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CHEMISTRY · JEE MAIN

# States of Matter

## Previous Year Questions with answers

**169** questions · **136** papers · **2002–2024** · newest paper first

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**What is in this PDF:** every States of Matter question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

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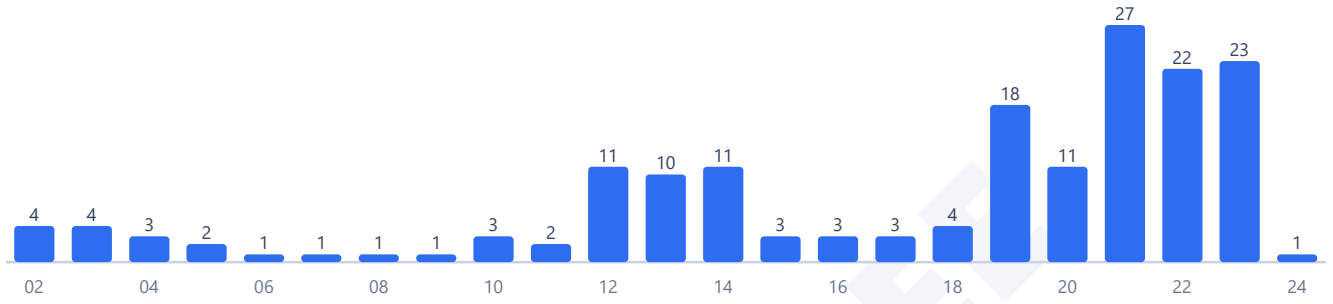
# Chapter at a glance

| 2.2% | 169 | 98 of 162 | 117 / 52 |
|---|---|---|---|
| of Chemistry questions, 2019–2026 | questions, 2002–2024 | papers asked it, 2019–2026 | MCQ / numerical, 2002–2024 |

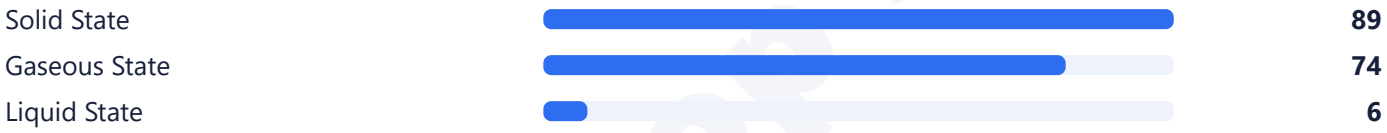
**Trend.** Falling: 0.7 questions per paper in 2022–2024 against 1 in 2019–2021.

### Questions per year




Counts are the questions we hold: 169 in 136 papers. 2 questions in this chapter came back in more than one paper.

### Most-asked topics in this chapter (2002–2024)




## How often it comes up

States of matter was formerly in the Class 11 chemistry curriculum before being removed in 2024, holding rank 22 among 31 chemistry chapters with a 2.2 percent share of total chemistry questions. Throughout the computerized testing period from 2019 to 2026, candidates tackled 102 questions across 162 papers, giving an average frequency of 0.6 questions per shift. The chapter featured in 98 of those 162 papers. Because it was removed from the official syllabus in 2024, testing declined sharply: only 1 question appeared across 58 papers in the 2024 to 2026 stretch, representing a 0.1 percent share and registering zero questions in 2025 and 2026. The chapter's share is down compared to both the 5.0 percent share in the 2002 to 2018 window and the 2.2 percent share across 2019 to 2026. Between 2019 and 2026, 52 questions were set in numerical answer format, reflecting heavy historical testing on unit cell densities, void numbers, and partial gas pressures.

## Most-asked topics

Questions in this chapter divide across three physical states:

- **Solid State**: 89 questions historically, with 56 appearing between 2019 and 2026, last tested in 2024. This area assesses primitive, body-centered, and face-centered cubic unit cells, packing efficiencies, tetrahedral and octahedral void enumerations in close-packed lattices, Bragg's law, non-stoichiometric defects in metal oxides, and density calculations.
- **Gaseous State**: 74 problems overall, including 43 from 2019 to 2026, last asked in 2023. Core concepts explore Boyle's and Charles's laws, Dalton's law of partial pressures, Graham's law of diffusion, Maxwell-Boltzmann molecular speed distributions, critical constants, and van der Waals parameters.
- **Liquid State**: 6 lifetime questions, with 3 between 2019 and 2026, last tested in 2023. Themes evaluate vapor pressure variations with temperature, surface tension, capillary action, and dynamic viscosity coefficients.

## What the questions look like

Past examination questions from this chapter featured structured crystal geometry and equation-of-state calculations:

- **Crystal formula from fractional site occupancies**: Atoms of element X occupy alternate corners and the body center of a cube, while atoms of element Y occupy one-third of the face centers, requiring determination of the empirical formula.
- **Non-stoichiometric metal-deficiency defects**: Analyzing transition metal oxides such as iron oxide to calculate the relative percentages of divalent and trivalent cations maintaining charge neutrality.
- **Compressibility factor interpretations**: Evaluating real gas deviations on compressibility factor plots against pressure under low-pressure and high-pressure regimes.
- **Total interstitial voids in metal lattices**: Calculating the absolute count of tetrahedral and octahedral voids present in a specified molar quantity of a hexagonal close-packed metal.

## How to practise it

Because states of matter has been removed from the JEE Main syllabus, aspirants should not devote core preparation time to this chapter.

If preparing for other competitive examinations that still include gaseous state or solid state, focus on unit cell density calculations using edge length a and formula units Z. Understand that face-centered cubic lattices contain four formula units with octahedral and tetrahedral voids in one-to-two ratios.

For real gases, practice evaluating van der Waals equations at low pressures where intermolecular attractions dominate and compressibility factor Z is less than one, and at very high pressures where molecular volume dominates and Z exceeds one.

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**Q1** JEE Main 2024 · 6 Apr · Shift 1 MCQ

Which of the following material is not a semiconductor.

(A) Silicon
(B) Copper oxide
(C) Germanium
(D) Graphite

**Answer: (D) Graphite** · Key from source paper

**Q2** JEE Main 2023 · 15 Apr · Shift 1 MCQ

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

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

**Answer: (B)** $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}}{2}a$ · Key from source paper

**Q3** JEE Main 2023 · 13 Apr · Shift 1 Numerical

A certain quantity of real gas occupies a volume of 0.15 $dm^3$ at 100 atm and 500 K when its compressibility factor is 1.07. Its volume at 300 atm and 300 K (When its compressibility factor is 1.4) is _____ $\times 10^{-4}$ $dm^3$ (Nearest integer)

Numerical value type: the answer is a number.

**Answer: 393.** · Checked by our team

**Q4** JEE Main 2023 · 13 Apr · Shift 2 Numerical

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

Numerical value type: the answer is a number.

**Answer: 17.** · Key from source paper

**Q5** JEE Main 2023 · 12 Apr · Shift 1 Numerical

At 600 K, the root mean square (rms) speed of gas X (molar mass = 40) is equal to the most probable speed of gas Y at 90 K. The molar mass of the gas Y is _____ $g\ mol^{-1}$. (Nearest integer)

Numerical value type: the answer is a number.

**Answer: 4.** · Key from source paper

**Q6** JEE Main 2023 · 11 Apr · Shift 1 Numerical

An atomic substance A of molar mass $12\ \mathrm{g\ mol^{-1}}$ 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 $3.0\ \mathrm{g\ m\ m^{-1}}$ and $N_A = 6.02 \times 10^{23}\ \mathrm{mol^{-1}}$

Numerical value type: the answer is a number.

**Answer: 4.** · Key from source paper

**Q7** JEE Main 2023 · 11 Apr · Shift 2 MCQ

Which one of the following pairs is an example of polar molecular solids?

(A) $\mathrm{SO_2(s), CO_2(s)}$
(B) $\mathrm{SO_2(s), NH_3(s)}$
(C) $\mathrm{MgO(s), SO_2(s)}$
(D) $\mathrm{HCl(s), AlN(s)}$

**Answer: (B)** $\mathrm{SO_2(s), NH_3(s)}$ · Key from source paper

**Q8** JEE Main 2023 · 10 Apr · Shift 1 Numerical

At constant temperature, a gas is at a pressure of $940.3$ mm Hg. The pressure at which its volume decreases by $40\%$ is _____ mm Hg. (Nearest integer)

Numerical value type: the answer is a number.

**Answer: 1567.** · Key from source paper

**Q9** JEE Main 2023 · 10 Apr · Shift 2 MCQ

The correct relationships between unit cell edge length 'a' and radius of sphere 'r' for face-centred and body-centred cubic structures respectively are:

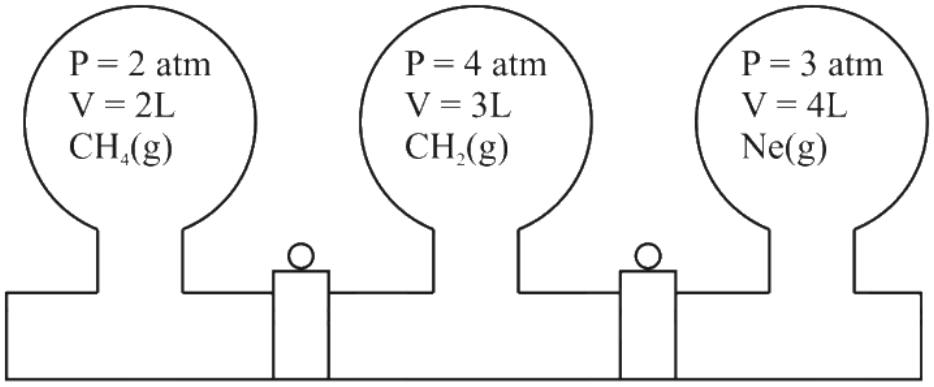
(A) $2\sqrt{2}\,r = a$ and $\sqrt{3}\,r = 4a$
(B) $r = 2\sqrt{2}\,a$ and $4r = \sqrt{3}\,a$
(C) $r = 2\sqrt{2}\,a$ and $\sqrt{3}\,r = 4a$
(D) $2\sqrt{2}\,r = a$ and $4r = \sqrt{3}\,a$

**Answer: (D)** $2\sqrt{2}\,r = a$ and $4r = \sqrt{3}\,a$ · Key from source paper

**Q10** JEE Main 2023 · 8 Apr · Shift 1 Numerical

*see figure*

**Q36.**




Three bulbs are filled with $CH_4$, $CO_2$ and Ne as shown in the picture. The bulbs are connected through pipes of zero volume. When the stopcocks are opened and the temperature is kept constant throughout, the pressure of the system is found to be_____ atm. (Nearest integer).

Numerical value type: the answer is a number.

**Answer: 3.** · Key from source paper

## Q11 JEE Main 2023 · 8 Apr · Shift 2 MCQ

Arrange the following gases in increasing order of van der Waals constant $a$

(A) Ar

(B) $CH_4$

(C) $H_2O$

(D) $C_6H_6$

Choose the correct option from the following.

(A) D, C, B and A

(B) B, C, D and A

(C) C, D, B and A

(D) A, B, C and D

**Answer: (D)** A, B, C and D · Key from source paper

## Q12 JEE Main 2023 · 6 Apr · Shift 1 MCQ

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?

(A) $X_2Y_3$

(B) $X_3Y_2$

(C) $X_3Y$

(D) $XY_3$

**Answer: (A)** $X_2Y_3$ · Key from source paper

**Q13** JEE Main 2023 · 6 Apr · Shift 2 Numerical

Number of crystal systems from the following where body centred unit cell can be found, is _____ .

Cubic, tetragonal, orthorhombic, hexagonal, rhombohedral, monoclinic, triclinic

Numerical value type: the answer is a number.

**Answer: 3.** · Key from source paper

**Q14** JEE Main 2023 · 1 Feb · Shift 1 MCQ

Which of the following represents the lattice structure of $A_{0.95}O$ containing $A^{2+}$, $A^{3+}$ and $O^{2-}$ ions?
Legend: green circle $A^{2+}$, red circle $A^{3+}$, black circle $O^{2-}$

A.

*(see the figure above)*

B.

*(see the figure above)*

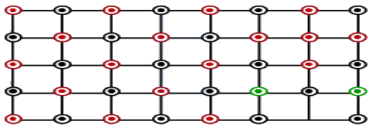
C.

*(see the figure above)*

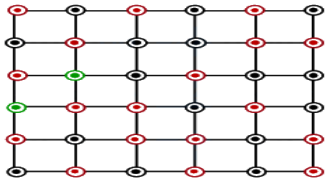
Q37. Which of the following represents the lattice structure of $A_{0.95}O$ containing $A^{2+}$, $A^{3+}$ and $O^{2-}$ ions?

$A^{2+}$ $A^{3+}$ $O^{2-}$

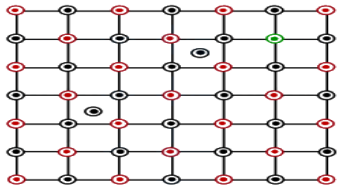
A.



B.



C.



(1) B and C only
(2) B only
(3) A and B only
(4) A only

(A) B and C only
(B) B only
(C) A and B only
(D) A only

**Answer: (D) A only** · Key from source paper

**Q15** JEE Main 2023 · 1 Feb · Shift 2 Numerical

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. 5$\mathrm{\AA}$ respectively. The ratio of densities of lattices fcc to bcc for the metal M is _____ (Nearest integer)

Numerical value type: the answer is a number.

**Answer: 4.** · Key from source paper

**Q16** JEE Main 2023 · 31 Jan · Shift 1 Numerical

The total pressure of a mixture of non-reacting gases X (0.6 $\mathrm{g}$) and Y (0.45 $\mathrm{g}$) in a vessel is 740 $\mathrm{mm}$ of Hg. The partial pressure of the gas X is _____ mm of Hg. (Nearest Integer)
(Given : molar mass X = 20 and Y = 45 $\mathrm{g\ mol^{-1}}$)

Numerical value type: the answer is a number.

**Answer: 555.** · Key from source paper

**Q17** JEE Main 2023 · 31 Jan · Shift 2 Numerical

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

Numerical value type: the answer is a number.

**Answer: 59.** · Key from source paper

**Q18** JEE Main 2023 · 30 Jan · Shift 2 Numerical

Iron oxide FeO, crystallises in a cubic lattice with a unit cell edge length of 5.0$\mathrm{\AA}$. If density of the FeO in the crystal is 4.0 g $\mathrm{cm^{-3}}$, then the number of FeO units present per unit cell is _____ (Nearest integer)
Given : Molar mass of Fe and O is 56 and 16 g $\mathrm{mol^{-1}}$ respectively.
$\mathrm{N_A}$ = 6.0 $\times$ $10^{23}$ $\mathrm{mol^{-1}}$

Numerical value type: the answer is a number.

**Answer: 4.** · Key from source paper

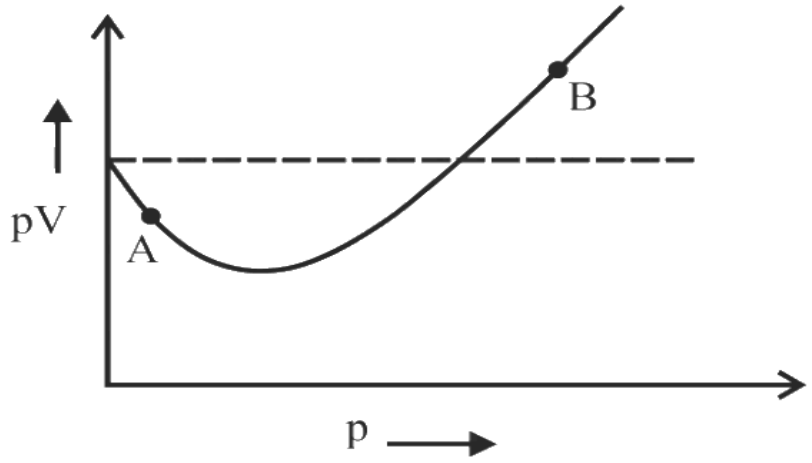
**Q19** JEE Main 2023 · 29 Jan · Shift 1 MCQ

For 1 mol of gas, the plot of pV vs p is shown below. p is the pressure and V is the volume of the gas.

*(see the figure above)*

What is the value of compressibility factor at point $A$?

**Q34.** For 1 mol of gas, the plot of pV vs p is shown below. p is the pressure and V is the volume of the gas.




What is the value of compressibility factor at point $A$?

(1) $1-\frac{a}{RTV}$ (2) $1+\frac{b}{V}$

(3) $1-\frac{b}{V}$ (4) $1+\frac{a}{RTV}$

(A) $1-\frac{a}{RTV}$

(B) $1+\frac{b}{V}$

(C) $1-\frac{b}{V}$

(D) $1+\frac{a}{RTV}$

**Answer: (A)** $1-\frac{a}{RTV}$ · Key from source paper

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## Q20 JEE Main 2023 · 29 Jan · Shift 2 Numerical

A metal M forms hexagonal close-packed structure. The total number of voids in 0.02 mol of it is _____ $\times 10^{21}$ (Nearest integer)

(Given $N_A = 6.02 \times 10^{23}$)

Numerical value type: the answer is a number.

**Answer: 36.** · Key from source paper

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## Q21 JEE Main 2023 · 25 Jan · Shift 1 MCQ

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

(A) $X_2Y_{1.5}$

(B) $X_{1.5}Y$

(C) $XY_{2.5}$

(D) $X_{1.5}Y_2$

**Answer: (B)** $X_{1.5}Y$ · Key from source paper

**Q22** JEE Main 2023 · 25 Jan · Shift 2 Numerical

Based on the given figure, the number of correct statement/s is/are

*(see the figure above)*

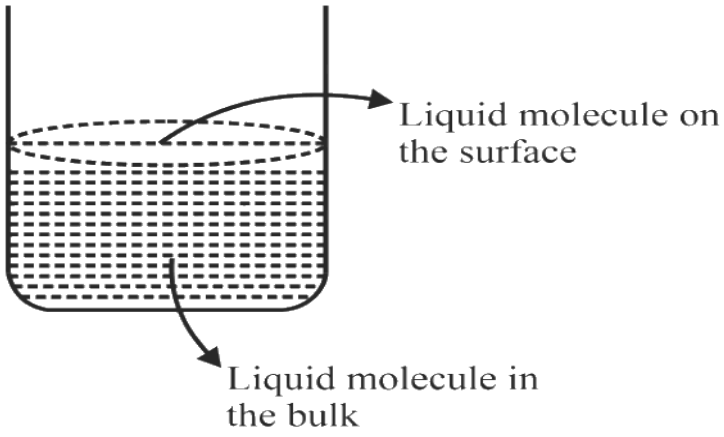
A. Surface tension is the outcome of equal attractive and repulsion forces acting on the liquid molecule in bulk.

B. Surface tension is due to uneven forces acting on the molecules present on the surface.

C. The molecule in the bulk can never come to the liquid surface.

D. The molecules on the surface are responsible for vapour pressure if the system is a closed system.

**Q47.** Based on the given figure, the number of correct statement/s is/are




A. Surface tension is the outcome of equal attractive and repulsion forces acting on the liquid molecule in bulk.
B. Surface tension is due to uneven forces acting on the molecules present on the surface.
C. The molecule in the bulk can never come to the liquid surface.
D. The molecules on the surface are responsible for vapour pressure if the system is a closed system.

Numerical value type: the answer is a number.

**Answer: 2.** · Key from source paper

**Q23** JEE Main 2023 · 24 Jan · Shift 1 Numerical

When $\mathrm{Fe_{0.93}O}$ is heated in presence of oxygen, it converts to $\mathrm{Fe_2O_3}$. The number of correct statement/s from the following is _____.

A. The equivalent weight of $\mathrm{Fe_{0.93}O}$ is $\frac{\text{Molecular weight}}{0.79}$

B. The number of moles of $\mathrm{Fe^{2+}}$ and $\mathrm{Fe^{3+}}$ in 1 mole of $\mathrm{Fe_{0.93}O}$ is 0.79 and 0.14 respectively.

C. $\mathrm{Fe_{0.93}O}$ is metal deficient with lattice comprising of cubic closed packed arrangement of $\mathrm{O^{2-}}$ ions.

D. The % composition of $\mathrm{Fe^{2+}}$ and $\mathrm{Fe^{3+}}$ in $\mathrm{Fe_{0.93}O}$ is 85% and 15% respectively.

Numerical value type: the answer is a number.

**Answer: 4.** · Key from source paper

**Q24** JEE Main 2023 · 24 Jan · Shift 2 Numerical

The number of statement's, which are correct with respect to the compression of carbon dioxide from point (a) in the Andrews isotherm from the following is _____.

*(see the figure above)*

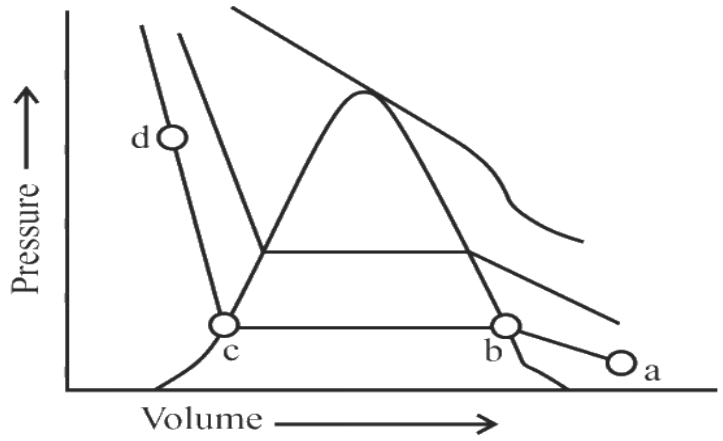
A. Carbon dioxide remains as a gas upto point (b)

B. Liquid carbon dioxide appears at point (c)

C. Liquid and gaseous carbon dioxide coexist between points (b) and (c)

D. As the volume decreases from (b) to (c), the amount of liquid decreases

**Q34.** The number of statement's, which are correct with respect to the compression of carbon dioxide from point (a) in the Andrews isotherm from the following is _____.




A. Carbon dioxide remains as a gas upto point (b)
B. Liquid carbon dioxide appears at point (c)
C. Liquid and gaseous carbon dioxide coexist between points (b) and (c)
D. As the volume decreases from (b) to (c), the amount of liquid decreases

Numerical value type: the answer is a number.

**Answer: 2.** · Key from source paper

**Q25** JEE Main 2022 · 29 Jul · Shift 1 Numerical

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.

Numerical value type: the answer is a number.

**Answer: 566.** · Key from source paper

**Q26** JEE Main 2022 · 29 Jul · Shift 2 Numerical

'x' g of molecular oxygen $O_2$ is mixed with 200 g of neon Ne. The total pressure of the nonreactive mixture of $O_2$ and Ne in the cylinder is 25 bar. The partial pressure of Ne is 20 bar at the same temperature and volume. The value of 'x' is
[Given: Molar mass of $O_2$ = 32 g $mol^{-1}$. Molar mass of Ne = 20 g $mol^{-1}$]

Numerical value type: the answer is a number.

**Answer: 80.** · Key from source paper

## Q27 JEE Main 2022 · 28 Jul · Shift 1 Numerical

An element M crystallises in a body centred cubic unit cell with a cell edge of $300\text{pm}$. The density of the element is $6.0\ \text{g cm}^{-3}$. The number of atoms present in $180\ \text{g}$ of the element is _____ $\times 10^{23}$. (Nearest integer)

Numerical value type: the answer is a number.

**Answer: 22.** · Key from source paper

## Q28 JEE Main 2022 · 28 Jul · Shift 2 Numerical

Metal M crystallizes into a FCC lattice with the edge length of $4.0 \times 10^{-8}\ \text{cm}$. The atomic mass of the metal is g/ mol.
(Use : $\text{N}_\text{A} = 6.02 \times 10^{23}\ \text{mol}^{-1}$, density of metal, $\text{M} = 9.03\ \text{g cm}^{-3}$)

Numerical value type: the answer is a number.

**Answer: 87.** · Key from source paper

## Q29 JEE Main 2022 · 27 Jul · Shift 1 MCQ

Given below are two statements.
Statement I : $\text{O}_2$, $\text{Cu}^{2+}$ and $\text{Fe}^{3+}$ are weakly attracted by magnetic field and are magnetized in the same direction as magnetic field.
Statement II : NaCl and $\text{H}_2\text{O}$ are weakly magnetized in opposite direction to magnetic field.
In the light of the above statements, choose the most appropriate answer form the options given below

(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) Both Statement I and Statement II are correct.** · Key from source paper

## Q30 JEE Main 2022 · 27 Jul · Shift 2 Numerical

for a real gas at 25 °C temperature and high pressure (99 bar) the value of compressibility factor is 2, so the value of Van 1der Waal's constant 'b' should be _____ $\times 10^{-2}$ L $\text{mol}^{-1}$ (Given R = 0.083 L bar $\text{K}^{-1}\ \text{mol}^{-1}$)

Numerical value type: the answer is a number.

**Answer: 25.** · Key from source paper

**Q31** JEE Main 2022 · 26 Jul · Shift 1 Numerical

A mixture of hydrogen and oxygen contains 40% hydrogen by mass when the pressure is 2.2 bar. The partial pressure of hydrogen is bar.

Numerical value type: the answer is a number.

**Answer: 2.** · Key from source paper

**Q32** JEE Main 2022 · 26 Jul · Shift 2 Numerical

A 10 g mixture of hydrogen and helium is contained in a vessel of capacity $0.0125\ \mathrm{m}^3$ at 6 bar and $27\ ^\circ\mathrm{C}$. The mass of helium in the mixture is _____ g.
(Given : R = $8.3\mathrm{JK}^{-1}\ \mathrm{mol}^{-1}$ (Atomic masses of H and He are 1u and 4u, respectively)

Numerical value type: the answer is a number.

**Answer: 8.** · Key from source paper

**Q33** JEE Main 2022 · 25 Jul · Shift 1 Numerical

The pressure of a moist gas at $27^\circ\mathrm{C}$ is 4 atm. The volume of the container is doubled at the same temperature. The new pressure of the moist gas is _____ $\times 10^{-1}$ atm. (Nearest integer)
(Given: The vapour pressure of water at $27^\circ\mathrm{C}$ is $0.4$ atm)

Numerical value type: the answer is a number.

**Answer: 22.** · Key from source paper

**Q34** JEE Main 2022 · 25 Jul · Shift 2 Numerical

A sealed flask with a capacity of $2\ \mathrm{dm}^3$ contains 11 g of propane gas. The flask is so weak that it will burst if the pressure becomes 2 MPa. The minimum temperature at which the flask will burst is $^\circ\mathrm{C}$. [Nearest integer]
(Given: $\mathrm{R} = 8.3\ \mathrm{J\,K}^{-1}\,\mathrm{mol}^{-1}$. Atomic masses of C and H are 12u and 1u respectively.) (Assume that propane behaves as an ideal gas.)

Numerical value type: the answer is a number.

**Answer: 1655.** · Key from source paper

**Q35** JEE Main 2022 · 29 Jun · Shift 1 Numerical

Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is $0.46\ \mathrm{g\,L}^{-1}$ at $257\ ^\circ\mathrm{C}$ and $100\ \mathrm{mmHg}$. The molar mass of geraniol is (Nearest Integer)
[Given $\mathrm{R} = 0.082\ \mathrm{L\ atm\ K}^{-1}\ \mathrm{mol}^{-1}$]

Numerical value type: the answer is a number.

**Answer: 152.** · Key from source paper

**Q36** JEE Main 2022 · 29 Jun · Shift 2 Numerical

A box contains $0.90\ \mathrm{g}$ of liquid water in equilibrium with water vapour at $27^{\circ}\mathrm{C}$. The equilibrium vapour pressure of water at $27^{\circ}\mathrm{C}$ $32.0$ Torr. When the volume of the box is increased, some of the liquid water evaporates to maintain the equilibrium pressure. If all the liquid water evaporates, then the volume of the box must be _____ litre. [nearest integer]
(Given: $\mathrm{R} = 0.082\ \mathrm{L\ atm\ K^{-1}\ mol^{-1}}$)
(Ignore the volume of the liquid water and assume water vapours behave as an ideal gas.)

Numerical value type: the answer is a number.

**Answer: 29.** · Key from source paper

**Q37** JEE Main 2022 · 28 Jun · Shift 1 MCQ

The incorrect statement about the imperfections in solids is

(A) Schottky defect decreases the density of the substance.
(B) Frenkel defect does not alter the density of the substance.
(C) Interstitial defect increases the density of the substance.
(D) Vacancy defect increases the density of the substance.

**Answer: (D) Vacancy defect increases the density of the substance.** · Key from source paper

**Q38** JEE Main 2022 · 28 Jun · Shift 2 Numerical

100 g of an ideal gas is kept in a cylinder of 416 L volume at $27\ ^{\circ}\mathrm{C}$ under 1.5 bar pressure. The molar mass of the gas is $\mathrm{g\ mol^{-1}}$. (Nearest integer)
(Given : R = 0.083 L bar $\mathrm{K^{-1}\ mol^{-1}}$)

Numerical value type: the answer is a number.

**Answer: 4.** · Key from source paper

**Q39** JEE Main 2022 · 27 Jun · Shift 1 Numerical

Metal deficiency defect is shown by $\mathrm{Fe_{0.93}\ O}$. In the crystal, some $\mathrm{Fe^{2+}}$ cations are missing and loss of positive charge is compensated by the presence of $\mathrm{Fe^{3+}}$ ions. The percentage of $\mathrm{Fe^{2+}}$ ions in the $\mathrm{Fe_{0.93}\ O}$ crystals is _____ (Nearest integer)

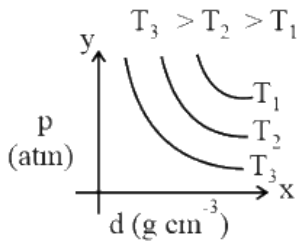
Numerical value type: the answer is a number.

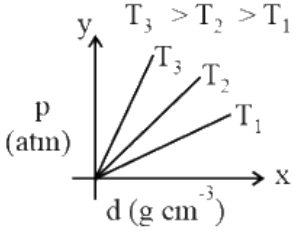
**Answer: 85.** · Key from source paper

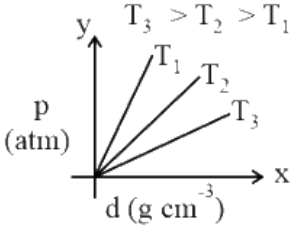
**Q40** JEE Main 2022 · 27 Jun · Shift 2 MCQ

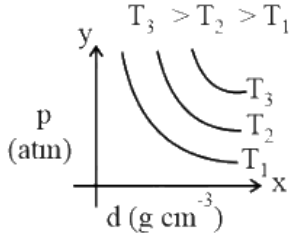
Which amongst the given plots is the correct plot for pressure (p) vs density (d) for an ideal gas?

**Q34.** Which amongst the given plots is the correct plot for pressure (p) vs density (d) for an ideal gas?

(1) 


(2) 


(3) 


(4) 


(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

**Answer: (B)** · Key from source paper

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## Q41 JEE Main 2022 · 26 Jun · Shift 1 MCQ

An evacuated glass vessel weighs $40.0$ g when empty, $135.0$ g when filled with a liquid of density $0.95$ g mL$^{-1}$ and $40.5$ g when filled with an ideal gas at $0.82$ atm at $250$ K. The molar mass of the gas in gmol$^{-1}$ is : (Given : $R = 0.082$ L atmK$^{-1}$ mol$^{-1}$)

(A) 35
(B) 50
(C) 75
(D) 125

**Answer: (D)** 125 · Key from source paper

---

## Q42 JEE Main 2022 · 26 Jun · Shift 2 Numerical

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 $A_xB_y$. The value of x is [nearest integer]

Numerical value type: the answer is a number.

**Answer: 3.** · Key from source paper

---

## Q43 JEE Main 2022 · 25 Jun · Shift 1 Numerical

The distance between $Na^+$ and $Cl^-$ ions in solid NaCl of density $43.1$ g cm$^{-3}$ is _____ $\times 10^{-10}$ m. (Nearest Integer)

(Given : $N_A = 6.02 \times 10^{23}\ mol^{-1}$)

Numerical value type: the answer is a number.

**Answer: 1.** · Key from source paper

---

**Q44** JEE Main 2022 · 25 Jun · Shift 2 Numerical

A rigid nitrogen tank stored inside a laboratory has a pressure of $30\ atm$ at $06:00\ am$ when the temperature is $27\ ^\circ C$. At $03:00 pm$, when the temperature is $45\ ^\circ C$, the pressure in the tank will be _____ atm. [nearest integer]

Numerical value type: the answer is a number.

**Answer: 32.** · Key from source paper

---

**Q45** JEE Main 2022 · 24 Jun · Shift 1 Numerical

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)

Numerical value type: the answer is a number.

**Answer: 43.** · Key from source paper

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**Q46** JEE Main 2022 · 24 Jun · Shift 2 Numerical

At $300\ K$, a sample of $3.0\ g$ of gas A occupies the same volume as $0.2\ g$ of hydrogen at $200\ K$ at the same pressure. The molar mass of gas A is g $mol^{-1}$. (nearest integer) Assume that the behaviour of gases as ideal. (Given: The molar mass of hydrogen $(H_2)$ gas is $2.0\ g\ mol^{-1}$.)

Numerical value type: the answer is a number.

**Answer: 45.** · Key from source paper

---

**Q47** JEE Main 2021 · 1 Sep · Shift 2 Numerical

An empty LPG cylinder weighs $14.8$ kg. When full, it weighs $29.0$ kg and shows a pressure of $3.47$ atm. In the course of use at ambient temperature, the mass of the cylinder is reduced to $23.0$ kg. The final pressure inside the cylinder is _____ atm. (Nearest integer)
(Assume LPG to be an ideal gas)

Numerical value type: the answer is a number.

**Answer: 2.** · Key from source paper

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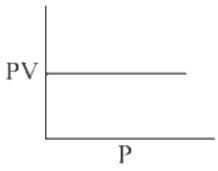
**Q48** JEE Main 2021 · 31 Aug · Shift 1 MCQ

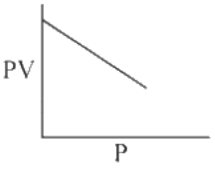
Which one of the following is the correct PV vs P plot at constant temperature for an ideal gas ? ( P and V stand for pressure and volume of the gas respectively)

**Q32.** Which one of the following is the correct PV vs P plot at constant temperature for an ideal gas ? ( P and V stand for pressure and volume of the gas respectively)

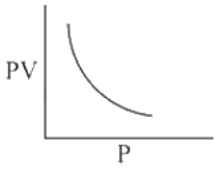
(1)



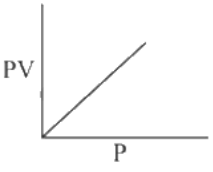

(2)




(3)




(4)




(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

**Answer: (A)** · Key from source paper

## Q49 JEE Main 2021 · 31 Aug · Shift 2 Numerical

The empirical formula for a compound with a cubic close packed arrangement of anions and with cations occupying all the octahedral sites in $\mathrm{A_x\ B}$. The value of x is (Integer answer)

Numerical value type: the answer is a number.

**Answer: 1.** · Key from source paper

## Q50 JEE Main 2021 · 27 Aug · Shift 1 MCQ

The unit of the van der Waals gas equation parameter 'a' in $\left(P+\frac{an^2}{V^2}\right)(V-nb)=nRT$ is:

(A) $\mathrm{dm^3\ mol^{-1}}$
(B) $\mathrm{kg\ ms^{-1}}$
(C) $\mathrm{atm\ dm^6\ mol^{-2}}$
(D) $\mathrm{kg\ ms^{-2}}$

**Answer: (C)** $\mathrm{atm\ dm^6\ mol^{-2}}$ · Key from source paper

## Q51 JEE Main 2021 · 27 Aug · Shift 1 MCQ

Match List - I with List - II:
List-I (Property)
(a) Diamagnetism
(b) Ferrimagnetism
(c) Paramagnetism
(d) Antiferromagnetism
List-II (Example)

(i) $MnO$
(ii) $O_2$
(iii) $NaCl$
(iv) $Fe_3O_4$
Choose the most appropriate answer from the options given below:

(A) (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii)
(B) (a) - (ii), (b) - (i), (c) - (iii), (d) - (iv)
(C) (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)
(D) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

**Answer: (D)** (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i) · Key from source paper

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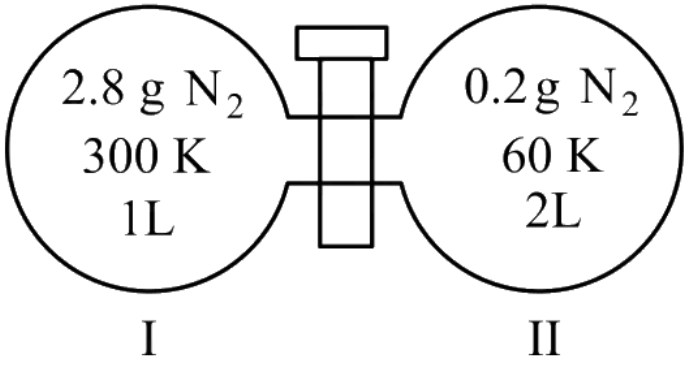
## Q52 JEE Main 2021 · 27 Aug · Shift 2 Numerical

Two flasks I and II shown below are connected by a valve of negligible volume.
*(see the figure above)*
When the valve is opened, the final pressure of the system in bar is $x \times 10^{-2}$. The value of x is (Integer answer)
[Assume : Ideal gas; $1\ bar = 10^5\ Pa$ : Molar mass of $N_2 = 28.0\ mol^{-1}$; $R = 8.31\ J\ mol^{-1}\ K^{-1}$]

**Q54.** Two flasks I and II shown below are connected by a valve of negligible volume.




When the valve is opened, the final pressure of the system in bar is $x \times 10^{-2}$. The value of x is (Integer answer)
[Assume : Ideal gas; $1\ bar = 10^5\ Pa$ : Molar mass of $N_2 = 28.0\ mol^{-1}$; $R = 8.31\ J\ mol^{-1}\ K^{-1}$]

Numerical value type: the answer is a number.

**Answer: 84.** · Key from source paper

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## Q53 JEE Main 2021 · 26 Aug · Shift 1 MCQ

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:

(A) Statement I is false but Statement II is true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Both Statement I and Statement II are true

**Answer: (C) Statement I is true but Statement II is false** · Key from source paper

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**Q54** JEE Main 2021 · 27 Jul · Shift 1 MCQ

The parameters of the unit cell of a substance are a = 2.5, b = 3.0, c = 4.0, $\alpha = 90^\circ$, $\beta = 120^\circ \gamma = 90^\circ$. The crystal system of the substance is :

(A) Hexagonal
(B) Orthorhombic
(C) Monoclinic
(D) Triclinic

**Answer: (C) Monoclinic** · Key from source paper

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**Q55** JEE Main 2021 · 27 Jul · Shift 2 MCQ

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.

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

**Answer: (D) (A), (C), (D) only** · Key from source paper

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**Q56** JEE Main 2021 · 25 Jul · Shift 1 Numerical

A home owner uses $4.00 \times 10^3\ \mathrm{m}^3$ of methane $\mathrm{CH_4}$ gas, (assume $\mathrm{CH_4}$ is an ideal gas) in a year to heat his home. Under the pressure of $1.0\ \mathrm{atm}$ and $300\ \mathrm{K}$, mass of gas used is $\mathrm{x} \times 10^5\ \mathrm{g}$. The value of x is _____. (Nearest integer)
(Given R = $0.083\ \mathrm{L\ atm\ K^{-1}\ mol^{-1}}$)

Numerical value type: the answer is a number.

**Answer: 26.** · Key from source paper

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**Q57** JEE Main 2021 · 25 Jul · Shift 2 Numerical

An LPG cylinder contains gas at a pressure of $300\ \mathrm{kPa}$ at $27^{\circ}\mathrm{C}$. The cylinder can withstand the pressure of $1.2 \times 10^{6}\ \mathrm{Pa}$. The room in which the cylinder is kept catches fire. The minimum temperature at which the bursting of cylinder will take place is _____ $^{\circ}\mathrm{C}$. (Nearest integer)

Numerical value type: the answer is a number.

**Answer: 927.** · Key from source paper

**Q58** JEE Main 2021 · 22 Jul · Shift 1 Numerical

A copper complex crystallising in a CCP lattice with a cell edge of $0.4518\ \mathrm{nm}$ has been revealed by employing X-ray diffraction studies. The density of a copper complex is found to be $7.62\ \mathrm{g\ cm^{-3}}$. The molar mass of copper complex is _____ $\mathrm{gmol^{-1}}$
(Nearest integer): [ Given : $\mathrm{N_A} = 6.022 \times 10^{23}\ \mathrm{mol^{-1}}$]

Numerical value type: the answer is a number.

**Answer: 106.** · Key from source paper

**Q59** JEE Main 2021 · 20 Jul · Shift 1 MCQ

Given below are two statements. One is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : Sharp glass edge becomes smooth on heating it up to its melting point.
Reason R : The viscosity of glass decreases on melting.
Choose the most appropriate answer from the options given below.

(A) A is true but R is false
(B) Both A and R are true but R is NOT the correct explanation of A.
(C) A is false but R is true.
(D) Both A and R are true and R is the correct explanation of A.

**Answer: (B) Both A and R are true but R is NOT the correct explanation of A.** · Key from source paper

**Q60** JEE Main 2021 · 20 Jul · Shift 2 Numerical

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 _____ .

Numerical value type: the answer is a number.

**Answer: 8.** · Key from source paper

**Q61** JEE Main 2021 · 18 Mar · Shift 1 MCQ

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:

(A) $M_2 A_3$
(B) $M_4 A_3$
(C) $M_4 A$
(D) $MA_3$

**Answer: (B)** $M_4 A_3$ · Key from source paper

**Q62** JEE Main 2021 · 18 Mar · Shift 2 MCQ

The oxide that shows magnetic property is:

(A) $SiO_2$
(B) $Mn_3 O_4$
(C) $Na_2 O$
(D) $MgO$

**Answer: (B)** $Mn_3 O_4$ · Key from source paper

**Q63** JEE Main 2021 · 18 Mar · Shift 2 MCQ

A hard substance melts at high temperature and is an insulator in both solid and in molten state. This solid is most likely to be a / an :

(A) Ionic solid
(B) Molecular solid
(C) Metallic solid
(D) Covalent solid

**Answer: (D) Covalent solid** · Key from source paper

**Q64** JEE Main 2021 · 17 Mar · Shift 1 Numerical

The pressure exerted by a non-reactive gaseous mixture of 6.4 g of methane and 8.8 g of carbon dioxide in a 10 L vessel at $27^{\circ}C$ is _____ kPa. (Round off to the Nearest Integer).
[Assume gases are ideal, $R = 8.314\ J\ mol^{-1}\ K^{-1}$ Atomic masses: C : 12.0 u, H : 1.0 u, O : 16.0 u]

Numerical value type: the answer is a number.

**Answer: 150.** · Key from source paper

**Q65** JEE Main 2021 · 17 Mar · Shift 2 Numerical

KBr is doped with $10^{-5}$ mole percent of $SrBr_2$ The number of cationic vacancies in 1 g of KBr crystal is $10^{14}$ . (Round off to the Nearest Integer). [Atomic Mass : $K = 39.1u, Br = 79.9u, N_A = 6.023 \times 10^{23}$]

Numerical value type: the answer is a number.

**Answer: 5.** · Key from source paper

**Q66** JEE Main 2021 · 16 Mar · Shift 1 Numerical

A certain element crystallises in a bcc lattice of unit cell edge length $27\ \text{Å}$. If the same element under the same conditions crystallises in the fcc lattice, the edge length of the unit cell in Å will be _____. (Round off to the Nearest Integer).
[Assume each lattice point has a single atom]
[Assume $\sqrt{3} = 1.73, \sqrt{2} = 1.41$]

Numerical value type: the answer is a number.

**Answer: 33.** · Key from source paper

**Q67** JEE Main 2021 · 16 Mar · Shift 2 Numerical

Ga (atomic mass 70 u) crystallizes in a hexagonal close packed structure. The total number of voids in $0.581\ \text{g}$ of Ga is _____ $\times 10^{21}$. (Round off to the Nearest Integer).

Numerical value type: the answer is a number.

**Answer: 15.** · Key from source paper

**Q68** JEE Main 2021 · 26 Feb · Shift 1 Numerical

A certain gas obeys $\text{P}(\text{V}_\text{m} - \text{b}) = \text{RT}$. The value of $\left(\frac{\partial Z}{\partial P}\right)_T$ is $\frac{xb}{RT}$. The value of x is _____ (Integer answer) (Z : compressibility factor)

Numerical value type: the answer is a number.

**Answer: 1.** · Key from source paper

**Q69** JEE Main 2021 · 26 Feb · Shift 2 Numerical

The number of octahedral voids per lattice site in a lattice is _____. (Rounded off to the nearest integer)

Numerical value type: the answer is a number.

**Answer: 1.** · Key from source paper

**Q70** JEE Main 2021 · 25 Feb · Shift 1 Numerical

A car tyre is filled with nitrogen gas at $35$ psi at $27\ ^\circ\text{C}$. It will burst if pressure exceeds $40$ psi. The temperature in $^\circ\text{C}$ at which the car tyre will burst is (Rounded-off to the nearest integer)

Numerical value type: the answer is a number.

**Answer: 70.** · Key from source paper

**Q71** JEE Main 2021 · 25 Feb · Shift 2 Numerical

The unit cell of copper corresponds to a face centered cube of edge length $3.596\ \text{Å}$ with one copper atom at each lattice point. The calculated density of copper in $\text{kg}/\text{m}^3$ is _____. [Molar mass of Cu : $63.54\ \text{g}$; Avogadro Number = $6.022 \times 10^{23}$ J]

Numerical value type: the answer is a number.

**Answer: 9076.** · Key from source paper

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**Q72** JEE Main 2021 · 24 Feb · Shift 1 Numerical

The coordination number of an atom in a body-centered cubic structure is _____. [Assume that the lattice is made up of atoms.]

Numerical value type: the answer is a number.

**Answer: 8.** · Key from source paper

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**Q73** JEE Main 2021 · 24 Feb · Shift 2 Numerical

The volume occupied by $4.75\ \mathrm{g}$ of acetylene gas at $50^{\circ}\mathrm{C}$ and $740\ \mathrm{mm\ Hg}$ pressure is _____ L.
(Rounded off to the nearest integer)
[Given $\mathrm{R} = 0.0826\ \mathrm{L\ atm\ K^{-1}\ mol^{-1}}$]

Numerical value type: the answer is a number.

**Answer: 5.** · Key from source paper

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**Q74** JEE Main 2020 · 6 Sep · Shift 1 Numerical

A spherical balloon of radius $3\ \mathrm{cm}$ containing helium gas has a pressure of $48 \times 10^{-3}$ bar. At the same temperature, the pressure, of a spherical balloon of radius$12\ \mathrm{cm}$ containing the same amount of gas will be _____ $\times 10^{-6}$ bar.

Numerical value type: the answer is a number.

**Answer: 750.** · Key from source paper

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**Q75** JEE Main 2020 · 6 Sep · Shift 2 MCQ

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 '$M_1$' occupies 50% of octahedral voids and the cation '$M_2$' occupies $12.5\ \%$ of tetrahedral voids of oxide lattice. The oxidation numbers of '$M_1$' and '$M_2$' are respectively :

(A) $+2,\ +4$
(B) $+1,\ +3$
(C) $+3,\ +1$
(D) $+4,\ +2$

**Answer: (A)** $+2,\ +4$ · Key from source paper

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**Q76** JEE Main 2020 · 5 Sep · Shift 1 MCQ

A diatomic molecule $\mathrm{X_2}$ has a body-centred cubic (bcc) structure with a cell edge of 300 pm. The density of the molecule is 6. 17 $\mathrm{gcm^{-3}}$. The number of molecules present in 200 g of $\mathrm{X_2}$ is :
(Avogadro constant ($\mathrm{N_A}$) = 6 $\times 10^{23}\ \mathrm{mol^{-1}}$)

(A) $40\ N_A$
(B) $8\ N_A$
(C) $4\ N_A$
(D) $2\ N_A$

**Answer: (C)** $4\ N_A$ · Key from source paper

## Q77 JEE Main 2020 · 5 Sep · Shift 2 MCQ

An element crystallises in a face–centred cubic (fcc) unit cell with cell edge a. The distance between the centres of two nearest octahedral voids in the crystal lattice is:

(A) $\frac{a}{\sqrt{2}}$
(B) $a$
(C) $\sqrt{2}a$
(D) $\frac{a}{2}$

**Answer: (A)** $\frac{a}{\sqrt{2}}$ · Key from source paper

## Q78 JEE Main 2020 · 3 Sep · Shift 1 Numerical

An element with molar mass $2.7 \times 10^{-2}\ kg\ mol^{-1}$ forms a cubic unit cell with edge length $405\ pm$. If its density is $2.7 \times 10^{3}\ kg\ m^{-3}$, the radius of the element is approximately _____ $\times 10^{-12} m$ (to the nearest integer).

Numerical value type: the answer is a number.

**Answer: 143.** · Key from source paper

## Q79 JEE Main 2020 · 3 Sep · Shift 2 MCQ

A mixture of one mole each of $H_2$ , He and $O_2$ each are enclosed in a cylinder of volume V at temperature T. If the partial pressure of $H_2$ is $2\ atm$, the total pressure of the gases in the cylinder is:

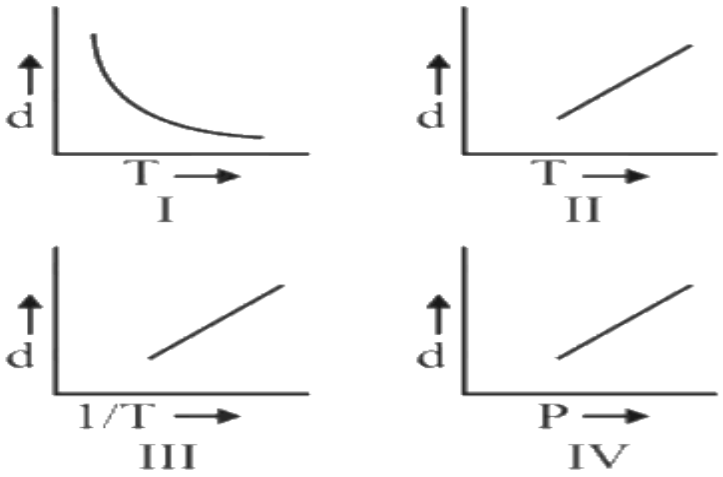
(A) $6\ atm$
(B) $38\ atm$
(C) $14\ atm$
(D) $22\ atm$

**Answer: (A)** $6\ atm$ · Key from source paper

## Q80 JEE Main 2020 · 2 Sep · Shift 1 MCQ

Which one of the following graphs is not correct for ideal gas?
d = Density, P = Pressure, T =Temperature
*(see the figure above)*

**Q29.** Which one of the following graphs is not correct for ideal gas?
d = Density, P = Pressure, T =Temperature




(1) I
(2) II
(3) IV
(4) III

(A) I
(B) II
(C) IV
(D) III

**Answer: (B) II** · Key from source paper

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## Q81 JEE Main 2020 · 9 Jan · Shift 1 MCQ

' X ' melts at low temperature and is a bad conductor of electricity in both liquid and solid state. X is:

(A) zinc sulphide
(B) Mercury
(C) Silicon carbide
(D) Carbon tetrachloride

**Answer: (D) Carbon tetrachloride** · Key from source paper

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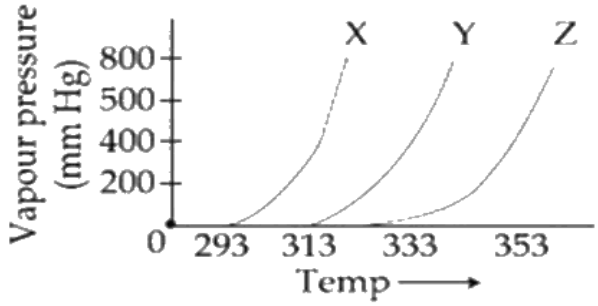
## Q82 JEE Main 2020 · 8 Jan · Shift 1 MCQ

A graph of vapour pressure and temperature for three different liquids X, Y and Z is shown below:
*(see the figure above)*
The following inferences are made:
(A)X has higher intermolecular interactions compared to Y.
(B)X has lower intermolecular interactions compared to Y.
(C)Z has lower intermolecular interactions compared to Y.
The correct inferences is/are:

**Q36.** A graph of vapour pressure and temperature for three different liquids X, Y and Z is shown below:




The following inferences are made:
(A)X has higher intermolecular interactions compared to Y.
(B)X has lower intermolecular interactions compared to Y.
(C)Z has lower intermolecular interactions compared to Y.
The correct inferences is/are:

(1) (A) and (C)
(2) (A)
(3) (B)
(4) (C)

A (A) and (C)
B (A)
C (B)
D (C)

**Answer: (C)** (B) · Key from source paper

## Q83 JEE Main 2020 · 8 Jan · Shift 2 MCQ

Which of the following compounds is likely to show both Frenkel and Schottky defects in its crystalline form?

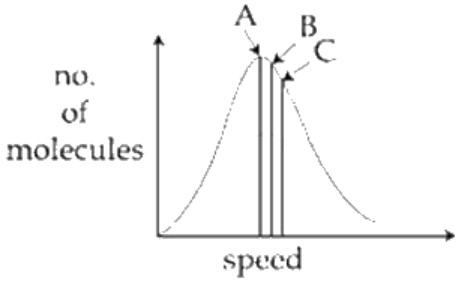
A $AgBr$
B $CsCl$
C $KBr$
D $ZnS$

**Answer: (A)** $AgBr$ · Key from source paper

## Q84 JEE Main 2020 · 7 Jan · Shift 2 MCQ

Identify the correct labels of A, B and C in the following graph from the options given below:
*(see the figure above)*
Root mean square speed $(V_{rms})$; most proable speed $(V_{mp})$; Average speed $(V_{av})$

**Q29.** Identify the correct labels of A, B and C in the following graph from the options given below:




Root mean square speed $(V_{rms})$; most proable speed $(V_{mp})$; Average speed $(V_{av})$

(1) $A - V_{mp}; B - V_{rms}; C - V_{av}$
(2) $A - V_{av}; B - V_{rms}; C - V_{mp}$
(3) $A - V_{rms}; B - V_{mp}; C - V_{av}$
(4) $A - V_{mp}; B - V_{av}; C - V_{rms}$

(A) $A - V_{mp}; B - V_{rms}; C - V_{av}$
(B) $A - V_{av}; B - V_{rms}; C - V_{mp}$
(C) $A - V_{rms}; B - V_{mp}; C - V_{av}$
(D) $A - V_{mp}; B - V_{av}; C - V_{rms}$

**Answer: (D)** $A - V_{mp}; B - V_{av}; C - V_{rms}$ · Key from source paper

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## Q85 JEE Main 2019 · 12 Apr · Shift 1 MCQ

An element has a face-centered cubic fcc structure with a cell edge of a. The distance between the centres of two nearest tetrahedral voids in the lattice is

(A) $\frac{a}{2}$
(B) $\frac{3}{2}$a
(C) a
(D) $\sqrt{2}$a

**Answer: (A)** $\frac{a}{2}$ · Key from source paper

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## Q86 JEE Main 2019 · 12 Apr · Shift 2 MCQ

The ratio of number of atoms present in a simple cubic, body centered cubic and face centered cubic structure are, respectively :

(A) 4 : 2 : 1
(B) 1 : 2 : 4
(C) 4 : 2 : 3
(D) 8 : 1 : 6

**Answer: (B)** 1 : 2 : 4 · Key from source paper

## Q87 JEE Main 2019 · 10 Apr · Shift 1 MCQ

Consider the following table:

| Gas | $a/\left(\text{k Pa dm}^6\text{mol}^{-1}\right)$ | $b/\left(\text{dm}^3\text{mol}^{-1}\right)$ |
|---|---|---|
| A | 642.32 | 0.05196 |
| B | 155.21 | 0.04136 |
| Gas | $a/\left(\text{k Pa dm}^6\text{mol}^{-1}\right)$ | $b/\left(\text{dm}^3\text{mol}^{-1}\right)$ |
| C | 431.91 | 0.05196 |
| D | 155.21 | 0.4382 |

a and b are vander Waals constants. The correct statement about the gases is:

(A) Gas C will occupy more volume than gas A ; gas B will be lesser compressible than gas D

(B) Gas C will occupy lesser volume than gas A ; gas B will be lesser compressible than gas D

(C) Gas C will occupy more volume than gas A ; gas B will be more compressible than gas D

(D) Gas C will occupy lesser volume than gas A ; gas B will be more compressible than gas D

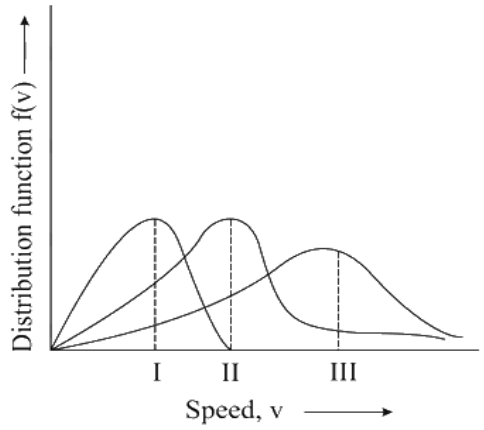
**Answer: (C)** Gas C will occupy more volume than gas A ; gas B will be more compressible than gas D · Key from source paper

## Q88 JEE Main 2019 · 10 Apr · Shift 2 MCQ

Points I, II and III in the following plot respectively correspond to ($V_{mp}$: most probable velocity)

*(see the figure above)*

**Q34.** Points I, II and III in the following plot respectively correspond to ($V_{mp}$: most probable velocity)




(1) $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $H_2$ 300 K; $V_{mp}$ of $O_2$ 400 K;

(2) $V_{mp}$ of $H_2$ 300 K; $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $O_2$ 400 K;

(3) $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $O_2$ 400 K; $V_{mp}$ of $H_2$ 300 K;

(4) $V_{mp}$ of $O_2$ 400 K; $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $H_2$ 300 K;

(A) $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $H_2$ 300 K; $V_{mp}$ of $O_2$ 400 K;
(B) $V_{mp}$ of $H_2$ 300 K; $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $O_2$ 400 K;
(C) $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $O_2$ 400 K; $V_{mp}$ of $H_2$ 300 K;
(D) $V_{mp}$ of $O_2$ 400 K; $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $H_2$ 300 K;

**Answer: (C)** $V_{mp}$ of $N_2$ 300 K; $V_{mp}$ of $O_2$ 400 K; $V_{mp}$ of $H_2$ 300 K; · Key from source paper

## Q89 JEE Main 2019 · 9 Apr · Shift 1 MCQ

Consider the van der Waal's constants, a and b, for the following gases.
*(see the figure above)*
Which gas is expected to have the highest critical temperature?

**Q35.** Consider the van der Waal's constants, a and b, for the following gases.

| Gas | Ar | Ne | Kr | Xe |
|---|---|---|---|---|
| $a/(atm\ dm^6\ mol^{-2})$ | 1.3 | 0.2 | 5.1 | 4.1 |
| $b/(10^{-2}\ dm^3\ mol^{-1})$ | 3.2 | 1.7 | 1.0 | 5.0 |

Which gas is expected to have the highest critical temperature?
(1) Kr (2) Ar
(3) Xe (4) Ne

(A) Kr
(B) Ar
(C) Xe
(D) Ne

**Answer: (A)** Kr · Key from source paper

## Q90 JEE Main 2019 · 9 Apr · Shift 2 MCQ

At a given temperature T, gases Ne, Ar, Xe and Kr are found to deviate from ideal gas behaviour. Their equation of state is given as $p = \frac{RT}{V - b}$ at T. Here, b is the van der Waals constant. Which gas will exhibit steepest increase in the plot of Z (compression factor) vs p?

(A) Ne
(B) Kr
(C) Ar
(D) Xe

**Answer: (D)** Xe · Key from source paper

## Q91 JEE Main 2019 · 8 Apr · Shift 1 MCQ

Element B forms ccp structure and A occupies half of the octahedral voids, while oxygen atoms occupy all the tetrahedral voids. The structure of bimetallic oxide is:

(A) $A_2BO_4$
(B) $AB_2O_4$
(C) $A_2B_2O$
(D) $A_4B_2O$

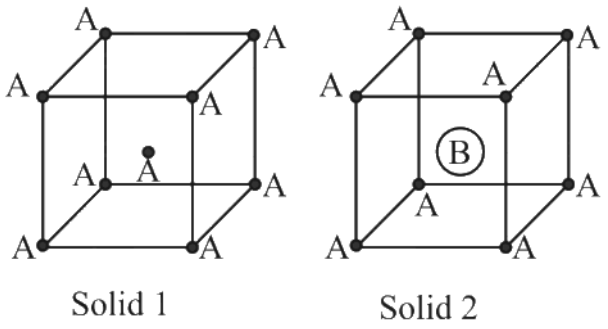
**Answer: (B)** $AB_2O_4$ · Key from source paper

## Q92 JEE Main 2019 · 8 Apr · Shift 2 MCQ

Consider the bcc unit cells of the solids 1 and 2 with the position of atoms as 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 ?

*(see the figure above)*

**Q44.** Consider the bcc unit cells of the solids 1 and 2 with the position of atoms as 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 ?




(1) 90 %
(2) 45 %
(3) 75 %
(4) 65 %

(A) 90 %
(B) 45 %
(C) 75 %
(D) 65 %

**Answer: (A)** 90 % · Key from source paper

## Q93 JEE Main 2019 · 12 Jan · Shift 1 MCQ

The volume of gas A is twice than that of gas B. The compressibility factor of gas A is thrice than that of gas B at same temperature. What are the pressures of the gases for equal number of moles?

(A) $2P_A = 3P_B$
(B) $P_A = 2P_B$
(C) $3P_A = 2P_B$
(D) $P_A = 3P_B$

**Answer: (A)** $2P_A = 3P_B$ · Key from source paper

**Q94** JEE Main 2019 · 12 Jan · Shift 2 MCQ

An open vessel at $27^oC$ is heated until two fifth of the air (assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature to which the vessel has heated is:

(A) $750^oC$

(B) $500^oC$

(C) $750K$

(D) $500K$

**Answer: (D)** $500K$ · Key from source paper

**Q95** JEE Main 2019 · 12 Jan · Shift 2 MCQ

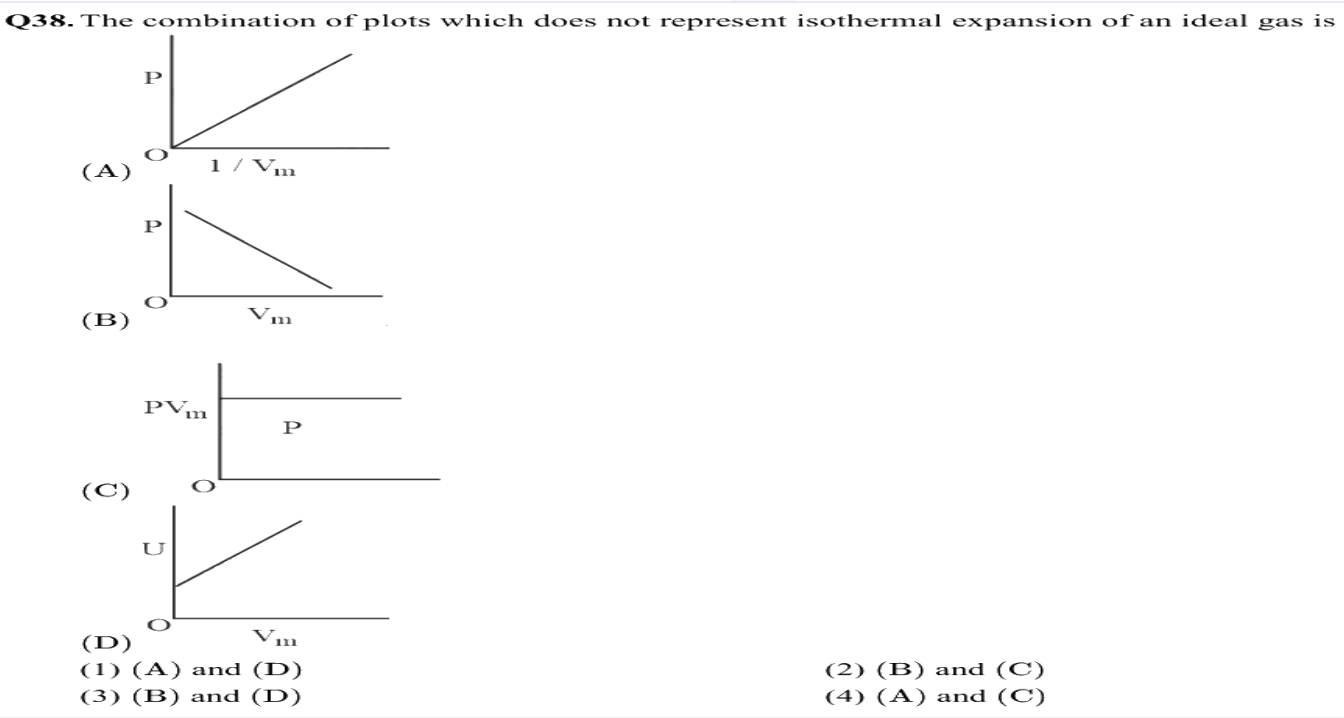
The combination of plots which does not represent isothermal expansion of an ideal gas is

(A) *(see the figure above)*

(B) *(see the figure above)*

(C) *(see the figure above)*

(D) *(see the figure above)*




(A) (A) and (D)

(B) (B) and (C)

(C) (B) and (D)

(D) (A) and (C)

**Answer: (C)** (B) and (D) · Key from source paper

**Q96** JEE Main 2019 · 11 Jan · Shift 1 MCQ

A solid having density of $9 \times 10^3$ kg m$^{-3}$ 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$^{-1}$, $\pi \approx 3$]

(A) 0.0432 kg mol$^{-1}$
(B) 0.0216 kg mol$^{-1}$
(C) 0.0305 kg mol$^{-1}$
(D) 0.4320 kg mol$^{-1}$

**Answer: (C)** 0.0305 kg mol$^{-1}$ · Key from source paper

**Q97** JEE Main 2019 · 11 Jan · Shift 2 MCQ

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')

(A) 0.027 a
(B) 0.047 a
(C) 0.134a
(D) 0.067 a

**Answer: (D)** 0.067 a · Key from source paper

**Q98** JEE Main 2019 · 10 Jan · Shift 1 MCQ

Which primitive unit cell has unequal edge lengths $(a \neq b \neq c)$ and all axial angles different from $90^o$

(A) Hexagonal
(B) Monoclinic
(C) Triclinic
(D) Tetragonal

**Answer: (C)** Triclinic · Key from source paper

**Q99** JEE Main 2019 · 10 Jan · Shift 2 MCQ

A compound of formula $A_2B_3$ has the HCP lattice. Which atom forms the HCP lattice and what fraction of the tetrahedral voids are occupied by the other atoms?

(A) HCP lattice - B, $\frac{2}{3}$ tetrahedral voids - A
(B) HCP lattice - A, $\frac{1}{3}$ tetrahedral voids - B
(C) HCP lattice - B, $\frac{1}{3}$ tetrahedral voids - A
(D) HCP lattice - A, $\frac{2}{3}$ tetrahedral voids - B

**Answer: (C)** HCP lattice - B, $\frac{1}{3}$ tetrahedral voids - A · Key from source paper

**Q100** JEE Main 2019 · 9 Jan · Shift 1 MCQ

$0.5$ moles of gas A and x moles of gas B exert a pressure of $200\ \mathrm{Pa}$ in a container of volume $10\ \mathrm{m}^3$ at $1000\ \mathrm{K}$ . Given, R is the gas constant in $\mathrm{JK}^{-1}\mathrm{mol}^{-1}$, x is:

(A) $\frac{4+\mathrm{R}}{2\mathrm{R}}$
(B) $\frac{2\mathrm{R}}{4+\mathrm{R}}$
(C) $\frac{4-\mathrm{R}}{2\mathrm{R}}$
(D) $\frac{2\mathrm{R}}{4-\mathrm{R}}$

**Answer: (C)** $\frac{4-\mathrm{R}}{2\mathrm{R}}$ · Key from source paper

**Q101** JEE Main 2019 · 9 Jan · Shift 1 MCQ

The one that is extensively used as a piezoelectric material is:

(A) Tridymite
(B) Quartz
(C) Amorphous silica
(D) Mica

**Answer: (B)** Quartz · Key from source paper

**Q102** JEE Main 2019 · 9 Jan · Shift 2 MCQ

At $100^{o}C$, copper $(Cu)$ has $FCC$ unit cell structure with cell edge length of $x\ \mathring{A}$ . What is the approximate density of $Cu$ (in $g\ cm^{-3}$ ) at this temperature?
$[\text{Atomic Mass of } Cu = 63.55\ u]$

(A) $\frac{105}{x^3}$
(B) $\frac{205}{x^3}$
(C) $\frac{422}{x^3}$
(D) $\frac{211}{x^3}$

**Answer: (C)** $\frac{422}{x^3}$ · Key from source paper

**Q103** JEE Main 2018 · 16 Apr · Online MCQ

Assuming ideal gas behavior, the ratio of density of ammonia to that of hydrogen chloride at same temperature and pressure is: (Atomic weight of Cl is 35.5 u)

(A) 1.46
(B) 1.64
(C) 0.46
(D) 0.64

**Answer: (C)** 0.46 · Key from source paper

## Q104 JEE Main 2018 · 15 Apr · Shift 1 MCQ

Which of the following arrangements shows the schematic alignment of magnetic moments of antiferromagnetic substance?

**Q50.** Which of the following arrangements shows the schematic alignment of magnetic moments of antiferromagnetic substance?

(1) 
(2) 
(3) 
(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

**Answer: (D)** · Key from source paper

## Q105 JEE Main 2018 · 15 Apr · Shift 2 MCQ

All of the following share the same crystal structure except.

(A) RbCl
(B) NaCl
(C) CsCl
(D) LiCl

**Answer: (C)** CsCl · Checked by our team

## Q106 JEE Main 2018 · 8 Apr · Offline MCQ

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

(A) Metal deficiency defect
(B) Schottky defect
(C) Vacancy defect
(D) Frenkel defect

**Answer: (D) Frenkel defect** · Key from source paper

**Q107** JEE Main 2017 · 9 Apr · Online MCQ

At 300 K, the density of a certain gaseous molecule at 2 bar is double to that of dinitrogen ($N_2$) at 4 bar. The molar mass of the gaseous molecule is

(A) $224\ g\ mol^{-1}$
(B) $112\ g\ mol^{-1}$
(C) $56\ g\ mol^{-1}$
(D) $28\ g\ mol^{-1}$

**Answer: (B)** $112\ g\ mol^{-1}$ · Key from source paper

**Q108** JEE Main 2017 · 8 Apr · Online MCQ

Among the following, the incorrect statement is:

(A) at low pressure, real gases show ideal behaviour.
(B) at very low temperature, real gases show ideal behaviour.
(C) at Boyle's temperature, real gases show ideal behaviour.
(D) at very large volume, real gases show ideal behaviour.

**Answer: (B) at very low temperature, real gases show ideal behaviour.** · Key from source paper

**Q109** JEE Main 2017 · 2 Apr · Offline MCQ

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

(A) $2\sqrt{2}\,a$
(B) $\sqrt{2}\,a$
(C) $\frac{a}{\sqrt{2}}$
(D) $2a$

**Answer: (C)** $\frac{a}{\sqrt{2}}$ · Key from source paper

**Q110** JEE Main 2016 · 10 Apr · Online MCQ

Initially, the root-mean-square (RMS) velocity of $N_2$ molecules at certain temperature is u. If this temperature is doubled and all the nitrogen molecules dissociate into nitrogen atoms, then the new RMS velocity will be:

(A) $2\ u$
(B) $14\ u$
(C) $4\ u$
(D) $u/2$

**Answer: (A)** $2\ u$ · Key from source paper

## Q111 JEE Main 2016 · 9 Apr · Online MCQ

At very high pressures, the compressibility factor of one mole of a gas is given by:

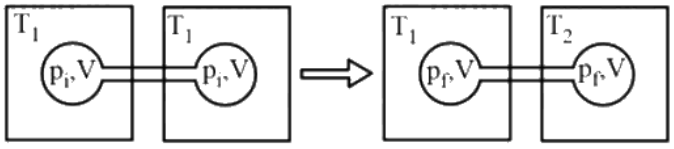
(A) $1+\frac{\mathrm{Pb}}{\mathrm{RT}}$
(B) $\frac{\mathrm{Pb}}{\mathrm{RT}}$
(C) $1-\frac{\mathrm{Pb}}{\mathrm{RT}}$
(D) $1-\frac{\mathrm{b}}{(\mathrm{VRT})}$

**Answer: (A)** $1+\frac{\mathrm{Pb}}{\mathrm{RT}}$ · Key from source paper

## Q112 JEE Main 2016 · 3 Apr · Offline MCQ

Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure $p_i$ and temperature $T_1$ are connected through a narrow tube of negligible volume, as shown in the figure below. The temperature of one of the bulbs is then raised to $T_2$. The final pressure $P_f$ is:
*(see the figure above)*

**Q35.** Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure $\mathrm{p_i}$ and temperature $\mathrm{T_1}$ are connected through a narrow tube of negligible volume, as shown in the figure below. The temperature of one of the bulbs is then raised to $\mathrm{T_2}$. The final pressure $\mathrm{P_f}$ is:




(1) $2\mathrm{p_i}\left(\frac{\mathrm{T_2}}{\mathrm{T_1+T_2}}\right)$
(2) $2\mathrm{p_i}\left(\frac{\mathrm{T_1T_2}}{\mathrm{T_1+T_2}}\right)$
(3) $\mathrm{p_i}\left(\frac{\mathrm{T_1T_2}}{\mathrm{T_1+T_2}}\right)$
(4) $2\mathrm{p_i}\left(\frac{\mathrm{T_1}}{\mathrm{T_1+T_2}}\right)$

(A) $2p_i\left(\frac{T_2}{T_1+T_2}\right)$
(B) $2p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$
(C) $p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$
(D) $2p_i\left(\frac{T_1}{T_1+T_2}\right)$

**Answer: (A)** $2p_i\left(\frac{T_2}{T_1+T_2}\right)$ · Key from source paper

## Q113 JEE Main 2015 · 11 Apr · Online MCQ

When does a gas deviate the most from its ideal behavior?

(A) At low pressure and high temperature
(B) At high pressure and high temperature
(C) At low pressure and low temperature
(D) At high pressure and low temperature

**Answer: (D) At high pressure and low temperature** · Key from source paper

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**Q114** JEE Main 2015 · 10 Apr · Online MCQ

Which of the following is not an assumption of the kinetic theory of gases?

(A) Collisions of gas particles are perfectly elastic.
(B) A gas consists of many identical particles which are in continual motion.
(C) At high pressure, gas particles are difficult to compress.
(D) Gas particles have negligible volume.

**Answer: (C) At high pressure, gas particles are difficult to compress.** · Key from source paper

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**Q115** JEE Main 2015 · 4 Apr · Offline MCQ

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

(A) $0.93$ Å
(B) $1.86$ Å
(C) $3.22$ Å
(D) $5.72$ Å

**Answer: (B)** $1.86$ Å · Key from source paper

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**Q116** JEE Main 2014 · 19 Apr · Online MCQ

Sulphur dioxide and oxygen were allowed to diffuse through a porous partition. $20\ \mathrm{dm}^3$ of $SO_2$ diffuses through the porous partition in 60 seconds. The volume of $O_2$ in $\mathrm{dm}^3$ which diffuses under the similar condition in 30 seconds will be (atomic mass of sulphur$= 32$ u);

(A) $28.2$
(B) $10.0$
(C) $14.1$
(D) $7.09$

**Answer: (C)** $14.1$ · Key from source paper

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**Q117** JEE Main 2014 · 19 Apr · Online MCQ

The total number of octahedral void (s) per atom present in a cubic close packed structure is :

(A) $1$
(B) $2$
(C) $3$
(D) $4$

**Answer: (A)** $1$ · Key from source paper

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**Q118** JEE Main 2014 · 19 Apr · Online MCQ

Choose the correct statement with respect to the vapour pressure of a liquid among the following :

(A) Increases non-linearly with increasing temperature
(B) Decreases non-linearly with increasing temperature
(C) Decreases linearly with increasing temperature
(D) Increases linearly with increasing temperature

**Answer: (A) Increases non-linearly with increasing temperature** · Key from source paper

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**Q119** JEE Main 2014 · 12 Apr · Online MCQ

In a monoclinic unit cell, the relation of sides and angles are respectively:

(A) $\mathrm{a} = \mathrm{b} \neq \mathrm{c}$ and $\alpha = \beta = \gamma = 90^\circ$
(B) $\mathrm{a} \neq \mathrm{b} \neq \mathrm{c}$ and $\alpha = \beta = \gamma = 90^\circ$
(C) $\mathrm{a} \neq \mathrm{b} \neq \mathrm{c}$ and $\beta = \gamma = 90^\circ \neq \alpha$
(D) $\mathrm{a} \neq \mathrm{b} \neq \mathrm{c}$ and $\alpha \neq \beta \neq \gamma \neq 90^\circ$

**Answer: (C)** $\mathrm{a} \neq \mathrm{b} \neq \mathrm{c}$ **and** $\beta = \gamma = 90^\circ \neq \alpha$ · Key from source paper

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**Q120** JEE Main 2014 · 11 Apr · Online MCQ

The initial volume of a gas cylinder is $750.0\ \mathrm{mL}$. If the pressure of gas inside the cylinder changes from $840.0\ \mathrm{mmHg}$ to $360.0\ \mathrm{mmHg}$, the final volume the gas will be:

(A) $1.750\ \mathrm{L}$
(B) $3.60\ \mathrm{L}$
(C) $4.032\ \mathrm{L}$
(D) $7.50\ \mathrm{L}$

**Answer: (A)** $1.750\ \mathrm{L}$ · Key from source paper

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**Q121** JEE Main 2014 · 11 Apr · Online MCQ

The appearance of colour in solid alkali metal halides is generally due to:

(A) Schottky defect
(B) Frenkel defect
(C) Interstitial position
(D) F-centres

**Answer: (D) F-centres** · Key from source paper

## Q122 JEE Main 2014 · 9 Apr · Online MCQ

The temperature at which oxygen molecules have the same root mean square speed as helium atoms have at 300 K is : (Atomic masses : He = 4 u, O = 16 u)

(A) 600 K
(B) 2400 K
(C) 1200 K
(D) 300 K

**Answer: (B) 2400 K** · Key from source paper

## Q123 JEE Main 2014 · 9 Apr · Online MCQ

Van der Waal's equation for a gas is stated as,
$P = \frac{nRT}{V-nb} - a\left(\frac{n}{V}\right)^2$.
This equation reduces to the perfect gas equation, $P = \frac{nRT}{V}$ When,

(A) temperature is sufficiently high and pressure is low.
(B) both temperature and pressure are very low.
(C) both temperature and pressure are very high.
(D) temperature is sufficiently low and pressure is high.

**Answer: (A) temperature is sufficiently high and pressure is low.** · Key from source paper

## Q124 JEE Main 2014 · 9 Apr · Online MCQ

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 :

(A) $A_2B_3$
(B) $AB_2$
(C) $A_5B_2$
(D) $A_2B_5$

**Answer: (D)** $A_2B_5$ · Key from source paper

## Q125 JEE Main 2014 · 6 Apr · Offline MCQ

If Z is the compressibility factor, then Van der Waal's equation at low pressure can be written as:

(A) $Z = 1 + \frac{RT}{Pb}$
(B) $Z = 1 - \frac{a}{VRT}$
(C) $Z = 1 - \frac{Pb}{RT}$
(D) $Z = 1 + \frac{Pb}{RT}$

**Answer: (B)** $Z = 1 - \frac{a}{VRT}$ · Key from source paper

## Q126 JEE Main 2014 · 6 Apr · Offline MCQ

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

(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)** $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}}{2}$ a · Key from source paper

## Q127 JEE Main 2013 · 25 Apr · Online MCQ

Which one of the following is the wrong assumption of kinetic theory of gases ?

(A) Momentum and energy always remain conserved.
(B) Pressure is the result of elastic collision of molecules with the container's wall.
(C) Molecules are separated by great distances compared to their sizes.
(D) All the molecules move in straight line between collision and with same velocity.

**Answer: (D) All the molecules move in straight line between collision and with same velocity.** · Key from source paper

## Q128 JEE Main 2013 · 25 Apr · Online MCQ

Copper crystallises in fcc with a unit length of 361 pm. What is the radius of copper atom ?

(A) 157 pm
(B) 128 pm
(C) 108 pm
(D) 181 pm

**Answer: (B)** 128 pm · Key from source paper

## Q129 JEE Main 2013 · 23 Apr · Online MCQ

The correct order of viscosity of the following liquids will be :

(A) Water < methyl alcohol < dimethyl ether < glycerol
(B) methyl alcohol < glycerol < water < dimethyl ether
(C) dimethyl ether < methyl alcohol < water < glycerol
(D) glycerol < dimethyl ether < water < methyl alcohol

**Answer: (C) dimethyl ether < methyl alcohol < water < glycerol** · Key from source paper

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**Q130** JEE Main 2013 · 23 Apr · Online MCQ

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 :

(A) $AB_3$
(B) $AB_4$
(C) $A_2B_5$
(D) $AB_2$

**Answer: (B)** $AB_4$ · Key from source paper

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**Q131** JEE Main 2013 · 22 Apr · Online MCQ

Which one of the following statements about packing in solids is incorrect ?

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

**Answer: (C) Void space in hcp mode of packing is 32%.** · Key from source paper

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**Q132** JEE Main 2013 · 9 Apr · Online MCQ

By how many folds the temperature of a gas would increase when the root mean square velocity of the gas molecules in a container of fixed volume is increased from $5 \times 10^4$ cm/s to $10 \times 10^4$ cm/s ?

(A) Two
(B) Three
(C) Six
(D) Four

**Answer: (D) Four** · Key from source paper

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**Q133** JEE Main 2013 · 9 Apr · Online MCQ

An element having an atomic radius of 0.14 nm crystallizes in an $f_{cc}$ unit cell. What is the length of a side of the cell ?

(A) 0.56 nm
(B) 0.24 nm
(C) 0.96 nm
(D) 0.4 nm

**Answer: (D)** 0.4 nm · Key from source paper

**Q134** JEE Main 2013 · 7 Apr · Offline MCQ

Experimentally it was found that a metal oxide has formula $\mathrm{M_{0.98}O}$. Metal M, is present as $\mathrm{M^{2+}}$ and $\mathrm{M^{3+}}$ in its oxide. Fraction of the metal which exists as $\mathrm{M^{3+}}$ would be:

(A) 6.05%
(B) 5.08%
(C) 7.01%
(D) 4.08%

**Answer: (D)** 4.08% · Key from source paper

**Q135** JEE Main 2013 · 7 Apr · Offline MCQ

For gaseous state, if most probable speed is denoted by $\mathrm{C^*}$, average speed by $\overline{\mathrm{C}}$ and root mean square speed by C, then for many molecules, what is the ratios of these speeds?

(A) $\mathrm{C^* : \overline{C} : C = 1 : 1.128 : 1.225}$
(B) $\mathrm{C^* : \overline{C} : C = 1 : 1.225 : 1.128}$
(C) $\mathrm{C^* : \overline{C} : C = 1.225 : 1.128 : 1}$
(D) $\mathrm{C^* : \overline{C} : C = 1.128 : 1.225 : 1}$

**Answer: (A)** $\mathrm{C^* : \overline{C} : C = 1 : 1.128 : 1.225}$ · Key from source paper

**Q136** JEE Main 2013 · 7 Apr · Offline MCQ

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

(A) Sulphur
(B) Phosphorus
(C) Iodine
(D) Silicon

**Answer: (D)** Silicon · Key from source paper

**Q137** AIEEE 2012 · 26 May · Online MCQ

The relationship among most probable velocity, average velocity and root mean square velocity is respectively

(A) $\sqrt{2} : \sqrt{3} : \sqrt{8/\pi}$
(B) $\sqrt{2} : \sqrt{8/\pi} : \sqrt{3}$
(C) $\sqrt{8/\pi} : \sqrt{3} : \sqrt{2}$
(D) $\sqrt{3} : \sqrt{8/\pi} : \sqrt{2}$

**Answer: (B)** $\sqrt{2} : \sqrt{8/\pi} : \sqrt{3}$ · Key from source paper

## Q138 AIEEE 2012 · 26 May · Online MCQ

Among the following the incorrect statement is

(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) Electrical conductivity of semiconductors and metals increases with increase in temperature.** · Key from source paper

## Q139 AIEEE 2012 · 19 May · Online MCQ

An open vessel at $300\ \mathrm{K}$ is heated till $2/5^{\mathrm{th}}$ of the air in it is expelled. Assuming that the volume of the vessel remains constant, the temperature to which the vessel is heated, is

(A) $1500\ \mathrm{K}$
(B) $400\ \mathrm{K}$
(C) $500\ \mathrm{K}$
(D) $750\ \mathrm{K}$

**Answer: (C)** $500\ \mathrm{K}$ · Key from source paper

## Q140 AIEEE 2012 · 19 May · Online MCQ

Ammonium chloride crystallizes in a body centred cubic lattice with edge length of unit cell of $390\ \mathrm{pm}$. If the size of chloride ion is $180\mathrm{pm}$, the size of ammonium ion would be

(A) $174\mathrm{pm}$
(B) $158\mathrm{pm}$
(C) $142\mathrm{pm}$
(D) $126\mathrm{pm}$

**Answer: (B)** $158\mathrm{pm}$ · Key from source paper

## Q141 AIEEE 2012 · 12 May · Online MCQ

$\alpha$, $v$ and $u$ represent most probable velocity, average velocity and root mean square velocity respectively of a gas at a particular temperature. The correct order among the following is

(A) $u > v > \alpha$
(B) $v > u > \alpha$
(C) $\alpha > u > v$
(D) $u > \alpha > v$

**Answer: (A)** $u > v > \alpha$ · Key from source paper

## Q142 AIEEE 2012 · 12 May · Online MCQ

The radius of a calcium ion is 94pm and of the oxide ion is 146pm. The possible crystal structure of calcium oxide will be

(A) tetrahedral
(B) trigonal
(C) octahedral
(D) pyramidal

**Answer: (C) octahedral** · Key from source paper

## Q143 AIEEE 2012 · 7 May · Online MCQ

For 1 mol of an ideal gas at a constant temperature $T$, the plot of $(\log P)$ against $(\log V)$ is a ( $P$ : Pressure, $V$ : Volume)

(A) Straight line parallel to $x$-axis.
(B) Straight line with a negative slope.
(C) Curve starting at origin.
(D) Straight line passing through origin.

**Answer: (B) Straight line with a negative slope.** · Key from source paper

## Q144 AIEEE 2012 · 7 May · Online MCQ

Among the following which is the best description of water in the solid phase?

(A) Covalent solid
(B) Molecular solid
(C) Ionic solid
(D) Network solid

**Answer: (B) Molecular solid** · Key from source paper

## Q145 AIEEE 2012 · 7 May · Online MCQ

A solid has a ' $bcc$ ' structure. If the distance of nearest approach between two atoms is $1.73 \mathring{A}$, the edge length of the cell is

(A) 314.20pm
(B) 1.41pm
(C) 200pm
(D) 216pm

**Answer: (C) 200pm** · Key from source paper

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**Q146** AIEEE 2012 · Offline MCQ

The compressibility factor for a real gas at high pressure is :

(A) $1 + \mathrm{RT/pb}$
(B) $1$
(C) $1 + \mathrm{pb/RT}$
(D) $1 - \mathrm{pb/RT}$

**Answer: (C)** $1 + \mathrm{pb/RT}$ · Key from source paper

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**Q147** AIEEE 2012 · Offline MCQ

Lithium forms body centred cubic structure. The length of the side of its unit cell is $351\mathrm{pm}$. Atomic radius of the lithium will be:

(A) $75\ \mathrm{pm}$
(B) $300\ \mathrm{pm}$
(C) $240\ \mathrm{pm}$
(D) $152\ \mathrm{pm}$

**Answer: (D)** $152\ \mathrm{pm}$ · Key from source paper

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**Q148** AIEEE 2011 MCQ

'a' and 'b' are van der Waals' constants for gases. Chlorine is more easily liquefied than ethane because

(A) a and $b$ for $\mathrm{Cl_2}$ < a and b for $\mathrm{C_2H_6}$
(B) a for $\mathrm{Cl_2}$ < a for $\mathrm{C_2H_6}$ but b for $\mathrm{Cl_2}$ > b for $\mathrm{C_2H_6}$
(C) a for $\mathrm{Cl_2}$ > a for $\mathrm{C_2H_6}$ but $b$ for $\mathrm{Cl_2}$ < b for $\mathrm{C_2H_6}$
(D) a and $b$ for $\mathrm{Cl_2}$ > $a$ and $b$ for $\mathrm{C_2H_6}$

**Answer: (C)** a for $\mathrm{Cl_2}$ > a for $\mathrm{C_2H_6}$ but $b$ for $\mathrm{Cl_2}$ < b for $\mathrm{C_2H_6}$ · Key from source paper

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**Q149** AIEEE 2011 MCQ

In a face centred cubic lattice, atom A occupies the corner positions and atom B occupies the face centre positions. If one atom of $B$ is missing from one of the face centred points, the formula of the compound is

(A) $AB_2$
(B) $A_2B_3$
(C) $A_2\ B_5$
(D) $A_2B$

**Answer: (C)** $A_2\ B_5$ · Key from source paper

## Q150 AIEEE 2010 MCQ

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

(A) 288pm
(B) 398pm
(C) 618pm
(D) 144pm

**Answer: (D)** 144pm · Key from source paper

## Q151 AIEEE 2010 MCQ

Percentage of free space in cubic close packed structure and in body centred packed structure are respectively

(A) 30% and 26%
(B) 26% and 32%
(C) 32% and 48%
(D) 48% and 26%

**Answer: (B)** 26% and 32% · Key from source paper

## Q152 AIEEE 2010 MCQ

If $10^{-4}dm^3$ of water is introduced into a $1.0dm^3$ flask to 300 K, how many moles of water are in the vapour phase when equilibrium is established? (Given : Vapour pressure of $H_2O$ at 300 K is 3170 Pa; $R = 8.314\ J\ K^{-1}\ mol^{-1}$ )

(A) $5.56 \times 10^{-3}$ mol
(B) $1.53 \times 10^{-2}$ mol
(C) $4.46 \times 10^{-2}$ mol
(D) $1.27 \times 10^{-3}$ mol

**Answer: (D)** $1.27 \times 10^{-3}$ mol · Key from source paper

## Q153 AIEEE 2009 MCQ

Copper crystallizes in fcc with a unit cell length of 361pm. What is the radius of copper atom ?

(A) 108pm
(B) 127pm
(C) 157 pm
(D) 181pm

**Answer: (B) 127pm** · Key from source paper

## Q154 AIEEE 2008 MCQ

In a compound atoms of element $Y$ from ccp lattice and those of element $X$ occupy $2/3^{\text{rd}}$ of tetrahedral voids. The formula of the compound will be

(A) $X_4Y_3$
(B) $X_2Y_3$
(C) $X_2Y$
(D) $\mathrm{X_3Y_4}$

**Answer: (A)** $X_4Y_3$ · Key from source paper

## Q155 AIEEE 2007 MCQ

Equal masses of methane and oxygen are mixed in an empty container at $25^{\circ}$C. The fraction of the total pressure exerted by oxygen is

(A) $\frac{2}{3}$
(B) $\frac{1}{3} \times \frac{273}{298}$
(C) $\frac{1}{3}$
(D) $\frac{1}{2}$

**Answer: (C)** $\frac{1}{3}$ · Key from source paper

## Q156 AIEEE 2006 MCQ

Total volume of atoms present in a face-centre cubic unit cell of a metal is ( $r$ is atomic radius)

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

**Answer: (D)** $\frac{16}{3}\pi r^3$ · Key from source paper

## Q157 AIEEE 2005 MCQ

Which one of the following statements is NOT true about the effect of an increase in temperature on the distribution of molecular speeds in a gas?

(A) The most probable speed increases
(B) The fraction of the molecules with the most probable speed increases
(C) The distribution becomes broader
(D) The area under the distribution curve remains the same as under the lower temperature

**Answer: (B) The fraction of the molecules with the most probable speed increases** · Key from source paper

## Q158 AIEEE 2005 MCQ

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

(A) $\mathrm{A\,B}$
(B) $\mathrm{A_2\,B}$
(C) $\mathrm{A\,B_3}$
(D) $\mathrm{A_3\,B}$

**Answer: (C)** $\mathrm{A\,B_3}$ · Key from source paper

## Q159 AIEEE 2004 MCQ

As the temperature is raised from $20^{\circ}\mathrm{C}$ to $40^{\circ}\mathrm{C}$, the average kinetic energy of neon atoms changes by a factor of which of the following?

(A) $1/2$
(B) $2$
(C) $\frac{313}{293}$
(D) $\sqrt{\frac{313}{293}}$

**Answer: (C)** $\frac{313}{293}$ · Key from source paper

## Q160 AIEEE 2004 MCQ

In Vander Waals equation of state of the gas law, the constant ' $b$ ' is a measure of

(A) intermolecular repulsions
(B) intermolecular collisions per unit volume
(C) Volume occupied by the molecules
(D) intermolecular attraction

**Answer: (C) Volume occupied by the molecules** · Key from source paper

## Q161 AIEEE 2004 MCQ

What type of crystal defect is indicated in the diagram below? $\mathrm{Na^+\ Cl^-\ Na^+\ Cl^-\ Na^+\ Cl^-}$ $\mathrm{Cl^-\ \square\ Cl^-\ \square\ Na^+\ \square\ Na^+\ \ Na^+\ Cl^-\ \square\ Cl^-\ Na^+\ Cl^-\ \ Cl^-\ Na^+\ Cl^-\ Na^+\ \square\ Na^+}$

*(see the figure above)*

**Q118.** What type of crystal defect is indicated in the diagram below? $Na^+Cl^-Na^+Cl^-Na^+Cl^-$ $Cl^-\square Cl^-\square Na^+\square Na^+$ $Na^+Cl^-\square Cl^-Na^+Cl^-$ $Cl^-Na^+Cl^-Na^+\square Na^+$

(1) Frenkel defect
(2) Frenkel and Schottky defects
(3) Interstitial defect
(4) Schottky defect

(A) Frenkel defect
(B) Frenkel and Schottky defects
(C) Interstitial defect
(D) Schottky defect

**Answer: (D) Schottky defect** · Key from source paper

## Q162 AIEEE 2003 MCQ

According to the kinetic theory of gases, in an ideal gas, between two successive collisions a gas molecule travels

(A) in a wavy path
(B) in a straight line path
(C) with an accelerated velocity
(D) in a circular path

**Answer: (B) in a straight line path** · Key from source paper

## Q163 AIEEE 2003 MCQ

Glass is a

(A) super-cooled liquid
(B) gel
(C) polymeric mixture
(D) micro-crystalline solid

**Answer: (A) super-cooled liquid** · Key from source paper

## Q164 AIEEE 2003 MCQ

How many unit cells are present in a cubeshaped ideal crystal of NaCl of mass 1.00 g ? [Atomic masses: Na = 23, Cl = 35.5 ]

(A) $5.14 \times 10^{21}$ unit cells
(B) $1.28 \times 10^{21}$ unit cells
(C) $1.71 \times 10^{21}$ unit cells
(D) $2.57 \times 10^{21}$ unit cells

**Answer: (D) $2.57 \times 10^{21}$ unit cells** · Key from source paper

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**Q165** AIEEE 2003 MCQ

A pressure cooker reduces cooking time for food because

(A) boiling point of water involved in cooking is increased
(B) the higher pressure inside the cooker crushes the food material
(C) cooking involves chemical changes helped by a rise in temperature
(D) heat is more evenly distributed in the cooking space

**Answer: (A) boiling point of water involved in cooking is increased** · Key from source paper

**Q166** AIEEE 2002 MCQ

For an ideal gas, number of moles per litre in terms of its pressure P, gas contant R and temperature T is

(A) PT/R
(B) PRT
(C) P/RT
(D) RT/P

**Answer: (C) P/RT** · Key from source paper

**Q167** AIEEE 2002 MCQ

Value of gas constant R is

(A) 0.082 litre atm
(B) $0.987 \text{cal mol}^{-1} \text{K}^{-1}$
(C) $8.3 \text{ J mol}^{-1} \text{K}^{-1}$
(D) $83 \text{ erg mol}^{-1} \text{K}^{-1}$

**Answer: (C)** $8.3 \text{ J mol}^{-1} \text{K}^{-1}$ · Key from source paper

**Q168** AIEEE 2002 MCQ

Kinetic theory of gases proves

(A) only Boyle's law
(B) only Charles' law
(C) only Avogadro's law
(D) all of these

**Answer: (D) all of these** · Key from source paper

**Q169** AIEEE 2002 MCQ

Na and Mg crystallize in BCC and FCC type crystals respectively, then the number of atoms of Na and Mg present in the unit cell of their respective crystal is

(A) 4 and 2
(B) 9 and 14
(C) 14 and 9
(D) 2 and 4

**Answer: (D)** 2 and 4 · Key from source paper

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