4. Gravity

By Sharon Fabian

1 Gravity is not just a force on planet Earth. Each planet has its own gravity, and each planet's gravity is different. Our moon has gravity too. So do the moons that circle other planets. The sun has gravity (lots of it). So do all of the other stars. In fact, everything has some gravity, but only really big things like planets, moons, and stars, have enough gravity to be measured.

2 Here on Earth we measure gravity using a scale. Any type of scale will do, whether it is a triple beam balance in your school's science lab or the bathroom scale in your house. Your weight is the measure of gravity's pull on you. Scientists often like to use the word mass instead of weight. For everyday matters, here on earth, your weight and your mass are the same, but that is not true everywhere! If you ever become an interplanetary traveler, you will see that your weight is different on each planet. This is because a planet's gravity is determined by its own size, or mass. Larger planets have more gravity; smaller planets have less gravity. This is true for suns and moons too.

3 Suppose you weigh 100 pounds here on Earth. Would you like to know what you would weigh in different locations in space? Just look at this list.

Earth - 100 lbs

Moon - 17 lbs

Mercury - 38 lbs

Jupiter - 236 lbs

Pluto - 7 lbs

the sun - 2407 lbs

a white dwarf - 130,000,000 lbs

a neutron star - 14,000,000,000,000 lbs

in a spaceship far out in space - 0 lbs

4 The force of gravity also depends on how close an object is to the centre of the planet. If you were in a spaceship travelling up through the earth's atmosphere, the pull of gravity would gradually be less and less, until you escaped from the pull of gravity altogether.

5 We can see an example of this here on earth too. Scientists who

study the oceans' tides know that tides are caused mainly by the pull of the moon's gravity, but also, just a little bit, by the pull of the sun. The reason why the moon's pull is so much stronger is because, even though it is much smaller than the sun, it is also much, much closer to earth.

6 Gravity is the force that holds moons in their orbit abound their planet, and planets in their orbit around the sun. Without gravity, moons, planets, or anything else would just keep going in a straight line. There is a special name for a force that holds something in a circular path. It is called centripetal force.

7 Space scientists have found an amazing use for planets' centripetal force. They have sent up the spacecraft named Cassini to explore the far away planets. Cassini could never carry enough fuel for its whole mission, so the scientists planned to have it do a flyby of several planets on its way. As it zips around each planet, it uses that planet's gravity, or centripetal force, to pick up speed. Cassini's mission included a flyby of Venus, Earth, and Jupiter, which all together would pick up as much power as 75 tons of rocket fuel.

8 The next time someone tells you that gravity is what holds us down on Earth, you can say that there is a lot more to gravity than that!

Gravity

1. If you weigh 100 pounds on Earth how much would you weigh on Jupiter?
   - (A) 17 lbs
   - (B) 100 lbs
   - (C) 2407 lbs
   - (D) 236 lbs

2. Gravity is measured using a
   - (A) Ruler
   - (B) Scale
   - (C) Measuring cup
   - (D) Speedometer

3. On Mercury, you would weigh
   - (A) More than an elephant
   - (B) Less than on Earth
   - (C) The same as on Earth
   - (D) More than on Earth

4. On a neutron star, you would weigh
   - (A) About as much as a train weighs on earth
   - (B) About as much as an elephant weighs on Earth
   - (C) About the same as on Earth
   - (D) Much more than any of these

5. Tides are mainly caused by
   - (A) The sun's gravity
   - (B) None of these
   - (C) The moon's gravity
   - (D) The Earth's gravity

6. From the information in the article, we can infer that an object's mass
   - (A) Would be greater on Jupiter than on Earth
   - (B) Would be less on Jupiter than on Earth
   - (C) Would always be the same
   - (D) Would be more on Jupiter than on Mercury

7. The force that holds the planets in their orbit around the sun is called
   - (A) Weight
   - (B) Mass
   - (C) Centrifugal force
   - (D) Centripetal force

8. How did scientists use the force of gravity on the Cassini spacecraft mission?
   - (A) Gravity pulls Cassini back to Earth from outer space.
   - (B) Cassini gets a power boost from planets' gravity.
   - (C) Cassini uses the Earth's gravity to help it blast off.
   - (D) Gravity keeps Cassini from crashing into Jupiter.

5. The Story Behind Our Seasons

By Laura G. Smith

1 Maybe the summer season is your favourite time of year-school's out, the weather's warm-you might take a trip to the beach or hang out at your neighbourhood pool. The fall season usually makes us think of leaves changing colours or the kick-off of a new football season. Then the winter months follow, bringing colder air and maybe snow for sledding or an icy pond for skating. Maybe spring is the season you look forward to the most! The blossoming trees and flowers can surely brighten things up after the drab, grey days of winter. All four of the seasons display their own unique characteristics, but what causes the change?

2 There are two things that cause the change in seasons: the earth's orbit (the path it travels around the sun), and the tilt of the earth's axis (which is at an angle of 23.5 degrees).

3 It takes the earth one year to make a single orbit (or revolution). At the same time the earth is revolving around the sun, it is also spinning (or rotating) on its axis. The earth completes one rotation every 24 hours. (Read about the earth's 24 time zones in "It's About Time.")

4 If you could stick a huge straight pin down through the North Pole and have it poke out through the South Pole, the pin would represent the earth's axis, but it would not be straight up and down. It would actually be slanted at an angle. The angle of the earth's axis is what causes different seasons. In summer, the earth is tipped toward the sun; in winter, it's tipped away. When it is summer in the northern hemisphere, it is winter in the southern.

5 If the earth's axis were not tilted, but straight up and down (or vertical), each location on earth would be exposed to a constant amount of sunlight during the entire year; there would be no changes in temperatures and no seasons! The regions near the equator would receive the most sunlight (much like they already do); the land at the north and south poles would receive almost no sunlight, so it would always be dark and winter-like. The regions between the equator and the poles would be warmest by the equator and then gradually cool off as we moved towards the poles. None of these regions would have a change in seasons. For example, if the weather in South Carolina was in the 70's during the month of April, it would also be in the 70's in August or December or any other month of the year.

6 On the other hand, if the earth were tilted at an angle much

greater than its current 23.5 degrees, let's say it was tilted at closer to 90 degrees, what would happen then? The northern hemisphere would experience very severe cold weather for about a six-month period of time in the winter; and the southern hemisphere would have an extremely hot, six-month-long summer. The conditions for the northern and southern hemispheres would be reversed for the second half of each year. This would no doubt impact plant and animal life on earth as we now know it.

7 Our Earth is an amazingly complex habitat! It was designed to provide a place where humans, animals, and vegetation would thrive. Just observe the consistent, systematic movement of our planet. We can count on the sun "rising" and "setting" at predictable times each day because the earth rotates every 24 hours. We know the earth will continue to travel around the sun every 365 days; and its axis will always be tilted at 23.5 degrees so we can look forward to the changing seasons, which occur like clockwork.

The Story Behind Our Seasons

1. The two things that cause our change in seasons are: (A) Changes in the environment and the sun's rays (B) The earth's orbit and the tilt of its axis (C) The earth's rotations and revolutions (D) Rainfall and temperatures	2. When the earth travels once around the sun, we call this a (A) Rotation (B) Axis (C) Season (D) Revolution
3. It takes 24 hours for the earth to make a single (A) Circle (B) Revolution (C) Rotation (D) Orbit	4. The earth's axis is perfectly vertical (straight up and down). (A) True (B) False
5. If the earth's axis were perfectly vertical, we would not have (A) Light (B) Seasons (C) Rain (D) Heat	6. The earth's axis is tilted at an angle of _____ degrees. (A) 12.5 (B) 53.5 (C) 23.5 (D) 90.5
7. When the northern hemisphere is tipped toward the sun, it is _____________ in the southern hemisphere. (A) Winter (B) Summer	8. My favourite season is ______________ because ___________________________ ___________________________ ___________________________ ___________________________

6. It's About Time

By Laura G. Smith

1 "Do you know what time it is?" It's a question we either ask or answer nearly every day. We plan to do certain things, meet certain people, or go to certain places at certain times, based on our schedules. Imagine how confusing our days would be if we had no organized way to measure time!

2 Before timekeeping and clocks were invented, people used to know approximately what time it was by watching the sun. When the sun is at its highest point in the sky, this is known to be 12 o'clock noon (or midday). Directly above every spot on the earth, an imaginary curved line called the celestial meridian passes through the sky. As the earth rotates on its axis (read more about the earth's axis in "The Story Behind the Seasons"), the sun crosses every celestial meridian once each day. When the sun crosses the celestial meridian above a particular place, the time there is noon. Every place on earth that is east or west of another place has noon at a different time. The time at any particular place is called the local time.

3 By the 1700's man had developed accurate clocks and watches that told time to the minute. Each town would set their clocks at noon each day based on the position of the sun. The town clock would be the "official" local time, and the citizens would set their pocket watches and clocks to the same time. Some of the townspeople even earned money by traveling house-to-house adjusting clocks in their customers' homes on a weekly basis. Since each town set its official clock according to the position of the sun at that particular location, travel between cities meant having to change one's pocket watch upon arrival.

4 As railroads grew to be a more widespread mode of transportation, time became a more important issue. In the early years of the railroads, the schedules were very confusing because each stop was based on a different local time.

5 In 1878, Sir Sanford Fleming, a Canadian civil engineer and builder of the Canadian Pacific (CP) Railway across Canada, proposed that the world should be divided into twenty-four time zones. Sir Fleming's idea was recognized worldwide as a brilliant solution to a chaotic problem and earned him the title of "Father of Standard Time."

6 Over the years, various railroads had simplified their schedules by establishing what they called railroad time along their routes. But by 1883, there were still about 100 different railroad times. On November

18, 1883, United States railroad companies began utilizing Fleming's standard twenty-four time zones that are still in use today.

7 In 1884 an International Prime Meridian Conference was held in Washington D.C. During this conference, the Greenwich Observatory in England was chosen as the prime meridian (or starting point) for the time zones. Twelve time zones were established to the west of Greenwich and twelve to the east.

8 The time is the same everywhere within one time zone, but different to the remaining twenty-three zones. When you move from one zone to the next, you change your watch by one hour. If you are travelling in an easterly direction, you move your watch forward by one hour. If you are moving westerly, you move it one hour backwards.

9 The "twelfth zone east" and "twelfth zone west" lie next to each other and are separated by an imaginary line called the International Date Line, which is halfway around the world from Greenwich. A traveler crossing this line while headed west, towards China, loses a day. If he crosses it traveling eastward, he gains a day.

10 The International Date Line is not a straight line. It runs in a zigzag pattern to avoid splitting countries apart into two days. However, the tiny country of Kiribati was originally separated by the line causing the western part to be a whole day and two hours behind the eastern part. In 1995, Kiribati moved the International Date Line so the entire country would be on the same day at the same time. Since there are no treaties or formal agreements established internationally concerning the line, the rest of the world followed Kiribati and moved the line.

11 The U.S.A. and its territories have nine time zones. They include Eastern, Central, Mountain, Pacific, Alaska, Hawaii-Aleutian, Samoa, Wake Island, and Guam.
In Canada there are 5 ½ time zones. Pacific Standard, Mountain Standard, Central Standard, Eastern Standard, Atlantic Standard and Newfoundland Standard which is ½ hour different than Atlantic Standard.

It's About Time

1. Before man invented timekeeping devices, how did people know what time it was? (A) By word of mouth (B) By observing the position of the moon (C) By ringing the church bells (D) By observing the position of the sun	2. Above every spot on the earth, an imaginary curved line called the _____ passes through the sky. (A) Prime meridian (B) International Date Line (C) Celestial meridian (D) Local time
3. The time at any particular place is referred to as the _________ time. (A) Local (B) Current (C) Prime (D) Official	4. When the sun crosses the celestial meridian above a particular place, the time there is (A) Ten o'clock (B) Midnight (C) Noon (D) Two o'clock
5. The issue of keeping track of time became more important because of the (A) People arriving late to work (B) Development of more towns (C) Increase in population (D) Development of the railroad system	6. The starting point for the 24 time zones is called the (A) Basic meridian (B) Prime meridian (C) Father of Time (D) Fleming's Line
7. When you travel across the International Date Line, you either lose or gain a day, depending which direction you're traveling. (A) True (B) False	8. Imagine you were travelling from the Province of B.C. in an easterly direction. During the course of your trip, you left the Pacific time zone, passed through the Mountain time zone and drove into the Central time zone where you stopped to spend the night. If you had left home (in Vancouver) at 6:00 a.m. that morning and travelled for 12 hours before stopping for the night, what time would you have to adjust your watch to in the Central Time Zone? (A) 8:00 p.m. (B) 6:00 p.m. (C) 9:00 p.m. (D) 7:00 p.m.