds?



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6. How will you distinguish between the following pairs of terms:

(i) Hexagonal close-packing and cubic close-packing?

(ii) Crystal lattice and unit cell?

(iii) Tetrahedral void and octahedral void?



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7. How many lattice points are there in one unit cell of each of the following lattice?

(i) Face-centred cubic

(ii) Face-centred tetragonal

(iii) Body-centred



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8. Explain

(i) The basis of similarities and differences between metallic and ionic crystals.

(ii) Ionic solids are hard and brittle.



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9. What is the efficiency of packing in case of a metal crystal for

(i) simple cubic (ii) body-centred cubic (iii) face-centred cubic (with the assumptions that atoms are touching each other)



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10. Silver crystallises in fcc lattice. If edge length of the cell is 4.07×10^{-8} cm and density is 10.5 g cm^{-3} , calculate the atomic mass of silver.



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11. A cubic solid is made of two elements P and Q. Atoms of Q are at the corners of the cube and P at the body-centre. What is the formula of the compound? What are the coordination numbers of P and Q?



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12. Niobium crystallises in body-centred cubic structure if density is 8.55 g cm^{-3} , calculate atomic radius of niobium using its atomic mass 93u.



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13. If the radius of an octahedral void is r and radius of atoms in close packing is R , the relation between r and R is

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14. Copper crystallizes into an fcc lattice with edge length $3.61 \times 10^{-8} \text{ cm}$, Show that the calculated density is in agreement with its measured value of 8.92 g cm^{-3} .

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15. Analysis shows that nickel oxide has the formula $\text{Ni}_{0.98}\text{O}$. What fractions of nickel exist as Ni^{2+} and Ni^{3+} ions?

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16. What is a semiconductor? Describe the two main types of semiconductors and contrast their conduction mechanism.



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17. Non-stoichiometric cuprous oxide, Cu_2O can be prepared in laboratory. In this oxide. Copper to oxygen ratio is slightly less than 2:1, can you account for the fact that this substance is a p-type semiconductor?



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18. Ferric oxide crystallises in a hexagonal close-packed array of oxide ions with two out of every three octahedral holes occupied by ferric ions. Derive the formula of the ferric oxide.



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19. Classify each of the following as being either a p-type or a n-type semiconductor:

(i) Ge doped with In (ii) Si doped with B.



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20. Gold (atomic radius= 0.144nm) crystallises in a face-centred unit cell.

What is the length of a side of the cell?



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21. In terms of band theory, what is the difference

(i) between a conductor and an insulator

(ii) between a conductor and a semiconductor?



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22. Explain the following terms with suitable example:

a. Schottky defect b. Frenkel defect

c. Interstitials



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23. Aluminium crystallises in a cubic close-packed structure. Its metallic radius is 125 pm.

(i) What is the length of the side of the unit cell?

(ii) How many unit cells are there in 1.00 cm^3 of aluminium?



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24. If NaCl is doped with $10^{-4} \text{ mol } \%$ of SrCl_2 , the concentration of cation vacancies will be $\left(N_A = 6.023 \times 10^{23} \text{ mol}^{-1}\right)$



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25. Explain each of the following with a suitable example: Paramagnetism



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1. Why amorphous solids are called as supercooled liquids?



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2. Why benzoic acid has a sharp melting point but glass does not?



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3. Classify the following into ionic, molecular, covalent and metallic crystals:

SiO_2 (quartz), brass bronze, dry ice, nitre diamond, H_2O (ice),

SO_2 , I_2 , CaO



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4. CsCl structure is interchanged into NaCl structure This can be done because



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5. A $NaCl$ crystal is found to have $CsCl$ structure. How it happened?



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6. What is the coordination number of TV_s and OV_s



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7. What is the coordination number of each ion present in the closed packed structures of (a) Na_2O (b) CaF_2 at ordinary temperature and pressure?



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8. What is the coordination number of hcp and ccp?



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9. How does amorphous silica differs from quartz?



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10. Do all metals posses a closed packed structure?



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11. Why do some substance exist as solids?



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12. Why do the window glass of old old building (a) look milky and (b) become thick at the bottom?



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13. Why the melting points of NaF and MgO ($990^{\circ}C$ and $2640^{\circ}C$) are so different although both have same number of electrons and nearly the same internuclear distance (236 pm and 216 pm)?



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14. How many types of centred unit cells exist?



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15. How many types of two-dimensional lattice exist? Why pentagonal lattices not possible?



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16. How many TVs and OVs occur per unit cell and per atom in a closest packed structure?



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17. Where the TVs and OVs are located in a closet packed structure?



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18. What is the distance between two TVs ?



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19. In an hcp structure, calculate

$$Z_{eff}$$



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20. In a diamond cubic (dc) structure, calculate

$$Z_{eff}$$



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21. What is the ratio of $(TV/OV)_{\text{occupied}}$ in spinel an inverse spinel structure?



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22. What is the CN of cation and anion in a corundum structure?



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23. What is the occurrence of different forms of the same compound called?



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24. How many allotropic forms of Carbon exist?



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25. How can a substance be made amorphous?



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26. Why does ZnO show increased electrical conductivity and turns yellow on heating?



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27. Why NiO and FeO are nonstoichiometric with the formula $Ni_{0.98}O$ and $Fe_{0.95}O$?



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28. Why the defects of the crystalline solids are called thermodynamic defects?



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29. Why stoichiometric defects are also called intrinsic defects?



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30. Give the name of one solid which shows both Schottky and Frenkel defects?



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31. why is Frenkel defects not found in pure alkali metal halides ?



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32. why does table salt ,NaCl sometimes appear yellow in colour?



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33. How do the electrical conductivity and resistivity of metallic conductors, semi-conductors, and super conductors vary with temperature ?



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34. What is energy gap in bond theory?



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35. What is photo voltaic cell?



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36. What happens when ferrimagnetic Fe_3O_4 is heated to $850K$?



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37. What happens when ferromagnetic substance is heated to high temperature?

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38. Which type of defect is product when $NaCl$ is dopped with $AlCl_3$?

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39. Which point defect lowers the density of a crystal?

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40. At what temperature range most of the metals becomes superconductors

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41. What is curie temperature?



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42. Name the compound that can be added to $AgCl$ so as to produce cation vacancies.



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43. Why does Frenkel defect not change the density of $AgCl$ crystals?



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44. What other elements may be added to silicon to make electrons available for conduction of an electric current?



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45. What are the types of lattice imperfection found in crystals?



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46. What is dislocation in the crystals



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47. Which transition metal oxide has appearance and conductivity like that of copper



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48. How is electrical conductivity caused in (a) semiconductors, (b) metals, and (c) ionic compounds?



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49. Name the compound which shows both electric and ferroelectric properties.



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50. Name the compound which shows anti-ferroelectric property.



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51. When and why is molality preferred over molarity in handling solution in CHMistry?



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52. What is the effect of temperature on the molality of solution?



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53. Which aqueous solution has higher concentration , 1 molar or 1 molal of the same solute?



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54. Why vapour pressure of a liquid decreases when a non — volatile solute is added to it ?



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55. $10dm^3$ of a liquid A was mixed with $10dm^3$ of liquid B . The volume of the resulting solution was found to be $19dm^3$. What do you conclude ?



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56. What do you expect to happen when red blood corpuscles ($RBCs$) are placed in (a) 0.5 % $NaCl$ solution and (b) 1 % $NaCl$ solution ?



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57. What will happen to the boiling point of a solution if the weight of the solute dissolved is doubled but the weight of solvent taken is halved ?



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58. What type of liquids form ideal solutions?



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59. How much molecular mass of NaCl is obtained experimentally using colligative properties ?



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60. Why an azeotropic mixture gets distilled without any change in composition ?



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61. Why do radioactive element decay?



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62. How can a nucleus lose electrons (β -particles) even though free electrons are not present in it?



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63. What is the total life of a radioactive element ?



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64. What is the source of radioactive CO_2 in the atmosphere?



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65. What are transactinides ? To which block do they belong ?



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66. Why is synthesis of transactinides difficult ?



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67. Name the fundamental particle which exists in the nucleus



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68. Which radioactive metal is used as an ingredient of atomic explosive weapons ?



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69. $C - 14$ is formed in the upper atmosphere. Why it does not occur at the ground level ?



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Ncert Exercise

1. Define the term solution. How many types of solutions are formed? Write briefly about each type with an example.



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2. Suppose a solid solution is formed between two substances, one whose particles are very large and the other whose particles are very small. What kind of solid solution is this likely to be ?



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3. Define the following terms:

(i). Mole fraction (ii). Molality

(iii). Molarity.

(iv). Mass percentage.



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4. Concentrated nitric acid used in laboratory work is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of the solution is 1.504 g mL^{-1} ?



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5. A solution of glucose in water is labelled as 10% w/w. what would be the molality and mole fraction of each component in the solution? If the density of solution 1.2 g mL^{-1} , then what shall be the molarity of the solution?



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6. How many mL of 0.1 M HCl are required to react completely with 1 g mixture of Na_2CO_3 and $NaHCO_3$ containing equimolar amounts of both?



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7. A solution is obtained by mixing 300g of 25% solution and 400 g of 40% solution by mass. Calculate the mass percentage of the resulting solution.



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8. An antifreeze solution is prepared from 222.6 g of ethylene glycol ($C_2H_6O_2$) and 200 g of water. Calculate the molality of the solution. If the density of the solution is 1.072 g mL^{-1} , then what shall be the molarity of the solution?



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9. A sample of drinking water was found to be severely contaminated with chloroform (CHCl_3) supposed to be a carcinogen. The level of contamination was 15 ppm (by mass).

(i). Express this in percent by mass

(ii). Determine the molality of chloroform in the water sample.



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10. What role does the molecular interaction play in a solution of alcohol and water?



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11. Why do gases always tend to be less soluble in liquids as the temperature is raised?



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12. State Henry's law and mention some important applications.



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13. The partial pressure of ethane over a solution containing 6.56×10^{-3} g of ethane is 1 bar. If the solution contains 5.00×10^{-2} g of ethane, then what shall be the partial pressure of the gas?



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14. What is meant by positive and negative deviations from Raoult's law and how is the sign of $\Delta_{\text{so}}H$ related to positive and negative deviations from Raoult's law ?



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15. An aqueous solution of 2% non-volatile solute exerts a pressure of 1.004 bar at the normal boiling point of the solvent . What is the molecular mass of the solute ?



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16. Heptane and octane form an ideal solution. At $373K$, the vapour pressure of the two liquids are 105.0 kPa and 46.0 kPa, respectively. What will be the vapour pressure, of the mixture of 25g of heptane and 35g of octane ?



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17. The vapour pressure of water is 12.3 kPa at 300 K. calculate vapour pressure of 1 molal solution of a non-volatile solute in it.



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18. Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114g octane to reduce its vapour pressure to 80%.



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19. A solution containing 30 g of a non-volatile solute exactly in 90 g water has a vapour pressure of $2.8 \text{ k } P_a$ at 298 K. Further 18 g of water is then added to solution, the new vapour pressure becomes $2.9 \text{ k } P_a$ at 298 K. Calculate.

- (i) Molecular mass of the solute
- (ii) Vapour pressure of water at 298 K.



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20. A 5% solution (by mass) of cane sugar in water has freezing point of 271K. Calculate the freezing point of 5% glucose in water if freezing point of pure water is 273.15K.

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21. Two elements A and B form compounds having molecular formula AB_2 and AB_4 . When dissolved in $20g$ of benzene, $1g$ of AB_2 lowers the freezing point by $2.3K$, whereas $1.0g$ of AB_4 lowers it by $1.3K$. The molar depression constant for benzene is $5.1Kkgmol^{-1}$. Calculate the atomic mass of A and B .

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22. At $300K$, $36g$ of glucose present in a litre of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of the solution is 1.52 bars at the same temperature, what would be its concentration?

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23. Suggest the most important type of intermolecular attractive interaction in the following pairs :

a. n – Hexane and n – octane

b. I_2 and CCl_4

c. $NaClO_4$ and water



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24. Based on solute-solvent interactions, arrange the following in order of increasing solubility in n -octane and explain. Cyclohexane, KCl , CH_3OH , CH_3CN .



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25. Amongst the following compounds. Identify which are insoluble, partially soluble and highly soluble in water?

(i). Phenol

(ii) toluene

(iii). Formic acid

(iv). Ethylene glycol chloroform

(vi). Pentanol.

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26. If the density of water of a lake is 1.25 gmL^{-1} and one kg of lake water contains 92 g of Na^+ ions, calculate the molarity of Na^+ ions in this lake water. (Gram atomic mass of $\text{Na} = 23 \text{ g mol}^{-1}$)

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27. If the solubility product product of CuS is 6×10^{-16} , calculate the maximum molarity of CuS in aqueous solution.

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28. Calculate the mass percentage of aspirin ($\text{C}_9\text{H}_8\text{O}_4$) in acetonitrile (CH_3CN) when 6.5 g of $\text{C}_9\text{H}_8\text{O}_4$ is dissolved in 450 g of CH_3CN .

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29. Nalorphene ($C_{19}H_{21}O_NO_3$), similar to morphine, is used to combat withdrawal symptoms in narcotic users. Dose of nalorphene generally given is 1.5 mg. calculate the mass of $1.5 \times 10^{-3}m$ aqueous solution required for the above dose.



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30. Calculate the amount of benzoic acid (C_6H_5COOH) required for preparing 250mL of 0.15M solution in methanol.



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31. The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order given above. Explain briefly.



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32. Calculate the depression in the freezing point of water when 10g of $CH_3CH_2CHClCOOH$ is added to 250 g of water:

$$K_a = 1.4 \times 10^{-3}, K_f = 1.86 \text{ K kg mol}^{-1}.$$



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33. 19.5g of CHM_2FCOOH is dissolved in 500g of water . The depression in the freezing point of water observed is $1.0^\circ C$. Calculate the Van't Hoff factor and dissociation constant of fluoroacetic acid.



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34. Vapour pressure of water at 293K is 17.535 mm Hg. Calculate the vapour pressure of water sat 293K when 25 g of glucose is dissolved in 450g of water.



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35. Henry's law constant for molality of methane in benzene at 298 K is 4.27×10^5 mm Hg. The mole fraction of methane in benzene at 298 K under 760 mm Hg is



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36. 100g of liquid A (molar mass 140g mol^{-1}) was dissolved in 1000g of liquid B (molar mass 180g mol^{-1}). The vapour pressure of pure liquid B was found to be 500 torr. Calculate the vapour pressure of pure liquid A and its vapour pressure in the solution If the total vapour pressure of the solution is 475 torr.



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37. The heat of formation of ethane is -19.46kcal . Bond energies of $H-H$, $C-H$ and $C-C$ bonds are 104.18, 99.0 and 80.0kcal , respectively. Calculate the heat of atomisation of graphite.



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38. The air is a mixture of a number of gases. The major components are oxygen and nitrogen with approximate proportion of 20 % is to 79 % by volume at 298 K. The water is in equilibrium with air at a pressure of 10 atm. At 298 K if the Henry's law constants for oxygen and nitrogen at 298 K are 3.30×10^7 mm and 6.51×10^7 mm respectively, calculate the composition of these gases in water.



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39. Determine the amount of $CaCl_2$ ($i = 2.47$) dissolved in 2.5 L of water such that its osmotic pressure is 0.75 atm at $27^\circ C$.



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40. Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 litre of water at $25^\circ C$, assuming that it is completely dissociated.



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41. Arrange the following metals in the order in which they displace each other from the solution of their salts.

Al, Cu, Fe, Mg and Zn.



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42. Given the standard electrode potentials ,

$$K^+ / K = -2.93V, Ag^+ / Ag = 0.80V, Hg^{2+} / Hg = 0.79V$$

$$Mg^{2+} / Mg = -2.37V, Cr^{3+} / Cr = -0.74V$$

arrange these metals in their increasing order of the reducing power .



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43. Depict the galvanic cell in which the reaction $Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$ takes place , Further show :

(i) which of the electrode is negatively charged,

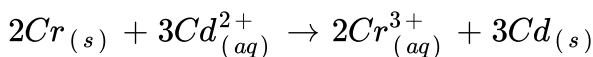
(ii) the carriers of the current in the cell, and

(iii) individual reaction at each electrode.



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44. What will be standard cell potential of galvanic cell with the following reaction?

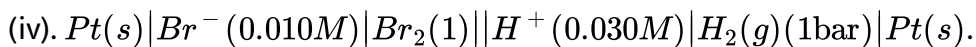
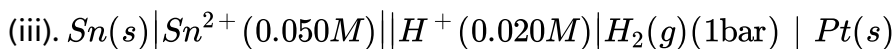
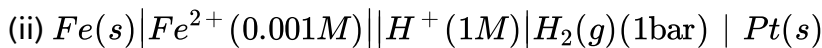
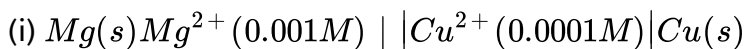


[Given: $E^{\circ}_{Cr^{3+}/Cr} = -0.74 \text{ V}$ and $E^{\circ}_{Cd^{2+}/Cd} = -0.40 \text{ V}$]



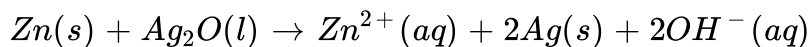
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45. Write the nernst equation and emf of the following cells at 298 K:



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46. In the button cells widely used in watches and other devices the following reaction takes place:



Determine $\Delta_r G^{\ominus}$ and E^{\ominus} for the reaction.



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47. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.



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48. The conductivity of 0.20 M solution of KCl at 298 K is $0.0248 S \text{ cm}^{-1}$.

Calculate its molar conductivity.



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49. The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500Ω what is the cell constant if conductivity of 0.001M KCl solution at 298 K is $0.146 \times 10^{-3} S \text{ cm}^{-1}$



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50. The conductivity of sodium chloride at 298 K has been determined at different concentrations and the results are given below:

Concentration / M	0.001	0.010	0.020	0.050	0.100
$10^2 \times k / S m^{-1}$	1.237	11.85	23.15	55.53	106.74

Calculate Λ for all concentrations and draw a plot between Λ and $c^{1/2}$.

Find the value of Λ^0 .



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51. Conductivity of 0.00241 M acetic acid is $7.896 \times 10^{-5} S \text{ cm}^{-1}$.

Calculate its molar conductivity. If Λ_m^0 for acetic acid is $390.5 S \text{ cm}^2 \text{ mol}^{-1}$, what is its dissociation constant?



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52. How much charge is required for the following reductions:

(i) 1 mol of Al^{3+} to Al?

(ii). 1 mol of Cu^{2+} to Cu?

(iii). 1 mol of MnO_4^- to Mn^{2+} ?



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53. How much electricity in terms of faraday is required to produce

(i) 20.0 g of ca from molten $CaCl_2$

(ii). 40.0g of Al from molten Al_2O_3 ?



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54. How much electricity is required I coulomb for the oxidation of

(i) 1 mol of H_2O to O_2 ?

(ii). 1 mol of FeO to Fe_2O_3 ?

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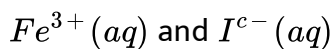
55. A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes using a current of 5 amperes for 20 minutes what mass of Ni is deposited at the cathode?

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56. Three electrolytic cells A,B,C containing solutions of $ZnSO_4$, $AgNO_3$ and $CuSO_4$, passed through them until 1.45g of silver deposited at the cathode of cell B. How long did the current flow? What mass of copper and zinc were deposited?

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57. Using the standard electrode potentials given in Table, predict if the reaction between the following is feasible:





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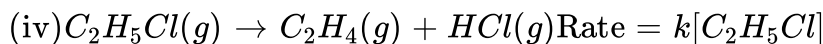
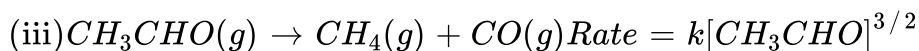
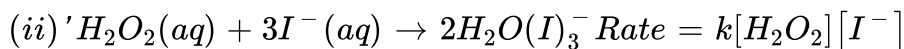
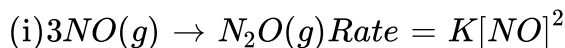
58. Predict the products of electrolysis in each of the following

- (i) an aqueous solution of $AgNO_3$ with silver electrodes.
- (ii). An aqueous solution of $AgNO_3$ with platinum electrodes.
- (iii). A dilute solution of H_2SO_4 with platinum electrodes.
- (iv). An aqueous solution of $CuCl_2$ with platinum electrodes.



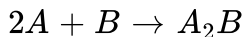
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59. From the rate expression for the following reactions, determine their order of reaction and the dimensions of the rate constants.



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60. For the reaction:



the rate = $k[A][B]^2$ with $k = 2.0 \times 10^{-6} \text{ mol}^{-2} \text{ L}^2 \text{ s}^{-1}$. Calculate the initial

rate of the reaction when $[A] = 0.1 \text{ mol L}^{-1}$, $[b] = 0.2 \text{ mol L}^{-1}$. Calculate the rate of reaction after $[A]$ is reduced to 0.06 mol L^{-1}



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61. The decomposition of NH_3 on platinum surface is zero order reaction

. What are the rates of production of N_2 and H_2 if $k = 2.5 \times 10^{-4} \text{ mol}^{-1} \text{ L s}^{-1}$?



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62. The decomposition of dimethyl ether leads to the formation of CH_4 , H_2 and CO and the reaction rate is given by

$$\text{Rate} = k[CH_3OCH_3]^{3/2}$$

The rate of reaction is followed by increase in pressure in a closed vessel, so

$$= k(P_{CH_3OCH_3})^{3/2}$$

If the pressure is measured in bar and time in minutes, then what are the units of rate and rate constants?



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63. Mention the factors that affect the rate of a chemical reaction



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64. A reaction is second order with respect to a reaction. How is the rate of reaction affected if the

(a) doubled, (b) reduced to $1/2$?



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65. What is the effect of temperature on the rate constant of a reaction? How can this effect of temperature on rate constant be represented quantitatively?



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66. A reaction is first order in A and second order in B. (i) Write the differential rate equation. (ii) How is the rate affected on increasing the concentration of B three times? (iii) How is the rate affected when the concentrations of both A and B are doubled?



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67. Calculate the half-life of a first order reaction from their rate constants given below: (i) 200s^{-1} (ii) 2 min^{-1} (iii) 4years^{-1}



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68. (a) List the factors on which the rate of chemical reaction depends.

(b) The half-life for decay of radioactive ^{14}C is 5730 years. An archaeological artefact containing wood has only 80 % of the ^{14}C activity as found in living trees. Calculate the age of artefact.



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69. The rate constant for a first order reaction is 60s^{-1} . How much time will it take to reduce the initial concentration of the reactant to its $\frac{1}{16^{\text{th}}}$ value?



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70. During nuclear explosion, one of the products is ^{90}Sr with half-life of 28.1 years. If $1\mu\text{g}$ of ^{90}Sr was absorbed in the bones of a newly born baby instead of calcium, how much of it will remain after 10 years and 60 years if it is not lost metabolically.

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71. For a first order reaction, show that time required for 99% completion is twice the time required for the completion of 90% of reaction.

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72. A first order reaction takes 40 min for 30% decomposition. Calculate $t_{1/2}$.

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73. The rate constant for the decomposition of hydrocarbons is $2.418 \times 10^{-5} \text{ s}^{-1}$ at 546 K. If the energy of activation is 179.9 kJ/mol , what will be the value of pre-exponential factor.

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74. Consider a certain reaction $A \rightarrow \text{Products}$ with $k = 2.0 \times 10^{-2} \text{ s}^{-1}$.

Calculate

the concentration of A remaining after 100 s if the initial concentration of A is 1.0 mol L^{-1} .



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75. Sucrose decomposes in acid solution into glucose and fructose according

to the first order rate law, with $t_{1/2} = 3.00$ hours. What fraction of sample

of sucrose remains after 8 hours



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76. The decomposition of a hydrocarbon follows the equation

$k = (4.5 \times 10^{11} \text{ s}^{-1}) e^{-28000 \text{ K} / T}$. What will be the value of activation energy?



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77. The rate constant for the first order decomposition of H_2O_2 is given by the

following equation:

$$\log k = 14.34 - 1.25 \times 10^4 k/t$$

Calculate E_a for this reaction and at what temperature will its half-period be 256 minutes?

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78. The decomposition of A into product has value of k as

$$4.5 \times 10^3 s^{-1} \text{ at } 10^\circ C$$

and energy of activation $60 kJ mol^{-1}$. At what temperature would k be

$$1.5 \times 10^4 s^{-1}?$$

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79. The time required for 10% completion of a first order reaction at 298K is equal to that required for its 25% completion at 308K. If the value of A is $4 \times 10^{10} \text{ s}^{-1}$. Calculate k at 318K and E_a .



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80. The rate of a reaction quadruples when the temperature changes from 293 K to 313 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature



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81. Why are powdered substances more effective adsorbents than their crystalline forms?



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82. What are the factors which influence the adsorption of a gas on a solid?



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83. What is the adsorption isotherm? Describe Freundlich adsorption isotherm.



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84. What do you understand by activation of adsorbent? How is it achieved ?



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85. What role does adsorption play in heterogeneous catalysis?



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86. Why is a absorption always exothermic ?



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87. How are the colloidal solutions classified on the basis of physical states of the dispersed phase and dispersion medium?



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88. Discuss the effect of pressure and temperature on the adsorption of gases on solids.



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89. What are lyophilic and lyophobic sols? Give one example of each type. Why are hydrophobic sols easily coagulated?



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90. What is the difference between multimolecular and macromolecular colloids? Give one example of each.

How are associated colloids different from these two types of colloids?



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91. What are enzymes?



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92. State the observation when Table salt is added to hydrated ferric oxide sol.



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93. What are emulsions ? What are their different types ? Give an example of each type.



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94. How do emulsifying agents stabilise the emulsion?



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95. Action of soap is due to emulsification and micelle formation.

Comment



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96. Give four examples of heterogeneous catalysis.



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97. What do you mean by activity and selectivity of catalysts?



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98. Describe some features of catalysis by zeolites.



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99. What is shape selective catalysis?



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100. Explain the following terms:

(i) Electrophoresis (ii) Coagulation

(iii) Dialysis

(iv) Tyndall effect



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101. Give four uses of emulsions.



Watch Video Solution

102. What are micelles? Given an example of micelle system.



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103. Explain the terms with suitable examples:

(i) Alcosol (ii) Aerosol (iii) Hydrosol



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104. Comment on the statement that colloid is not a substance but a state of substance.



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1. What would happen if no salt bridge is used in electrochemical cell ?



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2. What is the use of platinum foil in an *SHE* ?



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3. How the reduction potential of an electrode can be decreased?



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4. Cl_2 and F_2 are added to a solution containing $1M$ each of Cl^- and Br^- . What reaction will occur ?



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Short Answer Type Questions Electrochemical Cell

1. Cl_2 and Br_{c-} are added to a solution containing $1M$ each of Cl^{c-} and Br^{c-} . What reaction will occur ?



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2. Br_2 and I_2 are added to a solution containing $1M$ each of Br^{c-} and I^{c-} . What reaction will occur ?



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3. Why is equilibrium constant K related to only E_{cell}^{\ominus} and not E_{cell} ?



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4. What is the free energy change (ΔG) for galvanic and electrolytic cell ?



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5. If an electrochemical cell is made in which current does not flow, what it suggest ?



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6. In each of the following pairs, which will conuct more electricity?

- a. Cu wire at $30^{\circ}C$ and $60^{\circ}C$.
- b. KBr solution at $30^{\circ}C$ and $60^{\circ}C$.
- c. NH_4OH solution at $30^{\circ}C$ and $60^{\circ}C$.
- d. $1M$ and $0.1M$ propanioc acid solutions.



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7. How the weak and strong electrolytes are distinguished?



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8. What flows in the internal circuit of a galvanic cell?



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9. Why is it not possible to measure the single electrode potential ?



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10. Electrochemical Series



Watch Video Solution

11. What is the *EMF* of a cell?



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12. Why the cell stops working after some time?



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Electrolysis Batteries And Rusting

1. What is meant by electrochemical equivalent of a substance?



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2. An aqueous solution of $CuSO_4$ is electrolyzed using Pt electrodes in one case and Cu electrodes in another case. What are the products of electrolysis in both the cases ?



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3. What are the products of the electrolysis of aqueous solution of KF ?



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4. Silver is conducting as such while $AgNO_3$ is conducting in molten state or in aqueous solution. Explain ?



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5. Why Zn reacts with dilute H_2SO_4 to give H_2 gas but Cu does not ?



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6. What is overvoltage or bubble voltage ?



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7. Which allotrope of carbon is used for making electrodes?



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8. Name the electrolyte used in dry cell.



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9. What would happen if the protective tin coating over an iron bucket is broken in some places ?



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10. Which type of metal can be used in cathodic protection of iron against rusting.



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11. Write the names of the electrodes used in fuel cell.



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12. Name the electrolyte used in fuel cell and mercury cell.



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13. State True or False

Rusting of Fe is quicker in saline water than in ordinary water.



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14. Why Cr is used for coating Fe ?



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15. What is the role of $ZnCl_2$ in dry cell ?



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16. Why a mercury cell gives a constant voltage throughout its life ?



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17. Which types of cells are rechargeable ?



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18. Why a dry cell becomes dead after a long time even if it is not used ?



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19. Why lead storage can be recharged ?



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20. Out of Sn and Zn which one protects Fe better even after cracks ?



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Conductivity Of Ionic Solutions

1. Why ac is used in place of dc in measuring the conductance of electrolytes ?



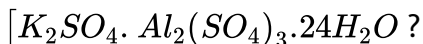
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2. Out of HBr and $NaBr$, which will have greater value for Λ_m° and why ?



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3. What is the relation between molar conductivity (Λ_m) and equivalent conductivity (Λ_{eq}) of potash alum



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4. Why in a concentrated solution, a strong electrolyte shows deviation from Debye — Huckel Onsager equation ?



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5. Which equation gives the relationship between equivalent or molar conductance and concentration of a strong electrolyte ?



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6. What is the effect of decreasing concentration on the molar conductivity of a weak electrolyte?



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7. Why Λ_m° for weak electrolyte (e. g. , NH_4OH or CH_3COOH) cannot be determined experimentally ?



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8. An aqueous solution of K_2SO_4 is diluted by adding water. How the values of G , k , Λ_m and Λ_{eq} vary ?



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Chemical Kinetics In Text Questions

1. For the reaction $R \rightarrow P$, the concentration of a reactant changes from 0.03M to 0.02M in 25 minutes. Calculate the average rate of reaction using units of time both in minutes and seconds.



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2. In a reaction, $2A \rightarrow \text{Products}$, the concentration of A decreases from 0.5 mol L^{-1} to 0.4 mol L^{-1} in 10 minutes. Calculate the rate during this interval?



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3. For a reaction, $A + B \rightarrow \text{Product}$, the rate law is given by, $r = k[A]^{\frac{1}{2}}[B]^2$. What is the order of the reaction?



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4. The conversion of molecules X to Y follows second order kinetics. If concentration of X is increased to three times how will it affect the rate of formation of Y?



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5. A first order reaction has a rate constant $1.15 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of this reactant take to reduce to 3 g?



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6. Time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction .



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7. What will be the effect of temperature on rate constant ?

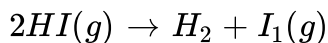


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8. The rate of the chemical reaction doubles for an increase of 10K in absolute temperature from 300K . Calculate E_a .

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9. The activation energy for the reaction



is $209.5 \text{ kJ mol}^{-1}$ at 581°C . Calculate the fraction of molecules of reactants having energy equal to or greater than activation energy?

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Short Answer Type Question

1. Why cooking food in an open vessel takes more time at a hill station ?

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2. Why coal or petrol does not burn by itself in air but once initiated by flame, it continues to burn?

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[Watch Video Solution](#)

3. Why in general does not proceed with a uniform rate throughout?



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4. Why instantaneous rate is preferred over average rate?



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5. Why are reactions of higher order less in number?



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6. Is there any reaction whose rate does not decrease with time ?



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7. What is the order of reaction whose rate constant has the same units as rate of reaction ?



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8. What type of plot is obtained for rate versus time for zero order reaction



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9. When is the rate of reaction equal to specific rate constants



Watch Video Solution

10. When does the average rate become equal to instantaneous rate ?



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11. On the basis of enthalpy of formation, graphite is more stable than diamond, yet diamond does not change into graphite for years. Why ?



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12. In some cases, it is found that a large number of colliding molecules have energy more than threshold value, yet the reaction is slow. Why?



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13. Can a reaction have negative activation energy?



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14. The reactions : $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ and $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ look to be similar. Yet the former is slower than latter at same temperature. Why ?



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15. What are the units of a pseudo unimolecular and pseudo bimolecular reaction ?



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16. What is the effect of adding a catalyst on

(a) Activation energy (E_a), and

(b) Gibbs energy (ΔG) of a reaction?



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17. Why equilibrium constant of a reaction does not change in the presence of a catalyst ?



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18. What is the value of K at high temperature. Is it feasible or not ?



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Surface Chemistry In Text Question

1. Why are substance such as platinum and palladium often used for carrying out electrolysis of aqueous solutions?



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2. Why does physisorption decrease with increase of temperature ?



Watch Video Solution

3. Why are powdered substances more effective adsorbents than their crystalline forms?



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4. Why is it necessary to remove CO when ammonia is obtained by Haber's process?

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5. Why is the ester hydrolysis slow in the beginning and becomes faster after sometimes?

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6. What is the role of desorption in the process of catalysis.

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7. What modification can you suggest in the Hardy Schulze, law?

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8. Why is it essential to wash the precipitate with water before estimating it quantitatively?



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Nuclear Chemistry Ncert Exercise

1. Clearly state, what do you understand by the terms : mass number, nucleons and nuclides?



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2. Describes the properties of radiations which are emitted by radioactive nuclei.



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3. Give one example each of (a) α – emission, (b) β^{c-} – emission, and (c) K – capture. Write an equation for these nuclear changes.



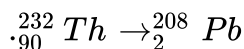
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4. What is group displacement law ? An element belonging to group 1 decay by β^{c-} – emission. To which group of the periodic table the daughter element will belong ?



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5. In the given radioactive disintegration series,



Calculate value of $(n + 2)$.

Where value of n is number of isobars formed in this series, suppose there is successive emission of β – particles.



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6. Write the nuclear reactions for the following radioactive decay:

(a) ${}_{92}\text{U}^{238}$ undergoes α – decay.

(b) ${}_{91}\text{Pa}^{234}$ undergoes $B\eta$ – decay.

(c) ${}_{11}\text{Na}^{22}$ undergoes $B\eta^{+}$ decay.



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7. How are radioactive decay series distinguished ? Name the decay series which is not natural but artificial.



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8. Calculate the binding energy per nucleon of Li isotope, which has the isotopic mass of 7.016amu . The individual masses of neutron and proton are 1.008665amu and 1.007277amu , respectively and the mass of electron = 0.000548amu .



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9. The atomic mass of ^{16}O is 15.995 amu while the individual masses of proton and neutron are 1.0073 amu and 1.0087 amu respectively. The mass of electron is 0.000548 amu. Calculate the binding energy of the oxygen nucleus.



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10. The isotopic composition of rubidium is $\text{Rb}^{85}:73\%$ and $\text{Rb}^{87}:28\%$. Rb^{87} is weakly radioactive and decays by β^- emission with a decay constant of 1.1×10^{-11} per year. A sample of the mineral pollucite was found to contain 450g Rb and 0.72mg of Sr^{87} . Estimate the age of mineral pollucite.



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11. The isotopic masses of $^1_1\text{H}^2$ and ^4_2He are 2.0141 and 4.0026 amu, respectively. Calculate the quantity of energy liberated when two moles of

${}_1^2\text{H}$ undergo fusion to form 1 mol of ${}_2^4\text{He}$. The velocity of light in vacuum is $3.0 \times 10^8 \text{ m s}^{-1}$.



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12. The radioactive isotope ${}_{27}^{60}\text{Co}$ which has now replaced radium in the treatment of cancer can be made by $\alpha(n, p)$ or (n, γ) reaction. For each reaction, indicate the appropriate target nucleus. If the half life of ${}_{27}^{60}\text{Co}$ is 7 year evaluate the decay constant in s^{-1} .



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13. A piece of wood from an archaeological source shows a ${}^{14}\text{C}$ activity which is 60 % of the activity found in fresh wood today. Calculate the age of the archaeological sample. ($t_{1/2}$ for ${}^{14}\text{C} = 5570$ year)



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14. What is a nuclear fission reaction ?



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15. What is meant by a fissionable isotope? How are such isotopes produced artificially ? Give one example.



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16. In the neutron – induced fission reaction of ${}_{92}\text{U}^{235}$ one of the products is ${}_{37}\text{Rb}^{95}$, in this mode, another nuclide and three neutrons are also produced. Identify the nuclide.



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17. Explain the principle of : Itbr. *a.* Activation analysis

b. Breeder reactor

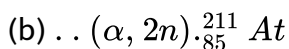
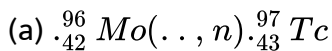
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18. Describe the chief applications of radioisotopes in :

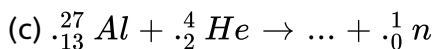
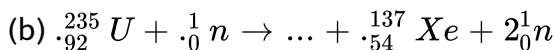
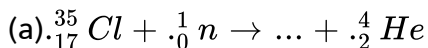
- a. The study of reaction mechanism
- b. Medicines

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19. Complete the following nuclear changes.

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20. Complete the equations for the following nuclear processes:



(d) $\dots(n, p) \cdot {}_{16}^{35}S$

(e) $\cdot {}_{94}^{239}Pu(\alpha, \beta^-)\dots$



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21. Calculate the mass of $\cdot {}^{140}La$ in a sample whose activity is $3.7 \times 10^{10} Bq$ (1 Becquerel, $Bq = 1$ disintegration per second) given that is $t_{1/2}$ is 40 hour.



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22. Calculate the binding energy per nucleon for C^{12} Masses of proton and neutron are 1.0078 and 1.0087, respectively.

$(m_u = 931 MeV)$



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23. The β^- activity of a sample of CO_2 prepared from a contemporary wood gave a count rate of 25.5 counts per minute (cpm) . The same mass of conditions. If the half life of ^{14}C is 5770 years, then the age of the statue is close to [Take $\log_1 \left(\frac{255}{205} \right) \approx 0.095$]



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24. How is C^{14} produced in nature and what happens to it subsequently? Give equations for these processes.



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25. What do you understand by tracers ? Give an example of a tracer that can be used in determining the mechanism of a chemical reaction.



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26. What are synthetic elements ? Mention two synthetic elements and write the nuclear equations leading to their synthesis.



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27. What is meant by thermonuclear reactions and why are they so called ? Why are these reactions not useful for peaceful purposes ?



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28. Describe the principle of an atom bomb. What is the critical mass of ${}_{92}^{235}\text{U}$?



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29. What is the effect of temperature and pressure on the rate of radioactive disintegration ?



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