Lesson 1: School B

Observation 1

**Teacher:** So students, we’re going to be talking about cell division and

we’ve already done the structure of the cell, we know what the cell looks like,

the organelles inside the cell e.g. the mitochondria, the nucleus,

and the chloroplast e.t.c. so right now we’re looking at the cell division, and

how the cell divides.

For interest sake, what is growing? (initiation move, closed-ended question)

When we say growing what is that?

(eliciting and acknowledging rejoinder move- restating a question)1

**Learner 1:** When someone or something increases in size maybe… (Lengthy)

**Teacher:** That is correct, but how does growing happen? How do things grow?

(extending rejoinder move- asking an extended question)3

for example, if it’s plants or animals… say human beings,

like you, how do you grow?

(extending rejoinder move- asking an extended question)3

**Learners:** It’s food. **(chorus)** (short/ limited)

**Teacher:** Food? (clarifying rejoinder move- revoicing)2

**Learners:** No! it’s cells (short/ limited)

**Teacher:** It’s cells right? (Eliciting and acknowledging rejoinder move- affirming)1

**Learners:** Yes! **(chorus)**

**Teacher:** The cells multiply, just like when you’re building a house,

first, you build a foundation then the more you add bricks, the house becomes

bigger and bigger until it’s a full house. It is the same thing that is happening

to you, when you’re growing, you’re multiplying those cells.

When you were you had a minimal number of cells, as you grow the cells are

being added and therefore, you grow in size and that is where the cell division

comes in as significant. It is for growth. For you to be able to grow,

the cells must multiply through cell division. Secondly, when you are injured,

you heal right? You fall and a wound opens up,

what causes the wound close up or get repaired?

(initiation move, closed-ended question)

**Learners:** The cells. **(chorus)** (short/ limited)

**Teacher:** It’s the cells right, (Eliciting and acknowledging rejoinder move- affirming)1

that means when you are wounded the cells are also torn

and damaged in that particular area. Try to picture a wall and a specific portion

is punctured on the wall, or say a brick has been removed…

this would be similar to what happens when you’re wounded,

the cells are damaged. So now we need to figure out how do we repair the

punctured whole or wound, so to fix the wound, cells must multiply by cell

division to patch the wound. So, this is another significance of cell division,

to repair damaged tissues. Now how does this cell division occur,

looking at the actual cell division, and how it occurs. We have what we call the

cell cycle. What is a cell cycle? We’re looking at the cyclic functioning of a

cell, this is like a life cycle in a way, meaning, whatever is happening during

the process repeats itself over and over again. In order for this process to

occur, we have a phase called the growth phase, where the cell grows in size

so that it can undergo cell division and produce another cell. This occurs

during the interphase, which is the preparatory stage. Let us say, in the growth

phase, the cell becomes bigger in size. There are then a few things that occur

during the preparatory stage. In humans, one normal human cell has

46 chromosomes, a body cell, which we call a somatic cell.

So in a somatic cell, how many chromosomes do we have?

(initiation move, closed-ended question)

**Learners:** 46 **(chorus)** (short/limited)

**Teacher:** Then, we want to divide a cell with 46 chromosomes to get two cells

that will have 46 chromosomes each. Understand that?

**Learners:** Yes! **(chorus)**

**Teacher:** You’re probably expecting that when we divide 46 between two cells we will

get half of it in each cell, yes? Which will be 23, but in this cell division we

divide a cell with 46 to get two cells with 46, 46 chromosomes.

As a result, we get a process called DNA replication which occurs during the

preparatory stage. A somatic cell, which is a normal body cell has 46

chromosomes, we are going to use this cell as our example.

So when we say the DNA becomes replicated, that means we are taking one

chromosome and making a copy of that chromosome. If I take this one

textbook and I am saying I am going to replicate this textbook,

which means I am making a copy of the textbook meaning I will have

how many textbooks? (initiation move, closed-ended question)

**Learners:** Two

**Teacher:** Two, right? (Eliciting and acknowledging rejoinder move- affirming)1

But on the other hand, I can say that I have one textbook,

just that I have two copies of the textbook. That means when DNA replication

occurs on this cell (teacher points to the board) with 46 chromosomes,

each chromosome must make a copy of itself. Then when the cell divides,

the original chromosomes will go to one side and the copies on the other side.

Now, at the end how many 46s are going to have?

**Learner:** Two (short/limited)

**Teacher:** Yes! Two, (Eliciting and acknowledging rejoinder move- affirming)1

so now this preparatory stage is very important to be able to

maintain the number of chromosomes.

Because if the copies are not made, it means when division occurs,

half the number of chromosomes will remain, therefore,

to maintain the number of chromosomes, we need to replicate.

Let us make another example. In this class, you’re Grade 10 C and

we want to form two Grade 10 C classes,

and each and every one of you must make copies of yourself.

Then when we want to divide this 10 C class into two,

the copies are going to be in class and the original will remain in one class,

then these two classes will be exactly the same, identical to each other.

This is due to the process known as What?

(initiation move, closed-ended question)

**Learner 1:** Replication (short/limited)

**Teacher:** Replication? (clarifying rejoinder move- requesting clarification)2

Of what? (extending rejoinder move- asking an extended question)3

**Learner 2:** Chromosomes (short/limited)

**Teacher:** Aybo! All right, listen, we said chromosomes replicate, right?

**Learners:** Yes!

**Teacher:** All right, and as they replicate,

what is within or part of the chromosome that becomes replicated?

(initiation move, closed-ended question)

Because we can’t just say replication, we need to specify.

**Learners:** DNA (short/limited)

**Teacher:** Right, and therefore we said the process is what?

(initiation move, closed-ended question)

**Learners:** DNA replication. (short/limited)

**Teacher:** Now, the importance of DNA replication,

it enables or results in the formation of cells that are genetically identical

to each other and genetically identical to the parent cell.

Right, if I ask you what is DNA replication? What is your answer going to be?

(initiation move, closed-ended question)

**Learner 1:** Making a copy, sir (short/limited)

**Teacher:** Making a copy? (Clarifying rejoinder move- requesting clarification2/

extending rejoinder move- asking an extended question3)

**Learners:** Making a copy of DNA (together) (short/limited)

**Teacher:** Let us say you’re asked in the exam to define the term DNA replication and

allocated 2 marks. Provide all the information you think is necessary.

**Learner 2:** Sir, DNA replication is a process whereby… uhm,

DNA makes an identical copy of itself. (Lengthy)

**Teacher:** Very good! Yes! Grade 10, DNA replication is a process!

you understand that right? Now I have just mentioned the importance,

and why it is necessary for it to occur.

It is the increase of the genetic material so that it can be equally shared

amongst the two cells during cell division.

Now, remember when we were drawing the structure of a nucleus,

inside the nucleus, we had a structure that we labeled as what?

(initiation move, closed-ended question)

**Learner 1:** Nucleolus (short/limited)

**Teacher:** Right, what else? (initiation move, closed-ended question)

Let us list the structures found in the nucleus.

**Learners:** Nucleoplasm, chromatin network (short/limited)

**Teacher:** Right, let us stop there, chromatin network right?

(eliciting and acknowledging rejoinder move- affirming)1

Now we said that the chromatin network contains DNA that

transmits hereditary characteristics and also plays a role in protein synthesis.

To elaborate and link this, chromatin networks are coiled strands of DNA.

And now, during cell division, this chromatin network,

when DNA replication occurs a strand will make a copy,

meaning there will be two strands, the original strand, and a copy.

That means all the genetic information found in the original strand

will also be in the copy,

therefore, the strands are genetically identical to each other. Right?

(Teacher draws a single-stranded chromosome on the board),

if this thing is like this, we call it an unreplicated chromosome, meaning?

Who can tell us what this means? (initiation move- closed-ended question)

**Learner 1:** That a copy has not been made. (Lengthy)

**Teacher:** Copy of what? Where are the specifications?

(extending rejoinder move- asking an extended question)3

**Learners:** The chromosomes, they uhm, they have not made a copy.

(Deep understanding)

**Teacher:** Right! The chromosomes have not undergone replication yet.

(Extending move- canvasing opinion)3

We call that unreplicated chromosome. Good.

After replication then this chromosome

( teacher points at the unreplicated chromosome) is now going to have a copy, and we will now call it a replicated chromosome.

That means when we divide the cell these two

(teacher points at the replicated chromosome)

will separate, one going to one cell and the other going to another cell.

Right! Unreplicated chromosome becomes replicated.

Single-stranded chromosomes become double-stranded, right?

One and the same thing.

Are we still together?

**Learner:** Yes

**Teacher:** Let us try to summarise what we have covered so far.

We said what is the importance of mitosis?

(initiation move closed-ended question),

Why is it necessary for it to occur? (initiation move open-ended questions)

the first one?

**Learners:** For growing (short/limited)

**Teacher:** Right, for growth, (eliciting and acknowledging rejoinder move- affirming)1

and the second one?

**Learner 1:** To heal wounds. (short/limited)

**Teacher:** Let us structure this one correctly, it is to repair old and damaged tissues.

All right? Now when a cell is going to divide it must have a growth phase.

We said what happens in that growth phase?

(initiation move closed-ended question)

**Learners:** The cell becomes big (short/limited)

**Teacher:** In size, yes to divide. correct.

(eliciting and acknowledging rejoinder move- acknowledging)1

We then have the preparatory stage we called what?

(initiation move closed-ended question)

What did we call the phase where the cell prepares to divide?

(initiation move- closed-ended)

**Learners:** Interphase (short/limited)

**Teacher:** And we said, how does the cell prepare itself?

(initiation move open-ended questions)

There is a process we mentioned there as a very important process.

**Learners:** DNA replication!

**Teacher:** Yes! It resulted in the duplication of the DNA,

(eliciting & acknowledging rejoinders- acknowledging)1

And we asked why it is important. (initiation move open-ended questions)

**Learner 1:** To form 2 cells. (short/limited)

**Teacher:** Right, but this is not clear,

(clarification rejoinder move- requesting clarification)2

who can phrase it differently?

What is the significance of DNA replication? (initiation move- closed-ended)

**Learner 2:** For even sharing of chromosomes. (lengthy)

**Teacher:** Right, now we need to link this. Oh yes, your hand was up?

**Learner 3:** Sir when DNA replication occurs, an identical copy is formed,

that will go to each of the two cells that will be formed in cell division.

(Deep understanding)

**Teacher:** Good! Very good! So it is the increase of the genetic material that can be

equally shared amongst the two cells during cell division.

(eliciting & acknowledging rejoinders- acknowledging)1

Now there is something we did not touch on, the labeling of the

double-stranded chromosome. So this one

(teacher points to the replicated chromosome) is called a chromatid now,

once it makes a copy of itself, we now call it a chromatid,

so both these structures are now called chromatids that are joined together

by a centromere, which joins both these chromatids,

we call it a centromere. Now, what is this entire structure called?

It is a chromosome, right? There is no need to also add replicated.

Earlier on we were trying to make a clear distinction. Are we still together?

**Learners:** Yes

Kol Lesson 1 Episode 1

**Teacher:** Let me ask then, what is DNA before cell division or in a non-dividing cell?

(initiation move closed-ended question)

**Learner 1:** DNA sir(short/limited)

**Teacher:** No!, when the cell has not started the process of dividing?

(extending rejoinder move- asking an extended question)3

The one we said appears as coiled str…

(clarification rejoinder move- reframing the question)2

**Learners:** Chromatin network (short/limited)

**Teacher:** Right, now, when the cell divides this does what?

We said it unwinds to form what? (initiation move closed-ended question)

**Learner:** Chromosomes (short/limited)

**Teacher:** Right, clearly visible chromosomes.

(eliciting and acknowledging rejoinder move- affirming)1

That means DNA has two stages where the cell is dividing and where the cell

is not dividing. In a non-dividing cell, its chromatin network, in a dividing

cell it unwinds and forms visible chromosomes. Okay? After the interphase,

we then get mitosis, which is divided into two; karyokinesis and cytokinesis.

Karyokinesis is the division of the nucleus.

**Learner:** What is Karyokinesis, sir?

**Teacher:** Karyokinesis is the division of the nucleus. Right?

And cytokinesis is the division of the cytoplasm. Are we together?

**Learner:** Yes

**Teacher:** Let me explain this further using a plant cell

(the teacher draws a typical plant cell on the board). So if we have this plant

cell, this will then be the nucleus and this one is the cytoplasm, right?

Let me also put the cell wall. If I had to divide this cell the first thing that must

the divide is the nucleus because there is only one and we will need two nuclei

because we are going to have two cells… the two nuclei must be the same.

Right, so when this nucleus is divided that is the process called, karyokinesis,

and when this cytoplasm was being divided that is the process we call

cytokinesis. Okay?

**Learner:** Yes

**Teacher:** Right, so that is it for today… we shall discuss this in the next few lessons.

Lesson 2

Observation2

**Teacher:** First, let us recap what we covered in our first lesson on cell division. As we

were introducing the topic of cell division, tell me what you recall from that

the lesson, starting with the significance. We said

why is cell division necessary? (initiation move open-ended questions)

**Teacher:** Right let me remind you, we said we do cell division for growth, we also said

we need cell division to repair the damaged cells. When there are wounded

cells we said the cell division can repair those cells. we said that cell division

occurs in a cyclic. Starting with the growth phase where the cell grows and the

DNA inside the cell must replicate and we referred to that as the interphase.

After preparation, we said we then get mitosis and we divided it into 2 if you

remember well.

Kol Lesson 2 Episode 2

**Teacher:** Yes! It is a continuous process. What is the starting point?

(initiation move closed-ended question)

where does this process start? (initiation move closed-ended question)

**Learner 1:** Interphase sir, (short/limited)

**Teacher:** Interphase, mhm do we all agree with him? And why?

(initiation move open-ended questions)

**Learner 2:** Yes sir, but before interphase, there is a growing stage then the first phase is

interphase. (lengthy)

**Teacher:** All right, all right, what happens in the interphase?

(initiation move closed-ended question)

the important process that occurs in the interphase.

**Learners:** DNA replication! (Short/limited)

**Teacher:** Right, can someone help us define this term?

(initiation move closed-ended question) Somebody, anybody.

**Learner 1:** Umh… Sir, we said it is a process whereby DNA makes an identical copy of

itself. (lengthy)

**Teacher:** Good! So people were listening, okay, and we said

why is this process important? (initiation move open-ended questions)

**Learner 2:** To produce 2 daughter cells. (Short/limited)

**Teacher:** mhm… yes, your hand was up?

**Learner 3:** For the equal sharing of chromosomes in the daughter cells produced.

(detailed)

**Learner 4:** It is a preparatory phase for cell division to occur. (lengthy)

**Teacher:** Wait, wait, wait! The interphase is the preparatory phase right,

(eliciting and acknowledging rejoinder move- affirming)1

where the cell prepares for cell division by replicating its DNA,

(eliciting and acknowledging rejoinder move- affirming)1where

single-stranded chromosomes become double-stranded. The DNA must be

replicated so that it can be equally shared amongst the 2 produced cells.

(eliciting and acknowledging rejoinder move- affirming)1Right?

**Learners:** Yes!

**Teacher:** Okay, we then said the remaining phases are the actual mitosis taking place,

Do you still remember? We divided it into two. We said it occurs by means of

two divisions, what did we call those divisions?

(initiation move closed-ended question)

**Learner 1:** Division of the nucleus and the cytoplasm. (lengthy)

**Teacher:** There are biological terms we used in relation to those definitions. I need those

terms.

**Learner 2:** Cyto…cytokinesis, and…uhm, cytokinesis (short/limited)

**Teacher:** Another one? Karyokinesis!

**Learner:**  Ooh!

**Teacher:** How did we define karyokinesis again?

(initiation move closed-ended questions)

**Learner 1:** Division of the nucleus.

**Teacher:** Division of the nucleus neh, correct? (eliciting and acknowledging rejoinder move- acknowledging)1

After the division of the nucleus, we said

we’re then going to divide the cytoplasm, right?

**Learner:** Yes

**Teacher:** Now that we have an idea, just a brief understanding of what happens in

mitosis. When asked to define mitosis, you will say it is the type of cell

the division where a parent cell divides to form two daughter cells identical to

each other and the parent cell (the teacher writes the definition on the board). I

now want to mention another type of cell division, meiosis. This type of cell

division halves the number of chromosomes, if a parent cell had 46

chromosomes it means the cells produced will have 23 chromosomes, half of 46, and these cells are not genetically identical. Right? Let us proceed to

mitosis. We said after the growth and the interphase we then have the four

phases by which mitosis occurs prophase, followed by metaphase, anaphase

and lastly, telophase, the abbreviation used is IPMAT. Cell division is

the step-by-step process, as indicated in the abbreviation. From interphase to

anaphase, where karyokinesis occurs, and telophase facilitate cytokinesis,

which is the division of the cytoplasm. So if the question says to list the

phases responsible for karyokinesis, which phases are you going to list?

(initiation move closed-ended questions)

**Learners:** Interphase, prophase, metaphase, and anaphase (short/limited)

**Teacher:** And the one responsible for cytokinesis?

(initiation move closed-ended questions)

**Learners:** Telophase (short/limited)

**Teacher:** Easy! Let us continue. After the interphase, which we have discussed, the

prophase occurs. During prophase, the chromatin network unwinds to form

visible chromosomes. Do recall that DNA occurs in 2 forms when the cell is

dividing and when the cell is non-dividing, they are not the same. Remind me

what do we call the DNA when the cell is not dividing?

(initiation move closed-ended questions)

**Learner 1:** Chromatin network (short/limited)

**Teacher:** Exactly! And what do we call it when the cell is dividing?

(initiation move closed-ended questions)

**Learner 2:** A chromosome (short/limited)

**Teacher:** Yes, chromosomes, so basically the visible chromosome are formed from the

unwinding of chromosomes, and this occurs during prophase. Step number 2

is, the nuclear membrane disappears. Recapping the structure of a nucleus, the

nucleus has a nuclear membrane, right? So it disappears to give enough space

for the chromosomes to be scattered in the cytoplasm. All right, then after, the

centrioles form and move to opposite poles of the cell. Does anyone who has a

recollection of where the centrioles arise from?

(initiation move closed-ended questions) I will give you a hint, it’s a

structure found in animal cells only.

**Learner 1:** Lys…no it’s centrosome! (short/limited)

**Teacher:** Yes! The centrosomes split to form centrioles, and those centrioles move to

opposite poles and give rise to spindle fibers. For those who are lost, this is on

your very last section of cells. The centrosomes only exist in animal cells not

in plant cells, right? Okay, let us continue, moving on to the next phase.

Which is? (initiation move closed-ended questions)

**Learners:** Metaphase (short/limited)

**Teacher:** Yes, the most simple phase and the easiest to understand, we said during

prophase centriole moves to opposite poles and spindle fibers form. Now, the

chromosomes form a single line or row at the center of the cell or the equator.

Then, the spindle fibers attach to the centromere, a structure that we said holds

the two chromatids together to form a chromosome. Again, the chromosomes

aline a the equator, the equator is the center of the cell. The spindle fiber then

attaches to the centromere of each chromosome. Right, let us stop there for

today. I want us to recap what we have covered though, starting with the

structure of a replicated chromosome. What is it composed of?

(initiation move closed-ended questions)

How did we label the structure of a re[plicated chromosome?

(initiation move open-ended questions)

**Learner 1:** Uhm, sir, it has two chromosomes joined by a centromere.

(lengthy)

**Learner 2:** Chromatids, it’s chromatids. (short/limited)

**Teacher:** Yes, 2 chromatids are joined together by a centromere.

(eliciting and acknowledging rejoinder move- affirming)1

Now let us look at the two phases we have treated, starting with interphase

and prophase

(the teacher draws interphase and prophase on the board).

How do you identify each of these diagrams representing phases of mitosis?

(initiation move open-ended questions)

How are you going to know the first diagram is interphase, how is it different

from the second diagram prophase? (initiation move open-ended questions)

Look at both these diagrams at tell me

what stands out to you. Yes!

**Learner 1:** In the first diagram there is a chromatin network and in the second diagram

there is no chromatin network. (descriptive)

**Teacher:** Another one,

**Learner 2:** Uhm… in the first diagram there are two membranes and in the second

diagram there is one membrane. (descriptive)

**Teacher:** Yea!

**Learner3:** The second diagram has double-stranded chromosomes (descriptive)

**Teacher:** Okay, okay, so DNA appears as a chromatin network during the interphase,

(eliciting and acknowledging rejoinder move- affirming)1

which is diagram one. Then diagram number 2, DNA appears as clearly visible

chromosomes (eliciting and acknowledging rejoinder move- affirming)1 and

the chromatin network is no longer appearing.

Secondly, these chromosomes are no longer in the nucleus and the

the nuclear membrane has disappeared,

(eliciting and acknowledging rejoinder move- affirming)1

but in the first diagram, there is still a

nuclear membrane enclosing the chromatin network. Are we still together?

**Learner:** Yes,

**Teacher:** Then, metaphase, how are you going to identify metaphase?

(initiation move open-ended questions)

(Teacher draws a diagram of metaphase on the board).

**Learner 1:** Chromosomes are arranged in the middle of the cell. (descriptive)

**Teacher:** Right, chromosomes are arranged in an orderly manner at the equator

(eliciting and acknowledging rejoinder move- affirming)1

and the spindle fibers are attached at the centromere of the chromosomes.

All right? Let us stop there for today.

Lesson 3

Observation 3

**Teacher:**

**Learner:**

**Teacher:**

**Learner:**

**Teacher:**

**Learner:**