NCERT Solutions Class 11 Physics chapter 13 Kinetic Theory

Kinetic Theory

ExerciseP.338

Q.13.1: Estimate the fraction Of molecular volume to the actual volume occupied by oxygen gas at STP. Take the diameter of an oxygen molecule to be 3Å.

Ans : Diameter of an oxygen molecule, d=3A=d2=32=1.5^A=1.5×10−8cm Diameter of an oxygen molecule, d=3A=d2=32=1.5A^=1.5×10−8cm

Actual volume occupied by 1 mole of oxygen gas at STP = 22400cm3V=43πr3·N Actual volume occupied by 1 mole of oxygen gas at STP = 22400cm3V=43πr3·N

Where, N is Avogadro's number =6.023×1023 molecules/mole ∴V=43×3.14×(1.5×10−8)3×6.023×1023=8.51cm3 Where, N is Avogadro's number =6.023×1023 molecules/mole ∴V=43×3.14×(1.5×10−8)3×6.023×1023=8.51cm3

Ratio of the molecular volume to the actual volume of oxygen =8.5122400=3.8×10−4 Ratio of the molecular volume to the actual volume of oxygen =8.5122400=3.8×10−4

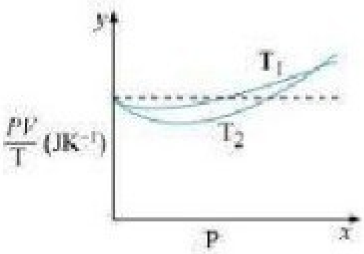
Q.13.2: Molar volume is the volume occupied by 1 mol of any (ideal) gas at standard temperature and pressure (STP : 1 atmospheric pressure, O ∘C∘C). Show that it is 22.4 litres.

Ans : The ideal gas equation relating pressure (P), volume (V), and absolute temperature (T) is given as: PV=nRT The ideal gas equation relating pressure (P), volume (V), and absolute temperature (T) is given as: PV=nRT

Where, R is the universal gas constant =8.314Jmol−1K−1n= Number of moles =1T= Standard temperature =273KP= Standard pressure =1atm=1.013×105Nm−2 Where, R is the universal gas constant =8.314Jmol−1K−1n= Number of moles =1T= Standard temperature =273KP= Standard pressure =1atm=1.013×105Nm−2

∴V=nRTP=1×8.314×2731.013×105=0.0224m3=22.4 litres ∴V=nRTP=1×8.314×2731.013×105=0.0224m3=22.4 litres

Q.13.3: Figure 13.8 shows plot of PV/T versus For 1.00×10−3kg of oxygen gas at two different temperatures. Figure 13.8 shows plot of PV/T versus For 1.00×10−3kg of oxygen gas at two different temperatures.



(a) does the dotted plot signify?
(b) Which is true. TI > T2 or TI

Ans : (a) The dotted plot in the graph signifies the ideal behaviour of the gas, I.e., the ratio PVT is equal. μR(μ is the number of moles and R is the universal gas constant) is a constant quality. It is not dependent on the pressure of the gas. (a) The dotted plot in the graph signifies the ideal behaviour of the gas, I.e., the ratio PVT is equal. μR(μ is the number of moles and R is the universal gas constant) is a constant quality. It is not dependent on the pressure of the gas.

(b) The dotted plot in the given graph represents an ideal gas. The curve of the gas at
temperature Tl is closer to the dotted plot than the curve of the gas at temperature T2T2. A real gas approaches the behaviour of an ideal gas when its temperature increases. Therefore, T1>T2T1>T2 is true for the given plot.

(c) The value of the ratio PV/T, where the two curves meet, is μR . This is because the ideal gas equation is given as: (c) The value of the ratio PV/T, where the two curves meet, is μR . This is because the ideal gas equation is given as:
PV=μRTPVT=μR Where, PV=μRTPVT=μR Where,
P is the pressure
T is the temperature
V is the volume
p is the number of moles
R is the universal constant
Molecular mass Of oxygen = 32.0 g
Mass of
oxygen =1×10−3kg=1gR=8.314mole−1K−1PVT=132×8.314 Mass of oxygen =1×10−3kg=1gR=8.314mole−1K−1PVT=132×8.314
=0.26JK−1 Therefore, the value of the ratio PV/T, where the curves meet on the y -axis, is 0.26JK−1=0.26JK−1 Therefore, the value of the ratio PV/T, where the curves meet on the y -axis, is 0.26JK−1

(d) If We obtain similar plots for 1.00×10−31.00×10−3 kg Of hydrogen, then we will not get the same value of PV/T at the point where the curves meet the V axis. This is because the molecular mass of hydrogen (2.02 u) is different from that of oxygen (32.0 u) We have:
PYT=0.26JK−1R=8.314Jmole−1K−1 Molecular mass (M) of H2=2.02uPVT=μR at constant temperature Where, μ=mMm= Mass of H2PYT=0.26JK−1R=8.314Jmole−1K−1 Molecular mass (M) of H2=2.02uPVT=μR at constant temperature Where, μ=mMm= Mass of H2
m=PVT×MR=0.26×2.028.31=6.3×10−2g=6.3×10−5kg Hence, 6.3×10−5kg of H2 will yield the same value of PV/Tm=PVT×MR=0.26×2.028.31=6.3×10−2g=6.3×10−5kg Hence, 6.3×10−5kg of H2 will yield the same value of PV/T

Q.13.4: An oxygen cylinder of volume 30 litres has an initial gauge pressure of 15 atm and a temperature of 27 oc. After some oxygen is withdrawn from the cylinder, the gauge pressure drops to 11 atm and its temperature drops to 17 oc. Estimate the mass of oxygen taken out of the cylinder (R = 8.31 J mole−1mole−1 K−1K−1, molecular mass of 02 = 32 u).

Ans : Volume of oxygen, V1=30 litres =30×10−3m3 Gauge pressure, P1=15atm=15×1.013×105Pa Volume of oxygen, V1=30 litres =30×10−3m3 Gauge pressure, P1=15atm=15×1.013×105Pa
Temperature, T1=27∘C=300K Universal gas constant, R=8.314Jmole−1K−1 Let the initial number of moles of oxygen gas in the cylinder be n1 The gas equation is given as: P1V1=n1RT1 Temperature, T1=27∘C=300K Universal gas constant, R=8.314Jmole−1K−1 Let the initial number of moles of oxygen gas in the cylinder be n1 The gas equation is given as: P1V1=n1RT1
∴n1=PV1RT1=15.195×105×30×10−3(8.314)×300=18.276∴n1=PV1RT1=15.195×105×30×10−3(8.314)×300=18.276
Where, m1= Initial mass of oxygen M= Molecular mass of oxygen =32g∴m1=n1M=18.276×32=584.84g Where, m1= Initial mass of oxygen M= Molecular mass of oxygen =32g∴m1=n1M=18.276×32=584.84g
After some oxygen is withdrawn from the cylinder, the pressure and temperature reduces
Volume, V2=30 litres =30×10−3m3 Gauge pressure, P2=11 atm =11×1.013×105Pa Temperature, T2=17∘C=290K Volume, V2=30 litres =30×10−3m3 Gauge pressure, P2=11 atm =11×1.013×105Pa Temperature, T2=17∘C=290K
P2V2=n2RT2∴n2=P2V2RT2=11.143×105×30×10−38.314×290=13.86P2V2=n2RT2∴n2=P2V2RT2=11.143×105×30×10−38.314×290=13.86
n2=m2M Where, m2 is the mass of oxygen remaining in the cylinder n2=m2M Where, m2 is the mass of oxygen remaining in the cylinder
∴m2=r2M=13.86×32=453.1g The mass of oxygen taken out of the cylinder is given by the relation: Initial mass of oxygen in the cylinder - Final mass of oxygen in the cylinder =m1−m2=584.84g−453.1g=131.74g=0.131kg Therefore, 0.131 kg of oxygen is taken out of the cylinder. ∴m2=r2M=13.86×32=453.1g The mass of oxygen taken out of the cylinder is given by the relation: Initial mass of oxygen in the cylinder - Final mass of oxygen in the cylinder =m1−m2=584.84g−453.1g=131.74g=0.131kg Therefore, 0.131 kg of oxygen is taken out of the cylinder.

Q.13.5: An air bubble of volume 1.0 cm³ rises from the bottom of a lake 40 m deep at a temperature of 12 °C. To what volume does it grow when it reaches the surface, which is at a temperature of 35 °C ?

Ans : Volume of the air bubble, V1=1.0cm3=1.0×10−6m3 Bubble rises to height, d=40m Temperature at a depth of 40m,T1=12∘C=285K Temperature at the surface of the lake, T2=35∘C=308K Volume of the air bubble, V1=1.0cm3=1.0×10−6m3 Bubble rises to height, d=40m Temperature at a depth of 40m,T1=12∘C=285K Temperature at the surface of the lake, T2=35∘C=308K

The pressure on the surface of the lake: P2=1 atm =1×1.013×105Pa The pressure at the depth of 40m : P1=1atm+dρg Where, ρ is the density of water =103kg/m3∴P1 is the acceleration due to gravity =9.8m/s2∴P1=1.013×105+40×103×9.8=493300Pa The pressure on the surface of the lake: P2=1 atm =1×1.013×105Pa The pressure at the depth of 40m : P1=1atm+dρg Where, ρ is the density of water =103kg/m3∴P1 is the acceleration due to gravity =9.8m/s2∴P1=1.013×105+40×103×9.8=493300Pa

P1V1T1=P2V2T2P1V1T1=P2V2T2

Where, V2V2 is the volume Of the air bubble when it reaches the surface

V2=P1V1T2T1P2=(493300)(1.0×10−6)308285×1.013×105=5.263×10−6m3 or 5.263cm3V2=P1V1T2T1P2=(493300)(1.0×10−6)308285×1.013×105=5.263×10−6m3 or 5.263cm3

Therefore, where, the air bubble reaches the surface, its Volume becomes 5.263 crn^3.

Q.13.6: Estimate the total number of air molecules (inclusive of oxygen, nitrogen, water vapour and other constituents) in a room of capacity 25.0 m^3 at a temperature of 27 °C and 1 atm pressure.

Ans : Volume of the room, V=25.0m3 Temperature of the room, T=27∘C=300K Pressure in the room, P=1atm=1×1.013×105Pa Volume of the room, V=25.0m3 Temperature of the room, T=27∘C=300K Pressure in the room, P=1atm=1×1.013×105Pa

The ideal gas equation relating pressure (p), Volume (V), and absolute temperature (T) can be written as:

PV=ksNT Where, KB is Boltzmann constant =1.38×10−23m2kgs−2K−1PV=ksNT Where, KB is Boltzmann constant =1.38×10−23m2kgs−2K−1

KB is Boltzmann constant =1.38×10−23m2kgs−2K−1N is the number of air molecules in the room KB is Boltzmann constant =1.38×10−23m2kgs−2K−1N is the number of air molecules in the room

N=PVkBT=1.013×105×251.38×10−23×300=6.11×1026 molecules Therefore, the total number of air molecules in the given room is 6.11×1026 . N=PVkBT=1.013×105×251.38×10−23×300=6.11×1026 molecules Therefore, the total number of air molecules in the given room is 6.11×1026 .

Q.13.7: Estimate the average thermal energy of a helium atom at

(i) room temperature (27 °C),

(ii) the temperature on the surface of the Sun (6000 K),

(iii) the temperature of 10 million kelvin (the typical core temperature in the case of a star).

Ans : (i) At room temperature, T=27∘C=300K Average thermal energy =32kT Where k is Boltzmann constant =1.38×10−23m2kgs−2K−1 (i) At room temperature, T=27∘C=300K Average thermal energy =32kT Where k is Boltzmann constant =1.38×10−23m2kgs−2K−1 ∴32kT=32×1.38×10−18×300=6.21×10−21J Hence, the average thermal energy of a helium atom at room temperature (27∘C) is 6.21×10−21J∴32kT=32×1.38×10−18×300=6.21×10−21J Hence, the average thermal energy of a helium atom at room temperature (27∘C) is 6.21×10−21J

(ii) On the surface of the sun, T=6000K Average thermal energy =32kT=32×1.38×10−38×6000=1.241×10−19J (ii) On the surface of the sun, T=6000K Average thermal energy =32kT=32×1.38×10−38×6000=1.241×10−19J

(iii) At temperature, T=107K Average thermal energy =32kT (iii) At temperature, T=107K Average thermal energy =32kT =32×1.38×10−23×107=2.07×10−16J Hence, the average thermal energy of a helium atom at the core of a star is 2.07×10−16 J. =32×1.38×10−23×107=2.07×10−16J Hence, the average thermal energy of a helium atom at the core of a star is 2.07×10−16 J.

Q.13.8: Three vessels Of equal capacity have gases at the same temperature and pressure. The first vessel contains neon (monatomic), the second contains chlorine (diatomic), and the third contains uranium hexafluoride (polyatomic). Do the vessels contain equal number of respective molecules? Is the root mean square speed of molecules the same in the three cases? If not, in which case is the largest ?

Ans : Yes. All contain the same number of the respective molecules. The root mean square speed Of neon is the largest. Since the three vessels have the same capacity, they have the same volume. Hence, each gas has the same pressure, volume, and temperature. According to Avogadro's law, the three vessels will contain an equal number of the respective molecules. This number is equal to Avogadro's number, N=6.023×1023N=6.023×1023The root mean square speed (vrm,) of a gas of mass m, and temperature T, is given by the relation:

vrms=√3kTmvrms=3kTm

Where, k is Boltzmann constant

For the given gases, k and T are constants.

Hence v depends only on the mass of the atorns, i.e. ,

vrms∝√1mvrms∝1m

Therefore, the root mean square speed of the molecules in the three cases is not the same. Among neon, chlorine, and uranium hexafluoride, the mass of neon is the smallest. Hence, neon has the largest root mean square speed among the given gases.

Q.13.9: At what temperature is the root mean square speed of an atom in an argon gas cylinder equal to the rms speed of a helium gas atom at – 20 °C ? (atomic mass of Ar = 39.9 u, of He = 4.0 u).

Ans : Temperature of the helium atom, THe=−20∘C=253K Atomic mass of argon, MAr=39.9u Atomic mass of helium, MHe=4.0u Temperature of the helium atom, THe=−20∘C=253K Atomic mass of argon, MAr=39.9u Atomic mass of helium, MHe=4.0u

Let, (v rms) ar be the rms speed of argon. Let (V rms) He be the rms speed of helium. The rms speed of argon is given by: Let, (v rms) ar be the rms speed of argon. Let (V rms) He be the rms speed of helium. The rms speed of argon is given by:

The rms speed of argon is given by: (vmat)Nx=√3RTArMNr Where, The rms speed of argon is given by: (vmat)Nx=3RTArMNr Where,

R is the universal gas constant T Ar is temperature of argon gas The rms speed of helium is given by: R is the universal gas constant T Ar is temperature of argon gas The rms speed of helium is given by:

(vms)He=√3RTHeMHe(vms)He=3RTHeMHe

√3RTNMN=√3RTHeMHe3RTNMN=3RTHeMHe

=2534×39.9=2523.675=2.52×103K Therefore, the temperature of the argon atom is 2.52×103K . =2534×39.9=2523.675=2.52×103K Therefore, the temperature of the argon atom is 2.52×103K .

Q.13.10: Estimate the mean free path and collision frequency of a nitrogen molecule in a cylinder containing nitrogen at 2.0 atm and temperature 17 0C. Take the radius of a nitrogen molecule to be roughly 1.0 Å. Compare the collision time with the time the molecule moves freely between two successive collisions (Molecular mass of N2N2 = 28.0 u).

Ans : Mean free path =1.11×10−7m Collision frequency =4.58×109s−1 Successive collision time ≈500×(Collision time) Mean free path =1.11×10−7m Collision frequency =4.58×109s−1 Successive collision time ≈500×(Collision time)

Pressure inside the cylinder containing nitrogen, P=2.0 atm =2.026×105Pa Temperature inside the cylinder, T=17∘C=290K Radius of a nitrogen molecule, r=1.0A=1×1010m Pressure inside the cylinder containing nitrogen, P=2.0 atm =2.026×105Pa Temperature inside the cylinder, T=17∘C=290K Radius of a nitrogen molecule, r=1.0A=1×1010m

Diameter, d=2×1×1010=2×1010m Molecular mass of nitrogen, M=28.0g=28×10−3kg The root mean square speed of nitrogen is given by the relation: vm=√3RTM Diameter, d=2×1×1010=2×1010m Molecular mass of nitrogen, M=28.0g=28×10−3kg The root mean square speed of nitrogen is given by the relation: vm=3RTM

Where, R is the universal gas constant =8.314 J mole −1K−1∴vms=√3×8.314×29028×10−3=508.26m/s Where, R is the universal gas constant =8.314 J mole −1K−1∴vms=3×8.314×29028×10−3=508.26m/s

∴l the mean free path (l) is given by the relation: l=kT√2×d2×P Where, k is the Boltzmann constant =1.38×10−23kgm2s−2K−1∴l=1.38×10−23×290√2×3.14×(2×1

0−10)2×2.026×105=1.11×10−7m∴l the mean free path (I) is given by the relation: l=kT2×d2×P Where, k is the Boltzmann constant =1.38×10−23kgm2s−2K−1∴I=1.38×10−23×2902×3.14×(2×10−10)2×2.026×105=1.11×10−7m

Collision frequency =v rme l=508.261.11×10−7=4.58×109s−1 Collision time is given as: Collision frequency =v rme l=508.261.11×10−7=4.58×109s−1 Collision time is given as:

T=dvmin=2×10−10508.26=3.93×10−13sT=dvmin=2×10−10508.26=3.93×10−13s

Time taken between successive collisions: T′=lv mys =1.11×10−7m508.26m/s=2.18×10−10s∴T′T=2.18×10−103.93×10−13=500 Time taken between successive collisions: T′=lv mys =1.11×10−7m508.26m/s=2.18×10−10s∴T′T=2.18×10−103.93×10−13=500

Hence, the time taken between successive collisions is 500 times the time taken for a collision.

Additional ExerciseP.340

Q.13.11: A metre long narrow bore held horizontally (and closed at one and) contains a 76 cm long mercury thread, which traps a 15 cm column of air. What happens if the tube is held vertically with the open end at the bottom ?

Ans : Length of the narrow bore, L=1m=100cm Length of the mercury thread, /=76cm Length of the air column between mercury and the closed end, la=15cm Length of the narrow bore, L=1m=100cm Length of the mercury thread, /=76cm Length of the air column between mercury and the closed end, la=15cm

since the bore is held vertically in air with the open end at the bottom, the mercury length that occupies the air space is: 100−(76+15)=9cm Hence, the total length of the air column =15+9=24cm Let hcm of mercury flow out as a result of atmospheric pressure. since the bore is held vertically in air with the open end at the bottom, the mercury length that occupies the air space is: 100−(76+15)=9cm Hence, the total length of the air column =15+9=24cm Let hcm of mercury flow out as a result of atmospheric pressure.

∴ Length of the air column in the bore =24+hcm And, length of the mercury column =76−hcm Initial pressure, P1=76cm of mercury Initial volume, V1=15cm3∴ Length of the air column in the bore =24+hcm And, length of the mercury column =76−hcm Initial pressure, P1=76cm of mercury Initial volume, V1=15cm3

Final pressure, P2=76−(76−h)=hcm of mercury Final volume, V2=(24+h)cm3 Temperature remains constant throughout the process. ∴P1V1=P2V276×15=h(24+h)h2+24h−1140=0 Final pressure, P2=76−(76−h)=hcm of mercury Final volume, V2=(24+h)cm3 Temperature remains constant throughout the process. ∴P1V1=P2V276×15=h(24+h)h2+24h−1140=0

∴h=−24±√(24)2+4×1×11402×1=23.8cm or −47.8cm∴h=−24±(24)2+4×1×11402×1=23.8cm or −47.8cm

Height cannot be negative. Hence, 23.8 cm of mercury will flow out from the bore and
522 cm of mercury will remain in it. The length of the air column Will be
24 + 23.8 — 47.8 cm

Q.13.12: A metre long narrow bore held horizontally (and closed at one end) contains a 76 cm long mercury thread, which traps a 15 cm column of air. What happens if the tube is held vertically with the open end at the bottom ?

Ans : Rate of diffusion of hydrogen, R1=28.7cm3s−1 Rate of diffusion of another gas, R2=7.2cm3s−1 According to Graham's Law of diffusion, we have: Rate of diffusion of hydrogen, R1=28.7cm3s−1 Rate of diffusion of another gas, R2=7.2cm3s−1 According to Graham's Law of diffusion, we have:
R1R2=√M2M1 Where, M1 is the molecular mass of hydrogen =2.020gM2 is the molecular mass of the unknown gas R1R2=M2M1 Where, M1 is the molecular mass of hydrogen =2.020gM2 is the molecular mass of the unknown gas
∴M2=M1(R1R2)2=2.02(28.77.2)232g is the molecular mass of oxygen. Hence, the unknown gas is oxygen. ∴M2=M1(R1R2)2=2.02(28.77.2)232g is the molecular mass of oxygen. Hence, the unknown gas is oxygen.

Q.13.13: A gas in equilibrium has uniform density and pressure throughout its volume. This is strictly true only if there are no external influences. A gas column under gravity, for example, does not have uniform density (and pressure). As you might expect, its density decreases with height. The precise dependence is given by the so-called law of atmospheres
n2=n1exp[−mg(h2−h1)/kBT]n2=n1exp[−mg(h2−h1)/kBT]
Where n2,n1n2,n1, refer to number density at heights h2h2 and hl respectively. use this relation to derive the equation for sedimentation equilibrium of a suspension in a liquid column:
n2=n1exp[−mgNA(ρ−P′)(h2−h1)/(ρRT)]n2=n1exp[−mgNA(ρ−P′)(h2−h1)/(ρRT)]Where p is the density of the suspended particle, and p' that of surrounding medium. CNA s Avogadro's number, and R the universal gas constant.] [Hint: use Archimedes principle to find the apparent weight of the suspended particle.]

Ans : According to the law of atmospheres, we have: n2=n1exp[−mg(h2−h1)/kBT]...(i) Where, n1 is the number density at height h11, and n2 is the number density at height h2 mg is the weight of the particle suspended in the gas column According to the law of atmospheres, we have: n2=n1exp[−mg(h2−h1)/kBT]...(i) Where, n1 is the number density at height h11, and n2 is the number density at height h2 mg is the weight of the particle suspended in the gas column
Density of the medium =ρ′ Density of the suspended particle =ρ Mass of one suspended particle =m′ Mass of the medium displaced =m Volume of a suspended particle =v Density of the medium =ρ′ Density of the suspended particle =ρ Mass of one suspended particle =m′ Mass of the medium displaced =m Volume of a suspended particle =v
According to Archimedes' principle for a particle suspended in a liquid column, effective weight of the suspended particle is given as: Weight of the medium displaced- Weight of the suspended particle According to

Archimedes' principle for a particle suspended in a liquid column, effective weight of the suspended particle is given as: Weight of the medium displaced- Weight of the suspended particle =mg−m′g=mg−Vρ′g=mg−(mρ)ρ′g=mg(1−ρ′ρ) Gas constant, R=kBNkB=RN...(iii)=mg−m’g=mg−Vρ’g=mg−(mρ)ρ ’g=mg(1−ρ’ρ) Gas constant, R=kBNkB=RN...(iii) n2=n1exp[−mg(h2−h1)/kBT]mg(1−ρ′ρ)(h2−h1)NRT=n1exp[−mg(ρ−ρ′)(h2−h1)NRTρ]n2=n1exp[−mg(h2−h1)/kBT]mg(1−ρ’ρ)(h2−h1)NRT=n1exp[−mg(ρ−ρ’)(h2−h1)NRTρ]

Q.13.14: Given below are densities of some solids and liquids. Give rough estimates of the size of their atoms:

Substance	Atomic Mass (u)	Density (10^3 Kg m^{-3})
Carbon (diamond)	12.01	2.22
Gold	197.00	19.32
Nitrogen (liquid)	14.01	1.00
Lithium	6.94	0.53
Fluorine (liquid)	19.00	1.14

[Hint : Assume the atoms to be ‘tightly packed’ in a solid or liquid phase, and use the known value of Avogadro’s number. You should, however, not take the actual numbers you obtain for various atomic sizes too literally. Because of the crudeness of the tight packing approximation, the results only indicate that atomic sizes are in the range of a few Å].

Substance	Radius (Å)
Carbon (diamond)	1.29
Gold	1.59
Nitrogen (liquid)	1.77
Lithium	1.73
Fluorine (liquid)	1.88

Ans :

Atomic mass of a substance =M Density of the substance =ρ Avogadro's number =N=6.023×1023 Volume of each atom =43πr3 Atomic mass of a substance =M Density of the substance =ρ Avogadro's number =N=6.023×1023 Volume of each atom =43πr3

Volume of N number of molecules =43πr3 Volume of one mole of a substance =Mρ... (ii) Volume of N number of molecules =43πr3 Volume of one mole of a substance =Mρ... (ii)

43πr3∴r=3√3M4πρN For carbon: M=12.01×10−3kgρ=2.22×103kgm−343πr3∴r=3M4πρN3 For carbon: M=12.01×10−3kgρ=2.22×103kgm−3 ∴r=(3×12.01×10−34π×2.22×103×6.023×1023)13=1.29A Hence, the radius of a carbon atom

is 1.29 A. ∴r=(3×12.01×10−34π×2.22×103×6.023×1023)13=1.29A Hence, the radius of a carbon atom is 1.29 A.
For Gold
M=197.00×10−3kgρ=19.32×103kgm−3M=197.00×10−3kgρ=19.32×103kgm−3
∴r=(3×12.01×10−34π×2.22×103×6.023×1023)13=1.29A∴r=(3×12.01×10−34π×2.22×103×6.023×1023)13=1.29A
For liquid nitrogen :
M=14.01×10−3kgρ=1.00×103kgm−3∴r=(3×14.01×10−34π×1.00×103×6.23×1025)13=1.77AM=14.01×10−3kgρ=1.00×103kgm−3∴r=(3×14.01×10−34π×1.00×103×6.23×1025)13=1.77A
For lithium :
M=6.94×10−3kgρ=0.53×103kgm−3M=6.94×10−3kgρ=0.53×103kgm−3
∴r=(3×6.94×10−34π×0.53×103×6.23×1023)13=1.73A∴r=(3×6.94×10−34π×0.53×103×6.23×1023)13=1.73A
For liquid Fluorine :
M=19.00×10−3kgρ=1.14×103kgm−3∴r=(3×19×10−34π×1.14×103×6.023×1023)13=1.88AM=19.00×10−3kgρ=1.14×103kgm−3∴r=(3×19×10−34π×1.14×103×6.023×1023)13=1.88A