

<u>Home</u> Physics Skills Units Essential Pre-Uni Physics G1.1

Essential Pre-Uni Physics G1.1



Give your answer to 3 significant figures. Remember that $0\,^{\circ}C=273\,K$ (no $^{\circ}$ in K).

Convert $23\,^{\circ}C$ into K.



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Physics

Thermal

Gases

Gas Laws, Density and Kinetic Energy 32.8

Gas Laws, Density and Kinetic Energy 32.8



Within a gas mixture at equilibrium, the mean kinetic energy of each type of molecule is the same. This is because the temperature is uniform. In a mixture of helium ($m=4.00\,\mathrm{u}$) and nitrogen ($m=28.0\,\mathrm{u}$),

Part A	Which molecules move faster	
state which molecules move faster.		
	Nitrogen	
	Helium	
Part B Ratio		
cal	culate the ratio $\overline{c_{\sf helium}^2}$ $/$ $\overline{c_{\sf nitrogen}^2}$.	



Thermal

Gases

Essential Pre-Uni Physics G2.6

Essential Pre-Uni Physics G2.6



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Don't forget that one mole of gas contains $6.02 \times 10^{23}\,$ molecules, and that the mass of this amount is called the 'molar mass'.

A tyre contains $800\,\mathrm{cm^3}$ of air at a pressure of about $5.0\times10^5\,\mathrm{Pa}$ at $9\,^\circ\mathrm{C}$. After a cycle ride, the volume is $760\,\mathrm{cm^3}$, the temperature is now $25\,^\circ\mathrm{C}$, and the pressure is $4.0\times10^5\,\mathrm{Pa}$. What percentage of the gas molecules have leaked out?



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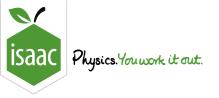
Gases

Gas Laws, Density and Kinetic Energy 32.6

Gas Laws, Density and Kinetic Energy 32.6



Calculate the mean kinetic energy of molecules in a gas at $15\,^{\circ}C.$



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Essential Pre-Uni Physics G2.5

Essential Pre-Uni Physics G2.5



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Don't forget that one mole of gas contains $6.02 \times 10^{23}\,$ molecules, and that the mass of this amount is called the 'molar mass'.

A tyre contains $800\,\mathrm{cm^3}$ of air at a pressure of about $5.0\times10^5\,\mathrm{Pa}$ at $9.0\,^\circ\mathrm{C}$. After a cycle ride, the volume is $810\,\mathrm{cm^3}$ and the temperature is now $25\,^\circ\mathrm{C}$. Assuming that none of the gas has leaked, what is the new pressure?



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Essential Pre-Uni Physics G2.1



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Don't forget that one mole of gas contains $6.02 \times 10^{23}\,$ molecules, and that the mass of this amount is called the 'molar mass'.

What is the volume of a mole of gas at atmospheric pressure $(1.01 \times 10^5 \, Pa)$ and at $20\,^{\circ}C$? Give your answer to two significant figures.



<u>Home</u> Physics

Gases

Gas Laws, Density and Kinetic Energy 32.2

Gas Laws, Density and Kinetic Energy 32.2



Element	Molar mass $/\ \mathrm{g}\ \mathrm{mol}^{-1}$
Н	1
S	32
О	16

What is the density of a sulfuric acid gas cloud on Venus if the temperature is $467\,^{\circ}\mathrm{C}$ and the pressure is $9308\,\mathrm{kPa}$? The chemical formula for sulfuric acid is $H_2SO_4\,.$



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Gases

Essential Pre-Uni Physics G2.3

Essential Pre-Uni Physics G2.3



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Don't forget that one mole of gas contains $6.02 \times 10^{23}\,$ molecules, and that the mass of this amount is called the 'molar mass'.

How many molecules of gas do you need in a $100\,\mathrm{cm^3}$ cylinder to exert a pressure of $1.0\times10^8\,\mathrm{Pa}$ at a temperature of $800\,^\circ\mathrm{C}$? Give your answer to 2 significant figures.



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Essential Pre-Uni Physics G2.2



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Don't forget that one mole of gas contains $6.02 \times 10^{23}\,$ molecules, and that the mass of this amount is called the 'molar mass'.

Calculate the density of nitrogen gas at atmospheric pressure and at $20\,^{\circ}\mathrm{C}$ if the molar mass of nitrogen is $0.028\,\mathrm{kg}$.

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Gases

Gas Laws, Density and Kinetic Energy 32.1

Gas Laws, Density and Kinetic Energy 32.1



Quantities:

P pressure $(N \, m^{-2})$

V volume of a gas (m^3)

T temperature (K)

m mass of particle (kg)

ho density of a gas $({
m kg}\,{
m m}^{-3})$

 $M_{
m M}$ molar mass $({
m kg}\,{
m mol}^{-1})$

n number of moles of gas (mol)

M total mass of gas (kg)

N number of particles in a gas

 $\overline{c^2}$ mean-square speed $\left(\mathrm{m^2\,s^{-2}}\right)$

 m_u molecular mass (u)

 \overline{K} mean molecule kinetic energy (J)

Equations:

$$PV=nRT$$
 $n=rac{M}{M_{ extsf{M}}}$ $PV=rac{Nm\overline{c^2}}{3}$ $n=rac{N}{N_{ extsf{A}}}$ $ho=rac{M}{V}$ $PV=Nk_{ extsf{B}}T$ $\overline{K}=rac{1}{2}m\overline{c^2}$ $m_u=rac{m}{1.66 imes10^{-27}\, ext{kg}}$

Use the equations above to derive expressions for:

Part A P using M, M_M , V, R, T

P in terms of M, M_{M} , V, R and T.

The following symbols may be useful: M, M_M, P, R, T, V

Part B ho using $M_{
m M}$, P, R, T

 ρ in terms of $M_{\rm M}$, P, R and T.

The following symbols may be useful: M_M, P, R, T, rho

