

LESSON PLAN 15

Title: Time and Tides Wait for No One

Content Area Subjects:

- Career and Educational Development, Science, Health and Physical Education, History, ELA, Math, Social Studies

Grade level(s): Grades 3-12+ (The Instructor could adapt portions of this lesson for lower grades; the computer exercise may require older students to be partnered with younger students, depending on the skills of the group)

Standard(s):

Maine Learning Results

- Career and Educational Development. Interpersonal Skills (A3.pre-k to diploma.a,c)
- ELA. Informational texts (A3.3.c); (A3.3.e); (A3.6.e); A3.9-diploma.b); Research (C1.3-5.a,c,d)(C1.6-8.g); (C1.9-diploma.a,c); Listening (E1.3-diploma.c); (E1. 9-diploma.a); Speaking (E2.3-8.d); (E2. 9-diploma.a)
- Health and Physical Education. Cooperative Skills (I1.pre-k to diploma.a-d); Responsible Behavior (I2.pre-k to diploma)
- Math. Data (B1.4-8.a,b); (B1.9-diploma); Measurement and Approximation (B1.4-diploma.a,b); (B1.9-diploma.a,b,c); (B2.3-6); (B2.7.1a, 1b); (B2.8-diploma.3)
- Science. Scientific Inquiry and Technological Design (B1.3-diploma.a); (B1.3-diploma.b); (B1.3-diploma.c); (B1.3-diploma.d); (C1.3-diploma.a)
- Social Studies. Taking Action Using Social Studies Knowledge and skills (A3.3-diploma)

Common Core:

- ELA. (V.3-12.6); (SL.3-12.1c); (SL.3-5.1); (L.3.5b);(L.3.5b)
- Science and Technology. (R.6-12.4); (R.7-12.4)

STEM Skills

Brief Description: The lesson is an introduction to using a tide chart and mapping tidal height over a calendar cycle

Adaptations for grade level/abilities:

LESSON PLAN 15

The concepts for this lesson can be presented to any age group. The written activities for this lesson are best suited to students who can read. Using the tide chart and graphing are skills that could be done as a group or individually.

Objectives/Goals: After completing this lesson, the students will be able to:

- demonstrate an understanding of the importance of the tidal changes to the economy and daily living in coastal communities.
- Show how to use a tide chart
- Explain the tidal cycle
- Describe the main forces involved in a tidal cycle
- Begin to understand the importance of buoys and weather stations

Time needed: Approximately one class period (one hour)

Background Information:

An information sheet for the Instructor has been developed for this series of lessons. The instructor should review the worksheet for the material on tides in Lesson 14. The lesson can be adapted to the age group. For older students, the instructor could select different times of the year for tide mapping. A suggestion would be March (Vernal Equinox), June (Summer Solstice), September (Autumnal Equinox), and December (Winter Solstice) to allow for the collection of data that could be expanded into further study for them.

As tides come and go on a daily basis, the following tide is usually about an hour later than the previous tide. Over time, this pushes the next scheduled tide into the next calendar day and a tide chart will show a blank space, on the previous day.

There are many terms for this lesson and they will be defined in the Answers to Key Questions for Lesson 15 as well as in the Master Vocabulary List.

Keywords and phrases:

Anemometer, apogee, autumnal equinox, barometer, bell buoys, daylight saving time, discus buoy, diurnal tides, ebb, flow, local daylight time (LDT), local standard time (LST), mean high water, mean low water, mixed tides, National Data Buoy Center, neap tides, perigee, phases of the moon, semidiurnal tides, spring tides, Station 44027 (Jonesport, Maine), summer solstice, tidal bore, tidal current tables, tide tables, vernal equinox, watch circle radius, waning crescent moon, waning gibbous moon, waxing crescent moon, waxing gibbous moon, weather station/ buoy, winter solstice

LESSON PLAN 15

Weather buoy/station terms: wind direction, wind direction, wind speed, wind gust, wave height, dominant wave period, average wave period, atmospheric pressure, pressure tendency, air temperature, water temperature, dew point, ice accretion, wind chill (combines wind speed, gust and air pressure)

Materials Needed: Computers and internet connection for each student/group (if computers are not available, the provided tidal chart from www.noaa.gov could be used. Even if the dates for the tidal chart worksheets may have expired, the skills can still be mastered. A visit to the website can provide an updated data.)

- Many websites have tide calendars. (The Instructor may want to allow some exploration of these sites. The ability of the group will dictate this process. As always, the instructor should make sure that any material printed for classroom use follows copyright law for that document)
- Worksheet for tidal computer work
- Worksheet/graph paper to graph tides
- Instructions for graphing the tides
- Worksheet for “Planning the Future” events
- Internet site of the National Data Buoy Center www.ndbc.noaa.gov will provide the data that is registered by a weather buoy; www.me.ussharbons.com can provide marine forecasts, buoy data, tide charts and more for student exploration

The Procedure:

Introduction: The Instructor will say, “Today we are going to look at a Tide Chart/calendar to learn how such a sheet is helpful to people who live, work, or hope to visit coastal areas. Much of the daily living on the coast is affected by the high and low waters that direct the commercial fishery’s operations. Divers, Diggers, Dragers and fishermen alike know that there are places they want to be during low water and places they want to be during high water, depending on what they need to do on a given day at a given time. They keep watch of the tides, conducting their work and maintenance schedules around the ebb and flow of the ocean.

“They have learned where tides drain out fast or slowly. They know that Tidal Current Tables can help them with navigating areas like this and that Tide Tables will not be as accurate in these instances. They have learned that actual movement of the water does not always coincide with the predicted times stated, depending on physical features of the harbor, bay and inlet. They know where currents are unpredictable and dangerous during the changing of tides; they have learned that caution can help them and their fellow workers to stay safe. They know that the moon phases dictate higher than usual high tides and lower than usual low tides.

LESSON PLAN 15

“The gravitational forces of the sun, moon, and earth are main factors on the fluctuation in the tidal range, but many other forces are also at work. Our lesson today will focus on the tidal change itself.”

The Instructor could research first and later have the students go to a website such as <http://maineboats.usharbors.com/maine-tide-charts> and print off two months' of tide calendars. (If this is a younger group, the instructor could have them print the same two months; if this is an older group, the instructor might choose to have each group of two choose different months, overlapping one month as an accuracy check for the group OR the Instructor could print off the tide charts prior to the lesson.)

Key Questions

(Some of these questions will review concepts introduced in Lesson 14)

How many low tides in a 24-hour period in Maine? How many high tides?

What is meant by ebb tide? flood tide?

What information can be found on a tidal chart? Where does this information come from? What is LDT and LST, why do we need to know the difference?

How is a tidal current chart different from a tidal chart? Why is knowledge of tidal current important?

How are spring tides different from neap tides?

What is a tidal bore? Where might a tidal bore occur?

What are semidiurnal tides? Diurnal tides? Mixed tides?

Explain what happens to the level of the tides during the phases of a moon cycle from new moon to full moon to new moon. How does the moon's elliptical orbit affect the tides? How does the moon's perigee or nearest point of orbit affect the tides? How does the moon's apogee or farthest point of orbit affect the tides?

What are weather buoys? What can be learned from them?

What are seamarks? What can be learned from them?

What are bell buoys? What can be learned from them?

Main Activity

Once the students have their tide calendars, worksheet “Highs and Lows” and instructions, it would be appropriate to assign 10 days to one quarter of the class, 10

LESSON PLAN 15

days to the next quarter of the class, 10 days to the third quarter of the class, and 10 days to the last quarter of the class. Errors in graphing would be more evident in comparing chart to chart. Start the charts on the new moon date and continue assigning the dates until the next new moon so that a full cycle has been repeated. Four chart pages taped together will depict approximately 40 days and will give more than a complete tidal moon cycle. The shading that students do between their graph lines will help to illustrate the concept of tidal height over a period of time. (The answer key will illustrate this for the Instructor)

If the group is made up of students with more graphing experience, the instructor can assign a different 10 days to each student. As a group, the class can check for accuracy and they could see the pattern of tides over a longer time period. The Instructor could pick dates around the calendar as suggested in [Background Information](#).

Conclusion

After the students have finished their tidal graphs, the Instructor should pose appropriate questions that will encourage the students to look at the information their tidal graph shows them about high and low tides such as:

On which date(s) did the highest tide occur in the moon cycle?

On which date(s) did the lowest tide occur?

Can you find any differences between tides that occur in the daylight and tides that occur at night in terms of their highs and lows?

How could this information on a tide chart help a person who makes his/her living on the coast?

The Instructor could introduce the concept of weather buoys and the data supplied by them on a regular basis. Have the students go to the National Data Buoy Center at www.ndbc.noaa.gov and www.me.usharbors.com to find out about weather buoys/stations near them. Station # 44027 is Jonesport; Buoy # CFWM1 is Cutler. Various other sites have other buoy stations as well. A brief look at such sites will help to reinforce the ever-changing conditions near bodies of water.

A discussion could bring in other aids to navigation that are used in the commercial fishery from VHF, to sonar, bell buoys, automated lighthouses, etc. Students could research current and past aids to navigation and present their findings to the class.

Assessment:

LESSON PLAN 15

Using the worksheet provided, “Planning for the future” as an extension of their learning, have the students check the tidal chart website to see if the planned activities can take place during those future dates. Discuss the worksheet as a group. Have them think of other situations when knowledge of high and low tide could be important.

**For further exploration, students can research www.noaa.gov;
www.tidesonline.nos.noaa.gov; tidesandcurrents.noaa.gov/gmap3**