

so the next topic which we are going to discuss is colligative property we have already learned that the vapor pressure of solvent in a solution is less than the vapor pressure of pure solvent and this relationship is given by Raoult's law the vapor pressure of solvent in solution is given by mole fraction of solvent multiplied by vapor pressure of pure solvent of course the change in vapor pressure can be written as vapor pressure of pure solvent minus the vapor pressure of solvent in solution and replacing p_1^0 from here we are going to get $p_1^0 - x_1 p_1^0$ which is equal to $p_1^0 (1 - x_1)$ and we know this x_1 is the mole fraction of solvent so $1 - x_1$ is the mole fraction of solute so we get $p_1^0 x_2$ in the binary solution x_2 is the mole fraction of the solute and if there is more than one component available in the solution then this is the mole fraction of all the solutes basically we are going to add a mole fraction of each and every component and then add it and that we are going to call it x_2 so Δp is directly related to x_2 we can write this as Δp divided by p_1^0 equal to x_2 x_2 is the mole fraction of solute present in the solution and this x_2 can be written as $\frac{n_2}{n_1 + n_2}$ we have already learned the moles of solute divided by total number of moles present in solution that is moles of solvent plus moles of solute okay and then doing a subtraction and Δp we can also write this whole equation as $\frac{\Delta p}{p_1^0} = \frac{n_2}{n_1 + n_2}$ here p_1^0 minus p_1 divided by p_1^0 and subtracting the denominator from numerator we are going to get n_2 divided by $n_1 + n_2$ equal to $\frac{p_1^0 - p_1}{p_1^0}$ and this equation can be used to determine the molecular weight of unknown solute if we don't know what is present in the solution which solute is present we can use this equation to calculate the molecular weight of solute as following so n_2 is the number of moles of solute so this is defined as a weight of solute divided by molecular weight of solute divided by weight of solution weight of solvent present in the solution divided by molecular weight of solvent we already know the information this weight of solvent present in the solution and we can use this information to calculate the molecular weight of solute ok let's do an exercise ok so this is an example from the textbook the example I am going to do this problem the vapor pressure of pure benzene at a certain temperature is p_1^0 .

850 bar okay

so for band gene we are given vapor pressure of pure energy that is p_1^0 at a certain temperature T^0 .

85 0 bar all right in a non-volatile non-electrolyte solid weighing 0.

5 gram we don't know what solute is this we have we are adding 0.

5 gram of this solute in in the benzene and how much benzene 39 gram of benzene

so we are given mass of uh solute and we are dissolving this unknown solute in in 39 gram of solvent and since it is benzene we know the molecular weight of engine molecular weight of engine would be 12 into 6 C6 plus H6 that is 6

so 78

so now the vapor pressure of the solution then after of the solution is vapor pressure of the solution is uh 0. 845 this is a non-volatile solute

so there's going to be no contribution from the solute

so this whole vapor pressure is coming from the benzene now we can just ah the formula is given right in front of this

so p_1^0 minus p_1 is simply point ah we subtract this and we get 5 into 10 minus 3 bar divided by p_1^0 that would be p_1 that is 0.

845 and that is equal to weight of solute which is given 0.

5 gram divided by molecular weight of the solute divided by weight of solvent that is 39 gram divided by molecular weight of solvent that is 78

so i can calculate the molecular weight of ah solvent now easily using this formula

so that would be ah

so i'm going to take molecular weight to other side and bring all the information to others this side

so i am going to get 0.

845 divided by 0.

005 ah and and that is going to give me the molecular weight so molecular weight of

unknown solute is simply 169 gram per mole

so we have used this lowering in the vapor pressure to calculate molecular weight of unknown solute if we have a some unknown pure

compound and we want to know what it is and if if we can find a solvent in which it can dissolve

a known solvent in which it can dissolve

so we are just going to dissolve some known amount of this unknown solute in this solvent and if we can calculate the vapor pressure and that's it we can

know this molecular weight and molecular weight will tell me give you some information about what

this compound might be okay okay next topic which we are going to discuss is elevation of boiling

point and at this point i want to spend a little time to discuss what is phase diagram of a pure

solvent

so okay let's see if i have a closed flask okay and this is evacuated there's nothing in

there it's a pure very good vacuum and in this i introduced some of the solvent ok

so i have a

solvent and we have learned in the previous class that this solvent is going to evaporate ok and this evaporated the solvent from

the liquid phase is going to go into this vapor phase and we have learned that that

lets say this is a compound a in a liquid phase and goes to gaseous phase and this is a dynamical

equilibrium and it will reach equilibrium and at this point whatever is the pressure exerted

by this gas on the surface of this liquid that will be called vapor pressure okay in this

container we have only the pure solvent and its it's a vapor nothing else because we started with a empty flask a evacuated flask

so this

all this pressure on the solvent and the liquid solvent is due to the its own vapor

and this is exactly called vapor pressure now if i start increasing the temperature

if i start providing some heat to this system as i am increasing the temperature

of course there would be a tendency tendency to as for the molecule solute solvent molecule to

escape from liquid phase into the gaseous phase and every time every time there would be

a new dynamical equilibrium as we increase the temperature and the vapor pressure

would keep on increasing and if i plot simply temperature versus this pressure pressure

exerted by the solvent vapor on the liquid that pressure then i'm going to get a a typical curve

like this

so it will the pressure is increasing as temperature is increased and we start at a point because below this point ah below this point the liquid will freeze

so we will get a relationship a vapor a curve between solid and gas not the solid and okay all right now

so this is a curve for pure

solvent now what would happen if i add to if i add a some solute into this again

i am going to do the same experiment and i am just going to measure the pressure exerted by

the solvent molecule on the uh solution but ah the solute which i am have added is non-volatile

so it is not going to contribute to the vapor pressure or to the the pressure exerted over the solution but now there is going to be decrease in the vapor

pressure at the given temperature if the vapor pressure at a given temperature is for the

pure uh solvent was p_1^0 now it is going to be $x_1 p_1^0$ ok

so now i am going to just plot this p_1 as a function of temperature

so this quantity multiplied by x_1 and i am going to get a curve something

like
this

so let's say i was at this temperature
so for pure solvent this is the vapor pressure as i has added some solute now
the new vapor

pressure is this and this is basically Δp where Δp we have just defined
is $p_1 - p_2$ as a temperature increase this is going to be the Δp and if
you keep on increasing the temperature this is going to be the Δp now what
is the normal boiling point normal

boiling point is when the vapor pressure $p_1 - p_2$ becomes equal to 1
atm if i have left this container open at 1 atm at the normal boiling
point the external pressure and the vapor pressure becomes equal and it will
simply boil i mean

all the this it will keep on condensing the boiling and this gaseous
molecule will

simply keep on escaping

so there would be a complete boiling and it will just everything will
escape okay

so let's assume that this is one atm

so this is the normal boiling point

so let me

clean this figure a little

so this is one atm this is the vapor pressure at this temperature this is
the normal boiling point and at this
temperature the vapor pressure is 180 mm and this is the normal boiling point
okay now what would be

the normal boiling point for the solution the solution curve is this
this is the vapor pressure of the vapor pressure curve of the

solution now this curve is going to have a vapor pressure of 1 atm at this
point and this is the boiling point for the solution

and this is the boiling point our solvent and this difference Δt is
the increase

in the boiling point with respect to increasing the boiling point of solution
with respect to the

pure solvent now one point few points to note this curve is i am simply
plotting using

this information okay

so it depends on this curve which is $p_1 - p_2$ and mole fraction of mole
fraction of solvent

so this curve does not depend upon the properties of
solute at all and the change in Δt depends upon the property of this
curve in

fact the slope of this curve at this point and and this concentration x_1 or
related

to x_2 x_1 and x_2 are related simply by x_2 is equal to $1 - x_1$

so it doesn't have

this property Δt as i defined here is proportional to simply the
concentration and there

is a proportionality constant which is called k_b which is basically is called
molar boiling point

elevation constant and this constant depends upon only the properties
of the solvent not on the solute as it is very clear from that figure okay

so now we can use this property

also to calculate about unknown solute constant k_b is specific to a

solvent

so let me write this and now let's try to and this m is the molality of a solute in the solution ok let's do one example ok here i read 18 gram of glucose 18 gram of glucose that is $C_6H_{12}O_6$ is dissolved in one kg of water in 1 kg of water at what temperature will boil at what temperature will boil water boil at one point zero one three bar and K_b for water is zero point five two

so when we are just asked to calculate ΔT to calculate ΔT i need K_b and more molality K_b is given right here and i

need to calculate molality what is the definition of molality molality is defined which we have

already discussed moles of solute

so moles of moles of solute that is n divide by weight of solvent in kg ok so to calculate this i need the moles of solute i am given 18 gram divided by molecular weight of glucose

so that would be $18 \div 180 = 0.1$

so six eight ten one

ten eleven eight one eighty divided by weight of a solvent which is water and we have given one kg

so it's simply 0.1

1 molal solution and now i have all the information and i can i have K_b i have m and i can calculate ΔT easily

so ΔT is going to be zero point five two into point one

so that is point zero five two

so initially the water was boiling at a hundred degree now it would boil at 100.

052 degree centigrade

so now we have

given the information about glucose if we do not know about the solute let's say we are

dissolving some unknown solute then we can use the same information to calculate the molecular

weight of a solute okay let's do one exercise okay the boiling point of benzene is 353.

23

kelvin

so we are given a normal boiling point of benzene that is 353.

23 kelvin when one point eight zero gram of one uh

non-volatile solute one point eight zero gram so that is solute weight of the solute dissolve in 90

gram of benzene 90 gram of benzene that is solvent the boiling point is raised to 354.0.

11 kelvin calculate the molar mass of

the solute K_b for the benzene this constant for the benzene

is given as two point five three kelvin kg per mole ok

so this information

is given and now we are going to use the formula which we have already seen

that is ΔT is equal to $K_b m$ okay let us see ΔT is already given

that is we are given the boiling point of the pure solvent this is the boiling point of

the solution

so Δt would be simply the difference the difference the Δt is equal to the difference would be eight kelvin which is equal to K_b K_b is also given 2.

53 multiplied by molality now to calculate molarity the definition of molarity is moles of solute divided by weight of solvent in kg okay to calculate the moles of solute we know the weight of solute which is

1.

80 gram divide that by molecular weight of solute divided by weight of solvent

which is 90 gram but we have to use that in kg

so divide 1000 now we

have all the information we just plug in this information in here and we get our equation

so equation is going to be point eight eight kelvin is equal to two point five three

into one point eight zero into thousand divided by ninety into molecular weight of the solute so we can calculate this

so molecular

weight is going to be 2.

53 multiplied by 1.

80 multiplied by

1000 divided by 90 divided by 0.

88

so we are going to get 57.

2

so molecular weight

we are going to get 57.

57.

5 moles gram per mole

so that way we can calculate

the molecular weight of this unknown solute okay the next topic which we are going to discuss

under this subject is depression of freezing point as that we have elevation or boiling

point in the same way we have a depression of freezing point and this can be understood by the same diagram which i just plot ok

so this is the phase diagram between liquid

and vapor at some temperature the liquid is going to freeze and below that we have a phase

diagram for phase diagram for solid and gas and of course we we can have a phase

diagram between solid and liquid

so at this point uh the solid or the liquid is going to freeze

if i keep on decreasing the temperature in this direction the temperature is increasing

so the

direction temperature is decreasing at this point the liquid will freeze and this is the vapor

pressure of pure solvent now i have the curve for the solution as i plotted earlier

and the curve would something look like like this

so initially the boiling this was

the one atm line

so this was the boiling this is the change in the boiling point and the same way we are going to have a change in freezing point

so this was the normal

freezing point and this one is the freezing point of this of the solution and again this

proper ah this line does not depend at all on the property of the solute it depends only on

the concentration and on this line and this how much shift is going to take place will depend

on the curvature of this line okay and again we get the similar formula that is ΔT_f is equal

to k_f multiplied by molality of the solution okay where k_f is constant which is called freezing

point depression constant okay this is again ah same kind of formula and this is very important

this is a very important for aquatic life in a polar region where temperature can go many

degree below the freezing point we still the water is not going to freeze due to very

high concentration of salt in water in sea water and that will ah that is the reason that

aquatic like money in life can survive okay in the same kind of formulation we can do and

of course k_f and k_b is related to the property of this curve k_b related to property of this

curve as i said the ah it depends upon the curvature of this curve k_b depends on the curvature of this curve and this curvature is depends

upon this curvature will depends upon the enthalpy of freezing curvature of this curve will

depends upon enthalpy of vaporization and k_b and k_f has the formula which can

be written as k_b is written as gas constant multiplied by molecular weight of ah solvent multiplied by boiling point

square divided by thousand multiplied by enthalpy of vaporization and same way i can write k_f as r into molar

mass of solvent multiplied by freezing point into square divided by

thousand into ΔH_{fusion} okay okay let's do some exercise

based on this concept okay example is as follows 40 gram of ethylene

glycol is mixed with 600 gram of water calculate a the freezing point

depression

be the freezing point of the solution

so we are dissolving 45 gram of ethylene glycol 45 gram of ethylene glycol that is $C_2H_6O_2$ in 600 gram of water 600 gram of water he is asking ΔT_f and T_f

the change in the

freezing point and what is going to the freezing point of this solution okay to

do this problem

we also need k_f and we need the k_f for water we because we need the freezing point ah constant

freezing point depression constant only for the ah for the solvent and that is given in

the table and that is ΔT_f sorry k_f for water is 1.

86 kelvin kg per mole

okay

so now i have all the information as required
so Δt that's what we need to calculate
 Δt_f which is equal to this constant multiplied by molar molal
concentration and we
need to calculate the molar concentration again the going by the definition
molal concentration
is moles of solute

so moles of solute would be 45 gram divided by molecular weight so
molecular weight is 24 plus 6 plus 32 36 62 by
so this is the moles of a solute divided by
the weight of solvent in kg
so that is 0.

6

so if i plug in all this number 45 divided
by 62 divided by 0.

6 i am going to get okay or i am going to get this as a 1.

2

and this is plugged in in this equation which is 1.

86 and 1.

2 and i am going

to get a final answer as 2.

2 kelvin

so what is going to be the freezing point of this solution we know the
water freezes at zero degree centigrade or so this solution will freeze at
minus two point two

degree centigrade okay let's do another exercise okay let me read one gram of
non-electrolyte

solute dissolved in 50 gram of benzene lowered the freezing point of benzene
by zero point

four zero kelvin

so the benzene is the solvent and the Δt is zero point four and the mass
of the solute is one point zero zero gram

so we so

one gram of non electrolyte soluble dissolve in 50 gram of benzene

so mass of solvent is 50 gram the freezing point depression

constant for benzene is 5.

12 kelvin kg per mole

so we are given t_f

also which is 5.

12 kelvin kg for mole find the molar mass of the solute okay so

we are again going to the same formula so we are given Δt which is zero
point four k t_f is given five point one two and we need the molality what

molality is

again moles of solute which is one gram of solute divided by molecular weight
of solute

ok

so this is moles of solute divided by divided by weight of solvent
in kg

so this would be point zero five

so we can use this relation

right here and we can calculate the molecular weight

so the

molecular weight is going to be 5.

12 divided by 0.

0.5 divided by point g divided by 0.
4

so answer comes out to be 256.

so the
molecular weight of unknown solute is 256 ok

so let's do some more

example from in text problem ok let me read the question vapor pressure of
pure water at 298 kelvin is 23.

8 millimeter edge 50 gram of urea dissolved in 850

gram of water calculate the pure calculate the vapor pressure of water
for the solution and its relative lowering okay

so we are given vapor pressure
of pure water at 290 kelvin

so p_0 is 23.

8 millimeter edge fifty gram of urea dissolved

so the solute

is urea

so weight of urea is 50 gram since we will need the molecular
weight

so i am just going to write urea molecular formula of
urea that is N_2CO and S_2

so 50 gram of solute this

solute in 850 gram of water is asking first the lowering and the
relative load Δp by p_0

so we are going to use the formula which we
have discussed Δp is going to be $p_0 \times x_2$ ok

so p_0 is given

so that is 23.

8 into x_2 mole fraction for
solute

so mole fraction x_2 is and 2 divided by n_1 plus n_2 and we can ignore n_2
with respect to n_1 that we can see in a minute

so n_2 is going to be 50 gram divided
by molecular weight

so that is $14 \frac{16}{32} \frac{48}{12} \frac{60}{60}$ sixty ok and n_1 we have eight fifty
divided by 18.

so you can see that this is approximately order
of 1 and this is approximately order of up around 50.

so if i ignore n_2 with

respect to n_1 i am making i am ignoring some a quantity 1 with respect to 50.

so this is approximately 2 percent error which is
acceptable even though i do not have to ignore just for the making the
calculation simpler

we usually ignore that quantity and

so x_2 is fifty and two fifty by sixty into eighty eight

so i put that quantity

right here fifty into eighteen 60 into 850 ok and lets use the calculator and
see what we get three

so lowering in vapor pressure is point four two and now what about this
quantity this is

nothing but x_2 which we have already calculated that

so x2 is right given here ok so we can handle this problem quite easily okay let's attempt the next problem okay let me read the problem this is in text question uh 2. 10 boiling point of water at 750 millimeter hg is 99. 63 degrees centigrade how much sucrose is to be added to 500 gram water such that it boils at 100 degree centigrade okay so this is a problem of elevation of boiling point so the boiling point of pure solvent is given as 99. 63 99. 63 degree centigrade at at uh say 150 millimeter edge of course one might wonder how come this boiling point of water is changing we know as we go at the higher elevation at some hill station the boiling point of water changes it boils at lower temperature and that is due to something the external pressure at 1 atm the normal boiling point is defined at one atm and one atm water boils at um at 100 degrees centigrade but at 750 millimeter at the external pressure water will boil at 99. 63 degree centigrade okay and then how much sucrose is to be added so we are adding sucrose to be added to 500 gram of water so ah weight of solvent is given that is 500 gram of water such that it boils at 100 degrees centigrade so boiling point for the solution is 100 degree centigrade okay so we are going to use the familiar formula that is Δt is equal to k_b multiplied by molality of course the k_b is listed at a normal ah boiling point and we have seen the k_b is a function of temperature but we are not going to wonder ah we are not going to wonder we are not going to wonder about that because this is quite close to 100 degree centigrade so we are going to assume k_b is same for this system and when the temperature is 100 degree centigrade okay so Δt so Δt is given right here the difference between the boiling point of the solution minus boiling point of solvent that will give me Δt that is 0. 37 degree centigrade or kelvin equal to k_b for water we know is listed one in one of the tables and that can we can find it k_b for water is 0. 52 0. 52 and i am in molality so the definition of molality is let us go to our abcdemo definition of molality is moles of of solute

divided by weight of of a solvent

so weight of solvent is given right here

500 gram in kg 5.

5 kg and the moles of solute

so we need to figure out what is the weight of solute

so we to convert the weight of solute to moles of solute we need the molar

weight of sucrose the sucrose is $C_{12}H_{22}O_{11}$ okay

so the weight of this would be

144 plus 22 and oxygen 11 16 into 11 176

so this would be 4 to 6 12 1 8 to

10 14 ah three three forty ah two

so if weight of solute is ah w two then the

moles of solute is simply going to be $\frac{w_2}{342}$ and we can put that information right here so

moles of solute is w_2 divided by 342 divided by weight of solvent in kg that would be 0.

5 we

take this information and put it right in here $\frac{w_2}{342}$ into 0.

5

one equation one unknown we solve it and we'll get the answer okay let's

use the calculator point three seven multiply by 342 multiplied by 0.

5 divided by 0.

52

so answer

comes out to be approximately 120 seven draw ok ok now let us look at the some problem from the end of the chapter

so the next problem which

we are going to discuss is 2.

18 let me read it out calculate the mass of a

non-volatile solute molar mass 40 gram per mole which should be dissolved in 114 gram of octane

to reduce its best vapor pressure to 80 percent okay calculate the mass of non volatile solute

so we are asked the mass of non-volatile solid whose molar mass is given molar

weight is 40 gram per mole which should be dissolved in 114 gram octane

so mass the solvent is obtained over here so mass of solvent is 114 gram and the

solvent is octane that is C_8H_{18} ah and to reduce the vapor pressure to 80 percent

so if original vapor pressure of octane is p_1^0 then the vapor pressure of solution

should be 80 percent of that

so this is the ah information given to us okay we know

from the rolls law that vapor pressure of solution is equal to mole fraction of ah

solvent multiplied by vapor pressure of pure solvent

so just by comparison we know x_1 one

is equal to zero point eight all right and let's see what is the definition of x_1 we need

to figure out m_2

so the definition of x_2 x_1 is moles of x component one that is solvent divided

by ah n one plus n two binary solution

so moles of solvent plus moles of solute total

moles okay

so we need n1 and n2 okay

so n2 we can figure it out right there as an unknown that is m2 divided by 40.

40 gram per mole

so weight of the solute divided by molecular weight of the solute

so that will give me moles of solute what about n1 for that we need the molecular weight and that would be 96 plus 18 oh that comes out to be one

one four

so that is convenient

so n one is simply one take this information put it in this equation and that would be one divided by one plus one plus m two by four t ah now simply doing a little bit of algebra

just subtracting numerator from denominator we will get 0.

8 divided by 1 minus 0.

8 equal

to one plus one plus m two by four t minus one

so that is zero point eight divided by zero

point two that is four four is equal to one by m two by four t

so this is now a simple

equation to solve m two is simply coming out to be out to be forty by four so the answer is simply ten gram ok let's discuss one last problem for this section okay 2.

19 the next problem a solution

containing 30 gram of non-volatile solute exactly 90 gram of water has a vapor pressure

of 2.

8 kilo pascal at 298 kelvin further 18 gram of water is then added to the solution and

the new vapor pressure becomes 2.

9 kilo pascal at 298 kelvin calculate molar mass of the solute

vapor pressure of water at 298 degree kelvin okay

so basically we have a two solution we

have to work with two solution the solution one is 30 gram of non-volatile

solute solute in 90 gram water 90 gram water and for this solution

the vapor pressure is 2.

8 kilo pascal and we have the second solution the second

solution is just prepared by adding 18 gram of water in this solution

so the amount of solute

remain same this is still 30 gram of solute in now we have added 18 gram of water

so amount of water becomes 108 gram water and the resultant

solution has a vapor pressure of 2.

9 kilo pascal okay now is asking what is molar mass

of solute

so molecular weight of solute and he is asking vapor pressure of water

so vapour pressure of pure solvent

so we have two unknown and we can get two equation from these two solutions so

let us go back to our rolls law rolls law is p_1 is equal to $x_1 p_1^0$ ok and
 what is x_1 x_1 is
 moles of component one divided by total binary system only two components
 ok and we are given only mass is so we need to convert ah this information the
 mass
 given to moles okay
 so 90 gram of water
 so that is the molecular weight of water is 18
 so we have simply 5 moles
 so n_1 is 5 what about n_2 n_2 we are given 30 gram of solute
 and the ah molecular weight is unknown that's what we have to figure it out
 so we will just put
 ah moles of ah solute in terms of molecular weight of solute
 so that would be 30 gram divided
 by molecular weight of solute multiplied by ok
 so this is x_1 now we can take this and
 put it in here and we get p_1 is equal to 5 divided by 5 plus 13 the molecular
 weight
 of solute multiplied by p_1^0 and and that is equal to two point eight kilo
 pascal and
 so we are
 going to calculate p_1^0 also in globe pascal now same equation we can
 set it up for the
 second solution and that would be two point nine kilo pascal is equal to ah x
 one
 so in
 this case now to calculate x_1 uh the amount of water present is one zero
 eight
 gram and that is conveniently is six moles
 so ah n_1 is six
 so x_1 is going
 to be six plus six ah divided by thirty by molecular weight of solve solute
 multiplied
 by p_1^0
 so we have two equations and two unknown simply divide equation one by
 equation two
 to remove one of the unknown
 so we get ah two point eight divided by two point nine and that
 is equal to ah 5 divided by 5 plus 30 divided by molecular weight of solute
 divided by this
 whole thing
 so that would be multiplying 6 six plus thirty by molecular beta two
 so now
 this equation has one variable one unknown ok
 so we can set it up this usually 6 plus 30
 by m m molecular weight of solute divided by 5 plus thirty divided by
 molecular
 weight of two is equal to two point eight into six divided by two
 point nine multiplied by five and this is ah two point eight multiplied
 by six sixteen point eight and two point nine multiplied by
 five that is ah fourteen point five ok now again ah subtracting numerator from
 denominator we can simplify the whole thing and we will get 6 plus 30 divided
 by molecular
 weight of solute mine divided by 5 plus 30 molecular weight of solute minus 6

minus

30 molecular weight of solute equal to 16.

8 divided by 14.

5 minus point eight

so this

simply cancels out and we get from here ah six plus 30 divided by molecular weight 2

divided by minus 1 equal to 16.

8 divided by minus 2.

3 now this can be solved 16.

8 divided by 2.

3 is going to give me 16.

8

divided by 2.

3 is equal to 7.

3 minus 7.

3 minus goes to other side becomes plus 6

goes to another side becomes 1.

3 and i get 30 divided by molecular weight is equal to 1.

3

so molecular weight becomes simply 30 divided by 1.

3

so we got our answer that is 30 divided

by 1.

3

so it is approximately 23 within the ah in the rounding error ok now we have molecular

weight

so using this i can ah put all this information right in here and i can calculate

p 1 0 ok

so that i will i will leave it as a exercise should not be a problem at all to finish this problem you