Lesson 2:

SNC1P

Earth & Space Unit

Lesson 2 – What are the Sun and the Moon, and how are they linked to Earth?

1. The Sun is our nearest star.

- Our Sun was born about 5 billion years ago, and will last for another 5 billion years. Strong gravitational forces pull this great mass together, creating great pressure and heat. Under these extreme conditions, **h**_____ atoms collide violently with each other, and they combine (or fuse). During this process, called **n**_____, two hydrogen atoms fuse together to form a **h**_____ atom, and great amounts of energy are released.
- During fusion, each gram of hydrogen releases 90 000 million kilojoules of energy. That's as much energy as you would get if you ate 1 trillion pizza slices. The Sun has 2.0×10^{23} grams of mass.

Size	14 000 000 km in **d**_____.
Distance between the Sun and Earth	____ AU (=150 000 000 km)
Composition	73% **h**_____ atoms, 25% **h**_____ atoms, and 2% other gases
Temperature	• About 15 000 000 °C at the core • About 6 000 °C at the photosphere • About 1 000 000 °C in the corona
Rotation	The sun makes one rotation in 26 days at its equator but it takes 37 days to rotate at its poles. (The Sun rotates **f**____ at its equator.)
Gravitational pull	Because of its huge **m**____, the Sun's gravitational pull on the much smaller masses of our solar system is very powerful. The planets, moons, far-ranging comets, and all other objects of the solar system are all kept in orbit due to the Sun's **g**_____.
Energy generation	Like all stars, the Sun gives off a spectrum of energy bands. These include **r**_____, **m**_____, **I**_____, **v**, **u**_____, and **X**_____. All of these forms of energy travel at the speed of light: _____ km/s.
	This ancient symbol for the **S**____ is also a symbol for the element hydrogen.

2. Interactions of Earth and the Sun make life possible.

- Earth's distance from the sun is "just right" for life. Astronomers call Earth's position in the solar system the "**G**_____." Earth's **m**_____ and **a**_____ provide the protection needed for life on our planet.

Source: Science Links 9. McGraw-Hill Ryerson. 2009

- **The link between the magnetosphere and the atmosphere.** Along with energy, the Sun also sends out streams of matter in the form of charged particles that travel through the whole solar system at great speed. These streams of charged particles are called the **s**_____. The solar wind bathes Earth and all other objects in the solar system.
- The highly energetic particles of the solar wind are deadly to life. Fortunately, Earth is protected from their effects by a field of magnetic force that surrounds the planet. This field of magnetic force around Earth is called the **m**_____. The magnetosphere **d**_____ the solar wind and **p**_____ much of it from entering the atmosphere.
- Charged particles can, however, enter Earth's atmosphere at the **p**_____. At times, especially powerful outbursts of solar wind particles enter at the poles and interact with atoms in the upper atmosphere to create shimmering curtains of beautiful, coloured light. This display of light created by the solar winds is called an **a**_____. In the northern hemisphere, it is called the **a**_____, or commonly called, the **N**_____.
- **The link between the atmosphere and life.** Green plants and other producers need light from the Sun for photosynthesis, and consumers need plants. Without the Sun, there would be no life. Sunlight includes bands of energy that are **h**_____ to living things. These include UV (**u**_____) rays and X-rays. Fortunately, **o**_____ and other gases in the atmosphere acts like a filter that helps to shield living things from much of the Sun's harmful effects.
- Earth's atmosphere acts like a **b**_____ that traps heat from the Sun and redirected back to the surface instead of escaping back into space. This helps to keep Earth at just the right **t**_____ for life to thrive. Without this atmosphere, extreme fluctuations of temperature would make life as we know it impossible. Moderate temperatures also allow water to exist in all three states on Earth – gas, solid, and especially liquid. Earth is the only known planet with this unique combination, which is a key factor for maintaining **l**_____. Unfortunately, some of the energy absorbed at the surface **e**_____ into space.

3. The Moon is our nearest neighbour in space.

- Our calendar and holidays are linked to appearance of the **M**_____ in the night sky. The Moon also affects the lives of animals. Some aquatic animals, for instance, mate or lay their eggs when the Moon becomes more full or less full. The word **l**_____ means moon.
- **Phases of the Moon.** The Moon looks like it shines with a light of its own, but moonlight is really sunlight that **r**_____ from the Moon's surface. The reflected light we see is always from the same side of the Moon. The reason involves how the Moon rotates (spins) and how the Moon orbits. It takes the Moon 27.3 days to make one full orbit around Earth. It takes the Moon 27.3 days to make one full rotation. The rotation rate and the orbiting rate match, so we always see the same side of the Moon from Earth. The other side of the Moon – called "the **d**_____ of the Moon" – always faces away from us, so we never see it.
- The lit-up side of the Moon is always fully lit up, but we can't always see the whole lit–up side. Instead, we see the changes in the amount of lit-up surface during a month: the **p**_____ of the Moon. The Moon, Earth, and Sun are arranged to produce the phases of the Moon. The phases of the Moon are caused by the **a**_____ of lit-up surface that we can see from Earth as the Moon orbits Earth.

4. The Sun, Moon, and Earth interact to create eclipses.

- An **e**_____ occurs when Earth or the Moon is lined up in space so that it blocks the Sun's light for a short time.
- **Solar eclipses.** In a solar eclipse the Moon moves directly between the Sun and Earth, so that the Moon casts its shadow on part of Earth. Solar eclipses occur in the **d**____, and the Sun's light is either totally or partially blocked. During a **t**_____ solar eclipse, the Moon covers the **w**_____ face of the Sun, leaving only a hazy, white glow of the Sun's atmosphere visible, like a halo. During a **p**_____ solar eclipse, the Moon covers only **p**____ of the Sun's face. Your location determines whether you see a total or partial

Source: Science Links 9. McGraw-Hill Ryerson. 2009

solar eclipse. If you are standing in the area covered by the full shadow of the Moon, you see a total solar eclipse. If you are standing in the area covered by part of the shadow of the Moon, you see a partial solar eclipse. A solar eclipse is best viewed through a telescope or other lens equipped with a solar flare. **N**_____ look directly at the Sun, either during the eclipse or any other time. The sun's energy can damage or destroy the parts of the eye that enable you to see, causing **b**_____.

- **Lunar eclipses**. A lunar eclipse occurs when Earth moves directly between the Sun and Moon, so that Earth casts its shadow on the Moon. During a total lunar eclipse, the whole Moon is covered fully by Earth's shadow. Sometimes this shadow appears **r**____ due to light bending in Earth's atmosphere. During partial lunar eclipse, Earth's shadow only partially covers the Moon. Lunar eclipses are more **c**_____ than solar eclipses. You can watch a lunar eclipse safely, because you are looking at reflected sunlight, not the direct energy from the Sun.

Homework (WORKBOOK): p. **99**

Source: Science Links 9. McGraw-Hill Ryerson. 2009

Name _____ Date _____

Topic **3.2** Summary

What are the Sun and the Moon and how are they linked to Earth?

Textbook pages 182–195

Before You Read

What do you know about how the Sun and the Moon and Earth all affect each other? Record your answers on the lines below.

_____

_____

Reading Check

1. How is Earth protected from charged particles?

_____

_____

_____

Reading Check

2. What is an eclipse?

_____

_____

_____

What is the nearest star to Earth? What is it like?

The Sun is the nearest star to Earth. The Sun is 1 AU, or 150 000 000 km from Earth. This huge sphere of mostly hydrogen gas is held together by strong gravitational forces. The temperature of the Sun ranges from 6000°C at the **photosphere** to 15 000 000°C at the core. The **nuclear fusion** reactions that take place at its core generate great amounts of energy. This energy can be in the form of radiowaves, microwaves, infrared waves, visible light, ultraviolet rays, and X-rays.

Why can Earth support life?

If Earth orbited closer to the Sun, our planet would be like a desert. If Earth orbited farther away, our planet would be a icy wasteland. Since Earth orbits in a zone called the "Goldilocks zone," the planet has ideal temperature ranges for life.

Earth is surrounded by a magnetic field called the **magnetosphere.** The magnetosphere prevents the **solar wind** and its charged particles from entering Earth's **atmosphere.** Earth's atmosphere acts as filter from harmful energy from the Sun. The atmosphere also acts as a blanket to trap heat from escaping back into space.

When some charged particles from the solar wind do enter Earth's atmosphere at the north and south poles, they cause **aurora**—also called the northern and southern lights.

Name Date

Topic 3.2 Summary

Why does the Moon change at night?

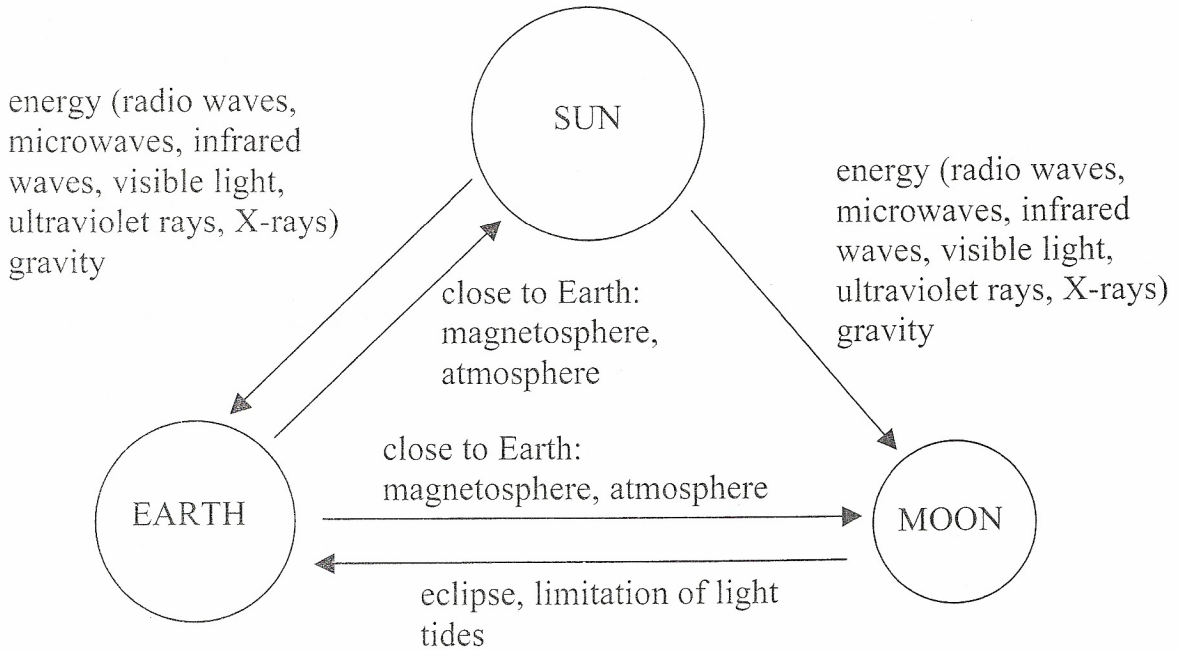
As you gaze into the night sky each evening, the amount of moonlight that you see will change. This moonlight is actually sunlight reflected back to Earth from the Moon's surface. The **phases of the Moon** are caused by the positions of the Moon orbiting around Earth. The same side of the Moon faces Earth all the time but, depending on where the Moon is in relation to Earth, we see more or less of that lit-up side.

What is an eclipse?

An **eclipse** is the total or partial blocking of sunlight that occurs when one object in space passes in front of another. There are two kinds: solar eclipses and lunar eclipses. Both kinds involve the interaction of the Sun, Earth, and the Moon.

In a **solar eclipse**, the Moon passes between the Sun and Earth, briefly blocking our view of the sun. A total solar eclipse happens when the full shadow of the Moon falls on Earth's surface. A partial solar eclipse happens when only part of the Moon's shadow falls on Earth's surface. In a **lunar eclipse**, Earth passes between the Sun and the Moon, briefly plunging the Moon into darkness as Earth's shadow moves across it. When the Moon lies fully in Earth's shadow, people see a total eclipse.

Earth, the Sun, and the Moon



Name _____ Date _____

Comprehension
Topic 3.2

Use with textbook pages 182–195.

How the Sun and Moon affect life on Earth

1. When was the Sun formed?

_____

2. What are effects of the strong gravitational forces found holding the mass of the Sun together?

_____

3. What protects life on Earth from the Sun's heat, light, and other types of solar energy?

_____

4. How does the magnetosphere protect life on Earth?

_____

5. How does Earth's atmosphere help keep temperatures within a stable range for supporting life?

_____

_____

6. Give an example of how the Moon can affect the lives of animals.

_____

7. What is moonlight?

_____

8. Explain what causes an eclipse.

_____

9. Why should you never look directly at the Sun during an eclipse?

_____

_____

Name _____ Date _____

Applying Knowledge
Topic 3.2

Use with textbook pages 184–189.

Comparing the Sun and the Moon

Complete the following table comparing characteristics of the Sun and the Moon.

	The Sun	The Moon
1. Ancient symbol		
2. Distance from Earth		
3. Size (diameter)		
4. Temperature range		
5. Rotation (number of days)	At the solar equator: At the solar poles:	

6. List the six different types of energy bands that are given off by the Sun.

_____

_____

7. How does the Sun affect the Moon's orbit?

_____

8. Who was the first astronaut to step on the surface of the Moon?

_____

Name _____ Date _____

Illustrating Concepts
Topic 3.2

Use with textbook pages 190–191.

Eclipses

Show what you know about eclipses. Draw diagrams as directed below.

1. Draw a diagram that shows what happens during a solar eclipse. Be sure to label the Sun, the Moon, and Earth.

2. Draw a diagram that shows what happens during a lunar eclipse. Be sure to label the Sun, the Moon, and Earth.

Name _____ Date _____

Assessment
Topic 3.2

What are the Sun and the Moon and how are they linked to Earth?

Use with textbook pages 182–195.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ aurora	A. term which means moon
2. _____ lunar	B. the area of space that contains a planet's magnetic field
3. _____ lunar eclipse	C. light shows, created by solar wind, in Earth's upper atmosphere
4. _____ magnetosphere	D. streams of charged particles that travel through the solar system at great speed
5. _____ nuclear fusion	E. phenomenon where the Moon moves directly between the Sun and Earth, so that the Moon casts a shadow on part of Earth
6. _____ rotation	F. the process where two hydrogen atoms fuse together to form a helium atom, and great amounts of energy are released
7. _____ solar eclipse	G. the motion of a planet as it spins on its axis
8. _____ solar wind	H. phenomenon where the Earth moves directly between the Sun and Moon, so that the Earth casts a shadow on the Moon

9. What is nuclear fusion?

_____

_____

_____

10. Why is Earth so well-suited for life?

_____

_____

_____

11. What causes the phases of the Moon?

_____

_____

_____

12. What appearance does the Sun have to an observer during a total solar eclipse?

_____

_____

_____