Physical Geography 12th edition Petersen Solutions Manual

SKU: 9780357142448-SOLUTIONS

Instructor Manual

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Chapter 1: Physical Geography: Physical, Spatial, and Environmental Science

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Purpose and Perspective of the Chapter

The purpose of this chapter is to explain the range and discipline of physical geography, which is the study of all aspects of Earth in its role as the home of people. Geographers take a holistic approach to problem solving, meaning that they are open to all factors that might be involved in the solution, including human factors. Being concerned with nearly all aspects of Earth, physical geographers are trained to view a natural environment and consider how it functions in its entirety. Maps are essential components of geography. Physical geographers use the scientific method to guide their learning about the processes and features on Earth. Physical geographers study Earth's principle subsystems–the atmosphere, lithosphere, biosphere, and hydrosphere-and many specialize in identifying and reducing environmental degradation and pollution. Geographers often employ models to give them information about a particular system.

Cengage Supplements

The following product-level supplements provide additional information that may help you in preparing your course. They are available in the Instructor Resource Center.

- PowerPoint presentation
- Cognero Test Bank files
- Physical Geography in Context short-answer essay activity
- Google Earth activity
- Country Identification activity
- Map Quiz

Chapter Objectives

The following objectives are addressed in this chapter:

01.01 Describe the fundamental difference between physical and human geography.

01.02 Explain why geography is considered a spatial discipline.

01.03 Discuss the concept of a geographic region.

01.04 List three ways in which modern technology is used in physical geography.

01.05 Distinguish among the three major perspectives of physical geography: physical science, spatial science, and environmental science.

01.06 Give an example of how a physical geographer might use the scientific method.

01.07 Specify why it is appropriate to consider Earth a system.

01.08 Explain why human interaction with the natural world is considered part of physical geography.

01.09 Discuss the relationship between physical geography and environmental sustainability.

01.10 Provide three examples of how physical geography is relevant to your everyday life.

Complete List of Chapter Activities and Assessments

For additional guidance refer to the Teaching Online Guide.

Chapter Objective	PPT Slide	Activity/Assessment	Duration in Minutes
		Knowledge Check	3-5
		Check Your Understanding	10-15
01.07		Concept Animation Quiz: Feedback Loops	5-10
01.06		Ch 01 Video Quiz: The Scientific Method	5-10
01.10		Ch 01 Video Quiz: Careers in Geography	5-10
01.01, 01.03, 01.04, 01.08		Physical Geography in Context	20-30
01.04		Map Analysis: Introduction to Digital Maps	20-30
01.01	2	Icebreaker: Geographers' Questions	10
01.01	10	Reflection Activity: Geography at Work	15
01.04	13	Case Study Activity: Personal Geographic Technology	10
01.06	26	Discussion: Interdisciplinary Geography	15

01.07	36-37	Knowledge Check Activity: The Earth as System	10
01.10	40	Breakout Group Activity: Geographers	15
01.02, 01.03, 01.08, 01.07	41	Self-Assessment	10

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Key Terms

absolute location: location of an object on the basis of mathematical coordinates on an Earth grid.

atmosphere: blanket of air, composed of various gases, that envelops Earth.

biosphere: the life forms—human, animal, or plant—of Earth that form one of the major Earth subsystems.

cartography: the science of mapmaking.

closed system: system in which no substantial amount of materials can cross its boundaries.

computer-generated model: a computer-developed representation of a feature, process, or environmental system.

conceptual model: image in a person's mind of an Earth feature or landscape as derived from personal experiences.

dynamic equilibrium: constantly changing relationship among the variables of a system, which produces a balance between the amounts of energy and/or materials that enter a system and the amounts that leave.

Earth system: set of interrelated components, variables, processes, and subsystems (e.g., atmosphere, lithosphere, biosphere, and hydrosphere), which interact and function together to make up Earth.

ecology: science that studies the interactions between organisms and their environment.

ecosystem: community of organisms functioning together through interdependent relationships with the environment that they occupy.

environment: surroundings, whether of people or of any other living organism; includes physical, social, and cultural conditions that affect the development of that organism.

environmental degradation: processes or results, usually related to human activities that are detrimental to an environment.

environmental overshoot: a situation where the rate of resource use is unsustainable, given the existing supply or renewability of that resource.

environmental sustainability: interacting with the environment in ways that will ". . . provide the best outcomes for the human and natural environments both now and into the indefinite future" (EPA).

equilibrium: state of balance between the interconnected components of a system; an organized whole.

feedback: sequence of changes in the elements of a system, which ultimately affects the element that was initially altered to begin the sequence.

feedback loop: path of change as its effects move through the variables of a system until the effects impact the variable originally experiencing change.

geography: study of Earth phenomena; includes an analysis of distributional patterns and interrelationships among these phenomena.

human geography: specialization in the systematic study of geography that focuses on the location, distribution, and spatial interaction of human (cultural) phenomena.

hydrosphere: major Earth subsystem consisting of the waters of Earth, including oceans, ice, freshwater bodies, groundwater, and water within the atmosphere and biomass.

input: energy and material entering an Earth system.

lithosphere: a general term for the solid (rock) part of the Earth system, in contrast to the atmosphere, hydrosphere, and biosphere.

mathematical/statistical model: quantitative representation of an area or Earth system using statistical data.

mental map: conceptual model or mental image of an area or a location in map form that people develop in their minds.

model: simplified representation of a more complex reality that is useful for analysis and prediction.

natural hazard: any natural process that has a detrimental impact on humans and the built environment.

natural resource: any element, material, or organism existing in nature that may be useful to humans.

negative feedback: reaction to initial change in a system that counteracts the initial change and leads to dynamic equilibrium in the system.

open system: system in which energy and materials can freely cross its boundaries.

output: energy and material leaving an Earth system.

physical geography: specialization in the systematic study of geography that focuses on the location, distribution, and spatial interaction of physical (environmental) phenomena.

physical model: three-dimensional representation of all or a portion of Earth's surface.

pictorial/graphic model: representation of a portion of Earth's surface by means of maps, photographs, graphs, or diagrams.

pollution: the presence or introduction of a harmful substance into the environment.

positive feedback: reaction to initial change in a system that reinforces the initial change and leads to imbalance in the system.

region: area identified by certain characteristics it contains that makes it distinctive and separates it from other areas.

relative location: a description of an object's location relative to the position of some other object or feature.

resilience: the ability for a system to tolerate change.

scientific method: answering questions (hypotheses) by collecting evidence, objectively analyzing the evidence, and proposing answers based on what the evidence supports.

spatial discipline: term used when defining geography as the science that examines phenomena as it is located, distributed, and interacts with other phenomena throughout Earth space.

spatial distribution: location and extent of an area or areas where a feature exists.

spatial interaction: process whereby different phenomena are linked or interconnected, and, as a result, impact one another through Earth space.

spatial pattern: arrangement of a feature as it is distributed through Earth space.

subsystem: separate system operating within the boundaries of a larger Earth system.

system: group of interacting and interdependent units that together form an organized whole.

systems analysis: determining the parts of a system, the processes involved, and studying how changes in interactions among those parts and processes may affect the system and its operation.

threshold: a limiting condition that if exceeded (or not met) will cause a dramatic, often irreversible change in the system.

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What's New in This Chapter

The following elements are improvements in this chapter from the previous edition:
A new section, "Physical Geography in Everyday Life," links the discipline directly to the students' life experiences. Geography as a spatial discipline, working with systems and models, and geographic applications of technology in career fields.

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Chapter Outline

In the outline below, each element includes references (in parentheses) to related content. The first number refers to the chapter learning objective; "PPT Slide #" refers to the slide number in the PowerPoint deck for this chapter (provided in the PowerPoints section of the Instructor Resource Center). Introduce the chapter and use the Icebreaker in the PPT if desired, and if one is provided for this chapter. Review learning objectives for Chapter 1. (PPT Slides 3-4).

- 1-1 Geography Is Physical, Human, and Spatial (01.01, 01.02, 01.06, PPT Slides 5-10)
  - 1-1a Physical Geography Focuses on the Natural Earth (01.01, PPT Slide 6)
  - 1-1b Geography Uses a Spatial Approach (01.02, PPT Slides 7-9)
- 1-2 Geographic Technology (01.04, PPT Slides 11-13)
- 1-3 Major Perspectives in Physical Geography (01.02, 01.03, 01.05, 01.06, 01.08, 01.09 PPT Slides 14-26)
  - 1-3a Physical Science Perspective (01.02, 01.05, 01.07, PPT Slide 18-20)
  - 1-3b Spatial Science Perspective (01.02, 01.03, PPT Slide 15-17)
  - 1-3c Environmental Science Perspective (01.05, 01.08, 01.09, PPT Slide 21-25)
- 1-4 Working with Models and Systems (01.07, PPT Slide 27-37)
  - 1-4a Systems Analysis (01.07, PPT Slides 28-30)
  - 1-4b Open and Closed Systems (01.07, PPT Slide 31-32)
  - 1-4c Equilibrium in Earth Systems (01.07, PPT Slide 33-35)
- 1-5 Physical Geography in Everyday Life (01.010, PPT Slide 39)

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Discussion Questions

You can assign these questions several ways: in a discussion forum in your LMS; as whole-class discussions in person; or as a partner or group activity in class.

1. Icebreaker: Geographers' Questions. Come up with at least five questions a physical geographer would ask, and five that a human geographer would want to research. (Chapter Introduction, 01.01, PPT Slide 2)
   Duration 10 minutes.
   a. This discussion can motivate students to think about geography as a discipline and consider its central questions.

2. Reflection Activity: Geography at Work: To what degree are the students interested in geography? Can they recognize the relevance of the subject in their future dream jobs or likely careers? (Geography Is Physical, Human, and Spatial, 01.01, PPT Slide 10)
   Duration 15 minutes
   - Students are likely to develop a stronger interest in the field and their study if they recognize how their own professional futures may connect with the subject.

3. Case Study Activity: Personal Geographic Technology. Ask students to mentally walk through their typical daily routine and count the number of times they make use of geographic technologies. (Geographic Technology, 01.04, PPT Slide 13)
   Duration 10 minutes
   - This activity should help students discover how vital geographic knowledge is in their daily lives and how much they take it for granted.

4. Discussion: Interdisciplinary Geography. Think about which disciplines in the sciences or humanities regularly rely on geographers, and which they imagine can work without geographic knowledge.
   (Major Perspectives in Physical Geography, 01.02, PPT Slide 26)
   Duration 15 minutes
   a. This discussion should encourage students to think about the many connections geography builds between the sciences and the humanities.

5. Knowledge Check Activity: The Earth as System. Chart a comparison table and identify the characteristics of the human body as a system that are similar to those of Earth as a system. (Working with Models and Earth Systems, 01.07, PPT Slides 36-37)
   Duration 10 minutes
   The human body has individual systems that all have a specific function (e.g., heart, lungs, kidneys), yet all work together to make us function as a person.

Just like the human body, the systems on Earth—for example, the oceans, the atmosphere, the biosphere—have specific functions that allow the system to function as a whole.

6. Breakout Group Activity: Geographers. Make a list of positive goals geographers work toward and a list of ways in which individuals' geographic knowledge improves individual life, the community, and society at large. (Physical Geography in Everyday Life, 01.10, PPT Slide 40)
   Duration 15 minutes
   - This will require students to identify scenarios in which the dew point is central to an explanation of physical processes (condensation on cold drinks or windows, foggy glasses, etc.)
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Suggested Usage for Lab Activities

This chapter does not have a lab activity, but the Map Analysis activity could be used as a lab.

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Additional Resources

Answers to Questions for Review

M.A. = Many answers possible

1. Some subfields of physical geography are meteorology, climatology, geomorphology, biogeography, and soil science. Meteorologists study and forecast the daily weather. Climatologists study regional climates, the averages and extremes of weather data, climate change, and climate hazards. Geomorphologists are interested in understanding and explaining variations in landforms and landscapes, as well as the processes involved, and the nature of Earth's surface features. Biogeographers examine the geographic ranges and patterns of vegetation and animal species. Soil scientists study soil formation, characteristics, and distribution.

2. (a). Geography's focus is spatial—understanding where things are, their spatial distributions, and their patterns. Geographers, rather than studying one type of phenomena like economics or rocks, study anything from a spatial perspective;

that is, focusing on where phenomena are located and how they are distributed over space, especially on Earth's surface. (b). For example, geographers may ask: Why are deserts located where they are? Where do tornadoes occur most frequently in the United States? Why do cold ocean currents flow along west coasts in the midlatitudes? Why do active volcanoes and earthquakes tend to occur in certain regions, but not in others? Why is the vegetation on a south-facing hillside different from the vegetation on a north-facing hillside? (c) The three major perspectives of geography—spatial science, physical science, and environmental science—allow geographers to gain a holistic view of systems.

3. Holistic means considering all relevant aspects (natural- and human-influenced) that affect an environmental concern (e.g., weather, climate, soils, landforms, water bodies, biota, human activities).

4. The four major divisions of the Earth system are the atmosphere, biosphere, hydrosphere, and lithosphere. Many examples of overlap exist among Earth's systems. M.A. For example: The content of water in the atmosphere often depends on evapotranspiration (the release of water to the atmosphere by plants). The soils of the lithosphere can be favorable for the growth of certain plants while not favorable for others. Humans, who are part of the biosphere, build structures that change the flow of water and the habitat of animals.

5. The use of system analysis is a physical science tool that helps physical geographers focus on the structure (flow paths) of matter and energy in the part of the natural environment that they are studying.

6. Geographers are interested in how humans affect their environments and how they adapt to their environments. Environmental science involves studying and understanding these interactions.

7. Open systems let matter and energy come into and leave the system. Closed systems do not let matter come into or leave the system. Earth can be considered an open system because people are able to travel to space and return. Because that exchange of matter across the Earth system boundary is so small, Earth is often considered closed to matter.

8. A threshold is a condition that causes systems to change dramatically. For example, earthquakes will not occur until the built-up stress reaches a threshold

level that overcomes the strength of the rocks to resist breaking. Fertilizing a plant will help it grow larger and faster, but if too much is added, a threshold is reached and the plant may be poisoned.

9. A negative feedback tends to regulate, offset, or minimize changes in a system in order to maintain equilibrium. An example of a negative feedback is when an increase in a deer population depletes the deer food supply, which leads to a decrease in population back toward the original number of deer.

Answers to Consider and Respond Questions

M.A. = Many answers possible

1. M.A., depends on the geography of the local area.

2. M.A., depends on the geography of the local area.

3. M.A., depends on the geography of the local area.

4. Advantages and disadvantages for geographers are the same as for other scientists. Chief advantages include 1) the ability to focus on a specific problem or subsystem and 2) to quantify the behavior, processes, and impacts of each system variable on other variables and on the system as a whole. Chief disadvantages include 1) difficulty in constructing an accurate model for the area studied and 2) obtaining results that may skew or distort interpretations for actual patterns and processes.

5. M.A., depends on the interests of the person. Faculty at the student's school can help with suggestions about geography-related employment and the courses that will help to prepare the student for a career in geography. Having a spatial outlook, skill at spatial analysis, and knowledge of mapping are advantageous skills in many career fields. Many jobs, even those not directly related to geography, require some skills in geospatial techniques, such as geographical information systems (GIS). Direct students to the American Association of Geographers website **www.AAG.org**. On that site there is a section on careers and jobs in geography.

Answers to Practical Application Questions

M.A. = Many answers possible

1. Students' mental maps of their home environments will vary greatly. This is an exercise in their ability to spatially visualize and diagram/map their home environment.

2. M.A. Students should follow the example in Figure 1.23 on page 22 and substitute some other process (deer numbers and food supply, for example).

Answers to Figure Legend Questions

M.A. = Many answers possible

Figure 1.1 M.A. The geographer has a unique understanding that involves multiple subfields and related physical sciences. This knowledge of, and relationship to, other sciences makes the geographer a good choice for coordinating cross-disciplinary work and for engaging scientists from a variety of disciplines.

Figure 1.2 M.A. Examples: steep mountains, a small pond or wetland, different types of vegetation, rock structures, landforms, soils, cloud patterns, time of day, season, and potential human impacts.

Figure 1.6 The four subsystems all interact with each other. Organisms need air, water, and nutrients. The lithosphere is affected by precipitation, flowing water, and organisms. The atmosphere contains small particles of soil and organic matter (e.g., pollen), as well as water. Gases from the atmosphere, sediment from the lithosphere, and organic matter are contained in water at Earth's surface.

Figure 1.7 Rain can cause gullies to form and wash ash down the slope. Birds and insects can arrive, bringing seeds for plants and fungi. Plants can become established and help to stabilize the slopes. Soil will continue changing with the addition of organic matter. Waves and currents of the ocean may move sediment along the island.

Figure 1.8 M.A. Examples of distribution: More people live in the European compared to the African part of the image. Settlements occur on land, not in the Mediterranean Sea. Examples of pattern: Settlements tend to

be contiguous along the coastline. Larger cities are closer to each other in Italy than in North Africa.

Figure 1.10 M.A. Examples: changes in sea level, changes in the glacier size, changes in vegetation in response to climate change and global warming.

Figure 1.11 Various aspects of an ecosystem are linked with each other, providing the necessary components for life to other members of the ecosystem. For example, rain falls, plants grow, animals eat the plants (primary consumer), a secondary consumer (e.g., fox) eats the primary consumer, and soils develop through decomposition.

Figure 1.12 Suitable living space is a limited resource. Currently, to sustain a large population, significant amounts of land are being devoted to agricultural production. Potential areas for settlement include areas that are currently forested, grassy areas, deserts, and tundra (high latitude) regions. In some future scenarios, underwater settlements have also been proposed.

Figure 1.15 Water supplies, the return of wildlife, the restoration of ecosystems, and the expansion of recreational opportunities should be considered. All of these options should be balanced against the cost of the project, the economic loss of farmland and pasture, and the threat of renewed flooding.

Figure 1.18 The human body has individual systems that all have a specific function (e.g., heart, lungs, kidneys), yet all work together to make us function as a person. Just like the human body, the systems on Earth—for example, the oceans, the atmosphere, the biosphere—have specific functions that allow the system to function as a whole.

Figure 1.19 M.A. Examples could be sunlight that comes into Earth's atmosphere and that either gets reflected by clouds or absorbed by Earth's surface, generating plant growth and changes in weather systems. A forest that gains energy from the sun, grows, and then decays. Soils that break down from parent rock, and the like.

Figure 1.20 M.A. Examples could include a pond that receives water from rain and streams and that loses water due to evaporation and stream outflow, or a forest that receives rainwater and that loses water through hydrological flow and soil from erosion.

Figure 1.22 M.A. A potential outcome from not curtailing the release of CFCs in the atmosphere could have been total destruction of the stratospheric ozone layer. Such a scenario would have led to additional UV at Earth's surface, more skin cancer, and devastating consequences for plant and animal life.

Figure 1.23 M.A. A background in spatial concepts can be beneficial for both science and business. Scientists and government planners need spatial information to outline potential future impacts of decisions on landscapes, water systems, and human and animal populations. Businesses need spatial information to determine routes for supplies and employees, the best way to cut costs during production, and so on.

Answers to Feature Box Questions

Geography's Environmental Perspective: Human Environmental Interactions
M.A. Answers will depend on location.

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Appendix

Generic Rubrics

Providing students with rubrics helps them understand expectations and components of assignments. Rubrics help students become more aware of their learning process and progress, and they improve students' work through timely and detailed feedback. Customize these rubrics as you wish. The writing rubric indicates 40 points, and the discussion rubric indicates 30 points.

Standard Writing Rubric

Criteria	Meets Requirements	Needs Improvement	Incomplete
Content	The assignment clearly and comprehensively addresses all questions in the assignment. 15 points	The assignment partially addresses some or all questions in the assignment. 8 points	The assignment does not address the questions in the assignment. 0 points
Organization and Clarity	The assignment presents ideas in a clear manner and with strong organizational structure. The assignment includes an appropriate introduction, content, and conclusion. Coverage of facts, arguments, and conclusions are logically related and consistent. 10 points	The assignment presents ideas in a mostly clear manner and with a mostly strong organizational structure. The assignment includes an appropriate introduction, content, and conclusion. Coverage of facts, arguments, and conclusions are mostly logically related and consistent. 7 points	The assignment does not present ideas in a clear manner and with strong organizational structure. The assignment includes an introduction, content, and conclusion, but coverage of facts, arguments, and conclusions are not logically related and consistent. 0 points
Research	The assignment is based upon appropriate and adequate academic literature, including peer-reviewed journals and other scholarly work. 5 points	The assignment is based upon adequate academic literature but does not include peer-reviewed journals and other scholarly work. 3 points	The assignment is not based upon appropriate and adequate academic literature and does not include peer-reviewed journals and other scholarly work. 0 points
Research	The assignment follows the required citation guidelines. 5 points	The assignment follows some of the required citation guidelines. 3 points	The assignment does not follow the required citation guidelines. 0 points
Grammar and Spelling	The assignment has two or fewer grammatical and spelling errors. 5 points	The assignment has three to five grammatical and spelling errors. 3 points	The assignment is incomplete or unintelligible. 0 points

Standard Discussion Rubric

Criteria	Meets Requirements	Needs Improvement	Incomplete
Participation	Submits or participates in discussion by the posted deadlines. Follows all assignment. instructions for initial post and responses. 5 points	Does not participate or submit discussion by the posted deadlines. Does not follow instructions for initial post and responses. 3 points	Does not participate in discussion. 0 points
Contribution Quality	Comments stay on task. Comments add value to discussion topic. Comments motivate other students to respond. 20 points	Comments may not stay on task. Comments may not add value to discussion topic. Comments may not motivate other students to respond. 10 points	Does not participate in discussion. 0 points
Etiquette	Maintains appropriate language. Offers criticism in a constructive manner. Provides both positive and negative feedback. 5 points	Does not always maintain appropriate language. Offers criticism in an offensive manner. Provides only negative feedback. 3 points	Does not participate in discussion. 0 points