Welcome back students.

We will continue with this unit.

Module #2 standard free energy change.

An equilibrium constant coupled reactions

and additive nature of standard free

energy change the outline for this

lecture is standard free energy change

and equilibrium constant and the additive

nature of standard free energy change.

The learning outcomes are you will

be able to describe the relation

between standard free energy change

and equilibrium constant an you will

gain knowledge about the additive

nature of the standard free energy in

the previous video we have already

learned the terms gives the energy.

Another state functions.

Now using these terms

will find new relations.

The equilibrium constant.

An equilibrium state concentration

of reactants and products,

rate of their properties and reverse

reactions are equal and no further

net change occurs in the system.

So if we take the reaction a

moles of a B moles of fee giving

see moles of C + D moles of tea.

The equilibrium constant for this

reaction can be given as the

molar concentration of C raised

to the number of moles of C.

Into the molar concentration of the

race to the number of moles of the.

Upon the molar concentration of a

raised to the number of moles of A

and the molar concentration of E

raised to the number of moles of B.

So this is the equilibrium constant.

Now the next term standard free energy

change a reacting system continuously

changes to attain equilibrium.

The magnitude of the driving force

which moves the reaction towards

equilibrium can be expressed as

free energy change of the reaction,

that is Delta Chi.

So under standard conditions.

Say 25 degrees Celsius temperature when

reactants and products are initially

present at one molar concentration

at one atmospheric pressure,

the force driving this system

towards equilibrium is defined as

standard free energy change which

is denoted as delta Gino.

Each chemical reaction has a

characteristic standard free energy

change which may be positive,

negative,

or zero depending on the quality

and constant of the reaction.

So Delta G knot indicates in

which direction and how far by

given reaction must go to reach

equilibrium under standard conditions,

this G is a constant.

It has a characteristic,

unchanging value for a given reaction,

so we know that delta,

G knot and K it will have got up

relation and they are independent.

Now if we consider a reaction

similar to the first one.

Very touchy of this reaction depends

on the concentration of the reactants

and the products temperature and pressure,

so the relation can be given as delta.

G is equal to delta G,

not plus RT.

Concentration of series to see

molar concentration of the race

to the number of moles of the upon

molar concentration of a raised.

A number of moles of a an molar

concentration of B says to the number

of moles of B wherein Delta G knot

is the standard free energy change.

R is the gas constant is the

absolute temperature,

so this is 1 equation we have got.

Now we have to find out the relation

between Delta G knot and K equilibrium.

So since we're tackling

with biochemical reactions,

we keep a standard pH of seven.

An estim as standard transformed constants

and returned with a prime cheap prime

and K equilibrium crime to distinguish

them from the untransformed constants

used by chemists and physicists.

OK, so we use this prime

for biochemical reactions.

The standard free energy change

can be calculated from the

equilibrium constant K equilibrium.

So Delta Chi is equal to death

Delta Chi not plus RTL in after the

concentrations of the products divided

by concentrations of the reactants.

So since reaction is at equilibrium,

delta G is equal to 0.

So since Delta G is equal to 0,

the equation will turn into delta G,

not prime is equal to

minus RTLNK equilibrium,

since K equilibrium is equal to

the ratio of the products to the.

Reactance there is a G,

not prime is the standard transform

free energy change and we can.

Convert Ln into.

Lock by using two point minus 2.303 RT.

Log off K Bryant equilibrium.

So now using this relation.

We can predict the reaction.

If the equilibrium is more than 1D G,

not will be negative and the

reaction will proceed forward.

If the equilibrium is equal to 1,

delta G not will be 0 and the

reaction will be at equilibrium.

If he equilibrium is less than one,

then delta G knot will be positive and

the reaction will proceed backwards.

Now will take an example to understand this.

Calculate the standard free energy change

of the reaction catalyzed by the enzyme.

For school, gluco mutates,

so we know this reaction.

Glucose 1/4 spade converts to glucose

6 phosphate using this enzyme.

So given that the reaction began

with $20 million of glucose,

one phosphate and no glucose 6 phosphate,

and the final equilibrium mixture at

25 degrees Celsius and PH-7 contains

one millimolar glucose one phosphate.

In 19 millimolar glucose 6 phosphate.

So we have to find her.

Standard free energy change of this

reaction and the second question is,

does the reaction in the direction of

glucose 6 phosphate formation proceed

with the loss of or gain of the energy?

So now we solve this.

First we have to calculate

the equilibrium constant,

which we can get by the concentration

of the product upon the concentration

of the reactant.

Since we know the final concentration

was 19 millimolar,

we can divide it by one millimolar

and we will get the answer 19.

And now you calculate the standard

free energy change that is delta

and she not prime,

which is equal to minus RTL

enough K equilibrium.

We can put in the values and the answer

will get is minus 7.3 kilo joules per mole.

OK,

now we have the next question whether

there will be gain or loss of energy.

So since the standard free

energy change is negative,

the conversion of glucose one

phosphate to glucose 6 phosphate

proceeds with loss of the energy and

therefore it's an exergonic reaction.

Now we'll go to coupling of

reactions in biochemical reactions.

Coupling plays a very important role.

What are catabolic and anabolic

reactions in the previous video?

I had already told you.

What is it?

The exergonic reactions are termed

katiba lism which means the breakdown

or oxidation of fuel molecules

and animalism is the synthetic

reactions that build up substances.

The combined catabolic anabolic

processes constitute metabolic.

Now standard free energy

changes are additive.

If we have a sequential reaction

wherein A is giving B&B is converting

to see then the DD G Not prime

values are edited so in the reaction

a converting to B we have Delta

G banner prime and we have we

converting to see we got delta G2 not.

So there that she not total will be equal

to Delta Chi one not plus Delta G tuner.

So I turn more dynamically,

fit unfavorable reaction can be

driven in the forward direction by

coupling it with an exergonic reaction.

How we will see in the next slide?

So if we have the synthesis of

glucose 6 phosphate glucose plus

inorganic phosphate gives us

glucose 6 phosphate plus water.

We know this reaction.

And for this,

delta G knot is 13.8 kilo joules.

And this will not proceed

spontaneously in this direction,

because it requires energy to be absorbed.

ATP plus water will give you

ADP plus inorganic phosphate.

This is the second reaction wherein

Delta G knot is negative 30.5.

So these react.

This is an exergonic reaction.

These reactions said this

common intermediates,

inorganic phosphate and water,

and may be expressed as glucose

plus inorganic phosphate giving

glucose 6 phosphate and water.

And the second reaction,

ATP,

does water giving ADP plus

inorganic phosphate.

So summing the Delta G north

of both these reactions we get

minus 16.7 kilo joules per mole.

So the overall reaction becomes exergonic.

Energy stored in ATP is used to

drive the synthesis of glucose 6

phosphate even though its formation

from glucose and inorganic

phosphate is and the governing the

pathway of glucose 6 phosphate.

Formation from glucose by

phosphoryl transfer from ATP

is different from reactions.

Yeah, thank you.