Gases worksheet 4

Question 3

3.1 A fixed mass of gas occupies a volume of 1,5 cm^3 in a gas syringe at 20°C. The volume of the syringe is now increased to 2 cm^3.

3.1.1 How does the average speed of the molecules in syringe now compare with the average speed when the volume was 1,5 cm^3?

Write down only INCREASE, DECREASE OR REMAINS THE SAME.

(1)

3.1.2 How will the pressure exerted by the gas now be affected? Write down only INCREASE OR DECREASE. (1)

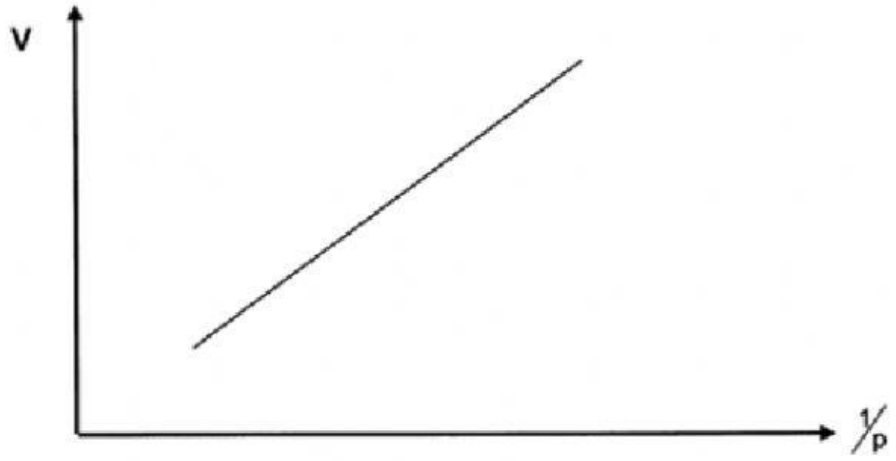
3.1.3 Name the law that explains this change in pressure. (1)

Questions dealing with gradients of graphs

Something to remember: if the question asks you to calculate the gradient, what does the gradient represent?

Well it depends on what is on your x and y axis.

Example 1



Gradient = $\frac{\Delta V}{\frac{\Delta 1}{p}}$

Or simplified: gradient = $\Delta V \div \Delta (1/p)$

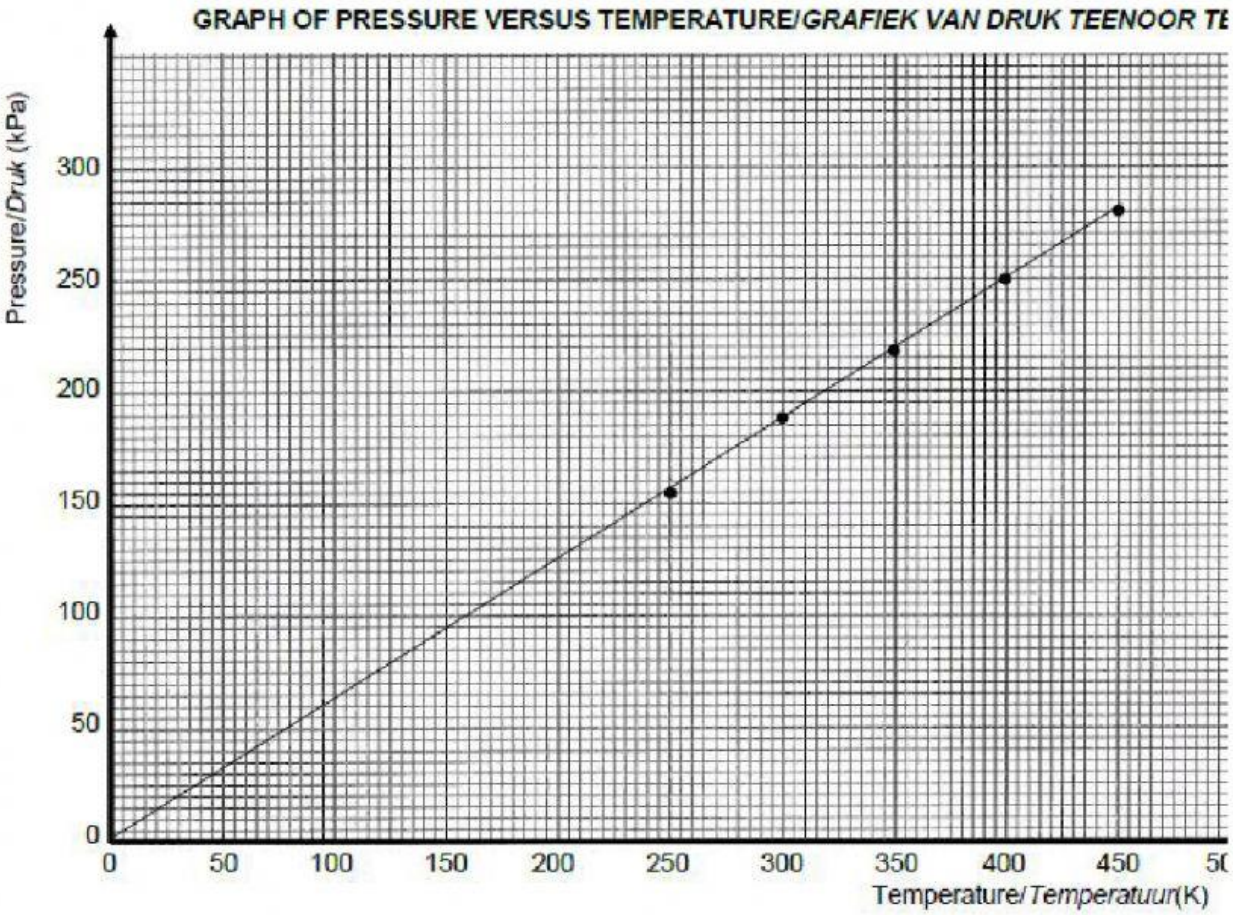
= $\Delta V \times p/1$

= V.p

Keep, change and flip

Thus the gradient represent = V.p if they ask

Example 2



Gradient = $\frac{\Delta P}{T}$

If they ask you to use this gradient to calculate the volume:

Firstly ,manipulate the formala to get P÷T

pV = nRT

$\frac{\Delta P.V}{T}$ = n.R

Then divide both sides by V

Thus $\frac{p}{T} = \frac{nR}{V}$

Thus the gradient also equal to = $\frac{nR}{V}$,

Which seems very random, but they could then ask you to calculate Volume for example.

Let's do this for the graph above:

Example

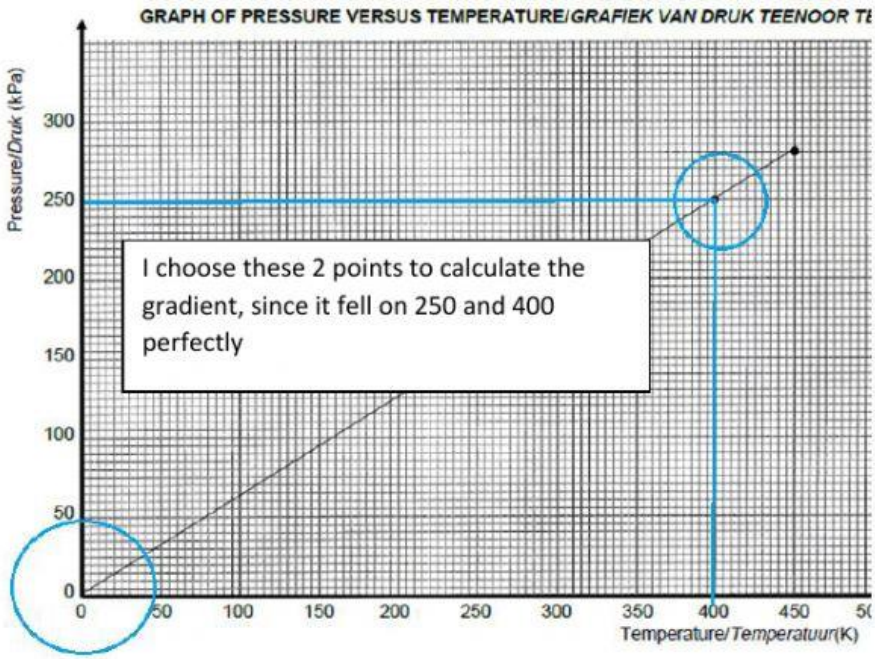
Calculate the volume of 2 moles of the gas represented on the graph.

Gradient = $\frac{\Delta P}{T}$

Pressure needs to be in Pa

$= \frac{(250\ x\ 1000) - 0}{400 - 0}$

= 625



$\frac{p}{T} = \frac{nR}{V}$

$625 = \frac{2(8{,}31)}{V}$

$625V = 16{,}62$

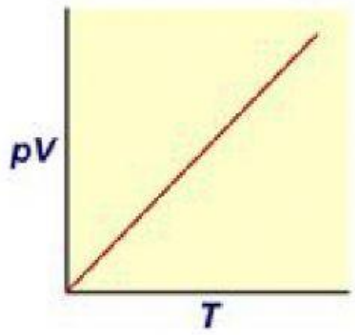
$V = 0{,}03\ m^3$

Then you can substitute into this formula and manipulate to get V by itself.

Example 3

pV / T graph: calculating number of moles

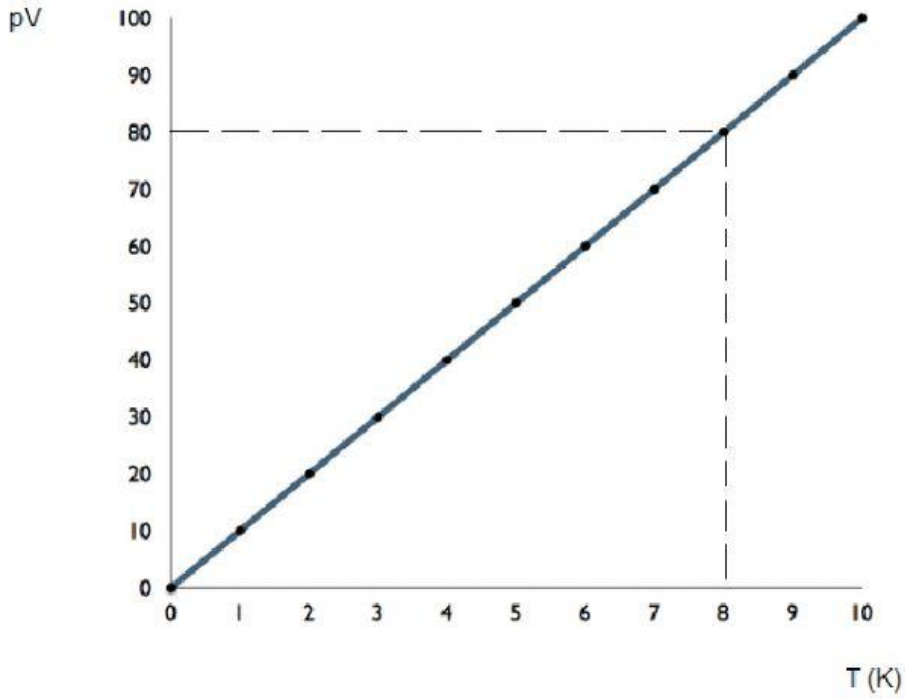
Plotting a graph of *pV* against *T* for an ideal gas:



$pV = nRT$, so $pV / T = nR$

Therefore the gradient of the graph is equal to nR.

Because R is a constant, the number of moles can be calculated from the gradient.



Firstly, what would the gradient of this graph represent?

pV = nRT

manipulate the formula so that pV÷T is on one side of the equation

$\frac{pV}{T}$= n.R

Thus the gradient equals to n.R

Since you always have the value of R, you can use the gradient and calculate the

Use the graph and determine the number of moles of gas from the graph

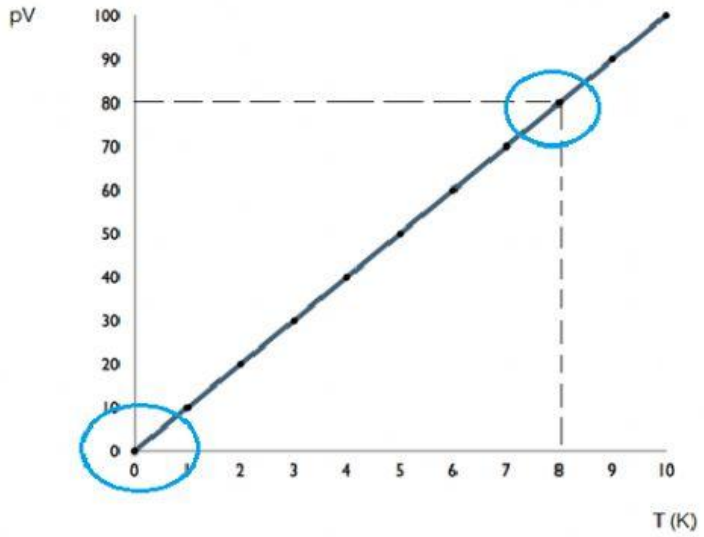
$\frac{pV}{T}$ = n.R

$\frac{80-0}{8-0}$ = n.R

10 = n.R

10 = n(8,31)

n = 1,2 mol



Determine what the unit for the gradient would be

The unit for the gradient would be $J.K^{-1}$

Why?

The unit for pV equals to Joules, why?

Pressure = Force per unit area = N/m^2

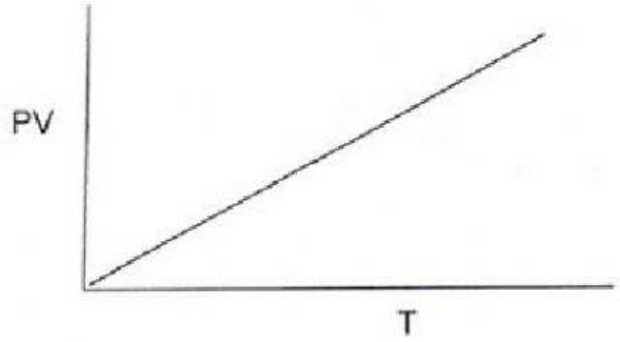
Pressure x Volume = N/m^2 x m^3 = N m

Force x distance (N m) = Energy (Joules)

Therefore Pressure x Volume is in unit of Joules

Exam question

A diatomic gas was studied at various temperatures and pressures. The following graph was obtained from results of the study.



Assume that this gas an ideal gas.

1.1 State the conditions under which real gases deviate from ideal gas behaviour. (2)

High pressure

Low pressure

Low temperature

High temperature

1.2 Determine the gradient of this graph, if the gas occupied 3,36dm^3 of STP.

Gradient = (2 decimal places)

{Don't leave any spaces between answer values and units}

STP – standard temp and pressure

T = 0°C + 273

= 273K

P = 1 atm (101,325kPa)

1.3 0,384 g of a gas occupied a volume of 200cm^3 at a pressure of 149,58 kPa and temperature of 27°C. Identify this gas. Show clearly how you arrived at this answer.

Firstly, convert all the values into the correct SI units

{leave no spaces between values and units}

p = {in decimal notation – not scientific notation)

V = {5 decimal places and in decimal notation}

T =

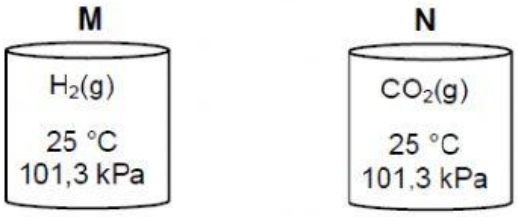
Answer for the mole(n) =

Final answer for M =

Thus the gas is (just state the element symbol) =

Multiple choice questions

1. Two identical containers, **M** and **N**, are shown below. Container **M** contains $H_2(g)$ and container **N** contains $CO_2(g)$. Both gases are at a temperature of 25 °C and a pressure of 101,3 kPa.



Consider the following statements:

(i) The average kinetic energy of the molecules is the same in both containers.
(ii) Container **M** contains more gas molecules than container **N**.
(iii) The mass of the gas in container **N** is greater than the mass of the gas in container **M**.

Which of the above statements is/are CORRECT?

A (i) only

B (iii) only

C (i) and (ii) only

D (i) and (iii) only

2. The volume of a gas at a certain temperature and pressure is *V*.

If the temperature is doubled and the pressure is halved, the volume of the gas will be ...

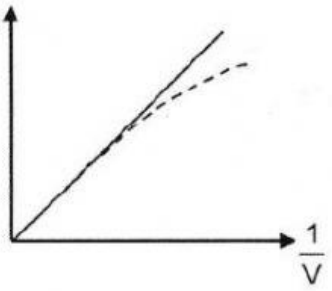
A $4V$

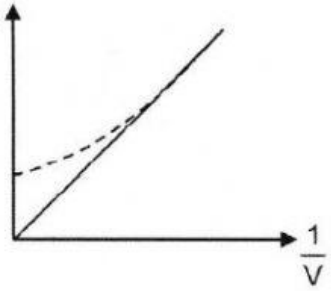
B $2V$

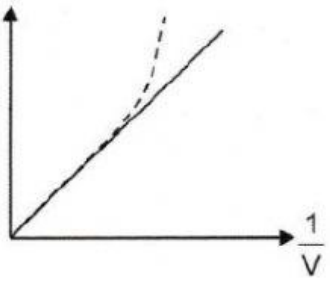
C V

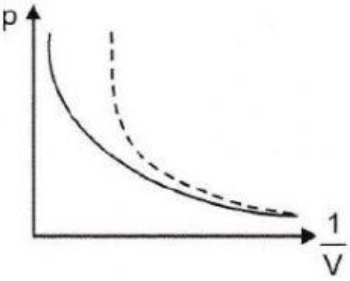
D $\frac{1}{2}V$

3. In which ONE of the following graphs does the dotted line CORRECTLY represent the deviation of a real gas from ideal gas behaviour?

A


B


C


D


4. A gas of volume V is at a temperature T_1 and pressure P_1 in a gas syringe. If the pressure on the gas is doubled and the temperature halved, then the volume that the gas will occupy is ...

A $\frac{1}{4}$ V

B $\frac{1}{2}$ V

C V

D 2 V