ST Questions 1–9, 12–17, 21–32, A, C and D

Checkups and follow-ups

CHAPTER 7 ANSWER KEY

The atmosphere and space

Checkup

1	THE ATMOSPHERE (pp.	222–239)
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- 1. True or false? Explain your answers.
 - a) The atmosphere is the 30-km-thick layer of air surrounding the Earth. False. It is more than 10 000 km thick, but its mass is concentrated within the first 30 km above the Earth's surface.
 - **b)** The atmosphere is composed mainly of oxygen. *False. It is composed mainly of nitrogen.*
 - c) The atmosphere protects us from the sun's harmful rays.

True. It protects us from ultraviolet rays in particular.

- 2. Which layer of the atmosphere matches each of the following descriptions?
 - a) It is the coldest layer of the atmosphere.
 - **b)** Meteorological phenomena occur in this layer.
 - c) It contains the ozone layer.
 - d) It is the warmest layer of the atmosphere.
 - e) Most satellites travel in this layer.
- **3.** On October 23, 2007, the space shuttle *Discovery* blasted off from the Kennedy Space Center, in Florida, to deliver equipment to the International Space Station. Name, in order, the layers of the atmosphere the shuttle passed through.

Troposphere, stratosphere, mesosphere, thermosphere and exosphere

4. Name three characteristics of air that are important to meteorology. *Pressure, temperature and relative humidity*

Mesosphere Troposphere Stratosphere Thermosphere Exosphere



ANSWER KEY

CHAPTER 7 The atmosphere and space

5. To measure atmospheric conditions at high altitude, meteorologists use weather balloons that can rise up to 30 km in the air. These balloons are equipped with measuring instruments and radars that send the data back down to Earth. As they rise, the air-filled balloons expand. Explain your answer.

Air pressure drops with altitude, allowing the air particles inside the balloons to expand.

6. Do air particles exert more or less pressure as the temperature rises? Explain your answer.

Air particles exert less pressure when the temperature rises because they move away from one another, so the number of collisions between particles falls. In the atmosphere, however, air pressure approaches a state of equilibrium, so air density drops when the temperature rises.

7. What causes winds to blow?

Winds are created by the movement of air from high-pressure areas to low-pressure areas.

8. A highly trained cyclist leaves Montréal for Québec. At the same time, another cyclist, of equal ability, makes the trip in the opposite direction. If a high-pressure system is hanging over Montréal, and a low-pressure system, over Québec, which cyclist will be the first to arrive at destination? Explain your answer.

The cyclist who leaves Montréal for Québec will arrive first because he or she will be cycling with a tail wind.

9. How is heat from the sun distributed between the equator and the poles? <u>Through atmospheric circulation, which is a phenomenon of convection, causing warm air to rise</u> above the equator and head toward the poles, while cold polar air makes its way to the equator.

 \Rightarrow Questions 10 and 11 are not intended for students in the ST program.



Name:	Group:	Date:

- 12. What does each of the following definitions describe?
 - a) a large expanse of the atmosphere where temperature and humidity are relatively uniform An air mass
 - **b)** the leading edge of a cold air mass where it meets a warm air mass, causing puffy clouds, or *cumulus*, to form
 - c) the leading edge of a warm air mass where it meets a cold air mass, causing long layered clouds to form
- **13.** Look closely at the photo opposite.
 - a) Was the photo taken in an area of high or low atmospheric pressure?

In an area of high pressure

- **b)** What is such an area called? *An anticyclone*
- c) If this area is in the Northern Hemisphere, in which direction do the winds turn?

Clockwise

d) What is the opposite phenomenon called?

A depression

14. Do winds generally blow in a straight line from a high-pressure area to a low-pressure area? Explain your answer.

No, they deviate because of the Coriolis effect, which is caused by the rotation of the Earth. Winds deviate to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

- **15.** True or false? Explain your answers.
 - a) The greenhouse effect is a recent phenomenon, caused by human activity on Earth. *False. Greenhouse gases have always been present in the atmosphere.*
 - **b)** By accumulating in the atmosphere, greenhouse gases trap increasing amounts of ultraviolet radiation.

False. They trap infrared rays emitted by the ground.

A	cold front
A	warm front



c) Clearing land intensifies the greenhouse effect because carbon dioxide is released as felled trees decompose.

True. The carbon stored in forests returns to the atmosphere in the form of CO_2 *when trees are felled.*

- **d)** Photosynthesis in plants plays a major role in stabilizing temperatures on Earth. *True. Plants absorb CO*₂ *during photosynthesis, reducing the greenhouse effect.*
- 16. For each of the following greenhouse gases, name a human-caused source of emissions.a) carbon dioxide (CO₂)

Answers will vary. Example: the combustion of oil, natural gas and coal in cars or industrial processes.

b) methane (CH₄)

Answers will vary. Examples: digestion in farm animals, manure storage and management, rice farming in paddy fields, decomposing household waste and the distribution of natural gas.

c) nitrous oxide (N₂O)

Answers will vary. Examples: certain chemical processes and applying nitrogen-rich fertilizer to farm crops.

17. Decomposing waste in landfills produces methane (CH₄). In some sites, this gas is collected and burned to transform it into carbon dioxide (CO₂). Does this practice have a positive or negative impact on the environment? Explain your answer.

Positive. Methane is a gas with a greenhouse effect 21 times greater than that of carbon dioxide.

\Rightarrow Questions 18 to 20 are not intended for students in the ST program.

21. Name two advantages and two disadvantages of wind power.

Answers will vary. Examples:

Advantages: It depends on a renewable form of energy.

- It does not emit greenhouse gases.

Disadvantages: Wind turbines may ruin the beauty of a landscape.

- Wind blows intermittently.

- It is impossible to store wind energy.

2 THE EFFECT OF THE SUN AND THE MOON ON THE EARTH (pp. 239–245)

- 22. What kind of reactions transform hydrogen into helium in the Sun's core? <u>Nuclear reactions</u>
- **23.** In what form does solar energy reach the Earth? *In the form of radiation energy (electromagnetic waves)*
- **24.** Which electromagnetic waves from the Sun reach the Earth's surface? *Visible light, some of the infrared rays and a tiny proportion of the ultraviolet rays*
- 25. Explain the meaning of the following statement: The curvature of the Earth is at the origin of many atmospheric phenomena.
 Because of the curvature of the Earth, the tropical regions receive more solar energy than the poles.
 The differences in temperature between areas of the world create winds and ocean currents.
- 26. What does each of the following definitions describe?
 - a) a large glass panel that captures the sun's heat and transfers it to a liquid running beneath the panel surface

Solar collector

- **b)** a device that converts sunlight into electric current *Photovoltaic cell*
- **27.** Describe two elements of a passive heating system.

Answers will vary. Examples: South-facing windows and materials such as concrete, which absorb solar energy.

28. Name two advantages and two disadvantages of solar power.

Answers will vary. Examples:

Advantages: It depends on a renewable form of energy.

- It does not emit greenhouse gases.

- It can be used to power facilities in isolated areas.

Disadvantages: Building costs are high.

- The amount of solar energy varies with the position of the Sun in the sky and cloudy conditions.

29. At 11 a.m., Jennifer left her towel and book on the beach to go for a walk. When she came back an hour later, her belongings had been swept away by the tide. She was surprised; the day before, the tide had been high around midnight. Why is it already high again?

The Earth has made a half-turn on its axis. Jennifer is now on the side of the Earth opposite the Moon. The tide is high because the water is less attracted to the Moon than the Earth itself is.

30. True or false? Explain your answers.

- a) Tides are caused by the gravitational force of the Moon only. *False. The Sun also plays a role in the phenomenon of tides.*
- b) At any one time, there are two high tides and two low tides on Earth.
 <u>True. High tides occur on the side facing the Moon and on the side opposite the Moon. Low tides occur on the other two faces of the Earth.</u>
- c) The Moon's gravitational force is due to its rotation.

False. Gravitational force is not due to the rotation of the Moon, but to its mass.

- 31. The following are stages in tidal power generation. Place them in the correct order.
 - A. The tide goes out. D. A gate is opened.
 - **B.** The tide comes in. **E.** The water is held in a basin.
 - $\ensuremath{\textbf{C}}.$ The water is released, setting a turbine in motion.
 - B, E, A, D and C
- **32.** Name two advantages and two disadvantages of tidal power.

Answers will vary. Examples:

Advantages: It depends on a renewable form of energy.

- It does not emit greenhouse gases.

Disadvantages: Tidal power plants are very expensive to build.

- The plants must be able to draw on a large tidal range.

REVIEW QUESTIONS

 \Rightarrow Question B is not intended for students in the ST program.

- A. Out of concern for the environment, Sophie has chosen to leave her car at home two days a week and walk to the office instead of driving. Before leaving home, she listens to the radio. According to the weather report, a high-pressure area has appeared over the city where she lives.
 - a) What is the name of the weather system affecting the city?

An anticyclone

- **b)** Should Sophie think about taking an umbrella to work? Explain your answer. *It will not be necessary. Anticyclones are associated with dry and sunny weather.*
- **C.** The Smith and Schwartz families each built a hunting cabin in an isolated region of northern Québec. The province's power grid does not reach their cabins. The Smiths decided to install a small wind turbine to meet their electrical needs. The Schwartzes installed solar collectors and photovoltaic panels.
 - a) In terms of greenhouse gas emissions, which family is the more environmentally friendly? Explain your answer.

No difference. In both cases, no greenhouse gases are emitted when the equipment is in use.

- b) What problem will each family have to deal with in its choice of power supply? <u>The Smiths will not have power when the wind stops blowing. The Schwartzes will not have</u> <u>electricity at night and when it is cloudy</u>.
- c) The two families are thinking of combining their generating systems to create a small supply network for the two cabins. What do you think? Is this the answer to their problems? *Excellent idea. When one system is not in production mode, the other system could take over. However, power supply will remain a problem at night or on cloudy days when there is no wind.*
- D. Prepare your own summary of Chapter 7 by building a concept map.

See the Concept maps section in Guide B.

Name:	Group:	Date:

Follow-up

1. In Québec, smog levels have increased by 15 percent on average since the early 1990s, primarily in the south of the province. Explain your answer.

Because of the increase in the number of vehicles on the roads and the development of industrial activities. Smog emissions are concentrated in the south because the province's urban areas are also concentrated there.

2. Québec cannot act alone to solve the problem of smog over its territory. It must collaborate with neighbouring provinces and states. Explain your answer.

Because atmospheric pollutants can be carried by the wind to places hundreds of kilometres from their emission points. Even if Québec reduces its emissions, the results will not be conclusive as long as its neighbours do not do the same.