The Solid State

Question1

A cubic solid is made up of two elements X and Y. Atoms of X are present on every alternate corner and one at the center of cube. Y is at $\frac{1}{3^{rd}}$ of the total faces. The empirical formula of the compound is

[25-Jan-2023 Shift 1]

Options:

A. $X_2Y_{1.5}$

B. X _{2.5}Y

C. XY_{2.5}

D. X $_{1.5}$ Y $_2$

Answer: B

Solution:

```
X_{4 \times \frac{1}{8} + 1 \times 1} Y_{6 \times \frac{1}{3} \times \frac{1}{2}}
\Rightarrow X_{\frac{1}{2} + 1} Y_{1}
\Rightarrow X_{\frac{2}{3}} Y_{1}
\Rightarrow X_{1.5} Y_{1}
\Rightarrow X_{3} Y_{2}
```

Question2

A metal M forms hexagonal close-packed structure. The total number of voids in 0.02 mol of it is ______× 10^{21} (Nearest integer) (. Given N_A = 6.02×10^{23}) [29-Jan-2023 Shift 2]

Answer: 36

```
One unit cell of hep contains = 18 voids
No. of voids in 0.02 mol of hep
= \frac{18}{6} \times 6.02 \times 10^{23} \times 0.02
\approx 3.6 \times 10^{22}
\approx 36 \times 10^{21}
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Iron oxide FeO, crystallises in a cubic lattice with a unit cell edge length of 5.0Å. If density of the FeO in the crystal is 4.0gcm^{-3} , then the number of FeO units present per unit cell is ______ (Nearest integer) Given : Molar mass of Fe and O is 56 and 16g mol⁻¹ respectively. $N_A = 6.0 \times 10^{23} \text{mol}^{-1}$ [30-Jan-2023 Shift 2]

Answer: 4

Solution:

 $d = \frac{Z \times M}{N_0 \times a^3}$ $4 = \frac{Z \times 72}{6 \times 10^{23} \times 125 \times 10^{-24}}$ $Z = 4.166 \approx 4$

Question4

A sample of a metal oxide has formula $M_{0.83}O_{1.00}$. The metal M can exist in two oxidation states +2 and +3. In the sample of $M_{0.83}O_{1.00}$, the percentage of metal ions existing in +2 oxidation state is _____ % (nearest integer) [31-Jan-2023 Shift 2]

Answer: 59

Solution:

 $M \rightarrow +x(0.83 - x)$ 2x + 3(0.83 - x) = 2

```
  x = 0.49 
 %M<sup>2+</sup> = \frac{0.49}{0.83} \times 100 
 = 59\%
```

Which of the following represents the lattice structure of $A_{0.95}O$ containing A^{2+} , A^{3+} and O^{2-} ions? $\odot A^{2+} \odot A^{3+} \odot O^{2-}$



[1-Feb-2023 Shift 1]

Options:

- A. B and C only
- B. B only
- C. A and B only
- D. A only
- Answer: D

Solution:

Applying electrical neutrality principle in metal defficiency defect.

A metal M crystallizes into two lattices :- face centred cubic (fcc) and body centred cubic (bcc) with unit cell edge length of 2.0 and 2.5Å respectively. The ratio of densities of lattices fcc to bcc for the metal M is .

(Nearest integer) [1-Feb-2023 Shift 2]

Answer: 4

Solution:

$$d = \frac{Z \times M}{N_A a^3}$$
$$\frac{d_{FCC}}{d_{BCC}} = \frac{\frac{4 \times M_w}{N_A \times (2)^3}}{\frac{2 \times M_w}{N_A \times (2.5)^3}} = 3.90$$

Question7

A compound is formed by two elements X and Y. The element Y forms cubic close packed arrangement and those of element X occupy one third of the tetrahedral voids. What is the formula of the compound? [6-Apr-2023 shift 1]

Options:

A. X_2Y_3

B. X₃Y

C. X₃Y₂

D. X ₃

Answer: A

Solution:

Solution: $Y : CCP \Rightarrow 4Y$ X = 1 / 3 THV = 1 / 3 × 8 ⇒ 8 / 3x ∴ Formula : $X_{8/3}Y_4$ or X_2Y_3

Question8

Number of crystal systems from the following where body centred unit cell can be found, is..... Cubic, tetragonal, orthorhombic, hexagonal, rhombohedral, monoclinic, triclinic. [6-Apr-2023 shift 2]

Answer: 3

Solution:

Solution: Cubic, tetragonal and orthorhombic have body centered unit cell.

Question9

The correct relationships between unit cell edge length ' a ' and radius of sphere ' r ' for face-centred and bodycentred cubic structures respectively are: [10-Apr-2023 shift 2]

Options:

- A. $2\sqrt{2}r = a$ and $\sqrt{3}r = 4a$
- B. $r = 2\sqrt{2}a$ and $4r = \sqrt{3}a$
- C. $r = 2\sqrt{2}a$ and $\sqrt{3}r = 4a$
- D. $2\sqrt{2}r = a$ and $4r = \sqrt{3}a$

Answer: D

FCC BCC

$$\sqrt{2}a = 4r \sqrt{3}a = 4r$$

 $a = \frac{4r}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$
 $a = 2\sqrt{2}r$

An atomic substance A of molar mass 12gmol^{-1} has a cubic crystal structure with edge length of 300 pm. The no. of atoms present in one unit cell of A is _____ (Nearest integer) Given the density of A is 3.0gmL^{-1} and $N_A = 6.02 \times 10^{23} \text{mol}^{-1}$ [11-Apr-2023 shift 1]

Answer: 4

Solution:

 $d = \frac{\frac{Z}{N_A} \times M}{a^3}$ $3 = \frac{Z}{6.02 \times 10^{23}} \times \frac{12}{(300 \times 10^{-10})^3}$ $Z = \frac{3 \times 6.02 \times 27 \times 10^6 \times 10^{-30} \times 10^{23}}{12}$ $= 40.635 \times 10^{-1} = 4.0635 \approx 4$

Question11

Sodium metal crystallizes in a body centred cubic lattice with unit cell edge length of 4Å. The radius of sodium atom is _____ $\times 10^{-1}$ Å (Nearest integer) [13-Apr-2023 shift 2]

Answer: 17

Solution:

 $\sqrt{3}a = 4r$ $\sqrt{3} \times 4 = 4r$ $r = 1.732\text{\AA}$ $= 17.32 \times 10^{-1}$

Question12

Which of the following expressions is correct in case of a CaCl unit cell (edge length 'a')?

[15-Apr-2023 shift 1]

Options:

A. $r_{Cs^{+}} + r_{Cl^{-}} = \frac{a}{\sqrt{2}}$ B. $r_{Cs^{+}} + r_{Cl^{-}} = a$ C. $r_{Cs^{+}} + r_{Cl^{-}} = \frac{\sqrt{3}}{2}a$ D. $r_{Cs^{+}} + r_{Cl^{-}} = \frac{a}{2}$

Answer: C

Solution:

 $\begin{array}{l} \textbf{Solution:} \\ \text{For CaCl, Cs}^{\oplus} \text{ is present at Body center and} \\ \text{Cl}^{\Theta} \text{ at all corner. } \frac{\sqrt{3a}}{2} = r_{cs^{\oplus}} + r_{Cl^{\Theta}} \end{array}$

Question13

Atoms of element X form hcp lattice and those of element Y occupy $\frac{2}{3}$ of its tetrahedral voids. The percentage of element X in the lattice is_____ (Nearest integer) [24-Jun-2022-Shift-1]

Answer: 43

Solution:

Solution: Since X occupies hop lattice, Number of particles of type X in a unit cell = 6 Number of particles of type Y = $\frac{2}{3} \times 12 = 8$ \therefore Percentage of element X = $\frac{6}{14} \times 100$ = $\frac{300}{7}$ = 42.85 $\approx 43\%$

Question14

The distance between Na⁺and Cl⁻ions in solid NaCl of density 43.1gcm⁻³ is _____×10⁻¹⁰m. (Nearest Integer)

(Given : $N_A = 6.02 \times 10^{23} \text{mol}^{-1}$) [25-Jun-2022-Shift-1]

Answer: 1

Solution:

 $\rho = \frac{Z \times M}{a^3 \times N_A}$ $43.1 = \frac{4 \times 58.5}{a^3 \times 6.02 \times 10^{23}}$ $a^3 = 0.9 \times 10^{-23}$ $= 9 \times 10^{-24}$ $a = 2.08 \times 10^{-8} \text{ cm}$ $= 2.08 \times 10^{-10} \text{ m}$ for NaCl, distance between Na⁺and Cl⁻ = $\frac{a}{2}$ $= 1.04 \times 10^{-10} \text{ m}$

Question15

In a solid AB, A atoms are in ccp arrangement and B atoms occupy all the octahedral sites. If two atoms from the opposite faces are removed, then the resultant stoichiometry of the compound is $A_x B_y$. The value of x

is _____[nearest integer] [26-Jun-2022-Shift-2]

Answer: 3

Solution:

$$\begin{split} A &\rightarrow 4 - \left(2 \times \frac{1}{2}\right) = 3\\ B &\rightarrow 12 \times \frac{1}{4} + 1 \times 1 = 4\\ \text{So, Compound is } A_3 B_4\\ \text{The value of x is 3} \,. \end{split}$$

Question16

Metal deficiency defect is shown by $Fe_{0.93}O$. In the crystal, some Fe^{2+} cations are missing and loss of positive charge is compensated by the

presence of Fe³⁺ ions. The percentage of Fe²⁺ ions in the Fe_{0.93}O crystals is ___(Nearest integer) [27-Jun-2022-Shift-1]

Answer: 85

Solution:

```
Fe<sub>0.93</sub>O
Let the number of O<sup>-2</sup> ions be 100 and the number of Fe<sup>+2</sup> ions be X The number of Fe<sup>+3</sup> ions be (93 − X)
\thereforeX (2) + (93 − X )3 = 200
279 − X = 200
X = 79
\therefore % of F<sup>+2</sup> ions = \frac{79}{93} × 100
\approx85%
```

Question17

Two elements A and B which form 0.15 moles of A_2B and AB_3 type compounds. If both A_2B and AB_3 weigh equally, then the atomic weight of A is ______ times of atomic weight of B. [27-Jun-2022-Shift-1]

Answer: 2

Solution:

```
Let atomic weight of A = x
and atomic weight of B = y
\therefore Molar mass of A_2B = 2x + y
and molar mass of AB_3 = x + 3y
Now, weight of 0.15 moles of A_2B = (2x + y)0.15
and weight of 0.15 moles of AB_3 = (x + 3y)0.15
Given, weight of 0.15 moles of A_2B and AB_3 are equal.
\therefore (2x + y)0.15 = (x + 3y)0.15
\Rightarrow x = 2y
\Rightarrow \frac{x}{y} = 2
\therefore Atomic weight of A is 2 times of atomic weight of B.
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Question18

The incorrect statement about the imperfections in solids is : [28-Jun-2022-Shift-1]

Options:

A. Schottky defect decreases the density of the substance.

B. Interstitial defect increases the density of the substance.

C. Frenkel defect does not alter the density of the substance.

D. Vacancy defect increases the density of the substance.

Answer: D

Solution:

Solution:

The vacancy defect increases the density of substance. It does not change the density of the crystal. It only creates cationic vacancies. Frenkel Defect causes vacancy defect at its original site and an interstitial defect at its new location. Therefore, it does not change the density of the solid.

Question19

An element M crystallises in a body centred cubic unit cell with a cell edge of 300 pm. The density of the element is 6.0gcm^{-3} . The number of atoms present in 180g of the element is _____ × 10²³ (Nearest integer) [28-Jul-2022-Shift-1]

Answer: 22

Solution:

M is body certred cubic, $\therefore Z = 2$ Let mass of 1 atom of M is A Edge length = 300 pm Density = 6g / cm³ $\therefore 6g / cm^3 = \frac{Z \times A}{(300 \times 10^{-10})^3} = \frac{2 \times A}{27 \times 10^{-24}}$ A = 81 × 10⁻²⁴g \therefore Atomic mass = 48.6g \therefore Mole in 180g = $\frac{180}{48.6} = 3.7$ moles Atoms of M = 3.7 × 6 × 10²³ = 22.22 × 10²³ atoms

Question20

Metal M crystallizes into a fcc lattice with the edge length of

 4.0×10^{-8} cm. The atomic mass of the metal is g/ mol. (Nearest integer) (Use : N_A = 6.02×10^{23} mol⁻¹, density of metal, M = 9.03gcm⁻³) [28-Jul-2022-Shift-2]

Answer: 87

Solution:

Solution: $\rho = \frac{Z M}{N_A a^3} \Rightarrow M = \frac{9.03 \times 6.02 \times 10^{23} \times (4 \times 10^{-8})^3}{4}$ $= \frac{9.03 \times 6.02 \times 64 \times 10^{-1}}{4}$ $= 86.9 \text{gmol}^{-1}$ $\approx 87 \text{gmol}^{-1}$

Question21

Ionic radii of cation A⁺and anion B⁻are 102 and 181 pm respectively. These ions are allowed to crystallize into an ionic solid. This crystal has cubic close packing for B⁻. A⁺is present in all octahedral voids. The edge length of the unit cell of the crystal AB is _____ pm. (Nearest Integer) [29-Jul-2022-Shift-1]

Answer: 566

Solution:

Solution: In cubic close packing, octahedral voids form at edge centers and body center of the cube $a = 2(rA^+ + rB^-)$ a = 2(102 + 181) $a = 566 \, pm$

Question22

Solution:

Solution: Let us assume, the crystal has fcc or ccp lattice which has octahedral voids. Number of lattice sites occupied = 8 corner +6 face centres = 14 Number of octahedral voids = 12 edge centres +1 body centre = 13 Number of octahedral void(s) per lattice site

$$=\frac{13}{14}=0.928\sim \text{eq1}$$

Question23

The unit cell of copper corresponds to a face centered cube of edge length 3.596Å with one copper atom at each lattice point. The calculated density of copper in kg / m^3 is [Molar mass of Cu = 63.54g; [25 Feb 2021 Shift 2]

Answer: 9076

Solution:

Density of copper, d = $\frac{Z \times M}{a^3 \times N_A}$ Given, Z = 4, for fcc lattice, M = 63.54gmol⁻¹ = 63.54 × 10⁻³kgmol⁻¹ a = 3.596Å = 3.596 × 10⁻¹⁰m, N_A = 6.022 × 10²³mol⁻¹ M = 63.54gmol⁻¹ = 63.54 × 10⁻³kgmol⁻¹, a = 3.596Å = 3.596 × 10⁻¹⁰m, N_A = 6.022 × 10²³mol⁻¹ On putting given values, we get \Rightarrow d = $\frac{4 \times (63.54 \times 10^{-3})}{(3.596 \times 10^{-10})^3 \times (6.022 \times 10^{23})}$ kg / m³ = 9076.26 ~ eq9076kg / m³

Question24

The coordination number of an atom in a body centered cubic structure is ____[Assume that the lattice is made up of atoms.] [24 Feb 2021 Shift 1]

Answer: 8

Solution:

Solution:

Coordination number is the number of nearest neighbours of a central atom in the structure. BCC has a coordination number of 8.

Question25

In a binary compound, atoms of element A form a hcp structure and those of element M occupy 2/3 of the tetrahedral voids of the hcp structure. The formula of the binary compound is [18 Mar 2021 Shift 1]

Options:

A. M $_2A_3$

B. M_4A_3

 $C. M_4A$

D. MA₃

Answer: B

Solution:

For HCP unit cell, Number of atom per unit cell Z = 6, so A = 6 Also we know If Z = 6, so the number of tetrahedral voids = 2×6 Now, if 2/3 of these voids are occupied by M the number of M = $\frac{2}{3} \times 2 \times 6 = 8$ \therefore Formula = M₈A₆ = M₄A₃

Question26

K Br is doped with 10^{-5} mole per cent of SrBr 2 . The number of cationic vacancies in 1g of KBr crystal is10 10^{14} (Round off to the nearest integer). [Atomic mass : K = 39.1u, Br = 79.9u, N_A = 6.023×10^{23}] [17 Mar 2021 Shift 2]

Solution:

Solution:

The number of cationic vacancies in 1g of K Br crystal is 5×10^{14} . For every Sr^{2+} ion, 1 cationic vacancy is created. Hence, number of Sr^{2+} ion = number of cationic vacancies Since, the mole percentage of $SrBr_2$ dopped is 10^{-5} to that of total moles of K Br.

Hence, number of cationic vacancy = $\frac{10^{-5}}{100} \times \frac{1}{119} \times N_A$ = $\frac{1}{119} \times 10^{-7} \times 6.022 \times 10^{23}$ (Mass of KBr = 119) = $5 \times 10^{-2} \times 10^{-7} \times 10^{23} = 5 \times 10^{14}$

Question27

Ga (atomic mass 70u) crystallises in a hexagonal close packed structure. The total number of voids in 0.581g of Ga is $\times 10^{21}$. (Round off to the nearest integer). [16 Mar 2021 Shift 2]

Answer: 15

Solution:

For HCP structure, Effective number of atoms per unit cell (Z) = 6 Number of tetrahedral void = 2Z = 12 Number of octahedral void = Z = 6 Total number of voids per unit cell = 18 Moles of Ga = $\frac{\text{Given mass}}{\text{Molar mass}} = \frac{0.581}{70}$ No. of atoms = $\frac{0.581}{70} \times \text{N}_{\text{A}}$ No. of unit cells = $\frac{0.581}{70} \times \frac{\text{N}_{\text{A}}}{6}$ No. of voids = $\left(\frac{0.581}{70} \times \frac{6.02 \times 10^{23}}{6}\right) \times 18 = 14.99 \times 10^{21}$. Nearest integer = 15×10^{21} So, correct answer is 15.

Question28

Select the correct statements.

(A) Crystalline solids have long range order.

- (B) Crystalline solids are isotropic.
- (C) Amorphous solid are sometimes called pseudo solids.

(D) Amorphous solids soften over a range of temperatures. (E) Amorphous solids have a definite heat of fusion. Choose the most appropriate answer from the options given below. [27 Jul 2021 Shift 2]

Options:

A. (A), (B), (E) only

B. (B), (D) only

C. (C), (D) only

D. (A), (C), (D) only

Answer: D

Solution:

Solution:

(A) Crystalline solids have definite arrangement of constituent particles and have long range order.(C), (D) Different constituent particles of an amorphous solid have different bond strengths and soften over a range of temperatures.

Question29

The parameters of the unit cell of a substance are a = 2.5, b = 3.0, c = 4.0, α = 90°, β = 120° γ = 90°. The crystal system of the substance is : [27 Jul 2021 Shift 1]

Options:

A. Hexagonal

B. Orthorhombic

C. Monoclinic

D. Triclinic

Answer: C

Solution:

 $a \neq b \neq c$ and $\alpha = \gamma = 90^{\circ} \neq \beta$ are parameters of monoclinic unit cell.

Question30

A copper complex crystallising in a CCP lattice with a cell edge of 0.4518nm has been revealed by employing X-ray diffraction studies. The

density of a copper complex is found to be 7.62gcm^{-3} . The molar mass of copper complex is _____ gmol ⁻¹ (Nearest integer) [Given :N_A = $6.022 \times 10^{23} \text{mol}^{-1}$] [22 Jul 2021 Shift 2]

Answer: 106

Solution:

$$d\left(\frac{gm}{cc}\right) = \frac{4 \times \frac{M}{N_{A}}}{(acm)^{3}}$$

7.62 = $\frac{4 \times M / 6.022 \times 10^{23}}{(0.4518 \times 10^{-7} cm)^{3}} \Rightarrow M = 105.8g / mol$

Question31

Diamond has a three dimensional structure of C atoms formed by covalent bonds. The structure of diamond has face centred cubic lattice where 50% of the tetrahedral voids are also occupied by carbon atoms. The number of carbon atoms present per unit cell of diamond is _____. [20 Jul 2021 Shift 2]

Answer: 8

Solution:

Solution:

Carbon atoms occupy FCC lattice points as well as half of the tetrahedral voids therefore number of carbon atoms atoms per unit cell = 8

Question32

The empirical formula for a compound with a cubic close packed arrangement of anions and with cations occupying all the octahedral sites in A_xB . The value of x is (Integer answer)

[31 Aug 2021 Shift 2]

Answer: 1

Solution:

```
ln A_x B
Effective number of B atom = 4 (in ccp)

Effective number of A atom = 4 (octahedral void)

So, formula of compound = A_4 B_4

\Rightarrow AB

\therefore x = 1
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Question33

Match List-I with List-II.

List-I	List-II
(Property)	(Example)
A.Diamagnetism	1. MnO
B.Ferrimagnetism	2.0 ₂
C. Paramagnetism	3. NaCl
D. Antiferromagnetism	4.Fe ₃ O ₄

Choose the most appropriate answer from the options given below. [27 Aug 2021 Shift 1]

Options:

A. A-2 B-1 C-3 D-4

B. A-1 B-3 C-4 D-2

C. A-3 B-4 C-2 D-1

D. A-4 B-2 C-1 D-3

Answer: C

Solution:

Solution:

A. NaCl is diamagnetic because all electrons are paired in Na^+ and in Cl^- . So, it shows diamagnetism.

B. Fe_3O_4 is ferrimagnetic because of the presence of the unequal alignment of magnetic moment in opposite direction.

C. O_2 molecule has two unpaired electrons. So, it is paramagnetic.

D. In MnO, the orientation of the electrons of Mn and O is such that they cancel their effects, hence it is antiferromagnetic.

So, the correct match is A-3, B-4, C-2, D-1.

Question34

Given below are two statements.

Statement I Frenkel defects are vacancy as well as interstitial defects. Statement II Frenkel defect leads to colour in ionic solids due to presence of F - centres. Choose the most appropriate answer for the statements from the options given below. [26 Aug 2021 Shift 1]

Options:

A. Statement I is false but Statement II is true.

- B. Both statement I and statement II are true.
- C. Statement I is true but statement II is false.
- D. Both Statement I and statement II are false.

Answer: C

Solution:

Solution:

Frenkel defect is vacancy as well as interstitial defect as atom leaves its place in lattice creating a vacancy and occupy interstitial site in a nearby location.

Hence, statement I is true.

Frenkel defect does not leads to colour in ionic solids due to absence of F - centres. Ionic solids having anionic vacancies because of metal excess defects. This leads to colour in ionic solids due to presence of F - centres. Hence, statement II is false.

Question35

'X' melts at low temperature and is a bad conductor of electricity in both liquid and solid state. X is: [Jan. 09,2020 (I)]

Options:

- A. Zinc sulphide
- B. Mercury
- C. Silicon carbide
- D. Carbon tetrachloride

Answer: D

Solution:

Solution:

 $CCl_4 \rightarrow$ Non-conductor in solid and liquid phase. Melting point of CCl_4 is $-23^{\circ}C$. It does not conduct electricity in both solid and liquid state.

Which of the following compounds is likely to show both Frenkel and Schottky defects in its crystalline form? [Jan. 08,2020 (II)]

Options:

- A. AgBr
- B. CsCl
- C. K Br
- D. Z nS
- Answer: A

Solution:

Solution:

AgBr shows both Schottkyas well as Frenkel defects.

Question37

A crystal is made up of metal ions ' $M_1^{'}$ and ° $M_2^{'}$ and oxide ions. Oxide ions. form a ccp lattice structure. The cation 'M ' occpies 50% of octahedral voids and the cation 'M, ' occupies 12.5% of tetrahedral voids of oxide lattice. The oxidation numbers of ' M_1 ' and ' M_2 ' are,

respectively: [Sep. 06, 2020 (II)]

Options:

- A. +2, +4
- B. +1, +3
- C. +3, +1
- D. +4, +2
- Answer: A

Solution:

```
\begin{array}{cccc} \mathbf{M_1} & \mathbf{M_2} & \mathbf{O} \\ 50\% & 12.5\% & ccp \\ \text{octahedral void} & \text{tetrahedral void} \\ \\ \hline \frac{50}{100} \times 4 & \frac{12.5}{100} \times 8 & 4 \\ 2 & 1 & 4 \\ 2x & 1y & 4 \times 2 \\ \\ \begin{array}{c} \text{Charge} \\ \text{So, } 2x + y = 8 \\ x = 2; y = 4 \end{array}
```

Question38

A diatomic molecule X $_2$ has a body-centred cubic (bcc) structure with a cell edge of 300pm. The density of the molecule is 6.17gcm^{-3} . The number of molecules present in 200g of X $_2$ is:

(Avogadro constant(N $_{\rm A}$) = 6 × 10²³mol⁻¹) [Sep. 05, 2020 (I)]

Options:

A. 40N _A

B. 8N_A

C. $4N_A$

D. $2N_A$

Answer: C

Solution:

For bcc, Z = 2 $d = \frac{Z \times M}{N_A \times (a)^3}$ $\Rightarrow 6.17 = \frac{2 \times M}{6.0 \times 10^{23} \times [3 \times 10^{-8}]^3}$ $\Rightarrow 6.17 = \frac{2 \times M}{6.0 \times 2.7} \Rightarrow M = 50$ No. of mole = $\frac{200}{50} = 4$ No. of molecules = $4N_A$.

Question39

An element crystallises in a face-centred cubic (f cc) unit cell with cell edge a. The distance between the centres of two nearest octahedral voids in the crystal lattice is : [Sep. 05, 2020 (II)]

Options:

A. $\frac{a}{\sqrt{2}}$

B. a

C. √2a

D. $\frac{a}{2}$

Answer: A

Solution:



Distance between two octahedral voids

 $\mathbf{x} = \sqrt{\left(\frac{\mathbf{a}}{2}\right)^2 + \left(\frac{\mathbf{a}}{2}\right)^2} = \sqrt{\frac{\mathbf{a}^2}{4} + \frac{\mathbf{a}^2}{4}} = \frac{\mathbf{a}}{\sqrt{2}}$

Question40

An element with molar mass 2.7×10^{-2} kgmol⁻¹ forms a cubic unit cell with edge length 405pm. If its density is 2.7×10^{3} kgm⁻³, the radius of the element is approximately ______ × 10⁻¹²m (to the nearest integer). [NV, Sep. 03, 2020 (I)]

Answer: 143

Solution:

 $d = \frac{Z \times M}{N_A \times \text{ Volume}}$ $2.7 = \frac{Z \times 27}{6.02 \times 10^{23} \times [4.05 \times 10^{-8}]^3}$ $Z = 4 \Rightarrow \text{fcc}$ unit cell For fcc unit cell 4r = $\sqrt{2}$ a r = $\frac{1.414 \times 405}{4}$ = 143.1675pm = 143.17pm

Question41

The one that is extensively used as a piezoelectric material is: [Jan. 9, 2019 (I)]

Options:

A. tridymite

B. amorphous silica

C. quartz

D. mica

Answer: C

Solution:

Solution: Quartz exhibits piezoelectricity and thus can be used as a piezoelectric material.

Question42

Which primitive unit cell has unequal edge lengths (a \neq b \neq c) and all axial angles different from 90°? [Jan. 10, 2019 (I)]

Options:

A. Triclinic

B. Hexagonal

C. Monoclinic

D. Tetragonal

Answer: A

Solution:

For triclinic crystal $a \neq b \neq c$ Edge lengths $\alpha \neq \beta \neq \gamma$ Axial angle

Question43

A solid having density of 9×10^3 kgm³ forms face centred cubic crystals of edge length $200\sqrt{2}$ pm. What is the molar mass of the solid? [Avogadro constant $\approx 6 \times 10^{23}$ mol⁻¹, $\pi \approx 3$] [Jan. 11, 2019 (I)]

Options:

- A. 0.0432kgmol⁻¹
- B. 0.0216kgmol⁻¹
- C. 0.0305kgmol⁻¹
- D. 0.4320kgmol⁻¹

Answer: C

Solution:

Density = $\frac{Z \times M}{N_A \times a^3}$ $9 \times 10^3 = \frac{4 \times M}{(200 \times \sqrt{2} \times 10^{-12})^3 6 \times 10^{23}}$ M = 305.4 × 10⁻⁴ = 0.0305kg / mol

Question44

The radius of the largest sphere which fits properly at the centre of the edge of a body centred cubic unit cell is : (Edge length is represented by 'a') [Jan. 11, 2019 (II)]

Options:

A. 0.027a

B. 0.047a

C. 0.134a

D. 0.067a

Answer: D

Solution:

For bcc

$$\Rightarrow R = \frac{\sqrt{3}a}{4}$$

Empty space at edge = $a - 2R = a - \frac{\sqrt{3} a}{2}$

= diameter of sphere.

$$\therefore r_{\text{sphere}} = \frac{a - \frac{\sqrt{3}}{2}a}{2} = \left(\frac{2 - \sqrt{3}}{4}\right)a = 0.067a$$

Question45

A compound of formula A_2B_3 has the hcp lattice. Which atom forms the hcp lattice and what fraction of tetrahedral voids is occupied by the other atoms: [Jan. 10, 2019 (II)]

Options:

A. hep lattice -A, $\frac{2}{3}$ Tetrahedral voids -B

B. hep lattice -A, $\frac{1}{3}$ Tetrahedral voids -B

C. hcp lattice -B, $\frac{2}{3}$ Tetrahedral voids -A

D. hcp lattice -B, $\frac{1}{3}$ Tetrahedral voids -A

Answer: D

Solution:

Solution:

Here, A_2B_3 can also be written as A_4B_6 . Thus, hep has six atoms so, 'B' forms hcp lattice and 'A' is present in tetrahedral void. Total tetrahedral voids = 12 \therefore Fraction of tetrahedral voids occupied by A = 4 / 12 = $\frac{1}{3}$

Question46

At 100°C, copper (Cu) has FCC unit cell structure with cell edge length of xÅ. What is the approximate density of Cu (in gcm³) at this temperature?

[Atomic Mass of Cu = 63.55u] [Jan. 9, 2019 (II)]

Options:

A. $\frac{205}{x^3}$ B. $\frac{105}{x^3}$ C. $\frac{211}{x^3}$

D. $\frac{422}{x^3}$

Answer: D

```
We know that, density = \frac{Z(M)}{N_A \times a^3}

Given that: Z = 4(f cc)

M = 63.5g

N_A = 6\infty10<sup>23</sup>

a = x\infty10<sup>8</sup>cm

After putting the values, we get

d = \frac{4 \times 63.5}{6.022 \times 10^{23} \times x^3 \times 10^{-24}}

= \frac{422 \text{gcm}^{-3}}{x^3}
```

Question47

The ratio of number of atoms present in a simple cubic, body centered cubic and face centered cubic structure are, respectively: [April 12, 2019 (II)]

Options:

A. 8 : 1 : 6

B. 1 : 2 : 4

C. 4 : 2 : 1

D. 4 : 2 : 3

Answer: B

Solution:

Unit cell	No. of atoms
Simple cubic	$\frac{1}{8} \times 8 = 1$
bcc	$\frac{1}{8} \times 8 + 1 \times 1 = 2$
fcc	$\frac{1}{8} \times 8 + \frac{1}{2} \times 6 = 4$

Question48

An element has a face-centred cubic (fcc) structure with a cell edge of a. The distance between the centres of two nearest tetrahedral voids in the lattice is : [April 12, 2019 (I)]

Options:

B. a

- C. $\frac{a}{2}$ D. $\frac{3}{2}a$
- -Answer: C

Solution:

Solution:

In f cc, tetrahedral voids are located on the body diagonal at a distance of $\frac{\sqrt{3}a}{4}$ from the corner. Together they form a smaller cube of edge length $\frac{a}{2}$. Therefore, distance between centres of two nearest tetrahedral voids in the lattice is also $\frac{a}{2}$.

Question49

Element 'B' forms cep structure and 'A' occupies half of the octahedral voids, while oxygen atoms occupy all the tetrahedral voids. The structure of bimetallic oxide is: [April 8,2019 (I)]

Options:

A. A_2BO_4

B. AB_2O_4

 $\mathsf{C.}~\mathsf{A}_2\mathsf{B}_2\mathsf{O}$

D. A_4B_2O

Answer: B

Solution:

No. of lattice points = No. of Oh voids = $\frac{1}{2} \times$ No. of T d voids in ccp structure \therefore No. of atoms of B = 4 No. of atoms of A = $\frac{1}{2} \times$ No. of Oh voids = $\frac{1}{2} \times 4 = 2$ No. of atoms of O = No. of all Td voids = $2 \times$ No. of lattice points = $2 \times 4 = 8$ Hence, A : B : O = 1 : 2 : 4 Therefore, the formula of the compound is AB₂O₄

Consider the bec unit cells of the solids 1 and 2 with the position of atoms are shown below. The radius of atom B is twice that of atom A. The unit cell edge length is 50% more in solid 2 than in 1. What is the approximate packing efficiency in solid 2?



[April 8, 2019 (II)]

Options:

- A. 45%
- B. 75%
- C. 90%
- D. 65%

Answer: C

Solution:

Volume occupied by atoms in solid 2 $= \frac{4}{3}\pi r^{3} + \frac{4}{3}\pi (2r)^{3} = 12\pi r^{3}$ Relationship between body diagonal and radius of atom (r), $6r = \sqrt{3}a$ $a = \frac{6r}{\sqrt{3}}$ Packing efficiency $= \frac{\text{vol. of particles}}{\text{vol. of unit cells}}$ Packing efficiency $= \frac{12\pi r^{3}}{\left(\frac{6r}{\sqrt{3}}\right)^{3}} \times 100 = 90\%$

Question51

All of the following share the same crystal structure except. [Online April 15, 2018 (II)]

Options:

- A. RbCl
- B. N aCl
- C. CsCl
- D. LiCl

Solution:

Solution:

RbCl, N aCl and CsCl share the same crystal structure except LiCl. LiCl is deliquescent. It crystalises as a hydrated LiCl.2H $_2O$. Other alkali metal chlorides do not form hydrates.

Question52

Which type of 'defect' has the presence of cations in the interstitial sites? [2018]

Options:

A. Schottky defect

B. Vacancy defect

C. Frenkel defect

D. Metal deficiency defect

Answer: C

Solution:

Solution:

In Frenkel defect some of ions (usually cations due to their small size) missing from their normal position, occupy position in interstitial sites.

Question53

Which of the following arrangements shows the schematic alignment of magnetic moments of antiferromagnetic substance? [Online April 15,2018(I)]

Options:

A.

0

Β.

000000

C.

000000



Answer: D

D.

Solution:

Solution:

When the magnetic moments align in a regular pattern with neighbouring spins pointing in opposite directions (as in d), the substance shows antiferromagnetism.

Question54

A metal crystallises in a face centred cubic structure. If the edge length of its unit cell is 'a', the closest approach between two atoms in metallic crystal will be: [2017]

Options:

- A. 2a
- B. 2√2a
- C. $\sqrt{2}a$

D. $\frac{a}{\sqrt{2}}$

Answer: D

Solution:

For a f cc unit cell r = $\frac{\sqrt{2}a}{4}$

 \therefore closest distance (2r) = $\frac{\sqrt{2}a}{4} = \frac{a}{\sqrt{2}}$

Question55

Sodium metal crystallizes in a body centred cubic lattice with a unit cell edge of 4.29Å. The radius of sodium atom is approximately: [2015]

Options:

A. 5.72Å

B. 0.93Å

C. 1.86Å

D. 3.22Å

Answer: C

Solution:

In bcc the atoms touch along body diagonal $\therefore 2r + 2r = \sqrt{3}a$ $\therefore r = \frac{\sqrt{3}a}{4} = \frac{\sqrt{3} \times 4.29}{4} = 1.857\text{\AA}$

Question56

In a monoclinic unit cell, the relation of sides and angles are respectively: [Online April 12, 2014]

Options:

A. $a = b \neq c$ and $\alpha = \beta = \gamma = 90^{\circ}$

B. $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^{\circ}$

C. a \neq b \neq c and $\beta = \gamma = 90^{\circ} \neq \alpha$

D. a \neq b \neq c and $\alpha \neq \beta \neq \gamma \neq 90^{\circ}$

Answer: C

Solution:

Solution:

Question57

CsCl crystallises in body centered cubic lattice. If ' a ' is its edge length then which of the following expressions is correct? [2014]

Options:

A. $r_{Cs^{+}} + r_{Cl^{-}} = 3a$ B. $r_{Cs^{+}} + r_{Cl^{-}} = \frac{3a}{2}$ C. $r_{Cs^{+}} + r_{Cl^{-}} = \frac{\sqrt{3}}{2}a$ D. $r_{Cs^{+}} + r_{Cl^{-}} = \sqrt{3}a$

Answer: C

Solution:

Solution:



Relation between radius of cation, anion and edge length of the cube $2r_{Cs^+} + 2r_{Cl^-} = \sqrt{3}a$ $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}a}{2}$

Question58

The correct statement for the molecule, CsI $_3$ is: [2014]

Options:

A. It is a covalent molecule.

B. It contains Cs^+ and I_3^- ions.

C. It contains Cs^{3+} and I $^-$ ions.

D. It contains Cs⁺, I $^-$ and lattice I $_2$ molecule.

Answer: B

Solution:

```
Solution:
CsI<sub>3</sub> dissociates as CsI<sub>3</sub> \rightarrow Cs<sup>+</sup> + I<sub>3</sub><sup>-</sup>
```

Question59

The appearance of colour in solid alkali meta halides is generally due to: [Online April 11, 2014]

Options:

A. Schottky defect

B. Frenkel defect

C. Interstitial position

D. F-centres

Answer: D

Solution:

Solution:

The appearance of colour in alkali metal halides is generally due to F-centres. F centers in N aCl produce a band of optical absorption towards the blue end of visible spectrum, thus the colour appears yellow under transmitted light. On the otherhand, K Cl with F-centers appears magenta, and KBr appears blue.

Question60

In a face centered cubic lattice atoms A are at the corner points and atoms B at the face centered points. If atom B is missing from one of the face centered points, the formula of the ionic compound is: [Online April 9, 2014]

Options:

A. AB_2

B. A_5B_2

C. A_2B_3

D. A_2B_5

Answer: D

Solution:

Number of atoms, $A = \frac{1}{8} \times 8 = 1$ Number of atoms, $B = \frac{1}{2} \times 5 = \frac{5}{2}$ (Since atom B is missing from one of the face centered point) \therefore Formula of ionic compound $= AB_{5/2} = A_2B_5$

Question61

The total number of octahedral void (s) per atom present in a cubic close packed structure is: [Online April 19,2014]

Options:

A. 2

B. 4

C. 1

Answer: B

Solution:

Solution:

The closed packed structure have both octahedral and tetrahedral voids. In a ccp structure, there is one octahedral void on the edge. Each one of which is common to four other unit cells. Thus, in cubic close packed structure, Octahedral voids in the centre of the cube = 1

Effective number of octahedral voids located at the 12 edge of cube = $12 \times \frac{1}{4} = 3$

 \therefore Total number of octahedral voids = 4

Question62

Which of the following exists as covalent crystals in the solid state ? [2013]

Options:

A. Iodine

B. Silicon

C. Sulphur

D. Phosphorus

Answer: B

Question63

Copper crystallises in fcc with a unit length of 361pm. What is the radius of copper atom? [Online April 25, 2013]

Options:

A. 157pm

B. 128pm

C. 108pm

D. 181pm

Answer: B

```
For f cc,

r = \frac{\sqrt{2}a}{4} = \frac{a}{2\sqrt{2}} = 0.3535a

Given, a = 361pm

r = 0.3535 \times 361

= 128pm
```

An element having an atomic radius of 0.14nm crystallizes in an fcc unit cell. What is the length of a side of the cell? [Online April 9, 2013]

Options:

A. 0.56nm

B. 0.24nm

C. 0.96nm

D. 0.4nm

Answer: D

Solution:

For a f cc unit cell $r = \frac{\sqrt{2}a}{4}$ $a = \frac{4r}{\sqrt{2}} = 2\sqrt{2} \times 0.14 = 0.39 \approx 0.4nm$

Question65

Which one of the following statements about packing in solids is incorrect? [Online April 22, 2013]

Options:

- A. Coordination number in bcc mode of packing is 8 .
- B. Coordination number in hcp mode of packing is 12.
- C. Void space in hcp mode of packing is 32%.
- D. Void space is ccp mode of packing is 26%.

Answer: C

Question66

In a face centred cubic lattice, atoms of A form the corner points and atoms of B form the face centred points. If two atoms of A are missing from the corner points, the formula of the ionic compound is: [Online April 23, 2013]

Options:

A. AB₃

B. AB_4

 $C. A_2B_5$

D. AB_2

Answer: B

Solution:

Solution:

A form corner points and two atoms of A are missing from corner \therefore Atoms at corner (A) = $6 \times \frac{1}{8} = \frac{3}{4}$ Atoms at face centre (B) = $6 \times \frac{1}{2} = 3$ $\therefore A_{3/4}B_3$ i.e., AB_4

Question67

Among the following which is the best description of water in the solid phase? [Online May 7,2012]

Options:

- A. Covalent solid
- B. Molecular solid
- C. Ionic solid
- D. Network solid

Answer: B

Molecular solid is the best description of water in the solid phase. For example ice is hydrogen bonded molecular solid.

Question68

The radius of a calcium ion is 94pm and of the oxide ion is 146pm. The possible crystal structure of calcium oxide will be [Online May 12, 2012]

Options:

A. tetrahedral

B. trigonal

C. octahedral

D. pyramidal

Answer: C

Solution:

Solution: Radius ratio = $\frac{\text{Radius of cation}}{\text{Radius of anion}} = \frac{94}{146} = 0.643$ Since the value is between 0.414 - 0.732 hence the coordination no. will be 6 and geometry will be octahedral.

Question69

Lithium forms body centred cubic structure. The length of the side of its unit cell is 351pm. Atomic radius of the lithium will be: [2012]

Options:

A. 75pm

B. 300pm

C. 240pm

D. 152pm

Answer: D

For bcc structure
$$\sqrt{3}a = 4r$$

r = $\frac{\sqrt{3}}{4}a = \frac{\sqrt{3}}{4} \times 351 = 152$ pm.
Question70

A solid has a 'bcc' structure. If the distance of nearest approach between two atoms is 1.73Å, the edge length of the cell is [Online May 7,2012]

Options:

A. 314.20pm

B. 1.41pm

C. 200pm

D. 216pm

Answer: C

Solution:

For bcc structure d = $\frac{\sqrt{3}a}{2}$ where d = distance between two atoms a = edge length $1.73 = \frac{\sqrt{3}}{2}a$ a = $\frac{2 \times 1.73}{\sqrt{3}} = 2\text{\AA} = 200\text{pm}$

Question71

Ammonium chloride crystallizes in a body centred cubic lattice with edge length of unit cell of 390pm. If the size of chloride ion is 180pm, the size of ammonium ion would be [Online May 19, 2012]

Options:

A. 174pm

B. 158pm

C. 142pm

D. 126pm

Answer: B

Solution:

Solution: For bcc structure Interionic distance $= r^{+} + r^{-} = \frac{\sqrt{3}}{2}a$ (a = edge length) $r_{NH_4^+}^{+} + r_{Cl^-}^{-} = \frac{\sqrt{3}}{2}a$ $r_{NH_4^+}^{+} + 180 = \frac{\sqrt{3}}{2} \times 390$ $r_{NH_4^+}^{+} = 338pm - 180pm = 158pm$

.....

Question72

Among the following the incorrect statement is [Online May 26, 2012]

Options:

- A. Density of crystals remains unaffected due to Frenkel defect.
- B. In bcc unit cell the void space is 32%.
- C. Density of crystals decreases due to Schottky defect.

D. Electrical conductivity of semiconductors and metals increases with increase in temperature.

Answer: D

Solution:

Solution:

In metals the electrons are free to move around like molecules in a gas. Conductivity or current density per unit electric field is decided by how often electrons collide with stationary ions. If temperature is increased the ions vibrate with more amplitude about their mean position and the number of collisions electrons make increase and impeden the flow of electron. So, the conductivity decreases as the temperature is increased. In metals no of electrons and its charge remains same but mobility reduces. In semiconductors a small number of electrons are free to move. If the temperature is increased more electrons free themselves from the parent atom and hence, the conductivity increases as the temperature is increase while the mobility increases little.

Question73

Copper crystallises in f cc lattice with a unit cell edge of 361 pm. The radius of copper atom is: [2011RS]

Options:

- A. 108pm
- B. 128pm
- C. 157pm
- D. 181pm

Answer: B

For f cc lattice $a\sqrt{2} = 4r$ a = 361pm (given) $r = \frac{361 \times \sqrt{2}}{4} = 127.6 \approx 128pm$

Question74

The edge length of a face centered cubic cell of an ionic substance is 508pm. If the radius of the cation is 110pm, the radius of the anion is [2010]

Options:

A. 288pm

B. 398pm

C. 618pm

D. 144pm

Answer: D

Solution:

For an f cc crystal $r_{cation} + r_{anion} = \frac{Edge length}{2}$ $110 + r_{anion} = \frac{508}{2}$ $r_{anion} = 254 - 110 = 144 pm$

Question75

Percentages of free space in cubic close packed structure and in body centered packed structure are respectively [2010]

Options:

A. 30% and 26%

B. 26% and 32%

C. 32% and 48%

D. 48% and 26%

Answer: B

Packing fraction is defined as the ratio of the volume of the unit cell that is occupied by the spheres to the volume of the unit cell. P.F. for ccp and bcc are 0.74 and 0.68 respectively. So, the free space in ccp and bcc are 26%&32% respectively.

Question76

Copper crystallises in f cc with a unit cell length of 361pm. What is the radius of copper atom? [2009]

Options:

A. 127pm

B. 157pm

C. 181pm

D. 108pm

Answer: A

Solution:

For f cc unit cell, $4r = \sqrt{2}a$ r = $\frac{\sqrt{2} \times 361}{4} = 127$ pm

Question77

In a compound, atoms of element Y form ccp lattice and those of element X occupy $2/3^{rd}$ of tetrahedral voids. The formula of the compound will be [2008]

Options:

A. X₄Y₃

B. X₂Y₃

C. X $_2$ Y

D. X₃Y₄

Answer: A

Solution:

From the given data, we have

Number of Y atoms in a unit cell = 4 Number of X atoms in a unit cell = $8 \times \frac{2}{3} = \frac{16}{3}$ From the above we get the formula of the compound as $X_{16/3}Y_4$ or X_4Y_3

Question78

Total volume of atoms present in a face-centred cubic unit cell of a metal is (r is atomic radius) [2006]

Options:

- A. $\frac{12}{3}\pi r^3$
- B. $\frac{16}{3}\pi r^{3}$
- C. $\frac{20}{3}\pi r^{3}$
- D. $\frac{24}{3}\pi r^{3}$

Answer: B

Solution:

The face centered cubic unit cell contains 4 atoms \therefore Total volume of atoms $= 4 \times \frac{4}{3} \pi r^{3}$ $= \frac{16}{3} \pi r^{3}$

Question79

An ionic compound has a unit cell consisting of A ions at the corners of a cube and B ions on the centres of the faces of the cube. The empirical formula for this compound would be [2005]

Options:

A. A₃B

B. AB₃

 $C. A_2B$

D. AB

Answer: B

Solution:

Number of A ions in the unit cell. = $\frac{1}{8} \times 8 = 1$ Number of B ions in the unit cell = $\frac{1}{2} \times 6 = 3$ Hence, empirical formula of the compound = AB₃

Question80

What type of crystal defect is indicated in the diagram below ? N a⁺Cl⁻N a⁺Cl⁻N a⁺Cl⁻ Cl⁻ square Cl⁻N a⁺ square N a⁺ N a⁺Cl⁻ square Cl⁻N a⁺ Cl Cl⁻N a⁺Cl⁻N a⁺ square N a⁺

[2004]

Options:

- A. Interstitial defect
- B. Schottky defect
- C. Frenkel defect
- D. Frenkel and Schottky defects

Answer: B

Solution:

Solution:

When equal number of cations and anions are missing from their regular lattice positions, we have schottky defect. This type of defects are more common in ionic compounds with high co-ordination number and where the size of positive and negative ionsare almost equal e.g. N = CI K CI etc.

```
_____
```

Question81

How many unit cells are present in a cube-shaped ideal crystal of N aCl of mass1.00g? [Atomic masses : N a = 23, Cl = 35.5] [2003]

Options:

A. 5.14 × 10^{21} unit cells

B. 1.28×10^{21} unit cells

C. 1.71×10^{21} unit cells

D. 2.57 × 10^{21} unit cells

Answer: D

Solution:

Since in N aCl type of structure 4 formula units form a cell. No. of unit cells present in a cubic crystal

 $= \frac{d \times a^{3} \times N_{A}}{M \times Z} = \frac{m \times N_{A}}{M \times Z}$ $\therefore \text{ units cells} = \frac{1.0 \times 6.02 \times 10^{23}}{58.5 \times 4}$ $= 2.57 \times 10^{21} \text{ unit cells.}$

Question82

Na and M g crystallize in bcc and f cc type crystals respectively, then the number of atoms of Na and Mg present in the unit cell of their respective crystal is [2002]

Options:

A. 4 and 2

B. 9 and 14

 $C.\ 14 \ and \ 9$

 $D.\ 2 \ and \ 4$.

Answer: D

Solution:

In ${\rm bcc}$ - points are at corners and one in the centre of the unit cell. Number of atoms per unit cell

$$= 8 \times \frac{1}{8} + 1 = 2$$

In $f\,cc$ - points are at the corners and also centre of the six faces of each cell. Number of atoms per unit cell

$$= 8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$$

Surface Chemistry

Question1

Statement I : For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration.

Statement II : For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential.

In the light of the above statements, choose the correct answer from the options given below.

[24-Jan-2023 Shift 1]

Options:

A. Statement I is true but Statement II is false

B. Statement I is false but Statement II is true

C. Both Statement I and Statement II are true

D. Both Statement I and Statement II are false

Answer: C

Solution:

Solution:

Statement I : For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration. : True Statement II : For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential. : True

Question2

The number of statement / s which are the characteristics of physisorption is_____ A. It is highly specific in nature B. Enthalpy of adsorption is high C. It decreases with increase in temperature

D. It results into unimolecular layer

E. No activation energy is needed

[24-Jan-2023 Shift 2]

Answer: 2

Solution:

For physisorptions (a)Decreases with increase in temperature (b)No appreciable activation energy is required

Question3

The number of incorrect statement/s from the following is/are

A. Water vapours are adsorbed by anhydrous calcium chloride.

B. There is a decrease in surface energy during adsorption.

C. As the adsorption proceeds, ΔH becomes more and more negative. D. Adsorption is accompanied by decrease in entropy of the system. [25-Jan-2023 Shift 2]

Answer: 2

Solution:

'A' water vapours are absorbed by calcium chloride. C. As the adsorption proceeds, ΔH becomes less and less negative.

Question4

Which of the following salt solutions would coagulate the colloid solution formed when FeCl₃ is added to NaOH solution, at the fastest

rate? [29-Jan-2023 Shift 1]

Options:

- A. 10 mL of $0.2 \text{ mol dm}^{-3} \text{AlCl}_3$
- B. 10 mL of 0.1 mol $dm^{-3} Na_2 SO_4$
- C. 10 mL of $0.1 \text{ mol dm}^{-3} \text{Ca}_3(\text{PO}_4)_2$
- D. 10 mL of $0.15 \text{ mol dm}^{-3} \text{CaCl}_2$

Answer: A

Sol. Formed is negatively charged solution, therefore Al³⁺ has highest coagulating power

Question5

Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : In expensive scientific instruments, silica gel is kept in watch-glasses or in semipermeable membrane bags.

Reason (R): Silica gel adsorbs moisture from air via adsorption, thus protects the instrument from water corrosion (rusting) and / or prevents malfunctioning. In the light of the above statements, choose the correct answer from the options given below :

[30-Jan-2023 Shift 1]

Options:

A. (A) is false but (R) is true

B. (A) is true but (R) is false

C. Both (A) and (R) are true and (R) is the correct explanation of (A)

D. Both (A) and (R) are true but (R) is not the correct explanation of (A)

Answer: C

Solution:

Solution:

Silica gel prevents water corrosion (rusting) and instrument malfunction by adsorbing moisture from the air.

Question6

The graph of log $\frac{x}{m}$ vs log p for an adsorption process is a straight line inclined at an angle of 45° with intercept equal to 0.6020. The mass of gas adsorbed per unit mass of adsorbent at the pressure of 0.4 atm is 10^{-1} (Nearest integer) Given : log 2 = 0.3010

[30-Jan-2023 Shift 2]

Answer: 16





Question7

Adding surfactants in non polar solvent, the micelles structure will look



[31-Jan-2023 Shift 1]

Options:

- A. b
- B. c
- C. a
- D. d

Answer: C

Non-Polar tail towards non-polar solvent Ans. 3

Question8

Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Amongst He, Ne, Ar and Kr; 1g of activated charcoal adsorbs more of Kr.

Reason R : The critical volume $V_c(cm^3mol^{-1})$ and critical pressure

 P_c (atm) is highest for Krypton but the compressibility factor at critical point Z $_c$ is lowest for Krypton.

In the light of the above statements, choose the correct answer from the options given below.

[1-Feb-2023 Shift 1]

Options:

A. A is true but R is false

B. A is false but R is true

C. Both A and R are true but R is NOT the correct explanation of A $% \mathcal{A}$

D. Both A and R are true and R is the correct explanation A $% \left({{\mathbf{R}}_{\mathbf{r}}} \right)$

Answer: A

Solution:

Adsorption \propto vanderwaal attraction forces $Z_c = \frac{3}{8}$ for all real gases

Question9

In figure, a straight line is given for Freundrich Adsorption (y = 3x + 2.505). The value of $\frac{1}{n}$ and log K are respectively.



Options:

A. 0.3 and $\log 2.505$

B. 0.3 and 0.7033

C. 3 and 2.505

D. 3 and 0.7033

Answer: C

Solution:

$$\frac{x}{m} = K p^{1/n}$$

$$\log \frac{x}{m} = \log k + \frac{1}{n} \log P$$

$$Y = 3x + 2.505, \ \frac{1}{n} = 3, \log K = 2.505$$

Question10

Match List I with List II

	List I Enzymatic reaction		List II Enzyme
А	Sucrose \rightarrow Glucose and Fructose	l.	Zymase
в	Glucose \rightarrow ethyl alcohol and CO_2	Π.	Pepsin
С	Starch \rightarrow Maltose	III.	Invertase
D	Proteins \rightarrow Amino acids	IV.	Diastase

Choose the correct answer from the options given below: [6-Apr-2023 shift 1]

Options:

A. A-III, B-I, C-II, D-IV

B. A-I, B-IV, C-III, D-II

C. A-III, B-I, C-IV, D-II

D. A-I, B-II, C-IV, D-III

Answer: C

Question11

The number of colloidal systems from the following, which will have 'liquid' as the dispersion medium, is______ Gem stones, paints, smoke, cheese, milk, hair cream, insecticide sprays, froth, soap lather. [6-Apr-2023 shift 2]

Answer: 5

Solution:

Paints, milk, hair cream, froth, soap lather.

Question12

The water gas on reacting with cobalt as a catalyst forms [8-Apr-2023 shift 1]

Options:

- A. Methanoic acid
- B. Methanal
- C. Ethanol
- D. Methanol

Answer: D

Solution:

$$(CO + H_2) + H_2 \xrightarrow[ZnO, Cr_2O_3]{} CH_3 OH$$

Question13

Which of the following represent the Freundlich adsorption isotherms?



Choose the correct answer from the options given below: [8-Apr-2023 shift 1]

A. A, C, D only

B. A, B only

C. A, B, D only

D. B, C, D only

Answer: C

Solution:



Question14

The statement/s which are true about antagonists from the following

is/are :

A. They bind to the receptor site

B. Get transferred inside the cell for their action

C. Inhibit the natural communication of the body

D. Mimic the natural messenger.

Choose the correct answer from the options given below: [8-Apr-2023 shift 2]

Options:

A. A and B

B. A and C

C. A, C and D

D. B only

Answer: B

Solution:

Solution: Antagonists bind to receptor site and inhibit the natural communication of both

Question15

Coagulating value of the electrolytes $AlCl_3$ and NaCl for As_2S_3 are 0.09 and 50.04 respectively. The coagulating power of $AlCl_3$ is x times the coagulating power of NaCl. The value of x is _____. [8-Apr-2023 shift 2]

Answer: 556

Solution:

Coagulating power
$$\propto \frac{1}{\text{coagulation value}}$$

 $\frac{(\text{CP})_{\text{AlCl}_3}}{(\text{CP})_{\text{NaCl}}} = \frac{50.04}{0.09} = 556$

Question16

Ferric chloride is applied to stop bleeding because -[10-Apr-2023 shift 2]

A. Blood absorbs FeCl_3 and forms a complex.

B. $FeCl_3$ reacts with the constituents of blood which is a positively charged sol.

C. Fe^{3+} ions coagulate blood which is a negatively charged sol.

D. Cl⁻ions cause coagulation of blood.

Answer: C

Solution:

Solution:

 ${\rm Fe}^{3+}$ coagulation negatively charged sol blood.

Question17

The number of correct statements about modern adsorption theory of heterogeneous catalysis from the following is

A. The catalyst is diffused over the surface of reactants.

B. Reactants are adsorbed on the surface of the catalyst.

C. Occurrence of chemical reaction on the catalyst's surface through formation of an intermediate.

D. It is a combination of intermediate compound formation theory and the old adsorption theory.

E. It explains the action of the catalyst as well as those of catalytic promoters and poisons. [11-Apr-2023 shift 2]

Answer: 3

Solution:

B, C and D are correct. (NCERT - Surface Chemistry)

Question18

Four gases A, B, C and D have critical temperature 5.3, 33.2, 126.0 and 154.3K respectively. For their adsorption on a fixed amount of charcoal, the correct order is: [12-Apr-2023 shift 1]

A. D > C > B > AB. C > B > D > AC. D > C > A > BD. C > D > B > A

Answer: A

Solution:

Extent of adsorption alpha critical temp.

Question19

What happens when a lyophilic sol is added to a lyophobic sol? [13-Apr-2023 shift 1]

Options:

A. Film of lyophobic sol is formed over lyophilic sol.

B. Lyophilic sol is dispersed in lyophobic sol.

C. Lyophobic sol is coagulated

D. Film of lyophilic sol is formed over lyophobic sol.

Answer: D

Solution:

Solution:

Protective film of lyophilic sol is formed over lyophobic sol. Which protects it from coagulation.

Question20

Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : The diameter of colloidal particles in solution should not be much smaller than wavelength of light to show Tyndall effect.

Reason R: The light scatters in all direction when the size of particles is large enough.

In the light of the above statements, choose the correct answer from the options given below :

[13-Apr-2023 shift 2]

A. Both A and R are correct but R is NOT the correct explanation of A

B. A is true but R is false

C. Both A and R are correct and R is the correct explanation of A

D. A is false but R is true

Answer: C

Solution:

Solution:

Tyndall effect is observed only when the following two conditions are satisfied (a) The diameter of the dispersed particle is not much smaller than the wave length of light used. (b) Refractive indices of dispersed phase and dispersion medium differ greatly in magnitude.

Question21

20 mL of 0.5M NaCl is required to coagulate 200 mL, of As_2S_3 solution in 2 hours. The coagulating value of NaCl is _____. [15-Apr-2023 shift 1]

Answer: 50

Solution:

Coagulating value is required milimole of electrolyte needed to coagulate 1L sol in 2 hours. Coagulating value $\frac{20 \times 0.5}{200} \times 1000 = 50$

Question22

Given below are two statements :

Statement I : Emulsions of oil in water are unstable and sometimes they separate into two layers on standing.

Statement II : For stabilisation of an emulsion, excess of electrolyte is added.

In the light of the above statements, choose the most appropriate answer from the options given below : [24-Jun-2022-Shift-1]

Options:

A. Both Statement I and Statement II are correct.

- B. Both Statement I and Statement II are incorrect.
- C. Statement I is correct but Statement II is incorrect.
- D. Statement I is incorrect but Statement II is correct.

Answer: A

Solution:

Oil in water emulsions can sometimes separate into two layers on standing. The most relevant example for the above case is milk, which can separate into two layers on standing for a longer time. Therefore, statement (I) is correct.

On adding excess of electrolyte, coagulation occurs and emulsion is further destabilised.

Question23

When 200 mL of 0.2M acetic acid is shaken with 0.6g of wood charcoal, the final concentration of acetic acid after adsorption is 0.1M. The mass of acetic acid adsorbed per gram of carbon is___g. [24-Jun-2022-Shift-2]

Answer: 2

Solution:

Mass of wood charcoal = 0.6g Initial moles of acetic acid = $0.2 \times 0.2 = 0.04$ Final moles of acetic acid = $0.1 \times 0.2 = 0.02$ Moles of acetic acid adsorbed = 0.04 - 0.02 = 0.02Mass of acetic acid adsorbed per gm of charcoal = $\frac{0.02 \times 60}{0.6} = 2.0g$

Question24

Incorrect statement for Tyndall effect is : [25-Jun-2022-Shift-1]

Options:

A. The refractive indices of the dispersed phase and the dispersion medium differ greatly in magnitude.

B. The diameter of the dispersed particles is much smaller than the wavelength of the light used.

C. During projection of movies in the cinemas hall, Tyndall effect is noticed.

D. It is used to distinguish a true solution from a colloidal solution.

Answer: B

Solution:

For Tyndall effect, the diameter of the dispersed particles is not much smaller than the wavelength of the light used.

Question25

2.0g of H₂ gas is adsorbed on 2.5g of platinum powder at 300K and 1 bar pressure. The volume of the gas adsorbed per gram of the adsorbent is <u>mL</u>.

[26-Jun-2022-Shift-1]

Answer: 9960

Solution:

```
PV = nRT

V = \frac{2 \times 0.083 \times 300}{2 \times 1} = 24.9 litre

∴ Volume of the gas adsorbed per gram of the adsorbent

= \frac{24.9}{2.5} = 9.96L

= 9960 ml
```

Question26

Choose the correct answer from the options given below:

	List - I		List - II
(A)	Lyophilic colloid	(I)	Liquid-liquid colloid
(B)	Emulsion	(II)	Protective colloid
(C)	Positively charged colloid	(111)	FeCl ₃ + NaOH
(D)	Negatively charged colloid	(IV)	FeCl ₃ + hot water

[27-Jun-2022-Shift-1]

Options:

A. (A) - (II), (B) - (I), (C) - (IV), (D) - (III)

B. (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

C. (A) - (II), (B) - (I), (C) - (III), (D) - (IV)

D. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)

Answer: A

Solution:

Solution:

- (A) Protective colloids are lyophilic colloids
- (B) Emulsions are liquid in liquid colloidal solutions
- (C) FeCl_3 + hot water forms positively charged colloidal solution of hydrated ferric oxide.
- (D) FeCl_3 + NaOH forms negatively charged colloidal solution due to preferential adsorption of OH⁻ ions

Question27

$$\log \frac{x}{m}$$
 Intercept = 0.602

If the initial pressure of a gas is 0.03 atm, the mass of the gas adsorbed per gram of the adsorbent is $__$ ×10⁻²g [27-Jun-2022-Shift-2]

Answer: 12

Solution:

Given that $\log K$ = intercept = 0.602 = log 4 $\therefore K = 4$ Slope = $\frac{1}{n} = 1$ and initial pressure = 0.03 atm $\frac{x}{m} = K (p)^{1/n} = 4 \times 0.03 = 0.12 = 12 \times 10^{-2}$ mass of gas absorbed per gm of adsorbent = 12×10^{-2} g

Question28

The Zeta potential is related to which property of colloids? [28-Jun-2022-Shift-1]

- A. Colour
- B. Tyndall effect
- C. Charge on the surface of colloidal particles
- D. Brownian movement

Answer: C

Solution:

Solution:

The potential difference between the fixed layer and the diffused layer of opposite charges is called zeta potential. It is related to the charge on the surface of colloidal particles.

Question29

Choose the correct answer from the options given below:

	List-I		List-II
(A)	negatively charged sol	(I)	$Fe_2O_3 \cdot xH_2O$
(B)	macromolecular colloid	(II)	CdS sol
(C)	positively charged sol	(111)	Starch
(D)	Cheese	(IV)	a gel

[28-Jun-2022-Shift-2]

Options:

A. (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

B. (A) - (II), (B) - (I), (C) - (III), (D) - (IV)

C. (A) - (II), (B) - (III), (C) - (I), (D) - (IV)

D. (A) - (I), (B) - (I I I), (C) - (I I), (D) - (I V)

Answer: C

Solution:

Negative charged sol = CdS sol (II) Macromolecular colloid = starch (III) Positively charged sol = $Fe_2O_3 \cdot xH_2O$ (I) Cheese = gel (IV)

Question30

Which of the following is a correct statement? [29-Jun-2022-Shift-1]

Options:

A. Any amount of dispersed liquid can be added to emulsion without destabilising it.

B. Presence of equal and similar charges on colloidal particles provides stability to the colloids.

C. Mixing two oppositely charged sols neutralises their charges and stabilises the colloid.

D. Brownian movement stabilises sols.

Answer: 0

Solution:

Solution:

If there are similar charges on colloidal particles, neutralization does not take place and the colloid becomes stable. So, option (B) is correct.

Brownian movement helps to counter the force of gravity acting on colloidal particles and thus doesn't allow them to settle down.

Therefore, option (D) is also correct.

When two oppositely charged sols are mixed, coagulation takes place due to neutralization. So, option (A) is wrong. When dispersed phase is added in excess, it forms a separate layer and thus the emulsion gets destabilized. So, option (C) is also wrong.

Question31

A 42.12%(w / v) solution of NaCl causes precipitation of a certain sol in 10 hours. The coagulating value of NaCl for the sol in 2 hours is : [Given : Molar mass : Na = 23.0gmol⁻¹; Cl = 35.5gmol⁻¹] [29-Jun-2022-Shift-2]

Options:

- A. $36 \text{m} \text{mol} \text{L}^{-1}$
- B. $36 \text{ mol } L^{-1}$
- C. $1440 \text{ mol } L^{-1}$

D. $1440 \text{ m} \text{ mol } \text{L}^{-1}$

Answer: D

Solution:

Solution: Data insufficient.

Question32

For micelle formation, which of the following statements are correct?

A. Micelle formation is an exothermic process.

B. Micelle formation is an endothermic process.

C. The entropy change is positive.

D. The entropy change is negative.

[25-Jul-2022-Shift-2]

Options:

A. A and D only

B. A and C only

 $C. \ B \ and \ C \ only$

 $D. \ B \ and \ D \ only$

Answer: C

Solution:

Solution:

Micelle formation is an endothermic process with positive entropy change. For micelle formation, DS >0 (hydrophobic effect) This is possible because, the decrease in entropy due to clustering is offset by increase in entropy due to desolvation of the surfactant, Also DH > 06.

Question33

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Finest gold is red in colour, as the size of the particles increases, it appears purple then blue and finally gold. Reason R: The colour of the colloidal solution depends on the wavelength of light scattered by the dispersed particles. In the light of the above statements, choose the most appropriate answer from the options given below. [26-Jul-2022-Shift-2]

Options:

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is NOT the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.

Answer: A

Solution:

Solution:

Finest gold sol is red in colour; as the size of particles increases, it appears purple, then blue and finally golden. The colour of colloidal solution depends on the wavelength of light scattered by the dispersed particles. The wavelength of light further depends on size and nature of the particles. _____

Question34

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A) : Dissolved substances can be removed from a colloidal solution by diffusion through a parchment paper.

Reason (R) : Particles in a true solution cannot pass through parchment paper but the colloidal particles can pass through the parchment paper. In the light of the above statements, choose the correct answer from the options given below : [27-Jul-2022-Shift-2]

Options:

A. Both (A) and (R) are correct and (R) is the correct explanation of (A)

B. Both (A) and (R) are correct but (R) is not the correct explanation of (A)

C. (A) is correct but (R) is not correct

D. (A) is not correct but (R) is correct

Answer: C

Solution:

Solution:

Parchment paper is a semi-permeable membrane which allows particles of true solution to pass through as their size are too small. Assertion is correct but reason is incorrect.

Question35

Statements about Enzyme Inhibitor Drugs are given below:

(A) There are Competitive and Non-competitive inhibitor drugs.

(B) These can bind at the active sites and allosteric sites.

(C) Competitive Drugs are allosteric site blocking drugs.

(D) Non-competitive Drugs are active site blocking drugs.

Choose the correct answer from the options given below: [28-Jul-2022-Shift-1]

Options:

A. (A), (D) only

B. (A), (C) only

C. (A), (B) only

D. (A), (B), (C) only

Solution:

Drugs can inhibit the attachment of substrate on active site of Enzyme in two ways. (1) Competitive, (2) Non-competitive Competitive inhibitors bind on the active site of Enzymes. Non-Competitive inhibitors bind on allosteric site.

Question36

Among the following the number of curves not in accordance with Freundlich adsorption isotherm is _____.



Answer: 3



Question37

100 mL of 5% (w\/v) solution of NaCl in water was prepared in 250 mL beaker. Albumin from the egg was poured into NaCl solution and stirred well. This resulted in a\/an : [29-Jul-2022-Shift-1]

Options:

- A. Lyophilic sol
- B. Lyophobic sol
- C. Emulsion
- D. Precipitate

Answer: A

Solution:

Solution:

Albumin from the egg was poured into $100 \,\mathrm{mL}$ of $5\%(w / v) \,\mathrm{NaCl}$ solution in water. This would result in the formation of lyophilic sol. Albumin molecules get dispersed in water the colloidal particles of albumin are stabilised by hydrogen bond with water molecules.

Question38

Given below are the critical temperatures of some of the gases:

Gas	Critical temperature (K)
He	5.2
CH ₄	190.0
CO ₂	304.2
NH3	405.5

The gas showing least adsorption on a definite amount of charcoal is

[29-Jul-2022-Shift-2]

Options:

A. He

 $\mathsf{B.}\ \mathsf{CH}_4$

C. CO_2

D. NH₃

Answer: A

Solution:

Solution:

The greater the value of critical temperature greater is adsorption as He has the least critical temperature so it adsorb least.

Question39

In Freundlich adsorption isotherm at moderate pressure, the extent of adsorption $\left(\frac{x}{m}\right)$ is directly proportional to p^x . The value of x is [25 Feb 2021 Shift 1]

Options:

A. 1

B. zero

C. ∞

D. 1 / n

Answer: D

Solution:

According to Freundlich isotherm, at moderate pressure, extent of adsorption $\left(\frac{x}{m}\right) \propto (p)^{\frac{1}{n}}$



```
\frac{x}{m} \propto p^x (Given in question) . . . (ii)
Compare Eqs. (i) and (ii),
```

 $(p)^{1/n} \propto p^{x}$ $x = \frac{1}{n}$

Question40

The nature of charge on resulting colloidal particles when F eCl $_3$ is added to excess of hot water is [26 Feb 2021 Shift 2]

Options:

A. Positive

B. Sometimes positive and sometimes negative

C. Neutral

D. Negative

Answer: A

Solution:

Solution:

When F eCl₃ is added to excess of hot water, a positively charged hydrated ferric oxide [F $e_2O_3 \cdot xH_2O$ / F e^{3+}] is formed due to adsorption F e^{3+} ion (adsorbate) on the surface of hydrated ferric oxide (adsorbent). F eCl e^{H_2O} (Excess) [F $e_2O_3 \cdot xH_2O$] · F e^{3+} + 3Cl⁻(ag)

 $F \text{ eCl}_{3} \xrightarrow{\text{H}_{2}O(\text{Excess})} [F e_{2}O_{3} \cdot xH_{2}O] \cdot F e^{3+} + 3Cl^{-}(aq)$ (Positively charged sol or positive colloid)

Question41

Which one of the following statements is false for hydrophilic sols ? [25 Feb 2021 Shift 2]

Options:

A. They do not require electrolytes for stability.

B. These sols are reversible in nature.

C. Their viscosity is of the order of that of H $_2$ O.

D. The sols cannot be easily coagulated.

Answer: C

Statement (c) is false whereas other statements are true. Corrected statement is as follows: Viscosity of hydrophilic sols is higher than that of the dispersion medium, i.e. H ₂O, because there is a high concentration of dispersed phase in water.

Question42

Most suitable salt which can be used for efficient clotting of blood will be [24 Feb 2021 Shift 2]

Options:

A. N aH CO₃

B. FeSO₄

C. M g(H CO_3)₂

D. F eCl₃

Answer: D

Solution:

Solution:

According to Hardy-Schulze rule, for negatively charged sol, most (+ve) charged ion is needed for efficient coagulation. Blood is a negatively charged sol. Hence $F eCl_3$ can be used for blood clotting and it from $F e^{3+}$ ion.

Question43

In Freundlich adsorption isotherm, slope of mathrmAB line is:



[24 Feb 2021 Shift 1]

Options:

- A. log n with (n > 1)
- B. n with (n, 0.1 to 0.5)

C. $\log \frac{1}{n}$ with (n < 1)

D.
$$\frac{1}{n}$$
 with $\left(\frac{1}{n} = 0 \text{ to } 1\right)$

Answer: D

Solution:

Freundlich adsorption isotherm $\frac{x}{m} = kp^{1/n}$ Taking logarithm $log\left(\frac{x}{m}\right) = log k + \frac{1}{n}log p \Rightarrow y = c + mx$ m = 1 / n so slope will be equal to 1 / n.



 $\frac{1}{n}$ can have value between 0 and 1.

Question44

Match List-I with List-II.

List I	List II
(A) Deacon's process	(i) ZSM-5
(B) Contact process	(ii) CuCl ₂
(C) Cracking of hydrocarbons	(iii) Particles 'Ni'
(D) Hydrogenation of vegetable oils	(iv) V_2O_5

[18 Mar 2021 Shift 1]

Options:

A. A - 2, B - 4, C - 1, D - 3 B. A - 1, B - 3, C - 2, D - 4 C. A - 3, B - 1, C - 4, D - 2 D. A - 4, B - 2, C - 1, D - 3 **Answer: C**

4-methoxy toluene in the presence of alkaline $\rm K\,M\,nO_4$ to give 4-methoxy benzoic acid. Chemical reaction is as follows:



Question45

The charges on the colloidal CdS sol and TiO₂ sol are, respectively [18 Mar 2021 Shift 2]

Options:

A. positive and positive

- B. positive and negative
- C. negative and negative
- D. negative and positive

Answer: D

Solution:

Solution:

Oxides and hydroxide sol are positively charged. So, T iO_2 is positive sol. Sulphide sol are negatively charge hence, Cd S is negatively charge sol.

Question46

For the coagulation of a negative sol, the species below, that has the highest flocculating power is [17 Mar 2021 Shift 2]

Options:

- A. SO_4^{2-}
- B. Ba²⁺
- C. N a⁺
- D. PO₄³⁻

Answer: B

To coagulate negative sol, Ba^{2+} cation has highest coagulation value. For a negative sol, a positive ion is required for flocculation. According to Hardy-Schulze law, greater the valence of the flocculating ion added, the greater is its power to cause precipitation.

Question47

A colloidal system consisting of a gas dispersed in a solid is called a/an [17 Mar 2021 Shift 1]

Options:

A. solid sol

B. gel

C. aerosol

D. foam

Answer: A

Solution:

A colloidal system consisting of a gas (dispersed phase) dispersed in a solid (dispersed medium) is called a solid sol.

DP	DM	Type of colloid
a. Gas	Solid	Solid sol
b. Liquid	Solid	Gel
c. Solid	Gas	Aerosol
d. Gas	Liquid	Foam

Question48

Given below are two statement : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : $SO_2(g)$ is adsorbed to a large extent than H $_2(g)$ on activated charcoal.

Reason $R : SO_2(g)$ has a higher critical temperature than H2(g).

In the light of the above statements, choose the most appropriate answer from the options given below. [27 Jul 2021 Shift 2]

Options:

A. Both A and R are correct but R is not the correct explanation fo A

B. Both A and R are correct and R is the correct explanation of A.

- C. A is not correct but R is correct.
- D. A is correct but R is not correct.

Answer: B

Solution:

Gases having higher critical temperature absorb to a greater extent.

Question49

 CO_2 gas adsorbs on charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of CO_2 adsorbed becomes 64 times when the pressure of CO_2 is doubled.

The value of n in the Freundlich isotherm equation is $____ \times 10^{-2}$. (Round off to the Nearest Integer) [27 Jul 2021 Shift 1]

Answer: 17

Solution:

Freundlich isotherm. $\frac{x}{m} = k \cdot p^{\frac{1}{n}}$ Substituting values ; $\left(\frac{64}{1}\right) = (2)^{\frac{1}{n}} \Rightarrow n = \frac{1}{6} = 0.166$ $\approx 17 \times 10^{-2}$

Question50

Which one of the following statements is not true about enzymes ? [20 Jul 2021 Shift 2]

Options:

- A. Enzymes are non-specific for a reaction and substrate.
- B. Almost all enzymes are proteins.
- C. Enzymes work as catalysts by lowering the activation energy of a biochemical reaction.
- D. The action of enzymes is temperature and pH specific

Solution:

Fact

Question51

Match List I with List II :

	List-I Example of colloids		List-II Classification
(a)	Cheese	(i)	dispersion of liquid in liquid
(b)	Pumice stone	(ii)	dispersion of liquid in gas
(c)	Hair cream	(iii)	dispersion of gas in solid
(d)	Cloud	(iv)	dispersion of liquid in solid

Choose the most appropriate answer from the options given below [25 Jul 2021 Shift 2]

Options:

A. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

B. (a)-(iv), (b)-(i), (c)-(iii), (d)-(ii)

C. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

D. (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

Answer: D

Solution:

Cheese \rightarrow liquid in solid Pumice stone \rightarrow gas in solid Hair cream \rightarrow liquid in liquid Cloud \rightarrow liquid in gas

Question52

100ml of 0.0018%(w / v) solution of Cl⁻ion was the minimum concentration of Cl⁻required to precipitate a negative sol in one h. The coagulating value of Cl⁻ion is _____. (Nearest integer) [20 Jul 2021 Shift 2]
The conditions given below are in the context of observing Tyndall effect in colloidal solutions: (A) The diameter of the colloidal particles is comparable to the

(A) The diameter of the colloidal particles is comparable to the wavelength of light used.

(B) The diameter of the colloidal particles is much smaller than the wavelength of light used.

(C) The diameter of the colloidal particles is much larger than the wavelength of light used.

(D) The refractive indices of the dispersed phase and the dispersion medium are comparable.

(E) The dispersed phase has a very different refractive index from the dispersion medium.

Choose the most appropriate conditions from the options given below: [20 Jul 2021 Shift 1]

Options:

A. (A) and (E) only

B. (C) and (D) only

C. (A) and (D) only

D. (B) and (E) only

Answer: A

Solution:

Solution:

The phenomenon of scattering of light by colloidal particles as a result of which the path of the beam becomes visible is called a tyndall effect.

smaller the diameter and similar the magnitude of refractive indices, lesser is the scattering and hence the tyndall effect and viced-versa.

The diameter of the dispersed phase particle should not be smaller than the wavelength of light used because they won't be able to scatter the light so, therefore, the diameter of the dispersed particles should be equal or not much smaller than the wavelength of the light used.

2. The refractive indies (i.e. the ratio of the velocity of light in vacuum to the velocity of light in any medium) of the dispersed phase and the dispersion medium should differ greatly in magnitude than only the particles will be able to scatter the light and tyndall effect will be obersved.

On the other hand, if the refractive indices of the dispersed phase and dispersion medium are almost similar in magnitude, then there will be no scattering of light and hence, therefore, no tyndall effect effect is observed. Hence answer A and E are correct.

 CH_4 is adsorbed on 1g charcoal at 0°C following the Freundlich adsorption isotherm. 10.0 mL of CH_4 is adsorbed at 100 mm of Hg, whereas 15.0 mL is adsorbed at 200 mm of Hg. The volume of CH_4 adsorbed at 300 mm of Hg is 10^x mL. The value of x is × 10^{-2} . (Nearest integer) [Use $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$] [31 Aug 2021 Shift 2]

Answer: 128

Solution:

According to Freundlich isotherm, $\frac{x}{m} = kp^{\frac{1}{n}}$ (Using, amount of adsorbate \propto Volume of absorbate) $\frac{10}{1} = k \times (100)^{\frac{1}{n}} \dots (i)$ $\frac{15}{1} = k \times (200)^{\frac{1}{n}}$...(ii) $\frac{v}{1} = k \times (300)^{n} \dots (iii)$ Divide Eq. (ii) by (i) $\frac{15}{10} = 2^{\frac{1}{x}}$ $\Rightarrow \log\left(\frac{3}{2}\right) = \frac{1}{n}\log 2$ $\frac{1}{n} = \frac{\log 3 - \log 2}{\log 2} = \frac{0.4771 - 0.3010}{0.3010}$ $\frac{1}{n} = 0.585$ Divide Eq. (iii) by (i) $\frac{v}{10} = 3^{\frac{1}{n}}$ $\log\left(\frac{v}{10}\right) = \frac{1}{n}\log 3$ $\log\left(\frac{v}{10}\right) = 0.585 \times 0.4771 = 0.2791$ $\frac{\mathrm{v}}{\mathrm{10}} = 10^{0.2791}$ $\Rightarrow v = 10 \times 10^{0.2791}$ $= 10^{1.279} = 10^{x}$ x = 1.279 $x = 128 \times 10^{-2}$

Question55

Select the graph that correctly describes the adsorption isotherms at

two temperatures T_1 and T_2 ($T_1 > T_2$) for a gas.

(x = mass of the gas adsorbed; m = mass of adsorbent; p = pressure) [31 Aug 2021 Shift 1]

Options:

A.

















Solution:

Solution:

The graph that correctly describes the absorption isotherms at two temperature T_1 and T_2 is given by option (d).

According to Freundlich's adsorption isotherm, the amount of the gas adsorbed is directly proportional to pressure applied raised to the power $\frac{1}{n}$.

$$\frac{x}{m} \propto p^{\frac{1}{n}} \left[0 < \frac{1}{n} < 1 \right]$$

So, on increasing temperature, $\frac{x}{m}$ decreases.

 \therefore Adsorption is basically exothermic in nature. Hence, correct option is (d).

Which one of the following is correct for the adsorption of a gas at a given temperature on a solid surface? [26 Aug 2021 Shift 1]

Options:

A. $\Delta H > 0$, $\Delta S > 0$ B. $\Delta H > 0$, $\Delta S < 0$ C. $\Delta H < 0$, $\Delta S < 0$

D. $\Delta H < 0$, $\Delta S > 0$

Answer: C

Solution:

Solution:

The ΔH (enthalpy change) and ΔS (entropy change) will be less than zero for adsorption of gas on solid surface, i.e. $\Delta H < 0$, $\Delta S < 0$.

Entropy change (Δ **S**) The randomness of the gas molecules decreases as they are adsorb on solid surface due to restriction in their motion.

$\therefore \Delta S$ is negative.

Enthalpy change (\DeltaH) Adsorption of gas on solid surface is an exothermic process, as there is force of attraction between adsorbate and adsorbent. $\therefore \Delta$ H is negative.

Question57

Lyophilic sols are more stable than lyophobic sols because [27 Aug 2021 Shift 2]

Options:

A. there is a strong electrostatic repulsion between the negatively charged colloidal particles.

B. the colloidal particles have positive charge.

C. the colloidal particles have no charge.

D. the colloidal particles are solvated.

Answer: D

Solution:

Solution:

Lyophilic sols are more stable than lyophobic sols. Lyophilic sols are solvent loving, whereas lyophobic sols are solvent hating. The dispersed phase in lyophobic sols has no attraction for the solvent. The dispersed phase in lyophilic sols has attraction for the solvent. The colloidal particles are solvated in the dispersed medium and therefore stabilised through solvation process.

Therefore, the option (d) is correct.

Tyndall effect is more effectively shown by [27 Aug 2021 Shift 1]

Options:

- A. true solution
- B. Iyophilic colloid
- C. lyophobic colloid
- D. suspension

Answer: C

Solution:

Solution:

Tyndall effect is more effectively shown by lyophobic colloid because in lyophobic colloids, the particles are not as highly solvated as in lyophilic sols. So, the difference in refractive index between the particles and the medium is quite large in lyophobic colloids. Therefore, the tyndall effect is more pronounced in lyophobic sols or colloids.

Question59

The sol given below with negatively charged colloidal particles is [26 Aug 2021 Shift 2]

Options:

A. FeCl₃ added to hot water

B. KI added to AgNO₃ solution

C. AgNO₃ added to KI solution

D. Al_2O_3 . XH_2O in water

Answer: C

Solution:

Solution:

When AgNO₃ is added to KI,

```
Kl \longrightarrow Agl \downarrow \longrightarrow Agl \downarrow I^{-}
Negatively charged
```

lodide ion gets adsorbed on the surface of AgI. This will result in formation of negatively charged colloids. • When KI is added to AgNO₃ following reaction takes place.

 $AgNO_{3} \xrightarrow{Kl} Agl \downarrow \xrightarrow{AgNO_{3}} Agl \downarrow Ag^{+}$

Silver cation gets adsorbed on surface of AgI, resulting in formation of positively charged colloids. • Option (a) and (d) will form positively charged colloids.

Match List-I with List - II.

List-I	List-II
(Colloid preparation method)	(Chemical reaction)
A. Hydrolysis	1. $2AuCl_3 + 3 HCHO + 3H_2 \rightarrow 2 Au(sol) + 3 HCOOH + 6 HCl$
B. Reduction	2. As $O_3 + 3H_2S \rightarrow As_2S_3(sol) + 3H_2O$
C. Oxidation	3. $SO_2 + 2H_2S \rightarrow 3S(sol) + 2H_2O$
D. DoubleDecomposition	4. $FeCl + 3H_2O \rightarrow Fe(OH)_3(sol) + 3 HCl$

Choose the most appropriate answer from the options given below. A B C D [1 Sep 2021 Shift 2]

Options:

A. A-1, B-3, C-2, D-4

B. A-4, B-1, C-3, D-2

C. A-4, B-2, C-3, D-1

D. A-1, B-2, C-4, D-3

Answer: B

Solution:

According to type of reaction for colloid preparation, colloidshave been classified. A. Hydrolysis - FeCl + $3H_2O \rightarrow Fe(OH)_3(sol) + 3 HCl$ B. Reduction - $2AuCl_3 + 3 HCHO + 3H_2 \rightarrow 2 Au(sol) + 3 HCOOH + 6 HCl$ C. Oxidation - $SO_2 + 2H_2S \rightarrow 3S(sol) + 2H_2O$ D. Double decomposition - $AsO_3 + 3H_2S \rightarrow As_2S_3(sol) + 3H_2O$ Hence, the correct match is $A \rightarrow 4$, $B \rightarrow 1$, $C \rightarrow 3$, $D \rightarrow 2$.

Question61

A mixture of gases O_2 , H $_2$ and CO are taken in a closed vessel containing charcoal. The graph that represents the correct behaviour of pressure with time is: [Jan. 09,2020 (II)]

Options:









Answer: B

Solution:

Solution:

Initially, adsorption of gases at the surface of charcoal occurs rapidly which results in a sudden decrease in pressure. As the number of vacant sites at the surface of adsorbent decreases with the passage of time, rate of adsorption decreases. Therefore, pressure tends to be constant.

Question62

As per Hardy-Schulze formulation, the flocculation values of the following for ferric hydroxide sol are in the order: [Jan. 08,2020 (T)]

Options:

A.
$$K_{3}[Fe(CN)_{6}] < K_{2}CrO_{4} < KBr = KNO_{3} = AlCl_{3}$$

B.
$$K_{3}[Fe(CN)_{6}] < K_{2}CrO_{4} < AlCl_{3} < KBr < KNO_{3}$$

C. Al Cl₃ > K₃[F e(CN)₆] > K₂CrO₄ > K Br = K N O₃

D. $K_{3}[Fe(CN)_{6}] > Al Cl_{3} > K_{2}CrO_{4} > KBr > KNO_{3}$

Answer: A

Solution:

According to Hardy-Schulze, Coagulation value or fluocculation value $\propto \frac{1}{Coagulation \text{ power}}$ order of coagulation power: K₃[F e(CN)₆] > K₂CrO₄ > K Br = K N O₃ = Al Cl₃ \therefore order of flocculation value : K₃[F e(CN)₆] < K₂CrO₄ < K Br = K N O₃ = Al Cl₃

Question63

The flocculation value of H Cl for arsenic sulphide sol. is 30m mol L^{-1} . If H ₂SO₄ is used for the flocculation of arsenic sulphide, the amount, in grams, of H ₂SO₄ in 250 mL required for the above purpose is_____

(molecular mass of H $_2$ SO $_4$ = 98 $\frac{g}{mol}$) [NV, Jan. 07,2020(II)]

Answer: 0.37

Solution:

0.37 For 1L sol 30m mol of H Cl is required \therefore For 1L sol 15mmol H₂SO₄ is required For 250mL of sol , H₂SO₄ required $= \frac{15}{1000} \times 250$ mmol H₂SO₄ = 3.75mmol of H₂SO₄ 1mol H₂SO₄ = 98g 3.75mmol of H₂SO₄ $= 3.75 \times 98 \times 10^{-3}$ = 0.3675gH₂SO₄

Question64

For Freundlich adsorption isotherm, a plot of log(x / m)(y - axis) and logp(x - axis) gives a straight line. The intercept and slope for the line is 0.4771 and 2, respectively. The mass of gas, adsorbed per gram of adsorbent if the initial pressure is 0.04atm, is $__ \times 10^{-4}g$ (log 3 = 0.4771)

[NV, Sep. 06, 2020 (II)]

Answer: 48

Solution:

Freundlich adsorption isotherm: $\frac{x}{m} = k_p^{1/n}$ $\Rightarrow \log \frac{x}{m} = \log k + \frac{1}{n} \log p$ Slope $\left(\frac{1}{n}\right) = 2$ Intercept =log k=0.4771, so k= Antilog (0.4771)=3 So, $\left(\frac{x}{m}\right) = k(p)^{1/n}$ $\frac{x}{m} = 3 \cdot p^2(p = 0.04atm)$ $= 3 \times (0.04)^2 = 48 \times 10^{-4}$

Question65

Adsorption of a gas follows Freundlich adsorption isotherm. If x is the mass of the gas adsorbed on mass m of the adsorbent, the correct plot of $\frac{x}{m}$ versus p is: [Sep. 05, 2020 (II)]

Options:

A.



В.



C.





Answer: A

Solution:

Solution:

As adsorption is exothermic process, hence $\frac{x}{m}$ decreases with increase of temperature.

Question66

The mass of gas adsorbed, x, per unit mass of adsorbate, m, was measured at various pressures, p. A graph between log x / m and log p gives a straight line with slope equal to 2 and the intercept equal to 0.4771. The value of x / m at a pressure of 4 atm is: (Given log 3 = 0.4771) [NV, Sep.02,2020(I)]

Answer: 48

Solution:

Solution:

Sol. $\left(\frac{x}{m}\right) = k(P)^{\frac{1}{n}}$ $\log\left(\frac{x}{m}\right) = \log k + \frac{1}{n}\log P$ $Slop = \frac{1}{n} = 2$ $So n = \frac{1}{2}$ Intercept $\Longrightarrow \log k = 0.477$ so k = Antilog (0.477) = 3 $\log\left(\frac{x}{m}\right)$ $\log k - 0.477$ $\log p \longrightarrow$ $So \left(\frac{x}{m}\right) = k(P)^{\frac{1}{n}}$ $= 3[4]^2 = 48$

Amongst the following statements regarding adsorption, those that are valid are :

(1) ΔH becomes less negative as adsorption proceeds.

(2) On a given adsorbent, ammonia is adsorbed more than nitrogen gas.

(3) On adsorption, the residual force acting along the surface of the adsorbent increases.

(4) With increase in temperature, the equilibrium concentration of adsorbate increases.

[Sep. 02,2020(II)]

Options:

A. (4) and (1)

B. (2) and (3)

C. (1) and (2)

D. (3) and (4)

Answer: C

Solution:

Solution:

(i) When gas is adsorbed on metal surface, ΔH becomes less negative with progress of adsorption. (ii) The gas having greater value of critical temperature (T_c) is adsorbed more compared to lower T_c containing gases. AsT_c(N H₃) > T_c(N₂), so N H₃ is adsorbed more than N₂ gas.

Question68

Kraft temperature is the temperature: [Sep. 06, 2020(I)]

Options:

A. below which the aqueous solution of detergents starts freezing.

B. below which the formation of micelles takes place.

C. above which the aqueous solution of detergents starts boiling.

D. above which the formation of micelles takes place.

Answer: D

Solution:

Above Kraft temperature the formation of micelles takes place and the conc. above which micelle formation become appreciable is called critical micelles conc.

Identify the correct molecular picture showing what happens at the critical micellar concentration (CMC) of an aqueous solution of a surfactant (o polar head, m non-polar tail, \cdot water)



[Sep.06,2020(I)]

Options:

- A. (D)
- B. (B)
- C. (A)
- D. (C)

Answer: A

Solution:

Solution:

In micelle formation, above "CMC" hydrocarbon chains are pointing towards the centre of sphere with COO part remaining outward on the surface.

Question70

A sample of red ink (a colloidal suspension) is prepared by mixing eosin dye, egg white, HCHO and water. The component which ensures stabilitiy of the ink sample is: [Sep.04, 2020 (II)]

Options:

- A. Egg white
- B. Water
- C. HCHO
- D. Eosin dye

Answer: A

Solution:

Egg white is used to stabilise the prepared colloidal solution of red ink.

Tyndall effect is observed when: [Sep. 03, 2020 (I)]

Options:

- A. The diameter of dispersed particles is much larger than the wavelength of light used.
- B. The diameter of dispersed particles is much smaller than the wavelength of light used.
- C. The refractive index of dispersed phase is greater than that of the dispersion medium.
- D. The diameter of dispersed particles is similar to the wavelength of light used.

Answer: D

Solution:

Solution:

Tyndall effect is observed only when the following two conditions are satisfied. (i) The diameter of the dispersed particles is not much smaller than the wavelength of the light used. (ii) The refractive indices of the dispersed phase and the dispersion medium differ greatly in magnitude.

Question72

An ionic micelle is formed on the addition of : [Sep. 03,2020 (II)]

Options:

A. liquid diethyl ether to aqueous mathrm N aCl solution

B.

excess water to liquid

excess water to liquid

C.



D. Sodium stearate to pure toluene

Answer: C

Solution:

Excess water of liquid

SO4 CH.

Due to presence of hydrophobic chain it forms micelle.

Question73

Which of the following is used for the preparation of colloids? [Sep.02,2020(I)]

Options:

- A. Ostwald Process
- B. Van Arkel Method
- C. Bredig's Arc Method
- D. Mond Process

Answer: C

Solution:

Solution: Bredig's Arc method is used for preparation of colloidal sol's of less reactive metal like Au, Ag, Pt.

Question74

The size of a raw mango shrinks to a much smaller size when kept in a concentrated salt solution. Which one of the following processes can explain this? [Sep. 02,2020(II)]

Options:

- A. Osmosis
- B. Dialysis
- C. Diffusion
- D. Reverse osmosis
- Answer: A

Solution:

Solution:

Given gas critical temperature /K for H $_2$ CH $_4$ CO $_2$ SO $_2$ is 33 190 304 630 On the basis of data given above, predict which of the following gases shows least adsorption on a definite amount of charcoal? [Jan. 12, 2019 (I)]

Options:

- A. SO_2
- B. CH $_4$
- $C. CO_2$
- D. H $_2$

Answer: D

Solution:

Solution:

Smaller the value of critical temperature of gas, lesser is the extent of adsorption. \therefore Least adsorption is shown by H $_2$ (least critical temperature).

Question76

Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, x is the mass of the gas adsorbed on mass m of the adsorbent at pressure p. $\frac{x}{m}$ is proportional to:



[Jan. 9,2019(I)]

Options:

A. p²

B. $p^{1/4}$

C. $p^{1/2}$

D. p

Answer: C

Solution:

In Freundlich adsorption isotherm the extent of adsorption $\left(\frac{x}{m}\right)$ of a gas on the surface of a solid is related to the pressure of the gas (p) which can be formulated as:

$$\frac{x}{m} = k(p)^{1/n}$$

$$\Rightarrow \log \frac{x}{m} = \log k + \frac{1}{n} \log p$$
In the given ploi, the slope between $\log \frac{x}{m}$ versus $\log p = \frac{2}{4} = \frac{1}{2}$

$$\therefore \quad \frac{\mathbf{x}}{\mathbf{m}} \propto \mathbf{p}^{1/2}$$

Question77

Which of the following is not an example of heterogeneous catalytic reaction? [Jan.10, 2019 (I)]

Options:

- A. Ostwald's process
- B. Combustion of coal
- C. Hydrogenatoin of vegetable oils
- D. Haber's process

Answer: B

Solution:

 $C + O_2 \rightarrow CO_2$ (No catalyst is required)

In Ostwald process, Haber's process and hydrogenation of vegetable oils, catalyst (solid) such as $\frac{Pt}{Rh}$, F e and Ni are used.

Question78

Among the following, the false statement is: [Jan,12, 2019(II)]

Options:

A. It is possible to cause artificial rain by throwing electrified sand carrying charge opposite to the one on clouds from an aeroplane.

B. Tyndall effect can be used to distinguish between a colloidal solution and a true solution.

- C. Lyophilic sol can be coagulated by adding an electrolyte.
- D. Latex is a colloidal solution of rubber particles which are positively charged.

Answer: D

Solution:

Latex is a colloidal solution of negatively charged rubber particles.

Question79

An example of solid sol is: [Jan. 11,2019(T)]

Options:

A. Paint

B. Gem stones

C. Butter

D. Hair cream

Answer: B

Solution:

Solution: Gem stones are solid sol

Question80

Among the colloids cheese (C), milk (M) and smoke (S), the correct combination of the dispersed phase and dispersion medium, respectively is: [Jan. 11, 2019 (II)]

Options:

A. C: liquid in solid; M : liquid in solid; S : solid in gas

B. C: liquid in solid; M $\,:$ liquid in liquid; S : solid in gas

 $C.\ C:$ solid in liquid; M: liquid in liquid; S: gas in solid

D. C: solid in liquid; M : solid in liquid; S : solid in gas

Answer: B

Solution:

Colloidsphase	Dispersedmedium	Dispersion
Cheese (C)	liquid	solid
Milk (M)	liquid	liquid
Smoke (S)	solid	gas

Question81

Hemoglobin and gold sol are examples of: [Jan. 10,2019 (II)]

Options:

A. positively and negatively charged sols, respectively

B. positively charged sols

C. negatively charged sols

D. negatively and positively charged sols, respectively

Answer: A

Solution:

Solution: Hacmoglobin and gold sol (metal) are examples of positive and negative sols, respectively.

Question82

For coagulation of arsenious sulphide sol, which one of the following salt solution will be most effective? [Jan.9,2019(II)]

Options:

A. BaCl₂

B. A1Cl $_3$

C. N aCl

D. N a_3PO_4

Answer: B

Solution:

For coagulation of a negatively charged arsenious sulphide sol, the cation which is in higher oxidation state will be most effective.

Question83

A gas undergoes physical adsorption on a surface and follows the given Freundlich adsorption isotherm equation $\frac{x}{m} = kp^{0.5}$ Adsorption of the gas increases with : [April 10, 2019 (I)]

Options:

- A. Decrease in p and increase in T
- B. Decrease in p and decrease in T
- C. Increase in pand decrease in T
- D. Increase in p and increase in T

Answer: C

Solution:

Solution:

Freundlich adsorption is applicable for physical adsorption. The variation of extent of adsorption with (i) Pressure and (ii) Temperature is given by the following curves.



Hence, extent of adsorption increases with increase in pressure and decrease in temperature.

Question84

10mL of 1 mM surfactant solution forms a monolayer covering 0.24cm² on a polar substrate. If the polar head is approximated as a cube, what is its edge length? [April 9, 2019 (II)]

Options:

A. 1.0pm

B. 2.0pm

C. 0.1nm

D. 2.0nm

Answer: B

Solution:

No. of surfactant molecule $=6 \times 10^{23} \times \frac{10}{1000} \times 10^{-3}$ = 6×10^{18} molecule Let edge length = a cm Total surface area of surfactant = $6 \times 10^{18} a^2$ = $0.24 cm^2$ $a^2 = \frac{0.24}{6 \times 10^{18}} = 0.04 \times 10^{-18} = 4 \times 10^{-20}$ $a = 2 \times 10^{-10} cm = 2 pm$

Question85

Adsorption of a gas follows Freundlich adsorption isotherm. x is the mass of the gas adsorbed on mass m of the adsorbent. The plot of $\frac{x}{m}$ versus log p is shown in the given graph. $\frac{x}{m}$ is proportional to:



[April 8,2019 (I)]

Options:

A. $p^{\frac{2}{3}}$ B. $p^{\frac{3}{2}}$ C. p^{3} D. p^{2}

Answer: A

Solution:

According to Freundlich adsorption isotherm $\frac{x}{m} \propto p^{\frac{1}{n}}; \quad \frac{x}{m} = kp^{\frac{1}{n}}$ Slope $= \frac{2}{3}$ $\log \frac{x}{m} = \log k + \frac{1}{n} \log p$ Slope $= \frac{1}{n} = \frac{2}{3}$ $\frac{x}{m} \propto p^{\frac{2}{3}}$

Peptization is a : [April 12, 2019 (I)]

Options:

A. process of bringing colloidal molecule into solution

B. process of converting precipitate into colloidal solution

C. process of converting a colloidal solution into precipitate

D. process of converting soluble particles to form colloidal solution

Answer: B

Solution:

Solution:

Peptisation is the process of converting a precipitate into a colloidal sol by shaking it with dispersion medium in the presence of small amount of electrolyte. It is also known as deflocculation.

Question87

Among the following, the INCORRECT statement about colloids is: [April 12, 2019 (II)]

Options:

A. They can scatter light.

B. They are larger than small molecules and have high molar mass.

C. The osmotic pressure of a colloidal solution is of higher order than the true solution at the same concentration.

D. The range of diameters of colloidal particles is between 1 and 1000nm.

Answer: C

Solution:

Due to the association of solute molecule till they

acquire colloidal dimensions, the osmotic pressure of a colloidal solution is of lower order than that of true solution at the same concentation.

π=iCRT

i (vant hoff factor) is less in colloidal solution than true solution. So, π (osmotic pressures) will also be less in colloidal solution.

The correct option among the following is: [April 10,2019 (II)]

Options:

A. Colloidal medicines are more effective because they have small surface area.

- B. Addition of alum to water makes it unfit for drinking
- C. Colloidal particles in Iyophobic sols can be precipitated by electrophoresis.
- D. Brownian motion in colloidal solution is faster if the viscosity of the solution is very high.

Answer: C

Solution:

Solution: The process of electrophoresis is used to precipitate colloidal particles in lyophobic sols.

Question89

The aerosol is a kind of colloid in which: [April 9, 2019 (I)]

Options:

A. solid is dispersed in gas

B. gas is dispersed in solid

C. gas is dispersed in liquid

D. liquid is dispersed in water

Answer: A

Solution:

Solution:

In aerosol, the dispersion medium is gas while the dispersed phase can be both solid or liquid.

Question90

Which one of the following is not a property of physical adsorption? [Online April 16,2018]

Options:

A. Higher the pressure, more the adsorption

- B. Greater the surface area, more the adsorption
- C. Lower the temperature, more the adsorption
- D. Unilayer adsorption occurs

Answer: D

Solution:

The physical adsorption is temperature and pressure dependent. It increases with increase in pressure and decreases with increase in temperature. Also, when there is more surface area then physical adsorption will be more. Physical adsorption formsmultiple layer of adsorption. Thus, statement given in option (d) is incorrect.

Question91

If x gram of gas is adsorbed by m gram of adsorbent at pressure P, the plot of log $\frac{x}{m}$ versus log P is linear. The slope of the plot is: (n and k are constants and n > 1) [Online April 15, 2018 (II)]

Options:

A. log k

- B. $\frac{1}{n}$
- C. 2k
- D. n

Answer: B

Solution:

According to Freundlich adsorption isotherm.

 $\frac{x}{m} = kp^{\frac{1}{n}}$

 $\log_{10} \frac{x}{m} = \frac{1}{n} \log_{10} P + \log_{10} k$

This is the equation of straight line of type

y = mx + c. Hence slope is $\frac{1}{n}(m)$ and intercept is $\log_{10}k$.

Question92

Which of the following statements about colloids is false? [Online April 15, 2018 (I)]

Options:

A. When silver nitrate solution is added to potassium iodide solution, a negatively charged colloidal solution is formed

B. Freezing point of colloidal solution is lower than true solution at same concentration of a solute

C. Colloidal particles can pass through ordinary filter paper

D. When excess of electrolyte is added to colloidal solution, colloidal particle will be precipitated

Answer: B

Solution:

(a) When silver nitrate solution is added to potassium iodide solution, a negatively charged colloidal solution is formed due to selective adsorption of I⁻ ion from the dispersion medium. However, if the order of addition is reversed, i.e, potassiumiodide solution is added to silver nitrate solution, due to selective adsorption of Ag⁺ ion from the dispersion medium, a positively charged colloidal solution is obtained.

(b) Freezing point of colloidal solution is same as that of true solutionat same concentration of a solute. The depression in freezing point is a colloidal property and depends on the number of solute particles and independent of size or shape of solute particles.

(c) Colloidal particles are so small that they can pass throughordinary filter paper. Also, they cannot be seen with ordinary microscope.

(d) When excess of electrolyte is added to colloidal solution, colloidal particle will be precipitated. Although electrolytes in minute quantities are necessary for the stability of colloids, they cause coagulation of disperse phase if present in large quantities.

Question93

Adsorption of a gas on a surface follows Freundlich adsorption isotherm. Plot of log $\frac{x}{m}$ versus log p gives a straight line with slope cqual to 0.5, then : ($\frac{x}{m}$ is the mass of the gas adsorbed per gram of adsorbent) [Online April 9, 2017]

Options:

A. Adsorption is independent of pressure.

B. Adsorption is proportional to the pressure.

C. Adsorption is proportional to the squareroot of pressure.

D. Adsorption is proportional to the square of pressure.

Answer: C

Solution:



According to Freundlich adsorption isotherm $\log \frac{x}{m} = \log k + \frac{1}{n} \log p$

$$\begin{split} \log \frac{x}{m} &= \log(k \cdot p^{1/n}) \\ \frac{x}{m} &= k \cdot p^{1/n} \\ \frac{x}{m} &\propto p^{1/2} \text{ (given } \frac{1}{n} &= \frac{1}{2} \text{)} \end{split}$$

Question94

The Tyndall effect is observed only when following conditions are satisfied:

(i) The diameter of the dispersed particles is much smaller than the wavelength of the light used.

(ii) The diameter of the dispersed particle is not much smaller than the wavelength of the light used.

(iii) The refractive indices of the dispersed phase and dispersion medium are almost similar in magnitude.(iv) The refractive indices of the dispersed phase and dispersion medium differ greatly in magnitude. [2017]

Options:

A. (i) and (iv)

B. (ii) and (iv)

C. (i) and (iii)

D. (ii) and (iii)

Answer: B

Question95

Among the following, correct statement is: [Online April 8, 2017]

Options:

- A. Brownian movement is more pronounced for smaller particles than for bigger-particles.
- B. Sols of metal sulphides are lyophilic.
- C. Hardy Schulze law states that bigger the size of the ons, the greater is its coagulating power.
- D. One would expect charcoal to adsorb chlorine more than hydrogen sulphide.

Answer: A

Solution:

Brownian movement is the random motion of particles suspended in a fluid (a liquid or gas) resulting from their collision with the fast moving atom or molecules in the liquid or gaseous state of the matter. That means smaller particles are responsible for the Brownian movement than for bigger particles.

Question96

For a linear plot of $log\left(\frac{x}{m}\right)$ versus log p in a Freundlich adsorption isotherm, which of the following statements is correct? (k and n are constants). [2016]

Options:

```
A. Only \frac{1}{n} appears as the slope.
```

B. $\log\left(\frac{1}{n}\right)$ appears as the intercept.

- C. Both k and $\frac{1}{n}$ appear in the slope term.
- D. $\frac{1}{n}$ appears as the intercept.

Answer: A

Solution:

According to Freundlich adsorption isotherm $\log \frac{x}{m} = \log k + \frac{1}{n} \log p$ Thus if a graph is plotted between $\log(x / m)$ and $\log p$, a straight line will be obtained



The slope of the line is equal to $\frac{1}{n}$ and the intercept on $\log \frac{x}{m}$ axis will correspond to operator name sl og k.

Question97

A particular adsorption process has the following characteristics : (i) It arises due to van der Waals forces and (ii) it is reversile. Identify the correct statement that describes the above adsorption process: [Online April 9, 2016]

Options:

A. Adsorption is monolayer.

- B. Adsorption increases with increase in temperature.
- C. Enthalpy of adsorption is greater than 100kJ mol $^{-1}$
- D. Energy of activation is low.

Answer: D

Solution:

The characteristics given suggests that this should be physical adsorption.

Physical adsorption usually takes place at low temperature and decreases with increase in temperature. The force of attraction holding the adsorbate are van der Waal's forces. Heat of adsorption is low. It is reversible and forms multimolecular layer. It does not acquire any activation energy.

Question98

The most appropriate method of making egg-albumin sol is: [Online April 9, 2016]

Options:

A. Break an egg carefully and transfer the transparent part of the content to 100mL of 5% $\frac{W}{V}$ saline solution and stir well.

B. Keep the egg in boiling water for 10 minutes. After removing the shell, transfer the yellow part of the content to 100mL of 5% $\frac{W}{V}$ saline solution and homogenize with a mechanical shaker.

C. Keep the egg in boiling water for 10 minutes. After removing the shell, transfer the white

part of the content to 100mL of 5% $\frac{w}{V}$ saline solution and homogenize with a mechanical shaker

D. Break an egg carefully and transfer only the yellow part of the content to 100mL of 5% $\frac{W}{V}$ saline solution and stir well.

Answer: A

Solution:

Preparation of egg albumin sol. is done in following two steps.

(I) Prepare 100mL of 5% $\left(\frac{W}{V}\right)$ solution of N aCl in water

in a 250mLbeaker

(ii) Break one egg in a porcelain dish and pipette out the albumin and pour it in sodium chloride solution. Stir well to ensure the preparation of sol.

Question99

Gold numbers of some colloids are : Gelatin : 0.005 – 0.01, Gum arabic: 0.15 – 0.25; Oleate :0.04 – 1.0; Starch :15 – 25. Which among these is a better protective colloid? [Online April 10, 2016]

Options:

A. Gelatin

B. Starch

C. Oleate

D. Gum arabic

Answer: A

Solution:

Gold number $\propto \frac{1}{Protective power}$ i.e., The smaller the value of gold number of lyophilic sol, the greater is the protective action. Hence, gelatin will be better protective colloid.

Question100

The following statements relate to the adsorption of gases on a solid surface. Identify the incorrect statement among them: [Online April 10,2015]

Options:

- A. Enthalpy of adsorption is negative
- B. Energy appears as heat
- C. On adsorption, the residual forces on the surface are increased
- D. Entropy of adsorption is negative

Answer: C

Solution:

Adsorption is a phenomena of attracting and retaining the molecules of a substance on the surface of a liquid or a solid resulting into a higher concentration of the molecules on the surface. After adsorption there is a decrease in the residual forces due to bond formation ΔG , $\Delta H \& \Delta S$ all are negative in the case of adsorption.

Question101

Match the catalysts to the correct processes:

Catalyst	Process
(A) $TiCl_4$	(i) Wacker process
(B) <i>Pd Cl</i> ₂	(ii) Ziegler - Nattapolymerization
(C) z	(iii) Contact process
(D) V ₂ O ₅	(iv) Deacon's process

[2015]

Options:

- A. (A) (ii), (B) (iii), (C) (iv), (D) (i)
- B. (A) (iii), (B) (i), (C) (ii), (D) (iv)
- C. (A) (iii), (B) (ii), (C) (iv), (D) (i)
- D. (A) (ii), (B) (i), (C) (iv), (D) (iii)

Answer: D

Solution:

Solution: (A) - (ii), (B) - (i), (C) - (iv), (D) - (iii)

Question102

Under ambient conditions, which among the following surfactants will

form micelles in aqueous solution at lowest molar concentration? [Online April 11, 2015]

Options:

- A. $CH_3 (CH_2)_8 COO Na^+$
- B. $CH_{3}(CH_{2})_{11}^{*}N(CH_{3})_{3}Br$
- C. $CH_3 (CH_2)_{13} OSO_3^{-}Na^{+}$
- D. $CH_3(CH_2)_{15}^{\oplus} (CH_3)_3 Br$

Answer: D

Solution:

Solution:

Greater the surface area, greater the van der waal forces of attraction and therefore at lesser concentration micelle formation will take place. In case of $CH_3(CH_2)_{15}N(CH_3)_3Br^-$ due to greater chain length, greater will be van der waal forces.

Question103

The coagulating power of electrolytes having ions N a⁺, Al ³⁺ and Ba²⁺ for arsenic sulphide sol increases in the order : [2013]

Options:

- A. Al $^{3+}$ < Ba $^{2+}$ < N a $^{+}$
- B. N $a^+ < Ba^{2+} < Al^{3+}$
- C. $Ba^{2+} < Na^{+} < Al^{3+}$
- D. Al $^{3+}$ < N a⁺ < Ba²⁺

Answer: B

Solution:

According to Hardy Schulze rule, greater the charge on cation, greater is its coagulating power for negatively charged sol (As_2S_3), hence the correct order of coagulating power : N a⁺ < Ba²⁺ < Al³⁺

Question104

The migration of dispersion medium under the influence of an electric

potential is called: [Online April 9,2013]

Options:

- A. Cataphoresis
- B. Electroosmosis
- C. Electrophoresis
- D. Sedimentation

Answer: B

Solution:

Solution:

The motion of a liquid through a membrane under the influence of an applied electric field is known as electroosmosis.

Question105

Flocculation value of BaCl₂ is much less than that of K Cl for sol A and flocculation value of N a_2SO_4 is much less than that of N aBr for sol B. The correct statement among the following is: [Online April 22, 2013]

Options:

A. Both the sols A and B are negatively charged.

- B. Sol A is positively charged and Sol B is negatively charged.
- C. Both the sols A and B are positively charged.
- D. Sol A is negatively charged and sol B is positively charged.

Answer: B

Solution:

Solution:

In first case the given compounds have same anion but different cations having different charge hence they will precipitate negatively charged sol i.e. ' A⁺. In second case the given compounds have similar cation but different anion with different charge. Hence they will precipitate positively charged sol. i.c. 'B'.

Question106

Smoke is an example of: [Online April 23, 2013]

Options:

- A. Solid dispersed in solid
- B. Gas dispersed in liquid
- C. Solid dispersed in gas
- D. Gas dispersed in solid

Answer: C

Solution:

Solution: Smoke is an example of solid particles dispersed in gas.

Question107

According to Freundlich adsorption isotherm which of the following is correct? [2012]

Options:

A.
$$\frac{x}{m} \propto p^0$$

B.
$$\frac{x}{m} \propto p^1$$

C.
$$\frac{x}{m} \propto p^{\frac{1}{n}}$$

D. All the above are correct for different ranges of pressure

Answer: D

Solution:

The Freundlich adsorption isotherm is mathematically represented as

 $\frac{x}{m} = kp^{1/n}$ At high pressure, 1 / n = 0 Hence, x / m \propto p° At low pressure, 1 / n = 1 Hence, x / m \propto p¹

Question108

If x is the mass of the gas adsorbed on mass m of the adsorbent at pressure p, Freundlich adsorption isotherm gives a straight line on plotting

[Online May 7, 2012]

Options:

A. $\frac{x}{m}$ vs p

B.
$$\frac{x}{m}$$
 vs $\frac{1}{p}$

C. $\log \frac{x}{m}$ vs $\log p$

D. $\log \frac{x}{m}$ vs p

Answer: C

Solution:

Solution:

Freundlich adsorption isotherm gives straight line on plotting $\log x$ / m vs $\log p$ as show below



Question109

The correct statement for both the processes of physisorption and chemisorption is [Online May 12, 2012]

Options:

A. both are endothermic

B. chemisorption is endothermic but physisorption is exothermic

C. both are exothermic

D. physisorption is endothermic but chemisorption is cxothermic.

Answer: C

Solution:

Solution: Both are exothermic.

Question110

On addition of 1mL of 10% N aCl solution to 10mL gold sol in the presence of 0.025g of starch, the coagulation is just prevented. Starch has gold number [Online May 19, 2012]

Options:

- A. 2.5
- B. 25
- C. 0.25
- D. 0.025

Answer: A

Solution:

We have to know that, the Gold Number is the base weight (in milligrams) of a defensive colloid needed to forestall the coagulation of 10 mL of a standard hydro gold sol when 1 ml of a 10% sodium chloride arrangement is added to it. It was first utilized by Richard Adolf Zsigmondy. An electrical twofold layer is ordinarily present on the gold sol particles, bringing about electrostatic repugnance between the particles. The sodium chloride particles upset this electrical twofold layer, making coagulation happen.

The coagulation of gold sol brings about an increment in molecule size, demonstrated by a shading change from red to blue or purple. The higher the gold number, the lower the defensive force of the colloid, in light of the fact that a more noteworthy measure of colloid is needed to forestall coagulation.

In the given details, the measure of starch is added to 10 mL of gold sol, which is needed to forestall coagulation of 1 mL of 10%NaCl = 0.0250g = 25 mg. At the point when the starch is needed to be added to 10 mL to gold sol totally. Forestall coagulation by 1 mL of 10%NaCl arrangement. Therefore,

 $=\frac{25}{100} \times 10 = 2.5$ mg

The gold number of starch is 2.5.

Question111

Fog is a colloidal solution of [Online May 19,2012]

Options:

- A. solid particles dispersed in gas
- B. solid particles dispersed in a liquid
- C. liquid particles dispersed in gas
- D. gaseous particles dispersed in a liquid

Answer: C

Solution:

Which of the following statements is incorrect regarding physisorptions? [2009]

Options:

- A. More easily liquefiable gases are adsorbed readily.
- B. Under high pressure, it results into multi-molecular layer on adsorbent surface.
- C. Enthalpy of adsorption ($\Delta H_{adsorption}$) is low and positive.
- D. It occurs because of van der Waal's forces.

Answer: C

Solution:

Solution:

Physiosorption is an exothermic process, so ΔH will always be negative.

Question113

Gold numbers of protective colloids A, B, Cand D are 0.50, 0.01, 0.10 amd 0.005, respectively. the correct order of their protective powers is [2008]

Options:

- A. D < A < C < B
- B. C < B < D < A
- C. A < C < B < D
- D. B < D < A < C

Answer: C

Solution:

Solution: For a protective colloid. Protective power $\propto \frac{1}{\text{Gold number}}$ Thus the correct order of protective power of A, B, C and D is

Question114

In Langmuir's model of adsorption of a gas on a solid surface [2006]

Options:

A. the mass of gas striking a given area of surface is proportional to the pressure of the gas

B. the mass of gas striking a given area of surface is independent of the pressure of the gas

C. the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered

D. the adsorption at a single site on the surface may involve multiple molecules at the same time

Answer: A

Solution:

Solution:

According to Langmuir's model of adsorption of a gas on a soild surface, the mass of gas adsorbed (x) per gram of the adsorbent (m) is directly proportional to the pressure of the gas (p) at constant temperature, i.e.

 $\frac{x}{m} \propto p$

Question115

The volume of a colloidal particle, V $_{\rm C}$ as compared to the volume of a solute particle in a true solution V $_{\rm S}$, could be [2005]

Options:

A.
$$\frac{V_{C}}{V_{s}} \approx 10^{3}$$

B.
$$\frac{V_C}{V_S} \approx 10^{-3}$$

C.
$$\frac{V_C}{V_S} \approx 10^{23}$$

D.
$$\frac{V_{C}}{V_{S}} \approx 1$$

Answer: A

Solution:

Solution:

Particle size of colloidal particle 10A to 1000A. Let it be 10mu For a true solution diameter range is 1A – 10Å, taking lower limits. V $_c=\frac{4}{3}\pi r^3$
$V_{c} = \frac{4}{3}\pi(10)^{3}$ $V_5 = \frac{4}{3}\pi(1)^3$ $\therefore \frac{V_c}{V_c} = 10^3$

Question116

The disperse phase in colloidal iron (III) hydroxide and colloidal gold is positively and negatively charged, respectively. Which of the following statements is NOT correct? [2005]

Options:

A. Magnesium Chloride solution coagulates gold sol readily than iron (III) hydroxide sol.

B. Sodium sulphate solution causes coagulation in both sols.

C. Mixing of two sols has no effect.

D. Coagulation in both sols can be brought about by electrophoresis.

Answer: C

Solution:

Solution:

We know a negatively charged gold solution is coagulated by a Magnesium Chloride solution readily than positively charged iron (III) hydroxide solution. Also, in Magnesium chloride, the charge on cation is twice the charge on the anion. Higher is the charge on ion, higher will be its coagulating power.

Also we have studied that Sodium sulphate solution causes coagulation in both solutions. Negatively charged gold sol is coagulated by sodium ions and positively charged iron (III) hydroxide sol is coagulated by sulphate ions.

The dispersed phase in colloidal gold and colloidal iron (III) hydroxide is negatively and positively charged respectively. Mutual Coagulation is affected when two solutions are mixed.. This is due to neutralization of the charge on one sol by opposite charge on another sol.

By electrophoresis, coagulation in both the solutions can be brought. We know that, during electrophoresis, through the colloidal solution an electric current is passed and the experiment is arranged in such a manner that only particles can move.

After studying above points, we can conclude that option A, B and D are correct and C is incorrect.

Question117

Identify the correct statement regarding enzymes [2004]

Options:

A. Enzymes are specific biological catalysts that cannot be poisoned

B. Enzymes are normally heterogeneous catalysts that are very specific in their action

C. Enzymes are specific biological catalysts that can normally function at very high temperatures(T 1000K $\,)$

D. Enzymes are specific biological catalysts that possess well-defined active sites

Answer: D

Solution:

Enzymes are very specific biological catalysts possessing well - defined active sites

Question118

Which one of the following characteristics is not correct for physical adsorption? [2003]

Options:

- A. Adsorption increases with increase in temperature
- B. Adsorption is spontaneous
- C. Both enthalpy and entropy of adsorption are negative
- D. Adsorption on solids is reversible

Answer: A

Solution:

Physical adsorption is inversely proportional to the temperature, as the temperature increases adsorption decreases.

Question119

The formation of gas at the surface of tungsten due to adsorption is the reaction of order [2002]

Options:

A. 0

- B. 1
- C. 2
- D. insufficient data.

Answer: A

Solution:

Adsorption on metal surface do not depends on concentration of gas i.e. zero order reaction.
