

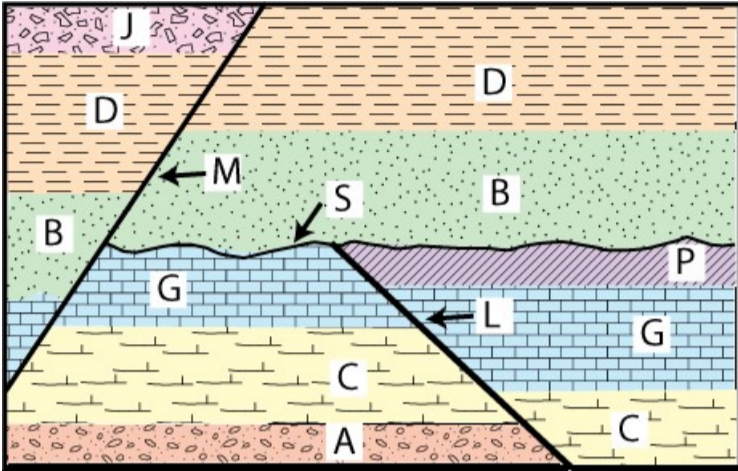
# [Hydrological and Carbon Cycle] Final Exam.

December 18th, 2018

Student ID (학번)	Name (이름)

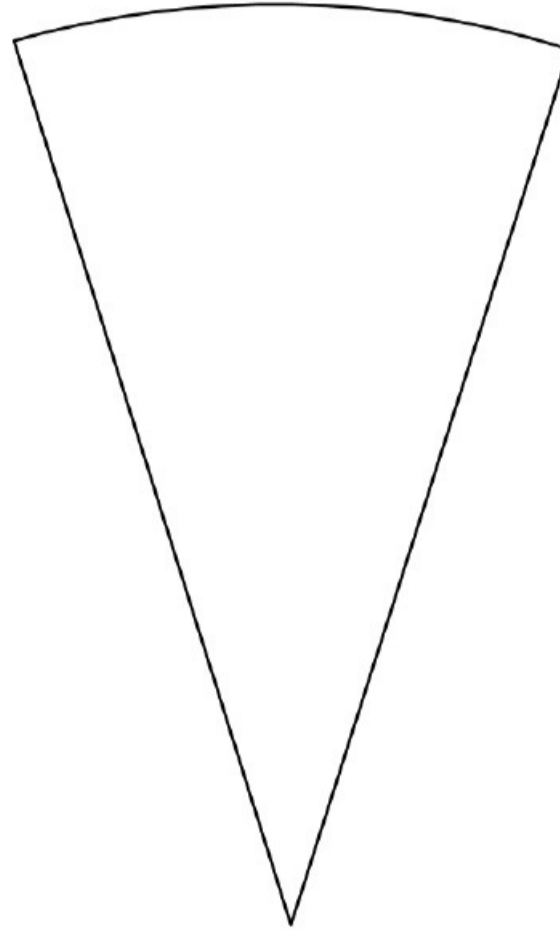
1. Cross-cutting relations can be used to determine the relative ages of rock strata and other geological structures. Describe each geologic event from A to S and the order of the events, in brief [15 pts.].

(관입의 법칙에 근거하여 아래 지질학적 사건들을 순서대로 배열한 후, 각 사건의 이름을 기입하고 간략히 설명하시오.)



2. On the diagram shown here, draw (from memory) and label the approximate locations of the following boundaries: crust/mantle, mantle/core, outer core/inner core [10 pts.].

(아래 빈 칸에 지구 내부의 구조를 간략히 그린 후, 주요 경계부를 중심으로 설명하시오.)



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3. Describe the important differences between P-waves and S-waves, in brief [5 pts.]. (P 파와 S 파 주요 차이를 간략히 서술하시오.)

5. Describe the definitions of porosity and permeability, respectively [10 pts.]. (암석의 공극률과 유체투과율의 정의를 각각 서술하시오.)

4. Why does P-wave velocity decrease dramatically at the core-mantle boundary? [5 pts.]. (핵과 맨틀의 경계에서 P 파의 속도가 급격히 감소하는 이유를 서술하시오.)

6. Explain the dynamic Rock Cycle with 8 keywords. Your explanations must not exceed 16 sentences [15 pts.].

(암석의 순환을 8 개의 주요어로 설명하시오. 답안은 16 문장 이내로 작성하십시오.)

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7. At high temperature the Urey (weathering / metamorphism) reaction favors a \_\_\_\_\_ [2 pts.].

- a) higher CO<sub>2</sub> concentration
- b) lower CO<sub>2</sub> concentration

8. At high temperature, the equilibrium state of the Urey reaction favors carbon in the form of \_\_\_\_\_ [2 pts.].

- a) CO<sub>2</sub>
- b) CaCO<sub>3</sub>

9. CO<sub>2</sub> uptake by weathering rocks acting on temperature is a \_\_\_\_\_ feedback [2 pts.].

- a) positive
- b) negative

10. Through the glacial/interglacial climate cycles, exchange between the atmosphere and the oceans has changed atmospheric CO<sub>2</sub> concentrations. This process is a \_\_\_\_\_ [2 pts.].

- a) negative feedback
- b) positive feedback

11. In which of the following is the average oxidation state of carbon the lowest (most reduced)? [2 pts.]

- a) solid Earth
- b) land surface
- c) ocean

12. Which of the following reservoirs contains the most carbon? [2 pts.]

- a) the land surface
- b) the atmosphere
- c) the ocean
- d) living things

13. Which of the following molecules contains the most reduced form of carbon? [2 pts.]

- a) CH<sub>4</sub>
- b) CO<sub>2</sub>
- c) CH<sub>2</sub>O

14. Carbon atoms in which of the following fossil fuels have the highest oxidation state (least reduced)? [2 pts.]

- a) coal
- b) oil
- c) natural gas
- d) they are all roughly the same

15. Which of the following fossil fuels was formed from peat? [2 pts.]

- a) oil
- b) natural gas
- c) coal

16. Which of the following contains the most oxidized form of carbon? [2 pts.]

- a) natural gas
- b) oil
- c) coal

17. Our use of which of the following will mainly determine whether the earth cooks or not? [2 pts.]

- a) oil
- b) coal
- c) natural gas

18. The atmospheric methane concentration has increased due to human activity by about \_\_\_\_\_ [2 pts.].

- a) 10%
- b) a factor of two
- c) 50%

19. The recent anthropogenic increase in atmospheric methane is due primarily to changes in \_\_\_\_\_ [2 pts.].

- a) the rate at which methane is being released to the atmosphere
- b) smog chemistry
- c) sulfate aerosols
- d) the rate of methane oxidation

20. The main process controlling uptake of CO<sub>2</sub> by the oceans is \_\_\_\_\_ [2 pts.].

- a) CO<sub>2</sub> dissolving in the water
- b) CO<sub>2</sub> uptake by phytoplankton

21. Today, the oceans are \_\_\_\_\_ [2 pts.].

- a) net sinks absorbing CO<sub>2</sub> from the atmosphere
- b) net sources of CO<sub>2</sub> to the atmosphere

22. What is the fraction of CO<sub>2</sub> released by human activity that will persist in Earth's atmosphere for more than 10,000 years? [2 pts.]

- a) almost 100%
- b) about half
- c) about 10%
- d) almost none
- e) about 75%

23. How long does it take for the pH of the oceans to recover from a bunch of extra CO<sub>2</sub> dissolving in them? [2 pts.]

- a) about a decade
- b) about a century
- c) one or a few millennia
- d) more than 100 millennia

24. The energy intensity (which has units Watt-years per dollar) has historically been \_\_\_\_\_ [2 pts.].

- a) decreasing
- b) increasing

25. What was the natural atmospheric methane concentration (before human activity), relative to the concentration today? [2 pts.]

- a) twice as high as today
- b) 10% of today
- c) 50% of today

26. In the Kaya identity, the term related to the carbon content of fuel sources for energy production has units of Gton C per Watt-year. If this quantity increases, the predicted CO<sub>2</sub> emission rate will \_\_\_\_\_ [2 pts.].

- a) decrease
- b) increase

----- This is the end line of the Final Exam. -----

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