TICK TOCK:
ALL ABOUT THE CLOCK

1 videocassette ............... 16 minutes

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INTRODUCTION

"Time to get up"..."time for dinner"..."time for school." Children learn early in their lives that we do things according to the time of day, and that their routines and rhythms are linked to the clock. It is no wonder, given time's central importance, that children are eager to tell time for themselves, and to gain the independence of not having to turn to an adult or older child for the answer to the vital question: "What time is it?"

The video program *Tick Tock: All About the Clock* is designed to help youngsters in the early elementary grades learn to read clock faces and understand basic principles and facts related to time. An interesting array of timepieces is shown in the video, and Mr. Clock, a cartoon character, helps guide viewers as they learn how to tell the time. Vivid examples help to convey the duration of the different units of time, and a section on the history of timekeeping helps viewers understand how our systems and technologies evolved over the ages. The cycle of day and night is explained and illustrated using a globe and a flashlight.

Throughout the program, simple questions keep children's attention and reinforce the information presented; frequently, children's voices give responses to these questions. Children are shown in numerous situations that relate to time, and simple clocks are depicted, that children can make themselves.
SUMMARY OF THE PROGRAM

The program opens with a montage of interesting clocks, followed by short clips of children doing things associated with various times of the day, such as lunchtime. Further examples of clocks are then shown, with brief explanations of how different kinds of clocks run. The swing of a pendulum, the unwinding of a spring, and the turning of gears are shown, and their role in operating clocks is noted.

The program points out that to see how the gears are moving and to know what time it is, it's necessary to have a clock face with hands. Mr. Clock, a cartoon character, points to the hands of the clock as the narrator identifies the hour, minute, and second hands. A cake decorated with a clock face disappears, one slice at a time, to show that when the small hand moves from one number to the next, an hour has elapsed. The program then shows the difference between a standard clock face and a digital display. The fact that time is measured in two 12-hour cycles is noted, and the two names for 12:00—noon and midnight—are given.

To reinforce the reading of the hour, a montage shows typical events of a child's day, while a small clock face on-screen shows the time of day (always on the hour) when the activity is happening (for instance, lunch at noon). The sequence ends with 3:00 p.m.—school dismissal.

The program moves on to deal with the span of a minute—what it means in real time, and how to read minutes on the clock. Students are shown that the number of minutes in an hour is 60, and that there are 5 minutes between each 2 numbers on the clock face. Half hours and quarter hours are explained, and children practice reading the time as differ-
ent clock faces are shown. The point is made that how you read the time depends on whether the minute hand has passed the halfway point between hours—for instance, it's correct to say 11:20 instead of 40 minutes to 12.

Astronauts in space and scuba divers beneath the sea, who depend on air tanks for oxygen, illustrate how important time can be. The program notes that most of us can hold our breaths for only a few seconds, and a discussion of seconds follows. Numbers flashing on a screen help children gauge the length of a second, and various examples help them get a sense of seconds in relation to minutes and hours.

The next part of the program looks at the history of time-telling. Early man probably judged the time of day by the shadows of trees, the program points out; and the same kind of measurement can be obtained by placing a stick in the ground. But a stick can fall down or break; so the sundial probably was invented as a sturdy alternative to the stick. Viewers are invited to read the time by looking at sundials.

Other ways to tell time are presented. Sand clocks and water clocks are shown, as are a variety of unusual clocks such as novelty clocks, cuckoo clocks and grandfather clocks.

The stopwatch, with its very different clock face, is shown as it measures the outcome of a children's foot race. It measures short periods of time. There also are longer periods of time than we see on a clock—days, months, and years. The way the Earth spins and the alternation of day and night are shown using lighted globes and animation. Photos taken from space clearly demonstrate these phenomena.

The program concludes with a review of key points.
LEARNING OBJECTIVES

After viewing the program, students will:

• recognize that clocks come in many forms and styles

• differentiate between mechanical clocks and electrical clocks

• be able to tell time, using both conventional clock faces and digital displays

• recognize the hour hand, minute hand, and second hand on a clock face and understand how these units of time relate to each other

• understand the principles behind sundials, sand clocks, water clocks, and candle clocks

• know what a stopwatch is and what its uses are

• comprehend how the Earth's rotation, and its position in relation to the sun, cause day and night
REVIEW QUESTIONS

1. What is a mechanical clock?
   *It is a clock that runs without electricity. Some mechanical clocks have springs that are wound up and then slowly unwind.*

2. What is an electrical clock?
   *It is a clock that runs on electricity.*

3. What is a clock face?
   *It is the surface with 12 numbers on it, that lets us see what time it is.*

4. What is the hour hand of the clock?
   *It is the small hand that tells us what the hour is. It moves around the clock face to the right, and goes from one number to the next in 1 hour.*

5. What is the minute hand of the clock?
   *It is the large hand that shows how many minutes have elapsed in each hour. Like the hour hand, it moves around to the right.*

6. How many minutes are in an hour?
   *There are 60 minutes in an hour. Between one number on the clock face and the next, there are 5 minutes.*

1. What is the second hand of the clock?
   *The second hand is the fast-moving hand on the clock face. It shows how many seconds have elapsed in each minute.*
8. How many seconds are in a minute?
   *There are 60 seconds in a minute.*

9. What is a digital clock?
   *A digital clock operates on electricity and shows the hours and minutes (and sometimes the seconds) in numbers, not with hands. A colon separates the hour from the minute on a digital clock.*

10. How many hours are in a day?
    *There are 24 hours in a day.*

11. How many hours are shown in numbers on a clock.
    *Twelve hours are shown.*

12. What are two names for 12:00?
    *They are 12:00 noon and 12:00 midnight.*

13. What are some important times during the day?
    *Answers will vary. Students probably will mention the beginning and end of the school day, dinner time, bedtime, and the times of favorite TV shows.*

14. What is another way to say 12:15? *You could say a quarter past 12.*

15. What is another way to say 1:30.
    *You could say half past 1.*

16. What is another way to say 5:40?
    *You could say 20 minutes to 6.*
17. What is another way to say 8:45? You could say a quarter to 9.

18. What is another way to say 3:55? You could say 5 minutes to 4.

19. How did early man probably tell time?
   Probably by putting a stick in the ground and watching the stick's shadow change position during the day.

20. Why was the sundial invented?
   The sundial probably was a more durable and permanent form of the stick in the ground.

21. What are some major problems with sundials?
   You can't tell the time on a cloudy day or when it's dark.

22. How does a sand clock work?
   The sand runs out from the top compartment of the clock to the bottom one in a certain time. A sand clock can measure hours or minutes.

23. How do some clocks help us tell time by making special sounds?
   Cuckoo clocks and clocks with chimes sound on the hour. They sound once for every hour—for instance, four times for 4:00.

24. How does a candle clock work?
   It burns down a certain amount to indicate that a certain amount of time has passed.
25. What does a stopwatch do and what is it used for? It measures times—usually brief times—down to the second. It is started and stopped by pushing, and is used to time races.

26. How is it that the day changes to night?  
The earth turns as it goes around the sun. As it turns, the part that is facing the sun is in sunlight, and it is daytime. The part that is turned away from the sun is in darkness, and there it is night.

27. Besides hours, minutes, seconds, and days, what are some other ways to measure time? There are months, years, and centuries.

28. What is a century? A century is 100 years.
DISCUSSION QUESTIONS AND ACTIVITIES

1. How Long Is a Minute?

We've all been told to "wait a minute"—but how long is a minute? Ask children to think of something they believe would take a minute. You could get them started with some suggestions: tying their shoes, writing the complete names of everyone in their family, singing "Mary Had a Little Lamb." Let children take turns doing their activities and time them, using a second hand or a stop watch. Children will come to a better understanding of how long a minute "feels" and how much can actually be done in a minute.

2. A Day in My Life

Let children make a "time line" for a typical day. They should use long shelf paper or staple together sheets of plain white paper and mark the resulting lengths into 24 hours. Each time line should begin at the time the child usually gets up in the morning and proceed from there, with the main activities of the child's day noted under the appropriate times. Children can decorate their time lines with illustrations, stickers, magazine cutouts, and so on. Finished time lines can be discussed and displayed.

3. Time Diary

As a weekend assignment, children can keep track of their activities for a day and note the times at which they did various things—both when they began activities and when the activities ended (example: 12:15-12:35—lunch). Children will need cooperation from parents or other adults, so notes about the activity should be sent home in advance.
4. Digital Numbers

Each number on a digital display is made of the same pattern pieces, called a 7-segment readout. The pattern looks like this:

By lighting up different segments, any of the digits from 1 to 9 can be displayed. Draw the pattern on the chalkboard and let children highlight different segments to show how each digit is made.


Water Clock

Children can make water clocks that measure a short time period. They can work individually or in pairs. For each clock, children will need:

- a container: a styrofoam cup or an empty, clean 8-oz. yogurt container will do
- a glass jar big enough for the container to sit in the mouth of the jar without falling in
- a strip of paper, about an inch wide and slightly taller than the jar
- two rubber bands
- a pin

Children should place the paper strip vertically along the side of the jar and secure it with the rubber bands. The strip
should run from the bottom of the jar to the top. Excess paper can be trimmed with scissors.

Children can use the pin to make a pinhole in the bottom of the cup. The cup should be placed in the container and filled with water. At 5-minute intervals, children should mark the level of the water in the jar by drawing a line on the paper at the water level. (Note: Intervals also could be shorter.) When all the water has run out, children will have a crude timer with which to measure short amounts of time.

**Note:** Children may notice that the higher the water goes in the jar, the farther apart the interval marks will be. Children could think about reasons for this and you could talk with them about the concept of pressure.

**Variation:** Have children add a second piece of paper on the jar next to the first one, then fill the top container with water to which a squirt of liquid dish detergent has been added. Does this make a difference? What other substances that could be added to the water might affect the flow?

**b. Sand Clock (using salt)**

Children can make hourglass-style clocks using salt, to measure short times. They can work individually or in pairs. For each clock, they will need:

- two identical small jars, very clean and dry. Putting the jars into a 150° oven for half an hour will dry them out.
- a piece of heavy paper such as oaktag
- masking tape
- salt
- a hole punch or nail
Children should trace a circle, the size of the mouth of the jars, on the heavy paper and cut it out. In the center of the circle, they should make a hole using the hole punch or nail. Next, they should fill one jar with salt almost to the top, and place the paper circle over the mouth of this jar. They should then place the other jar upside-down on top of the first jar. The two jars should then be taped together so they are well sealed, turned upside-down, and timed to see how long it takes for the salt to run from one jar to the other. If children want to adjust their timers to take more or less time, they can take them apart and rebuild them, either using less salt or making the hole in the paper circle larger or smaller. They can continue to make adjustments until they are satisfied.

These clocks are described in *This Book Is About Time*, by Marilyn Burns. Other clocks that children can build are described in detail in the book *Clocks* by Bernie Zubrowski. Both books are listed in the bibliography.

6. Time Zones

Some children may be aware of the different time zones in the United States. A child with relatives in another part of the country may know that the relatives' clocks are set either earlier or later, and this is important to consider when calling them on the phone.

Talk with children about the different time zones and show them how these zones are set up on a map. Help them relate the time zones to what the video showed them about the Earth's rotation and how it affects day and night.
7. Where Do We Get Moonlight?

The light of the moon is mysterious and beautiful. Talk about moonlight with the children and show them how it is reflected light from the sun. You could, as a homework assignment, ask them to observe the moon on a clear night and write several sentences describing the moon and the moonlight.

8. Day and Night Around the World

The relative length of day and night depends on the seasons and on one's location on the Earth. The seasonal variations between night and day are more extreme the farther one travels from the equator. Discuss with children the seasonal variations in the length of the daylight hours in the place where they live. (Daylight savings time could be part of the discussion.) Then talk with them about differences in other parts of the world—in the extreme northern or southern latitudes, for instance, and in countries that are on the equator. You can discuss the fact that the Earth tips on its axis and this affects the angle at which the sun strikes the Earth. The bibliography in this guide lists some books that include discussions of this subject. The school librarian could help provide other materials.
BIBLIOGRAPHY


NARRATOR:

Why is it important to know how to tell time? If you didn't know how to tell time, how would you know when it's time for school,

when it's lunchtime, or when it's time to go home? How would you know when it's time to do your homework,

or when it's time for bed?

If you don't know how to tell time, how will you know when it's time to watch a program on time?

TITLE: Tick Tock: AH About the Clock

There are many different kinds of clocks and watches. Clocks come in all sizes. Some are big, and some are small. Some have hands that move, to show what time it is.

Some clocks have numbers. Some clocks have special numbers that we call Roman numerals, which means Roman numbers.

Clocks that are plugged into the wall are electric. Other clocks and watches run on batteries. Mechanical clocks and watches run without electricity, like spring-powered clocks.

This is called a pendulum. It swings back and forth, causing the pointer of the clock to move.
Let's take a look at the inside of a clock. As you can see, some clocks have a lot of parts and things in them. Some mechanical clocks have a spring inside that you wind up. As the spring unwinds, the hands of the clock move.

This is a gear. It has sharp edges called teeth. Someone figured out how many teeth the gear needed to turn all the way around in 12 hours.

If we put a pointer on this gear, we could watch the gear move easier. But we still couldn't tell what time it was. We need a face for our clock with numbers on it, so we can see a number when the gear and the pointer move.

This is what we call a clock face. It has 12 numbers. Each number represents one hour of the day.

Here's a cake with a clock face on top. Each piece of cake is one hour.

Of course, it doesn't take an hour to eat a slice of cake. Now let's call on Mr. Clock to give us a hand.

A clock face has two and sometimes three pointers, or hands. The short hand is the hour hand. The longer hand is the minute hand, and the fast-moving hand shows us seconds. When the short hand points to a number, that tells you what hour it is.

Here it's 2:00...and here it's 6:00. What time is it now? It's 10:00.
This clock doesn't have pointers. It just has numbers. This is called a digital clock. Digital clocks work on electricity, like the kind you plug in, or on tiny batteries. Digital clocks are easy to use. They show you the time with numbers, not hands. This says that it's 1:30,

and here it's 2:35.

In a whole day, there are 24 hours. Have you ever heard of 24 o'clock? Or 15 o'clock? Of course not. A clock only has 12 numbers, so it must go all the way around twice in a day.

12:00 has two names: 12:00 noon for daytime and 12:00 midnight for night time.

12:00 noon is usually time for lunch. At 12:00 midnight, you should be in bed and fast asleep.

Let's look at a few important times of the day with Mr. Clock.

(A video montage of events of the day appears. A clock shows the time for each scene.)

Let's not forget an important hour—3:00 p.m., time for school to get out.

Have you ever heard someone say "Just a minute" or "Wait a minute"? Most of us have—but what is a minute? Another important hand of a mechanical clock is the minute hand, the longer one.

We need to keep track of smaller pieces of time. We wouldn't say, "Just an hour!" What if TV commercials were on for a whole hour?
Minutes are much shorter than hours. The big hand must go all the way around for each hour, but moves only one mark for each minute.

There are 60 minutes in one hour. Each little mark between the hour numbers is a minute. Five minutes...5 marks.

The time it takes for the long hand to move from one number to the next number is 5 minutes: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and finally 60.

If the school bus picks you up at 8:25, you had better be ready, because if you're late, even a minute, the bus may leave without you.

On this clock, you could say it is close to 1:00, but a much better way would be to say 5 minutes before 1, or 12:55.

When the long hand points straight up to the 12, it's exactly on the hour.

Here it's 9:00. Here both hands are pointing straight to the 12, meaning it's 12:00.

What is half an hour? One half hour is...that's right, 30 minutes. One fourth hour, or a quarter hour would be... 15 minutes.

How would you say what time it is here? You could say it's 4:30, or you could say it's half past 4, meaning that it's half an hour past 4. Here, you could say that it's a quarter after 7, and here it's a quarter of 11.
The two dots on the digital clock separate the hour from the minute. What time is it here? Good—1:25.

Digital clocks and watches are easier to read, but mechanical ones are more fun to watch. Let's look at the minute hand a little closer. If the minute hand is past the 6, then it's closer to the next hour. We could say 1:45, or 15 minutes till 2.

What time is it now? 1:55...1 hour and 55 marks, or minutes—but an easier way would be to say 5 minutes till 2.

This clock reads 8:10. Another way to say this would be 10 after 8.

Here it's 11:20. Although it would be correct to say it's 40 minutes to 12, we would not say that because it's closer to eleven. It has not passed the half way point. It would be much better to say 20 after 11.

This astronaut is in space. There is no air to breathe in space, so he has to breathe air from a tank in his space suit. His air may only last 30 minutes, so he had better know how to tell time.

This scuba diver also breathes air from a tank while diving underwater. He has only 10 minutes of air left.

What happens if they run out of air? They better do something fast! They can't hold their breath for too long.
How long can you hold your breath? A minute? An hour? Probably not. Most of us can only hold our breaths for a few seconds.

Seconds are the spaces between the minute marks. A third hand or a number on a digital clock show us seconds. There are 60 seconds in one minute, just like there are 60 minutes in an hour.

Seconds are fast! Blink your eyes once. That took about a second.

Each number you see here stays on the screen one second.

Thirty seconds is how long one TV commercial usually lasts. One minute is how long it takes to brush your teeth.

Catching fish might take only a few seconds, or a few minutes, and for some a whole hour.

The astronaut and the diver only had seconds left to find more air. What if they didn't have a clock or watch?

How did we tell time before we had clocks? Early man probably watched the shadows made by the sun...like the shadows made by trees.

If you stand in the same place all day, you could watch your shadow. It starts long in the morning and gets shorter, until at 12:00 there would be very little shadow. Then it would grow longer in the afternoon.

If you put a tall stick in the ground around 12 noon and marked each hour by putting small sticks in the ground
where the shadow reaches, the next day you could tell what time it was just by looking at the small stick that the shadow was close to.

What time is it when the shadow is touching this stick?

Sticks can get knocked down and are not very strong. Man needed something better to tell time. That's probably why the sundial was invented.

The sundial worked by using numbers on a dial and watching the shadow as it moved from one number to the next one. Can you tell what time it is here? The shadow is touching the 3, so it must be 3:00.

Here the shadow is right on 11. It must be 11:00.

The sundial was not very good when it was cloudy or night time. Other ways to tell time came later, like the sand clock. An hourglass is a sand clock that takes one hour for the sand to run out of the top and into the bottom, but it wasn't very good for a wrist watch.

This sand clock is used to time eggs. It takes 3 minutes before it needs to be turned over.

Here is another clock you wouldn't want to wear on your wrist—a candle clock...or this water clock!

We have many kinds of clocks today, from the big grandfather clock to this Kit-Cat clock. And we have windup alarm clocks and the funny cuckoo clock.

A cuckoo clock will tell you the time even if you're not looking at it. Every hour, the clock will cuckoo. If you want
to know what time it is, count how many times it cuckoos. It will cuckoo once for 1:00, twice for 2:00, and so on. What time is it now?...It's 4:00.

Many other clocks make noise on the top of the hour, too—like this grandfather clock. Many clocks tell us what time it is, and are fun to watch.

This is a candle clock. As the candle burns down from one mark to the next, an hour has passed. By the time it burns down this far, three hours have gone by.

This is an unusual watch. It's called a stopwatch. Its clock face is different. Stopwatches are used to time races.

When the starter says "Go," he pushes a button on the watch, and as the winner crosses the finish line he pushes it again, which stops the clock. This runner ran the race in just over 5 seconds.

A stopwatch measures short periods of time. Besides hours, minutes, and seconds, we can also measure time in days, months, or even years.

First let's look at what a day of time is. The earth spins in space like a merry-go-round, only much slower.

It takes 24 hours, or one day, for the earth to spin all the way around once. When astronauts go up in the space shuttle, they sometimes take pictures of Earth. See how the Earth is spinning.

Each 24-hour day is made up of day, and night. Night is when the sun isn't shining on our side of Earth.
Here is the Earth and the sun. See how part of the Earth is in day and part in night.

It's like this globe. Pretend the light is the sun. See how some parts of the earth are in light and some are dark? As the earth spins, parts that were in the dark become light.

When astronauts went to the moon, they took these pictures of Earth. We can only see the part of the Earth that is in sunlight. The part of the Earth that isn't facing the sun is in darkness and we can't see it here.

As the sun starts shining on this part of America in the morning, it would still be dark on this part because the Earth is spinning slowly and, like our globe shows, the sun hasn't reached that far.

From here on Earth, what do we see when the Earth goes from night to day? We see the sunrise, and when the earth goes from the light into the darkness, it's sunset.

There are even more ways to measure time that you will learn about, like months, years, and even a hundred years, which is called a century.

Time to review. We've learned that there are many different kinds of clocks and watches, and that they all tell time.

Mr. Clock showed us the 12 numbers on a clock's face and what they mean.

We learned about the clock's hands: the hour hand, the minute hand, and the fast-moving second hand.
We've learned about half hours and quarter hours.

We've learned how a clock can tell us what time it is. Do you know what time it is on this clock?

We know that 12:00 noon and 12:00 midnight are two names for 12:00.

We've learned that each hour has 60 minutes, and that there are 60 seconds in a minute.

Digital clocks are easy to read, and the two little dots separate the hours from the minutes.

We looked at shadows and how they helped early man invent the sundial.

And finally, we learned how the Earth and sun working together make time work, with the sun shining to give us daylight and the Earth slowly spinning to create nighttime and daytime.

Well, I wish we had more time, Mr. Clock—but it's time to go!

The End