PHYSICAL GEOGRAPHY, EXAM 1 (CH 1-4) STUDY GUIDE

NOTE: This guide is to cover some of the main topics we have discussed but does not cover everything on the exam. To do well, you need to carefully read and study the assigned chapters in the book.

Note that Exam 1 will be split into two shorter exams (Exam 1A and Exam 1B) so that we have at least part of an exam before the first drop date. Exam 1A will cover ONLY CHAPTER 1 and the notes below. Exam 1B will cover Chapter 2 though the first section of Chapter 4 (The Electromagnetic spectrum and solar Energy). Note that the rest of Chapter 4 (starting with the section Composition of the Atmosphere) will be on Exam 2.

EXAM 1A (CHAPTER 1)

We will have an early exam that only covers Chapter 1 and additional information provided on the study guide.

CHAPTER 1. INTRODUCTION TO PHYSICAL GEOGRAPHY

The Science of Geography

Geography as a discipline and profession

Geography is a science concerned with space and spatial relationships

- The extent of where features exist
- Arrangement of features in space
- Often called the spatial science for this reason

This is true not just for physical geography but other types of geography as well (human geography, economic geography, political geography, biogeography, etc…)

Uses spatial analysis as its method

- Maps
  - The science of map-making is called cartography
- Geographic information systems (GIS)
  - Combines cartography (maps) and databases.
- Remote sensing
  - The ability to “see” the earth using sensors on airplanes or satellites
    - Provide rapid, worldwide view of the environment
    - Can view places that are difficult to travel to in person
    - Can measure and locate natural resources
- Models – models are a useful simplification of reality and include parts of the above items
  - Maps and globes
  - Remote sensing images
  - Conceptual models – how we picture “systems” in action
    - Rivers, weather, climates, vegetation, etc…
  - Mental maps – conceptual models that are ideas in our heads
    - How you get to school, how you get around your house
Physical Geography

Is concerned with the geography of the physical environment
Offers unique perspectives in comparison to other sciences

- Spatial perspective
- Human-environmental perspective
  - Looking at both physical science and culture

Some subfields of Physical Geography

- Climatology and meteorology – interaction of atmospheric components
- Geomorphology – nature and development of landforms
- Biogeography – environments and processes that influence characteristics and distribution of species
- Soil science – processes that form soil, distribution of soils
- Hydrology – movements, processes, characteristics of water

The Spatial Science Perspective

Location

- **Absolute location** – precise mathematical location (latitude and longitude)
  - 36.5 degrees north, 120.25 degrees west
- **Relative location** – where something is in relation to another place
  - 10 miles north of downtown Merced

Place

- Places are more than their mathematical, or absolute location
  - Have names, like children and pets

Region

- An area on the earth that shares some characteristics
  - Climate region, language region, vegetation region

Spatial distribution and spatial patterns

- **Distribution** – extent of area where a feature exists
- **Pattern** – arrangement of features in space

Spatial interactions

- A condition or occurrence in one place has impacts on other places

Ever-changing earth

- Things do not stay the same but change over time

Earth’s four “Spheres” (BE SURE YOU READ THIS WELL IN THE BOOK)

Three abiotic (or non-living) systems

- Atmosphere – The gasses that surround the Earth
- Hydrosphere – Earth’s water, both in the atmosphere and on the Earth’s surface
- Lithosphere – The top layers of the solid planet below the atmosphere

One living system

- Biosphere – Interconnected web that links living organisms with their physical environment.

Ecology

- Study of the relationships between living things (part of the biosphere) and their non-living (or abiotic) environment (atmosphere, hydrosphere, lithosphere)
Models and Systems (additional notes to what is in textbook).

Systems

- Ordered system of things
- Linked by flows of energy and matter
- Individual components are called variables

Closed system

- No flows of matter or energy in or out of the system
- Rarely found in nature

Open system

- Just about any system in physical geography is an open system
- Energy and matter flow in and out of an open system
- The Earth is an open system in terms of energy, but a closed system in terms of matter.

System Feedback

Negative Feedback

- Feedback information discourages response in the system
  - Like your thermostat at home, keeps temperature not too hot, not too cold
- Causes self-regulation in a system, Makes things stable

Positive Feedback

- Feedback information encourages response in the system, Causes a run-away process, or a “snowballing” condition

States of Systems

System Equilibrium – The maintenance of a state in a system, or how a systems stays stable over time

- Steady-state equilibrium – System remains balanced over time, Little fluctuation around average
- Dynamic Equilibrium – System demonstrates a changing trend over time (ups and downs)

Threshold – or tipping point

- The point at which a system moves to a different state
- System comes to a new equilibrium

Feedback loop

- Chain of processes in a system operating in cycle

Model of Systems

- A model is a simplified representation of part of the real world
  - Its simplicity makes it easier to understand a real-world process
CHAPTER 2. THE GEOGRAPHERS' TOOLS

Location and on Earth

Latitude and Longitude

**Latitude** – measurement of (angular) distance north or south of the equator (to the poles)
- Latitude *increases* from the equator to the north pole or south pole
  - These are the two fixed reference points for the Earth
- Is strongly related to yearly patterns, like sunlight and seasons
- Lines are called **parallels**

**Longitude** – measure of (angular) distance east or west of a point on the Earth’s surface
- Longitude is measured as east and west from Greenwich, England for historical reasons
- Is strongly related to 24-hour cycles like the time in any given location
- Lines are called **meridians**

Latitude and longitude are measured and subdivided, like time:
- Degrees, minutes, and seconds (each degree is about 69 miles)
  - Latitude goes from 90 degrees north to 90 degrees south
  - Longitude goes from 0 degrees to 180 degrees (east or west)
- Minutes – There are 60 minutes in each degree (like the minutes of an hour)
- Seconds – There are 60 seconds in each minute (like time also)

Map Projections

Because latitude and longitude are angular distances (think circles on a globe!), they are not ideal for looking at the earth as a flat surface.

So why do we want to look at the Earth as a flat surface?
- So we can use geometry to measure areas of regions, distance between locations, etc…

There are many types of map projections and I don’t expect you to remember all of these in detail, but for the sake of understanding the concept, remember this one:

**Universal Transverse Mercator (UTM)**
- The earth is divided into zones that run north and south
- Each zone acts as a flat grid with geometric coordinates
  - X coordinate (east-west) is measured from the edge of the zone (or just beyond it actually)
  - Y coordinate (north-south) is measured from the equator to the north pole, or from the equator to the south pole

[Diagram of Universal Transverse Mercator grid]

Figure 1. The Universal Transverse Mercator grid that covers the continental United States comprises 60 zones, with Zone 18 at the west coast through Zone 20 at the east coast.
Map Scales

- How much area is covered by a map at one time
- There is a trade-off between scales
  - The amount of area that is covered
  - The amount of detail that is shown
    - Think of the zoom feature on a camera
- Is described by a representative fraction
  - 1:24,000
    - Or, one inch equals 24,000 inches
  - 1:100,000
    - Or, one cm equals 100,000 cm
  - Think about this like if you were building a scale model of a house or model car
    - A 1/4 scale model would have a representative fraction of 1:4
- In geography, a large-scale map is “zoomed in”
  - Remember that the representative fraction is relatively large (like 1:5,000 = \(\frac{1}{5,000}\))
  - And the fraction \(\frac{1}{5,000}\) is larger than something like \(\frac{1}{5,000,000}\)
  - Covers a small amount of area
  - Has greater detail
- A small scale map is “zoomed out”
  - Remember that the representative fraction is relatively small (like 1:5,000,000 = \(\frac{1}{5,000,000}\))
  - And the fraction \(\frac{1}{5,000,000}\) is smaller than \(\frac{1}{5,000}\)
  - Covers more area, but in less detail

Public Land Survey System (PLSS)

Reference system used to divide property in the western US
Land is divided into 36 square mile (6x6) townships
- Referenced by their township (north-south) and range (east-west)
- Each township has 36 one-mile square sections
- Sections (640 acres) can be subdivided into smaller parts
CHAPTER 3. EARTH-SUN GEOMETRY AND THE SEASONS

Movements of Earth

There are 3 basic ways that the Earth moves in space.

- **Galactic movement** – movement of Earth, sun, and the solar system around the Milky Way
  - These movements have limited effect on Earth systems and is more Astronomy than Geography
- **Rotation** – the spin of the Earth on its axis (imaginary line from North to South poles)
  - Earth spins in an eastward direction (why sun rises in the east)
  - The sun appears to move to the west across the sky
    - But, it is really the Earth that is moving as it spins
  - Defines the time of day and day/night cycles
    - Sun is over different *longitudes* as the earth spins
    - Also affects the movements of winds and oceans
- **Revolution** – Earth revolves around the sun once per year
  - Its orbit is slightly elliptical (not perfectly round)
    - Is closest to sun in January
      - Called the *perihelion*
    - Is farthest from sun in July
      - Called the *aphelion*

Sun Angle, Duration, and Insolation

Variations of Insolation with Latitude

**Insolation** – incoming solar radiation

- Uneven distribution of Insolation
- Caused by uneven angles of insolation on Earth’s curved surface
- Equator receives 2-3 times the insolation as the poles.
- See figure 2.9 – Insolation receipts and Earth’s curved surface.

The Seasons

Seasonality

- Seasonality is caused by
  - The seasonal variation of the sun’s position above the horizon (*subsolary point*)
  - Changing day lengths during the year

Reasons for the Seasons – Seasons caused by:

- Earth’s revolution around the sun (1-year)
- Earth being tilted at an angle (23.5 degree angle)

Lines on Earth Delimiting Solar Energy (from north to south)

- Arctic Circle (66.5 degrees north)
- Tropic of Cancer (23.5 degrees north)
- Equator (0 degrees)
- Tropic of Capricorn (23.5 degrees south)
- Anarchic Circle (66.5 degrees south)
- (makes 6 zones)
CHAPTER 4. THE GLOBAL ENERGY SYSTEM

The Earth–Sun System

The sun is a big deal. It is the primary source of energy for the systems of Earth and its atmosphere and is responsible for life on Earth. Some additional energy is generated from the interior of the Earth, but it is insignificant compared to the amount of energy we get from the sun.

Solar Energy and Atmospheric Dynamics

Electromagnetic energy – the energy from the sun

- Travels at the speed of light
- Comes in a spectrum of wavelengths (from short waves to longer waves)

### Electromagnetic Spectrum

**Shortwave radiation (from the sun)**

Higher-powered energy from the sun is called shortwave radiation.

- The shorter the wavelength, the more powerful the energy
  - X-rays have very short wavelengths and are very powerful and potentially harmful

The **visible wavelengths** are that part of the spectrum that we see with our eyes

- Ranges from violet/blue to red (like a rainbow)

**Infrared** (or “less than red”) are the part of the spectrum with longer wavelengths than the color red

- Near infrared is part of the shortwave radiation from the sun
  - We don’t see it with our eyes but plants reflect near infrared very strongly
  - In remote sensing, satellites measure near-infrared to map where plants are
    - We usually display it using the color red (which we can see)
    - Called a “false-color” image

**Longwave radiation (or heat, from the Earth)**

Middle or far infrared is less powerful energy that is basically heat energy. It is reflected back to space from the Earth. It also includes some very long wavelengths we use like:

- Microwaves, TV and radio signals, mobile phone signals, radar