CHEMISTRY

PHYSICAL, INORGANIC, AND ORGANIC CHEMISTRY

SOLID STATE

Physical Chemitry Solid State

1. Sodium $(Na = 23)$ crystallizes in bcc arrangement with the interfacial separation

between the atoms at the edge $53.6 \pm$. The density of sodium crystal is :

A. $2.07 g / cc$

B. $2.46 g / cc$

C. $1.19 g / cc$

D. none of these

Answer: 3

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2. In F.C.C. arrangement of identical spheres, distance between two nearest octahedral void is $89.51A$. The distance between two nearest tetrahedral voids would be ?

A. $6A$

B. $9A$

C. $12A$

D. $30A$

Answer: 1

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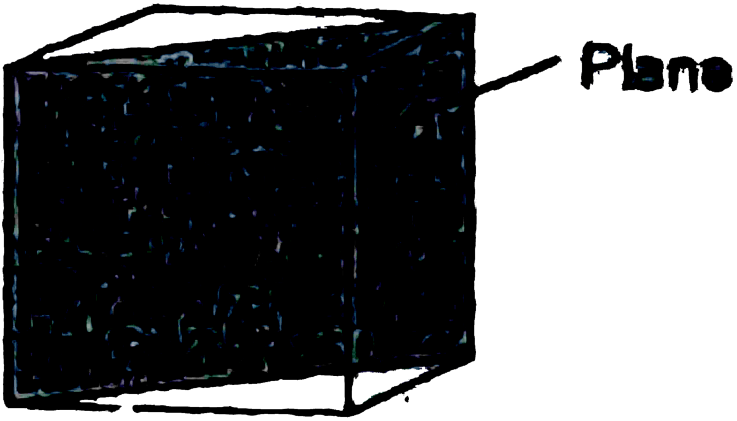
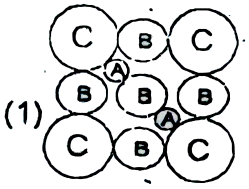
3. In a hypothetical solid C atoms form C C P lattice with A atoms occupying all the Tetrahedral Voids and B atoms occupying all the octahedral voids A and B atoms are of the appropriate size such that there is no distortions in the CCP lattice. Now if a plane is

cut (as shown) then the section would like



A.



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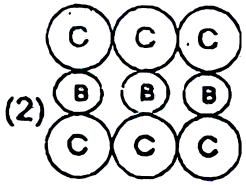

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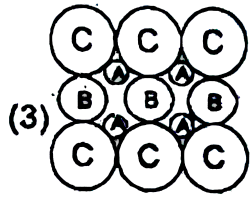

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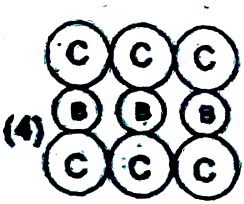

Answer: C

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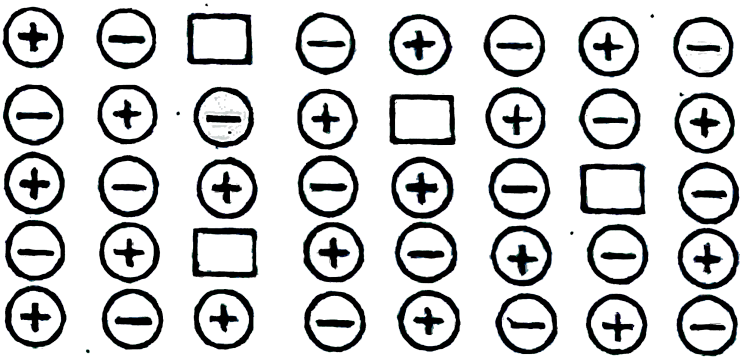
4. Which of the following is incorrect



A. The defect is known as schottky defect

B. Density of compound in the defect decreases

C. $NaCl(s)$ is example which generally shows this defect

D. Stoichoimetry of compound will change slightly.

Answer: 4

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5. In the fluorite structure if the radius ratio is $\left(\sqrt{\frac{3}{2}}-1\right)$, how many ions does each cation touch ?

A. 4 anions

B. 12 cations

C. 8 anions

D. No cations

Answer: 2

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6. The density of KBr is $2.75gm/cc$ length of the unit cell is $654\pm$ (atomic masses of $K=38, Br=80)$ then what is true about the predicted nature of the solid

A. Solid has F.C.C structure with co $-$ ordination number $=6$

B. Solid has simple cubic structure with co $-$ ordination number $=4$

C. Solid has F.C.C. structure with co $-$ ordination numbers -1

D. None of these

Answer: 1

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7. A hypothetical ionic compound $AB(mol.Wt. = 240g/mole)$, having co $-$ ordination number of anion equal to 6, has a closest anion $-$ anion distance of $4\sqrt{2}A$. Determine the density of ionic compound AB in gm/cc

A. 6.24

B. 3.12

C. 1.56

D. 0.78

Answer: 2

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8. An fcc lattice has a lattice parameter $a = 400$ pm. Calculater the molar volume of the lattice including all the empty space.

A. $10.8mL$

B. $96mL$

C. $8.6mL$

D. $9.6mL$

Answer: 4

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9. A metal crystallizes into two cubic phases, face-centred cubic and body-centred cubic, which have unit cell lengths 3.5 and $3.0A$,

respectively. Calculate the ration of densities of fcc and bcc.

A. 3.12

B. 2.04

C. 1.26

D. 0.72

Answer: 3

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10. The arranegement $ABC, ABC, ABC \ldots\ldots$ is referred as

A. Octahedral close packing

B. hexagonal close packing

C. tetrahedral close packing

D. cubic close packing

Answer: 4

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11. Following three planes (P_1, P_2, P_3) in an FCC unit cell are shown :

Consider the following statement and choose the correct option that follow :

(i) P_1 contains no voids of three dimensions.

(ii) P_2 contains only Octahedral voids.

(iii) P_3 contains both Octahedral and Tetrahedral voids.

A. All are true

B. Only $(i)\&(ii)$ are true

C. $(i)\&(iii)$ are true

D. Only (iii) is true.

Answer: 1

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12. KCl has $NaCl$ type face centred cubic crystal structure and CsF has $CsCl$ type cubic crystal structure. Calculate the ratio of densities of CsF and KCl it is given that the

molar mass of CsF is two that of KCl and edge length of KCl unit cell of 1.5 times that for CsF.

A. 1.68

B. 2.72

C. 3.12

D. 4.62

Answer: 1

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13. In an ionic solid $r_{(+)} = 1.6A$ and $r_{(-)} = 1.864A$. Use the radius ratio to determine the edge length of the cubic unit cell in A.

A. 4

B. $2\sqrt{3}$

C. $3\sqrt{3}$

D. $\frac{4}{\sqrt{3}}$

Answer: 1

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14. A crystal is made up of particals X, Y, and Z. X froms f packing. Y occupies all octahedral voids of X and Z occupies all tetrahedral voids of X. If all the particles along one body diagonal are removed. Then the fromula of the crystal would be

A. XYZ_2

B. X_2YZ_2

C. $X_8Y_4Z_5$

D. $X_5Y_4Z_8$

Answer: 4

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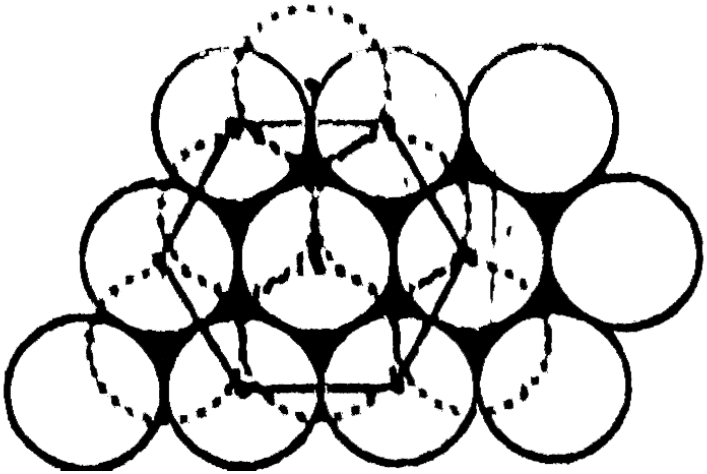
15. In hexagonal close packing of shpere in three dimesions, which of the following statements is correct.



A. In one unit cell there are 12 octahedral voids and all are completely inside the unit cell.

B. In one unit cell are six oxtahedral voids and allare completely inside the unit cell.

C. In one unit cell are six octahedral void and of which three are completely inside the unit cell and other three are partially inside the unit cell.

D. In one unit cell there are 12 tetrahedral voids, all are completely inside the unit cell.

Answer: B

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16. An alloy of copper and gold crystallizes in cubic lattic, in which the $Au-$ atoms occupy the lattice points at the corners of cube and

$Cu-$ atoms occupy the centre of each face.

The formula of this alloy is :

A. $AuCu$

B. Au_3Cu

C. $AuCu_3$

D. $AuCu_2$

Answer: 3

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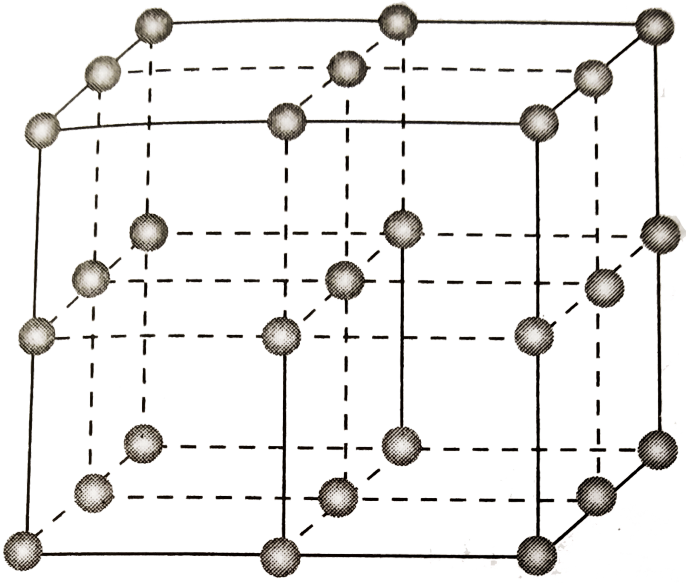
17. The following diagram shows the arrangement of lattice points with $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$. Choose the correct



options.

A. The arrangement is SC with each lattice point surrounded by 6 nearest

neighbours.

B. The arrangement is SC with each lattice point surrounded by 8 nearest neighbouts.

C. The arrangement is FCC with each lattice point surrounded by 12 nearest neighbours.

D. The arrangement in BCC with each lattice point surrounded by 8 nearest neighbours.

Answer: 1

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18. The silver perchlorate benzene complex, $AgClO_4.C_6H_6$ is orthorhombic with unit cell dimensions $a_0 = 7.96, b_0 = 8.34$ and $, c_0) = 11.7\text{Å}$. The formula weight is 285 and there are four molecules per unit cell. Calculate the density of the crystal.

A. $2.44g/cm^3$

B. $24.4g/cm^3$

C. $3.5g/cm^3$

D. $34.4g/cm^2$

Answer: 1

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19. $CsBr$ has bcc stucture with edge length 4.3 pm .The shortest interionic distance in between Cs and Br is

A. 3.72

B. 1.86

C. 7.44

D. 4.3

Answer: 1

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20. A solid has a $b.c.c.$ structure . If the distance of closest approach between the two

atoms is 1.73Å. The edge length of the cell is

:

A. $\sqrt{2}pm$

B. $\sqrt{(3/2)}pm$

C. $200pm$

D. $142.2pm$

Answer: 3

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21. The radius of the metal atom can be expressed in terms of the length of a unit cell is :

A. it is $a/2$ for simple cubic lattice

B. it is $\left(\sqrt{3}a/4\right)$ for b.c.c. lattice

C. it is $\left(a/2\sqrt{2}\right)$ for F.C.C. lattice

D. All of the above

Answer: 4

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22. The fraction of total volume occupied by atoms in a simple cube is

A. $\pi / 6$

B. $\sqrt{3\pi} / 8$

C. $\sqrt{2\pi} / 6$

D. $\pi / 3$

Answer: 1

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23. Lithium borohydride crystallizes in an orthorhombic system with 4 molecule per unit cell. The unit cell dimensions are $a = 6.8\text{Å}, b = 4.4\text{Å}$ and $c = 7.2\text{Å}$. If the molar mass is 21.76, calculate density of crystal.

A. $0.6708gcm^{-2}$

B. $1.6708gcm^{-3}$

C. $2.6708gcm^{-3}$

D. None of these

Answer: 1

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24. Tetragonal crystal system has the following unit cell dimensions :

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

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

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

D. $a = b \neq c$ and $\alpha = \beta = 90^\circ, \gamma = 120^\circ$

Answer: A

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25. The most unsysmmetrical and the most symmetrical crystal systems based on lattice parameters $(i.e.,$ unit cell lengths and angles $)$, are respectively represented by the examples.

A. $CuSO_4, 5H_2O, NaCl$

B. Monoclinic sulphur, diamond

C. rhombic sulphur,$NaCl$

D. diamond ,$NaCl$

Answer: N/A

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26. Three elements P, Q and R crystallize in a cubic solid lattice. The P atoms occupy the corners. Q aroms the cube centres and R atoms the edges. The formula of the compound is

A. PQR

B. PQR_2

C. PQR_3

D. PQ_3R

Answer: 3

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27. In the fcc arrangement of A and B atoms whose A atoms are at corners of the unit cell and B are at the face centres one of the A

atom is missing from one corner in each unit cell. What is the simplest formula of the compound?

A. A_7B_3

B. AB_3

C. A_7B_{24}

D. A_2B_3

Answer: C

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28. How many 'nearest' and 'next nearest' neighbours respectively does sodium have in f.c.c. lattice

A. $8, 8$

B. $12, 6$

C. $6, 8$

D. $8, 2$

Answer: 2

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29. if a metal has a bcc crystal structure, the coordination number is 8,because :

A. each atom touches four atoms in the layer above it, four in the layer below it and none in its own layer

B. each atom touches four atoms in the layer above it, four in the laayer below it and one in its own layer

C. two atoms touch four atoms in the layer above them, four in the layer below

them, and none in their own layer.

D. each atom touches eight atoms in the layer above it, eight in the layer below it and none in its own layer

Answer: 1

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30. In a ccp structure, the :

A. first and third layers are repeated

B. first and fourth layers are repeated

C. second and fourth layers are repeated

D. first, third and sixth layers are repeated

Answer: 2

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31. The numbers of tetrahedral and octahedral holes in a ccp array of 100 atoms are respectively

A. 200 and 100

B. 100 and 200

C. 200 and 200

D. 100 and 100

Answer: 1

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32. In a face centred cubic arrangement of metallic atoms, what is the relative ratio of the sizes of tetrahedral and octahedral voids ?

A. 0.543

B. 0.732

C. 0.414

D. 0.637

Answer: 1

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33. An element $X(At, wt = 80g/mol)$ having fcc structure, calculate the number of unit cells in $8gofX$

A. $9.4 \times N_A$

B. $0.1 \times N_A$

C. $4 \times N_A$

D. none of these

Answer: 4

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34. The atomic radius of strontium (Sr) is $215pm$ and it crystallizes with a cubic. Closest packing . Edge length of the cube is :

A. $430pm$

B. $608.2pm$

C. $496.53pm$

D. none of these

Answer: 2

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35. In the spinel structure, oxides ions are cubical $-$ closest packed whereas $1/8th$ of tetrahedral voids are occupied by A^{2+} cation

and $1/2$ of octahedral voids are occupied by B^{2+} cations. The general formula of the compound having spinel structure is :

A. $A_2B_2O_4$

B. AB_2O_4

C. $A_2B_4O_2$

D. $A_4B_2O_2$

Answer: B

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36. Select the incorrect statement :

A. Stoichiometry of crystal remains uneffected due to Schottky defect.

B. Frenkel defect usually shown by ionic compounds havin low coordination number.

C. $F-$ centres generation is responsible factor for imparting the colour to the crystal

D. Density of crystal always increases due to substitutional impurity defect.

Answer: 4

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37. When $NaCl$ is dopped with 10^{-8} mole $\%$ of $SrCl$. What is the no. of cationic vacancies?

A. $10^{-5} \times N_A$

B. $10^{-7} \times N_A$

C. $2 \times 10^{-7} N_A$

D. None of these

Answer: 2

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38. The ionic radii for Na^+ and Br^- ions a 1.012Å and 1.973Å respectively. What the coordination number of Na^+ is predictaed on the basis of the radii ratio. $\frac{r_+}{r_-}$?

A. 6

B. 8

C. 4

D. 2

Answer: 1

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39. The size of Cl^- ion is 1.8Å . The size of a cation for which a change in coordination just

becomes possible from 6 to 8 in an ideal ionic crystal would be :

A. 0.7452Å

B. 1.3176Å

C. 0.405Å

D. 1.8Å

Answer: 2

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40. Li forms a body-centred cubic lattice. If the edge of the cube is $3.5 \times 10^{-10} m$ and the density is $5.3 \times 10^{2} kgm^{-3}$, calculate the percentage occupancy of Li metal.

A. $25.78\ \%$

B. $1.54 g / cm^{2}$

C. $3.4 g / c^{3}$

D. $5.4 g / cm^{3}$

Answer: D

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41. Calcium crystallises in a face $-$ centred cubic unit cell with $a = 556nm$. Calculate the density if it contained $0.1\ \%$ Vaccancy defects.

A. $1.90g/cm^3$

B. $1.54g/cm^3$

C. $3.4g/cm^3$

D. $5.4g/cm^3$

Answer: 2

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42. How many 'nearest' and ' next nearest' neighbours respectively does potassium have in s.c. lattice

A. $8, 8$

B. $6, 12$

C. $6, 8$

D. $8, 2$

Answer: 2

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43. An fcc lattice has a lattice parameter $a = 400$ pm. Calculater the molar volume of the lattice including all the empty space.

A. $19.8mL$

B. $96mL$

C. $8.6mL$

D. $9.6mL$

Answer: 4

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44. Copper has a face – centred cubic structure with a unit – cell edge length of 3.61Å. What is the size of the largest atom which could fit into the intersectices of the copper lattice without distorting if ?

A. 0.53Å

B. 0.33Å

C. 0.58Å

D. 0.13Å

Answer: 1

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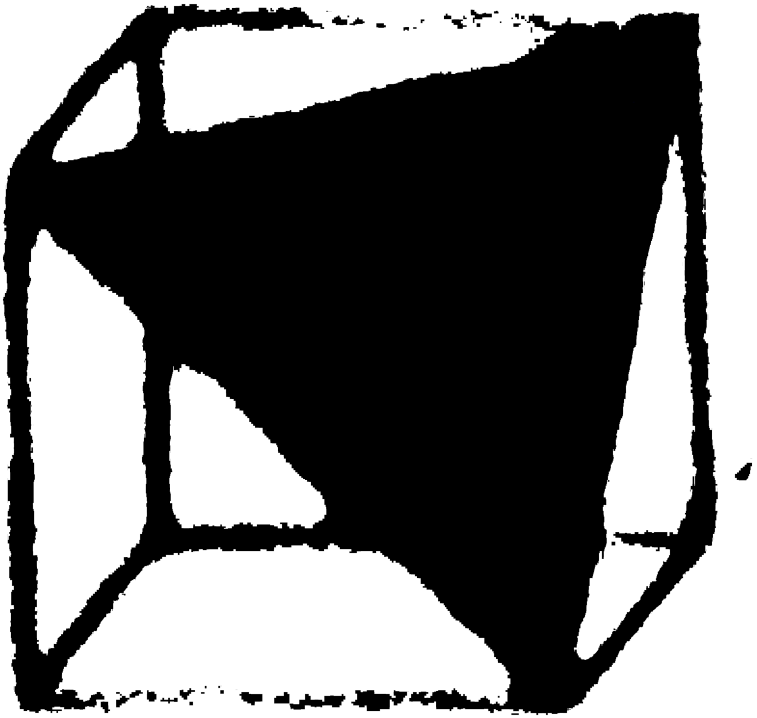
45. Consider the plane shown in the figure :



A rock sale $(NaCl)$ lattice is cut across this plane in which anions occupy fcc positions. It passes through centers of how many cations ?

A. zero

B. 4

C. 6

D. 12

Answer: 1

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